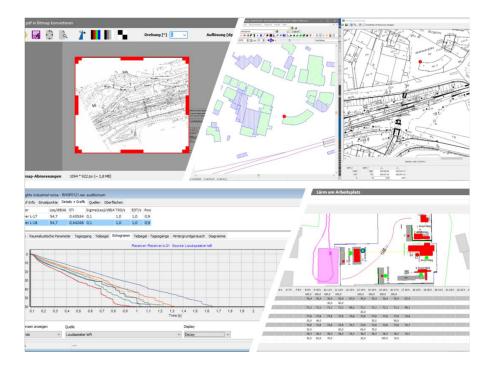
SoundPLAN

User's manual



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SoundPLAN GmbH

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1 Installation and Service

New installation

The SoundPLANnoise software can be installed using several different formats and license models. Demo versions only require the installation DVD or the installation file downloaded from our website. This version only allows the user to experience SoundPLAN via projects downloaded from the web or the SoundPLAN DVD or from someone with a licensed copy of SoundPLAN. A SoundPLAN user can use the demo version to pass on a project so that the client can explore but not modify it, the SoundPLAN demo version acts as a reader for SoundPLAN data. The function to save data to the hard-disk is disabled in the demo version. If you want to experience SoundPLAN as a fully licensed copy, you can request a license file from your SoundPLAN trading partner for a provisional license. This provisional license does not require a copy protection key but is restricted to a life of a maximum of 30 days. Once the provisional license has expired on a PC, it is not possible to install it again on the same PC.

When you have acquired SoundPLAN as a licensed copy, you can install it as a stand-alone program requiring the copy protection key attached to your PC or as a network license where the copy protection key is installed on one PC in your network and the executable copy can be installed on another PC. The network license can have up to 50 users working with SoundPLAN at the same time, depending on how many seats have been ordered for the network license. Regardless if you have a stand-alone or a network copy of SoundPLAN, the initial copy of your license file will contain temporary elements. When the license fee has been paid, SoundPLAN (GmbH or LLC) will automatically send you the new license file. This file must be installed and also should be saved to a safe place as this file should be used if you have the need to move SoundPLAN to a different PC. (See license update below)

Newer SoundPLAN versions can be installed parallel to older versions on the same PC.

New installation

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If you have a 64-Bit operating system it would be wise to install both SoundPLAN versions, SoundPLAN 32-Bit and SoundPLAN 64-Bit, as the 32-Bit SoundPLAN version has some advantages for everyday work:

Google Earth at the moment is only available as a 32-Bit-version and therefore cannot be started from the 64-Bit variant. On some computers and some graphics cards OpenGL also is causing some problems in the native 64-Bit version.

The SoundPLAN installation files are delivered on a DVD. For the installation you also need a Hardlock/HASP copy protection key and your specific license file. The license file needs to have the same 4-digit serial number as was printed on the copy protection key. If you are new to SoundPLAN, have purchased new modules or use an educational license, your license file will have modules with a temporary setting. This temporary license file must be replaced later by either a new temporary license file (with an expiration date in the future if you are using an educational license) or by a permanent license file. See below in the chapter Update License.

The DVD has an auto run function, automatically opening the DVD browser. Within the browser, you can install the software and get additional information. During the installation the manual is copied to your PC. Demo and test projects can be copied after the software installation. If the auto run function is disabled on your PC, please call "SPbrowser.exe" from the Windows Explorer.

Before starting with the SoundPLAN installation, log in as the **Administrator**.

- Attach the SoundPLAN Hardlock / HASP to the USB port before you start the installation.
- If you want to install SoundPLAN as a demo version, there is no need for a license file. To install SoundPLAN as a fully licensed copy, you should copy the license file you received as an attachment of an e-mail to a location on your PC from where you can retrieve it during the installation.
- Insert the DVD, auto run opens the SoundPLAN Browser.
- Call INSTALL SOUNDPLAN from the browser and decide whether you want to install the FULL VERSION or the DEMO VERSION.

The installation program will prepare the installation and guides you through it.

SoundPLAN delivers templates (pre-settings for the calculation standard selection and time slices, templates for tables and graphics sheets) and libraries for the requirements in different countries. Moreover, the program user interface and the online help and manual are available in several languages.

The language selection is performed in accordance to the language and country settings of Windows. You can add further languages and country settings.

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New installation

elect Languages (Countries) To Install
Program Language Templates Libraries Help file
□ Chinesisch (VR China) □ Deutsch (Deutschland) ☑ Englisch (USA)
Französisch (Frankreich) Italienisch (Italien) Polnisch Potrugiesisch (Brasilien) Russisch Spanisch (Traditionelle Sortierung) Tschechisch Ungarisch
Select All << Back Next >>

When starting SoundPLAN for the first time, select the language and country settings you want to use - you can change these settings any time in the SoundPLAN Manager.

To complete the installation of the full version, the installation program will ask for the path where you stored the license file (BABGxxxx.007). Select the path and click "OK". SoundPLAN transmits your program modules.

Open SoundPLAN using "Start -> All programs".

Installation of a new version if SoundPLAN has already been installed

Several SoundPLAN versions can be installed and run parallel on the same PC.

The installation checks whether an older SoundPLAN version has been installed on your PC. If so, you don't need the license file, the installation looks for a valid file on the hard disk.

As soon as a license file has been found, the installation will display the path. Click OK or enter another path here.

Starting SoundPLAN for the first time

When starting the program for the first time, fill in the settings for the SoundPLAN initialization:

New installation

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Path for global settings an D:\Eigene Dateien\SoundF		Ē.				
✓ transfer global settings	from the previous SoundPLAN version Eigene Dateien \SoundPLAN Globdata 7.0\"					
Program language	Englisch (USA)	~				
Libraries	Englisch (Kanada)	~				
System files / Templates	Englisch (USA)	~				
Manual/Help File	Englisch					
internet update	rch for new updates					

If an older SoundPLAN version is found on the PC, you will be asked with the first start of the new version if you want to copy your existing "Globdata" folder to a new location. If you have customized the global settings (object definitions, colors, libraries etc.), it makes sense to copy them to the new Globdata. If not, it is better to start with a fresh set of templates taken over from the system settings. It is also possible to copy individual files to the new Globdata using the Windows explorer.

Updating SoundPLAN

After you have installed the latest DVD version, updates of SoundPLAN are available for download from the Internet. Via **HELP -> UPDATES & DOWNLOADS** you get access to the latest update as well as to updated files in the system folder such as libraries and templates and also help text, the handbook and demo projects.

SoundPLAN analyzes the files installed on your computer and indicates the dates of the files available versus the dates on your computer. As soon as the files on the SoundPLAN web are of a more recent date, they are automatically checked for download, however you can decide if you want to load these files or are also interested in loading others. Activate/deactivate the check mark in the box accordingly.

This way you can for example download the most recent version of the manual even if the new manual was not ready when the SoundPLAN installation DVD was produced. Another possibility is to download and install templates and libraries for other regional markets.

In the lower part of the dialog you can define the path where these files are to be stored. By default, these files are set to be saved in the location where your SoundPLAN Globdata is stored, the downloaded files are saved to the sub folder Download.

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Updating SoundPLAN

Updates and down	loads						
		and the second					
				Info			
30.11.2012:	We are prepar to Oxford. Pla about 5PM. Se	ces will be limite oundPLAN 7.2 w	ng at Monday th d to 15 people. T ill be released in	he meetingwill sta	2012 for our UK us art at 10AM and fir ire so the meeting n as possible.	hish at	E
Ecologie	em File Update Demos						
Download File name		Latest Version	Installed Version	Downloaded version	Size [kB]		
Bugfix History	21203.exe	03.12.2012	03.12.2012		26444		
27.11.2012 Runkerne	e texts, which are edited el - Aircraft noise of level for NAT(90/180) = base - Import / Export	from user, have been res	et.				
4							,
Folder for downle Download ok	oad: "C:\Users\corinna.ku	urz'(Documents'(SoundPLA)	N Globdata 7.2\"; SubFold	er "downloads 7.2"			
	Insta						

Please assure that you have the administrator rights. Click on **DOWNLOAD**. The files are subsequently copied into the download folder you specified. To install/activate the downloaded files click on **INSTALL UPDATES**. Before the SoundPLAN update is installed you can look at the changes in the readme file and change the installed program languages. With OK the update is installed.

Via the download path you can also make the files available in your computer network to distribute the update amongst your colleagues or to update multiple computers from this location.

License update

A license update updates the license information of your version, e.g. if you had a temporary license file or purchase additional modules. Copy the license file (BAB?xxxx.007) to your PC and execute the license update from **START** -> **ALL PROGRAMS** -> **SOUNDPLAN XX** -> **SOUNDPLAN UPDATE LICENSE** (may be slightly different for other Windows versions than Windows 10). The program will ask for the location where you had stored your license file BAB?xxxx.007.

Notification of new updates

The first time you open SoundPLAN you can set a check mark that the program should search the web if a new version of the program is available.

In the program settings (**OPTIONS -> SETTINGS**) you can modify this setting any time.

🐺 Settings		
Program Distributed Computing	Internet Update	
System <mark>Internet Update</mark> ⊕Global ⊛Current Project	Check automatically for new version Checking interval (days) Confirm internet connection	
	Confirm Internet connection	Yes

Updating SoundPLAN

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Install network license

Aside from the single seat license safeguarded by a locally installed Hardlock or HASP key, SoundPLAN is available as a network license. The individual PC running SoundPLAN does not need a copy protection key, the copy protection is managed as a cooperation between the user's PC and the license server PC. The license server PC does not have to be a special "server" with extra computation power, a standard PC running 24/7 in the company's network is sufficient. The licensing software installed as a service has the advantage that it automatically starts with the PC and can cooperate with the SoundPLAN software in the entire network, regardless of the SoundPLAN version (7.2, 7.4, 8.0...) or if the software is 32 or 64 bit.

It is absolutely paramount that the license server is installed first, starting with attaching the HASP key to one of the servers USB ports. After the server installation the SoundPLAN software can be installed on the user's PC. As the licensing requires constant cooperation between the license server and the user's PC, the PC needs to be on the network with a connection to the server PC. The parameters for this communication will become the basis of future logins at the license server.

The network must be stable and available 100% of the time so that the license manager will get informed when you terminate the SoundPLAN program. Basically, you get a license from the license server and must return it to the license server when you end the program, otherwise your license server will run out of license to give to SoundPLAN users.

SoundPLAN can be installed on an unlimited number of PCs but it can only be used when a license is available. If you log in from a PC in the network, a request for a login is sent to the license server and if a license is available, SoundPLAN starts and the number of available licenses is decremented. If the number of user PCs logged in to the license server PC is already equal to the number seats acquired, additional request for a login to the SoundPLAN license server will be denied.

In a SoundPLAN networked installation as many users can work concurrently as license seats are available.

The network license can work with a normal in-house network and also via VPN (Virtual Private Network) to connect to a SoundPLAN license server out-of-house (in another building, from home or another town). If your network is stable but you still receive notice that the communication is not working properly, please contact the SoundPLAN hotline.

Another additional (additional charges) option is the borrow function for the network license to work for a limited time with a detached license that does not require a constant network connection. With this option, a license is detached from the license pool from the SoundPLAN license server and assigned to the PC borrowing the license. When the borrowed license is returned, the number of available parallel logins is incremented. The borrow function for the network

license can be installed at any time after the installation of the network license. The borrow function is not available for educational licenses.

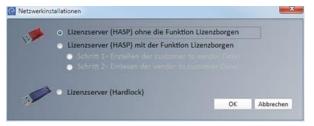
Installation of the license server PC

Any computer in the network can act as the SoundPLAN license server, if you expect to be able to start SoundPLAN at any given time, the PC of the license server must run 24/7 (does not get powered down at night or on weekends). On the license server PC, the HASP driver is installed that organizes the communication between the user PC and the license server PC. This installation is not dependent on the version of SoundPLAN. This means that the installation at the license server is only required one time.

- 1. Log in at the PC with the Administrator rights
- 2. Attach the HASP HL Net Key to a USB port of the PC.
- 3. Install the HASP driver:

Place the DVD in the appropriate drive and navigate in the auto start browser to **SOUNDPLAN NOISE / AIR** and start the **NETWORK INSTALLATION**.

Select INSTALL LICENSE SERVER and select the option LICENSE SERVER (HASP) WITHOUT BORROW FUNCTION.



Click OK to start the driver installation. Please follow the installation script.

To inspect and diagnose the HASP Net Key, you can use the **Admin Control Center**, that was installed along with the HASP driver. It is a web browser based application and can be opened directly from the SoundPLAN Manger under **HELP** -> **LICENSE INFORMATION** or with a web browser such as the Internet Explorer with the address http://localhost:1947/.

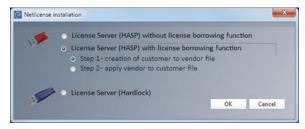
Activate the additional option "borrow license"

License borrowing is an additional functionality of a HASP based network license. This option needs to be activated one time on the license server PC and does not depend on the version of SoundPLAN. Keep in mind that when all licenses are detached and connected to a user's PC, no additional licenses are available in the net.

Important: The license for borrowing is bound to the license server PC and is using the unique identifiers of this PC, therefore it cannot easily be moved to a different PC. If you need to replace the license server PC, get in touch with your trading and support partner before you replace the PC.

Log in as the administrator.

Place the DVD in the appropriate drive and in the DVD Browser open the **NETWORK INSTALLATION** for **SOUNDPLAN NOISE / AIR**. Select **INSTALL LICENSE SERVER** and here the option **LICENSE SERVER (HASP) WITH BORROW FUNCTION, STEP 1**.



Click OK, the installation of the driver starts and the HASP-update program is started, the tab *Collect Key Status Information* is active.

Click on **COLLECT INFORMATION.** The next dialog shows all installed HASP-licenses.

SoundPLAN	Select HASP key			
HASP License Update	Multiple matching HASPs for the hase select one from the list below or disconnect all but one process refresh. HASP FL (13300259 HASP SL (111550-0587555566)			
Order a new license or license update; a) for a HASP SL license (associated to a HASP network lice				
b) for a HASP HL key Run this utility on the machine where the SL license shall be or updated rsp. where the HASP HL key is connected. Ock the "Collect Information" button, create a C2V file.	Neores (111153-0558/356)			

Select the line with HASP SL and click OK.

In the following **SAVE UNDER** dialog a file is generated for the key-status. The file has the extension c2v. Please enter the file name as BABN and your four-digit license number (printed on the HASP LH Max Net key), for example BABN1234. The file extension is automatically added.

Please send this file, in our example BABN1234.c2v, attached to an e-mail to <u>marketing@soundplan.com</u>. In the e-mail please write how many of your licenses you would like to be able to be borrowed, this can be at the most the number of licenses that you have seats for in your network license.

We will send you back an activation file (BABN1234.v2c) and a modified license file BABN1234.007.

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Save both files to your PC and in the SoundPLAN Browser (SoundPLAN DVD) open **SOUNDPLAN NOISE / AIR NETWORK INSTALLATIONS**.

Select the option **INSTALL LICENSE SERVER** and select the function **LICENSE SERVER** (HASP) WITH THE FUNCTION LICENSE BORROWING, STEP 2. Click on ok and the HASP update program will open. Move to the tab *Apply License Update*.

Sentinel HASP RUS	- 🗆 ×
Collect Key Status Information Apply License Update	
Update File D:\Download\BABN9999.v2c	
Apply Update	

With the selection button select the activation file (BABN1234.v2c); click on **APPLY UPDATE**.

Now open the **Admin Control Center** in the internet browser with <u>http://localhost:1947/</u> to activate the borrowing.

The list of Sentinel Keys now should show your HL Net key and a -License:

Sentinel Keys Available on COMPILE							
#	Location	Vendor	Key ID	Кеу Туре	Version	Sessions	Actions
0	Local	89940	500202813	HL Net 50 🔳	3.25	7	Features Sessions Blink on
1	Local	89940	55	SL-Legacy 📷 @	2.01	-	Products Features Sessions

On the left of the Admin Control Center click on **CONFIGURATION** and select the tab *Detachable Licenses*.

	Configuration for Sentinel	License Man	ager on CK	-023-2	
Options Sentinel Keys	Basic Users Access to License Ma	Remote A	ccess from note Clients	Detachable Licenses	Network
Products Features Sessions	Note: These settings affect a Enable Detaching of Licenses	III Products			
Update/Attach	Initial Detach Limits (for new				
Access Log Configuration Diagnostics	Reserved Licenses	0 of total licens	but at least 0	%	
Help	Max. Detach Duration	14 (max. days: 9		Product Settings	
About		Submit Cancel S	Set Defaults		

Activate ENABLE DETACHING OF LICENSES and click the function SUBMIT.

Install network license

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Replace the license server

If the license server needs to be replaced, first the HASP driver and the HASP HL Net Key must be installed at the new license sever PC, see "<u>Installation of the</u> <u>license server PC</u> (page 27)".

Normally the client PCs automatically recognize the new license server. In case it fails, please check the configuration settings in the ACC (Admin Control Center), see section "Troubleshooting (page 31)".

Installation on you work PC

Install SoundPLAN like described under "<u>New installation</u> (page 21)". The license file is BABNxxx.007 with xxxx being your license number. During the installation your PC needs to be connected to the SoundPLAN license server via your network.

If SoundPLAN has already been installed on your PC, it is enough to do a "<u>License</u> <u>update</u> (page 25)" to update the settings for your new capabilities.

If a borrow function was activated, the license file (BABNxxx.007) sent with the .v2c file must be stored in the SoundPLAN folder and then must be activated with a "License update (page 25)" on your PC.

It is also possible to install a user PC installation on the same PC as the SoundPLAN license server PC.

Borrow license

To borrow (detach) a license from the pool, open the SoundPLAN Manager **HELP** -> **BORROW NETWORK LICENSE**.

SoundPLAN License Bor	rowing	
Borrow license	Borrow a license from the network pool and attach it to the local of Expiration time for the borrowing license 7 days	computer.
Return license	Cancel a borrowed license and return it to the network pool.	
	Close	Details >>

BORROW LICENSE: Takes a license from the networked license pool and binds it to the requesting computer. At the same time the number of licenses available in the pool is decremented by one. The detached license is valid for the requested time frame, but it can be returned before the end of the time, then the detached license is no longer functioning and the number of licenses available in the network pool is incremented by one.

RETURN A BORROWED LICENSE: When you decide, you do no longer need the detached license although the borrowing time is not used up, you can return it to the network license pool.

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After detaching a license:

- SoundPLAN needs to be re-started in order to log on to the borrowed license.
- If you have disconnected the computer from the network, wait 1-2 minutes before starting SoundPLAN. The license manager needs a little bit of time to recognize the new status. If not the program will indicate a network connection error.
- The preferred login of SoundPLAN is to the local borrowed license, even if a network connection exists. Before you can log on to a conventional network license, you need to return the borrowed license.

Click on **DETAILS**, to get more detailed information on the status of the network license. When you for example get the message that no more licenses are available for borrowing, here you can look up which computer currently has the borrowed licenses.

Troubleshooting

If you have installed a HASP network license and the installation of SoundPLAN on the client PCs fails (e.g. Setup Error 1130,7) then maybe the HASP HL Net Key on the server PC is not recognized at the client PC.

Then check the configuration in the Admin Control Center.

Open the Sentinel Keys list in the ACC of the local PC: <u>http://localhost:1947/_int_/devices.html</u>.

The SoundPLAN HL Net key should be displayed as shown with the Vendor ID "89940".

SafeNet				Senti	nel A	dmin Control Cent
otions	Sentinel K	eys Av	ailable on PA-022			
entinel	# Location	Vendor	Key ID	Кеу Туре	Version	Sessions Actions
ys	0 Local	100	1.	Trans and	2.01	- Products Features Sessions
ducts atures	1 COMPILE	89940	500232813	HL Net 50	3.25	- Browse Net Features
sions	2 COMPILE	The second	100 100	Sector Sector	3.25	- Browse Net Features
	3 COMPILE	-		Acres 11	2.01	- Browse Net Features
late/						

If the SoundPLAN HL Net key is not displayed, then enter the configuration page:

- Select the tab sheet "Access to Remote License Managers"
- Set the check marks as shown.
- Specify the computer name or the IP address of the server PC in the Search Parameters field.
- Then press "Submit" to activate the changes; wait a few seconds.
- At persistent problems try the check mark "Aggressive Search...".

Install network license

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Options	Configuration for Sentinel License Manager on PA-022					
Sentinel Keys	Basic Settings Users Access to Remote License Managers Access from Remote Clients Detachable Licenses					
Products Features	Allow Access to Remote Licenses Vou may experience a delay of a few minutes before your changes will take effect.					
Sessions	Broadcast Search for Remote Licenses					
	Aggressive Search for Remote Licenses					
Update/ Attach	Specify Search Parameters 10.0.100 PA-022-2					
Access Log						
Configuration						
Diagnostics						

Check the keys list again: if the HL Net key is displayed, SoundPLAN will recognize it too and work normally.

If there should be still problems, please send the update.log file (c:\ProgramData\SoundPLAN\) and a report from the Diagnostics page (http://localhost:1947/ int /diagnostics.html) of the concerned PC.

Additional hints

On a work PC multiple different licenses can be installed with various configurations of (Hardlock, HASP, network license; SoundPLAN noise and SoundPLAN air). When starting the application, the following license selection is shown.



For each license file that should be installed, the license update needs to be carried out.

If you are the proud owner of a new PC and want to move an older version of SoundPLAN to the new PC, please keep in mind that the HASP driver is always downwards compatible but most likely not upwards compatible if your new PC has a new operating system. In this case download a new version of the HASP driver from the web. The latest HASP driver is always available under: www.soundplan.eu/tools/HASP Run-time setup.zip.

Install updates simultaneously on several computers

The program "distribute updates" is a tool to install updates and updated libraries, system files/templates and manual/online help from your computer simultaneously on any number of computers within a network. Once the update program has been installed as a service, administrator rights are no longer required to install the updates. "Distribute updates" is automatically installed with the SoundPLAN installation.

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Install updates simultaneously on several computers

Distribute updates and system files

Download the latest update vial **UPDATES & DOWNLOADS** in the Help menu of the SoundPLAN Manager of from the external update website. User name and password are available from the SoundPLAN support.

It is advisable to store the updates you downloaded from the internet in the specified folder on a specified PC. (This folder does not have to be on the PC you use to distribute the updates, it can be on any computer in the network.)

Select the path where the updates have been stored clicking on the button with the two small dots and double click on the update. The path and the update date are displayed on the screen.

Call the program from the start menu (ALL PROGRAMS -> SOUNDPLAN XX -> DISTRIBUTE UPDATES).

Use **EDIT PC LIST** to type in the computer names or the IP addresses of the computers which should be updated. With **SEARCH** (within the PC list) you can search for all computers logged in to the network and display them in the list. (This might take some time within large networks.)

Computers for which no update installation is planned can be removed from the list.

Highlight the desired computers on the left-hand side and select them with the arrow button. The double arrow activates all listed computers.

Version 7.4-32 v Path = "D:\Users\coinna.kuz\Documents\SoundPLAN Globdata 7.4\downloads 7.4\"					
letwork PC	Ca	Available/Connected			
ck-023-2		Name	Name Status		
seminar-03		ck-023-2 (10.0.10.98) Durrent Update: 04.03.2015 15:38:06			
		seminar-03 (10.0.10.138)	ar-03 (10.0.10.138) Durrent Update: 11.02.2015 12:06:02		
think-d30-02		seminar-04 (10.0.10.79)	seminar-04 (10.0.10.79) Current Update: 11.02.2015 12:06:02		
minar-05					
Edit P	Edit PC-List Connect and Send Update				
logram up	date				
Distribute File name			Size [kB]		
	SPUPD32_2015	0209.exe	32990		
ystem files	/ templates				
istribute	Language	Description	Size [kB]		
	Englisch	Manual and Help	63339		
	Englisch	System files and templates	140		
	Englisch	Libraries	4132		
V	default	System files and templates	40		
07.44 [1 07.44 [1 07.46 [1 07.46 [1 07.46 [1	ientSocketSktSrv ientSocketSktSrv 0.0.10.138} Insta 0.0.10.138 Vers	# Update: 04.03.2015 15:38:06 Disconnect 10.0.10.88 Retrieve/VersionConnect 10.0.10. #Path=C:Vhogram Files (x86)/Soc			
107:46: D 107:47: D 107:47: [1 107:47: [1	ientSocketSktSrv ientSocketSktSrv 0.0.10.79} Install 0.0.10.79] Versio	Disconnect 10.0.10.138 Retrievel/ersionConnect 10.0.10. Path=C:VProgram Files (x86)/Sour			

From the table select the updates and system files to be installed.

Click **CONNECT AND DISTRIBUTE UPDATE**. As soon as the installation has been successful the date of the installed update version is displayed next to the computer name. If the old update version is still displayed, the network connection was successful but for some reason the update couldn't be installed (often because SoundPLAN or one of its sub-programs is currently open on this computer). The logbook shows warnings and errors in red color (for example if a computer was running while attempting to distribute the update).

Install updates simultaneously on several computers

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The control program for distributed computing does not have to be terminated before starting the update. The update program closes the socket server and opens it again automatically. The automatic update installation is also possible for Computers on which the demo version is installed for Distributed Computing.

Parameters for the windowless installation

x.x stands for the SoundPLAN version, e.g. 8.0

xxxx stands for the BABG/BABN number

jjjjmmtt stands for the date of the update, you want to install.

New installation

Calling program

The program starting the windowless installation is the program "Install32SPx.x.exe" from the DVD (as an alternative you can copy the content of the folder ...\Install SP\WIN32\ to your disk and start the installation from there).

/LANGUAGE=<LocalID>

The program language needs to be set as the local ID from Microsoft. A list of the language ID parameters can be found on

https://technet.microsoft.com/de-de/library/cc179219.aspx. https://technet.microsoft.com/en-us/library/cc179219.aspx.

1033 is English for the USA: EN_US 1031 is German for Germany: DE_DE

/LANGUAGE=1033

/BABG=<FileDescriptor>

This parameter needs to contain the license file to be used in the installation. As the BABG/BABN is most likely not in the same folder as the installation program, the drive and path must be part of the entry. In case the path contains blanks, the blanks must be encapsulated with quotation marks.

/BABG="C:\MyFolder\BABGxxxx.007"

/S

This parameter indicates that a windowless installation is to be performed.

/D=<PathDescriptor>

The parameter for the target of the installation, the parameter must be made for a valid folder. In case the path contains blanks, the path must be encapsulated with quotation marks.

/D="C:\Program Files (x86)\SoundPLAN x.x\"

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Parameters for the windowless installation

Example

"D:\Install SP\Win32\Install32SPx.x.exe" /LANGUAGE=1033 /BABG="C:\My folder\BABGxxxx.007" /S /D="C:\Program Files (x86)\SoundPLAN x.x\"

Installation of program updates

Calling program

The calling program is SPUPDxx_jjjjmmtt.exe with the full drive letter and path.

D:\Updates\SPUPD32_20170101.exe

/LANG=<LocalID>

The program must be installed with the same local ID from Microsoft as the already installed version from SoundPLAN.

1033 is EN_US 1031 is DE_DE

/LANG=1033

/SILENT

Parameter indicates that a silent installation is desired.

Example

"D:\Updates\SPUPD32_20170101.exe" /LANGUAGE=1033 /SILENT

System update

Calling program

The program starting the installation is program "SPUpdlic.exe" which was installed in the SoundPLAN program folder.

"C:\Program Files (x86)\SoundPLAN x.x\SPUpdlic.exe"

/SILENT

The parameter indicates that a windowless installation is desired.

/INSTALL=<FileDescriptor>

The parameter describes the files to be installed.

/INSTALL="C:\Users\SoundPLAN\Documents\SoundPLAN Globdata x.x\downloads x.x\lfiles.*.zip"

/INSTALLPATH=<PathDescriptor>

The parameter describes the path where SoundPLAN is installed.

/INSTALLPATH="C:\Program Files (x86)\SoundPLAN x.x\"

Parameters for the windowless installation

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Example

"C:\Program Files (x86)\SoundPLAN x.x\SPUpdlic.exe" /SILENT /INSTALL="C:\Users\SoundPLAN\Documents\SoundPLAN Globdata x.x\downloads x.x\lfiles.*.zip" /INSTALLPATH="C:\Program Files (x86)\SoundPLAN x.x\"

The SoundPLAN service modules

The **SoundPLAN Handbook** is available in printed form and as a pdf document and is copied to your hard disk during the installation. Open the manual in the SoundPLAN Manager using **HELP -> READ MANUAL**.

The **SoundPLAN On-Line Help** in the program provides information to current problems and is updated with every SoundPLAN version.

The **SoundPLAN Hotline** is available from your local distributor or SoundPLAN International LLC (<u>mailto:support@soundplan.com</u>). Find information on your local distributor in the SoundPLAN Manager via **HELP -> INFO**.

Local user group meetings keep you up-to-date (ask your local distributor).

Software and hardware suggestions

SoundPLAN is available as 32-Bit and 64-Bit-software. Thus, it is possible to process projects without a limit to the size (depending only on the amount of memory installed in your computer). This is especially interesting for some special tasks and for huge projects.

SoundPLAN supports both **multi core** and **multi-processor PCs**. Each processor of a multi-processor PC may have several cores.

For new PCs we recommend purchasing the latest **processor type** but not the fastest processor in the series, because the fastest processor is often too expensive. If you choose a slightly slower processor you will get a much better ratio of cost versus speed.

As the pre-calculation in the calculation core (calculation of emissions, searching DGM triangles, preparing buildings ...) are not (yet) designed to make use of multiple core processors, processors with a very high operating frequency (or with turbo boost) will yield the highest throughput of the entire system. For this reason, the clock speed at the moment is more important than the number of cores in a processor.

Operating system: Current Windows version and Windows Server version - preferably the 64-bit version, because this operating system can request much more memory and you have the choice between SoundPLAN 32 and SoundPLAN 64.

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The SoundPLAN service modules

SoundPLAN is always executable with the current operating system. If software adjustments are necessary, they will be made available at short notice.

We suggest making the decision for **graphics card**, **RAM memory**, **hard disk** and **monitor** the same way as for the processor itself: Choose the best hardware available at a sensible price. The monitor should have FullHD resolution.

Per calculation core (thread) 1 GB **RAM** should be included. The **graphics card** must support OpenGL for the 3D Graphics and should have its own memory, because the 3D performance of so-called "onboard-graphics card" is rather weak.

All Windows compatible printers and plotters can be used.

A **second monitor** is strongly recommended for checking geometry data in the Geo-Database (Property Explorer, 3D-Graphics and connection to Online Map Services and Google Earth).

Software and hardware suggestions

2

2 SoundPLAN Manager

SoundPLAN consists of multiple programs that jointly assure the functionality of the suite of SoundPLAN. One of the main advantages of splitting SoundPLAN into individual program modules is the possibility to edit data for one variation while another is prepared for printing and another is being calculated. Multitasking with SoundPLAN not only works within the same project but can also be applied for different projects.

Data organization

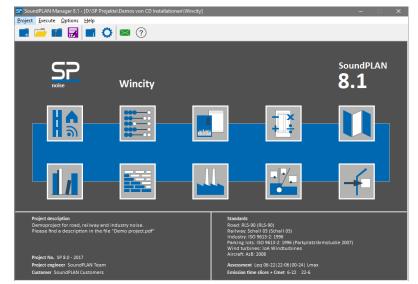
In SoundPLAN a project folder (subdirectory) is generated for each project. This way it is guaranteed that all data belonging to the project are stored together. This procedure helps you and your colleagues to efficiently manage big and small projects.

In the SoundPLAN Manager you can generate new general subdirectories and new project folders. You can also convert general folders into project folders. This way it is possible to further organize the project to keep, for example, bitmaps and imported files separate from the rest of the project.

Data organization

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Functions of the SoundPLAN Manager



All threads come together in the SoundPLAN Manager. At a glance you see information on your project and the selected calculation standards. You create new projects here, select existing projects and invoke the different program parts of the SoundPLAN program group.

As soon as you home in to an area where you can change settings, the mouse cursor changes to a hand so that you can quickly access the information, e.g. changing the selected standards or extending the project info.

In the help menu you have access to the SoundPLAN website; in addition, you can directly send a request to the hotline.

Create new project

A SoundPLAN project consists of several files which are stored jointly in one project folder. When you create a new task or select a project, you select a folder, not a file.

When you start SoundPLAN for the very first time the SoundPLAN opens without a project; later on, SoundPLAN will always open the last project you worked on.

Create a new SoundPLAN project with **PROJECT -> NEW**.

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Functions of the SoundPLAN Manager

D:\SP Projekte\Demos			\sim	Ĕ:
Name of project folder:	Project 4			
Project title:				
Project No.:				
Project engineer:				
Customer:				
Description:				
Description:				^
Description:		 		<
Description:				~
Coordinate system:	not defined		~	V
	not defined		~	0
Coordinate system:			~	V
Coordinate system: Reference system:	not defined		~	V

When you create your first project, the selection list on top of the dialog shows a standard path, later on the path of the last selected project will be shown. Select other project paths using the selection list.

If you want to store the project in another main directory, click on the symbol button **SELECT DIRECTORY** on the right side of the selection list.

Enter the name of the project folder. The following fields can be used to store additional information to your project. If you don't enter a project title, the project folder name is used as title.

It is up to you to fill in the fields project number, project engineer and customer, however you can use this information in text variables to later design your tables and maps.

The **DESCRIPTION** enables you to store your own information such as contact data of the customer or hints on the status of the project. Open the project info with a click on the corresponding area or **PROJECT -> PROJECT-INFO** to amend the description.

Select a project coordinate system (page 41) and click OK to create the project.

Define the project coordinate system

There are many coordinate and reference systems, historical and global ones. It is wise to generate the project using the coordinate system that is used by your client. If you want to import data from outside sources, the coordinates might be using a different coordinate system. If the project coordinate system is defined and the coordinate system of the data to be imported are known (and defined in SoundPLAN), the data are converted at import time into the coordinate system of the project. If the coordinate systems are not made available to SoundPLAN, the data most likely will not match.

Create new project

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With more and more data becoming available on-line through Online Map Services, Open Street Map or Google Earth, you can and should define the project coordinate system when starting a new project. Under **OPTIONS** ->**SETTINGS** -> **GLOBAL** in the SoundPLAN Manager you can define a default project coordinate system that will automatically be activated for new projects. This is very helpful if your work is mostly regional with always using the same basic coordinate system.

Select the coordinate system and the reference system from the selection lists and, if needed, an offset (false easting / northing) and a stripe, see "<u>Coordinate and</u> <u>reference systems</u> (page 45)".

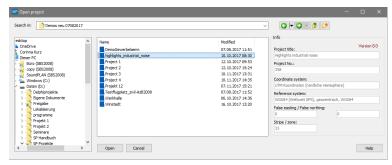
Create project		_0
D:\SoundPLAN Projekte	emoprojekte V7	✓ É:
Name of project folder:	Project 1	
And the second design of the	and all and a second	Allow deta, Allow da dansi
Coordinate system:	undefiniert	× (
Reference system:	undefiniert	
False easting:	0,00	
False northing:	0,00	
Stripe / zone:	0	
	ОК	Cancel Help

You can define the project coordinate system later in the Geo-Database when opening an Online Map Service or Google Earth for the first time or when you start a transformation.

Under **OPTIONS** -> **SETTINGS** -> **GLOBAL** in the SoundPLAN Manager, you can set a default project coordinate system that will be automatically entered for new projects.

Open project

The project that was active when the program was terminated last is loaded as the default project. Select a different one with **PROJECT** -> **OPEN**.



SoundPLAN projects can be identified in the pick list by blue and gray folder symbols, depending on the version the project was created with. Additionally,

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Open project

normal yellow folders can be found in the project directory. In the info field on the right side, the project description and version number is displayed.

SoundPLAN projects can be selected by double clicking or with the button OPEN.

Use the right mouse button -> **CONVERT** to convert Windows folders into SoundPLAN projects, for example when you have already generated the folder to store bitmaps or other external data in it.

Convert projects to newer versions

When you open a SoundPLAN project with a newer version you are asked for permission to convert the project. This procedure is important as files may have a different structure. Please note that converted projects cannot be read by an older version, therefore if you intend to work with this project in an older version of SoundPLAN, back it up!

Define how the program shall organize the conversion:

 Backup project before converting: 			
Archive:	Zugvorbeifahrt Murrbahn.zip		
Copy project and convert copied project			
New name: Copy of Zugvorbeifahrt Murrbahn			
Convert without backup			

Depending on the settings the project is first archived (packed) or copied. This procedure can take several minutes.

Copy, delete, paste and pack projects

Within the "Open dialog" click right on a project folder to copy, paste, delete and rename projects or to pack and extract them. Some of the functions are not accessible all the time, for example the option "Paste" can only be used after a project has been copied before.

Project-Info

The project info is displayed on the bottom left of the SoundPLAN Manager. You can change it or extend it during the project lifetime e.g. to enter contact persons, information on the project progress or dates. If you want to modify the description, either click on the project description or on the icon or open the menu **PROJECT -> PROJECT-INFO**.

Save project as

You can generate copies of the project through the menu selection **PROJECT** -> **SAVE AS** without accessing the project selection.

Open project

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Enter the name for the project folder and, if needed, a new project title.

New project folder:	2011 WINCITY
New project title:	WinCity for the current SoundPLAN version

Pack and extract projects

To save space when archiving projects or when you want to send the project to someone, SoundPLAN has the capability to compress entire projects into packed archives. To pack your project open **PROJECT -> PACK**.

Pack project 🛛 🔀
Project folder to pack
D:\SoundPLAN projects\Demo projects\WINCITY 2011\
Packed project file
D: \SoundPLAN projects \Deho projects \WINCITY 2011.
Files to pack
✓ Include all files Selection
Include only result files Only result file number
Exclude result files
Exclude DGM files
Exclude temporary and non SoundPLAN files, sub folders and pictures
Pack & Send Pack Cancel Help
Zip Size: 0

Click on the symbol **FOLDER SELECTION** and select the location in order to store the packed project in another path than the suggested one.

When data are sent to an overseeing agency or to the hotline, some of the data may not be necessary. In order to keep the packed file as small as possible, SoundPLAN has options to customize what is stored in the archive and what is not.

The setting **EXCLUDE TEMPORARY AND NON SOUNDPLAN FILES, SUB FOLDERS AND PICTURES** should be clicked if you send a project to the hotline. The bitmap for tile projects is recognized and packed anyway.

With the combination of **ALL FILES** and **EXCLUDE RESULT FILES** all data but the result files will be part of the packed project, for example if you have a graphics or data entry problem you want to discuss with the hotline.

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Open project

If a special result file of a big project should be checked, you can use **INCLUDE ONLY RESULT FILES** and enter the calculation run number to send this single result in a second round as a separate email.

After packing the files with **PACK**, the size of the archive is displayed in the bottom of the entry box. With **PACK + SEND** the zipped project is directly copied as an attachment to a new email to send it to the SoundPLAN support (or any other email address).

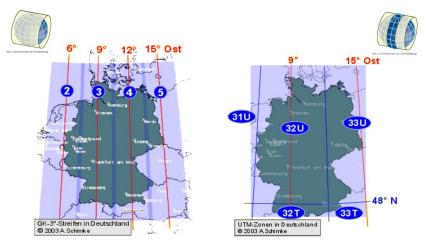
To extract a project, click on the project in the project selection, invoke **EXTRACT** from the right mouse menu and enter the path where the archive is to be extracted to.

Coordinate and reference systems

For different functions, SoundPLAN must know the coordinate system in which the project data is available, or which should be used as a basis for a project. This is necessary for working with map services (such as OSM, WMS, Google Maps, Google Earth), as well as for transformation, when the project data and additionally imported data are in different coordinate systems.

The coordinate reference system (CRS) is described by a coordinate system (e.g. UTM, ...) and a reference system (e.g. WGS84, ERTS89, ...).

The coordinates of the data can have an **OFFSET** in x and y direction for example, if the zone ID for UTM coordinates is missing.

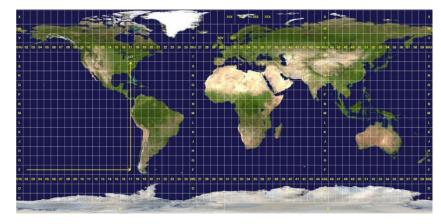


Geodetic coordinate systems such UTM are divided into zones or strips.

For UTM coordinates, the earth is mapped in sixty 6 ° wide zones. Zone 1 is located between 180 ° and 174 ° west of Greenwich. The zones are numbered consecutively to the east. The polar regions are not covered by UTM.

Coordinate and reference systems

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Overview of the UTM zones

Photo credits: https://commons.wikimedia.org/wiki/File:Utm-zones.jpg#/media/File:Utm-zones.jpg

A missing zone or stripe specification may lead to distortions and incorrect transformations!

It is best to use <u>EPSG-codes</u> (page 46) for entering the coordinate system. The website <u>https://www.geoplaner.com/</u> offers a very helpful converter in different coordinate systems. For example, specify a location in your study area. The coordinates are displayed in different coordinate systems. This will allow you to quickly find out in which coordinate system the data is available. Use the connection to online map services (*Shift + Ctrl + O*) to verify that the project coordinate system is correctly selected. The map contents jump to the correct place. If this is not the case, perhaps an offset or the stripe / the zone is wrongly selected.

EPSG-codes

Very often, the coordinate systems that a WMS Server is compatible with, or the coordinate system for the download of geometry data, are identified by the EPSG code. Wherever you can enter coordinate systems in SoundPLAN, you can enter the EPSG code directly with the **EPSG-CODE** button. This saves typing and avoids errors.

Define coordinate syste	m by EPSG code		×
Enter the EPSG code:			
25832			check
Coordinate system deter	ted from the EPSG code		
Coordinate system	ETRS-TMzn Europaweite Transversal Mercator (UTM)		
Reference system	ETRS89 (EU), geozentrisch, GRS80		
Stripe / zone	32		
Used unit	International Meter		
Best for	European continent		
Used in	Multinational System		
		ОК	Cancel

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Coordinate and reference systems

Click on **CHECK**, then the coordinate system underlying the code is evaluated and entered into the corresponding dialog with OK.

The website <u>http://spatialreference.org/ref/epsg/</u> offers a list of EPSG-codes together with its geographical scope.

2

Non-metric geographical coordinate systems, can only be selected in SoundPLAN as the source system for the transformation of geographic data.

Branching into SoundPLAN modules

In the SoundPLAN Manager you have access to all modules of the program.

Select the icon of the program module and click on it to get into:

Geo-Database

Entry of data via digitizer and on screen on top of a scanned bitmap, import of data from older SoundPLAN versions, DXF, AutoCAD and GIS systems. Data are assembled to Geo-Files that can be freely combined to form Situations.

Calculation Core

Calculation on the basis of the data entered in the Geo-Database. Extensive log book functions with error and warning log, graphics control of the calculation, spreadsheet type definition of the calculation to carry out multiple calculations in a row.

Result tables (Documentation)

Table type preparation of the result data from single point calculation and Façade Noise Maps from *one calculation run* with all characteristics of a receiver. Master/detail organization of the data, scalable detail for receivers, sources and the transmission path. Table type presentation on the printer; document manager for easily creating the result documentation as an annex of the investigation survey.

• Spreadsheet

Spreadsheet type presentation of results from single point receivers and Facade Noise Maps. Extra columns can be generated for text and values, additional calculation results can be read into the extra columns, result columns and formulas can be added to do arithmetic with results *from multiple calculations*.

The area table is used to generate and evaluate statistics in accordance to the requirements of the EU directive on environmental noise.

Graphics

Efficient graphics presentation of calculation results in various formats; flexible arrangement of different map types with multiple maps per sheet; templates to define an office standard.

Branching into SoundPLAN modules

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Library

Access to the emission-, absorption-, transmissions- and mitigation library, the definitions of 2D- and 3D-directivity as well as day histograms, wind statistics, pollution component library and the assessment library. Free definition of your own elements in each of the libraries.

Wall Design

Dimensioning of noise protection walls and berms for multiple receivers, minimization of cost of the walls, interactive dimensioning with corrections to the wall form and instant results, 3D solid view of wall and surrounding, wall performance diagram.

• Expert Industry

Detailed analysis of the interaction of sources and receivers, sorted lists of sources, receivers and source contributions. Generation of noise control concepts with cost optimization. Additional detail windows can be added to have different views on the data; 3D solid graphics modeling to see where the sources and receivers are located.

Noise Allotment

The module Noise Allotment is used to calculate emission contingents and additional contingents of industrial sites for land-use plans according to DIN 45691. The module contains a complete documentation of the results.

• BA-Outside

BA Outside calculates which measures at the walls and windows are necessary to keep the resulting R'w or the permissible interior level. The calculation can be executed according to EN 12354 and the German standards 24. BImSchV, DIN 4109, DIN 2719 and 2. Aircraft noise protection order. Measure lists and cost tables allow to quickly arrange the tender documents for noise redevelopment programs.

Window dimensioning

A dimensioning of noise protection windows for simple cases is included in the Spreadsheet: **SPREADSHEET -> WINDOW CLASS -> ADD WINDOW COLUMNS**. This feature contains the dimensioning of the windows for given receivers according to the German standards 24. BImSchV, DIN 4109 and DIN 2719. The restriction is that each calculation point can only be assigned to one room.

Long Straight Road

(EXECUTE -> LONG STRAIGHT ROAD) Rough screening type calculations according to German RLS 90 for road noise to determine the necessary height of noise protection walls and berms.

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Branching into SoundPLAN modules

Hotline support with email and internet

Open the menu entry **HELP** -> **SEND EMAIL** to send an e-mail to the SoundPLAN hotline. If you submit a zipped hotline problem (see page 44), please describe in detail what the nature of the problem is, for example the calculation run, the situation, the graphics sheet that is causing questions. Questions about the functionality of the license, hardlock etc should be accompanied with the file UPDATE.LOG (C:\documents and settings\all users\application data\SoundPLAN\update.log) and the license file BABG*.* file (SoundPLAN installation folder). Having the answers makes the turnaround time of the help line much faster.

Internet updates

Registered customers with guarantee or maintenance can download updates via the internet. Use **HELP -> UPDATES AND DOWNLOADS** to directly access the download page. See also "Upgrading SoundPLAN".

Options -> Settings

Settings		_ 🗆 🔀
Settings Program Distributed Computing System Internet Update Current Project Current Project Emission time slices traffic Graphics Geo-Database Floor Descriptors	Program Path for global settings and templates D-\Eigene Dateien\SoundPLAN Globdata 7.1\ Shared path for global settings D-\Eigene Dateien\SoundPLAN Globdata 7.1\ Path for global fixaries D-\Eigene Dateien\SoundPLAN Globdata 7.1\bbx\	
Standards Standards selection list Run commands	No. of history list entries 10 Driving on right side Yes	teb
	Close	Help

The options provide various pre-settings that are stored globally and edited to meet the requirements of each project.

Path for global settings and templates

When you first call up SoundPLAN you will be asked to enter a path to a folder where the folder "SoundPLAN Globdata xx" will be hosted. In this folder SoundPLAN keeps all data (templates and settings) not bound to a specific project.

Hotline support with email and internet

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Program settings

The **SHARED PATH FOR GLOBAL SETTINGS** determines a folder, for example on the server, where the color palette and the global object types as well as templates for general plots, results tables, spreadsheets and graphics sheets are stored. The files are **not** automatically stored to this folder, but for organizing reasons the user himself must copy them. This procedure is necessary in order to solve questions such as "How should SoundPLAN react if the network is not available?" or "Who has priority when two people want to access files in this directory?"

Therefore, SoundPLAN still uses a fix folder for the global settings (..\My Documents\SoundPLAN x.x\Globdata). To adjust the data, right click in the tree view on the left side on **program** -> COPY THE CONTENTS OF THE GLOBAL FOLDER TO GLOBDATA, or COPY THE CONTENTS OF GLOBDATA TO THE GLOBAL FOLDER.

The **PATH FOR GLOBAL LIBRARIES** defines where the global libraries are stored. If the global path is not accessible, you will not be able to open the global libraries.

The **NUMBER OF RECENTLY OPENED FILES** defines the number of files displayed in the history list of the menu file for all parts of SoundPLAN.

For standards which distinguish between ascending and descending **DRIVING ON THE RIGHT SIDE YES / NO** takes the position of the emission bands into account. In the animation track of the 3D graphics this setting also determines whether the displacement of the viewer from the axis is added to the left or to the right.

Settings for Distributed Computing

Distributed computing (DC) uses other PCs in a network, not currently in use for calculations. One PC, called the workstation PC or client PC controls the allocation of calculation jobs to the server PCs. In order to make a PC a server PC, at least a demo version of SoundPLAN and a control program, DC control, must be installed.

The network port for the workstation PC, the server PC and DC control can be changed here if necessary. The ports must be identical for all PCs used for distributed computing.

For server PCs, data is stored during the calculation, which is deleted after the distributed calculation is finished. Because the server PC cannot calculate if there is not enough hard disk space available, it is possible to change the **PATH FOR DATA FOR DISTRIBUTED COMPUTING**.

System settings

Some computers have hardware components that do not fully support the 3D-Graphics and the bitmap processing. In order to run these modules satisfactorily, you can change some of the system settings.

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Options -> Settings

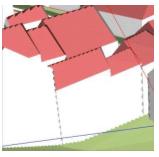
If parts of the bitmap are missing, the size of the original bitmap probably exceeded the max size. You can define the max size in **MAX BITMAP SIZE IN PIXEL**.

2

If geometry bitmaps are not printed or are printed incorrectly, the printer driver might not support the more effective standard routine for bitmap output. In this case, switch **USE ALTERNATIVE PRINT ROUTINE FOR BITMAPS** to **YES**.

The **NEAREST CLIP PLANE** is also relevant for 3D-Graphics. Even good graphics cards often have difficulties displaying the nearest clip plane, which is 0.1m for the 3D-Graphics. This leads to incorrect display of areas.

Set the nearest clip plane to 5 m for example and check the result in the 3D-Graphics.



Example Clip plane 0.1 m



Example: Clip plane 5 m

You can also change the nearest clip plane for individual scenes in the 3D graphics itself (GEOMETRY VIEWPORT -> GEOMETRY PARAMETERS when you edit a 3D model).

STANDARD PRINTER FOR THE GRAPHICS: Often a different printer than the Windows standard printer is used for the graphical printouts. Therefore, you can select another printer installed on your system which is automatically selected for printouts in the graphics. The Windows standard printer is still used for the table printouts.

DEFAULT FONT: Select a font that is used as default for new tables and graphics sheets. When using templates, the font is taken from the template.

Default font name for tables and graphics	
Gill Sans MT	~

Project settings: Global and current project

Define project settings as needed in most of your projects. When creating new projects, SoundPLAN automatically uses global pre-settings for the new project. You can change these settings for the current project.

To transfer settings from one project to another or to the global settings, right click on the tree view to the left, select **LOAD SETTINGS**, select the project6.sp from the desired project and press OK.

Options -> Settings

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Hint: The settings of the current project are also accessible from the Geo-Database, the Calculation and the Graphics via **OPTIONS** -> **PRESETTINGS**. Each of the programs leads you to the settings in the branch which is relevant for this part of SoundPLAN. But you can also open every other branch in the settings, for example to create a new graphics object type in the Geo-Database. The changes take immediately effect (only the Geo-Database must be closed and reopened if you change standards for the current project). Open these nodes in the calculation kernel with **OPTIONS** -> **STANDARDS** and **OPTIONS** -> **CALCULATION TYPE SETTINGS**.

Definition object number

The format for the object numbers of receivers / buildings, industrial sources and photo locations is defined separately in order to meet the requirements of different numbering systems. See "Object Numbering" for details.

Emission time slices traffic noise

Define how the traffic data shall be distributed to the different time slices. For three time slices, for example

Day	6 am to 7 pm	(6-19)
Evening	7 pm to 10 pm	(19-22)
Night	10 pm to 6 am	(22-6)

If you only need the assessment levels for day and night, select **2 TIME SLICES** and determine the hours for each time slice. The time slices must not overlap and must include the 24 hours of a day.

Graphics settings

The **GRAPHICS-SETTINGS** provide the <u>object types</u> (page 542). You can edit the global object types directly.

For the length scale you can also select 'feet'.

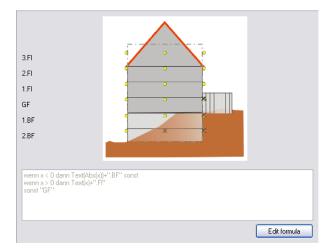
Presettings Geo-Database

It is possible to change the standard properties of some Geo-Database objects in the settings (e.g. the height of the first receiver above ground floor, the height of the floors, the distance of a receiver from the facade and the alignment of road and house number.

Floor descriptor

The correct formatting for the floors in the different countries can be adapted.

Options -> Settings

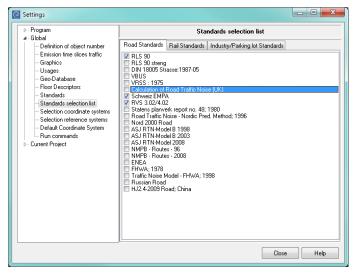


2

Change the formula if necessary, you will immediately see the result. The selected floor descriptor will be used automatically in all parts of the program.

Calculation standards selection

SoundPLAN supports so many standards that a selection list with all implemented standards would be cluttered. The enabled standards are selected according to your country settings by default. You can activate other standards or deactivate the standards you do not want to have included in the normal standard selection. The standards can only be deactivated in the global part of the settings under **STANDARD SELECTION LIST**. For new projects, only the enabled standards are visible, but if others are needed in a particular project, the list can be extended under the current project section.



Options -> Settings

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Presettings for calculation standards

The **STANDARDS** are set here globally and for the current project. Click on the standards in the SoundPLAN Manager to directly access the branch standards in the settings (the mouse cursor is displayed as a hand).



Presettings of coordinate and reference systems

To transform coordinates between different coordinate systems and when working with Google Earth it is paramount to know which coordinate system (Gauß-Krüger, UTM ...) and in which reference system (DHDN90, ETRS89 ...) the project data are present. In addition, the data can also contain an offset in x and y (when, for example, the first 2 digits in a Gauss-Krüger coordinate system are missing, or with the UTM32).

Most often the transformation automatically recognizes in which stripe / zone the coordinates are located (0 in the field stripe). If a coordinate system which refers all coordinates to one stripe is used the reference stripe must be defined.

Example: UTM 32 refers all coordinates in Denmark to the stripe 32. Copenhagen however is within the stripe 33. If you move the Google Earth camera to the cursor position, the viewport looks correct. As soon as you draw a bitmap of this position the viewport is completely displaced from the geo data, because the automatic transformation locates the coordinates in stripe 33. In this case it is therefore necessary to explicitly enter the stripe / zone number to which the coordinates refer (here 32).

SoundPLAN uses the Tool GeoDLL from Killetsoft for the coordinate transformations (www.killetsoft.de).

As the GeoDLL contains many different systems (530 coordinate systems and 198 reference systems), please open the SoundPLAN Manager and select the systems that should be presented when the project coordinate system is defined (located under OPTIONS -> SETTINGS in the global settings SELECTION COORDINATE SYSTEMS and SELECTION REFERENCE SYSTEMS).

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Options -> Settings

⊳ Program ⊿ : Global	Selection coordinate systems
Laobal Definition of object number Emission time slices traffic Graphics Usages Geo-Database Floor Descriptors Standards selection list Selection coordinate systems Selection reference systems Default Coordinate System Run commands Current Project	US-SPCS 1983 (5103) Hawaii 3 Transv. Mercator-Koord. US-SPCS 1983 (5104) Hawaii 4 Transv. Mercator-Koord. US-SPCS 1983 (5105) Hawaii 5 Transv. Mercator-Koord. US-SPCS 1983 (500) Puerto Rico Lambert-Koordinaten US-SPCS 1983 (500) Deleto Rico Lambert-Koordinaten US-SPCS 1983 (500) Deleto Rico Lambert-Koordinaten US-SPCS 1983 (900) Deleware Transv. Mercator-Koord. US-SPCS 1983 (901) Florida 0st Transv. Mercator-Koord. US-SPCS 1983 (902) Florida Vest Mercator-Koord. US-SPCS 1983 (903) Florida Nord Lambert-Koordinaten UTM-Koordinaten (nördliche Hemisphäre) ✓ UTM Koordinaten (südliche Hemisphäre) ✓ UTM-Koordinaten (südliche Hemi

2

Unfortunately, the developers do not have proper knowledge of the coordinateand reference systems used country by country. The language dependent system settings include a presetting with worldwide used coordinate systems. You can get access to the list of the worldwide used coordinate systems via the blue question mark when assigning a project coordinate system. Additional information can be found here: <u>http://www.killetsoft.de/t_0901_e.htm</u>. Use *Ctrl+F* to search for a specific coordinate system.

Default project coordinate system: In the global branch you can define a default project coordinate system that will automatically be activated for new projects. This is very helpful if your work is mostly regional with always using the same basic coordinate system.

Presettings calculation type

Use **CALCULATION TYPE** to predefine standard settings that the calculation kernel will use when this calculation type is used. Set the definitions for each calculation type in the tab index card "settings" in the run properties and set the parameters for the calculation type itself, such as the grid size or the calculation height above ground for a grid noise map calculation.

Object numbering

SoundPLAN provides three different numbering systems in order to administer the objects and to clearly assign them in the tables and graphics:

Object ID - is a unique key, automatically assigned to the objects during the input or import in the Geo-Database. It appears in the status bar. The ID is displayed in the calculation log book if error messages occur (e.g. road properties of road #2333 are missing) and it can be used to find an object in the Geo-Database.

Serial number - is automatically assigned to each receiver during the calculation according to the sequence of the data. Since the serial number is assigned automatically, it might change after a recalculation.

Object numbering

Page • 55/793

Object number - the user assigns the object number to receivers, buildings and noise sources in the Geo-Database. The object number doesn't change - unless you consciously change the number.

The object number is not a value but a text. This has the advantage that the object number is not sorted alpha-numerically but via a freely definable sort sequence. The object number is incremented automatically

Changing the format string and sort order allows you to accomplish many tasks. For example:

- Mark free field receivers separately, but sort continuously.
- Add additional receivers or sources later, without changing the original sort • order.
- Insert receivers or sources at a defined location in the table.
- Use specified object numbers, e.g. for different parts of a project.

Input and display of the object number

Define the format string and an additional sequence for the sort order in the settings for buildings / receivers, sources and photo points. During data entry in the Geo-Database, enter the number as you want it to appear in the output.



Use the button DEFINE NEW BASIC NUMBER to define the number just entered as the new basic number, from which the number for additional objects is automatically incremented.

👋 Photo prop	erties	
<u>N</u> ame:	Building Old Kent Road	
Obj. No.:	1-7	

If the defined format string contains letters and/or separation signs, the object number might be A100 or 11.1, for example. If the entered object number doesn't correspond to the format string, a message comes up showing the defined format string.



Use TOOLS -> OBJECT NUMBER to assign the number for receivers, buildings or sources alphabetically according to the object name. If no objects are marked, the automatic numbering is executed for all objects in the situation, otherwise it is only executed for the marked objects.



Object numbering

Placeholders for the format string

The entry of the format string uses placeholders for letters and numbers in the SoundPLAN Manager in **OPTIONS -> SETTINGS**:

0,9,1 as a place holder for numbers. 0 fills the numbers from the right to the left and is ignored if no number is entered. 9 fills the numbers from the left to the right and expects that a number is entered. 1 defines which number block is incremented if more than one number block is present in the format string.

A,a as place holder for characters. The characters in the format string are displayed the way the user entered them (small or capital letters). In character blocks, any characters, spaces and special characters except separation marks and numbers are allowed. A format string may contain several character blocks.

.,; - as separation marks. Use separation marks to separate character blocks and number blocks. Valid separation marks are , (comma) . (point) ; (semicolon) and - (minus).

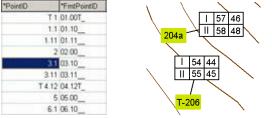
🐺 Settings		
Program Global Current Project	Definition of object r	number
Definition of object number DEN Time Slices Graphics Usages Geo-Database Standards	Receiver + Building Format String Receiver sort string Source format string Source sort string	AA0000.0 56123478 0000 1234
- Enabled Standards - Run commands	Photo Format String Photo Sort String	0a00 3412

Definition of the numbering in the settings

Hint: If you want to change the format for the object number while you are working on a project, call **OPTIONS** -> **PRE-SETTINGS** in the Geo-Database and change the format string or the sort order for the current project. The changes take effect as soon as you close the settings and return to the Geo-Database.

Display of the object number

The object number is written to the result file during the calculation and entered in to the table output in the results tables and the spreadsheets. For the graphical output, you can use the object number as a reference in the file type "level tables".



Object number and format string in the tables and as a reference in the graphical output

Object numbering

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For the result tables, call the sort order via the right mouse button and select the sort column "Format string Obj.-No.".

For the spreadsheet, click right on the column header - > sort and select the column "Format string Obj.-No." as the first sort criterion and if necessary, the floor as the second sort criterion.

Examples for format string and sort order

Add additional receivers or sources to a later stage of a project without changing the original sort order.

Format string	0	0	0		0
Sort order	1	2	3	4	5

Entry in the Geo-Database = Display in tables /graphics	stored format for the sort order
1	001.0
1.1	001.1
1.2	001.2
2	002.0
2.1	002.1

The original format string in a project was 00 ...

Entry in the Geo-Database = Display in tables /graphics	stored format for the sort order
1	01
11	11

... now you want to add more receivers and you need to use three-digit numbers. Supplement the format string to 000.0.

The display for existing receivers will not change, only the stored format changes:

Entry in the Geo-Database = Display in tables /graphics	stored format for the sort order
1	001.0
1.1	001.1
2	002.0
11	011.0

Object numbering

In addition, you can use characters to identify receivers and sources, (for example for free field receivers).

Because the objects should be sorted according to the actual number, the sort order becomes important.

Format string	А	А	0	0	0	0	А
Sort order	5	6	1	2	3	4	7

Entry in the Geo-Database = Display in tables /graphics	stored format for the sort order
Τ1	0001T_
2	0004
G 3	0003G _
5	0005
5a	0005a
T-5	005T

The sort order defines the order in which the characters should be considered. Assign a number to each component of the format string: 1 for the first sort order, 2 for the second sort order and so on.

Buildings are grouped to different sections. The object number shall include the section description which may include a letter and if necessary, a number, and a consecutive number for each building.

Format string	а	0	-	0	0	0	1
Sort order	1	2	7	3	4	5	6

Entry in the Geo-Database = Display in tables /graphics	stored format for the sort order
A-1	A00001-
B1-11	B10011-
B1-12	B10012-
C-15	C00015-
D2-1245	D21245-

Object numbering

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3 Geo-Database

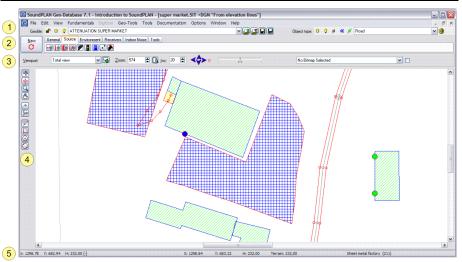
3

All geometry data and their properties (building height, road width, sound power level, emission level ...) are entered or imported into the Geo-Database and prepared for calculation.

Quick Reference: Data Entry

In the Geo-Database all geometry data and their properties (building height, road width, sound power level, emission level ...) are entered or imported and prepared for the calculation.

Sections of the graphical user interface



Geo-Database - graphics screen

This picture gives you a first overview of the elements found on screen:

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(1) The top part of the screen shows on the left-hand side the current Geo-File, in which all new data will be stored, together with the settings for the display of Geo-Files (e.g. hidden or read only) and the Geo-File administration (e.g. save Geo-File or load additional Geo-Files). On the right-hand side, you see the currently selected object type (e.g. road, railway, building, receiver) and the settings for the display of the object types (e.g. highlighted or hidden).

(2) Below you see the grouped object selection icons (you can also opt to see all object types at the same time with **OPTIONS -> OBJECT SELECTION 2)**.

(3) Below follow the controls for the selection of view ports to quickly and directed zoom into parts of the investigation area. Next to it are the functions for scaling and rotating the map (in 90°-steps or continuous). Geo-referenced bitmaps are selected for display with the selection list on the right. 4 control arrows help to fine tune the fit between the bitmap and the other data. View ports and rotations are ignored when bitmaps are loaded into the background.

(4) On the left side in the tool box you can see icons for different modes of input (edit mode, digitizing mode, zoom mode and move mode). Below are the buttons for the right-angle mode, for coordinates with relative elevations, circle and rectangle construction tools and an additional mode to show the line segment length.

(5) On the left side of the status bar on the bottom of the screen you see the world coordinate of the cursor position and the elevation of a loaded digital ground model. From the second coordinate the distance between the last coordinate and the new cursor position is displayed. When you move the cursor to an already digitized coordinate, the middle of the status bar will present the coordinate and elevation of this point and the right part will show the name of the object and the object ID.

Principle steps of data entry

Elevation model: A consistent 3-dimensional elevation model is paramount for noise propagation calculations (with the exception of very simple models where all elevations can be placed on 0.0-elevation). From the available elevations the Geo-Database can generate a continuously triangulated ground model (DGM) that functions as the base for many processing steps in the generation and refinement of the entire noise model. The elevation edges from the DGM are also used to determine the ground effect and screening.

Elevation data present on an importable file (for example from an aircraft flyover) can be imported and filtered via the import interface "ASCII elevation data". Often the importable elevation data is present in an equivalent resolution of meter by meter, thus putting a huge burden on the calculation program. With the filtering it is possible to enter a maximum deviation from the original DGM and have the triangulation thinned out in a fashion that guarantees that the new triangulation does not exceed the set tolerance. "Filtering Elevations" most of the time reduces

Quick Reference: Data Entry

the DGM to 10% or less of its original size, thus speeding up data loading and calculation time.

Initialize the background graphics: Load a bitmap background graphic and calibrate it via pass-coordinates (generate an internal coordinate transformation (geo-reference) to project the pixel coordinate system to the world coordinate system). If you can find a geo-referenced bitmap, this step is obsolete. After creating the geo-reference once, each time you open the bitmap, it will be in its correct place. You can also get the geo-referenced bitmap directly from OpenStreetMap, Google Maps or Google Earth; SoundPLAN has direct links to the software and services.

Enter objects: Click on the object type icon of choice and select the desired Geo-File, click on the canvas to generate the first coordinate of the new object. Check the objects elevation, enter the objects properties, and digitize additional coordinates. To close the entry of a new object, click on the symbol **C**, double click or hit F2. As the properties for a new object are taken from the settings of the previous one, it is advisable to digitize multiple objects of the same type in sequence.

Import objects: Object data available in digital format (on file) can be imported using one of the many import interfaces.

DXF data are imported as points, lines, areas, and texts in generic, raw format and then can be assigned to a SoundPLAN object type.

With the ESRI ArcView data (shape files) each data file is a small database that fits only to the appropriate SoundPLAN object type (CityGML fits only to buildings). The shape database can contain any number of properties, some may not even have a SoundPLAN equivalent, therefore in the process in importing the data you need to reference the shape file properties to the SoundPLAN equivalent.

Other import data contain a data model in a format where the importation is already fixed and SoundPLAN therefore knows how to interpret the data and assign the correct properties and objects from the import file to objects inside SoundPLAN. An example for this is the QSI data interface and data from OpenStreetMap.

Edit objects: The data objects digitized or imported can be further edited and refined in the Geo-Database. For this purpose, the Geo-Database supplies a multitude of efficient Geo-Tools. In the Property Explorer the properties of all objects of a single type are presented in spreadsheet form. Like in all spreadsheets it is possible to visualize/hide columns, to assign values to columns or marked rows of columns and to use user defined formulas to set the values. If additional properties are available in ASCII- or dbf-files, they can be incorporated into existing objects.

In the SoundPLAN Library additional data is contained, for example emission spectra, reflective properties or time history of sources. In order to enter these

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data only once and being able to apply them to multiple data objects, the data are hosted in the library and only referenced to the objects on the Geo-Database.

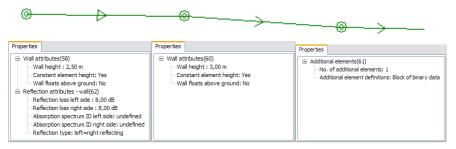
Object coordinates

The object coordinates present valuable hints about the properties and data entry direction of the object. As the screen can become very cluttered if these options are enabled for all objects all of the time, you can toggle this function by clicking on the button \mathcal{N} (activate) \mathscr{I} (deactivate) for each object type.

	Coordinate without any properties
	Coordinate with a property defined from this coordinate on
⊚₽—⊶	Coordinate with an arrow marking the data entry direction (between the first and second coordinate of an object)
* *** *	Direction arrow between the coordinates
- 0-0	The last coordinate of an object is presented in red color (as long as the object is not closed). If the object is already closed, the last point has the same color as previous points.
<u>@₽-•>@</u> -	Objects with properties changing at multiple points. New properties are valid from the current coordinate on. (Variant objects)

Variant objects

For several object types it is possible that the properties are changing from coordinate to coordinate, for example the height of a noise protection wall or traffic data on a road or the speed of trains on a railway line. The new object definition is valid until it is replaced by a new definition.



The first coordinate of an object always saves all properties of the object; properties are always preset with default settings. At further coordinates, the properties of the object may change, but only the properties that change are saved at this coordinate so all previously defined properties are keeping their validity

In the example above the second coordinate has a change of the height of a noise protection wall from 2.5 meters to 3 meters. At the third coordinate a cantilevered

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wall element is added. If you want to alter the reflective properties of the wall, you only need to do so at the first coordinate, the modification is passed on to all successive elements.

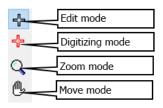
All properties defined at a specific coordinate can be visualized by clicking on the symbol "tree view" in the object dialog.

With the double arrow move directly from one coordinate with defined properties to the next/last one.

Left, right mouse button and the data entry cursors

In the Geo-Database the mouse is used for numerous functions, for this the left and the right mouse button have -depending on the cursor mode- different functions.

Selection of the cursor modes:



Edit mode

In the edit mode you can enter new objects and also edit existing objects. If the cursor is a crosshair type, the **left mouse button** is the coordinate entry button, the **right mouse button** opens a menu with editing commands often used.

As soon as the cursor gets in range of a coordinate, the appearance of the cursor changes from a crosshair to an arrow. The left mouse button in the arrow mode opens the properties and the coordinates. For objects without properties, the coordinate list and is displayed.

Object types without properties are general points, general lines, general areas, spot elevations, elevation lines and calculation areas.

Object types with properties are for example roads, railways, industrial sources, buildings, receivers.

Left click to get the object dialog, right click to get to additional editing functions.

In order to modify objects, they often need to be selected (see below). Selected objects can be recognized by the black squares on the coordinates, secondly by the pink diamond in the center of gravity of the object.

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As soon as you home in to a selected object and get into the range of a coordinate, the cursor changes into a movement arrow. Keeping the left mouse button pressed enables you to move a single coordinate. If you home in on the pink diamond, you can move the entire object.

Synopsis of the editing modes:

Enter coordinates on: open often used editing functions for selected heel: zoom geometry
heel: zoom geometry
with the left mouse button pressed: Create a line,
e with the right mouse button pressed: Select all covered by the move
Open the property dialogue
n: Actions for single objects
: Move individual coordinates (by grabbing the black he entire object (by grabbing the pink diamond)
tton: Duplicate selected objects (pink diamond)
n: Rotate the entire object (pink diamond)
l: zoom in and out
2

Digitizing mode

The digitizing mode helps with entering new coordinates, especially when there are a lot of coordinates already present. The cursor changes into a cross with a dot in the middle and a circle around it.

In the digitizing mode you enter new coordinates by **left clicking**, with the **right mouse button** you capture coordinates that are already present. This way it is very easy to connect one object to another one.

Synopsis of the digitizing mode:

¢	Left mouse button: digitize coordinates Right mouse button: capture existing coordinates Scroll mouse wheel: zoom geometry Pull open a frame with the left mouse button pressed: generate line, rectangle or circle Pull open a frame with right mouse button pressed: select objects in an
	area
Q	Scroll mouse wheel: zoom in and out

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Quick Reference: Data Entry



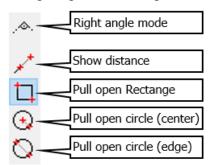
Move with mouse wheel pressed: pan geometry

Elevations

By default, the elevations are displayed in the object dialog as soon as the object is completely digitized. If a DGM is loaded in a Situation, the absolute elevation at each coordinate is extrapolated from the triangulated mesh. In the menu "Options" you can decide whether the object dialog with the elevations should be opened at every coordinate or at the first point.

Tool bar

Below the controls for the data entry modes are some tools that can be activated in the digitizing and the editing mode:



For the four lower tools keep the left mouse button pressed. A dialog will open where you can enter numeric values for length, width or radius.

If for example you want to enter a roundabout, click on the object type for road, select the tool for circle and pull open the roundabout.

Select objects and coordinates

To process a command, SoundPLAN needs to know for which object the command was meant. For this purpose, objects need to be selected. There are different objectives and different methods for selecting objects, some can be used only by themselves; others can be combined.

Select all objects visible on screen (setting in the menu "View" ("current Geo-File" or "current object type") are processed): *Ctrl+A* (EDIT -> SELECT ALL OBJECTS).

Select all objects in an area: Pull a frame with the **right mouse button** pressed from the upper left corner to the lower right-hand corner of the area to be selected. All objects that have at least one coordinate in this area are being selected. To select additional areas, keep the *Ctrl-key* pressed.

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Select a single object: Either pull a frame around this single object or home in on the object and use the right-hand function ->**SELECT OBJECT** or keep the Alt-key pressed and click on the point, line or area. For area type objects the corresponding object type in the symbol bar must be active. To select additional objects, keep the *Ctrl-key* pressed.

Clear selection: Pull open a frame with the right mouse button pressed, this time moving from the lower right-hand corner to the upper left-hand corner, use the shortcut *Ctrl+Q* or **EDIT -> CLEAR SELECTION**.

Clear selection of single objects: keep the *Ctrl-key* pressed, home in on the selected object, right click and use the function **SELECT OBJECT** or keep *Ctrl* **+ ***Alt-key* pressed and click on a point, line or area. For area type objects the object type must be selected in the object selection bar.

Connect lines, fill gaps, split lines

Other software products often manage polylines as lines with two coordinates. Shape files for example (ArcView, QSI) have one property set per object; therefore, the objects are split at each change in properties. To benefit of the advantages of variant objects they are connected to polylines. Duplicated property records if, for example, the "average daily traffic (ADT)" of a road changes but not the speed, the properties that are not necessary are removed.

Connect lines

Use the "Geo Tools -> connect lines". The lines can only be connected when the last coordinate of one line is identical (x, y and z) to the first coordinate of the next line.

How to recognize double, identical coordinates?

When you select the lines you want to connect, the selection marks of the squares are canceling each other, thus the coordinate appears not to be selected:



Each of the lines at the first coordinate has a double circle and between the first and second coordinate an arrow to mark the data entry direction. The double circle indicates that properties have been assigned to the object at this coordinate.

If the lines are present like in the picture above, you can connect the lines with the geo-tool "connect lines". If the operation was successful, all selection squares of the entire line will be visible and the direction arrow from the second line vanished:



It may also be that the lines in the original software have been connected with small circles. In this case the coordinates are not identical. Using the geo-tool

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Quick Reference: Data Entry

Fill gaps

Unfortunately, often the data are not available with gaps of less than 10 cm, in this case you must manually modify the data.

- If the gap is small and the deviation of the moved coordinates is not critical: Select the first object and move the last coordinate to the first point of the second object.
- Extend the first object with an additional coordinate. The location of the original coordinates is not modified:

Right click on the first object and select the command "Activate object". The last coordinate now will be presented as a red circle. In case the red circle is at the wrong end of the line, use the right mouse button function -> "change input direction".

Now right click on the first coordinate of the object you want to connect to and select the command "capture coordinate".

• Digitize a new object in the gap, the original coordinates remain intact and unchanged:

Activate the digitizing mode. Right click on the last coordinate of the first object and then right click on the first coordinate of the second object. Close the digitizing with F2 or the Symbol "Finish".

Split lines

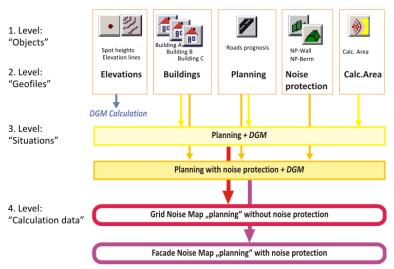
Click on the coordinate where you want to cut the line into two sections and with the right mouse button select the function "Split object".

In case the object has properties defined, they are automatically assigned to both lines, this manifests itself with the double circle in the beginning of the second object.

Structuring of the data

All objects entered in the Geo-Database are stored in Geo-Files and can be managed in Situations. The Geo-Files are comparable to the layers in AutoCAD. The Geo-Files can be used to group objects in accordance to a user defined logic.

The Situations are acting as a folder that can contain any number of different Geo-Files; the same Geo-File can be part of multiple different Situations. This organization concept has the advantage that corrections and adjustments made in the data of one Geo-File are automatically present in other Situations containing the corrected Geo-File. If for example the sound power for a source is modified for a source that is used in multiple calculations, the source needs to be adjusted only once.



The example above shows the principle possibilities of structuring a small project.

The objects "spot elevations" and "elevation lines" were saved to form the Geo-File "elevations". This Geo-File is used to generate the <u>Digital Ground Model</u> from within the Geo-Database. Once the DGM is calculated, it is assigned to all Situations.

All buildings, the road, the noise protection walls and the calculation area are saved in additional Geo-Files. The "road" and the "building" Geo-Files are assigned to both Situations the "noise protection" and the "calc_area" Geo-Files are only referenced in one of the Situations.

The Situations are assigned to the calculations, if desired additional singular Geo-Files can be added, for example to include a calculation area that was never part of a Situation.

The data structures in the background

Geo-Files (*.geo) contain the coordinates and elevation information and all properties of the objects.

Situations (*.sit) are a list of all Geo-Files included in the Situation. The Geo-Files are not stored physically in the Situation, only references are stored here. This has the big advantage that as no redundant data is generated, it is not necessary to edit the same data in each Situation where they occur. If a Geo-File in a Situation is renamed, the name will automatically be updated in all other Situations where this Geo-File is referenced.

When a Situation is opened, a database copy of the properties of the included objects (TmpWorks.*) is generated. During the editing of data, you actually work

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Quick Reference: Data Entry

3

with the copy of the data until you save the Situation. When the data are stored, the temporary copy is replaced and all properties are stored again in the Geo-Files. The last version of the Geo-Files or the Situation is always saved as a backup copy under the normal names with the extensions *.~si or *.~ge. Aside from the "undo" function this feature of backup copies of the data is increasing the data security.

The Situation Manager - Situations and Geo-Files

With the first opening of the Geo-Database in a new project, the program automatically generates a new Situation (Situation1.sit) with a Geo-File (Geo-File1.geo) so that you can start with entering or importing data right away. When you leave the Geo-Database, you are asked to rename the Situation and the Geo-File. The next time you open the Geo-Database the Situation Manager is displayed to select a Situation.

New Situation / Edit Situations

C Situation Manager	
Situation Tools Help	
D 🖻 🗙 🔳	
⊕ 30 2 Fload Analysis ⊕ 30 3 Road Prognosis ⊕ 30 4 Road Prognosis ⊕ 30 5 Road Prognosis ⊕ 30 7 Road Prognosis ⊕ 30 10 20 Deta ⊕ 31 2 Poteol station ⊕ 39 - All Data	Road noise Prognosis with new Itallic data and noise protection Image: constraint of the constraint of the constraint of the corresponding Geo-Files at 21.06.2011 16:55:50 ? • pictore might be invalid
	OK Cancel Help

Call FILE -> OPEN SITUATION. On the screen you see the following dialog:

Situation manager

On the left side you see all Situations of the project, on the right side there are the description and graphics preview of the highlighted Situation. It might be that the preview doesn't match to the Geo-Files in the Situation. In this case, yellow question marks are added to call your attention.

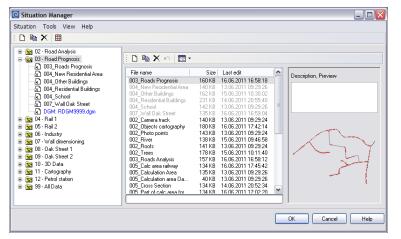
Situations like Geo-Files can be duplicated, renamed or deleted. Execute the functions via the symbol icons the menu **SITUATION** or the right mouse button.

NEW generates a new empty Situation which you need to name first and then assign Geo-Files (existing ones or new ones).

The Situation Manager - Situations and Geo-Files

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As soon as you click on the + or triangle symbol, the display changes. Instead of the Situation information you now see the Geo-Files contained in the Situation. In the middle section of the box all Geo-Files of the project are displayed, on the right side is a description and the preview graphics.



Geo-Files contained in the Situation are displayed in gray, once they are assigned to the Situation, they cannot be assigned a second time to the same Situation. In case you still want to assign the file again, you need to duplicate the file first and then assign it and modify it.

You can jointly move the assignment of Geo-Files to a Situation. To select adjoining Geo-Files press the shift key and left click on the first and last Geo-File. Single Geo-Files are selected with Ctrl and left click.

Open the selected Situation with a double click on the Situation or the \mathbf{OK} icon.

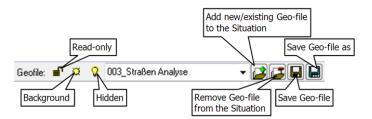
Hint: If you are working on a tile project, you can distribute ASCII files or Shapefiles in the Situation Manager to different Geo-Files (TOOLS -> IMPORT ASCII, TOOLS -> IMPORT ESRI SHAPEFILE). See Import data in tiles (page 651).

Managing Geo-Files

In the Situation you work on in the Geo-Database user interface you can generate and activate additional Geo-Files and remove the Geo-Files from the Situation, save Geo-Files and save them under a new name. When you remove a Geo-File from the Situation it is always the current Geo-File shown in the Geo-File selection list. In case you made changes to the Geo-File you are removing, you will be asked if you want to store the data.

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The Situation Manager - Situations and Geo-Files



For details on the three Geo-File display options please read Geo-File options (page 90).

Click on the symbol ADD GEO-FILE next to the Geo-File selection list to request a new Geo-File or to activate an existing Geo-File and open it for editing in the current Situation.

💽 Geofile			
File Edit View			
D 🖻 🗙 🗠 🎫 -			
File name	Size Last edit		Description, Preview
005_Receivers general	140 KB 16.06.2011 16:58:46	6 .	vescription, riteview
005_Receivers Oak Street	136 KB 16.06.2011 16:58:50		
005_Receivers petrol station	137 KB 13.06.2011 09:33:32 68 KB 16.06.2011 16:58:56		
005_Single Receiver 006_Railway	155 KB 13.06.2011 09:29:26	-	
000_naiway 007 Berm at railway	139 KB 15.06.2011 10:30:02		
007 NP wall rail	135 KB 16.06.2011 16:58:32		\times 42 $ M$
007_Wall base line Oak Street	40 KB 16.06.2011 16:59:00		
008 Terrain elevation	6.571 KB 21.06.2011 16:54:42	2	
009_Industrial Sources	140 KB 16.06.2011 16:59:08		
009_Petrol station	173 KB 13.06.2011 11:41:34		
011_Area Usages	143 KB 16.06.2011 16:58:38		
014_Ground effects	137 KB 13.06.2011 11:44:06	6 💌 🗌	
ι			
		ОК	Cancel Help

Geo-File Selection

Only Geo-Files not already open in the existing Situation are presented. When all Geo-Files of your project are activated in the open Situation, the selection list will be empty. Click **NEW** to generate a new Geo-File.



In the window on the left side you can select whether you want to see just the file name or with details enabled the information with date and time when the file was edited last. On the right side the description and a preview picture of the Geo-File are presented.

The following functions are available either with the menu FILE, the right mouse button or the symbol icons.

Ľ	New
Ē	Duplicate
	Rename
×	Delete

The Situation Manager - Situations and Geo-Files

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You can select multiple adjacent Geo-Files by using the shift + left click or you can select single files with Ctrl + left click. In addition, you can activate all Geo-Files (EDIT -> SELECT ALL OBJECTS) or invert the selection (EDIT -> INVERT SELECTION).

With OK or a double click on the Geo-File you get back into the data editing mode.

View filters for Geo-Files

Especially in huge projects containing a multitude of Geo-Files, the Geo-File list may become so overcrowded that it is cumbersome to navigate. For this case the program allows to filter the Geo-Files contained in a project.

Filter

As a filter you can either show all files that contain the filter keyword in the file name or you use the file description to host the searchable keywords. If you filter via the file name the filter text "building" would find all Geo-Files that have "building" in their file name. If you filter via the description **M**, using e.g. "variant 1"as a key word finds all Geo-Files relevant for variant 1

Click 🕅 to terminate the filter definition and to view all Geo-Files again.

Enter Objects

The object coordinates are entered with the left mouse button. The elevation and the object properties are defined in the object dialog. Information on the properties of each of the objects is described in chapter <u>"Objects and their properties</u> (page 183)".

To enter the data first click on the object type icon on the object type bar or select the object type from the object list.

General Source	Environment	Receivers	Indoor Noise	Tools
	35.	2		

There are two display options for the object type bar. Select either **OBJECT SELECTION: GROUPED** or **OBJECT SELECTION: ALL OBJECTS** from the menu **OPTIONS**.

Line type and area type objects are finished with a double click, F2 or the symbol

The Object Dialog

The object dialog contains all information relating to an object. The sections "properties" and "geometry" can optionally be fold in or out.

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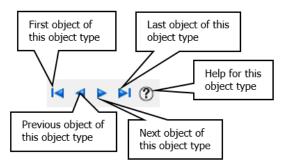
Enter Objects

	Kingsland	Road					•			?
Geo-File:	003_Road	ls Analysis					~			
Properties										
Section:					D: 0		Gradient: -0,1 (% Driving on right s			
General Emissi	on ''RLS-90'	Cross-sec	tion Bridge	9						
Group:	Inner ci	ty roads						~		4
Emission "RLS-	90''									
calculated										
			(10.00)	(00.01.)						
Levels			e(18-22h)							
[dB(A)]		69,89	69,23	65,29						
101 A 1 1 1										
Kilometer indica Kilometer index	····	000		ending	~					
		000		ending rence axis	×					
Kilometer index										
Kilometer index calculated	0,00									
Kilometer index calculated Cross-section	0,00									
Kilometer index calculated Cross-section	0,00									
Kilometer index calculated Cross-section	0,00									
Kilometer index calculated Cross-section 3,25/3,25 (RQ	0,00									
Kilometer index calculated Cross-section 3,25/3,25 (RQ Geometry	9,5)						_			
Kilometer index calculated Cross-section 3,25/3,25 (RQ Geometry	9,5)					~	Segment lengt	1 [m]	37,*	4
Kilometer index calculated Cross-section 3,25/3,25 (RQ Geometry Height definition X [m]	9,5)	bsolute	Refe	rence axis		^	Segment length Total length [m		37,-	
Kilometer index calculated Cross-section 3,25/3,25 (RQ Geometry Height definition X [m > 1 358	9,5)	bsolute Y [m]	Refe Habs [m]	rence axis Hrel [m]		^				

Example: Object dialog road

The upper section shows the object name, the Geo-File in which the object is stored and for some objects additionally the object number.

On the right, there is a navigation bar to navigate between the objects of one object type.



First, previous, next and last object refers to the input order. Point, line and area sources are treated as one object type.

The section "Properties" shows the properties (for objects which have properties). Information on the properties for each of the object types can be found in chapter "<u>Objects and their properties</u> (page 183)".

Enter Objects

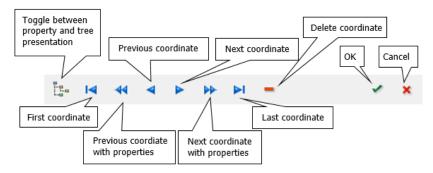
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The section "Geometry" shows coordinates (H_{abs} and H_{rel} only for objects which have an elevation) together with information about length or area of the object. Please read details regarding the elevation definition under "(Elevation) height definitions (page 77)".

	ometry						
Height	definition	absolute					
	X [m]	Y [m]	Habs [m]	Hrel [m]	^	Segment length [m]	12,2
5	36114,82	29706,97	266,67	0,00		Total length [m]	229,7
6	36125,93	29715,79	266,93	0,00			
7	36138,96	29724,89	266,90	0,00			
> 8	36151,08	29732,84	267,16	0,00			
9	36161,76	29738,82	266,47	0,00			
10	36170,17	29742,70	266,82	0,00	U		

Blue coordinates indicate coordinates, where properties are changing. The current coordinate is marked with > in the node number.

Below the geometry, you see a symbol to toggle the presentation between the properties themselves and the tree presentation as well as a navigation bar to navigate within the coordinates of this object.



The symbols "next / previous coordinate with properties" are only active for variant objects with property changes.

The object dialog can be opened during the entry of the data at different stages:

Opt	ions	Window	Help
	Show	v object dia	alog at each point
	Show	v object dia	alog at the first point of the object
٠	Show	/ object dia	alog when finishing the object

For objects with relative elevations the object dialog is always opened at the first point, so that you enter the relative elevation immediately.

To later view the properties and coordinates, select the edit mode and click on an object coordinate with the mouse (mouse cursor is an arrow).

With the general objects point, line, area and measurement tape the object dialog is suppressed during input.

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Enter Objects

Tree presentation for variant objects

Click on the symbol "tree presentation" in the last row of the object dialog to toggle from the property presentation to the tree presentation.

⇒	Properties			
Gr	aphic object:	Railway (0 / 1007)		
	X Delete selec	ted property block	X Delete all properties	
>	Object name(1 Stationing(2)	10)		
Ś	Group(3)			
;	Bridge(4) Traffic data - C	CNOSSOS-EU Rail(5)		
2		- CNOSSOS-EU Rail(6) NOSSOS-EU Rail(7)		
ľ			eper on medium stiffness rail pad	
		Transfer Idx: CNOSSOS-		
	-	ness Idx: EN ISO 3095 2 ise Idx: empty impact noi		
	-	Predominantly concrete Radius r >= 500m (no co	or masonry bridges with any trackform	
>	DGM(11)	Raulus I >= 50011 (10 C	inectiony	

At the first coordinate all properties are stored and listed in the tree presentation (picture above). For variant objects such as road, railway or wall, for which single properties may change during the course of the object, only the properties that were changed at a coordinate are stored and listed (picture below).

➢ Properties						
Graphic object: Railway (0 / 1007)						
	ted property block	X Delete all properties				
> Bridge(8) > Corrections -	CNOSSOS-EU Rail(9)					

The properties are grouped in blocks that are organized in a tree structure. If one property of a block changes, all properties in this block are stored.

With the black cross you can delete individual blocks of properties, with the red cross you delete all properties at this coordinate.

All properties assigned to the third coordinate have been deleted, the properties assigned to the first coordinate apply.

Hint: To delete all changes in the emission definition for roads and railways you can use **TOOLS -> RESET EMISSION**.

The graphics object type can also be assigned or generated in the tree view of the object dialog, see "Graphics-Object type" page 150.

(Elevation) height definitions

For noise simulations the spatial position of the objects is very important. In general, when working with SoundPLAN a <u>D</u>igital <u>G</u>round <u>M</u>odel (DGM) is

Enter Objects

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generated. If the project terrain is relative flat, it may be adequate to assume a flat terrain height of 0 m throughout the project area without the need to use a DGM.

The height H_{abs} assigned to the objects must be defined according to the object type.

roads, parking lots	road surface. The height of the source depends on the standard selected
railways	referenced to the rail head, the source heights depend on the standard selected and the train type
buildings / industrial buildings	height of the floor slab, difference to the height assigned to the building is accounted for as the building base
floating building / floating industrial building	height of the floor slab, no building base but the possibility that there is a space underneath where noise can propagate through
point-, line-, area sources	emission height
noise protection walls	base height of the wall, difference to the terrain will be treated as the wall base height
floating noise protection walls	base height of the wall, no wall base but air space underneath is possible
Noise protection berme	terrain
floating screen	base height of the horizontal surface (the bottom of)
free-field receiver	entered height of the first receiver
Receiver assigned to building	automatically generated from the buildings slab height and the receiver specific properties of the building.
opening of tunnels	a base height averaged from the coordinates left and right of the tunnel mouth.
mitigation area	No height information needed always referenced directly to the DGM

The height definitions can be absolute values above mean sea level or relative to the DGM or in the case of a totally flat model 0.0. The geometry definitions of the property dialog show if an object has the relative or the absolute definition.



Absolut height

The absolute height H_{abs} is the height above mean sea level in meters. When an object is defined with absolute heights, the height of the object does not change if

Enter Objects

the DGM is altered. In most road and railway projects that work with absolute heights, the objects are placed manually anew on to the DGM in case the DGM is altered.

Relative height

The relative height H_{rel} is the height above the DGM or above 0 meters. With the relative height definition, the objects position changes with the DGM, it is automatically fitted to the terrain. If the terrain is changed – for example in the different stages of excavating in a quarry, the objects defined relative will automatically adjust to the new terrain location. In this case the relative definition is an excellent choice. For identical source geometries that may be present at different location (for example a standardized power plant or super market with buildings, parking lots, gas station and other sources) the relative height definition is sensible.

For the better visualization all coordinates with relative reference to the terrain are presented in red.

Terrain following heights

For line - and area sources and parking lots (such as construction equipment moving over the terrain), it is also possible to have the elevation definition following the terrain.



For these terrain following objects, not only the coordinates entered are directly referenced to the terrain but the entire object. When the data are loaded in the calculation core, the terrain following object will be intersected with the triangles of the terrain which mean that the source will be following the entire terrain triangle by triangle. All coordinates of an object have the same height above the terrain. If the relative height changes at one coordinate it will be changed for all coordinates.



If an object has only a few entered coordinates, it might be possible that the display in the in the 3D view in the Geo-Database and in the Graphics might be incorrect as the exact calculation of the object height is done on loading time in the Calculation core.

Enter Objects

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Change height definition

In the object dialog you can alter the entry of relative height to absolute height and vice versa by moving the slider from one side to another.

With the GeoTool **CHANGE HEIGHT DEFINITION** the height definition of selected objects can be toggled between **ABSOLUT**, **RELATIV** and for some objects to **TERRAIN FOLLOWING**. When you had defined the height as absolute and then change to relative height definition, the difference between the absolute height of the object and the height at this position in the DGM is entered as the relative object height H_{rel} . In the other way where the object is defined with relative height, the absolute height of the object is then calculated as the sum of the DGM height plus the relative H_{rel} , the result is entered as H_{abs} for the coordinate. When you have a height definition that is absolute and switch to terrain following height, the **height of the first coordinate** will be used for **all** coordinates of the object. All objects that cannot be defined as terrain following keep their original height definition.

Height above terrain from the emission spectrum

For point -, line-, area- sources and wind turbines the height of the source can be already set with the data in the emission spectrum of the emission library, because the emission height above terrain is often dependent from the process defined in the spectrum.

General	Values	Groups	Charact	eristics	OLE1	OLE2					
1/1 Octa	ave spectr	um			~	63Hz	~ -	8kHz	~	dB(A) \checkmark / Lp level	~
Table er	itry				- Hei	ght above	terrain (m]	2,00	Standard deviation [dB]	
	Sum	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz		
dB	98,79	90,00	90,00	90,03	95,03	90,00	85,00	75,03	75,01		
dB(A)	95,00	63,80	73,90	81,40	91,80	90,00	86,20	76,00	73,90		

In this case please activate the setting **TAKE OVER TERRAIN REFERENCE FROM LIBRARY** in the object dialog in the Geo-Database. This checkbox is only available if the emission height is defined in the spectrum.

Objects that are associated with a local coordinate system the local and the world coordinates are displayed in the object dialog.

	X [m]	Y [m]	LX [m]	LY [m]	LHabs [m]	Habs [m]	Hrel [m]
1	36242,90	29502,01	0,22	-0,26	-0,06	265,12	-0,20
2	36244,04	29483,71	0,22	-0,29	-0,06	265,12	0,16
3	36245,18	29465,42	0,22	-0,32	-0,06	265,12	0,20
4	36246,32	29447,13	0,22	-0,36	-0,06	265,12	0,15
> 5	36247,46	29428,84	0,22	-0,39	-0,06	265,12	0,11
6	36261,49	29429,71	0,25	-0,39	-0,06	265,12	0,23
7	36260,35	29448,00	0,25	-0,36	-0,06	265,12	0,10

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Enter Objects

Enter objects with right angles

Click on the icon $\stackrel{\text{def}}{=}$ in the tool bar on the left side of the screen to enter the objects with right angles.

From the third coordinate of a string the entry cursor can only be moved in a right angle to the last coordinate. When closing the object, the last coordinate is moved so that all angles of the object are right angles.

The right-angle mode automatically calculates the last coordinate of an area object, so that you do not need to enter it.

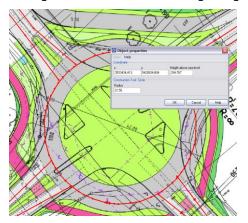


Selected area objects can be converted into right angle objects. Select **GEOTOOLS** -> **MORE GEOMETRY TOOLS** -> **CALCULATE RIGHT ANGLED**. All areas with angles in an acceptable range (>= 45°) will be rectified. If the message "angles not in acceptable range" is shown, the program cannot decide if an angle is 90 or 180 degrees. In this case SoundPLAN leaves the original version of the data unchanged.

Moreover, area type objects can be generated as rectangular objects with a north orientation by pulling open the object with the left mouse button.

Tools circle and rectangle

Select the desired object type (line or area type object). Pick the rectangle, the circle defined with the center coordinate and the radius O, or the circle defined with two coordinates on the perimeter O in the tool bar to the left. Pull open a frame and enter the elevation of the object and the radius or length and width in the following dialog.



Enter Objects

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Measure distances

You can see the difference between the last entered coordinate and the cursor position in the left part of the status bar:

X: 981.50 Y: 765.58 D: 29.70

You can also measure the distance between any positions on the screen: Keep the left mouse button and move the mouse from one position to the next.



The temporary object type **measuring tape** (in the option "objects in groups" under "Tools") is used to digitize dimensional chains.



The 2-dimensional distance between the coordinates as well as the sum of the distances is displayed. Using the right mouse button -> **CAPTURE COORDINATE**, the exact position of a coordinate is captured. Because the measuring tape is an object, you can use all object options, e.g. insert or delete points. The dimensional chain disappears after the data have been updated with **Ctrl+***R*.

The tool "measure" (toolbar on the left side of the screen) can be used with any of the object types. Enter the first coordinate as usual. For the entry of the next coordinate keep the left mouse button pressed to display the distance to the previous coordinate. When **OPTIONS** -> **ELEVATION DIALOG ALWAYS** is selected, or you press the **shift key** in addition, you can enter the exact distance in the next dialog.

The different display options

Top View, Side Projection and 3D-Wire Model

As an important tool for the elevation control of your data you can toggle between top view, projections and a 3D wire frame presentation. Select **VIEW** -> **FRONT ELEVATION** (*F8*), **SIDE ELEVATION** (*F9*) or **3D WIREFRAME** (*F10*).

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The different display options

Current object type Objects without properties	F6	
Selected objects	F3	
Top view	F7	
Front view	F8	
Side view	F9	
3D wire frame	F10	
3D Map	Ctrl+F10	
DGM elevation		
DGM triangles		
DGM contour lines		
DGM edge		
Show viewports		
Navigator		
Rotate selected objects	Shift+Ctrl+R	
Extended view	F4	
Geo-File options		
Object options		
Refresh	Ctrl+R	

Front elevation projection in the Geo-Database, here it is evident that a bridge is missing

You see all objects contained in the current Situation in the top view (site map) and as a projection. The following information is displayed:

- Coordinates that contain properties are depicted with a bigger dot than regular coordinates.
- For receivers that are assigned to buildings the base elevation is drawn as a double circle, the receivers relevant for the calculation are displayed as circles. For receivers without building assignment, the entered object elevation is the first calculation point.

Hint: When your data are displayed very compactly at the upper edge of the projection window, objects with incorrect elevations or "zero elevations" are within your model data.

Use EDIT -> SELECT OBJECTS WITH ELEVATION <= [M] to find objects that do not have correct elevations.

With the mouse you can move to the objects in the projection and see the elevation of the cursor position in the status line on the bottom. A left mouse click

The different display options

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3

opens the property dialog; a right mouse click opens a popup menu to execute further actions.

The elevation stretch factor can be zoomed by pulling up the frame of the lower window. Click on the upper edge of this window and keep the left mouse button pressed. When the cursor shape changes to \ddagger , move the mouse upwards.

An additional aid in checking your model is the 3D wire frame model. Open it with **VIEW -> 3D WIREFRAME (F10).**

Situation -Road Noi	se without Noise protect							
⊻iewport: Total v	iew 💌 属	<u>Z</u> oom: 507 €	Inc: 50 호	< <>> ∞	, , , , , , , , , , , , , , , , , , ,	Tit: 10	No Bitmap Selected	•
순								-
<u>ха</u> <u>Хан</u>				_				
							>	
					<	\langle		~
•					-	Insert new obj	ect	

3D-wire frame model in the Geo-Database

TILTING the model is accomplished with the selection box on the right side of the bar on top of the graphics window or with the up/down arrow keys.

In the wire frame model, you zoom by choosing the magnifying glass cursor and clicking on the screen. Click with the left mouse button to zoom in and zoom out using the right mouse button.

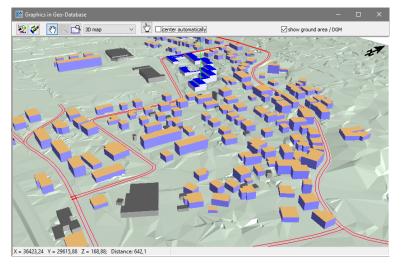
Objects without elevations (e.g. Texts or calculation areas) are disregarded in the 3D view. Other objects can be hidden with the setting hidden 3D in the object options (VIEW -> OBJECT OPTIONS or the cogwheel symbol next to the current object type).

Solid 3D-Graphics Model

[Module 3D-graphics] The 3D-graphics opens in a detached window via VIEW -> 3D-MAP or *Ctrl+ F10*.

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The different display options



The view of the 3D-graphics window and the top view of the Geo-Database are controlled separately so you can see different views. You can move in both windows with the mouse wheel depressed and can rotate the 3D-graphics with Ctrl+ pressed mouse wheel.

Depending on the project size a DGM will be rendered only for the existing view in the Geo-Database. For this reason, the loading times are much shorter for big projects. Via the settings you can define a buffer around the visible area for which the DGM is to be rendered.

1 Settings		×
Center automatically	False	
show DGM	True	
Use GeoDB viewport	True	\sim
Buffer size around the viewport [m]	100	
	1	×

If no DGM is loaded in a Situation, you can select in the object types to view a 0 m based area.

Receivers and point sources have the option to draw a line from the point type object to the ground. This allows a better understanding of the position in space. To activate this feature, go to the object types/3 D Graphics and activate **LINE TO GROUND**.



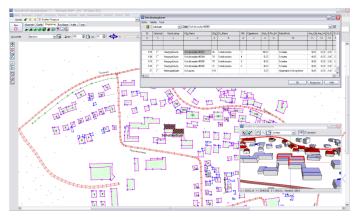
The different display options

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Oheck the user defined object types in the graphics window

Open the 3D-window and switch the selection list to "site map" to check your own object types defined in the object types and assigned to the objects via the Property Explorer or EDIT -> GRAPHICS-OBJECT TYPE.

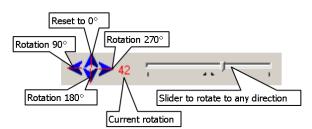
The cooperation between the Geo-Database, 3D-graphics and the Property Explorer make an efficient and effective project data check possible. Especially when a lot of data is imported, a critical eye is required to ensure the model is correct. The height of hundreds of buildings can be easily scanned with 3D graphics. Then use the Property Explorer to sort the buildings according to height. When you scroll through the list, the location of the object can be easily traced in the 2D graphics. In addition, the elevation base can be generated, refined and tested from within the Geo-Database.



The object selected in the Property Explorer is highlighted in the top view, and if the center button is clicked, will also display the object in the center of the screen.

Rotate

The data can be rotated in steps of 90 degrees by clicking on the arrow buttons or any increment with the slider. The controls are as follows:



Tip: With the left / right arrow key of the keyboard the view is rotated in increments of 2 degrees for each click. It is not possible to rotate the geometry when a bitmap is loaded.

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The different display options

Display of object dots and object properties

The object dots mark the location of the coordinates; double rings indicate that the object has the definition of descriptive properties. The arrow between the first and the second coordinate of an object marks the start point and the entry direction.

~~~~~

Object dot, the start of string marker and property changes in the course of an object

It is much easier to find the coordinates when the object dots are activated. On the other hand, the editing speed is much slower especially with big data models. You can therefore change the settings to meet your needs, see "<u>Settings for Geo-Files</u> and Object types (page 87)". When digitizing new objects, the object dots of the new object are always visible.

The start arrow of an object helps you to check if data loaded from external sources are present as poly line or were imported as single stand-alone line segments. See the GeoTool <u>"Connect lines and generate areas</u> (page 158)".

The object properties are always defined at a coordinate. For some objects (roads, railways, noise protection walls ..) it is also possible to modify the object definitions at any coordinate of the string. The object properties are valid until they are replaced by a new definition. To open the object definitions, close in on the coordinate until the mouse cursor changes into an arrow and click left.

When you are still entering a new object or have activated an existing object, the last coordinate is displayed with a red circle, this helps finding the object to continue with the data entry.

## Settings for Geo-Files and Object types

For structured editing of complicated data, it is often beneficial that Geo-Files and Object types have their own controls of display states. This way all files except for the one to be amended can be protected against overwriting and all data except the active one can be grayed out whereas a reference object (for example a road) can be highlighted while another object (for example a noise barrier) is edited.

Moreover, you can display only the current object type (VIEW -> CURRENT OBJECT TYPE (*F6*)) or the data in the current Geo-File (VIEW -> CURRENT GEO-FILE (*F5*)).

#### **Object options**

For the object options click on the wheel symbol.

Display of object dots and object properties

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| Object options                                                      |        |             |                 |            |             | _ 🗆 🔀     |
|---------------------------------------------------------------------|--------|-------------|-----------------|------------|-------------|-----------|
| 🖾 🔹 🗠 🛛 Point size                                                  | 2      |             |                 |            |             |           |
| Object                                                              | hidden | with points | with properties | background | highlighted | hidden 3D |
| *T Geometry text<br>Parking lot<br>Railway<br>Noise protection wall |        |             |                 |            |             |           |
|                                                                     |        |             |                 | ок (       | Cancel      | Help      |

All object types contained in the open Situation are displayed. Activate the setting for the object type of choice by clicking in the appropriate box.

**HIDDEN** - the object type is invisible but will be stored as usual.

**WITH POINTS** - for this object type the entry coordinates are made visible with little circles.

**WITH PROPERTIES** - if available, selected properties are shown (for example the kilometers or the facades activated for a facade noise map) see picture below.

**BACKGROUND** - the object-type cannot be edited and is displayed in gray color. When you select objects, the background objects are not included. However, background data are still snapped to when capturing coordinates with the right mouse button in the digitizing mode with the red cross.

**HIGHLIGHTED** – the object type is drawn with double thick lines in the normal object color. This setting is very helpful when working with background bitmaps.

General areas with the visual property "highlighted" are presented with a hatch.

|   | Ĩ  | E | E | Η | Ŧ | Ē | E | E | Η | [  |
|---|----|---|---|---|---|---|---|---|---|----|
| ł | ,→ | Þ | Þ | H | + | ŧ | F | F | k | k. |
|   |    | E | E |   |   | ł | E |   | E | ļ  |

The current object type settings are stored in the project.

Hint: When an object vanishes after it has just been digitized, the currently used object type is probably set to the "hidden" state.

In the field **OBJECT DOT SIZE**, the size of the dots can be customized. Object dots do not change with the zoom factor of the normal map view. When you are displaying large amounts of data with a big magnification, the object dots may become so big that it may be necessary to resize the object dot size or zoom in the data.

You can reset all settings for all object types or set the options for several object types at the same time.

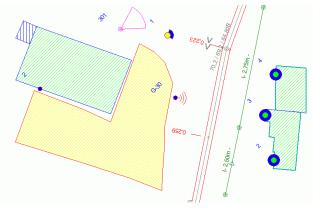
Reset all settings

Highlight object-types with the *Shift* or *Ctrl-key* and set the options for the highlighted object types.

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Display of object dots and object properties

**Hint:** Press F4 to temporarily deactivate the current object type settings. This might be helpful if you in general want to view the road properties, but while checking the road course, the display of the kilometer is annoying.



Display of object dots and additional information

The screen section above shows which additional properties are offered in the object properties presentation:

• For roads, the emission level is drawn next to coordinates where the level definition changes and the rate of incline > 5% on roads is visualized.

```
>5 - 10% "<" or ">"
```

>10-15% "<<" or ">>"

```
>15% "<!!!>"
```

- For roads and railways, the kilometer post is displayed if selected as reference road or railway.
- For traffic lights (German RLS-90) the position of the signal points is shown
- For noise protection walls, the height of the wall is printed next to each coordinate where the height of the wall changes.
- Facades of buildings enabled for Façade-Noise calculations are marked with a bold turquoise line; facades not selected for the calculation are drawn with a thin blue line.
- For receivers, industrial sources and photo points, the object number is displayed.
- If a 2d-directivity is assigned to the frequency spectrum of an industrial source, the direction is shown.
- For photo points, the view direction and the view angle are printed.
- Receivers assigned to a building are displayed in green color; receivers not assigned to buildings are drawn in yellow. Receivers that were originally assigned to a building where the reference has been lost (by deleting the building or copying them for example) are marked in red. In addition, the

sweeping angle from where the noise can be received is drawn with a blue arc. Full circles indicate that the incoming noise is not restricted, a half circle indicates a sweep angle of 180 degrees.

#### **Geo-File options**

For the Geo-File settings right click on selection list for the Geo-Files or open VIEW - > GEO-FILE-OPTIONS.

All Geo-Files contained in the Situation are listed.

| C Geofile view            |           |          |                   |
|---------------------------|-----------|----------|-------------------|
| X · N                     |           |          |                   |
| File name                 | read only | backgro  | und data   hidden |
| 003_Roads Prognosis       |           |          |                   |
| 004_Other Buildings       |           | $\times$ |                   |
| 004_Residential Buildings |           |          |                   |
| 007_Wall Oak Street       |           |          |                   |
|                           |           |          |                   |
|                           |           | OK       | Cancel Help       |

Geo-Files can assume one of the following states:

**READ ONLY** – the Geo-File is drawn normally and can also be edited but any modifications will be discarded unless the status of read only is modified before storing the Situation. When storing the Situation, you will be asked what to do with modifications in a read only Geo-File. If you click **CANCEL**, you will return to the Situation.

**P** HIDDEN – the Geo-File is not visible.

BACKGROUND – the content of the Geo-File cannot be edited and is drawn in gray color.

F4 or VIEW -> EXTENDED OBJECT VIEW toggles the display between the status of "selected settings" and "without settings". The selected settings are still active even if the extended object view is not activated.

The property "read only" or "background" set for the Geo-Files is stored with the Situation.

You can reset all settings for all object types or set the options for several object types at the same time.

Reset all settings

Highlight Geo-Files with the *Shift* or *Ctrl-key* and set the options for the highlighted Geo-Files.

Display of object dots and object properties

# Data entry

SoundPLAN allows data entry in many different forms and ways depending on the format of your data. If you have physical plans you can scan them and digitize on screen with the mouse. If your data are already in electronic form you can import them with the interfaces to external data (DXF, ESRI shape files<sup>1</sup>, CityGML<sup>1</sup>, OpenStreetMap<sup>1</sup>), the QSI interface or via the free programmable ASCII interface.

# **Digitizing mode**

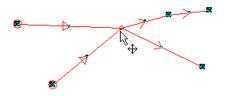
When coordinates are close together it often happens that the cursor homes in on an existing coordinate and changes into an arrow. As this is usually not desirable when digitizing new objects, the Geo-Database offers an additional entry mode that does not home into other objects. Click on the red cross icon on the left side of the data entry area. The cursor changes into a crosshair cursor. To later edit the object properties of already digitized coordinates, activate the default editing mode by clicking on the black cross icon. You can also use or **F12** to toggle between digitizing and editing mode.

## Capture coordinates

You can capture coordinates that are already present in your Situation. Capturing coordinates copies the location and elevation information; thus, the coordinates are twice in your data set. The data are handled separately from one another so if one gets moved to a new location, the other one will not automatically move. See also "Move / capture selected point (page 149)".

To capture a single coordinate, right click on the coordinate and select -> CAPTURE COORDINATE (data entry mode - black cross). For multiple coordinates, it is advisable to activate the digitizing mode and to right click on each of the coordinates. When a coordinate has been captured and the X, Y and Z component has been taken over, there is a confirmation gong.

**Hint**: Identical coordinates are visible when you pull a "rubber band" frame around them by moving the mouse over it with the right button pressed. The selection mark for double coordinates are canceling each other out so that the movement cursor becomes visible when you home in on the coordinate, but the coordinate appears to be not selected.



<sup>1</sup> Not included in the SoundPLAN basic configuration Data entry

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# Digitizing from scanned maps (bitmaps)

If you don't receive scanned geo-referenced maps, you can create a geo-reference for your own scanned maps.

Please keep in mind that the color depth of the bitmap should not be too high and think about possibly reducing a color bit map to a gray scale one. The larger the bitmap the more memory is consumed by it and the slower the processing speed. To work with scanned plans in SoundPLAN they need to be in the formats \*.bmp, \*.tif, \*.jpg or \*.png.

The connection to online map services (Google Maps and OpenStreetMap) and Google Earth allows selecting a view and use it with GET IMAGE in the window of the online map services or with BACKGROUND GRAPHICS -> TAKE OVER CURRENT GOOGLE EARTH VIEW AS BITMAP in Google Earth as project basis.

If you already have vector data in your project use the right mouse button -> INITIALIZE ONLINE MAP SERVICES AT CURRENT CURSOR POSITION or GOOGLE EARTH BITMAP FOR CURRENT CURSOR POSITION, see "Connection to online map services" or "Connection to Google Earth".

You can also integrate WMS servers, which display the geometry viewport in the background and update the background bitmap when moving. You can also request a bitmap from images from WMS servers with the right mouse button. See "Connection to Web Map Service (WMS) Servers"

## Load background bitmap and enter the reference points

Scanned plans that are to be used as a background graphic in the Geo-Database must be loaded into memory and then adapted to the world coordinates. The geo-reference can be made differently:

- Geo-reference in the graphics file
- Geo-reference in a separad word file (e.g. \*.tfw, \*.jpw, \*.pnw)
- Project coordinate system (OpenStreetmap, Google Maps, WMS server, Google Earth)
- Project coordinates in SoundPLAN if vector data are available
- Word coordinates

Call **FUNDAMENTALS** -> **BACKGROUND BITMAP** -> **LOAD BITMAP** FILE / PDF and open the scanned map or PDF file. The PDF file is first converted to a grapic file, see "PDF as background graphics", page 95. SoundPLAN loads the map and presents it in the reference coordinate entry screen.

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Data entry

| C Load Bitmap                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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Load bitmap

In the upper area the graphic is displayed, in the lower part the table in which the world coordinates are assigned to the bitmap coordinates. If a reference file exists, close the bitmap dialogue with OK, the bitmap is automatically geo-referenced.

With the button **SAVE AS** in the geo referencing dialog you can select the button **OPTIONS** to modify the size of the graphics file. This is helpful when the graphics are very large and threaten to exceed the available memory. The geo referencing files are recalibrating the control points so that it is possible to use this modified graphics in the Graphics without extra alterations.

| Graphics settings           | ×                   |
|-----------------------------|---------------------|
| Graphics type               | PNG Format V        |
| Bitmap size [pixels]        |                     |
| Width                       | 5069 4843           |
| Size of Windows bitmap [MB] | 73,65               |
| PNG Settings                |                     |
| Color depth                 | True color (24 bit) |
|                             | 🗸 🗙 Ø               |

Depending on the type of graphics file there are additional controls. For BMP, TIF and PNG you can alter the color depth, for JPG the compression.

Use the button O to transform the coordinate system in a single background graphic.

Data entry

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## Word files – geo-reference files

World files (tfw, jgw, pgw) or SoundPLAN geo referenced .grf graphics can be opened via FUNDAMENTALS -> BACKGROUND BITMAP -> LOAD WORLD FILE(S) (GEO REFERENCING). If you keep *Shift*- or *Ctrl*-key pressed, you can load multiple file at once. If a project coordinate system was defined, the transformation dialog opens so that you can transform the background bitmap to conform with the project coordinate system. This way you can read already geo referenced bitmaps and transform them to a different coordinate system.

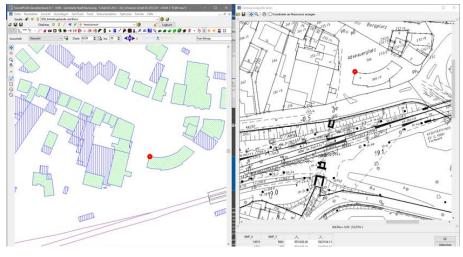
### Geo-referencing bitmaps in a new project

If there are no objects in your project yet, mark two easy-to-find coordinates on the plan and note the x / y values. The most suitable are coordinate crosses with even values.

Enter the first numerical value of the reference coordinates with the keyboard in the white fields and then click with the mouse on the coordinate in the graphics. To accurately enter the data even on a relatively big scale, the first mouse click opens a zoom window with the coordinate in its center. Home in on the reference coordinate as accurately as possible and click again. Repeat this procedure with the other reference coordinate.

### Adapting bitmaps to already existing vector data

When data are contained in a Situation, the reference point entry dialog opens parallel to the regular Geo- Database display in order to enter the reference points directly with a mouse click.



In the Geo-Database zoom in on the desired reference point and click on it. The coordinates are transferred into the reference point referencing dialogue. Use the mouse wheel to zoom in on the reference point and click to synchronize the

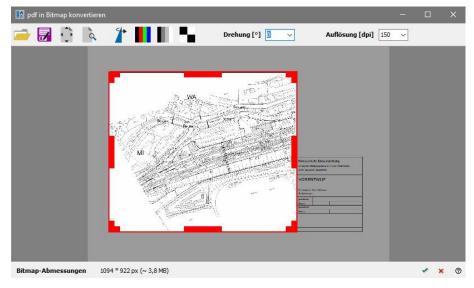
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Data entry

coordinates. Proceed the same way with the second reference point. It is irrelevant whether you first click on the reference point in the Geo-Database or in the in the referencing dialog. The reference points are presented in the Geo-Database and in the referencing dialog.

## PDF as background graphics

Plans available in PDF files format can now be used directly as a background bitmap in the Geo-Database, the industrial building, BA-Façade and a graphics box in the SoundPLAN graphics. If the PDF file contains multiple pages you can select which page to convert for the background bitmap; additionally, you can save view ports for example to cut out the plans description box or to save the top view and the projections of buildings in separate files.



Click on the green checkmark or press the enter key to convert the entire page into a bitmap. By default, the file name for the bitmap is the same as the name of the PDF file, however you can also customize the file name.

To convert only a portion of the PDF page, please use the left mouse button to pull open a frame around the area you wish to convert. If this area is sufficient, click on the green checkmark and enter a file name for the graphic.

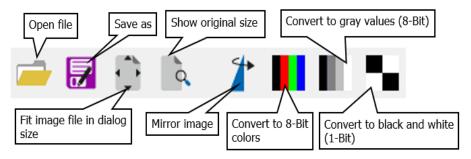


If you want to convert multiple parts of the same page, use the mouse to mark this portion and then select **SAVE AS** and enter a file name. In this case the PDF convert dialog remains open. Move the frame to the next area you to save. If you re-use the frame, the size of the bitmap will remain the same

want to save. If you re-use the frame, the size of the bitmap will remain the same size, if you need a different area, pull open a new frame with the mouse. With *Esc* or by clicking outside the frame, reset the selection.

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#### Further options:



Select to show the file either in **ORIGINAL SIZE** or **FITTED TO DIALOG SIZE**. **MIRROR PICTURE** is useful for example if you want to change the assignment of the bitmap of a ceiling in the industrial building to show the view from above.

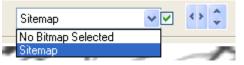
The PDF section is first converted to a 24-bit bitmap as at this time the required number of colors of the PDF file is not known. If the color resolution exceeds your needs or the PDF has less unique colors, you can reduce the color depth of the bitmap to make the file smaller.

Additionally, you can rotate the PDF file and change the resolution of the conversion. For most PDF files the default setting of 150 dpi is sufficient.

In the status line of the dialog you can see the dimensions and the estimated size of the bitmap in MB / kB.

#### Working with multiple bitmaps

Projects may have multiple bitmaps however, in the Geo-Database only a single bitmap can be open at a time because the vector data are adapted to the bitmap. Select the desired bitmap from the bitmap selection list and use the click box to hide the bitmap temporarily. Additional controls allow the bitmap to be moved in small increments.



Multi bitmap selection, click box to temporarily hide the bitmap and move controls

### Restrictions when working with bitmaps

Certain restrictions are imposed when a bitmap is loaded on screen. Neither the 3D wire frame model nor the projections can be used while the bitmap is loaded (also if temporarily hidden). Rotating the screen was disabled because it would take too much calculation time to rectify rotated bitmaps on screen. While the bitmap is in memory, the customary viewports are disabled.

If you want to use one of these functions, select **NO BITMAP** from the selection list. You can quickly reload the bitmap afterwards.

#### Bitmap Zoom box

Via **OPTIONS** -> **BITMAP ZOOM BOX** you can activate a zoom window when digitizing in the Geo-Database interface, which displays the original scale of the bitmap when entering the coordinates.to activate or deactivate the zoom window.

#### Helmert transformation for cases of doubt

If you enter a third reference point, an error calculation is performed according to the Helmert transformation. It is the quadratic error from the comparison of the given plan and sent bitmap coordinates. This can be compensated for any inaccuracies when scanning or paper distortion. The reference points should be as far away as possible or include the investigation area as far as possible.

The magnitude of the standard deviation decreases with the number of coordinate pairs and increases with the scale of the plan.

The standard deviation should not exceed:

| Scale 1:500   | 5  |
|---------------|----|
| Scale 1:5000  | 20 |
| Scale 1:10000 | 30 |

When the standard deviation is too high the reason could be:

- Entry not precise enough (activate the reference coordinates in the table and click on the coordinates on screen again).
- X and Y swapped (Correct the values in the table)

Press OK to leave the reference coordinate entry and start digitizing on screen. The reference coordinates are stored with the bitmap, so the calibration of the map needs to be done only once for this project.

# Data import / export

## **DXF Import**

The geometry (X, Y, Z coordinate) from the DXF file is imported as general point, line and area information. The actual object type is not known.

The objects relevant for SoundPLAN use the AutoCAD 2002 format specification.

To efficiently work with DXF data it is paramount that you know the organization of the data in the DXF file.

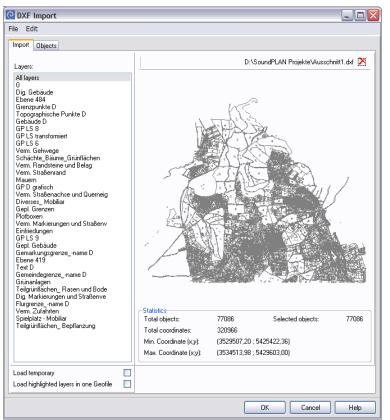
In AutoCAD, the data are provided in different layers. Knowledge of the layers in the file, the naming convention and possibly a description of the layers (layer list) is important for the distribution of the incoming data to SoundPLAN object types. In

Data import / export

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AutoCAD there is no fixed naming convention for the layers, so it is advisable to get information about the layer names from the data supplier. You have the least amount of work with importing the data if the supplier of the data only exported the data you need. However, in practice this will be seldom the case.

Call **FILE** -> **IMPORT** -> **DXF**, load the DXF-file and click OK. The layer list is alphabetically generated from the content of the file and a preview is shown on screen.



DXF-Import layer list

"All layers" presents the entire content of the dxf file, the coordinate range and the number of objects. Use the arrow keys or the left mouse button to move through the layer list and view the content of each layer. Highlight the layers you want to import. Select a single layer with the left mouse button or select an area of layers with shift and the left mouse button. Multiple single layers can be activated with ctrl and the left mouse button. After selecting the layers, click on the OK button to import the data.

Via **EDIT -> INVERT SELECTION** you can reverse the layer selection (i.e. selected layers get unselected and unselected get selected).

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Use the mouse to pull open a box on the preview panel with the result that only the data contained within the box are imported. To cancel the box and import data from the entire area, click on the red **CANCEL SYMBOL** on top of the preview panel.

The layer can be imported optionally when you check mark **TEMPORARY GEO-FILES**. Temporary Geo-Files (TMP\_LAYERNAME) are only stored after they have been assigned to user defined Geo-Files, SoundPLAN ignores the temporary data when saving the Situation. Permanently imported layers (DXF\_LAYERNAME) are always stored in the Situation.

When importing DXF data without knowing the content and structure of the file, it is advisable to import all data into temporary Geo-Files and to then select the view to look at the data Geo-File by Geo-File (VIEW -> CURRENT GEO-FILE (F5)). By scrolling through the list of Geo-Files you see the content of each file as a graphics on screen. If you discover that you only need the data from a few Geo-Files, you can scroll to the temporary Geo-File, select the data and then move the data to a different Geo-File with EDIT -> CHANGE ASSIGNED GEO-FILE. You do not need to delete the other temporary Geo-Files, when you close the Situation; the temporary Geo-Files are discarded. If you need most of the data from the DXF file in multiple layers, it may be faster to import the data again without activating the check box temporary.

You can also import several layers into one Geo-File. Select **LOAD ALL HIGHLIGHTED LAYERS TO ONE GEO-FILE** and define the Geo-File name.

The following objects are imported, some of them with additional properties and functions:

| Import Objects     |                                        |
|--------------------|----------------------------------------|
| Import objects: Ge | neral Line Circle Text Transformation  |
| Line               | nport as elevation point (spot height) |

DXF Objects

- Coordinates with the elevation equal to zero can be ignored when importing.
- Individual line elements are connected to polylines when CONNECT LINES is activated. Several lines are connected to polylines if the end coordinate of one line is identical to the begin coordinate of the following line. The lines must be adjacent in the data file for this function to work.

Data import / export

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- Polylines with dense coordinates can be filtered during the import (filter value 5 cm).
- Circles and arcs are transformed into polylines. For the conversion you can set the density of coordinates in the polyline to low, middle and high.
- Texts are imported as Geometry texts which you can assign sizes at import time.
- Furthermore, there is the possibility to directly convert texts into spot heights. Often the DXF file is not 3 dimensional but the heights are written on the plan as a text. With the setting **IMPORT AS SPOT HEIGHT** you convert the text into the Z part of a coordinate. When activating this setting, make sure that you only import the layers where the elevation information is hosted; the data would become unusable if the property numbers or the address of a building were converted into the elevation information. The coordinates of the spot height are derived from the position marks of the text. This might lead to a systematic position error which needs to be corrected with the coordinate operations.
- With the **COORDINATE TRANSFORMATION**, reference coordinates from a local DXF-scale can be transformed into the world coordinate system SoundPLAN uses. You need to read the coordinate twice, once to locate the local coordinates of the reference coordinates and the second time to assign the coordinates to the reference points. Select 3 or 4 reference points that you can identify in the local coordinate system and in the world coordinate system. The reference coordinates should be apart as far as possible to minimize potential coordinate errors. SoundPLAN uses the Helmert transformation to convert coordinates from the local into the world coordinate system. SoundPLAN stores the coordinate so that you must execute the coordinate transformation only once per project.

When you press the OK button, the DXF data are imported and converted into SoundPLAN unspecified objects of the type point, line, area and texts. Edit the data with the functions "<u>Convert object type</u> (page 153)" and "<u>Change Geo-File</u> <u>Assignment</u> (page 152)".

## **DXF-Export**

Situations from the Geo-Database can be exported into DXF files. Select the menu **FILE -> EXPORT -> DXF**. SoundPLAN exports the displayed geometry data. This allows you to export a specific Geo-File with **VIEW -> CURRENT GEO-FILE (F5)** or a specific object type with **VIEW -> CURRENT OBJECT TYPE (F6)**. Choose whether you want to export one layer **PER OBJECT TYPE** or **PER GEO-FILE**.

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# **ESRI Shapefile Import**

[GIS interface] Via the ESRI Shapefile import Shapefiles from GIS software (coordinates and descriptive properties) can be imported into SoundPLAN.

This interface is loading the data directly into a Geo-File of your choice with the correct data type (e.g. road or building) and the assigned properties.

The import data for one object type normally consist of at least 3 files:

- \*.shp contains the coordinates and the elevation
- \*.dbf contains the properties of the objects
- \*.shx is an index file

DBF files can be opened and if necessary modified in the SoundPLAN Spreadsheet. This way, you can see the defined properties and decide which columns you want to assign to the properties of the SoundPLAN objects.

Properties that are valid for all objects (e.g. "emission calculated" or "entry type" for the import of roads) can be assigned in the standard properties which are opened before the data are imported.

Invoke the import via **FILE** -> **IMPORT** -> **ESRI SHAPEFILE** and click on the "open" symbol to select the shapefile(s) (multiple selection via *Ctrl*- or *shift key*):

| 🔝 Import Shape                                                                                | efile                             |                                                                                                                                                                 |       |               |                 |                                                                                                                                                                | -    |    | ×      |
|-----------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----|--------|
| Shapefile:                                                                                    | "D:\SP Projel                     | <te∖demos cd="" installat<="" td="" von=""><td>ioner</td><td>Wincity\Impor</td><td>t files\Buildir</td><td>ıgs_SHI 🔁</td><td></td><td></td><td></td></te∖demos> | ioner | Wincity\Impor | t files\Buildir | ıgs_SHI 🔁                                                                                                                                                      |      |    |        |
| Geo-Database<br>Object type:<br>Geo-File:<br>Filter point densi<br>Filter                     | Building<br>Import<br>ty on lines |                                                                                                                                                                 |       | ~<br>~ ]      | ž               |                                                                                                                                                                |      |    |        |
| Assignment table<br>Property from in<br>STREET<br>H_NO<br>B_HEIGHT<br>INHABITANT<br>DWELLINGS |                                   | Property in SoundPLAN<br>Road name<br>House No.<br>Building height [m]<br>Number of inhabitants<br>no impot                                                     |       | <<br>><br>>>  |                 | uilding properties-general<br>Caracteria Road name<br>Caracteria Road<br>Owner<br>Suilding height [m]<br>Reflection loss [dB]<br>Land parcel No.<br>Area usage |      |    | ^<br>~ |
|                                                                                               |                                   |                                                                                                                                                                 |       |               |                 | OK Can                                                                                                                                                         | ncel | He | lp     |

The selection of multiple shape files is only sensible, if all files have the same object type.

Define to where (object type and Geo-File) and how (assignment of columns from the source file to the properties of the SoundPLAN object) the contents of the shape file should be imported.

Data import / export

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All saved property assignments can be revoked at once using the double arrow  $\boxed{}$ 

**OBJECT TYPE** and **GEO-FILE**: Select the object type and the Geo-File into which the data are to be imported. It is also possible to create a new Geo-File. With the switch **DEFINE DEFAULT PROPERTIES** you can define the default properties for all properties that are not explicitly defined in the shape file. The assignment of the default object properties pops up after you finished all entries in this dialog and pressed **OK**.

ASSIGNMENT TABLE and OBJECT TYPE PROPERTIES: The column PROPERTY FROM IMPORT FILE shows the column headers from the shape file. In the column PROPERTY IN SOUNDPLAN you can assign the fields of the respective SoundPLAN object type with a double click or the arrow key.

Click on the **OK** button to first view the properties set for the first data record and add additional properties valid for all objects to be imported and afterwards import the file.

**Hint:** If a unique identifier for the objects is included in the properties it is wise to import it in an unused field (e.g. as object number). You can use this identifier to later add further properties, see "Add properties via the search key (page 110)".

For the import of roads all dependent properties are automatically calculated, see "Import of roads (ASCII, Shape, dbf)", page 109.

Use the **GEOMETRY FILTER** to filter lines with a high point density directly during the import of a shape file.

#### Shape files with Triangle Strips and Triangle Fans

When an object consists of triangle stripes or triangle fans, most of the time the object is a completely 3D surface approximated with triangles. With the exception of the object types "area" and "building" the triangle stripes and triangle fans are ignored.

For the object type "area" each triangle will be become a unique stand-alone triangle. After importing, SoundPLAN does not know any longer that all triangles once formed a single object, that connection has been lost.

For the object type "buildings", all triangles of the object are imported. In a second step the program uses all triangles projected to the terrain surface to generate a continuous hull. For this reason, also balconies are part of the buildings floor plan.

If not, further detailed settings are made, the lowest z-coordinate of the building will be used defining the elevation of the lowest floor slab. Often there is an extra column in the dbf-file defining the floor elevation. A more accurate model can be made when you assign the field h1 to this value (before doing this, check the data in the dbf file).

# **ESRI Shapefile Export**

[GIS interface] Call the shape file export via FILE -> EXPORT -> ESRI SHAPEFILE. Define which properties shall be exported in addition to the coordinates. Enter the name of the folder in which the exported shape files shall be written; the default setting is the name of the Situation. The export files are stored in this sub folder in the project folder.

In a tree structure all object types contained in the Situation are listed, for each object type all properties are listed as the next level. By clicking on the node sign the tree structure is opened up and displays all details.

| lame of folder for exported Shapefiles (within the project folder):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| 3 - Road Prognosis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| ▼         Road Road           >         Döpect Info           >         Noise emission levels           >         Traffic data - RIS-50           >         Speeds - RIS-50           >         Traffic data - TINA 25           >         Speeds - TIMA 25           >         Corrections - RIS-30           >         Corrections - TIMA 25           >         Speeds - TIMA 25           >         Noise protection walt Noise protection wall           >         Miding Sulding           >         Bleviding protic Elevation point           >         Receiver: Receiver | Read as Read<br>Bidge as Bicke<br>Distance to let dege as Br_Abit_is<br>Distance to let dege as Br_Abit_is<br>Distance to ight dege as Br_Abit_is<br>Prove the set of the set of the set of the set of the<br>Read Distance of the set of the set of the set of the<br>Read Distance of the set of the set of the set of the<br>Prove of the set of the set of the set of the set of the<br>prove of the set of the set of the set of the set of the<br>prove of the set of the set of the set of the<br>prove of the set of the set of the set of the set of the<br>prove of the set of the set of the set of the set of the<br>prove of the set of the<br>prove of the set of |

If you click on the object type, the geometry of the corresponding object type is exported (marked by an unfilled square). Open the properties using the "Node" symbol. If you click on the property block, for example "profile", all properties stored in it are exported (the property block is marked with a check mark). Click on individual properties to switch them on or off for the export. If not, all properties are switched on, the block is marked with a black, filled square.

The objects and properties defined for the export are displayed in the window on the right-hand side.

For buildings or noise protection walls you can toggle between export of the **object basis elevation** or **the top edge** (right mouse click on the object type).

| Coggle height basis | Noise protection wall as Noise protection wall<br>[Top edge] |
|---------------------|--------------------------------------------------------------|
| Rename              | Building as Building [Top edge]                              |

**Field names in the Shape files can only be 10 characters long without blanks and special characters.** As SoundPLAN truncates the names the identifiers can become unreadable. Press F2 to enter a meaningful label. You can define a <u>short title</u> (page 144) for the Shapefile export in **OPTIONS -> SELECTION OF OBJECT PROPERTIES**.

The selections and settings are stored either for the project or in the global context.

Data import / export

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# QSI Interface (DIN 45687)

The QSI exchange format was developed to exchange model data between different noise modeling programs. The format is based on the ESRI Shapefile format. A Shapefile is generated for each object type. The database connected to the Shapefile contains all descriptive data and has been agreed upon by the manufacturers of the participating noise modeling software. For a complete definition of the interface, please read amendment #1 of the DIN 45687.

With the QSI format, entire situations can be imported or exported. The qsi model file (\*.qsi) generated during the export contains all object types and the file names of the generated shape files.

Call FILE -> IMPORT -> QSI to import QSI files or FILE -> EXPORT -> QSI to export a SoundPLAN Situation to the QSI format.

## Import of single shape files from QSI data

For noise protection walls and buildings z is described as the upper edge of the object; in addition, a shape file with elevation points is generated containing the basic elevation at each coordinate. Import this shape file additionally, calculate a DGM from the terrain points, set the basic elevation with **EDIT** -> **SET OBJECTS TO DGM** and determine the building or wall height with the Geotool "<u>Calculate the</u> <u>object height from the top edge</u> (page 170)".

# **CityGML Import**

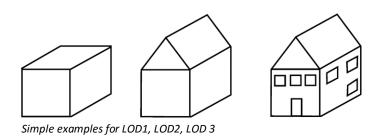
[GIS interface] Building data are often issued by the authorities no longer as shapefiles, but in the CityGML format.

CityGML is a very openly formulated standard for the exchange of 3D data, which allows many different interpretations and dialects. In Germany, for example, the information in the CityGML data differs for each federal state. Of course, this makes it difficult to develop a general import interface.

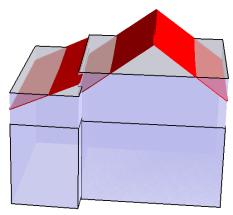
There are different levels of detail for city models in CityGML (Level of Detail [LoD]):

- LOD 0: Terrain model with texture
- LOD 1: City model, block model without roof structure
- LOD 2: City model with roof structures and texture
- LOD 3: geometrically detailed architectural models
- LOD 4: Geometrically detailed architectural models (inside and outside)

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In SoundPLAN, LoD1 and LoD2 CityGML data are read in as a block model (LoD1). The building heights of LoD2 data are calculated from the heights of the roof areas. Here, the average height and the swept floor area are determined per roof area. From this the average building height based on the proportionate floor plan areas is determined.



Block building with building height averaged from the roof areas and original roof surfaces from LoD2 data

#### Method to import CityGML data

Invoke the import via **FILE** -> **IMPORT** -> **CITYGML** and select the file(s) with the "open" symbol. You can also import CityGML data, which is available in several tiles, at once using the **Shift** or **Ctrl** key

Note: CityGML files larger than approx. 500 MB cannot be imported with the 32-bit version. Please use the 64-bit version.

After importing the file(s), the building properties contained in the CityGML data are displayed in the assignment table. Depending on the data supplier, the most diverse properties can be contained - or none at all - then the assignment table is empty.

We distinguish between the properties between "normalized" properties that can be identified by a normalized keyword and other (free) properties. The normalized keywords currently only contain address data.

Data import / export

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If normalized properties are contained in the CityGML data, it makes sense to use these for the assignment of road name and house number. If only free properties are included, they may also contain useful properties.

Make the assignment by double-clicking or using the arrow to assign the SoundPLAN building properties.

The building name is - if not explicitly assigned - formed from the GML identifier.

#### **Calculation of building heights**

If you assign a building height in the assignment table, this is used. Otherwise, the search is first made for floor and ceiling surfaces and the building heights are determined from their average heights. If there are no floor and ceiling surfaces, the heights of the wall bottom and top edges are used for the building height. If no information is contained in the CityGML file, the default value of the standard building properties will be used.

## **OpenStreetMap Import**

[GIS interface] OSM data can be automatically downloaded and imported via **FUNDAMENTALS** -> **CONNECTION TO ONLINE MAP SERVICES** (see "Connection to online map services"). You can also manually import OSM files via **FILE** -> **IMPORT** -> **OSM IMPORT XML**, for example, if you have received an osm file or if you have a modified osm file.

Select the file(s) you want to import and additionally the object types.

Some objects may be helpful only for orientation but are not detailed enough for a SoundPLAN model. Data of different object types are imported each into their specific Geo-File with the prefix "OSM\_". This procedure should make it easier to later on deleted data of object types not desired in the model. After finishing these definitions click on **IMPORT**.

## 6 Kml Export

Buildings, noise barriers, roads, railways, parking lots, point sources, line sources and area sources, industrial buildings (including point sources, line sources and area sources outside) and wind turbines can be exported to a kml file.

These objects are exported with absolute heights. If the ground model in SoundPLAN has lower heights than the ground model in Google Earth (which is the case often), the objects disappear in the ground.

You can lower the terrain height in Google Earth so that all objects get visible again (Tools -> Settings -> "Elevation Exaggeration"), or you could put all objects in SoundPLAN onto a Google Earth terrain model.

Buildings and walls are exported with their object height. If the elevation exaggeration in the Google Earth settings is defined <1.0, they seem very flat.

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Open **FILE** -> **EXPORT** -> **KML** and enter a file name. All relevant objects contained in the Situation will be exported. Click on Yes if you want to check the data directly in your KML viewer. With the shortcut **Ctrl** + **K** the data are loaded as a temporary file into the KML viewer.

## ASCII Import

With the ASCII interface you can import ASCII data (\*.ASC, \*.CSV, \*.TXT,) and ASCII exported SoundPLAN DOS data (coordinates + properties) into SoundPLAN. As soon as properties are contained in the same file, the import file must be restricted to a single object type.

This interface is loading the data directly into a Geo-File of your choice with the correct data type (e.g. road or building) and the correctly set properties. Properties that are valid for all objects (e.g. "emission calculated" or "entry type" for the import of roads) can be assigned in the standard properties which are opened before the data are imported.

Call the import with FILE -> IMPORT -> ASCII-TABLE and answer the entry fields.

| Import         | ASCII                    |                  |                  |                   |                 |           |   |   |
|----------------|--------------------------|------------------|------------------|-------------------|-----------------|-----------|---|---|
| le: D:\        | SP Projekte\Demos v      | ron CD Installat | ionen\Wincity\Ir | nport files\Build | dings_SHP\Buil  | dings.txt | 2 |   |
| Format         |                          |                  |                  |                   |                 |           |   |   |
| Fixed          | column width             |                  |                  |                   |                 |           |   |   |
| Field :        | separator                | Т                | ab 🗸             |                   | Text identifica | tion      | ~ |   |
| Start imp      | ort with line            | 1                |                  |                   |                 |           |   |   |
| 🗹 First li     | ne contains column he    | eader            |                  |                   |                 |           |   |   |
| Object se      | parator                  |                  |                  |                   |                 |           |   |   |
| Comment        | lines begin with         | ×                |                  |                   |                 |           |   |   |
| Number of      | of columns to import     | 7                | -                |                   |                 |           |   |   |
|                | STREET H_NO              | B_HEIGHT         | INHABITANT       | DWELLINGS         | NO_FLOORS       |           |   | ^ |
| NAME           |                          |                  |                  |                   |                 |           |   |   |
|                | adWinstad1               | 6,00             | 7                | 2                 | 2               |           |   |   |
| Winst          | adWinstad1<br>adWinstad2 | 6,00<br>6,00     | 7<br>8           | 2<br>3            | 2<br>2          |           |   |   |
| Winst<br>Winst |                          |                  |                  |                   |                 |           |   |   |

FILE: Enter the path to your file here.

**FIXED COLUMN WIDTH / FIELD SEPARATOR:** Data can be imported from files where they have been written either with a fixed format or separated either by semicolon, TAB, blank, comma or |. If you are not sure about the format, please try it out. The content of the file is displayed in the file preview window. For files with fixed column widths, define the column width for each column by moving the slider in the column header with the left mouse button pressed.

TEXT IDENTIFIER: if necessary, select one of the identifiers, " or '.

**IMPORT STARTING FROM LINE:** determines how many lines of file header are not interpreted as regular data.

**FIRST LINE CONTAINS COLUMN HEADERS:** defines whether the first imported row contains a column description. The table header is important for the correct assignment of the data.

**OBJECT SEPARATOR:** select whether a new object is separated with an **EMPTY LINE**, a single character or a sequence of characters (**LINE BEGINS WITH SUBSTRING**). When new objects begin with a substring, please enter the string in the box next to the selection.

**COMMENT LINES BEGIN WITH:** Defines how comment and text lines are marked so that they are filtered out (for example '\*' for SoundPLAN DOS Import)

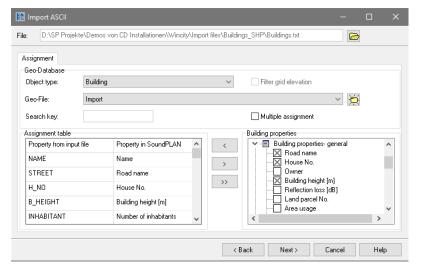
With NEXT the tab index card for the ASSIGNMENT opens.

Define to where (object type and Geo-File) and how (assignment of columns from the source file to the SoundPLAN objects) the data should be imported.

**OBJECT TYPE** and **GEO-FILE**: Select the object type and the Geo-File into which the data are to be imported. It is also possible to create a new Geo-File. With the switch **DEFINE STANDARD PROPERTIES** you can assign default settings for all imported objects. The object properties dialogue is activated after you finished the entry of this dialogue and start the import with **NEXT**.

ASSIGNMENT TABLE and OBJECT TYPE-PROPERTIES: If all settings in the format menu are correct, the column headers from the imported file are presented in the **PROPERTY FROM IMPORT FILE**. In the column **PROPERTY IN SOUNDPLAN** you can assign the fields of the respective SoundPLAN object type with a double click or the small arrows.

All saved property assignments can be revoked at once using the double arrow.



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**Hint:** If the properties contain a unique identifier for the objects, it is wise to always import it to an unused field (e.g. the object number). The identifier can be used to later add additional properties, see "Add properties via the search key (page 110)".

For the import of roads all dependent properties are automatically calculated, see "<u>Import of roads (ASCII, Shape, dbf)</u>", page 109.

Click on the **NEXT** button to first view the properties set for the first data record and add additional properties valid for all objects to be imported and afterwards import the file.

In the case of import errors, the line in which the error occurs is displayed. Such errors in certain lines can occur, for example, if incorrect key characters appear in the file or if a column is empty when you separate columns with TAB. You can use the line number to quickly recognize and repair the error. Prerequisite is an editor that outputs the line numbers (for example Notepad++ - Download https://notepad-plus-plus.org/).

## ASCII Export

Use **FILE** -> **EXPORT** -> **ASCII GEOMETRY** to create a txt file with the coordinates and the elevation above sea level or the relative height above terrain and the elevation of the DGM. Depending on the Geo-File or object settings all data included in the Situation, the data in the current Geo-File or all objects of the current object type are exported.

## Import of roads (ASCII, Shape, dbf)

All dependent properties of the traffic data are automatically calculated, e.g. the percentage cars from the imported truck fraction.

The traffic data can be assembled from all existing traffic data fields available in the import file. The program interprets the assigned fields and sets the entry type. If the import fails, you will find more detailed information in the logbook.

Example: The ASCII file contains for the composition of the traffic data ADT (average daily traffic) as well as the hourly traffic figures and the percentages of trucks for the individual time slices. The assignment table then looks as follows:

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| Property from input file | Property in SoundPLAN  | ∧ < Y · E Traffic data · RLS-90 |
|--------------------------|------------------------|---------------------------------|
| ADT                      | ADT [Veh/24h]          | Road type ID     Entry type     |
| ROAD_TYPE                | no import              | ADT [Veh/24h]                   |
| HVEH_D                   | Veh/h(d)[1/h]          | >> One-way traffic              |
| HVEH_E                   | Veh/h[e][1/h]          | k(d)                            |
| HVEH_N                   | Veh/h(n)[1/h]          | DCars(d)[%]                     |
| -<br>M_T16H              | no import              | k(e)                            |
| PTR_D                    | pTrucks(d)[%]          |                                 |
| PTR_E                    | pTrucks(e)[%]          | k(n)<br>□ pCars(n)[%]           |
| PTR_N                    | pTrucks(n)[%]          | pTrucks(n)[%]                   |
| P_T16H                   | no import              |                                 |
| V_CARS_D                 | Speed car - d [km/h]   | Trucks/h(d)[1/h]                |
| V_CARS_E                 | Speed car - e [km/h]   |                                 |
| V_CARS_N                 | Speed car - n [km/h]   | Trucks/h(e)[1/h]                |
| V_TR_D                   | Speed truck - d [km/h] |                                 |
| V_TR_E                   | Speed truck - e [km/h] | Trucks/h(n)[1/h]                |
| V_TB_N                   | Speed truck - n [km/h] | p24nLasg*)                      |

## Add properties via the search key

You can import further properties or update already imported properties for existing objects via a **SEARCH KEY**. These properties can be stored either in an ASCII file or in a DBF file (properties of a shape file).



If the properties are stored in an ASCII file, call **IMPORT -> ASCII TABLE**; for properties from a shape file call **IMPORT -> DBF**. Select the file and, for ASCII data additionally the format settings.

Assign the column which contains the unique identifier (for example name, section or object number) in the assignment table. With a **double click** on this cell in the assignment table the **SEARCH KEY** is defined and displayed in red. The search key won't be imported but used to identify the objects.

Assign the properties you want to add to the existing objects as usual.

Activate the check mark **MULTIPLE ASSIGNMENT** if the properties for line objects might change within the course of the object (e.g. different section names during the course of a road). If the check mark is deactivated, the additional properties are only imported at the first coordinate of an object.

As soon as you start the import, the newly assigned properties are imported, all other properties remain unchanged.

Example: You have imported buildings without information on the building height. Afterwards, you receive data with building heights. Assign the column identifying

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the objects and the column containing the building height. Double clicking the identifier defines the search key and displays it in red. Proceeding with the import will change the building height; all other properties remain unchanged.

### Import of point sources (ASCII)

**IMPORT** -> **ASCII NOISE SOURCES** imports point sources in a fixed format, for example data coming from a sound level meter. It generates the point source and a library entry. The field definition is fix and without column header.

The ASCII file must have the following format:

source name,x,y,z1,z2,v1,v2,v3,v4,v5,v6,v7,v8

The data must be comma separated with the decimal separator point.

v1 .. v8 stands for 8 frequency values from 63 Hz to 8 kHz of an octave band spectrum.

The weighting filter of the spectrum in the library is set to dB but you can change it to the needed filter (dB(A)..) by selecting the correct filter from the selection list. Click "no" when you are asked whether you want to recalculate the values, so that only the weighting filter will be changed but not the values.

## Import of SoundPLAN Geo-Files

Geo-Files from other than the current project can be imported into the Geo-Database with IMPORT -> SOUNDPLAN -> SINGLE GEO-FILES or IMPORT -> SOUNDPLAN -> ALL GEO-FILES OF A SITUATION. Select the project and click on the Geo-File(s) or Situation you want to import. Multiple selections are carried out with the Shift and the Ctrl keys. The Geo-Files are inserted into the current Situation and the objects and their references to the library are copied into the project. Library entries such as spectra and time histories are automatically copied to the appropriate libraries. Changes made to the copied objects have no influence on the original data.

Imported data can be placed centered in the active view by request. This way you can import a discount store and place it centered into the piece of property so that additional correction of the location is minimal.

When importing **road and railway Geo-Files** and no data is present in the road type respective train type library, the road/railway type will be imported into the road/ train type library. If roads and railway lines are already present, the existing libraries will not be overwritten. A message will inform you that it is possible to have discrepancy between the road/railway type definitions. Please check your emission calculation in this case.

As soon as the import finds an **industrial object** with a reference to the library, you are asked how the library elements should be treated in the new project.

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| 5  |
|----|
| D) |
|    |

| 🖸 Updating project libraries 📃                                                                                                                    |       |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Objects with library elements are going to be imported!                                                                                           |       |
| How should the link between objects and library be established, in case a library element<br>the same name exists already in the project library? | nt of |
| ● link to existing element                                                                                                                        |       |
| O enter as a new element and refer to it                                                                                                          |       |
| OK Cancel He                                                                                                                                      | lp    |

The option you select will be applied to all data imported in that session, even if they are in multiple Geo-Files.

In the first option, an existing element will be used if it points to the same object name. In the other option, a new element will be generated regardless of whether an element of the same name already exists, in which case the object name will be appended with "(1)". The first option is helpful if the project already contains the library element copied from the system or global library.

The connection between the object and the library entry is guaranteed in any case.

This possibility opens the option to generate "Geo-File-libraries" that you can fill with standard cases for recurring tasks that contain all noise sources and their properties, as well as the libraries involved (for example, the emission, day histogram or transmission library).

Example:

You have already completed an investigation for a big discount store and the customer is satisfied and gives you a new job for a very similar store. The building follows a similar pattern; the cooling for the refrigeration unit is the same, as is the parking and supply of goods to the store.

Import the "existing" discount market into the project. If objects are already in existence in the new project before the "existing" store got imported, you will be asked if the data to be imported should be moved to the screen viewport. With **YES**, all data is visible on the screen. Adjust the data to the new location. When working with relative heights, the elevations automatically adjust to the new terrain.

### Import of photos with GPS data as photo points

If the metadata of photos contain GPS data (coordinates and view direction), SoundPLAN can import them. The geometrical coordinates are converted into the coordinate and reference system used in the project. This means that you need to have the project coordinate system established if you want to make use of this feature.

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| 🕎 Import pho      | to points                                                     |
|-------------------|---------------------------------------------------------------|
| File:             | D:\SP Projekte\GPS Import\photo\Foto 1.JPG                    |
| <u>G</u> eo-File: | Photo points                                                  |
| The image files   | need to be in the project subfolder "\photo"; how to proceed: |
| move              | © сору                                                        |
|                   | OK Cancel Help                                                |

Open FILE -> IMPORT -> PHOTOS WITH GPS DATA. If no project coordinate system has been established, click on OK to open the coordinate system dialog. Select a photo (file) and define the Geo-File where you want to store the photo. By default, the photos are expected in the project sub folder \photo. If the photos are not already present in this location, select if you want to COPY or MOVE the photo to this location. The program always will import all photos contained in this folder.

## CARD/1, Stratis, Verbund, Vestra Interface

Select FILE -> IMPORT -> CARD/STRATIS (German road planning software.)

As the exporting programs have a dedicated SoundPLAN export interface, the data are already assembled to import an entire project in the correct format for SoundPLAN. The object types are assigned automatically but you still must define some of the object properties in the edit object properties menu.

## **LIMA BNA Interface**

The LIMA BNA interface automatically imports the data and the object properties. Select the Geo-File to which you want the data to be imported and the correct object type. Then call the import menu with **FILE** -> **IMPORT** -> **LIMA BNA**. The properties are imported, however, with some objects like roads the emission level is imported but not the parameters that are used in the computation of the emission level. Only the German standards are supported for the import of the sources. The interface LIMA BNA is no longer developed as it will be replaced by the QSI interface in the future.

## Import of SoundPLAN DOS data

Old data generated from the SoundPLAN DOS version 4.0 and newer can be imported directly into the Geo-Database. Select **FILE -> IMPORT -> SOUNDPLAN DOS**.

First select the path to your DOS data in the right field of the entry screen and then select the data type you want to import from the pick list. The available files are in the right field. When you select a file, the first comment lines of the DOS files are printed in the info box. Select the files you want to import by left clicking, multiple

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successive files are selected with Shift+ left click and multiple single files with Ctrl+ left click. Press **OK** to import the data.

The following object types are converted from the DOS format to the Windows version, some of the object properties have changed and many properties are new, others do not have an equivalent under Windows:

**Road alignments** - The emission level is calculated, and the width of the traffic lanes is assigned to the new object.

**Railway lines** - Only the geometry is imported, the emission level needs to be recomputed.

**Industrial noise sources** - Only the geometry is imported, all other object properties need to be redefined.

**Buildings** - are imported with the geometry and properties; however, the area usage needs to be defined.

**Receivers** - are imported with geometry and property but without the assignment of the area usage. When receivers are located at buildings, the assignment of the receiver to a specific building must be redone.

**Elevation lines, spot heights, calculation area** - are imported completely, no properties needed.

Mitigation areas - are imported with geometry and properties

**Noise screens** - are interpreted as noise protection walls and the properties are assigned.

Ground effect - is imported with geometry and properties.

## **Filter and Import Elevation Data**

Elevation data from laser scanning are nowadays provided mostly in a digital way as equidistant grids (e.g. 1x1 m or  $10 \times 10$  m) or as point clouds. Apart from the terrain model itself the data partly contain also roof points of buildings to determine the height of buildings, and sometimes spot heights on bridges.

SoundPLAN can read different formats and filter them efficiently to reduce the size of the DGM. The size of the DGM has big influence on the work in the Geo-Database and especially on the calculation time.

Elevation data in the formats ASCII, ESRI ASCII Grid, GeoTiff, LAS (specification see "Import of elevation points in the LAS Format (page 120)") or Winput SCOP can be filtered before they are actually imported.

In case the spot elevations are present in a different format (for example DXF), you can import the data unfiltered and filter them afterwards in the Geo-Database via **GEOTOOLS -> MORE ELEVATION TOOLS -> FILTER ELEVATION DATA**.

There are two different interfaces for filtering the elevations before the import (the following description is valid for both interfaces):

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**Filter and Import Elevation Data** 

1. **FILTER AND IMPORT ELEVATION DATA** for projects for which you want to import elevation spot heights into the Geo-Database and further process the data there (generate a DGM, calculate embankments, define men height for a building from elevation points, ...).

2. **PREPROCESSING ELEVATION DATA** [Module Noise Mapping Toolbox] for projects with huge amounts of data that are too big to be processed in the Geo-Database, for example elevation points for complete cities or districts. For these data normally a tile DGM is calculated in the calculation kernel, see "<u>Preprocess</u> <u>elevation data for the Calculation Kernel</u> (page 654)" in the chapter Noise Mapping Toolbox.

Hint: If, during the filter process, you find out that the direct import is not suitable for the amount of data, you can toggle to the import interface for preprocessing the data for the calculation kernel, because the data are processed the same way.

The import data can be in a single file or can be tiled, thus distributed over many individual files.

Invoke FILE -> IMPORT -> FILTER AND IMPORT ELEVATION DATA for conventional projects.

Use the **OPEN** symbol to select the folder where the elevation data are stored.

| Elevation tools                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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                                                                                                                                | Cancel Help |

By selecting one file with a double click, all files with the same extension will be sent to the elevation filter.

Filter and Import Elevation Data

3

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On the left-hand side, the files are displayed as well as a preview of the first file. If needed, select the first row for the import and the column numbers (position) for the coordinates X and Y and the elevation Z.

You can select one or several areas and / or lines with a corridor width that are used to filter and import the data according to your settings (see "Use areas and line corridors (page 118)").

Before further tasks can be invoked the elevation tool needs to know the data structure. Therefore, as a first step only the option **GET FILE INFORMATION** is available in the selection list.

In this step the elevation data are additionally stored binary (file extension \*.elg for grid data and \*.elv for point clouds). The binary stored data are much faster accessible for the next steps.

It is necessary for you to have write permission on the folder where the data are stored, because SoundPLAN stores file information and interim results in this folder. Therefore, you enter a target folder for the scanned files in the **SCAN OPTIONS**, for example if the elevation data have been delivered on a CD. If you don't change the target folder, you can select whether you want the original ASCII files to be deleted, moved to the subfolder "OriginalData" or that the data should remain in the same folder as the binary files.

To scan the file information, select the files with *Ctrl+ A* (if desired single files with shift or the Ctrl key) and click on **EXECUTE**. SoundPLAN loads the files, extracts the structure and stores them binary.

Depending on the number and size of the files, this may take some time. This procedure only needs to be done once; SoundPLAN remembers the structure and additional information.

As soon as the **FILE INFORMATION** is filled in, the option in the selection list changes to "filter elevations" and the filter options are displayed.

### **Filter elevations**

For spot elevations positioned on a regular grid, the **GRID DISTANCE** is displayed. For unstructured spot elevations a grid with a spacing of four times the average distance between coordinates is assumed but this value can be modified at will. The finer the base grid, the smaller the number of iterations needed to force a structure where all elevation deviations of the remaining coordinates are below the set tolerance, yet for finer grids the number of coordinates remaining will be higher, thus the results are not as efficient as with a courser base grid.

Enter MAXIMUM HEIGHT DIFFERENCE TO ORIGINAL POINTS that shall not be exceeded.

**MAXIMUM POINT DISTANCE**: It turned out that the maximal spacing between the coordinates shall not be too big and that if the spacing was moderate, the number of iterations was smaller. The filtering generated more equal sided triangles that

Filter and Import Elevation Data

were better suited for all processing later on. If you do not like the results of the filtering, try again with reduced maximum point distance. If a tile DGM should be calculated afterwards (see "<u>Preprocess elevation data for the Calculation Kernel</u> (page 654)") the maximum point distance may not exceed 80 m.

After filtering the elevation points according to your settings, a DGM is calculated from the remaining spot elevations and compared with the original elevations. If elevation points are outside the tolerance, SoundPLAN will insert coordinates to force the DGM to conform to the original data. This procedure is repeated iteratively until all differences are within the tolerance.

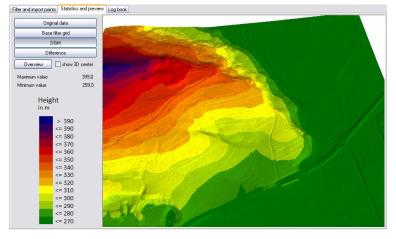
In the **logbook** you can also view each iteration step.

If the elevation data are splitted into several files, test the filter options for a selected file, see "<u>Filter single elevation file</u> (page 117)". Then select all files with *Ctrl+ A* and click **EXECUTE**. Because it can be very time consuming if many files are processed, we recommend using a lunch break or night time for filtering the data.

The filtered data are stored in tiles of 10 x 10 km in the subfolder "ResElev". After all files have been filtered, the option in the selection list changes to **IMPORT ELEVATIONS**. Click OK to import the filtered elevations to the Geo-Database.

## Filter single elevation file

In order for you to get a feeling for the settings and the resulting DGM, the **statistics and preview** tab of the filter box shows the result of the elevation filtering for one selected file with elevation data. (The tab disappears as soon as more than one file is selected.)



You can view:

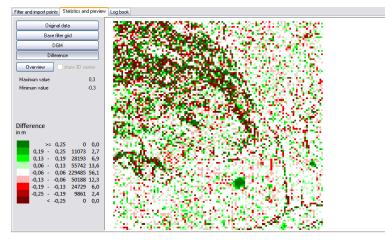
- the original data
- the remaining elevation points in the site map (result)
- the DGM as a 3D-model

Filter and Import Elevation Data

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• the difference grid map with the statistics

The difference to the original elevation points is an important criterion to prove the quality of the result.



In the example above the elevation points have been filtered with a maximum deviation of  $\pm$  0.25 m. The difference map proves that 80 % of the remaining points are within a range of  $\pm$  0.13 m and that the maximum deviation is kept.

If you are not satisfied with the results, activate the first tab, change the filter parameters and start the filter action again.

## Use areas and line corridors

#### Reduce the area for the elevation data

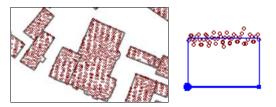
Often you get data with a much bigger scope than you need. You can select an area to only process the data within this area. Enter a general area in the Geo-Database that generously covers the area for which you need elevation supplied and save the area in a Geo-File of its own. Select the Geo-File in **USE AREAS AND / OR LINE CORRIDORS** and filter the data as described above.

If the area has already been selected when scanning the file information, elevation data that are outside the area are disregarded for further processing.

#### Unfiltered elevations within the circumference of buildings

If the elevation of the roofs of buildings is provided, the average height of the building can be calculated most accurately with the Geotool **EVALUATE POINTS FOR BUILDING HEIGHT** when you import the elevations within the circumference of buildings without filtering. For this option enter a Geo-File or a Situation with the buildings under **USE AREAS AND / OR LINE CORRIDORS** and select the task **IMPORT ELEVATION POINTS**.

Filter and Import Elevation Data

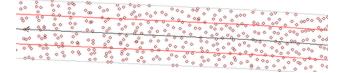


As no elevation differences need to be filtered, the import is very fast.

Important: If the elevations of the roofs of buildings have been delivered in the same folder as the terrain elevations - only with a different file extension, you must select a different folder for the edge data in the step "get file information" because otherwise the binary stored files of the terrain and the edge elevation points (\*.elv) would overwrite each other.

#### Unfiltered elevations within bands of roads and railways

When the terrain information within bands of roads and railways is very accurate, it can be sensible to use unfiltered elevation information to set the elevation of the road and the railway axis. For this purpose, the unfiltered elevation information can be imported only in the band around the road and railway master alignment. In order for the import to get the geographical location of roads and railways, enter the Geo-File or Situation with the roads or railways under **USE AREAS AND / OR LINE CORRIDORS** and select the corridor width I [m].



As no elevation differences need to be filtered, the import is very fast.

Generate a DGM from the unfiltered imported coordinates and place the road and railway alignment with the **COORDINATE OPERATIONS** on top of this DGM. For railways the elevation of the rail head must be adapted according to the used standard.

If additional files with the elevations on the bridge are available, the DGM is generated from the elevations in road / railway bands and the elevations on bridges.

#### Extract areas from an overall pool of elevation data

You have for example received elevation data for a whole city, filtered the data and used it perhaps for an action plan. Now you are asked to do detail investigations for single hotspots. Enter the area(s) that generously cover the smaller investigation area(s) and select them under **USE AREAS AND / OR LINE CORRIDORS.** In the project with the overall elevation data select the filtered elevation points from the sub folder "ResElev" and select the task **IMPORT ELEVATION DATA**. Alternatively, you can cut individual areas from a total DGM, see "Extract DGM via an area (page 341)".

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#### **Delete identical elevation points**

If filtered elevation points imported from an external source contain double elevation points, select the elevation points and invoke **GEOTOOLS** -> **MORE ELEVATION TOOLS** -> **FILTER ELEVATION DATA**. Here you can select **DELETE IDENTICAL POINTS** from the selection list. If double points have different elevations, the point with the higher elevation is deleted.

## **Transform coordinates**

The task transform coordinates transforms the elevations from the source coordinate system to the project coordinate system, see "<u>Transformation between</u> coordinate systems (page 175)".

## Import of elevation points in the LAS Format

SoundPLAN has implemented the LAS specification version 1.4-R13 from July 15, 2013. The LAS Format is a standard by the American society of photogrammetry and remote sensing and was designed to share coordinates from laser scanning.

The point cloud can be considered raw data, the coordinates can be located on the terrain, on buildings or on vegetation (trees), and therefore it is paramount to have a classification of the data. This classification is normally part of the data file. As the classification can vary in accordance to the LAS version, SoundPLAN is only distinguishing between two classes, terrain points and surface points.

The "Terrain model" contains the LAS classes "terrain" and "water", from point format 6 on also the classes for "railway" and "road surface", if data are contained in the data file.

The "surface model" contains all other LAS classes. From the point format 6 on the classes for "railway" and "road surface" are included in order to import the coordinates within the railway or road surface without filtering them.

If you select the option to filter the elevation (IMPORT -> FILTER ELEVATIONS AND IMPORT) for LAS files, additionally select weather you want to import the terrain model or the surface model. If you have already imported and filtered the terrain model, the scanned data will be deleted before importing the surface model.

After reading the LAS file header, the logbook shows the LAS classes contained in the file. The detail information shows the class ID, the meaning of the points and the number of points imported for each LAS class.

Even if the LAS import offers the distinction between the terrain model and surface model data, the option "filter elevations" after scanning the surface model, for the surface model this option is not sensible, please select a different option.

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Filter and Import Elevation Data

## Example for the efficiency of the elevation filter

Below, the example shows the same 3D view and cross-section, on the left-hand side as the original and on the right side as the filtered data with an elevation tolerance of 50 cm:



The number of coordinates in the original for the grid of 300 x 150 meters with a resolution of 1x1 meters was 40326 points. The filtered elevations consist of 2027 points, almost 95% of the points were filtered out and still the railway line berm is sufficient.

If you want to test the filtering of elevations, you can use the laser scan data in the demo project "Wincity" (subfolder import data).

See also "Evaluate spot heights for mean building heights (page 169)" and "Calculate the object height from the top edge (page 170)".

# **Digital Ground Models (DGM)**

After importing and filtering or digitizing terrain information (elevation points and / or elevation lines), calculate a Digital Ground Model. The DGM edges form the diffraction edges for the propagation calculation.

The elevations of other objects are assigned from the DGM. The elevations are either entered as absolute height above sea level or relative to a DGM, see "Set objects to DGM", page 153.

You can further refine the DGM during project processing, or you can calculate different DGMs for different planning variants.

Often you will first calculate an initial DGM from imported (and filtered) elevation points, then place the roads or railways on the DGM, set or detect bridges and tunnels if necessary, identify jumps in elevations in the front and side view and smooth them. The road and railway edges, bridges, tunnel portals, parking lots, area sources and berms will be included in the DGM calculation for the DGM, which will later be used for the propagation calculation.

To calculate embankments, use the calculation run "Calculate objects into the DGM", see chapter Calculation Core. Call this run from within the Geo-Database with **FUNDAMENTALS -> DGM -> CALCULATE OBJECTS INTO DGM (***Alt+Ctrl+D*).

Digital Ground Models (DGM)

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## Calculate DGM from within the Geo-Database

Open the DGM calculation via the menu **FUNDAMENTALS** -> **DGM** -> **CALCULATE DGM** (*Ctrl+ D*).

| 🗱 Run Command Editor 🛛 🕹 🗙                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General Description                                                                                                                                                                                                                                           |
| Run name :                                                                                                                                                                                                                                                    |
| 003_Roads Analysis.geo"                                                                                                                                                                                                                                       |
| Group:                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                               |
| Calculation type:                                                                                                                                                                                                                                             |
| Geometry $\checkmark$ Digital Ground Model $\checkmark$                                                                                                                                                                                                       |
| Data:                                                                                                                                                                                                                                                         |
| "003_Roads Analysis.geo" >>                                                                                                                                                                                                                                   |
| Calculation in tiles (only for huge amount of dat<br>Tile size [m]                                                                                                                                                                                            |
| Object types to be used for DGM calculation         ✓ Spot heights         ✓ Elevation lines         Ø Road edges         Ø Center reservation         Ø Railway edges         Ø Tunnel portals (not for air pollution)         Ø Area source         Ø Berms |
| Number for result files 6                                                                                                                                                                                                                                     |
| Start Cancel Help                                                                                                                                                                                                                                             |

Enter a result file number, opt to overwrite an existing DGM, or search for a free result number.

In the lower part, select which object types shall influence the DGM calculation. The objects must be part of the Situation for the DGM calculation.

If the plan contains tunnels, it is wise to generate a new DGM after the tunnel portals are defined so the DGM can correctly model the area around the tunnel.

In the background the calculation kernel is opened during the DGM calculation in the Geo-Database and calculates the DGM. The DGM is stored there as a calculation run. This has the advantage, that all information regarding the DGM (used Geo-Files and object types, version date, possible warnings, ...) are permanently recorded.

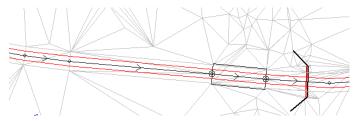
A DGM calculated in the Geo-Database can be recalculated any time in the calculation kernel if needed. DGMs for large areas and tile DGMs are preferably calculated in the calculation kernel so that the Geo-Database is not blocked.

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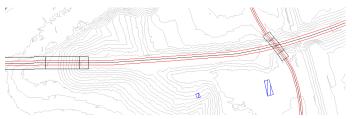
Digital Ground Models (DGM)

## **DGM views**

As default the edge line of the DGM is displayed, to visualize the area which is provided with elevations. The elevation of the current cursor position is presented in the status line of the Geo-Database screen. The (+) and (-) sign indicates if the elevations in the path or the cursor movement is increasing or decreasing. When you activate the **DGM TRIANGLES**, all triangles are presented in light gray on screen.



To help find problems in the DGM and to set the beginnings/ends of bridges correctly, you can display elevation lines derived from the DGM with **VIEW** -> **DGM CONTOUR LINES**.



Enter the elevation spacing in [m]. The closer the elevation lines the longer it will take to display the elevation lines on screen. If the screen refresh times are excessive, close the DGM elevation line option and re-open it with a different spacing.

If you really need the elevation lines in the Geo-Database as an object of its own, you can generate them by loading the DGM into the graphics and then exporting the elevation lines in "edit map" into a Geo-File via EDIT -> EXPORT CONTOUR LINES. The distance between the elevation lines is determined in the "additional intervals" in the object type DGM.

You can select a default DGM in the Situation Manger (TOOLS -> SELECT DEFAULT DGM which is automatically loaded with all new Situations in this project.

Use the **Del** key to remove the DGM from a Situation.

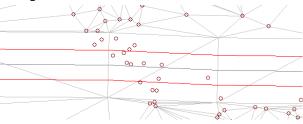
You can place both the DGM and a bitmap into the background of the Geo-Database screen.

**Digital Ground Models (DGM)** 

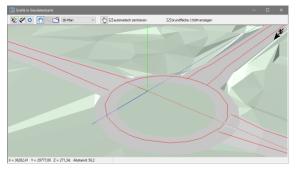
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## Embankment alignment for road and railway in the DGM

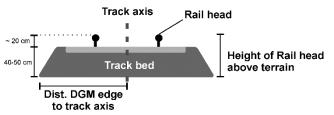
Spot heights that lay on the road surface or on the ballast bed of railways (see below) are excluded from the DGMs triangulation if the appropriate box is checked during the DGM calculation.



If roads or railway tracks are part of a DGM calculation, the program will check if at intersections the road/rail edge of one road/rail will fall within the surface area of another road/rail. If there are coordinates found laying in another road/rail area, they will be discarded during the triangulation.



For the embankment alignment of railways two additional parameters are needed for regular trains to set the elevation at the foot of the ballast bed that are entered in the railway properties:



- Delta h between the rail head and the terrain (basically the thickness of the ballast bed)
- The distance of the DGM edge to the track axis (half the width of the ballast bed

For road and railway bridges elevation points are triangulated on the surface below the bridge. If tunnel portals are included in the calculation, they should be present for the triangulation.

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Digital Ground Models (DGM)

Use the following object types in the DGM calculation

- Spot heights
   Elevation lines
   Road edges
- Rail edges
- Tunnel portals

If the situation in the Geo-Database has a DGM that was re-calculated in the calculation core, you will be asked after the calculation finished if you want to reload the DGM.

## Onnection to online map services

[Cartography] (Connection to Google Maps + OSM) [GIS interface] (OSM-Import)

OpenStreetMap and Google Maps are free on-line map services that can be used in SoundPLAN. After loading them, the online maps are presented in a window of their own so that you can work parallel either in the Geo-Database or with the map server. The current map view can also be downloaded as a bitmap. It is also an option to import data from OpenStreetMap maps (see below). Additioanlly a very course elevation grid for relatively even terrain can also be imported.

If no geometry data are present in the situation, you may position the map view via an address search. To use the address search or to import elevation data will require you to generate a free user account at Google or respectively MapQuest (for OSM), to generate API keys and to define the settings for the API keys

# SoundPLAN only supplies the tools, it is the user's responsibility to work in accordance to the license conditions of the Map Servers.

#### **Google Maps**

Google Maps is the online map service developed by Google. In SoundPLAN a component is integrated that either shows satelite immages or mapped data with text labels or as a background bitmap. The user can also choose to activate the tilted presentation or the street view mode.

To work with Google Maps at the first call, you must accept the Google usage/license conditions.

#### **OpenStreetMap**

"**OpenStreetMap** is an initiative to create and provide free geographic data, such as street maps, to anyone. The OpenStreetMap Foundation is an international not-forprofit organization supporting, but not controlling, the OpenStreetMap Project. It is dedicated to encouraging the growth, development and distribution of free geospatial data and to providing geospatial data for anyone to use and share." Quoted from: <u>https://wiki.osmfoundation.org/wiki/Main\_Page</u>.

Connection to online map services

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**Hint:** As OpenStreetMap (OSM) is an "Open Source" project where various map makers merge geometry and additional data, the quality of the data can vary. Please be aware that SoundPLAN only delivers the tools to use the data, SoundPLAN is not responsible for the correctness of the data. The export page of the OSM website contains a link to the EULA of the Open Street Map data.

There are several "keys" which the founders of the OSM project have defined, these should be used by the map makers for the classification of data.

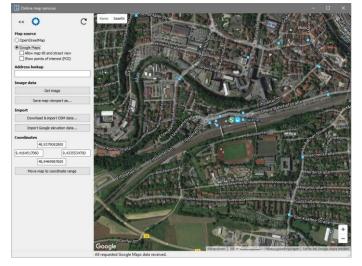
The key "highway" for example is for any road or path. This key is further detailed by the "value", which further specifies the type of road with the distinction of freeway, motorway, main roads or a simple foot path. SoundPLAN only imports roads that are roads for car travel. Additional information about the "keys" and "values" you can find on the website

http://wiki.openstreetmap.org/wiki/Map Features.

#### Method

To use either OSM or Google Maps, a project coordinate system needs to be defined. It is highly recommended to work with two computer monitors.

Open FUNDAMENTALS -> CONNECTION TO OSM & GOOGLE MAPS (*Shift+Ctrl+O*) or right mouse button -> INITIALIZE ONLINE MAP SERVICES AT CURRENT VIEWPORT.



The online map services open up with the same viewport as what you have open in the Geo-Database edit screen. If no data are in the project yet, the map services are just initialized to location SoundPLAN. From there move to the location of your project or use the **ADDRESS LOOKUP** (API key necessary, see below) to move to the appropriate location.

On the left side select the **BACKGROUND MAP**. Select from the three views: Google Map 2D, Google Map 3D and the OpenStreetMap map.

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Connection to online map services



When you check the box **ALLOW MAP TILT AND STREET VIEW** in the satellite view of Google Maps, Google Maps will show the tilted view if the distance between the viewer and the ground is less than 50 meters. With the orange figure activate Street View or switch to 360° panorama photos. Both options of course require that Google has data for these services available four your current location.

3



With this service it is very easy to count the number of floors in a building and to assess what the building is used for (residential, non-residential).

**"SHOW POINTS OF INTEREST" (POI)** references to points of interest in the Google 2D map. In the satellite view use the checkbox **LABELS** to get descriptive labels for the objects you see.

With the button **GET IMAGE**, the viewport visible in the map will be loaded and displayed as a background picture in the Geo-Database. If the tilt view mode of Google Maps is active this function is not active.

The advantage of Google Maps in comparison to Google Earth:

In contrast to Google Earth, the API interface of Google Maps is continuously upgraded. As no terrain is active in the Google Maps display, some of the potential differences between the map in Google Earth and the reality is avoided. (Google Earth is probably using different data for their triangulation than SoundPLAN and these differences will cause inaccuracies in the projection). You do not need to install additional software on your PC and the web-based navigator of Google Maps is also faster than the one from Google Earth.

#### Import OSM-data

[GIS interface] Select the desired map viewport. Click on **DOWNLOAD AND IMPORT OSM DATA** and select the files to be imported.

Connection to online map services

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| DpenStreetMap XML Import          | - | × |
|-----------------------------------|---|---|
| Import the following object types |   |   |
| ☑ Buildings                       |   |   |
| Roads                             |   |   |
| Railways                          |   |   |
| Parking lots                      |   |   |
| ☑ Elevations                      |   |   |
| Barriers                          |   |   |
| ☑ Water surfaces                  |   |   |
| Unknown geometries                |   |   |

Select which object type you want to import. Some objects may be helpful only for orientation but are not detailed enough for a SoundPLAN model. Data of different object types are imported each into their specific Geo-File with the prefix "OSM\_". This procedure should make it easier to later on deleted data of object types not desired in the model. After finishing these definitions click on **IMPORT**.

The data from OSM can contain additional information. Often you find the street name and house numbers associated with buildings and names of other objects.

These definitions are always imported. If available, other additional information e.g. the building usage, zip code or city are imported into the additional text properties of the buildings.

If object elevations for buildings and walls are contained in the data, they are imported, and the values are assigned as a property to the SoundPLAN objects. If no data are in the import file, the default data remain. Our tests have shown that object elevations/heights are seldom contained on OSM.

For example, you can use OSM data to extract address data into OSM Geotexts and assign these later to more accurate cadaster data.

Hint: If you want to import an osm file manually, for example because it had been modified in an OSM Viewer, call the import via **FILE -> IMPORT -> OSM IMPORT XML**.

#### API keys for address lookup and elevation import

To use the functions, for which API keys are necessary you need to open an account at Google or MapQuest (OSM elevations).

| Please enter your credentials           |                         | ? | × |
|-----------------------------------------|-------------------------|---|---|
| Google credentials                      |                         |   |   |
| API key for Geocoding (address lookup): |                         |   |   |
| API key for Google Elevations:          |                         |   |   |
| MapQuest credentials                    |                         |   |   |
| API key for Open Elevations:            | 1                       |   |   |
|                                         |                         |   |   |
| Open Google in browser C                | pen MapQuest in browser | ~ | × |
|                                         |                         |   |   |

Click on the symbol **SETUP API KEYS**. Select open Google in browser or open MapQuest in browser. You will access the respective website. If you don't yet have an account, you must open one with "SignUp". Follow the steps of the

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Connection to online map services

wizzard. As soon as you have successfully opened the account, you must generate the keys.

#### Generate API keys for Google:

Open a project and go to "Library". Enter "Places" in the search bar, select "Google Places Web Service" and activate it. The Google Places API is only needed to give you address suggestions for the address lookup.

Then enter "Elevation" in the search bar, select "Google Maps Elevation API" aus and activate it. Then search for "Geocoding", select "Google Maps Geocoding API" and activate it. The next step is to go to "access data" and copy the API keys in the dialog in SoundPLAN.

#### Generate API keys for MapQuest:

Log in to the website and go to "Manage Keys". Click on "Create a New Key". On the next page enter an "App Name" (e.g. elevations OSM) and click "Create APP". Open the details of the newly generated App by clicking on the name and copy the "Consumer Key" in the dialog in SoundPLAN.

After you closed the setup dialog with the green tick the functions are ready to use.

#### **Elevations from Google Maps or OSM**

Google Maps elevations (the same as elevations from Google Earth) are based on free SRTM elevation data. These elevations have a resolution of approx. 90 m, which means, that the measured points have a distance of 90 meters. In-between a spline interpolation is done. Changing topography cannot be represented with these elevations.

The elevations of MapQuest are based on elevations, OSM is using for the display of the terrain. The resolution is similar to the resolution of Google Earth / Maps and therefore also unsuitable for changing topography. For smaller areas with relatively flat terrain, for example for smaller industry noise projects, these data are certainly possible. Please check whether the data are suitable for your project.

This is a 3D comparison between laser scan data and the elevations from Google Maps and OSM for changing terrain:



Click on the button import elevation data to import the elevations within the viewport. The data is imported and automatically filtered, so that the actually relevant elevation points are meshed for the DGM.

Connection to online map services

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## Onnection to Google Earth

[Module Cartography] With the connection to Google Earth you can

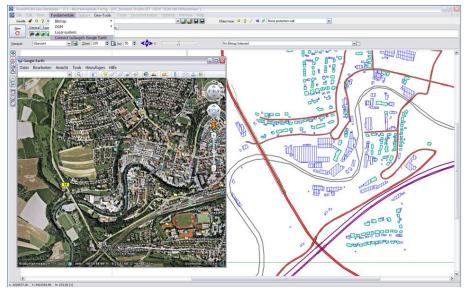
- coordinate the camera position of Google Earth with your data
- use a background bitmap from Google Earth
- reference a project on the basis of a Google Earth viewport
- get elevations

It is advisable to have two screens at your disposal.

Google Earth will discontinue operation of versions 5 and 6 as of 31 October 2018. They will no longer function from that date. With the current Google Earth versions 7 (free and pro) a smooth operation with SoundPLAN cannot always be guaranteed and we will therefore not support this interface further in the future. Please only use the Google Maps interface available since SoundPLAN 8.0 in the future.

A good agreement between already entered model data and Google Earth can only be attained when the setting "show terrain" is disabled in Google Earth (in tools > options).

When using Google Earth, please observe their usage and licensing conditions. SoundPLAN supplies the tools but is not responsible for the licensing conditions. This is entirely the responsibility of the Google Earth user. As Google Earth licensing may vary between countries, SoundPLAN can't even assist.



Define the <u>project coordinate system</u> (page 41). Activate Google Earth in the Geo-Database via **FUNDAMENTALS -> CONNECT TO GOOGLE EARTH.** 

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**Connection to Google Earth** 

Afterwards, you can use the right mouse button function -> **MOVE GOOGLE EARTH CAMERA TO CURRENT CURSOR POSITION** to view the project area in Google Earth without first navigating to the correct place.

The right mouse button click -> **GOOGLE EARTH BITMAP FOR CURRENT CURSOR POSITION** generates a geo referenced bitmap for the view you have on screen. The bitmap is available in the bitmap selection under the name "GoogleEarth.bmp". When you select a different view and again request a bitmap, the GoogleEarth.bmp will replace the old view.

If you want to work in a project from scratch with a Google Earth bitmap, activate Google Earth, determine a project coordinate system and call **FUNDAMENTALS** -> **CURRENT GOOGLE EARTH VIEW AS BITMAP**.

#### **Elevations from Google Earth**

Google Earth elevations can be imported from Google Earth via **FUNDAMENTALS** -> **DGM** -> **GET TERRAIN POINTS FROM GOOGLE EARTH**. As the origin of the elevations cannot be verified and are not very accurate, it is only sensible to use these elevations for relatively small projects in areas that are not critical for the propagation of noise. Sharp terrain edges are not getting across from the Google Earth elevations. Activate the field "show terrain" in Google Earth (in tools > options). Navigate in Google Earth to the area of interest; SoundPLAN imports the elevations within the screen section (the smaller the section the smaller the distance between the elevation points).

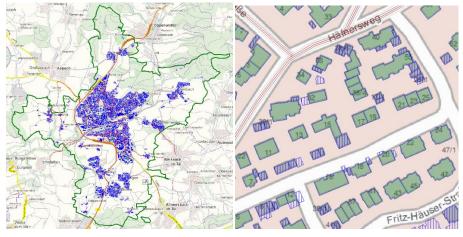
## Onnection to Web Map Service (WMS) Servers

[Module Cartography] With the WMS (Web Map Service) you can load maps to form the background of SoundPLAN graphical output. As an example, it is possible to load cadaster data or aerial photos that are supplied by the authorities or made available by independent services such as OpenStreetMap (OSM).

Contrary to online map services or Google Earth you do not get fixed sized bitmaps but the server will custom generate the bitmaps according to the selected window and resolution. Depending on the internet download speed and on the bandwidth of the server, sometimes it can be a bit time consuming to load the maps. In order to allow you to work without being tethered to the internet, SoundPLAN can save the bitmap for the next editing session.

Connection to Web Map Service (WMS) Servers

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Different scopes and resolutions depending on the scope of what you need to do

At the moment the intellectual property rights for the data are handled in very different ways depending on the WMS server. Some suppliers make the data available for you to use for free, others require the user to be registered and then can use them for free and others are using the WMS as a commercial business where you have to order the data and pay for them.

What is available in your area you must research on the web or ask the local mapping agencies for their suggestion?

We deliver SoundPLAN with the connection to the WMS Server Terrestris, here you can get worldwide OpenStreetMap-data.

*Hint: The WMS servers are not completely standardized and fixed, some servers that were free of charge in the past as an introduction offer may become pay for play or entirely vanish. For this reason, an occasional web search may advisable.* 

#### Configure the connection to a WMS server

WMS server settings are available under SoundPLAN Manager via **OPTIONS** -> **SETTINGS**, node *WMS settings* for all new projects (global settings) or in the Geo-Database via **FUNDAMENTALS** -> **SETUP WMS SERVER** for the current project.

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Connection to Web Map Service (WMS) Servers

| Selection of WMS servers                    | ?   | ×          |
|---------------------------------------------|-----|------------|
| Define and choose WMS server                |     |            |
| Terrestris                                  |     |            |
| Maps for BW                                 |     |            |
|                                             |     |            |
|                                             |     |            |
|                                             |     |            |
|                                             |     | • <b>•</b> |
| Choose layers and their order (Drag & Drop) | -   |            |
| OSM-WMS                                     | * - |            |
| ØSM-WMS OSM-Overlay-WMS ØSM-Overlay-WMS     |     |            |
| OSM-WMS                                     |     |            |
| Cosm-WMS OSM-Overlay-WMS TOPO-WMS           |     |            |
| Cosm-WMS OSM-Overlay-WMS TOPO-WMS           |     |            |
| Cosm-WMS OSM-Overlay-WMS TOPO-WMS           |     |            |

In the top list you find the WMS servers you have already had contact with. The checkmark indicates that the server is included in the selection list for bitmap/WMS server in the Geo-Database.

• Klick on the symbol PLUS, to configure the connection to a new WMS server.

| WMS Server setup                                                                                                     |                                       |         |  |  |  |
|----------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------|--|--|--|
| Basic settings                                                                                                       |                                       |         |  |  |  |
| Name for this WMS connection:                                                                                        | Terrestris                            |         |  |  |  |
| Address of the WMS Server:                                                                                           | http://ows.terrestris.de/osm/service/ |         |  |  |  |
| ☑ I agree to the terms of use of                                                                                     | this server Show terms of use         | Connect |  |  |  |
| Coordinate systems of the W                                                                                          | MS server                             |         |  |  |  |
| Select a coordinate system:                                                                                          | EPSG:25832                            | $\sim$  |  |  |  |
| Do not automatically choose n                                                                                        |                                       |         |  |  |  |
| Coordinate system detected from the EPSG code                                                                        |                                       |         |  |  |  |
| Coordinate system ETRS-TMzn Europaweite Transversal Mercator (UTM) Reference system ETRS89 (EU), geozentrisch, GRS80 |                                       |         |  |  |  |
|                                                                                                                      |                                       |         |  |  |  |
| Stripe / zone 32<br>Hint: The transformation between coordinate systems might lead to distortions.                   |                                       |         |  |  |  |
| nint: The transformation between coordinate systems might lead to distortions.                                       |                                       |         |  |  |  |
| Error handling                                                                                                       |                                       |         |  |  |  |
| Color not received / unreadable areas red                                                                            |                                       |         |  |  |  |
| Check if requested area is within the server's parameters                                                            |                                       |         |  |  |  |
| Check if requested area is wit                                                                                       | nin the server's parameters           |         |  |  |  |
| Check if requested area is with Authentification settings                                                            | nin the server's parameters           |         |  |  |  |
|                                                                                                                      | in the server's parameters            |         |  |  |  |
| Authentification settings                                                                                            | in the server's parameters            |         |  |  |  |
| Authentification settings<br>No password                                                                             | in the server's parameters            |         |  |  |  |

Enter a unique name for the connection and the web-address of the server (best found on the website of the WMS server and entered via cut and paste).

WMS servers can deliver the maps based on a multitude of coordinate and reference systems which are defined in <u>EPSG-codes</u> (page 46).

Connection to Web Map Service (WMS) Servers

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Click on **CONNECT**. SoundPLAN connects to the WMS server, evaluates the best matching EPSG code and enters the found coordinate system. In case SoundPLAN did not find the right coordinate system, for example at the boundary of zones and stripes, use the pick list to select the correct EPSG code and tell the program that you did not take the suggested coordinate system but rather use the one you picked from the list. Via the checkmark **DO NOT AUTOMATICALLY CHOOSE NEW COORDINATE SYSTEM**, you can prevent SoundPLAN from overriding your choice of a coordinate system.

If the server does not require a password, confirm that you accept the license conditions and click on OK.

If the server requires an authentication, select the right option for the WMS server you selected. Some servers contain a link to the WMS server that contains an access code that is sent every time a request is transmitted to the WMS server. (This access code can be free of charge or require a fee payment) SoundPLAN recognizes that an access code is used and automatically takes it from the link.

| Link with keyphrase |                                 |  |  |  |
|---------------------|---------------------------------|--|--|--|
| Given link:         | map=c:/srv/mapfiles/traffic.map |  |  |  |
| Extrac              | t keyphrase                     |  |  |  |

The WMS server just configured is automatically connected.

WMS server can have any number of layers that contain various type of information. It is possible that layers overly others or supplements them. When you activate multiple layers, you can generate a custom hybrid basis of information for your maps.

With the layer list, activate one or multiple layers; with Drag & Drop you can change the sequence of the layers. The topmost active layer is drawn first; this means that it is most often hidden by other data in layers below. It is advisable to have layers with transparent areas near the bottom of the list; fully covering ortho photos should be at the top. This assures that as much data as possible will be visible.

You can also switch on and off the layers later with the right mouse button -> (DE-)ACTIVATE WMS LAYER.

After ending the configuration session for the WMS server, SoundPLAN is automatically connected to the server.

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Connection to Web Map Service (WMS) Servers

#### Working with WMS servers

In order to work with WMS servers, the Situation must already be present with geometry data. If the Situation does not contain any data yet, you can import them from OpenStreetMap (see "Connection to online map services"), after this you can call the WMS server.

All defined and for the display activated WMS servers are listed in the selection list "Bitmap".

Select a server from the selection list. The WMS server establishes the web connection - which, depending on the connection, may take time. The status line of the Geo-Database will indicate "SoundPLAN is loading WMS background bitmap".

With the mouse wheel pressed move the viewport of the WMS Servers; rotating the mouse wheel zooms the viewport. When you let go of the mouse wheel, the background picture is updated – which may take some time.

Right click to -> SAVE CURRENT VIEW OF THE WMS SERVER AS A BITMAP, to save the bitmap in your project under a file name of your choice.

#### WMS server in the Graphics

WMS servers are regarded by the Graphics as its own data type. Select the data type for the WMS and the server from which you want to incorporate the background pictures. The background pictures are loaded dynamically, when you change your SoundPLAN geometry viewport by zooming or rotating, the Graphics will re-load the background bitmap from the WMS to suite the new viewport. Downloading the data from the WMS server may take time depending on your internet speed and the capabilities of the WMS server.

The WMS bitmap is controlled from the object setup via the object type **GEOMETRY BITMAP**. In the 3D Graphics the WMS bitmap can be used as normal if a DGM or a Grid Noise is loaded providing the needed elevation information for the projection of the bitmap to the ground. Additionally, the presentation must be requested in the object setup under the 3D tab.



Picture left: Colored facades on a cadastral map, the SoundPLAN buildings are deactivated. Picture right: 3D buildings on an aerial photo.

Connection to Web Map Service (WMS) Servers

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## **Editing the data**

After initially entering or importing the data the objects need to be further defined and corrected. SoundPLAN offers many different editing tools. The editing tools are located in the menus **EDIT** and **GEOTOOLS**. Some of the functions have a redundant access through the right mouse button. The objects need to be selected before the editing can take place.

## The edit mode

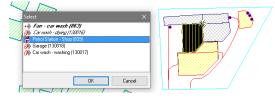
In the edit mode, existing coordinates or their properties are opened for editing by moving the cursor to the coordinate dot. When the cursor is within the search radius of the coordinate, it changes from the crosshair cursor into an arrow cursor.

For editing your data, it is a good advice to activate the object dots (page 87).

The arrow cursor is important for editing the data. When the cursor comes close to a coordinate, the shape of the cursor changes from the edit cross to the selection arrow.

Define the distance to the coordinate in which the cursor changes to the selection arrow in **OPTIONS** -> **SEARCH RADIUS=X**. The default setting of the search radius is 5 pixels.

Often more than one object is found within the search radius. In this case a list is presented with all objects found to select the appropriate object.



If you click on the objects in the selection list, the different objects are highlighted to make it easier to find the desired object. Selected objects are displayed in bold in the list, coordinates with assigned properties in italics.

Tipp: Selected objects always appear first in the list. This feature can be used to faster find an object from which to capture coordinates.

The object selection list shows object type, object name and object ID. During the entry or the import in the Geo-Database the object ID is generated automatically in ascending order. If you copy objects, the objects will lie on top of each other. The higher object ID identifies the copied object.

As soon as the selection arrow appears, the status line will present the coordinates and elevations of the nearest coordinate.

Editing the data

By **left clicking** you open the property dialog of the object, by **right clicking** you open a popup menu with further options to edit the data.

#### Zoom

To enlarge or shrink the data range, use the mouse wheel, the "page up" / "page down" keys or invoke the zoom mode with the magnifying glass. Then you can either pull a "rubber band" around the area you want to enlarge or by left mouse click (enlarge) or right mouse click (shrink).

When opening the Geo-Database, the size in the field **ZOOM** is set to 100%. In the field **INC** you can select the factor by which you want to scale the view port up and down. The default setting is 50 meaning that the view is zoomed in/out by 50%. By clicking on the button **TOTAL VIEW** the zoom is reset. The symbol button **TOTAL VIEW** is also used to update the coordinate range to the coordinates included in the Situation (e.g. after a coordinate transformation).

When the scroll-wheel is pressed, the cursor changes to a hand symbol and you can move the data on the screen. In the "hand mode" (hand button on the tool bar) the data are moved using the left mouse button.

#### Object zoom

When you want to zoom a specific object to the maximal size, the object zoom is the suitable tool. Select the magnifying glass cursor and hold the **ALT key** pressed. The magnifying glass cursor has an additional mark with the letters OBJ as soon as the cursor is within the reach of an object. Clicking the left mouse button will enlarge the object to maximal size with the scale factor set to 100% so that you can zoom in further. If multiple objects are found in the search radius a selection list is displayed from which you can pick the correct object.

#### Store geometry viewports

The data included in a Situation are fit in the graphical user interface so that all objects are visible.

For larger projects it might be sensible to store special areas as geometry view port, which you can afterwards select directly.

When you want to store a view as a repeatable view port, zoom and move to the desired settings and store the view port with **SAVE CURRENT VIEW PORT** and enter a name for the view.

When you want to recall a view port to screen, select **VIEW** -> **VIEW** PORTS activate the zoom mode and click on the little square in the top left-hand corner or select the view port by name from the view port list.

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| Beer garden 💌     | T <b>r</b> |
|-------------------|------------|
| Total view        |            |
| Beer garden       |            |
| Crossing 1        |            |
| Crossing 2        |            |
| Business district |            |
| Mixed area        |            |
| Residential area  |            |
| Petrol station    |            |

Selection list of stored viewports

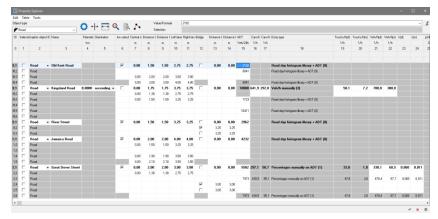
#### Rename or delete a geometry view port

Select the view port you want to delete, move the mouse to the selected view port and **right click**. Select from the options **DELETE VIEWPORT** or **RENAME VIEWPORT**.

## **The Property Explorer**

The Property Explorer enables a table type view of properties of objects. One object type is displayed at a time, the objects in this table are either all objects –if no objects are selected- or all objects of a type. The properties contained in this table are user selectable. The purpose is to enable the user to control and manipulate the data. Changes can be made to a single cell or a block of cells, modifications can be made to parameters directly or to references to the library. For the manipulation of blocks/entire columns it is possible to sort columns and design formulas that involve different columns, it is even possible to insert one temporary column.

Open the Property Explorer via *Ctrl+ E* or EDIT -> PROPERTY EXPLORER.



Modifications to individual objects can be made directly in the table, while changes for multiple objects are done by entering new values or formulas into the field **CELLS**. Formulas are commands that are valid for the active rows in current column.

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If a property is missing in the columns of the property explorer, you can switch it on via the property selection (blue wheel).

When objects in the Geo-Database are selected prior to opening the Property Explorer, only the objects that are selected and of the selected object type are opened in the table.

A double click on the "splitter"-cursor between two columns will optimize the column width of the left of both columns.

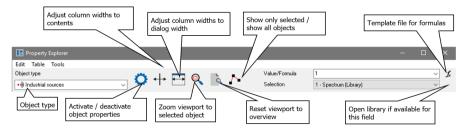
| Double dick |          |               |          |      |     |          |               |                      |      |  |
|-------------|----------|---------------|----------|------|-----|----------|---------------|----------------------|------|--|
| ID          | Selected | Building type | Name     | Juml | ID  | Selected | Building type | Name                 | Numl |  |
| 0           | 1        | 2             | 3 (+     | ++   | 0   | 1        | 2             | 3                    | 4    |  |
| 686         |          | Main building | Thomas N | 27   | 686 | Γ        | Main building | Thomas More Street 7 | 27   |  |
| 690         |          | Main building | Thomas N | 22   | 690 |          | Main building | Thomas More Street 6 | 22   |  |
| 687         |          | Main building | Thomas N | 26   | 687 |          | Main building | Thomas More Street 5 | 26   |  |

#### Using formulas in the Property Explorer

Cells for which a command (formula) shall be carried out must be *activated* beforehand. To activate an entire column, use *Ctrl+A*, the right mouse button -> ACTIVATE ENTIRE COLUMN or left click on the column number. You can also activate adjacent cells with the left mouse button depressed using the arrow keys - individual cells cannot be highlighted.

In contrast to activation, selected objects are identified with the selection mark in the Geo-Database.

Example: If you want to select all buildings with a height of 6 m, the entire column 1 shall be *activated* and afterwards they should be *selected* via a formula.



The **formulas** in the Property Explorer follow the same syntax as the formulas in the SoundPLAN Spreadsheet. Please read "<u>Calculating using Formulas</u>", page 425.

The entry of values and formulas has a separate facility from the management of selection lists. Simply enter the formula in the field **VALUE/FORMULA**.

In a text file accessible with the button *f* you can save formulas for all projects in the Globdata folder and when needed use *Ctrl+C* and *Ctrl+V* to copy/paste the formula in the formula entry of the property explorer.

As the formulas in the property explorer only allow single line formulas, it is prudent to save the formulas in the text file the same way. To allow a bit more

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general use, the "own" column can be substituted with x#. The property explorer will insert the correct column number for the substitute command.

To recognize a formula, the Property Explorer expects the formula statement to begin with an "=" sign. Columns are referenced by their column number in format **x+column number**. The column number is displayed in the column header below the name. The columns of the Property Explorer are numbered sequentially; when you select different columns, the numbering will change.

The **own column** is addressed via x#. This way the same formula can be applied to several columns.

After executing the command, the formula will be replaced with the calculated value. The formulas are not saved with the table, but it is possible to open the last formulas with a pick-list in the field **CELL**.

If an error occurs in the execution of a formula a specific and precise error message is displayed. The cursor jumps to the line where the error was found, the error description is available in the object-ID.

#### **Objects with variant parameters**

Variant objects are automatically segmented when opened in the Property Explorer. The first segment is displayed in a different color. Individual segments are presented in the Geo-Database with the highlighted display property.

- Properties of the first object coordinate are always presented in bold font
- Cells that cannot be edited are presented on gray background (calculated results. Cells with constant content of fields not relevant to the current type of data entry)
- Blanc lines fields that do not change at the current position
- White cells at this point the properties of a variant object has been changed
- Lite blue cell cursor position (if the properties are constant the font is italic)
- The last object point is shown for objects where it matters (bridges, road surface)

When leaving the Property Explorer, the objects are re-joined.

#### Core functions:

 You determine which of the -sometimes plentiful- properties shall be presented in one of the columns (yellow wheel or via TOOLS -> SELECT DISPLAYED PROPERTIES). If you want to hide a column temporarily without changing the standard display settings, you can do so by right clicking on the table header and selecting -> REMOVE COLUMN (or Shift+ Del in the explorer).

- To sort the table in ascending or descending order, right click on the column header that is to be used as the sorting parameter and select -> **SORT**.
- As the field-names sometimes are too long for the table header, you can display a self-defined short title. (The short title is defined via TOOLS -> SELECT DISPLAYED PROPERTIES in the settings of the object properties.
- With the statistics functions (right mouse button on the statistics line in the column header of value columns) you can generate entries for the sum, average or the smallest/highest value and for noise levels also the energetical sum of the levels.
- In value columns you can highlight a block of lines and with the field **CELL** assign a value to all highlighted lines of the current column.
- Elements from the library can be referenced either with the element names or via the element number.
- A block of references to the library can be reassigned via a pick list containing the element names.
- With the column "selected", you can select objects with a mouse click in the box, with the space bar (also possible for multiple highlighted lines) or with formulas (enter "1" for selected "0" for unselected). This selected status remains active when you close the Property Explorer and further process the data on the level of the Geo-Database-canvas (for example to change in which Geo-File the data shall be saved).
- The graphics object type is always visible as a column of its own so you can assign a different (already existing) graphical object type to the object.
- In the Geo-File column, the Geo-File assignment can be changed in the Property Explorer, also via a formula
- <u>.</u>With a temporary column (TABLE -> INSERT TEMPORARY COLUMN) you can store intermediate calculation results and use them for further actions in additional formulas. Data in this column will not be saved, they are lost when the property explorer is closed.
- You can search for any property of the objects (*Ctr*I+F) or for the object-ID (*Shift+CtrI+F*) or invoke "search + replace" with *F4*.

#### Examples of how to use the Property Explorer:

# Redefine the height of all buildings with less than 2 meters to a height of 4 meters:

Open the Property Explorer for buildings, click on the column header for the height of the building and sort all buildings in ascending order. Click on the top line and keep the shift key pressed while you move down in the table with the arrow keys. Highlight all values smaller than 2 and then enter the number 4 in the field CELL in order to transfer the value 4 into all highlighted cells.

#### Select all buildings with multiple apartments:

Either: Sort column "Number of Dwellings" in descending order, activate all rows with values > 1 in the column "selected" and select them with the space bar.

Or: Activate column 1 with a right click on column header or Ctrl + A and write the formula

=x"No. Column number of dwellings" > 1

into CELL and execute it.

# Convert the number of inhabitants to the number of dwellings using statistical values:

Activate the column "number of dwellings" and execute the formula "=x"Number of inhabitants"/*statistical value*".

#### Modify the emission spectrum for all sources of a group

Sort sources according to the group ID they are part of. In the column emission spectra for all sources of this group, select all sources with a depressed left mouse button and select the new desired element from the selection list in the box CELL. Via the symbol "Library", you have direct access to the libraries.

#### **Free properties**

Each object allows the use of "free properties", to import additional information that are not required by noise or air pollution calculations but may be helpful later on to process the data in the property explorer. By default, 3 text-, 3 integer- and 3 floating point variables are presented. If you need more entries, you can change the number for all variables via **OPTIONS -> NUMBER OF ADDITIONAL PROPERTIES**.

If the free properties are not displayed in the Property Explorer, use the wheel symbol to open the object property settings and select the additional properties (deactivate **SHOW ONLY EXISTING PROPERTIES**).

Free properties can also be used to assign a preload to receivers (single point calculation) and buildings (Façade Noise Map) for the evaluation in the Spreadsheet.

Free properties are only accessible in the Property Explorer not in the properties of the objects.

## **Object info**

Activate the object info with the setting for it under **OPTIONS** -> **SHOW OBJECT INFO**. You can deselect either the coordinates or the properties with the click boxes. The object info window can be moved to any position or align it to the frame of the screen.

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| 🖌 Coordinates 👘 🔽                            | Info                 |  |  |  |  |  |
|----------------------------------------------|----------------------|--|--|--|--|--|
| Coordinate                                   |                      |  |  |  |  |  |
| x= 36507,4450<br>y= 29496,6180<br>h1= 264,48 |                      |  |  |  |  |  |
| a= 92,69 m^2                                 |                      |  |  |  |  |  |
| 着 Info                                       |                      |  |  |  |  |  |
| Property                                     | Value                |  |  |  |  |  |
| Name                                         | Thomas More Street 3 |  |  |  |  |  |
| Owner                                        | Moeck                |  |  |  |  |  |
| Building height                              | 8,24 m               |  |  |  |  |  |
| Property No.                                 | 102/9                |  |  |  |  |  |
| March and a family and a                     | 2,23                 |  |  |  |  |  |
| Number of occupants                          |                      |  |  |  |  |  |

According to the settings in the <u>property selection</u> (page 143), you select which parameter is presented when the mouse is moved over a coordinate of an object of the particular type.

## Selection of object properties

You can determine which properties you want to check or modify in the Property Explorer, the object info and for "select via properties" in order to keep the list of properties simple. Additionally, you can specify your own short title for the column header in the Property Explorer and for the shape file export.

Use **OPTIONS** -> **OBJECT PROPERY SELECTION** or right click on the symbol of the object type. In the Property Explorer you click on the blue wheel.

| Property settings                                                                                                                                                                                                                                                                                     |                                                                                                                                                               | _ 🗆 🔀            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Object type Noise protection wall                                                                                                                                                                                                                                                                     | Show only existing properties                                                                                                                                 | Allow collecting |
| <ul> <li>Object ID</li> <li>Wall attributes</li> <li>Wall height [m]</li> <li>Constant element height</li> <li>Wall floats above ground</li> <li>Reflection attributes - wall</li> <li>Transmission loss barrier</li> <li>Edge modified barrier (ASJ - Japan)</li> <li>Additional elements</li> </ul> | Wall height Short title (for Attribute Explorer and Shape export) * Wal_H Show property in object info ✓ Show for attribute operations / attribute explorer ✓ | m                |
|                                                                                                                                                                                                                                                                                                       | Ok                                                                                                                                                            | Help             |

The object properties are stored in multiple records. Each node represents a record; the properties contained in the record are expanded by clicking on the +

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sign in front of the record header (the same as in the Windows explorer). As soon as you click on a property itself, the translated field name and the descriptive comment is displayed on the right side. The field name is shown in the property operations and presented in the object info. The original field name is presented in square brackets.

Enable the check box **SHOW PROPERTY IN OBJECT INFO** and/or **SHOW FOR PROPERTY EXPLORER** for the desired properties. For roads and railways there are several standard dependent properties that are always presented for one standard at a time, the standard selected in the SoundPLAN Manager for the current project.

#### Short title

For the Shape-file export the field description may have at the most ten characters and must not include special characters and blanks. Moreover, it is often sensible to define shorter column headers for the Property Explorer. Use the short title to define shorter field names. The short title is stored for all projects in the Globdata folder.

### Undo

Use **EDIT** -> **UNDO** (*Ctrl+ Z*) to cancel changes for coordinates and property definition until you stored the Situation. The action for "undo" is included in the menu.

## Activate objects

If you want to amend an object by adding coordinates at the end, you must first activate the object. With the right mouse button select -> **ACTIVATE OBJECT**. You see that the coordinates already entered, the start arrow and the last coordinate now appear in red. You only can continue digitizing at the last coordinate of a string. If you want to add coordinates at the beginning of the string, you first need to change the data entry direction.

## Select (mark) points or objects

Already existing objects and object coordinates often need to be selected in order to edit them. Some of the GeoTools refer to all objects visible on the screen if no objects are selected (marked).

Under VIEW -> SELECTED OBJECTS (F3) you can show only objects that are selected.

Selecting objects always is in reference to the data shown on screen. To limit the selection, use the <u>filter options</u> (page 87).

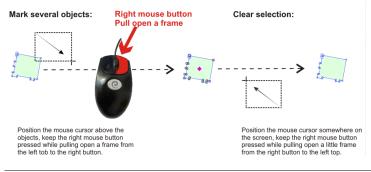
To select objects there are several options that can be used alone or in combination.

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#### Select objects with the right mouse button

Click the right mouse button on an object and select the menu entry **SELECT POINT** or **SELECT OBJECT**. Multiple adjacent coordinates (for example of a noise protection wall with zero wall height after dimensioning the wall) you can select by holding the Shift-key pressed, with the Ctrl-key pressed you can select multiple, not adjacent coordinates. When multiple objects are within the search radius, first select the appropriate object from the pick list.

To select multiple objects or all objects in an area, click with the mouse on the top left-hand corner of the area and hold the right mouse button down while moving over the area where you want to select the coordinates. All objects with at least one coordinate within the activation rectangle are selected. If you hold down the Ctrl-key, you can repeatedly activate areas with all objects of subsequent swipes selected.



#### **Clear selection**

Deselect objects with EDIT -> CLEAR SELECTION (CTRL+ Q), the menu on the right mouse button or by moving the mouse cursor to the lower right-hand of the entry screen and moving the mouse with the right button pressed to the top left position.

### Select all objects

**EDIT -> SELECT ALL OBJECTS (CTRL+ A)**, selects all objects loaded. If you want to select all objects fitting a filter first filter out the objects with **VIEW -> CURRENT OBJECT TYPE** (*F6*) or **VIEW -> CURRENT GEO-FILE** (*F5*) and then select all objects.

#### Select objects with the Alt + left mouse button

Objects can also be selected with the Alt+ left mouse button by clicking on the object of choice. To select additional objects, hold the Ctrl-key pressed. For area type objects the correct object type must be the current object type in the selection list. With an additional click (with the Alt and Ctrl-keys still pressed) you deselect the object.

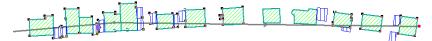
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## Select objects via a line or an area

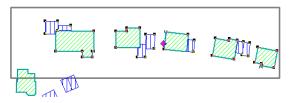
Select a line or area and invoke the menu EDIT -> SELECT OBJECTS VIA AREA OR LINE to select all objects that are intersected by the line or are inside the area. You can either use an existing object or generate an auxiliary line or polygon. The line or area object if it is selected in the process will remain selected and thus can be deleted later on. If you do not want to delete the object used to select the others undo the selecting with *Alt+Ctrl+left click* on the object before you delete all selected objects.

This function too is applied to all visible data, so use the filter options in VIEW -> CURRENT OBJECT TYPE (F6) or VIEW -> CURRENT GEO-FILE (F5) to show only certain objects.

Selection via an intersection along a line:



Selection within an area:



When the selection area cuts objects, you can decide whether only objects completely within the area or all intersected objects shall be selected.

#### Invert the selection

The function **EDIT** -> **INVERT SELECTION** deselects all previously selected objects and selects all previously unselected objects. This is an easy option to crop data that were imported and are exceeding the scope of the study. Generate a polygon around the area you want to keep, select the coordinates in the area with **SELECT OBJECTS VIA AREA OR LINE** and then invert the selecting to select all data outside the polygon.

### Selecting objects in the Property Explorer

Call the Property Explorer with *Ctrl+ E* and select the desired object type from the pick list.

Click the checkbox or press the space bar in the column "selected" to select objects in the Property Explorer. If you highlight several objects and then press the space bar, all highlighted objects are selected at the same time. You can also use formulas

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(1 for selected and 0 for unselected) to select objects. After you close the Property Explorer the selection marks remain active.

#### Selecting objects via object properties

In many cases it is faster and clearer to use the Property Explorer.

If you want to select all objects of the same object type and common properties, open menu EDIT -> SELECT VIA OBJECT PROPERTY (or *Ctrl+ F*).

| 🔝 Select via obje | ect property       |   |      | × |
|-------------------|--------------------|---|------|---|
| Object type:      | Road               |   |      | ~ |
| Property:         | Name (Object name) |   |      | ~ |
| Criterion:        | * Vhitfield Drive  |   |      |   |
|                   | OK Cance           | : | Help |   |

To define the criteria, the relationship operators <, >, =, <>, <=, >= and \* (part) can be selected from the selection list. Select the object type and the property for the selection. Use the criterion \* to find all objects of one object type with a common part in one of the properties.

When the property has the addition named index or ID, you cannot directly use the name but have to first find the reference number for the name and then use the index number or the number of a library element. Internally, there are references often in the database rather than the full object properties.

Examples:

You want to select all buildings in Jamaica Road. But the building name also includes the house number. Enter the criterion \* and the operation "Jamaica". All buildings with the common text part "Jamaica" in the building name will be selected (but the "Jamaica Sports Area" would also be found).

Searching for objects with an undefined property: Enter the criterion = and leave the field search string empty.

Properties that are assigned from the library (source spectra, absorption spectra, day histograms etc.) reference the library via the number of the element in the project library. The element number is always presented in the library when you move the mouse over the element name.

#### Select points with elevation <= [m]

**EDIT** -> **SELECT POINTS WITH ELEVATION** <= **[M]** is a good tool to for example find objects that have been imported without any elevation. The selected points afterwards can be deleted or corrected with elevation information from the DGM.

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# Select objects with elevation <= [m]

The GeoTool **SELECT OBJECTS WITH ELEVATION** <= **[M]** is a tool to find and select objects that were imported without elevation information. Delete the selected objects or use a DGM to provide the elevation information.

Tip: If you import DXF data, you can ignore coordinates without elevation information during the import.

## Select objects with length <= [m]

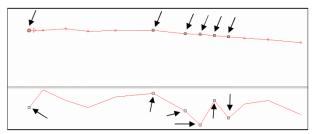
**SELECT OBJECTS WITH LENGTH <= [M]** selects all line objects that have a length smaller than a threshold value.

#### Select objects with an area <= [m<sup>2</sup>]

With the GeoTool **SELECT OBJECTS WITH AN AREA <= [M<sup>2</sup>]** small buildings e.g. with a ground area of less than 40 m<sup>2</sup> like garages, can be identified and selected. The auxiliary buildings once selected can be transferred into a Geo-File of their own.

## Select road segments with gradient > $|x|^{\circ}$

Use **EDIT** -> **SELECT ROAD SEGMENTS WITH GRADIET** >  $|X|^\circ$  to visualize road gradients up or down that are greater than the threshold entered.



*Geo-Database editor with projection: the arrows indicate the selected points* 

Right click on the points with problems to correct the elevations manually -> EDIT OBJECT PROPERTIES. A second choice is the Geotool ADJUST SHARP ELEVATION STEPS to automatically change the elevation problems.

# **Delete points or objects**

Move the cursor to the point you want to delete until the cursor changes from the crosshair into the arrow. Right click and select **DELETE POINT** or **DELETE OBJECT**. To delete points and objects with the right mouse button, the coordinates do not need to be selected. Selected objects are deleted with **EDIT** -> **DELETE** (*Del*).

# Insert point after

If you want to insert a coordinate into an already existing object, select the coordinate in front (in data entry direction), press the right mouse button and select the menu entry **INSERT POINT AFTER**. The new coordinate is generated in the middle between the selected coordinate and the next one. The elevation is interpolated between the 2 bordering coordinates and the point is selected so that you can move it to the correct position.

# Insert point before

With a right click on a coordinate, you can generate a new coordinate before this coordinate. If the point was the first point of the object, a new first coordinate for the object is generated and the properties of the previous first coordinate is transferred to the "new" first coordinate.

# Insert a point at any location

In addition to the "insert point before" and "insert point after" you can insert new coordinates in a line directly by selecting the *red digitizing cursor* and inserting the new coordinate on the object with a *pressed shift key and the right mouse button*. The elevation for the new coordinate is interpolated from the coordinates before and after, it is not read from the DGM. Graphically inserting coordinates this way helps to insert the beginning and the end of bridges that might be visible from the background bitmap. Select *F12* to toggle between the digitizing and the edit mode.

# Move / capture selected point

When a point or an object is selected, the cursor changes into the movement cursor when you are getting in range of the search radius around the point. Move the point with the left mouse button to the new position.

Keep the right mouse button pressed to move a point to the x, y and z coordinate of an existing point. When you release the right mouse button and the cursor is close enough to the new position, the coordinate is moved, if you were not close enough, the point reverts to the original position.

With the *shift key* pressed the captured point will only move the X,Y coordinates but not the elevation to the new location. This is particularly helpful if you have stacked area sources that should be at the same location but different elevations.

# Move, duplicate and rotate objects

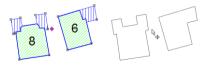
As soon as one or multiple objects are selected, the Geo-Database places a **magenta square** in the center of gravity of the group. Clicking on this square and

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keeping the left mouse button pressed will **move** the group to a new location. The new location is indicated as an outline.



Hold the Ctrl-key pressed while attempting to move the objects will **rotate** the object around the center of gravity.

**Rotating** objects can also be activated via **VIEW** -> **SHOW DIALOG "EDIT SELECTED OBJECTS"** (*Shift+Ctrl+R*).

| Edit selected objects |          |  |
|-----------------------|----------|--|
| Rotation<br>Degree    | Inc. 0,5 |  |

You can either enter the rotation angle in **DEGREES** [°] via the keyboard or use the arrows next to the entry field to get to the desired angle. The field **INC** sets the increment for the angle field. Enter 0° to reset the rotation. You can leave the window open parallel to the normal data entry window.

Keep the Alt-key pressed and move the objects with the left mouse button to **duplicate** the selected objects.

# **Copy object**

Select the object you want to copy into another Geo-File and invoke the function **EDIT -> COPY OBJECT**.

| Copy to  |             |                |              | × |
|----------|-------------|----------------|--------------|---|
| Geofile: | residential | area           |              | • |
|          | Ok          | <u>C</u> ancel | <u>H</u> elp |   |

Copy object

You can also use **EDIT** -> **COPY** (*Ctrl+ C*) and **EDIT** -> **PASTE** (*Ctrl+ V*) to copy selected objects. The objects are pasted to the Geo-File displayed in the Geo-File selection list. After you pasted the objects, only the copy is selected.

# **Graphics-Object type**

You can change the basic object types to other predefined layouts, for example redefine a noise protection walls or lines as ridges for 3D or assign the different buildings types (e.g. auxiliary building, school or hospital). With the module Cartography you can additionally assign free definable layouts.

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| Select graphics object type [Building]         |
|------------------------------------------------|
| 2                                              |
| Auxiliary building<br>Hospital<br>Kindergarten |
| Main building<br>School<br>Unknown             |
| OK Cancel Help                                 |

Select the objects you want to process and click on the symbol EDIT -> GRAPHICS-OBJECT TYPE – for a single object you can assign another layout from the selection list in the tree view of the object dialog. In the list you find all possible variations for the selected basic object type. Assign the desired layout. A single object can be assigned a graphics-object type by right clicking and then executing GRAPHICS -OBJECT TYPE.

If you want to assign a new own layout to an object type, click on the symbol **EDIT OBJECT TYPE**. This opens the project object types (see "Generate own object types").

The presentation of the object according to the object design is only done in the Graphics, not in the Geo-Database. Store the Situation and then view it in the Graphics.

### *Generate own object types*

Duplicating object types allows you to generate multiple layouts for the same object type. For example, it may be useful to draw different types of roads with different layouts to show one road is under federal jurisdiction, another is the responsibility of the state and another is under local jurisdiction.

Activate the object type you want duplicate. Press the symbol button duplicate. Enter a new name for the new object type and customize the legend text. Then modify the layout for the new sub-object as described in "Site map / geometry data (page 545)". The following example assumes roads and buildings have been duplicated for different layouts:

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# Signs and Symbols



# Split objects

Use this function to split an object into 2 separate objects. Right click on the point where the new object should start and invoke the function **SPLIT OBJECT**. If the object dots are activated, you will see that the property definition mark is repeated at the beginning of the new object and that the new object has between the first and second coordinate a new direction arrow.



If you split roads or railways the property "reference line" is transferred to the second object.

# **Invert entry direction**

Sometimes it is necessary to change the entry direction of a line object (for example when you want to add coordinates at the beginning of the line). Another use of this facility is to uniform the entry of buildings so that the documentation provides a better overview. Trigger the function by right clicking **CHANGE INPUT DIRECTION**.

For industrial buildings the entry direction is automatically adjusted to have the entry of the coordinates in a counter clockwise direction.

# **Change Geo-File Assignment**

Select the objects you want to move into another Geo-File and invoke the menu **EDIT** -> **CHANGE ASSIGNED GEO-FILE** (*Ctrl* + *G*) (or click the right mouse button in an area where you do not home in on another existing coordinate). All Geo-Files present in the Situation are listed in the selection box. When storing your data next, all objects that were selected are removed from the old Geo-File and are moved to the newly assigned one.

Editing the data

| Move to  |             |                |              | × |
|----------|-------------|----------------|--------------|---|
| Geofile: | residential | area           |              | • |
|          | Ok          | <u>C</u> ancel | <u>H</u> elp |   |

It is also possible to open right mouse menu -> **EDIT OBJECT PROPERTIES** for one single object and select another Geo-File included in the Situation.

# **Convert object type**

Select the objects you want to convert and trigger the function EDIT -> CONVERT OBJECT TYPE (*Ctrl* + *U*) (or right click at a place where you do not home in to another coordinate) and select the new object type from the pick list.

| Convert objec | t type      |                           |      | × |
|---------------|-------------|---------------------------|------|---|
| Object type:  | Road        |                           |      | • |
|               | Define defa | Define default properties |      |   |
|               | Ok          | Cancel                    | Help |   |

After you selected the target object type, the property dialog is opened. If the object in the existing object type has defined properties, they will be lost when converting to the new object type. If this is the case, SoundPLAN will give you a warning.

# Set objects to DGM

| Set objects on DGM      |        | ×    |
|-------------------------|--------|------|
| Add up to DGM elevation |        | 0,00 |
| ОК                      | Cancel | Help |

Selected objects are set to the digital terrain model which is loaded in the background with EDIT -> SET OBJECTS TO DGM (*Shift+Ctrl+D*) (or right click in an area where you do not activate another coordinate). The elevation from the DGM is assigned to the z-coordinate.

If you want to add e.g. a pedestal to the buildings, enter the value in the field ADD UP TO DGM ELEVATION.

When buildings or industrial buildings are placed on top of a DGM, you can select if the ground floor slab elevation shall be derived from the elevation at the corners of the building as the highest/lowest or if it shall be averaged from all coordinates.

Editing the data

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| Set objects on DGM                                   | ×                          |
|------------------------------------------------------|----------------------------|
| Terrain reference:<br>building / industrial building | mean terrain height $\sim$ |
| Add up to DGM elevation                              | 0,00                       |
| ОК                                                   | Cancel Help                |

This way you can determine in cases where the terrain is sloping where the building has its entrance. Along with the building property, "number of basement floors," you can position the receivers more exactly in their elevation.

#### Bridge detection without known gradient

If roads or railways are included in the data, you can check the **SEARCH FOR BRIDGES** box and then set the bridge search parameters. The checkbox is deactivated if bridges are already present in the course of one of the roads or railways.

| 🔛 Set objects to DGM        | – 🗆 X |
|-----------------------------|-------|
| Options                     |       |
| Add up to DGM elevation [m] | 0,00  |
| Bridge detection            |       |
| search for bridges          |       |
| Smooth heights              |       |
| Number of iterations        | 1     |
|                             | 🖌 🗙 🖉 |

The bridge detection automatically detects bridges based on the gradient between the object points, sets the bridge start and end with a width of 10 m to the right and left and adjusts the height of coordinates within the bridge to the bridge level. The bridge addition for railways must be assigned manually (Property Explorer).

| 🔛 Set objects to DGM -                   | - [  |      | × |
|------------------------------------------|------|------|---|
| Options                                  |      |      |   |
| Add up to DGM elevation [m]              | 0,00 |      |   |
| Bridge detection                         |      |      |   |
| search for bridges                       |      |      |   |
| Min. allowed bridge length [m]           |      | 10   |   |
| Min. allowed bridge height [m]           |      | 2,5  |   |
| Mean terrain gradient (begining/end) [%] |      | 20,0 |   |
| Max. allowed bridge gradient [%]         |      | 4,0  |   |
| Max. allowed bridge length [m]           |      | 1000 |   |
| Smooth heights                           |      |      |   |
| ☑ Number of iterations                   |      | 1    |   |
|                                          | ~    | ×    | 0 |

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Editing the data

You can use **SMOOTH ELEVATIONS** to compensate for small height outliers from the DGM. The more **ITERATIONS** you run through, the more the coordinates are adjusted.

Use "Control bridges", page 180 to verify the length and position of bridges.

## **Coordinate operations**

With the coordinate operations you can modify the x and y coordinates and, which is more likely, the elevation for one or multiple objects at the same time. Select the objects and trigger the function **EDIT** -> **COORDINATE OPERATIONS** (or right click in an area where you do not activate another coordinate). In the selection box select the parameter that should be modified "x", "y" or "z", in the field below enter the function you want to use for example +0,5 or =125. The DGM elevation is set via "Assignment of elevation from a DGM to objects" (page Fehler! Textmarke nicht definiert.)".

In rare cases your data may be stored with y, x instead of x, y coordinates. In this case you must swap the x and y coordinates via the "Coordinate Transformation", see page 173.

| Coordinate oper | ation |        | ×       |
|-----------------|-------|--------|---------|
| Value:          |       | z ~    |         |
| Operation:      |       | +1,5   | Execute |
| [               | OK    | Cancel | Help    |

The following operations are possible:

Set equal to (=), Add (+), Subtract (-), Multiply (\*), Divide by (/)

# **Property operations**

This tool requires comprehensive knowledge of the properties. It is therefore often faster and clearer to use the Property Explorer!

Property operations are used to modify the properties associated with a single object type for one or many objects at the same time. In order not to make the selection list too long, you can define the properties you want to be listed for property operations, see "<u>Selection of object properties</u>" on page 143.

Select the objects you want to modify and trigger the function EDIT -> PROPERTY OPERATIONS (or right click on an area where the cursor will not snap to a coordinate). Select the property from the pick list and enter the desired operation in the field below. For example, +3, =102,5 or =Main Street.

Editing the data

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| 🔝 Property ope | ration Building                                |      | × |
|----------------|------------------------------------------------|------|---|
| Object type:   | Building                                       |      | ~ |
| Property:      | Number of floors (Building properties - floor) |      | ~ |
| Operation:     | =1 Execute                                     |      |   |
|                | OK Cancel                                      | Help |   |

The following operations are possible:

Set equal to (=), Add (+), Subtract (-), Multiply (\*), Divide by (/)

# Search for an object known by its ID number

Hint: Search object is nowadays only used rarely. In most cases it is easier to directly access the object in question with the <u>Pre-flight</u> (page 179). in the calculation logbook can be a

In the logbook of the SoundPLAN calculation core the warning and error messages are sometimes indicating that a particular object in a Situation/Geo-File has a problem. (For example, "Road properties of road #1793 are missing"). The search function helps to find the object with the ID that is listed in the error message. Select EDIT -> SEASRCH OBJECT and enter the object ID number (or right click on an area where the cursor will not snap to a coordinate). The data on screen are redrawn in a way that shows the maximum size of the searched object.

# **Geo-Tools and Tools**

The Geo-Tool dialogs contain a preselection of the object types that are sensible for the individual GeoTools.

| Select for "Set objects to DGN                                    |                        |         |     |
|-------------------------------------------------------------------|------------------------|---------|-----|
| There are no objects selected.<br>objects of the checked object t |                        | ith all |     |
| Tunnel opening                                                    |                        |         | 1   |
| Road<br>Building                                                  |                        |         |     |
| Wall                                                              |                        |         |     |
| Receiver                                                          |                        |         |     |
| There are objects with absolute<br>Execute Geo-Tool for           | and relative elevation | selecte | ed. |
| absolute objects                                                  | relative objects       |         |     |
|                                                                   | 1                      | ×       | 0   |

The Geo-Database only interferes if nothing is marked or a possible error is detected, otherwise the dialog opens directly.

There are error messages or logbook entries, for example if a DGM is required, if there is no object valid for the selected tool in the data or if objects are marked that a certain tool cannot process. If objects with absolute and relative elevation

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are included or marked, please select for which objects the Geo-Tool should be executed.

If no DGM is loaded and you want to run a GeoTool that requires a DGM, you will be prompted to load the DGM before running the Geo-Tool.

# **Geometry Tools**

Some geometry tools are explicitly working only on line type objects when they are selected. The menu options are only shown when the object has been selected (marked).

### Create a parallel object

Parallel objects are used for example to generate a base line of a noise protection wall parallel to a road alignment or for the generation of a 2-track railway line. Select the object and trigger the function **GEOTOOLS** -> **CREATE PARALLEL OBJECT** (Shift+Ctrl+P).

| Create parallel object |                          |   |
|------------------------|--------------------------|---|
| Object type:           | Noise protection wall    | ~ |
| Distance:              | 8,50 (left <0; right >0) |   |
|                        | OK Cancel Help           |   |

Select the object type from the pick list and enter the distance in [m] between the existing line and the new one. A positive value will generate the new line to the right (in entry direction of the existing line) and a negative value will generate the parallel to the left of the existing line. The input direction can be recognized by the small arrows when you switch on the object points for the object type (see "Display of object dots and object properties (page 87)").

If the object type for the parallel object is the same as for the original object, already defined properties are carried over.

### Parallel object from calculated object lines

Calculated object lines are lines that results from the input of properties. For example, the berme top from the height and the tilt of a berme or the position of the road edge from the lane width which may also change in the course of the road. Start this extra function by right clicking on one of the object coordinates and selecting the function **CREATE PARALLEL OBJECT.** Select the object type of the new object and the distance to the existing object. With the distance 0.0 the new object is just like copy/paste would generate.

## Connect lines and generate areas

Data imported from external sources sometimes are not present as complete lines and areas but rather as fragments. Activate the **object dots** to check the data. To process the objects in SoundPLAN, the line fragments should be combined to polylines and completed area. This function is done with **GEOTOOLS** -> **CONNECT LINES** (*Shift+Ctrl+V*) and **GEOTOOLS** -> **MORE GEOMETRY TOOLS** -> **CREATE AREAS**.

The Geo-tool **connect lines** expects the entry of a maximal distance between the closest coordinates of the objects to be connected. This distance is interpreted as the three-dimensional distance.

With **ALT + CONNECT LINES** (or **Shift+Ctrl+Alt+V**) the height difference is not taken into account; the upper elevation is used.

The name of the object is deleted if multiple objects are concatenated with the function.

The algorithm **CREATE AREAS** is able to generate the areas if the coordinates defining line elements are **within 10 cm** of each other. The algorithm recognizes the area and connects the polyline and converts it into areas.

Select all lines you want to connect and then trigger the function **CONNECT LINES** or **GENERATE AREAS** from the menu **GEOTOOLS**. Activate the object dots to check if all object coordinates now share a single start arrow.

**Hint:** If not all line fragments are connected into a polyline, the most likely reason is that the first and last coordinate of subsequent line elements are not identical or that the distance is bigger than 10 cm for areas. On selected objects that share the same coordinates the selection mark is not visible. The second drawing of the selection mark "undraws" the first drawing.



"Undrawn" selection for identical coordinates

The example below shows how the lines should look before and after connecting the lines:



Lines converted to polylines and lines converted to areas

When the two sets of coordinates are not identical, a bit of extra work is needed: Either select the lines and pull the last coordinate of a line segment with the **right mouse button** depressed on to the first coordinate of the next line (when the selection mark vanishes, the point is available twice). The other option, especially suitable if the gap between the objects is bigger, is to select the first line with the

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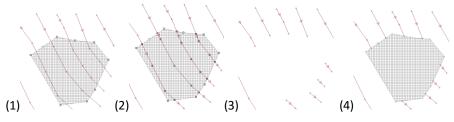
right mouse button and the option **SELECT OBJECT**, and then capture the first coordinate of the following line with the **CAPTURE COORDINATE** command of the right mouse button. When both lines have different entry directions, the direction of the selected object will set the direction for the new object.

#### Insert intersections and split

If you want to split the lines and cut them so that the buffer remains free of the line, use this GeoTool. It generates points along the selected intersection line and splits the objects. The area itself and the objects within are selected so that both are deleted when you hit the **Del**. When inserting cutting points along a line, the cutting line will remain selected.

Procedure with the example of an area, the functions are the same as with the line: You can either use an existing area or digitize an auxiliary polygon. Select the area and trigger **GEOTOOLS** -> **INSERT INTERSECTIONS AND SPLIT** (1).

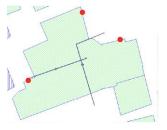
The start arrows indicate that the elevation lines within the area now are objects of their own and are also selected (2). With **Del** the elevation lines in the area are deleted (3). If the original area (that was used to select and split the elevation lines) shall not be deleted, eliminate the select with an **Alt + Ctrl left click** on the area (4). Be aware that the object type for the area must be the currently selected type!



Another option to generate the cutting polygon is via the GeoTool CREATE BUFFER.

#### Divide areas

This function is particularly useful to subdivide an apartment building into multiple apartments, to separate a string of town houses, or to subdivide area sources and parking lots into homogeneous areas.



All properties are copied to all sub areas. For buildings, the number of inhabitants is distributed in accordance to the surface area of the sub areas.

**Geo-Tools and Tools** 

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Enter lines where you want the area objects to be divided and then trigger the function **GEOTOOLS -> DIVIDE AREAS**.

#### Clean-up overlapping areas

With this Geo-tool (GEO-TOOLS -> CLEAN UP OVERLAPPING AREAS (Shift + U)) smaller areas overlapping a bigger area are cut out.



This tool is also useful to make sure contradicting definitions of ground absorption areas or volume attenuation areas that cause errors in the calculation are corrected.



#### Filter coordinates

If the distance between the coordinates of line objects is very small, unneeded points, that don't have influence on the accuracy can be deleted with the filter function. A smaller point density reduces the amount of data and has a positive effect on the calculation time. Filtering with a maximum deviation of 10 cm is in most of the cases not critical.

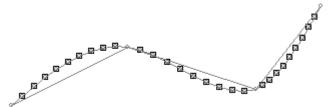


Select the objects and invoke the function **GEOTOOLS > MORE GEOMETRY TOOLS -> FILTER**. Enter the filter width and click the OK button. The coordinates selected for the filter width of 10 cm as in the above example, are all within a zone of 10 cm left and 10 cm right between existing, unselected coordinate. Elevation differences are considered and the coordinates are not selected. Points with property definitions are not selected, even if they are within the filter width.

If you agree with the result and want to delete the selected coordinates from the data pool, press the **Del** key or use **EDIT -> DELETE**. If not, clear the selection with **Ctrl+Q** or right mouse button -> **CLEAR SELECTION**. The objects then remain unchanged.

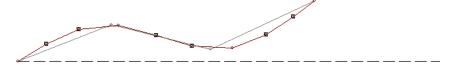
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Interpolation -> n points per segments



The line must at least contain 3 coordinates. SoundPLAN inserts the number of coordinates you requested in a 3-dimensional spline, the already existing coordinates will not be modified. Trigger the function GEOTOOLS > MORE GEOMETRY TOOLS -> INTERPOLATION -> CREATE N POINTS EACH SEGMENT and enter the desired number of intermediate coordinates. The interpolated coordinates are selected. The picture above shows the result in the projection.

#### Interpolation -> segments with constant distance



The line must at least contain 3 coordinates. SoundPLAN inserts coordinates on a 3dimensional spline in the spacing you requested. The existing coordinates remain unchanged. Invoke the function with GEOTOOLS > MORE GEOMETRY TOOLS -> INTERPOLATION -> CREATE SEGMENTS WITH CONST. DISTANCE IN [M] and enter the desired spacing of the coordinates along the line in [m]. The interpolated coordinates are selected. The picture above shows the result in the projection.

### Interpolation -> Create a point in a defined distance

Coordinates are connected with straight lines, which will re result in a light error of road length in curved roads and railway lines. This tool inserts a coordinate in a selected distance from the start of the line. The distance is calculated using a 3-dimensional spline rather than the straight-line connections so the distance from the start coordinate is very accurate. The line must at least contain 3 coordinates. Trigger the function with GEOTOOLS > MORE GEOMETRY TOOLS -> INTERPOLATION -> CREATE POINT WITH [M] DISTANCE TO THE FIRST POINT. The interpolated coordinate is selected.

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## Divide into sections

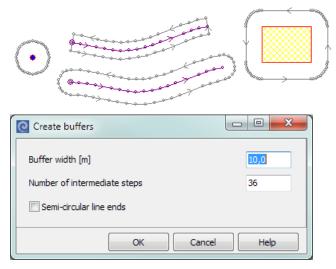
Object edges of line and area type objects can be subdivided into smaller sections so that noise protection walls or facades of buildings can be structured more. The objects are not cut.



Trigger **GEOTOOLS > MORE GEOMETRY TOOLS -> DIVIDE INTO SECTIONS** (*Shift + Ctrl + L*) and enter the distance between points to insert in [m]. The elevation of the new coordinates is interpolated. Existing points are remaining, if the requested distance is smaller than the minimum distance, no further coordinate is inserted.

### Create a buffer

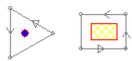
**GEO-TOOLS** -> **MORE GEOMETRY TOOLS** -> **CREATE BUFFER** allows generating buffers around points, lines and areas.



The **BUFFER WIDTH** in [m] is the distance between the marked object and the border of the buffer area (for example: enter 4.5m if you want to create a buffer with a width of 9 meters). Via the **NUMBER OF INTERMEDIATE STEPS**, you determine how detailed arcs are generated with regard to 360°. For example, if you set 36 intermediate steps for a point object, you will get an approximation of a circle with 36 coordinates (or an angle of 10° between coordinates).

Examples: With the setting 1 intermediate step for area-type objects the corners are not radiused. The setting 3 for a point object will result in a triangle.

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The switch **SEMI-CIRCLE LINE ENDS** will cause the ends of a line to be set as a half circle.

[Module "Noise Mapping Toolbox"] With *Shift* + GEO-TOOLS -> MORE GEOMETRIE TOOLS -> CREATE BUFFER areas around the emission bands of roads are generated, the width of the band left and right of the emission line is set with the entered parameter. The buffer is selected so that you can quickly select building with EDIT -> SELECT OBJECTS VIA AREA OR LINE to detect where the emission band is in conflict with buildings.

Fix area geometries

If the warning message "*Receiver x is within the assigned building, possibly due to right angle correction*" appears in the logbook during calculation of a facade noise map, this is often due to the fact that the lines of a building were put together like an 8 after import. This warning and also other errors when calculating, for example, if area usages or ground effect areas cut itself, can be cleaned with the Geotool **MORE GEOMETRY TOOLS -> FIX AREA GEOMETRY**. This Geo-Tool goes through all areal objects objects of a Situation and cleans up the geometry. The log shows how many areas were corrected, how many buildings with courtyards are included and whether areas could not be corrected.

#### Fix building geometries

If you receive a warning message, such as "receiver x is within the assigned building, possibly because of the right angle correction," in the logbook, it could be that this building was imported, but the sequencing of the coordinates was wrong and the building actually resembles a figure 8. Use the Geo-tool **MORE BUILDING TOOLS -> FIX BUILDING GEOMETRY** to check and correct all buildings of a Situation. The protocol will indicate how many buildings are corrected, how many buildings contain an inner courtyard, and if there are buildings that could not be corrected.

#### Unite areas

This Geotool generates a hull around all marked areas (regardless of the object type) to generate a bigger area containing all marked sub areas. This can be used for example to use areas of city boroughs to generate a calculation area. Holes (areas not part of a marked area but totally encapsulated) and overlapping areas are ignored. The resulting area is of the type of general area and can then be converted into any other type. Select the areas and invoke **GEOTOOLS -> MORE GEOMETRY TOOLS ->UNITE AREAS**.

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## Calculate right angles

Selected area type objects can subsequently be adapted to right angles using **GEOTOOLS > MORE GEOMETRY TOOLS -> CALCULATE RIGHT ANGLES.** You will get a message if the angle is smaller than 45°.

#### Clean multiple points

**GEOTOOLS > MORE GEOMETRY TOOLS -> CLEAN MULTIPLE POINTS** filters coordinates with a default minimum distance of 1 cm. This Geo-tool can also be used to clear up double coordinates at the beginning and the end of buildings.

# **Building tools**

#### Prepare buildings

**GEOTOOLS** -> **PREPARE BUILDINGS** is very useful to jointly prepare many buildings in an imported set of data and set the needed parameters for the Façade Noise Map. The automatically generated properties are entered into the properties of the buildings. If no buildings are selected, this Geotool processes all buildings visible on screen.

| Prepare buildings                             |                   |       |
|-----------------------------------------------|-------------------|-------|
| Define building name                          |                   |       |
| Define road name                              |                   |       |
| Define house numbers                          | start with        | 1     |
| Select all facades for Facade Noise Map (FNM) | min. length       | 0,00  |
| Deselect all facades selected for FNM         |                   |       |
| Calculate number of floors                    |                   |       |
| Adapt height of GF                            |                   |       |
| Different height of ground floor [m]          |                   | 3,50  |
| Calculate building height                     |                   |       |
| Create geometry texts from house numbers      |                   | 1.00  |
| Create geometry texts from object numbers     | Text size [m]     | 4,00  |
| Define inhabitants                            | m2 per inhabitant | 40,00 |
| ОК                                            | Cancel            | Help  |

Select the buildings you want to process. **DEFINE BUILDING NAME** fills in the field building name with road name and house number. You can create a **ROAD NAME** as well as a continuous **HOUSE NUMBER**. The number can be automatically converted into a Geotext.

SELECT ALL FACADES FOR THE FACADE NOISE MAP means all facades of all selected buildings that are longer than the MINIMAL LENGTH (min. length in [m]) are

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selected. Use the minimum length to exclude small areas of the main buildings. When you activate the properties of the buildings (Symbol selection list) you can see which facades are selected for the Façade Noise Map as thick dark turquoise lines. With **DESELECT ALL FACADES** for FNM the calculation of receivers for the selected buildings is deactivated.

With the height of the building in place, SoundPLAN can **CALCULATE THE NUMBER OF FLOORS** of the building and thus define the positions of the receivers. The calculation is carried out with the floor height entered in the building properties as well as the possibly differing height of the ground floor (check mark **DIFFERENT HEIGHT OF GROUND FLOOR**).

The height of the first receiver above GF has no relevance on the calculation of numbers of floors.

If, in addition, the **ADJUST ELEVATOR HEIGHT** switch is activated, the building height is changed to a multiple of the floor height and the GF of the building is corrected upward, so that the upper edge of the building (diffraction edge) remains the same. For building heights smaller "floor height", the GF is adjusted down so that the diffraction edge does not change.

Vice versa you can use **CALCULATE BUILDING HEIGHT** to calculate a generalized building height if instead of the wall height the number of floors is known. The building height is calculated from the *floor height* \* (*number of floors* + 0.5 \* *floor height*). The additional half floor height is used to find a mean height for the top floor. A more individual building height can be calculated in the Property Explorer, for example to take different floor heights for ground floor and upper floors into account.

**HOUSE NUMBER AS GEOTEXT** creates a Geotext within the building from value in the field house number.

**OBJECT NUMBER AS GEOTEXT** creates a Geotext within the building from value in the field object number.

You can use TOOLS -> CREATE GEOTEXTS FROM PROPERTIES to display any property as text.

**DEFINE INHABITANTS** calculates the number of inhabitants per building from the parameters ground area, number of floors and a user defined area per inhabitant.

**Hint:** Data imported from other programs often do not place main buildings and auxiliary buildings (garages etc.) into separate layers. For auxiliary buildings no Façade Noise Map needs to be produced. Use the GeoTool **SELECT OBJECTS WITH AREA** <= [M<sup>2</sup>] to select auxiliary buildings and place them into a separate Geo-File.

#### Reassign receivers to buildings

You can reassign receivers to buildings if the Geo-Database lost the assignment. As every object in the Geo-Database has a unique object ID and the ID is used as the

**Geo-Tools and Tools** 

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building reference for the receiver, assignment can be lost, e.g. because the buildings have been copied.

**Hint:** You can see lost assignments if receivers assigned to buildings are displayed in red instead of green. See "<u>Display of object dots and object properties</u> (page 87)".

Aside from the assignment of receivers to buildings, you can use this Geo-tool to assign changed buildings properties to the receivers.

| 🔝 Reassign receivers                                                                       |       |      | × |  |  |
|--------------------------------------------------------------------------------------------|-------|------|---|--|--|
| <ul> <li>assign new building reference</li> <li>use existing building reference</li> </ul> |       |      |   |  |  |
| Options Update receiver name update floors and heights                                     |       |      |   |  |  |
| update area usage                                                                          |       |      |   |  |  |
| change distance [m]                                                                        |       | 0,01 |   |  |  |
| ОК С                                                                                       | ancel | Help | ) |  |  |

If no objects are selected all receivers will be processed. Call GEO-TOOLS -> REASSIGN RECEIVERS TO BUILDINGS.

Select **REASSIGN BUILDING REFERENCE**, if the connection between buildings and receivers has been lost (red receivers).

To update the receiver properties from the building, click on the relevant checkboxes. You can reassign independently from each other the **AREA USAGE**, the **RECEIVER NAMES**, or the information on **FLOORS** and **HEIGHTS** (this option also derives the receiver height above ground from the ground floor elevation of the building). As the reassignment, depending on the size of the project, may take a while, you may use the button **USE EXISTING BUILDING REFERENCES** to reassign the properties from the buildings to the receivers.

Activate one or more of the options, if you want to update information in the receivers. You can transmit separately **RECEIVER NAME**, **USAGE**, and the information on **FLOOR** and **HEIGHT** (this option also updates the object height of the receiver from the GF of the assigned building).

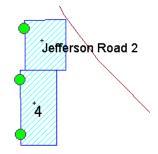
If the existing building reference is used, you can use the check mark **CHANGE DISTANCE [M]** to change the distance of the selected receivers to the façade, for example, if the same receivers are to be used for calculations according to different guidelines with different position and calculation height requirements (e.g. <u>Total noise assessment according to VDI 3722-2</u> (page 680)).

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Check the result. In case the receiver was not assigned, the distance of the receiver to the facade might be too large. The façade can be found if it is within twice the distance as set in the field of the receiver setting the "Dist. Façade".

#### Assign texts to buildings

Texts that have the position marker (black plus sign) inside the building can be automatically assigned to the building properties.



Buildings and texts do not have to reside in the same Geo-File. The buildings must be visible on screen. The texts must be selected.

With the Geo-tool **ASSIGN TEXTS TO BUILDINGS**, it is possible to automatically set texts in all available fields, for example the property number or the owner of the building.

| C Text as property  | $\overline{\mathbf{X}}$                           |
|---------------------|---------------------------------------------------|
| Building property:  | Number of occupants (Building attributes - gener. |
| Type of assignment: | Assign one text (overwrite)                       |
|                     | OK Cancel Help                                    |

Select the assignment type **ASSIGN ONE TEXT (OVERWRITE)**. This assignment type overwrites whatever text/value was assigned before. When multiple texts are found inside the building, the text found first will be used as the text assigned to the field.

#### Gather multiple texts in a single field

When multiple texts are inside a building, the texts can be concatenated to one single field. For this option select **ASSIGN MULTIPLE TEXTS (ADD)**.

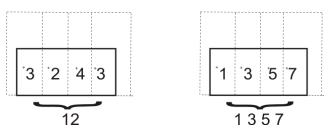


If multiple buildings of terraced houses have been digitized as a single building and the house number or the number of inhabitants is available for each of the terraced houses, the text assignment will treat the data appropriately.

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Value fields (inhabitants, # of dwelling units) are added to a single value (left sketch), for text fields (house number, name...) the individual texts are concatenated with a blank in between (right sketch).

Existing texts are not overwritten but amended.

#### Transfer area usage to buildings

With this Geo-Tool the zoning definition from objects of the object type "usage areas" is transferred to the appropriate property of the marked building objects.

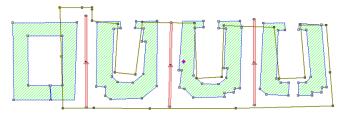
Mark the area usages and all buildings that you want to define the area usage property and invoke **GEOTOOLS** -> **MORE BUILDING TOOLS** -> **TRANSFER AREA USAGE TO BUILDINGS**. If no buildings are marked, all buildings contained in a usage area will have the property set.

### Distribute Occupants/ or Dwellings

If you have the population numbers for the entire town or district by district, you can assign the population figures or dwellings to the SoundPLAN usage areas and distribute them to all residential buildings in accordance to the number of square meters of living space (for each building area times number of floors). To distribute the population or dwellings, select the usage areas and call the **GEOTOOLS -> MORE BUILDING TOOLS -> DISTRIBUTE OCCUPANTS** or **DISTRIBUTE DWELLINGS**.

**UNIQUE ASSIGNMENT** distributes the inhabitants only to buildings where the center of gravity is completely inside the area.

**EXTENDED ASSIGNMENT** distributes the inhabitants also to buildings that are not completely inside the areas as long as the center of gravity or the multitude of the corners is within the area.



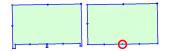
This tool distributes the figures only to buildings assigned the property main building.

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# Simplify buildings

[Module "Noise Mapping Toolbox"] With the **GEO-TOOL** ->**MORE BUILDING TOOLS** -> **CLEAN WALL LEDGES** (*Shift* + *M*) you can cut off small outcroppings of buildings and thus simplify the buildings. This way you can prevent the program from calculating excessive numbers of receivers for a Façade Noise Map at places that are not relevant.

Enter the maximal width of the outcropping on a facade that is supposed to be rectified. By default, this parameter is set to 1 meter.



If the wall outcropping is not on the border of the building, the program will automatically set a coordinate to separate the facade.

#### Select buildings by Spreadsheet

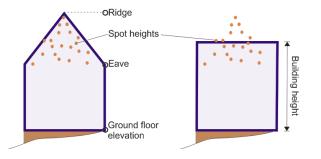
With this Geo-Tool you can use a Boolean column from the spreadsheet to assign buildings and receivers a criterion to mark/unmark the object (if the Boolean value is true, the object is marked). Buildings marked this way can for example be moved to a different Geo-File or can be assigned a different graphics object type.

Invoke **GEO-TOOLS** -> **MORE BUILDING TOOLS** -> **SELECT BUILDINGS BY SPREADSHEET** and select the spreadsheet and the column which contains the criterion to be evaluated.

# **Elevation Tools**

#### Evaluate spot heights for mean building heights

A geo-tool polls all spot height points located in a building, averages the elevations, calculates the difference between the foot of the building and the average height and places this parameter into the building property for the building height.



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Select the buildings and import the spot elevations within the circumference of buildings (see page 114). Invoke **GEO-TOOLS -> EVALUATE SPOT HEIGHTS FOR BUILDING HEIGHT**. The buildings need to be selected.

## Calculate the object height from the top edge

If the object base elevation contains the tops of buildings / industrial buildings or the tops of noise protection walls, a SoundPLAN GeoTool calculates the wall height by evaluating the tops of the object with the elevation found in the DGM. SoundPLAN averages the heights and writes the results into the field "wall height" for walls and respectively "building height" for buildings. The DGM must be loaded.

Select the objects and invoke GEOTOOLS -> CALCULATE OBJECT HEIGHT FROM TOP EDGE.

For buildings or industrial buildings, you can select if the ground floor slab elevation shall be derived from the elevation at the corners of the building as the highest/lowest or if it shall be averaged from all coordinates.

| 🔛 Calculate object height from top ed | - |   |     | × |
|---------------------------------------|---|---|-----|---|
| Wall settings                         |   |   |     |   |
| Horizontal wall top                   |   |   |     |   |
| Constant wall element height          |   |   |     |   |
| use segment height of [m]             |   |   | 0,5 |   |
| Option                                |   |   |     |   |
| ☑ Ignore existing wall heights        |   |   |     |   |
|                                       |   | 1 | ×   | 0 |

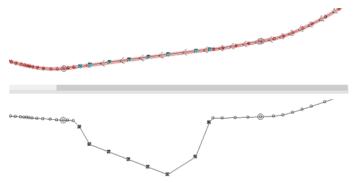
When you select **HORIZONTAL WALL TOP** the program -if necessary- will insert an additional coordinate at the end of the wall to make sure the horizontal top is correct. The base height of the wall is defined as such that the maximum wall surface is generated. **CONSTANTE ELEMENT HEIGHT** is setting the element height at the end of the wall in such a way that the wall has a constant height, the height of the top of the wall may be variant. **USE SEGMENT HEIGHT** uses the height of the segments and the number of stacked elements of your choice and sets the base height of the wall to assure that the section's height is a multitude of the segment height. The gap between the bottom of the lowest element and the DGM is regarded as a non-reflective base. All three parameters can be combined.

Additionally, you can use the option **IGNORE EXISTING WALL HEIGHTS.** This setting sets the top of the diffracting edge to the z-component of coordinate, even is a wall height is defined explicitly in the properties. When you deactivate the checkmark and the wall height is greater than zero, the top of the wall will be lifted by the wall height.

View the results in the 3D view or side projection.

#### Interpolate elevations

Between selected coordinates of a line type object you can interpolate the elevations. For example, for ramps to motorways where only the start elevation and the end elevation of the road are known or to smooth elevation peaks within a line type object.



Select the entire object or within an object the coordinates to interpolate in between (select the first coordinate with a right click -> **SELECT POINT**, press the **shift key** and select the last coordinate with a right click -> **SELECT POINT**) and then start **GEO-TOOLS** -> **MORE ELEVATION TOOLS** -> **INTERPOLATE ELEVATIONS** or **Ctrl+ H**. You can also use the front or side projection to mark the beginning and end coordinate for the interpolation.

In conjunction with the function EDIT -> SELECT POINTS WITH ELEVATION <= X [M] it is easy to select all coordinates of a freeway ramp and interpolate the elevation between all coordinates to get a smooth elevation profile.

#### Interpolate elevations on bridges

**GEO-TOOLS** -> **MORE ELEVATION TOOLS** -> **INTERPOLATE ELEVATIONS ON BRIDGES** interpolates between the beginning of the bridge and the end of the bridge the elevation of all bridges of all selected roads and railways. If you have several bridges in the course of an object, but you only want to interpolate the elevations of a specific bridge, select the bridge points of the desired bridge <u>except</u> the bridge beginning and the bridge end point and perform the Geo-Tool **INTERPOLATE ELEVATIONS** (*Ctrl* + *H*).

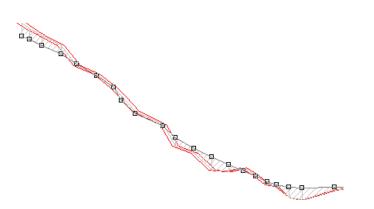
#### Smooth elevations

If the digital ground model is inaccurate, some of the road sections will show jumps in the elevation that will exceed the allowable limits for roads and will cause excessive road incline additions in the emission calculations.

The elevations of the existing coordinates are moved in an iterative way so that it does not result in a systematic error.

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Open **GEOTOOLS** -> **MORE ELEVATION TOOLS** -> **SMOOTH ELEVATIONS** and enter the number of iterations. As the coordinates remain selected, you can view the results afterwards and, if needed, run additional iterations.

This function is also very useful to smooth a road that shall be used as an animation track for the 3D-Graphics.

#### Adjust sharp elevation steps (out of bounds gradients)

When objects imported without elevation information are placed on top of a DGM, it can happen that DGM triangles are intersecting the road and are pulling the coordinates unreasonably up or down. This Geo-tool finds elevation inconsistencies within DGMs that are in general correct.

The Geo-tool under **MORE ELEVATION TOOLS** -> **ADJUST SHARP ELEVATION STEPS** searches for gradients between 2 coordinates and corrects the gradients that are above 10% by adjusting the elevation of the road coordinates (a planned extension of this function is to make the threshold user definable). If two coordinates have a smaller distance than defined in **CONCENTRATE POINTS** these coordinates are concentrated in one point. Coordinates that contain property information are also adjusted in their height but not concentrated even if they are very close to another coordinate.

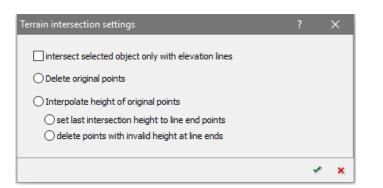
Please check the result in the projection and via EDIT -> SELECT ROAD SEGMENTS WITH GRADIENT >  $|X|^{\circ}$ .

In the projection you can manually adjust the elevations grabbing and moving individual coordinates with the mouse.

#### Elevations from terrain intersection

A line object can be fit into the terrain in such a way that all intersections with elevation lines define the elevation of the line object.

Select the objects you want to use for the Geo-Tool and open GEO-TOOLS -> MORE ELEVATION TOOLS -> ELEVATIONS FROM TERRAIN INTERSECTIONS.



For each selected line object, the program inserts the intersections to the objects that are fitted with elevations and sets the elevation in the selected object to the elevation of the object that is intersecting. Objects containing elevation information are elevation lines, roads, railway tracks, walls and the berm ground line. In the settings of the Geo-Tool, you can restrict the usage of intersecting objects to just elevation lines, then other objects that are not marked such as other roads will not interfere with the elevations of the objects to be set.

Additionally, you can determine what to do with the original coordinates:

- Delete the original coordinates
- Interpolate the coordinates (only linear interpolation is possible)

When you opt for the interpolation, the program will search for intersections in the extension of the line to produce an intersection with the known terrain. This extrapolation will set the beginning and end coordinate of the line to be interpolated as long as the program can find an intersection. In no intersection can be found, you have the choice to take over the elevation from the next possible intersection or to delete the coordinate.

The default setting what to do with the original coordinates depends on the type of object. If only elevation lines are selected, "delete" is the default. SoundPLAN assumes that you want to generate extra elevation information to force the DGM to connect a ridge of the terrain with the basis. For this purpose, it would be difficult if the original terrain points would remain. For all other line objects, we assume that you want to keep the original coordinates and have set the default to "interpolate".

### Bridge detection

The Geo-Tool Bridge Detection (GEO-TOOLS -> MORE ELEVATION TOOLS -> BRIDGE DETECTION) searches for brides in the course of roads or railways, for which the gradient is known. This means, the elevation of the given coordinates will not be changed.

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| Bridge detection               |            | × |
|--------------------------------|------------|---|
| Bridge detection               |            |   |
| Min. allowed bridge length [m] | 10         |   |
| Min. allowed bridge height [m] | 2,5        |   |
|                                | <i>~</i> , | 0 |

Enter the **MINIMUM BRIDGE LENGTH** and the **MINIMUM BRIDGE HEIGHT** as search criteria.

Use "Control bridges", page 180 to verify the length and position of bridges.

# **Coordinate transformation**

#### Coordinate transformation with rotation / reference points

The GeoTool Coordinate Transformation offers two alternative transformation methods. The first method requires a fixed point for the rotation and a rotation angle; the second one uses transformation vectors as are used to initialize bitmaps.

The transformation is a very useful tool to rotate entire groups of objects for example to reorient a planned industrial plant with sources and buildings.

Select one or multiple objects and use the **GEOTOOLS** -> **COORDINATE TRANSFORMATION (ROTATION / REF. POINTS).** To rotate selected objects, enter the rotation angle and the coordinate around which the rotation shall be carried out (for example the corner of the plant).

| Rotation          | General  |   |          |  |
|-------------------|----------|---|----------|--|
| angle<br>Rotation | 90.00    |   |          |  |
| x                 | 36280.73 | v | 29651.46 |  |

To move the data to their new location via the full transformation, open the tab *General* and enter at least 2 pairs of reference coordinates.

| otation Ge  | meral     |          |          |       |
|-------------|-----------|----------|----------|-------|
| Coordinates | ir<br>San |          |          |       |
| OLD_X       | OLD_Y     | X        | _Y_      | □ Inv |
| 36280.73    | 29451.46  | 36280.73 | 29651.46 |       |
| 36330.00    | 29444.00  | 36330.00 | 29644.00 |       |

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If you enter more than 2 pairs, you can also stretch the objects and correct them further.

#### Transformation between coordinate systems

For the work with SoundPLAN, it is not important which coordinate system you use. Knowledge of the coordinate system becomes important when you want to join data from different sources and suppliers or when you are asked to deliver results in a specific coordinate system.

Define the project coordinate system (page 41), select all objects and select under **GEOTOOLS** -> **TRANSFORM COORDINATES (SYSTEMS)** if the object shall be transformed into the project coordinate system or if the project coordinate system needs to be transformed into a target system.

In the first case, enter the point of origin in the existing coordinate system. In the second case, enter the origin of the target system.

| Coordinate transformation  | on to target coordinate system                | ×              |
|----------------------------|-----------------------------------------------|----------------|
| Coordinate system for futu | re use                                        |                |
| Coordinate system          | UTM coordinates (northern hemisphere)         | × 0            |
| Reference system           | WGS84 (World-wide GPS), geocentric, WGS84     | ~ 🦉            |
| False easting              | 0,00                                          |                |
| False northing             | 0,00                                          |                |
| Stripe / zone              | 32                                            | EPSG code      |
| Coordinate system defined  | l in project                                  |                |
| Coordinate system          | Gauss-Krueger coord. (3 degrees wide strips)  |                |
| Reference system           | DHDN90 (DE-B₩ 2007 <±0.4m), Rauenberg, Bessel |                |
| False easting              | 0                                             |                |
| False northing             | 0                                             |                |
| Stripe / zone              | 3                                             |                |
|                            |                                               | OK Cancel Help |

After the transformation, the screen will be empty because the coordinate range changed. Click on the Symbol "Zoom 100%" to get the coordinate range updated. You can verify the correctness of the transformation if you use the "Connection to online services" to show the area in question. If you transformed from your current project coordinate system to a new one, you must adjust the stored coordinate system to the new system in **FUNDAMENTALS** -> **EDIT PROJECT COORDINATE SYSTEM** before you can verify the transformation.

#### Coordinate transformation during import

The coordinate system is often defined in the import data. In order for the import data to be available in the desired coordinate system after the import, it may be necessary to perform a transformation during the import.

The following combinations are possible:

• Project coordinate system and coordinate system of the import data are the same: The import data is imported without transformation.

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- Project coordinate system and coordinate system of the import data differ: You can change the coordinate system of the import data for the transformation.
- No project coordinate system, but a coordinate system is defined in the import data: The coordinate system of the import data is displayed for information. You can use a check mark to specify a project coordinate system, which is pre-assigned with the coordinate system from the import data. If another coordinate system is to be used, select it in the selection list. The import data is then transformed into the desired system.
- The project coordinate system and the coordinate system in the import data are defined, but the coordinate system of the import data was not recognized: In the dialog, you can choose a coordinate system for the import data. If possible, the definition of the coordinate system is displayed as text in the import data, from which you can optionally close which coordinate system is behind it.

# Road /Railway tools

### Location correction of the road master alignment

Road / Railway alignments are available from various sources and in various qualities. For example, it is common that road alignments are divided into sections with common traffic characteristics and cross-sections, but they lack the accuracy of the master alignment.

The accuracy of the alignments can be improved by combining the alignment with other geometrical data. The higher quality data must be available as object type lines (or converted to lines). As an example, Navteq data can be purchased to improve the geometrical accuracy (data used in navigation systems).

Select the objects and invoke **GEOTOOLS** -> **ADAPT ROAD** / **RAILWAY** (*Shift* + *Ctrl* + *S*). Enter the maximum displacement within which the road alignment is corrected and fit to the geometrical course of the lines. Coordinates that are not moved because of spacing, are selected. Under **HELP** -> **PROTOCOL** both the moved and not moved coordinates are documented.

Divide the road segments to small sections (5 - 10 m) so that they can be adapted to the line.



Left: original situation, middle: road divided into sections, right: result

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#### Center road axis

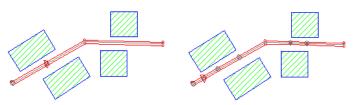
If you have moved road edges, you can use **GEOTOOLS** -> **CENTER ROAD AXIS** to center the road axis between the road edges. The position of the emission lines and the road edges are not changed, only the distances in the tab *cross section*.



## Estimate multiple reflections (from RLS-90)

(Only for roads) The Geo-tool **ESTIMATE MULTIPLE REFLECTIONS** checks according to a check line for homogeneous building situations on both sides of the road. If this is the case, the multiple reflection addition is calculated from the average height of the lower side and the average spacing of the buildings. For the length of the checking line, values between 10 and 50 meters are reasonable.

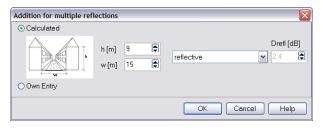
At the position on the road where the multiple reflection addition changes the value, coordinates with the new multiple reflection addition are inserted. The elevation is interpolated between the existing points.



Left: present situation, Right: with inserted points

The program always assumes hard facades; the program only uses facades of buildings, not noise control walls. This addition can only be estimated for road noise levels derived from calculations, it cannot be incorporated for levels that are calculated elsewhere and set in the program.

The parameters h and w calculated on the basis of the checking line are automatically displayed in the emission dialog, tab index card *"additions*" and the multiple reflection addition is calculated.



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See multiple reflections (page 193) in chapter "Objects – Road master alignment"

If you want to use another check line length you can reset the multiple reflection records with **GEOTOOLS** -> **RESET MULTIPLE REFLECTIONS**.

# Reset emissions for roads and railways

With **TOOLS** -> **RESET EMISSIONS FOR...** you can reset the emission records that are the basis of the emission calculations (for roads for example traffic volume, speeds and corrections). You can keep the properties at the first coordinate of an object. If no objects are selected, the program will reset the emissions for all roads or for all railways.

| Which records should be deleted?                                                                                         | $\overline{\mathbf{X}}$ |
|--------------------------------------------------------------------------------------------------------------------------|-------------------------|
| ☐ Traffic attributes - Guide du Bruit<br>☐ Speed attributes - Guide du Bruit<br>☐ Correction attributes - Guide du Bruit |                         |
| Keep emission definitions at the 1. point?                                                                               |                         |
|                                                                                                                          | OK Cancel Help          |

# Oreate geometry texts from object properties

[Module Cartography] With this tool you can generate texts from any object. Mark the objects for which you wish to generate descriptive texts from the properties and call **TOOLS** -> **CREATE GEOTEXTS FROM PROPERTIES.** 

| 🔢 Create geomet      | try texts form object propertie | es – |      |      | ×      |
|----------------------|---------------------------------|------|------|------|--------|
| Select object proper | ty                              |      |      |      |        |
| Object type:         | Road                            |      |      |      | $\sim$ |
| Property:            | ADT (Traffic data - RLS-90)     |      |      | ~    | 3      |
| Options              |                                 |      |      |      |        |
| Text size [m]        |                                 |      | 5    |      |        |
| Move horizontal / v  | ertical                         |      | 0,00 | 0,00 |        |
| Vertical alignment   |                                 |      | Left |      | $\sim$ |
| Decimals             |                                 |      | 0    |      |        |
|                      | ОК                              | Can  | cel  | Hel  | p      |

If needed, select a different object type and the property. If the desired property is not listed in the selection list, click on the wheel symbol and activate it in the "Selection of object properties (page 143)".

Under options choose the **TEXT HEIGHT** in [m] (world coordinates). For area type objects all other options are grayed out, the reference point for the text is always

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the center of the area. For line type objects choose the **VERTICAL ALLIGNMENT** of the geo texts along the line, depending on the data entry direction. Another option is to have a vertical displacement (**MOVE VERTICAL**). For point type objects the texts by default will be placed to the right of the object, the vertical alignment is centered. For point objects the placement can be set with **VERTICAL ALIGNMENT**, or with **MOVE HORIZONTAL / VERTICAL**.

The newly generated geometry texts "know" the object and the property they were generated from. If you generate a new geometry text for the same object and property, the previous text is deleted.

## **Regenerate new object numbers**

Object numbers can be regenerated for a special area (selected objects) or for all objects included in the Situation in accordance with the format string.

Select **TOOLS** -> **OBJECT NUMBER** and select whether you want to generate new object numbers for receivers, buildings or sources. SoundPLAN knows the last used object number for this object type and offers the next free number. Enter any number, in accordance to the format string. If the number does not correspond to the format string, SoundPLAN shows a message with the current format string.

# Separate objects that occur multiple times

For each object to be relocated a new Geo-File is generated. The object with the lower object ID will remain in the original Geo-File while the one with the higher ID is placed into the new Geo-File. If a third identical object is found, this object is again placed in a new Geo-File. After the separation, go through the Geo-File list and decide about the objects to use and the objects to reject.

Select the data that may contain multiple identical objects and trigger TOOLS -> SEPARATE MULTIPLE OBJECTS.

After checking and finding the duplicates, you are asked to enter a name for the duplicate object Geo-Files.

### **Pre-flight**

With the tool pre-flight it is possible to check data of the open Situation directly from the Geo-Database. Errors that would cause the Calculation core to abort are noted in a logbook along with all warnings you normally find in the calculation logbook. Select **TOOLS -> PRE-FLIGHT** to trigger the check of the geometry, the logbook will open automatically.

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| Teo-Database Logbook                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| SoundPLAN 7.4 - 18.02.2015<br>GeoDL 13.15.0<br>Globdata Path = C1\Jesrs\corinna.kurz\Documents\SoundPLAN Globdata 7.4\<br>ProPath=d:\sp projekte\pffizielle demoprojekte\en\windty73\                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |
| Cancelet: Check bridge at coordinate (XX)=(36618,36,2697,88); no lateral distance entered<br>(Simmp: Budget) and Sim (Simm); Sim | ati |
| Clear Print Save Close Help                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |

It can be moved at will, even to a secondary screen. When clicking on a warning or an error message, the coordinate(s) where the warning/error was detected will be marked with circles. By double clicking the object zooms to its max size for a complete display.

With a right mouse click you can select what the preflight shall note in the logbook. Errors always will be shown; hints and warnings are optional.

|   | Display time       |  |
|---|--------------------|--|
| ✓ | Show warnings      |  |
| ✓ | Show hints         |  |
| ✓ | Show protocol data |  |

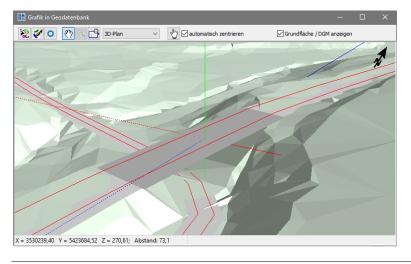
## Control bridges

The logbook writes a protocol where bridges are found and what length the bridges have.

As a warning for the user to check there are messages in the logbook about geometrical situations where the bridge is smaller than half the minimum length or is one of the embankments has an incline that is consistently smaller than 30°. All other bridges are inserted as a hint. Bridges having a warning associated with them should be manually checked.

In addition to the logbook the 3D-graphics (*Ctrl+F10*) should be opened. With a double click on an entry in the logbook the program jumps to the position of the bridge in the 3D graphics, the view is rotated so that you see the bridge in the side view.

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#### Load calculation run logbook

A logbook can also be loaded from the calculation kernel in the logbook. This makes it easier to check and correct errors that occur during calculation.

Open the logbook and load the log file for the calculation run where errors occurred from the results subdirectory in the project directory. The file has the same name and the same number as the calculation run, for example RSPSxxxx.log for a faulty single point calculation.

# **Overview of short cut keys in the Geo-Database**

| Esc                     |
|-------------------------|
| Page up / down          |
| Arrow keys left / right |
| Ctrl +E                 |
| Ctrl +G                 |
| F2 (or double click)    |
| Ctrl +U                 |
| Ctrl +C                 |
| Shift + Ctrl +K         |
| Del key                 |
| Ctrl +V                 |
| Ctrl +A                 |
| Shift + Ctrl +D         |
| Ctrl +R                 |
|                         |

Overview of short cut keys in the Geo-Database

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| Edit: Select with object properties                   | Ctrl +F                                                  |
|-------------------------------------------------------|----------------------------------------------------------|
| Edit: Toggle extended view (object dots, settings)    | F4                                                       |
| Edit: Undo (Caution, not all actions can be un-done)  | Ctrl +Z                                                  |
| Edit: Un-select                                       | Ctrl +Q                                                  |
| File: Open Situation                                  | Ctrl +O                                                  |
| File: Save Situation                                  | Ctrl +S                                                  |
| Fundamentals: Calculate the DGM                       | Ctrl +D                                                  |
| Fundamentals: Connection to online map services       | Shift + Ctrl +O                                          |
| Geo-Tools: Adjust road / railway course               | Shift + Ctrl +S                                          |
| Geo-Tools: Clean up overlapping areas                 | Shift +U                                                 |
| Geo-Tools: Clean up wall ledges                       | Shift +M                                                 |
| Geo-Tools: Concatenate areas                          | Shift +W                                                 |
| Geo-Tools: Connect lines                              | Shift + Ctrl +V                                          |
| Geo-Tools: Divide lines into segments                 | Shift + Ctrl +L                                          |
| Geo-Tools: Filter                                     | Shift +Ctrl +F                                           |
| Geo-Tools: Interpolate elevations                     | Ctrl +H                                                  |
| Geo-Tools: Parallel object                            | Shift +Ctrl +P                                           |
| Geo-Tools: Transform to project coordinate system     | Shift +Ctrl +I                                           |
| Geo-Tools: Transform out of project coordinate system | Shift +Ctrl +A                                           |
| Insert a free point on a line or an area              | Digitizing mode (F12),<br>Shift+ Ctrl + R. mouse button  |
| Tools: Toggle between Edit and Digitizing mode        | F12                                                      |
| Tools: Toggle right-angle mode on /off                | F11                                                      |
| View: 3D-solid model                                  | Ctrl+F10                                                 |
| View: 3D-wire frame model                             | F10                                                      |
| View: All objects                                     | Depending of prior selection or again with, F3, F5 or F6 |
| View: Current Geo-File                                | F5                                                       |
| View: Current object type                             | F6                                                       |
| View: Front view                                      | F8                                                       |
| View: Only marked objects                             | F3                                                       |
| View: Rotate selected objects                         | Shift +Ctrl +R                                           |
| View: Side view                                       | F9                                                       |
| View: Top view                                        | F7                                                       |
|                                                       |                                                          |

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Overview of short cut keys in the Geo-Database

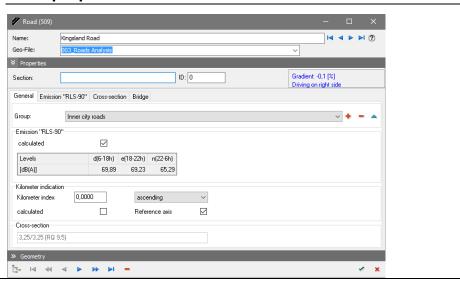
# **4 Objects and their Properties**

4

Some of the objects, especially the noise sources, noise barrier and ground effect, have special standard dependent properties. Please read the standard or ask your local distributor for details.

# Road Alignments

Roads are used in the acoustics as a line element. The road master alignment is entered with X and Y coordinates and the elevation of the road surface above sea level. The width of the road and the distance of the emission bands are defined in the tab index card *Profile*. The elevation of the emission band is computed automatically from the elevation of the road surface according to the used standard and is considered for the propagation calculation.



**Road Alignments** 

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## Road properties

The properties menu for roads is divided into separate tab index cards for the noise emission, the kilometer post, the road cross section and the bridge definition. The kilometer post and reference line definition are the same for all the calculation methods. The emission properties depend on the calculation standard and are different for each of the calculation standards in SoundPLAN.

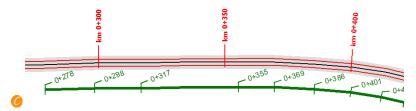
#### Name, section and group

The **NAME** describes the object; the **SECTION NAME** is used to further describe parts of a road. Both name and section are displayed in the road emission documentation. The **SECTION ID** can be used to assign a unique key for assignment of traffic data from external traffic nets. The road name can only be entered at the first coordinate of a road. If the road name changes in the course of the road, please define a new road.

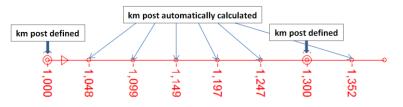
With the **GROUP ASSIGNMENT** (see "Using the group assignment of sources (page 253)") roads can be assigned to groups, for example roads under different road authorities.

#### Kilometer posts and Reference line

The km post is used in the SoundPLAN Spreadsheet, in the emission table of roads and in Wall Design and can be displayed in the Graphics, if desired, together with the reference kilometer of a noise protection wall (Cartography).



A kilometer post is assigned to each road coordinate together with the direction (ascending or descending). You can enter the kilometer post manually or let SoundPLAN calculate the distances. Activate the check box **CALCULATED** for the automatic calculation. As line objects are entered as straight lines in SoundPLAN, there might be differences between the calculation and the real world. Deactivate the automatic calculation in the course of the road entry, if needed, and enter a correct value. The automatic calculation is continued with the manually entered value.



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View the kilometer in the Geo-Database with **VIEW** -> **OBJECT OPTIONS** or much faster click the symbol "with properties" (road as active object type).

In order to use the kilometer in the Spreadsheet and in the Graphics, one road axis must be defined as **REFERENCE LINE**. Activate the checkbox at the first coordinate of the road.

| Stationing       |        |                |   |
|------------------|--------|----------------|---|
| <u>k</u> m post: | 0,0000 | ascending      | ~ |
| Calculated       |        | Reference line |   |

If a reference axis is defined, it is automatically loaded in the Spreadsheet from the situation used in the calculation. If you want to assign a reference line later, use **FILE -> ADD ADDITIONAL COLUMNS -> COLUMNS WITH FURTHER INFORMATION**. You can change the Situation or Geo-File used with **FILE -> TABLE CONTENTS**.

# **Emission documentation of roads**

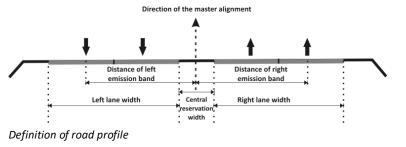
The emission data of roads are documented in the Geo-Database via **DOCUMENTATION** -> **ROAD** (NOISE). The format of this table cannot be changed. A table for the road emission data is stored during a road noise calculation and is displayed in the Result Tables in the tab index card "*Roads*".

#### Cross sections / road profiles

| General Emission "RLS-90" Cross-section Bridge |
|------------------------------------------------|
| Definition                                     |
| 7,50/2,00/7,50 (RQ 20) 💙 >>                    |
| Single emission band                           |
| left right                                     |
| Lane width [m] 7,50 7,50                       |
| Distance emission band [m] 6,38 6,38           |
| Central reservation width [m] 2,00             |

Entry of the road cross section

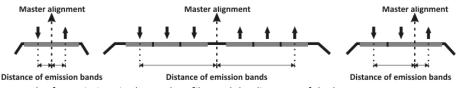
Roads are digitized as line objects. The line depicts the **road master alignment**. For the acoustics calculations, the place of emission is not always the middle of the road. For the exact definitions of your standard, please read the standard. In the RLS 90 for example, the emission is placed in the middle of both outer lanes.



**Road Alignments** 

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Either select one of the predefined profiles or enter the lane width, the distances of the emission bands for both lanes, and the dimensions of the central reservation. Road profiles can also be asymmetric needed to define turning lanes.

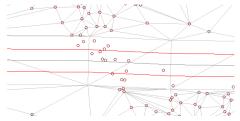


Examples for variations in the road profiles and the distances of the lanes

The lane width is important for all standards where the roads are used as hard surfaces for the propagation calculation. With the setting **CREATE GROUND EFFECT AREAS FROM ROAD SURFACES** (calculation run properties, tab index card *Settings*) all roads are regarded as hard ground without the need to enter ground effect areas.

The lane width is also used to display the roads in the Graphics.

The position and elevation of the road edges can be taken into account for the <u>calculation of the digital ground model (DGM)</u> (page 124). Elevation information within the road bands are clipped from the meshing, so that the emission line cannot be beneath the terrain.



DGM meshing with road edges, spot heights within the road band are not meshed

The **CENTRAL RESERVATION** is symmetrically added to the right and the left of the road master alignment.

**Modify the road cross section graphically**: When a road is activated for editing, the emission bands and the road edges can be moved manually. Emissions- and border lines themselves are not presented as "marked" but the cursor will change in the proximity of the coordinates into the movement arrow. Emission and border line can be moved along a line marking the bisector between the last and the next coordinate. Road width and distance of the emission line to the master alignment are automatically adjusted in accordance to the manual movement of the coordinates. When the road is displayed with the view option HIGHLIGHTED the road surface is displayed as a gray band. Press *Ctrl+ R* (VIEW -> REFRESH) to update the display of the road.

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| -<br>**********- | <br> |
|------------------|------|
|                  |      |

Keep the *Shift*-key pressed to move emission line and road edge line independently.

# Single Emission Band

If you don't want to split the emission to the outer lanes, activate the check box **SINGLE EMISSION BAND** road at the first coordinate of the road axis. Roads with one single lane cannot be combined with roads with two emission lines. In this case a new road must be defined. Therefore, the check box single emission band is only available at the first coordinate of a road. Use the navigation bar to go to the first coordinate.

For roads with one emission line, enter the **LANE WIDTH** to the right and to the left for ground effects and graphical display.

| <br>Single emission band |      |       |
|--------------------------|------|-------|
|                          | left | right |
| Lane width [m]           | 3,00 | 5,00  |

# **Emission level calculation for roads**

The entries for the emission calculation of roads differ according to the used standard. The definition of the emission level may have different vehicle types, different emission heights or other corrections.

The emission level can be calculated automatically from the emission parameters, directly entered or imported in the field **LEVELS** if the emission level itself is known.

At all locations where the emission changes due to a change in traffic volume, road surface, traffic speed etc., the changes in the emission properties definition is stored. Each of the emission definitions is valid from the coordinate of origin to the end of the data string or to the place where a new definition is present.

For roads with 2 separate emission bands, SoundPLAN assumes equal conditions in both lanes, so the emission level for both lanes will be equal. If this is not the case and you want to enter both lanes with different properties, you must define 2 separate roads with single emission bands.

To calculate the emission level from the number of vehicles, speeds etc., activate the check box **CALCULATED** and go to the tab index card *Emission*. As soon as the check box **CALCULATED** is active, you cannot enter the levels directly.

Depending on the calculation standard set in the SoundPLAN Manager, additional entry fields are displayed with the parameters needed in the standard. Please read the standard for details on the different standards or ask your local distributor.

For the NMPB 2008 the emission calculation of the Nord2000 road can be selected to enable a more flexible definition of the emission coefficients. With this added flexibility it is possible to define your own vehicle types and configure them in their emission properties (for example to define 2-stroke and 4-stroke driven motor rickshaws for Southeast Asia). For details of the Nord2000 please read the road documentation from (on <u>www.delta.dk</u> search for <u>User's Guide Nord2000 Road (2006)</u>).

The number of time slices is defined in the project options (SoundPLAN Manager **OPTIONS** -> **SETTINGS**), node "Emission time slices traffic noise (page 52)".

| Traffic Speed, Tr | affic flow, Add | itions   |          |              |                     |
|-------------------|-----------------|----------|----------|--------------|---------------------|
| Input type        | Veh/h manua     | dy (3)   |          |              | M                   |
|                   |                 |          |          |              |                     |
| One-way traffic   |                 |          |          | ADT[VeF      | /24h] 30920         |
|                   | Veh/h(d)        | p(d)[%]  | Veh/h(n) | p(n)[%]      |                     |
|                   | 1584,0          | 100,0    | 697,0    | 100.0        |                     |
|                   | Veh/h(d)        | p(d)[%]  | Veh/h(n) | p(n)[%]      |                     |
| Light vehicles    | 1298,9          | 82,0     | 460,0    | 66,0         |                     |
| Heavy vehicles    | 285,1           | 18,0     | 237,0    | 34,0         |                     |
| من المليسين       | يحاضحان وسياه   |          | التر يوم | ************ | has dig a san dia a |
| Levels            | d(6-22h)        | n(22-6h) |          |              |                     |
| [dB(A)]           | 88,59           | 85,72    |          |              |                     |

# **Entry of the Traffic Volume**

The dialog for the entry of the traffic volume is the same for nearly all standards; only the number of vehicle types can vary.

**ONE-WAY TRAFFIC:** Some standards need the information whether the traffic flows uphill or downhill. If the check box one-way traffic is clicked, the total traffic volume is in entry direction or versus entry direction, otherwise the traffic volume is divided symmetrically in both directions.

The **GRADIENT** in % (see "<u>Gradient Addition</u>" (page 192) is calculated from the coordinates and displayed in the lower left corner in blue letters.

The information driving on the left / right side might be important for two lane roads with gradient to decide which level is assigned to which lane. This parameter

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is entered in the SoundPLAN Manager under **OPTIONS** -> **SETTINGS**, branch "program". For your information the selection is displayed in the lower left corner in blue letters.

### Parameters for the emission calculation

ADT [vehicles/24h]: Average daily traffic volume

**Vehicles/h**: Traffic volume per hour for each of the time slices in total or separately for different vehicle types.

**k**: Factors for the calculation of the hourly traffic volume from the ADT: k\*ADT=vehicles/h for each of the time slices

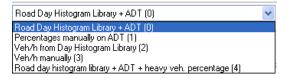
**p[%]:** Portion of the selected vehicle type at the total traffic volume per time slice.

**Road day histogram:** The factors for typical road types are stored in the <u>road day</u> <u>histogram library</u> (page 311). There you can add any kind of temporal sequences.

The k-factors (M/DTV) for individual road type in accordance to table 3 of the German RLS-90 are decoupled from the percentage of trucks so that own entries will not overwrite the road type and the percentage of trucks settings will remain when the road type is modified.

#### Entry type

Define the entry type with the selection list (the number in brackets indicates the number of the record; this is relevant for the import of traffic data):



#### Road Day Histogram Library + ADT (0)

The distribution of the traffic volume over time originates from the road day histogram library; the average daily traffic (ADT) is entered manually or imported.

You will only see the library elements compatible to the selected emission standard. Press the button >> and open the library to edit elements, enter new elements or copy elements from another library.

#### Portion of the ADT manually (1)

The portions of the ADT are entered as factors and the heavy traffic portion is entered in per cent.

If a road type of the road day histogram library has been selected, the hourly distribution is averaged to the time slices and converted into factors.

**Road Alignments** 

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#### Vehicle/h from the industry day histogram library (2)

For investigations of the traffic at industrial facilities or the traffic lanes of a parking lot a day histogram from the industry day histogram library can be assigned to each vehicle type. If you want to add elements to the industry day histogram library, click on the double arrow next to **OPEN DAY HISTOGRAM LIBRARY**.

#### Vehicle/h manually (3)

Enter the vehicles per hour for each vehicle type and each time slice or the total number of vehicles per time slice and the percentage of the vehicle types.

#### Road Day Histogram Library + ADT + HT (4)

Nearly the same as the entry type road day histogram library + ADT, but here you can correct the global portion of the traffic parts (e.g. portion of heavy traffic). The day histograms of the different vehicle types are scaled respectively i.e. multiplied with a suitable factor.

There are two additional entry types for CRTN (UK): 12, 4, 8, and 18 hour data.

# Entry of Speed, Road Surface and Additions

| mission cal                          | ulation acco                                                     | ording to "N | IMPB 2008"      |
|--------------------------------------|------------------------------------------------------------------|--------------|-----------------|
| Traffic Sp                           | eed, Traffict                                                    | low, Additio | ns              |
| -Vehicle sp                          | eeds [km/h]-                                                     |              |                 |
| Road se                              | ction charact                                                    | eristic      | driving section |
| Time slice                           | vLight veh.                                                      | vHeavy veh.  | Traffic flow    |
| day                                  | 100,0                                                            | 70,0         | steady          |
| night                                | 80,0                                                             | 70,0         | steady          |
| BBTM 0/6<br>Road Surf                | ace (acc. NM<br>- type 1<br>ace Age [yea<br>lections (acc<br>0,0 | ars]         | 10,0            |
| Levels<br>[dB(A)]                    |                                                                  |              | 22-6h)<br>85,72 |
| Gradient: 2,6 [%<br>Driving on right | •                                                                |              | OK Cancel Help  |

Enter the additional parameters for the calculation of the emission level in the fields of the next tab index card.

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The **SPEED** is defined for each vehicle type and time slice. All other parameters (e.g. driving conditions, corrections for different road surfaces, age of road surface) are standard dependent and are therefore described in different sections.

The displayed emission levels for the selected time slices are the average levels over the hours of the time slice. For the entry types where the road day histogram library is used, the emission is stored per hour, so that you can select assessments with any assessment time range definition.

# **CoRTN** specialties

The input mask shows only the L10-emission values. The calculation of Leq-values is performed during the noise propagation calculation since it depends on the L10-value at the receiver.

| nission calculation acc                  |               | V (Lden)"   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   | -x    |
|------------------------------------------|---------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------|----------|-------------------|-------|
| Traffic Speed, Surface                   | e, etc.       |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
| Input type                               | CRTN: 18 hour | data        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   | •     |
|                                          |               |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
| 🔲 One-way traffic                        |               |             | Motorw                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ay    |           |          |                   |       |
|                                          | N18(6-24h)    | N1(6-24h)   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
|                                          | 100,0         | 60,0        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
|                                          | p18(6-24h)    | p1(6-24h)   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
| Cars                                     | 90,0          | 80,0        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
| Trucks                                   | 10,0          | 20,0        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       |           |          |                   |       |
| hanna aireitea                           | ساسب          |             | and the street of the street o | , mar | ha seta a | 146./INA | -1. <sup>-1</sup> | <br>- |
|                                          | L10d(6-22h)   | L10n(22-6h) | L10,18h(6-24h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |           |          |                   |       |
| [dB(A)]                                  |               |             | 44,08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |           |          |                   |       |
| radient: 0,0 [%]<br>riving on right side |               |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |       | OK        | C        | ancel             | Help  |

The propagation calculation has been reworked and improved. Now all annexes of the CoRTN are fulfilled.

On request an adopted version of the CoRTN for Australia (North South Wales) has been introduced.

**Road Alignments** 

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| raffic Speed, Surface, etc.  |             |             |                | $\sim$ |  |
|------------------------------|-------------|-------------|----------------|--------|--|
| Mean speed                   |             |             |                |        |  |
| / [km/h]                     |             | 50          |                |        |  |
| isable speed correction (Cha | rt 5)       |             |                |        |  |
| Road surface                 |             |             |                |        |  |
| Concrete surfaces v>=75 km   | /h          | -5,2        | 2              |        |  |
| exture depth                 | q           |             |                |        |  |
| fultiple reflection          |             |             |                |        |  |
| Drefi [dB]                   | 0,0         |             |                |        |  |
| mission heights              |             |             |                |        |  |
| Vehicle Type                 | Height [m]  |             | C [dB]         |        |  |
| Ca                           |             |             |                |        |  |
| Truc                         |             |             |                |        |  |
| Truc                         |             |             |                |        |  |
| Truc                         | k 3,6       | 40,0        | 0,0            |        |  |
|                              |             |             |                |        |  |
| n [m]                        | L10d(6-22h) | L10n(22-6h) | L10,18h(6-24h) |        |  |
| 1.5                          | 56,38       | 50,36       | 54,75          |        |  |
| ,5                           | 51,40       | 45,38       | 49,77          |        |  |
| 3,6                          | 54,41       | 48,39       | 52,78          |        |  |
| Sum                          | 59,28       | 53,26       | 57,66          |        |  |
| adient: 0,0 [%]              |             |             |                |        |  |

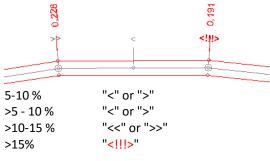
This includes a new emission input which gives the user the possibility to split the emission of the truck over three source lines with user definable heights. The split is defined in the column Traffic [%]. With the column C[dB] the user can apply a correction for each source line to consider for example corrections due to measurements.

For the noise propagation calculation two options are available for the CoRTN in the standard details (calculation kernel).

### **Gradient Addition**

The rate of incline is usually calculated from the elevation of the coordinates.

Depending on the used emission standard, the gradient addition might lead to very high additions and thus wrong calculation results. Therefore, it is visualized in the Geo-Database. Please activate the object option "with properties" for roads in the object options.



The calculation kernel returns an error message if the gradient is higher than 30%.

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You can also use **EDIT** -> **SELECT ROAD SEGMENTS WITH GRADIENT** > **|X|** % to find sections with implausible gradients.

During the calculation (tab *Emission* in the road standards) the gradient is by default averaged over a reference line of 15 m.

#### **Multiple reflection**

The multiple reflection addition included in most of the emission dialogs is described in the German RLS-90. For other emission calculations, it is a deviation from the standard. However, it may be good practice. Multiple reflections in street canyons are added as a correction on value to the LME. In this case, the propagation calculation may only evaluate the first reflection as otherwise the multiple reflections would be overcompensated. The multiple reflections depend on the average building height of the lower side of the street (hBeb[m]) and width (w[m]) of the street canyon, as well as on the average reflection loss. The reflection loss only distinguishes between reflective and absorbent walls.

**Reflecting surfaces:** 

D<sub>refl</sub> = 4 \* H<sub>eight of walls</sub> / Distance of retaining walls =< 3.2 dB

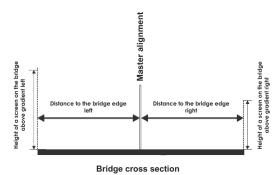
If the walls have been built with absorbent material, the formula changes to:

D<sub>refl</sub> = 2 \* H<sub>eight of walls</sub> / Distance of retaining walls =< 1.6 dB

Multiple reflections can be set automatically with the GeoTool **ESTIMATE MULTIPLE REFLECTIONS** for bigger communities, but only if the multiple reflection addition is part of the emission dialog of the selected standard.

#### **Road bridges**

The bridge definition uses its own tab index card. Activate the check box bridge at the first coordinate of the bridge and enter the distance between the axis and the bridge edge (left and right from the axis) and, if necessary, the height of a screen on the bridge above the gradient.



Deactivate the bridge check box at the end of the bridge again.

**Road Alignments** 

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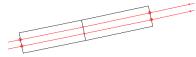
The bridge surface is calculated at a right angle to the master alignment. If this doesn't correspond to the actual situation, the bridge must be prolonged.

| mission/Station  | Emission "NMF           | PB 2008" Pr       | ofile Bridge      |      |                |                         |                   |                   |       |
|------------------|-------------------------|-------------------|-------------------|------|----------------|-------------------------|-------------------|-------------------|-------|
| V Bridge         |                         |                   |                   |      |                |                         |                   |                   |       |
| Bridge thicknes  | s [m]                   |                   |                   | 0,5  |                |                         |                   |                   |       |
|                  |                         |                   |                   | left |                |                         |                   |                   | right |
| istance to brid  | ge edge [m]             |                   |                   | 3,25 |                |                         |                   |                   | 3,25  |
| leight of bridge | wall above surfa        | ice [m]           |                   | 0,80 |                |                         |                   |                   | 0,80  |
| Constant eleme   | nt height               |                   |                   | V    |                |                         |                   |                   |       |
| Reflection pro   | perties (left wall)     |                   |                   |      | Reflection pro | perties (right wall)    |                   |                   |       |
| Single val       | ue 🔘 Absorpti           | on spectrum       |                   | 0    | Single val     | ue 💿 Absorpti           | on spectrum       |                   | 0     |
|                  | Reflection loss<br>[dB] | Absorption coeff. | Reflection coeff. |      |                | Reflection loss<br>[dB] | Absorption coeff. | Reflection coeff. |       |
| Inner            | 1,0                     | 0,206             | 0,794             |      | Inner          | 1,0                     | 0,206             | 0,794             |       |
| Outer            | 1.0                     | 0,206             | 0,794             |      | Outer          | 1,0                     | 0,206             | 0,794             |       |

Please observe the following characteristics:

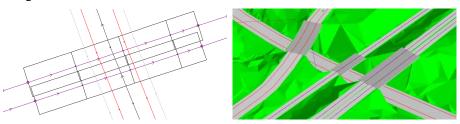
- Elevations below the bridge are recognized as terrain for the DGM calculation.
- Bridge bottom and bridge thickness are not reflective (except for ASJ Japan).
- If CREATE GROUND EFFECT AREAS FROM ROAD SURFACES is checked in the calculation run properties, the bridge surface is recognized as hard surface.

Bridges are visualized in the Geo-Database as a black band.



### Modeling of bridges

In case you must model bridges for multiple single lane roads, SoundPLAN expects the **bridge definition for each lane**. The individual bridges should overlap if it is one bridge in the model.



# Walls on bridges

You can enter walls on bridges in the bridge tab index card. If noise protection walls come from outside the bridge and continue on the bridge you are more flexible if you define only the bridge plate and enter the wall outside the bridge and a wall on

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the bridge as one noise protection wall, on the bridge with the characteristics **WALL FLOATS ABOVE GROUND** see "<u>Wall Properties</u>" (page 266).

The reflection properties of bridge walls are similar to the properties of <u>noise</u> <u>protection walls</u> (page 267). For spectral assessment of the reflection loss for standards that calculate the noise in frequency bands rather than as a mean frequency, the absorption spectra from the library are used. Activate the selection list for which you want to assign an absorption spectrum and click on the library button.

### **Maximum Level Road**

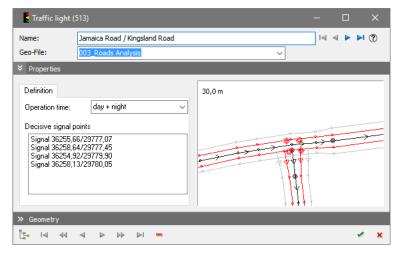
LMAX-ROAD: This represents a maximum noise level of a single vehicle pass by (in general a truck). Depending on the receiver location the maximum noise level can be caused by different roads. At the moment the Lmax-road is only used in the standards "Statens planverk report no. 48; 1980" and "Road Traffic Noise – Nordic Pred. Method; 1996".

# Signal - Intersection Addition only RLS-90

The signal addition accounts for the increased annoyance of traffic noise close to a traffic signal. As the physical effect is hardly measurable, the addition is very questionable. However, as it is part of the RLS 90, it is part of SoundPLAN.

Depending on the distance between the receiver and the traffic signal, the addition is between 1 and 3 dB(A).

The signal object is placed at any position within the junction **at the same elevation as the road** (e.g. using the right mouse menu "Capture Coordinate" on a coordinate in the intersection).



Signal - Intersection Addition only RLS-90

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The traffic light can be active all day (0:00 to 24:00), during day time (6:00 to 22:00) or during night time (22:00 to 6:00).

Enter the intersection points in the preview box to the right at the intersections of the outer traffic lanes (emission lines). For T-junctions please enter also four signal marks.

On the basis of the signal marks the roads concerned are determined during the calculation within a horizontal distance of 5 m and a vertical distance of 2 m.

The intersection addition is assigned if the 3-dimensional distance between the nearest signal mark and the receiver is within the following intervals:

|      | 0 m  | to | 40 m  | => | + 3.0 dB(A) |
|------|------|----|-------|----|-------------|
| from | 40 m | to | 70 m  | => | + 2.0 dB(A) |
| from | 70 m | to | 100 m | => | + 1.0 dB(A) |

All roads connected with the traffic light by the signal marks get the addition of the nearest signal mark.

Delete signal marks: click on the signal mark in the list and press the delete key.

# Parking Lots

Parking lots are area sources with a uniform sound power. Enter the outside border with the elevation of the asphaltic surface. SoundPLAN adds 0.5 meters for the source height above the terrain. The parking lot is triangulated at calculation time.

If sections of the parking lot are used by different vehicle types or the usage of the parking lot is not uniform, subdivide the parking lot into homogenous units e.g. with the Geo-Tool "divide areas (page 159)".

Enter a NAME and, if necessary, an OBJECT NUMBER for sorting the sources.

With the group assignment for parking lots according to the Bavarian parking lot study (see "Using the group assignment of sources (page 253)") parking lots can be assigned to groups.

# Calculation of the emission level of parking lots

Depending on the propagation calculation you selected in the SoundPLAN Manager with **OPTIONS** -> **SETTINGS**, the emission is calculated according to RLS-90 (propagation calculation RLS-90) or the Bavarian parking lot study (all other industrial calculation methods). The propagation is calculated according to the selected standard. To change the emission calculation for parking lots, you need to close the Geo-Database in order to activate the new setting. It is not possible to mix the calculation standards (parking lot A according to RLS-90, parking lot B according to the Bavarian parking lot study).

#### Parking lot RLS 90

The calculation is performed in accordance with the 16<sup>th</sup> and 18<sup>th</sup> Federal German Immission Regulation.

| RLS 90                                                                               |                   |                        |
|--------------------------------------------------------------------------------------|-------------------|------------------------|
| Emission levels calculated     O Emi                                                 | ssions levels set |                        |
| Number of parking bays:                                                              | 12                | Near the sports ground |
| Number of moves (per parking bay and hour): <ul> <li>Time histogram [E/h]</li> </ul> |                   |                        |
| Near the sports ground                                                               | ~ 1               | 5. 0,6                 |
| O day: 0,000 night:                                                                  | 0,000             | 0,4                    |
| Addition parking lot type:                                                           |                   |                        |
| Own entry                                                                            | ~ 0,0             | h                      |
| LmE for one movement per parking bay and hour                                        |                   |                        |
| LmE, ref [dB(A)] = 47,79                                                             |                   |                        |

4

The traffic volume of a parking lot is entered with the number of parking bays and the movements per parking bay and hour. The number of movements can be defined by a day histogram in events per hour or by the movements per time slice day and night.

One parking action (into a parking bay and out of the parking bay) is 2 parking movements.

The **ADDITION FOR THE PARKING LOT TYPE** considers the different emissions of the vehicle types:

| Car parking:           | 0 dB  |
|------------------------|-------|
| Motorcycle parking:    | 5 dB  |
| Truck and bus parking: | 10 dB |

The addition is automatically added to the emission level. If you have evidence that the additions do not fit your situation, the field "own entry" allows you to enter and document your own values.

The result is the LmE of the total parking lot in a distance of 25 m.

#### Parking lot study 2007

The 6<sup>th</sup> revised edition of the parking lot study "Recommendations for the Calculation of Sound Emissions of Parking Areas, Motorcar Centers and Bus Stations as well as of Multi-Storey Car Parks and Underground Car Parks" published by the Bavarian Landesamt für Umwelt provides calculation methods to determine the emissions of parking lots. The document is on the SoundPLAN installation DVD and can be downloaded from the web

(www.laerm.ch/dokumente/Parking Area Noise.pdf).

**Parking Lots** 

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**Hint:** In this manual and in SoundPLAN we use the terms "parking lot" and "parking bay" instead of "parking area" and "car park".

The emissions depend on the type of vehicles, the number of parking moves during the different time slices, the behavior of people and other noise on the parking lot (e.g. rattling of the shopping trolleys).

The parking lot study 2007 provides the calculation methods "integrated method" and "separated method".

The **general case ("integrated method")** assesses the driving lanes as part of the overall noise emission level. This method calculates levels "on the save side".

The **special case ("separated method")** discounts the driving lanes from the parking lot and requests they be modeled separately as line sources or roads. The results of this method are lower or equal to the general case. This method is often used for big parking lots or if a parking lot can be divided into separate parts.

The base value for one car parking move per parking bay and hour is a sound power of  $L_{W0}$  = 63 dB(A). Additions for the parking lot type  $K_{PA}$ , noise peak  $K_1$  (e.g. German TA-Lärm), driving lanes  $K_D$  and the road surface  $K_{StrO}$  (both parameters only for the combined method) are added.

The displayed Ref. Lw is calculated according to the formula

Ref. Lw = 63 + KPA + KI + KD + KStrO + 10\*log (B)

The number of parking movements N is only taken into account from the day histogram during the calculation.

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**Parking Lots** 

| P Parking lot (8  | 02)                                                     |                |                   |        | -                              | D X                |
|-------------------|---------------------------------------------------------|----------------|-------------------|--------|--------------------------------|--------------------|
| Name:             | Parking Lot (Beer Ga                                    | rden)          |                   |        | I4 4                           | ⊳ ⊳ ?              |
| Geo-File:         | 009_Industrial Sourc                                    | es             |                   |        | V Obj. No. 3                   | ./                 |
| ✓ Properties      | L                                                       |                |                   |        |                                |                    |
| Group: unde       | fined                                                   |                |                   |        | ~                              | + = 🔺              |
| LFU Bayern 2007   |                                                         |                |                   |        |                                |                    |
| Parking lot type  | Restaurants                                             |                |                   | $\sim$ | KPA [dB]                       | 3,00               |
|                   | low noise s                                             | hopping trolle | у                 |        | KI [dB]                        | 0,00               |
| Unit B0           | 1 parking bay                                           | ,              |                   | ~      | KD [dB]                        | 4,55               |
| Page P            |                                                         |                |                   |        | KStro [dB]                     | 0,00               |
| Base B            | 75                                                      | f=1,000        |                   |        | Ref. Lw [dB(A)                 | ] 89,30            |
| Road surface      | Asphaltic driv                                          | Parking lo     | t                 |        |                                |                    |
| Time histogram    | Parking lot                                             |                | ~                 | ∕ I∕I  | 250                            |                    |
| Center frequer    | cy (500 Hz)                                             |                |                   |        | 5 150<br>50<br>0 2 5 8 12<br>h | 17 22              |
| Own spectrum      | - K 1                                                   |                |                   | - Dr   | LwA=72.0 dB/                   | m. m²              |
| Maximum level [dB | nod (driving lanes sep<br>KI instead of default<br>(A)] |                | ed)<br>0,/<br>0,/ | )<br>) |                                | 1000 4000<br>[ftc] |
| ✓ Geometry        |                                                         |                |                   |        |                                |                    |
| Height definition | relative                                                | follow ter     |                   |        | ∧ Area [m <sup>2</sup> ]       | 5826,4             |
| X [m]             | Y [m]                                                   | Habs [m]       | Hrel [m]          |        | Area [m²]                      | 3020,4             |
| 1 3639<br>2 3639  |                                                         | 264,50         | 264,50            |        |                                |                    |
| 2 36393           | 3,89 29425,38                                           | 264,50         | 264,50            |        |                                |                    |
| 3 3642            | 3,65 29427,74                                           | 264,50         | 264,50            |        |                                |                    |

According to the selected **PARKING LOT TYPE** the addition for the parking lot type  $(K_{PA})$  and for impulsiveness (if present) are automatically added.

The reference value **BASE B** defines the size of the parking lot. Hereby the **UNIT**  $B_0$  should be noted. The **UNIT**  $B_0$  is preset by the parking lot type (1 parking bay, m2 sales area, m2 restaurant area or 1 bed) but can generally be changed to1 parking bay. The number of the parking bays of the total parking lot is f\*B; f is a prescribed value of the parking lot study.

To fit the different base units into the formula for calculating the noise emission, they needed a "factor of adjustment". This factor called "f" is to refer the base unit back to "one parking bay". In case of a supermarket, f is 0.07, which means 0.07 parking bays for each m2 sales area. "f" is fix because the parking lot study defines it precisely.

Parking Lots

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This is because the authors of the parking lot study did a lot of countings at different parking lots (documented in the parking lot study). They found out that the number of vehicles is not always linked to the number of parking bays. Especially supermarkets out of town often have a lot of parking bays – more than they need. In this manner the parking lot always looks empty and people think they won't have to spend much time at the supermarket checkout. The unit "m2 sales area" is much more suitable in this case.

Regardless of the parking lot type you can always choose the base unit "1 parking bay" if the factor f doesn't fit to the parking lot in question.

The selection of the **ROAD SURFACE** (this is the surface of the driving lanes, not the surface of the parking bays) defines the addition  $K_{StrO}$ .

The traffic volume is defined with a **day histogram** in events per hour (E/h). The values must match with the number of parking moves per unit  $B_0$  and hour. One parking action (into a parking bay and out of the parking bay) is 2 parking moves.

Example:  $B_0 = 1$  parking bay: the values of the day histogram must match with the parking actions per parking bay and hour.

 $B_0 = 1m^2$  net sales area: The values of the day histogram must match with the number of parking actions per m<sup>2</sup> sales area and hour.

The estimated values from the parking lot study (table 33) can be entered directly into the day histogram.

The parking lot can be calculated with a **CENTER FREQUENCY** of 500 Hz, a **TYPICAL SPECTRUM**, or an **OWN SPECTRUM**.

**TYPICAL SPECTRUM** refers to a frequency spectrum for "starting car" normalized to the reference level of 63 dB(A)

|       |       | 63    | 125            | 250   | 500   | 1     | 2     | 4     | 8     | 16    |
|-------|-------|-------|----------------|-------|-------|-------|-------|-------|-------|-------|
|       | Sum   | Hz    | Hz             | Hz    | Hz    | kHz   | kHz   | kHz   | kHz   | kHz   |
| dB(A) | 63,00 | 46,34 | 57 <i>,</i> 94 | 50,44 | 54,94 | 55,04 | 55,44 | 52,74 | 46,54 | 33,74 |

Activate the check mark **SEPARATED METHOD** to change to the special case calculation which doesn't include a surcharge for the driving lanes ( $K_D + K_{StrO}$ ).

In this case you need to model the driving lanes and the additions for the surface of the lanes separately. Either use the object types road or line source. The propagation calculation is done according to the selected road or industry standard (the parking lot study refers to RLS-90 and ISO 9613-2). For a line source, you can use, for example, emissions of  $L_{WA} = 47.8 \text{ dB}(A)/m$  for cars (referring to the RLS-90) or  $L_{WA} = 63 \text{ dB}(A)/m$  for trucks and busses according to the Hessian truck study 2005. You can enter the driving lanes on top of the parking lot, it is not necessary to cut them out from the parking lot.

Activate the check mark **OWN CORRECTION KI INSTEAD OF DEFAULT VALUE** if the addition for the noise peak does not equal the default values from the parking lot study.

The field **STANDARD DEVIATION FOR LW SIGMA** allows to enter a value to calculate the <u>uncertainty of a prognosis</u> (page 225).

The right-hand part of the dialog shows the additions and visualizes the day histogram and the spectrum. The day histogram is not included in the displayed sound power (Ref Lw) and is therefore only an intermediate value for the calculations.

#### Important: Enter the parking lot surfaces additionally as ground effect areas.

# Additions

Г

Additions for parking lot type and noise peak:

|                                                                                                      | Addition | in dB(A) |
|------------------------------------------------------------------------------------------------------|----------|----------|
| Parking lot type                                                                                     | Кра      | Kı       |
| Car parking lots                                                                                     |          |          |
| P+R parkings, parkings at house estates, visitors and<br>staff parkings, parkings at the city border | 0        | 4        |
| Parking lots at shopping centers                                                                     |          |          |
| Normal shopping trolley on asphalt                                                                   | 3        | 4        |
| Normal shopping trolley on cobbles                                                                   | 5        | 4        |
| Low noise shopping trolley on asphalt                                                                | 3        | 4        |
| Low noise shopping trolley on cobbles                                                                | 3        | 4        |
| Parking lots at discotheques (incl. noise from talking and car radios)                               | 4        | 4        |
| Restaurants                                                                                          | 3        | 4        |
| Fast food restaurants                                                                                | 4        | 4        |
| Central bus stops                                                                                    |          |          |
| Busses with diesel engine                                                                            | 10       | 4        |
| Busses with natural gas engine                                                                       | 7        | 3        |
| Parking lots for trucks                                                                              | 14       | 4        |
| Parking lots for motorbikes                                                                          | 3        | 4        |

The traffic is calculated according to:

 $\begin{aligned} K_D &= 2,5 \text{-} \text{lg} \left( f \text{-} \text{B} - 9 \right) \left[ \text{dB}(\text{A}) \right] & \text{for } f \text{-} \text{B} > 10 \\ K_D &= 0 \text{ dB}(\text{A}) & \text{for } f \text{-} \text{B} \leq 10 \end{aligned}$ 

**Parking Lots** 

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Additions for parking lot surfaces:

|                                         | Additions Kst                     | ro <b>in dB(A)</b>                  |  |  |
|-----------------------------------------|-----------------------------------|-------------------------------------|--|--|
| Lane surface                            | Combined<br>method * <sup>)</sup> | Separated<br>method ** <sup>)</sup> |  |  |
| Asphaltic lanes                         | 0 *)                              | 0                                   |  |  |
| Concrete paving with joints $\leq$ 3 mm | 0,5 *)                            | 1,0                                 |  |  |
| Concrete paving with joints > 3 mm      | 1,0 *)                            | 1,5                                 |  |  |
| Water bound surface (gravel)            | 2,5                               | 4,0                                 |  |  |
| Natural stone paving                    | 3,0                               | 5,0                                 |  |  |

 $^{\ast)}$  Not for parking lots at shopping centers

 $^{**)}$  The addition must be taken into account for the separate modeling of the driving lanes

# Maximum level parking lot

Enter the maximum level to calculate the Lmax of a parking lot. Make sure that the Lmax is defined in the used assessment library element and check mark Lmax industry in the tab index card "assessment" in the run properties of the calculation kernel.

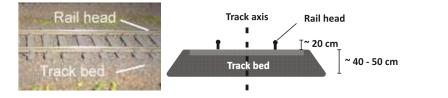
The Bavarian parking lot study includes information on typical maximum levels at parking lots:

|            |                        | L <sub>WA,max</sub> | in dB(A)                       |                              |
|------------|------------------------|---------------------|--------------------------------|------------------------------|
|            | Accelerated<br>pass-by | Closing doors       | Closing<br>tail gate/ boot lid | Noise from<br>compressed air |
| Car        | 92,5                   | 97,5                | 99,5                           | -                            |
| Motor bike | 98 <i>,</i> 5          | -                   | -                              | -                            |
| Bus        | 105,5                  | 96,5                | -                              | 102,5                        |
| Truck *)   | 103,5                  | 98,5 (100)          | -                              | 103,5 (110)                  |

\*) The values in brackets are added from the Hessian truck study 2005

# 🗹 Railways

The track master alignment is entered with the coordinates and the elevation of the rail head as reference elevation.



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The emission elevation(s) are calculated from the elevation of the rail head according to the terms in the standard.

The railway alignment can be taken into account for the calculation of the digital ground model. To do so you need two additional DGM parameters see "embankment alignment for road and railway in the DGM (page 124)".

#### Multiple Tracks

Multiple tracks are defined as a set of single track railway lines. Enter geometry and properties for one track first, duplicate the track with the GeoTool "<u>Create a parallel object</u>" (page 157) and adjust the number of trains for the duplicated tracks.

# **Railway Properties**

| General Emis          | ssion "FTA / FRA - HSGT; 2005       | 'Bridge                |              |      |       |  |  |
|-----------------------|-------------------------------------|------------------------|--------------|------|-------|--|--|
| Track No.:<br>Status: | 1 Direction:                        | Design town            |              |      |       |  |  |
| Group:                | local railways                      |                        |              | ~    | • - • |  |  |
| Emission "FT/         | A / FRA - HSGT; 2005"               |                        |              |      |       |  |  |
| 🗹 calculated          |                                     |                        |              |      |       |  |  |
| [dB(A)] d<br>LmE      | i(6-22h) n(22-6h)<br>78,2 78,5      |                        |              |      |       |  |  |
| Kilometer indic       | cation                              |                        |              |      |       |  |  |
| Kilometer inde        | ex 25,10                            | ascending              | $\sim$       |      |       |  |  |
| calculated            |                                     | Reference axis         | $\checkmark$ |      |       |  |  |
| Position of the       | e DGM edges when including the      | track bed in the DGM ( | alculation   |      |       |  |  |
| Vertical distar       | nce below rail top [m]              |                        |              | 0,60 |       |  |  |
| Horizontal dis        | stance from track axis [m] (half th | e track bed width)     |              | 1,80 |       |  |  |

#### Railway properties

Aside from the emission level calculation with the vehicle and track specific correction factors you also define the kilometer posts and a reference axis in the railway properties.

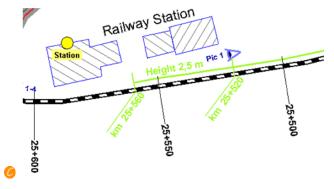
With the group assignment (see "<u>Using the group assignment of sources</u> (page 253)") railways can be assigned to groups.

For the documentation of the emission calculation you can enter the name of the railway, the track number, the direction and a status present or future.

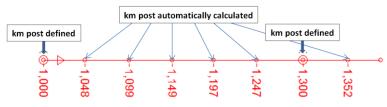
The rail track can be included in the calculation of the digital ground model. You will need two additional DGM parameters for this, see "<u>Embankment alignment for</u> road and railway in the DGM (page 124)".

#### Kilometer posts and reference axis

The km post is used in the SoundPLAN Spreadsheet, in the railway emission documentation in the Geo-Database (**DOCUMENTATION -> RAILWAY**) emission table of roads and in Wall Design and can be displayed in the Graphics, if desired, together with the reference kilometer of a noise protection wall (Cartography).



A kilometer post is assigned to each road coordinate together with the direction (ascending or descending). You can enter the kilometer post manually or let SoundPLAN calculate the distances. Activate the check box **CALCULATED** for the automatic calculation. As line objects are entered as straight lines in SoundPLAN, there might be differences between the calculation and the real world. Deactivate the automatic calculation in the course of the road entry, if needed, and enter a correct value. The automatic calculation is continued with the manually entered value.



View the kilometer of the reference axis in the Geo-Database with VIEW -> **OBJECT OPTIONS** (activate the **PROPERTIES**) or click the symbol "with properties" (railway as active object type).

To use the kilometer in the Spreadsheet and in the Graphics (e.g. for the animated train pass-by), one railway axis must be defined as **REFERENCE AXIS**. Activate the checkbox at the first coordinate of the railway.



If a reference axis is defined, it is automatically loaded in the Spreadsheet from the situation used in the calculation. If you want to assign a reference line later, use

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**FILE -> ADD ADDITIONAL COLUMNS -> ADD ADDITIONAL INFORMATION COLUMNS.** You can change the Situation or Geo-File used with **FILE -> TABLE CONTENTS**.

### **Emission Documentation Railway**

The emission calculation of railway tracks is documented in the Geo-Database via **DOCUMENTATION -> RAILWAY**. You can preview and print the emission table (table of trains and resulting emission level) and the emission succession table (changes in the emission level because of track specific corrections) separately or as a complete printout including all information. It is also possible to export the tables to ASCII I or copy them to the clipboard **b**.

| Fede           | ral Rai | Track 1                             |                               |                             | Track: 1                   | Direction        | n: Sh     | epne  | зy              | Section: 1      | 1 P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (m: 25+100      | )    | L <sub>den:</sub> | 62,2/60,       | ,1/61,6      |
|----------------|---------|-------------------------------------|-------------------------------|-----------------------------|----------------------------|------------------|-----------|-------|-----------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|-------------------|----------------|--------------|
| Train type     |         |                                     | D                             | Disk break Number of trains |                            |                  | Length pe | Speed | Correction      |                 | Em                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | hission lev     | /el  |                   |                |              |
| No.            |         | Name                                |                               | pe                          | rcentage                   | day              | eve       | ning  | night           | train           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Train type      | Max  | day               | evening        | night        |
|                |         |                                     |                               |                             | %                          | -                |           |       | -               | m               | km/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | dB              |      | dB(A)             | dB(A)          | dB(A)        |
| 28             |         | erkehrszug(2000                     | )                             |                             | 30                         | 10               |           | 2     | 3               | 150             | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               | Yes  | 59,5              | 57,1           | 55,9         |
| 40             |         | Regio                               |                               |                             | 100                        | 6                |           | 2     | 1               | 205             | 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               | -    | 57,1              | 57,1           | 51,1         |
| 33             | Gute    | rzug (Fernv.)                       | ates of trac                  | -                           |                            | 2<br>Trac        | <b></b>   | 0     | 4<br>Jurve      | 300             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | Yes  | 54,3              | -<br>Corrected | 59,8         |
|                |         |                                     |                               | жах                         |                            |                  | . 1       |       |                 | Multiple        | Bridge                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | ing  |                   |                |              |
|                | meter   | x                                   | X Y Z                         |                             | 2                          | type             | , 1       |       | adius           | reflections     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |      |                   | evening        |              |
|                |         |                                     |                               |                             |                            | D <sub>Fb</sub>  |           |       | D <sub>Ra</sub> | D <sub>Rz</sub> | D <sub>Br</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | D <sub>B0</sub> |      | day               | -              | -            |
|                | +100    | 37135,728                           | 29377,                        |                             | 266,21                     |                  |           | -     | -               | -               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 62,2            | 60,1 | 61,6              |                |              |
|                | +494    | 36744,013<br>36690,150              | 29349,9<br>29338,0            |                             | 265,93<br>265,72           |                  |           | -     |                 | -               | 3,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               |      | 65,2<br>62,2      | 63,1<br>60,1   | 64,6<br>61,6 |
|                | +388    | 35881.613                           | 29334.3                       |                             | 264.00                     |                  |           |       | 2               |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |      | 62.2              | 60.1           | 61.6         |
| _              |         | Track 2                             | 20004,                        |                             |                            | Direction        | n: Wir    | nsto  | n               | Section: 2      | 2 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (m: 25+100      |      |                   | 62.7 / 60.     |              |
| _              |         | Train type                          |                               | D                           | isk break                  | Number of trains |           |       | Length pe       | Speed           | Correction                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |      | hission lev       | /el            |              |
| No.            | 1       | Name                                |                               | -                           | ercentage                  | dav              |           |       | night           | train           | 1 State 1 Stat | Train type      |      | dav               | evening        |              |
| 140.           |         | Namo                                |                               | pe                          | %                          | uay              | 010       |       | mgin            | m               | km/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | dB              | max  | dB(A)             | dB(A)          | dB(A)        |
| 28             | Nahy    | erkehrszug(2000                     | )                             |                             | 30                         | 10               |           | 2     | 3               | 150             | 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |      | 59.5              | 57.1           | 55.9         |
| 40             |         | Regio                               | ,                             |                             | 100                        | 6                |           | 2     | 1               | 205             | 200                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               | -    | 57.1              | 57.1           | 51.1         |
| 33             | Güte    | rzug (Fernv.)                       |                               |                             | -                          | 2                |           | 0     | 4               | 500             | 100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               | -    | 56,5              | -              | 62,0         |
| Tr             | ack     | Coordin                             | ates of trad                  | k ax                        | is                         | Trac             | k         | С     | urve            | Multiple        | Bridge                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | e Cross         | ing  | (                 | Corrected      | i            |
| kilo           | neter   | х                                   | Y                             |                             | Z                          | type             | •         | ra    | adius           | reflections     | additio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | n               |      | Em                | ission ley     | /el          |
|                | m       |                                     |                               |                             |                            | D <sub>Fb</sub>  |           |       | D <sub>Ra</sub> | D <sub>Rz</sub> | D <sub>Br</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | DBO             |      | day               | evening        | night        |
|                | +100    | 37135,529                           | 29374,                        | 241                         | 266,21                     | -                |           |       | -               | -               | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -               |      | 62,7              | 60,1           | 63,2         |
|                |         |                                     |                               |                             | 005.01                     |                  |           |       |                 |                 | 3.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               |      | 65.7              | 63.1           | 66.2         |
| 25<br>25       | +493    | 36744,682                           | 29346,                        |                             | 265,94                     |                  |           |       | -               | -               | 3,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -               |      |                   |                |              |
| 25<br>25<br>25 |         | 36744,682<br>36690,764<br>35881,320 | 29346.0<br>29335.0<br>29331.1 | 698                         | 265,94<br>265,74<br>264.00 | -                |           |       | 2               | -               | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -               |      | 62,7<br>62,7      | 60,1<br>60,1   | 63,2<br>63,2 |

Define the page layout for the final printout of the emission level documentation. The page layout is a central function in SoundPLAN used for all printouts. It is described in the chapter "Result Tables", section "page layout."

# **Emission Level Calculation Railway**

The entries for the emission calculation differ according to the used standard. The definition of the emission level may have different vehicle types, different emission heights or other corrections.

The emission level can be calculated automatically from the emission parameters, directly entered, or imported if the emission level itself is known.

At all locations where the emission changes due to a change in corrections, speed etc. the changes are stored in the course of the railway axis. Each of the emission definitions is valid from the coordinate of origin to the end of the data string or to the place where a new definition is present. Enter known emission levels in the lower part of the tab index card *Emission*. Track specific corrections can also be added for known emission levels. Please check whether the known emission levels already include possible track specific corrections.

The emission table shows the levels with and without corrections. In some standards, the corrections are displayed separately.

To calculate the emission level, activate **CALCULATED** in the railway properties and go to the tab index card *Emission* to enter the train data and the corrections. As soon as the check box **CALCULATED** is active, you can no longer enter the levels directly.

Depending on the calculation standard set in the SoundPLAN Manager, additional entry fields are displayed with the parameters needed in the standard. Please read the standard for details on the different standards or ask your local distributor.

| mission Correction             |              |              |       |             |           |                 |     |                   |                   |            |
|--------------------------------|--------------|--------------|-------|-------------|-----------|-----------------|-----|-------------------|-------------------|------------|
| Train type                     | N(d)<br>6-22 | N(n)<br>22-6 | p[%]  | v<br>[km/h] | l(m)      | DFz+DAo<br>[dB] | Мах | LmE(d)<br>[dB(A)] | LmE(n)<br>[dB(A)] |            |
| -Bahn (Triebzug mit Radscheibe | 14,0         | 0,0          | 100,0 | 120,0       | 135,0     | -2,0            |     | 51,3              | -                 |            |
| -Bahn (Triebzug mit Radscheibe | 25,0         | 8,0          | 100,0 | 120,0       | 203,0     | -2,0            |     | 55,6              | 53,7              |            |
| ilzug (2000)                   | 14,0         | 2,0          | 30,0  | 140,0       | 205,0     | 0,0             |     | 62,3              | 56,8              |            |
| iüterzug (Fernv.)              | 1,0          | 0,0          | 1,0   | 100,0       | 500,0     | 0,0             |     | 52,9              |                   |            |
|                                | 0,0          | 0,0          | 0,0   | 0,0         | 0,0       | 0,0             |     |                   |                   |            |
| Delete row                     |              | 10           | 0     | ]           |           |                 |     |                   |                   | Train setu |
| mission                        |              |              |       | M           | faximum   | Level           |     |                   |                   |            |
| dB(A)] d(6-22h) n(22-6h)       |              |              |       | T           | rain leng | th [m]          |     |                   |                   |            |
| LmE 63,8 58,5                  |              |              |       | S           | peed (kr  | n/h]            |     |                   |                   |            |
| nE+Corr 66,8 61,5              |              |              |       | Ŀ           | maxE (dB  | B(A)]           |     |                   |                   |            |

Click twice on the first field of the table to open the selection list of the train types defined for the selected standard in the train library.

When selecting one of these trains, the **default settings**, such as maximum speed and train dependent corrections are copied from the library.

You can enter a **TRACK SPEED** for the train track. As soon as a train speed from the library is higher than the maximal track speed, the speed is lowered, and the emission is calculated for the track speed.

Complete the emission table with the number of trains or units per train  ${\bf N}$  for each time slice.

Use the button **TRAIN SETUP** to define own trains in the library.

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Railways

Train data

# **Track dependent additions**

The standard dependent track specific additions are defined in the tab index card *corrections*.

This may be, for example, the following corrections:

- Addition for the track bed [dB]
- Addition for the track joints [dB]
- Addition for the track condition [dB]
- Addition for crossings [dB]
- Addition for bridges [dB]
- Addition for curve squealing [dB]
- Multiple reflection, see page 193.

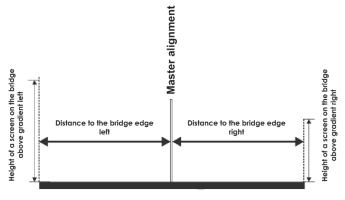
| C Emission calcul                                                                                      | ation according to "Sc   | hall 03"                                  |       |        |      |
|--------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------|-------|--------|------|
| Emission Correction                                                                                    |                          |                                           |       |        |      |
| Ballast<br>curve<br>Multiple reflections<br>Crossings<br>Bridges                                       |                          | el bed - wooden sleeper<br>is r >= 500m   |       |        |      |
| Track speed [k                                                                                         | n/h] 10                  | 0                                         |       |        |      |
| Emission           [dB(A)]         d(6-22h)           LmE         63,8           LmE+Corr         66,8 | n(22-6h)<br>58,5<br>61,5 | Maximu<br>Train ler<br>Speed [<br>LmaxE [ | km/h] |        |      |
|                                                                                                        |                          |                                           | ОК    | Cancel | Help |

# **Railway bridges**

The bridge definition uses its own tab index card. Activate the check box bridge at the first coordinate of the bridge and enter the distance between the axis and the bridge edge (left and right from the axis) and if necessary, the height of a screen on the bridge above the gradient.

Railways

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Bridge cross section

Deactivate the bridge check box at the end of the bridge. The bridge surface is calculated at a right angle to the master alignment.

Emission/Station Emission "NMPB 2008" Profile Bridge

| <b>V</b> Bridge                              |                                       |                   |                   |      |                |                                        |                      |                   |          |
|----------------------------------------------|---------------------------------------|-------------------|-------------------|------|----------------|----------------------------------------|----------------------|-------------------|----------|
| Bridge thicknes                              | s [m]                                 |                   |                   | 0,5  |                |                                        |                      |                   |          |
|                                              |                                       |                   |                   | left |                |                                        |                      |                   | right    |
| Distance to brid                             | ge edge [m]                           |                   |                   | 3,25 |                |                                        |                      |                   | 3,25     |
| Height of bridge wall above surface [m] 0,80 |                                       |                   |                   |      |                |                                        |                      |                   | 0,80     |
| Constant element height                      |                                       |                   |                   |      |                |                                        |                      |                   | <b>V</b> |
|                                              | perties (left wall)<br>ue 💿 Absorptio | on spectrum       |                   |      | Reflection pro | perties (right wall)<br>ue 💿 Absorptio |                      |                   | <b>(</b> |
|                                              | Reflection loss<br>[dB]               | Absorption coeff. | Reflection coeff. |      |                | Reflection loss<br>[dB]                | Absorption<br>coeff. | Reflection coeff. |          |
| Inner                                        | 1,0                                   | 0,206             | 0,794             |      | Inner          | 1,0                                    | 0,206                | 0,794             |          |
| Outer                                        | 1,0                                   | 0,206             | 0,794             |      | Outer          | 1,0                                    | 0,206                | 0,794             |          |

Please observe the following characteristics:

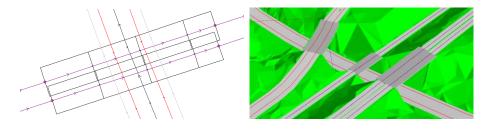
- Elevations beneath the bridge are recognized as terrain for the DGM calculation.
- Bridge surface, bridge bottom and bridge thickness are not reflective (except for ASJ Japan).
- Bridges are visualized in the Geo-Database as a black band.



### Modeling of bridges

In case you must model bridges for multiple single lane railway tracks, SoundPLAN expects the **bridge definition for each track**. The individual bridges should overlap if it is one bridge in the model.

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# Walls on bridges

You can enter walls on bridges in the bridge tab index card. If noise protection walls come from outside the bridge and continue on the bridge you are more flexible if you define only the bridge plate and enter the wall outside the bridge and a wall on the bridge as one noise protection wall, on the bridge with the characteristics **WALL FLOATS ABOVE GROUND** see "<u>Wall Properties</u>" (page 266).

The reflection properties of bridge walls are like the properties of noise protection walls. For spectral assessment of the reflection loss for standards that calculate the noise in frequency bands rather than as a mean frequency, the absorption spectra from the library are used. Activate the selection list to which you want to assign an absorption spectrum and click on the library button.

### Lmax-railway (pass-by level)

The pass-by level Lmax can be calculated for all railway standards where the check box Lmax is available in the emission calculation in the Geo-Database. Some of these standards allow more than one train for the Lmax calculation (more than one Lmax check box can be activated in the emission calculation).

You can either calculate single points or a Grid Noise Map for the train pass-by. The Grid Noise map can be displayed as a 2D or 3D animated noise map [module 3D Graphics Animation]. Read <u>2D and 3D animated noise map</u> (page 642) for details.

Select the train(s) for the maximum noise level in the **emission calculation** for railway, add the time slice Lmax railway in the **assessment library element**, and check mark the **LMAX RAILWAY** in the tab index card *assessment*. To display the level-time chart in the result tables check mark the **LEVEL CHARTS** in the tab index card *SPS* in the **calculation properties**.

#### Emission

The train is regarded as a moving line source. The length of the line source is the length of the train. The length related emission of the line source is related to the Leq emission of the trains.

$$L_{max} = L_{eq} + 10 \log \left(1000 * \frac{V}{N * L}\right) = L_{eq} + 10 \log(\frac{v}{n * L})$$

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#### Whereby

V, v: Train speed [km/h], [m/s]

N, n: Number of trains per hour, second

L: Train length [m]

L<sub>eq</sub>, L<sub>max</sub>: L<sub>eq</sub>, L<sub>max</sub> - Emission of a train type

For standards which allow the emission calculation separately for engine and wagons, the emission is calculated in train sections (e.g. for Schall 03-2006). In this case the train must be entered according to the train composition.

As the emission is evenly distributed on the whole train or the train sections, effects due to inhomogeneity and increase the Lmax level cannot be described by this method. The smaller the distance receiver to track is the higher is the difference between the real and the calculated Lmax level.

#### **Pre-calculation**

From each point along the track to the receiver, transmission losses and elapse time (due to the finite speed of sound) are recorded for the direct sound as well as for all possible reflection paths.

#### Calculation of the level-time history for one train pass-by

The position of the line source is now iterated along the whole track. The time window is about 125 ms between two steps. Therefore, the step size depends on the train speed. The level time history at the receivers is determined by integrating over the whole train length considering the Lmax emission, the transmission losses and the elapse time.

#### Lmax, Lmax statistics

The highest level in the level time history is the Lmax level. If N trains run on this track in the time slice day, evening or night, N occurrences are assigned to the level class Trunc(Lmax)...Trunc(Lmax)+1 of this time slice. The level time history is calculated for all tracks. The occurrences are added to the corresponding level classes. If a railway A reaches a switch and branches into k railways, this corresponds to k tracks each of them from the beginning of railway A to the end of each railway after the switch.

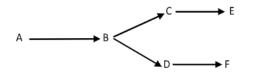
#### Generating tracks for calculation of Lmax-Rail

From the entered railways SoundPLAN tries to build up tracks to be used for Lmax calculation. The first and last coordinate of a railway is declared as a knot. If two railways have the same first or last coordinate (within a tolerance of 1 cm) they are linked to the same knot. Now each of the knots might have some ingoing links to knots and some outgoing links to knots, depending on the direction of entry.

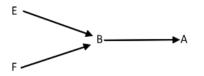
Trains always travel in the direction of entry. The direction of traveling is very important because the speed of trains and the speed of sound are taken into account (except Nord2000 simplified Method).

Tracks are built up by following the knot links, starting at a knot which has only outgoing links.

Examples (the letters stand for knots; the arrows are links to knots):



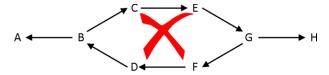
will lead to the two tracks: A>B>C>E and A>B>D>F



will lead to the two tracks: E>B>A and F>B>A

The knot B represents a switch.

If the railways are entered the way that there is no knot having only outgoing links, there is no track at all. Therefore, these trains won't contribute to Lmax at all!



If a train object is travelled by trains in both directions, you should actually create a parallel train object (with a distance of more than 1 cm) and invert direction of entry. For tracks with switches, this is absolutely mandatory.



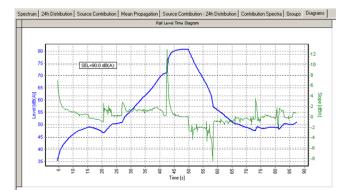
The best way to check that all trains have been correctly recognized is to calculate a Grid Noise Map or an animated noise map.

#### Level time chart

The level time chart is available in the Result Tables.

Railways

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Open the level-time-chart in the calculation results under the tab Details + Graphics. By right clicking -> **DIAGRAM PROPERTIES** you can switch the scaling of the level axis from the auto setting to a fixed scale and can disable the curve depicting the speed of the noise increase.

You can store the diagram in various graphics formats by right clicking and selecting the option -> SAVE DIAGRAM.

You can also calculate the pass-by of a train as a grid noise map and display it as an animated noise map [module 3D Animation], see "<u>2D and 3D animated noise map</u> (page 642)".

# Tunnel openings

With the object for tunnel-openings the emissions of roads and railway lines inside the tunnel are used to determine the sound power and directivity of the propagation of noise from the tunnel opening. From the geometry of the tunnel opening, the length of the tunnel and the absorption properties close to the tunnel opening the program calculates the sound power which is then assigned to four point sources in the opening. The directivity is considered. The procedure is based upon the Nord2000, in the annex of his paper you can find literature references. The tunnel opening is not suitable for underground car park entrances or similar. Such objects should be modeled with area sources at an industrial building.

The propagation direction from the coordinates of the tunnel opening is to the left as seen in the direction of entry of the coordinates. If the object is to be displayed with properties, as soon as it is closed with F2, the propagation direction of the tunnel is shown on screen. When opening the tunnels properties, you can change the propagation direction of the tunnel by clicking on **ADJUST GEOMETRY**, or via the right click menu with -> **CHANGE INPUT DIRECTION**.

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**Tunnel openings** 

This plan shows the increase of noise levels due to the noise emitted from the tunnel opening:

The calculation regards the different directivity for road and railways and therefore is done separately for roads and railways.

All roads or railway lines intersected by the tunnel opening are contributing to the emission of the tunnel. The program uses the local emissions at the tunnel opening, so any changes of the emission further in the tunnel will not have any influence on the sound power at the tunnel opening. The emissions inside the tunnel are summed up as L'w, the sound power per meter, which is used to determine the sound power handed over to the 4 substitute sources in the tunnel opening. In the tunnel opening the program inserts a coordinate, the section inside the tunnel does not contribute to the outside contribution.

For roads or railways intersecting the tunnel opening multiple times, only the first intersection is relevant.

The 4 point sound sources in the tunnel opening each have  $LwT - 10 \log(4)$  as the sound power.

The propagation of the four point sources is done according to ISO 9613-2, except for TNM roads (TNM industry), Nord2000 roads and railways (Nord2000) and NMT-96 railways (General Prediction Method).

# Properties of the tunnel opening

The tunnel opening is defined with a line consisting of 2 coordinates. After the entry of the first coordinate the properties dialog for the tunnel itself is started, however the entries for the tunnel are only generated after the second coordinate is entered. This line must intersect the road-alignment or railway alignment

**Tunnel openings** 

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(multiple road or railway lines are also possible) in order to take over geometry and emissions from the road/rail into the tunnel opening.

| 0                                    |          |             |                    |                   |  |  |  |
|--------------------------------------|----------|-------------|--------------------|-------------------|--|--|--|
| Name: Tunnel at S                    | ulzbach  |             |                    |                   |  |  |  |
| Tunnel opening<br>Shape              | Semi Cir | de 🗸        | •                  |                   |  |  |  |
| Width [m]                            | 10,00    |             |                    |                   |  |  |  |
| Radius [m]                           | 5,00     |             |                    |                   |  |  |  |
| Base height [m]                      | 269,32   |             |                    |                   |  |  |  |
| Adjust geometry                      | >>       |             |                    |                   |  |  |  |
| Emission calculation                 |          |             |                    |                   |  |  |  |
| Total length of tunnel [m]           | 500,0    |             |                    |                   |  |  |  |
| Length of portal section             | [m] 30,0 | 🔽 use diffe | rent tunnel lining | in portal section |  |  |  |
| Portal section lining tunnel lining  |          |             |                    |                   |  |  |  |
| Absorption properties portal section |          |             |                    |                   |  |  |  |
| Typical sound absorbing treatment    |          |             |                    |                   |  |  |  |
| Frequency range [Hz]                 | f<160    | 160-400     | 500-1250           | f>=1600           |  |  |  |
| Absorption coeff.                    | 0,15     | 0,50        | 0,80               | 0,65              |  |  |  |
| Frequency range [Hz]                 | f<160    | 160-400     | 500-1250           | f>=1600           |  |  |  |
| dLmE                                 | 16,28    | 11,20       | 7,69               | 9,40              |  |  |  |

For the **SHAPE** of the tunnel opening select either a semi-circle or a rectangle. The **WIDTH** of the tunnel opening is first taken from the length of the line; however, it can be refined via the control **ADJUST GEOMETRY**. For the form "semi-circle" the radius is automatically calculated, if you select the form "rectangle" you need to enter the **HEIGHT**. **BASE HEIGHT** is calculated from the intersection between the tunnel opening and the road/railway axis.

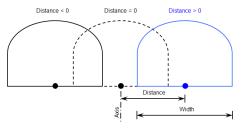
The tunnel can be acoustically split into 2 sections, the area directly behind the portal, which often is clad with acoustics panels and the area further into the tunnel that most often is left acoustically hard. For the acoustical description of the walls, SoundPLAN supplies 4 typical cases with the sound absorption coefficient  $\alpha$ , see "Formulas for the calculation of tunnel openings (page 216)".

With 2 separate tunnel portals for a road with 2 separate lanes, 2 separate tunnel openings must be defined. To connect the tunnel opening with the road, the following procedure is to be followed: First enter the tunnel opening over the master alignment of the road, then open the object definitions and move the tunnel opening with **ADJUST GEOMETRY**. Although the tunnel opening may not intersect with the road alignment any longer, the connection between road and tunnel is made. Repeat this procedure with the second tunnel opening.

#### Adjust geometry

| Adjust geometry             |        | ×      |
|-----------------------------|--------|--------|
| Change portal width [m]     | 10,00  |        |
| Change base height [m]      | 269,32 |        |
| Change distance to axis [m] | 0,00   | Adjust |
| Reverse emitting direction  |        |        |
|                             | ОК     | Cancel |

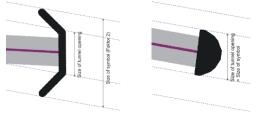
The tunnel opening width (portal width) is extracted from the length of the digitized tunnel opening, the base height is derived from the intersection between tunnel opening and road/railway alignment. Both values can be adjusted here. When the **DISTANCE TO AXIS** is 0 m, the tunnel opening is located centrally over the road/railway. For separate tunnel openings for both directions of the road, one of the distances to axis must be a positive number while the other must be negative. The tunnel opening can be moved by clicking on the **ADJUST** button.



With the checkmark **REVERSE EMITTING DIRECTION**, the tunnel opening can be reversed.

#### Particularities for the object type tunnel opening in the Graphics

A separate object type is delivered for the display of the tunnel opening in the site map of the Graphics. In order to show the emitting direction, the symbol is twice as large as the tunnel opening. As a default the factor is set to 2 in the base settings of the object type.



If you want to use another symbol for the tunnel opening (e.g. a semi-circle), please change the factor (size) to 1, in order to display the correct size of the tunnel opening.

Tunnel openings

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The 3D Graphics uses a semi-circle or a rectangle, depending on the selected form of the tunnel opening in the Geo-Database.

# Formulas for the calculation of tunnel openings

The noise transmission loss (as a factor not in dB) from a stationary source in a distance to the tunnel opening is defined as [1]:

For tunnels with a semicircular cross-section:

$$dP_T(a,x) = \frac{1}{2} \left( 1 - \frac{ax}{\sqrt{r^2 + (ax)^2}} \right)$$

For tunnels with rectangular cross-section:

$$dP_T(a,x) = \frac{1}{\pi} \tan^{-1} \left( \frac{w_T h}{\sqrt{(ax)^4 + (w_T^2 + h^2)(ax)^2}} \right)$$

With

- R: radius of tunnel [m]
- w<sub>T</sub>: half the width of the tunnel opening [m]
- h: height of tunnel [m]
- a: parameter defining the average absorption of the tunnel (0<=a>=1)

in general:  $a \approx 1 - \sqrt{1 - \alpha}$ 

where  $\alpha$  is the sound absorption index of the walls of the tunnel.

#### Typical values for $\alpha$

| Frequency range [Hz]              | <160 | 160-400 | >400-1250 | >1250 |
|-----------------------------------|------|---------|-----------|-------|
| Smooth concrete surfaces;         | 0.08 | 0.08    | 0.08      | 0.08  |
| Roads or reflecting ballast bed   |      |         |           |       |
| Reference case for directivity    |      |         |           |       |
| Rough concrete surfaces;          | 0.08 | 0.11    | 0.14      | 0.14  |
| Roads or reflecting ballast bed   |      | -       | -         | -     |
| Concrete surfaces;                | 0.1  | 0.2     | 0.3       | 0.3   |
| Ballast beds for railways         | -    | -       |           |       |
| Typical sound absorption material | 0.15 | 0.5     | 0.8       | 0.65  |

If a line source in the tunnel is regarded with a sound power per meter L'w, the total sound power radiated from the tunnel mouth is:

$$L_{WT} = 10 \log \int_0^L 10^{0.1L'_W} dP_T(a, x) dx$$

With

L: length of tunnel [m]

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**Tunnel openings** 

If L'w is constant within the tunnel:

$$L_{WT} = L'_{w} + 10 \log \int_{0}^{L} dP_{T}(a, x) dx$$

When the tunnel opening is built with absorption material it can be stated [2]:

$$L_{WT} = 10 \log \left[ 2dP_T(a1,x1) \int_{x1}^{L} 10^{0.1L'_W} dP_T(a2,x-x1) dx + \int_0^{x1} 10^{0.1L'_W} dP_T(a1,x) dx \right]$$

With

| a1: | Absorption parameter in area 1 (0x1) |
|-----|--------------------------------------|
|-----|--------------------------------------|

a2: Absorption parameter in area 2 (x1..L)

x1: distance between tunnel opening and the transition from area 1 and 2

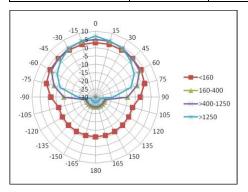
When L'w is constant within the tunnel:

$$L_{WT} = L'_{W} + 10 \log \left[ 2dP_{T}(a1,x1) \int_{x1}^{L} dP_{T}(a2,x-x1) dx + \int_{0}^{x1} dP_{T}(a1,x) dx \right]$$

### Directivity

For roads a directivity correction factor ( $\Phi$ ) is calculated. For the reference case (smooth concrete surfaces) this correction is:

| Angle Φ [deg] | Frequency | Frequency range [Hz]         |     |     |  |  |  |
|---------------|-----------|------------------------------|-----|-----|--|--|--|
|               | <160      | <160 160-400 >400-1250 >1250 |     |     |  |  |  |
| 0             | 3         | 5                            | 6   | 7   |  |  |  |
| 15            | 3         | 5                            | 5   | 5   |  |  |  |
| 30            | 3         | 4                            | 4   | 4   |  |  |  |
| 45            | 3         | 3                            | 2   | 1   |  |  |  |
| 60            | 3         | 2                            | 0   | -2  |  |  |  |
| 75            | 2         | -3                           | -6  | -7  |  |  |  |
| 90            | -2        | -10                          | -17 | -19 |  |  |  |
| 105180        | -6        | -24                          | -26 | -27 |  |  |  |



**Tunnel openings** 

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For the Non-reference case the difference level  $dL_{WT} = L_{WT}(Ref) - L_{WT}$  between the sound power in the tunnel opening and for the reference and the non-reference case is set and the directivity is set according to the table below.

| angle $\Phi$ [deg] | Frequency range [Hz] |                          |                               |                               |
|--------------------|----------------------|--------------------------|-------------------------------|-------------------------------|
|                    | <160                 | 160-400                  | >400-1250                     | >1250                         |
| 0                  | 3                    | 5+0.15dL <sub>WT</sub>   | 6+0.15 <i>dL<sub>WT</sub></i> | 7+0.15 <i>dL<sub>WT</sub></i> |
| 15                 | 3                    | 5+0.15dL <sub>WT</sub>   | 5+0.15 <i>dL<sub>WT</sub></i> | 5+0.15 <i>dL<sub>WT</sub></i> |
| 30                 | 3                    | 4-0.15dL <sub>WT</sub>   | 4-0.35dL <sub>WT</sub>        | 4-0.4dL <sub>WT</sub>         |
| 45                 | 3                    | 3-0.15dL <sub>WT</sub>   | 2-0.35dL <sub>WT</sub>        | 1-0.4 <i>dL<sub>WT</sub></i>  |
| 60                 | 3                    | 2-0.15dL <sub>WT</sub>   | 0-0.35dL <sub>WT</sub>        | -2-0.4dL <sub>WT</sub>        |
| 75                 | 2                    | -3-0.15dL <sub>WT</sub>  | -6-0.35dL <sub>WT</sub>       | -7-0.4dL <sub>WT</sub>        |
| 90                 | -2                   | -10-0.15dL <sub>WT</sub> | -17-0.35dL <sub>WT</sub>      | -19-0.4dL <sub>WT</sub>       |
| 105180             | -6                   | -24-0.15dL <sub>WT</sub> | -26-0.35dL <sub>WT</sub>      | -27-0.4dL <sub>WT</sub>       |

Values for all other angles derived by linear interpolation.

#### Literature

[1] K. Takagi et.al., Prediction of Road Traffic Noise around Tunnel Mouth Proc. Internoise 2000, pp3099-3104

[2] Jonasson, Storeheier, Nord 2000. New Nordic Prediction Method for Road Traffic Noise, Version 1.0, 2001-12-21

[3] Jonasson, Storeheier, Nord 2000. New Nordic Prediction Method for Rail Traffic Noise, Version 1.0, 2001-12-21

# Industrial Noise Sources

The noise sources for industrial applications (and sports and leisure facilities) can be point, line and area sources.

For **point sources**, the coordinate marks the source.

**Line sources** can be approximated using a polygon. Generate a new line source whenever the sound power changes.

**Area sources** are defined by the border coordinates. Area sources can be placed in any shape or orientation, but they must always form a plane, except they are defined as "follow terrain". Small deviations are automatically adjusted. If the source does not form a plane, and does not follow terrain, subdivide the source into smaller units that are planes. Area sources can be vertical.

It is possible to nest area sources with different sound power levels.

**Industrial Noise Sources** 

The ground effect is greatly influenced by the height of the source above the terrain. SoundPLAN can evaluate the source height for every possible source position.

### **Source Properties**

The properties for a source are identical for point, line and area sources.

| • Point source       | (812) — 🗆 🗙                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Name:<br>Geo-File:   | Loud Speaker 1 (Beer Garden)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I |
| ➢ Properties         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| General Directivi    | ty Additional Geometry / building assignment Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Group:               | Beer garden 🗸 🔶 = 🔺                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Comment:             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Time histogram:      | Loud speaker V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Calculation metho    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| O Center frequen     | cy 500,00 Hz 120                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Sound power s        | pectrum 80                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Pop music            | ✓ M <sup>⊕</sup> 60<br>40<br>20<br>Uu 50 150 500 200 10000<br>Uu 50 150 500 200 10000<br>Frequency (Hz]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Lw                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Lw 108,5             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                      | urce Leq emission<br>tion for Lw Sigma [dB]: 0,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Lmax<br>Lw_Max 130,0 | dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Terrain reference    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

Enter the **SOURCE NAME** for the documentation of your project data.

The **OBJECT NUMBER** is used for the description of the sources in the Result Tables and can be displayed as a text attribute in the Graphics.

With the group assignment (see "<u>Using the group assignment of sources</u> (page 253)") sources can be assigned to groups.

|        |          | Delete group assignment |
|--------|----------|-------------------------|
| Group: | Car wash | · • • •                 |
|        |          | Add group Rename group  |

**COMMENT** is used to describe the source. This comment can be placed in the Result Tables. You can enter further comments as a "reminder" for the project in the tab index card *notes*.

Assignment of **DAY HISTOGRAMS**. Day histograms are defined in the <u>day</u> <u>histogram library</u> (page 310) and can be assessed here directly via the library

**Industrial Noise Sources** 

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button or a click on the day histogram graphics. All industrial sources which do not operate 24 hours a day at a constant sound power output need a day histogram. The day histogram is evaluated according to the assessment selected for the calculation run.

The **CALCULATION TYPE** allows you to choose between mean frequency and entire spectral calculations.

If you want to calculate only the noise in the center frequency, enter the value in the **CENTER FREQUENCY** box, select the dB-weighting. If spectral data are unknown, industrial applications in the project phase most often are calculated using the center frequency of 500 Hz. Enter the sound power level into the appropriate field, select the dB-weighting and additionally for line and area sources, whether the sound power level is a level per meter or per unit (see below).

*Hint: The dB-weighting entered here and the dB-weighting in the settings of the calculation run must match otherwise the calculation will be aborted.* 

For spectral calculations with a **FREQUENCY SPECTRUM** select the desired spectrum from the <u>emission library</u> (page 300) or generate a new entry in the library and assign it.

You can open the emission library here via the library symbol or a click on the spectrum graphics.

The field **STANDARD DEVIATION FOR LW SIGMA** allows to enter a value or assign it from the library (**USE LIBRARY DEFINITION** must be enabled) to calculate the <u>uncertainty of a prognosis</u> (page 225).

**USE LIBRARY DEFINITION:** Spectra are referenced in the library as a sound power per unit or as the value of the entire unit. When the data is assigned a source, the reference is automatically transferred. You can select whether the library element is used with all its properties (including the sound power level) or as a reference spectrum with a different sound power level. Please check the settings filter and reference.

#### Level per meter, unit or level

The sound power can be assigned to line and area noise sources either as a noise level for the complete unit as LW/UNIT or as a LW/M,M<sup>2</sup> (square meter).

If the sound power is defined per LW/UNIT, the total emission of the entire source is entered and will be distributed evenly over the entire source line / area.

The setting per LW/M,M<sup>2</sup> will interpret the entered sound power as a sound power per meter of length of a line source and as a level per square meter for an area source. The total sound power of the source is the value entered plus 10 \* log (size of source).

The library includes elements that result from measurements. These elements are referenced as sound pressure levels with the reference **LP/LEVEL**. Either use the spectrum as reference spectrum with a manually entered sound power level except

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Industrial Noise Sources

if you want to use an element as indoor level Li or transform the spectrum in the library to a sound power level (see "<u>Conversion of sound pressure spectra into</u> sound power spectra (page 302)").

If you calculate with a **CENTER FREQUENCY**, set the correct sound power level and possibly adjust the figure to accommodate the source size.

#### Moving point source / Haul road

| -Lw                    |     |       |   |          |  |
|------------------------|-----|-------|---|----------|--|
| use library definition |     |       |   | $\frown$ |  |
| Lw' 61,7               | per | meter | ~ |          |  |

When the sound power level of a vehicle and the speed are known, SoundPLAN calculates a sound power level per meter - e.g. to enter the sound power per meter of a truck only once regardless of the track the truck took.

| Moving Point Source Definition |       |            |  |  |
|--------------------------------|-------|------------|--|--|
| Lw                             | 107,7 |            |  |  |
| speed [kmh]                    | 40,0  | Lw'= 61,68 |  |  |
|                                | ОК    | Cancel     |  |  |

Click on the pocket calculator and enter LW and SPEED. The result is the length related sound power level for one pass-by per hour. Correct the number of hourly movements with a day histogram with the setting events per hour (E/h).

#### Lmax Industry

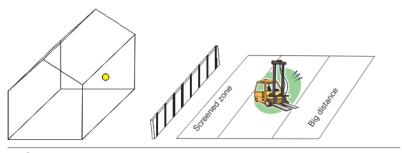
It is possible to calculate the maximum noise level caused by one or more sources at the receiver. If multiple sources are present in the calculation, the contribution level of the loudest source at the receiver is regarded as the maximum level. It is evaluated separately for each time slice.

The program will use the same emission spectrum, directivity, weighting (dB, dB(A)...) and for time related maximum levels the reference (per meter/unit) as for the Leq calculation. The day histogram is only evaluated to make sure that the source is active in at least one hour of the time slice.

For point sources the maximum is a temporary maximum, for line and area sources the maximum may also depend on the location within the source. For line and area sources a spatial maximum level is calculated (Lw\_Max is interpreted as level per unit) if the checkmark **TOTAL SOUND POWER LOCATED IN ONE POINT** is activated.

**Industrial Noise Sources** 

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Most unfavorable position of a point source within an area

As shown in the sketch above, the maximum noise level of an area source is caused by moving the entire sound power to the spot on the line/area that produces the highest noise levels. SoundPLAN determines the worst possible position and the corresponding maximum level.

#### Sources with a defined height above the terrain

Noise sources often emit sound at a fixed height above the terrain (for example a fork lifter or a truck) and follow the terrain (often relating to coordinates that follow the terrain).

You can therefore define a **HEIGHT ABOVE TERRAIN** in the emission library under the tab "*value*". When you select a spectrum from the library that has been given this property, the check box use library definition will become active, so that you can use this value.

Terrain reference

#### Correction for directivity (D Ω Wall), impulsiveness and tonality

The level increase due to vertical reflecting areas in close vicinity to a source can be considered with directivity or the addition k-Wall.

| Example for D-omega Wall: |                        |
|---------------------------|------------------------|
| Source in front of a wall | $D \Omega$ Wall = 3 dB |
| Source in a corner        | D $\Omega$ Wall = 6 dB |

If a source is assigned to a building all reflections of reflecting surfaces with a vertical distance of less than 20 cm are suppressed.

The corrections  $k_l$  and  $k_T$  take account of the increased annoyance of sources with an impulse characteristic and sources with a strong tonal component. Physically, both adjustments should be assigned as add-ons to the noise level at the receiver because a tonal or impulse adjustment may be justified for some receivers but not for those with different propagation geometry. When one source is dominant, the

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**Industrial Noise Sources** 

corrections may be needed. When the ambient noise level masks the previously dominant source, the additions should be removed.

D  $\Omega$  wall is considered for the maximum level calculation, but not kI and kT.

The reflection at the ground is considered with ground effect areas and evaluated according to terms of the different calculation standards ( $A_{gr}$ ). In some elder standards the reflection at the ground is considered with the correction k-Floor in dB.

 $D \ \Omega$  wall and the correction factors for tonality and impulsiveness are entered in the tab Additional.

| General                 | Directivity | Additional | Geometry / building assignment | Notes |     |
|-------------------------|-------------|------------|--------------------------------|-------|-----|
| Correction factors [dB] |             |            |                                |       |     |
| k-Impul                 | siveness    | 0,0        | k-Tonalit                      | у     | 0,0 |
| DΩ-Wa                   |             | 0,0        |                                |       |     |

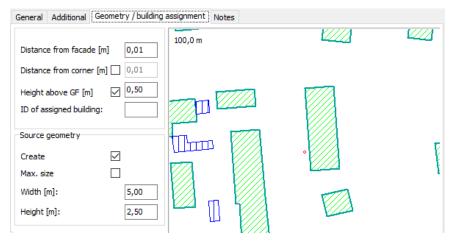
### Source documentation

Under **DOCUMENTATION** -> **SOURCES** the spectra and day histograms of all sources and parking lots contained in the Situation are listed without the need to calculate the situation first.

## Assigning sources to buildings

SoundPLAN allows individual point, line and area sources to be assigned directly to buildings, e.g. for fans or windows.

If you want to assign several sources, it is advisable to use "🕮 Industrial building / office".



**Industrial Noise Sources** 

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Enter the **first coordinate** of the source near the building; skip the elevation dialog with **OK**, because the elevation is taken from the building. In the index card *Geometry/Building Ref.* you see a zoomed view of the site map in the preview window.

Tools for the assignment (make these entries before you assign a source):

- The source can be anchored at a set distance from the beginning of a wall.
- You can define the height of the source coordinate above the ground floor (different heights for line sources possible)
- If the spectrum of the source has been assigned a 2-dimensional directivity before assigning it to the building, the rotation angle is adapted so that the 0° axis of the directivity chart is orthogonal to the façade.
- There are additional possibilities for the generation of the source geometry for line and area sources. The source geometry is no longer displayed after the source has been defined and assigned.

Click left on the side of the building where you want to assign the source. In the field **BUILDING REF.** you will see the Object ID of the building. The first coordinate is placed to the position where you clicked on the façade, except you activated the check box **DISTANCE FROM CORNER**. D  $\Omega$  wall is automatically set to 3 dB(A) and the first reflection (seen from the source) of all reflection areas is suppressed for this source, if it is less than 20 cm away from the façade.

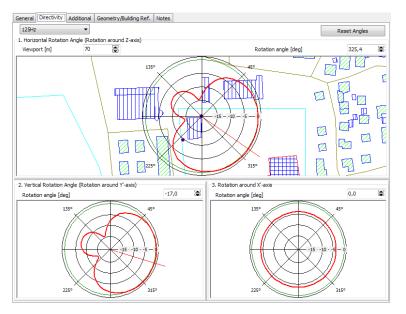
# Assignment of directivity to sources

In the <u>emission library</u> (page 300) the directivity is assigned to a spectrum, via the spectrum this directivity then is assigned to the sources.

Under the tab *directivity* in the source properties you need to give the source an orientation for the main direction. Use the pictures to horizontally rotate the source and the set the tilt towards the horizon. A rotation around the X'-axis should be relevant only in very rare cases.

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**Industrial Noise Sources** 



Click with *Ctrl+left mouse button* on one of the pictograms to set the rotation with a single mouse click, with the *right mouse button* freely rotate the directivity. Additionally, a direct entry of the numerical rotation angle is possible. For frequency dependent directivities it is possible to assign the main directions for a specific frequency as some of them are more pronounced than others and the main angles matter the most for the directivity with the biggest differences.

When you assign a source with a spectrum with directivity to a building, you are asked whether the horizontal rotation angle should be aligned to the normal of the façade. Please check whether the directivity replaces D-Omega Wall or whether D-Omega Wall should be used in addition.

When you activate the properties of the source in the Geo-Database canvas, the main direction is presented.

# Estimating the uncertainty of a prognosis

For point-, line- and area sources (also for industrial buildings and parking lots but not indoor calculations) a standard deviation can be assigned to the source as an extra parameter. With the uncertainties of all sources, the cumulative uncertainty of the entire prognosis can be assessed.

Define the standard deviation in the Geo-Database when defining the noise level of the source. The standard deviation and the cumulative uncertainty are only available with the calculation of the Leq. The Lmax is always calculated without the standard deviation.

**Industrial Noise Sources** 

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For sources without a given value of the standard deviation, the value 0.0 is used instead. This is also true for sources that do not have any association with the standard deviation (road, rail).

The standard deviation is carried through the propagation calculation of all sources. At the receiver, the cumulative standard deviation is calculated from all source contributions. The standard deviation for a time slot t (only Leq-time slots!) is calculated with the formula:

$$\sigma_{L_p}(t) = \frac{1}{10^{0.1L_p(t)}} \sqrt{\sum_k \left(\sum_i 10^{0.1L_k(t)}\right)^2 \sigma_k^2 + \sum_j \left(10^{0.1L_j(t)}\right)^2 \sigma_{L_{W_j}}^2}$$

With

 $L_p(t)$  Noise level at the receiver for the time slice t

 $\sigma_{L_p}(t)$  Standard deviation at the receiver for the time slice t

 $\sigma_k$  Standard deviation of the sound power of all sources in the correlation group  ${\bf k}$ 

 $L_{ki}(t)$  Partial noise level of the source i of the correlation group k in the time slice t

 $\sigma_{L_{W_j}}$  Standard deviation of the sound power of an uncorrelated source j

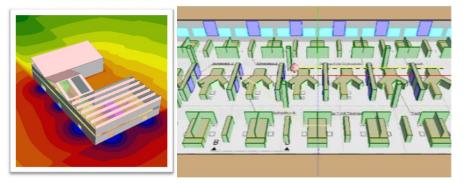
 $L_j(t)$  partial noise level of the uncorrelated source j in the time slice t

The standard deviation of the assessed noise level is presented as an addition time slot (for each Leq-time slot) in the result documentation or the Grid Noise Map as long as this has been requested in the calculation settings (tab for noise assessment).

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**Industrial Noise Sources** 

# Industrial building / office



The industrial building is a specialized building where all outside surfaces can radiate sound (although called "Industrial" for historical reasons, the Industrial Building Editor allows you to design a broad spectrum of rooms and buildings for various purposes)<sup>2</sup>.

If the floor plan has right angles, the roof can be composed using the pre-defined roof forms (shed roof, flat roof, saddle roof).

The radiating sound power level (Lw) can either be entered directly as a numerical value or calculated from the noise level inside and the noise reduction index R of the outside building shell. The noise level (Li) inside can be predicted or derived from measured sound pressure values or set in accordance to values found in literature.

[The SoundPLAN module Indoor Noise] With the module Indoor Noise it is possible to calculate the level inside the building from the sound power defined in the building and the acoustical properties of all objects in the building. Sound power over frequency, exposure time, absorption spectra, transmission spectra and other properties are used to simulate the acoustic environment inside the building and generate sound pressure levels inside and automatically turn them into sound power levels for the exterior noise propagation.

The Indoor Noise Module allows to design complex interior noise models, for example to simulate a call center or office environment or to simulate a fabrication

Industrial building / office

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<sup>&</sup>lt;sup>2</sup> It is not impossible to simulate analogues of "outdoor" situations with the method but caution is required. An outdoor situation can be created by defining a simple industrial building that is sufficiently large to act as a bounding box for the region of interest (the user should ensure that the roof is sufficiently high). The walls of this bounding box should then be defined as "Opening" so that they are fully absorbing. Solid structures may be placed within this open environment. They should be at least a few meters away from the bounding box walls to avoid anomalous effects. Furthermore, it should be noted that the sound particle method is more naturally suited to reverberant situations – larger distances in free field lead to longer run times.

shop or the machine house of a power plant with its multiple floors and walls. Indoor Noise calculates the noise at individual receivers in the building or noise maps in the vertical the Grid Noise Maps or horizontal the Cross-Sectional Noise Maps. The calculations are performed using the SoundPLAN **S**ound **P**article **D**iffraction (SPD) model or with somewhat limited functionality in accordance to the VDI 3760.

Room acoustical descriptors such as the STI or EDT as well as measurement paths according to the VDI 2569 (E 02/2016) or ISO 3382-3 can be calculated with the optional module Room Acoustics.

# Entry of the buildings shell of the factory / office building

Enter the ground plan in the Geo-Database using the object type of the industrial building. With closing the building, the industrial building editor opens with the register tabs for *Building / room*, to set principle parameters such as the height of the building or the form and parameters of the roof. When you open the industrial building later, it will directly open with the register tab *Editor* so that you can edit the content of the building.

**Important:** If the geometry of the industrial buildings is changed, the already entered embedded objects are taken over if possible. However, subsequent changes to the envelope geometry may lead to the loss of already entered sub-objects of the affected enveloping surfaces. It is therefore advisable to first define the geometry before further processing the hall / room inside! Changes such as changing coordinates (graphically or in the coordinates list), inserting intermediate points, aligning at right angles, changing height, etc. can lead to possible loss.

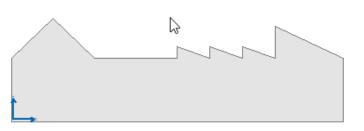
Roof shapes and embedded objects in the roof cannot be taken over. Subsequent changes result in an empty flat roof!

#### Definition of the roof

For industrial buildings with a floor plan that **only has rectangular corners**, the roof can be generated using one of the roof forms:

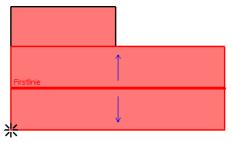
- o Flat roof
- o Saddle roof
- o Shed roof

If the industrial building has more than 4 corners with varying height, enter the building height using the value of the lowest eve height. It is also possible to generate buildings with different partial roofs and combinations of roof forms and roof heights.



The surfaces of the roof are intersected with the facades. Each facade element and surface of the roof are listed separately in the building editor and can be assigned the parameters for absorption, transmission etc.

Select the roof form from the picklist. Next click on the facade that is perpendicular to the ridge of the roof. In order to generate a roof for this position, the marked facade must be smaller or equal to the facade opposite of the selected position. If this is the case, the program will show the area for the future roof as a red rectangle. If the roof is not a flat roof, the ridges are shown as thick red lines, the flow direction of the water is indicated as blue arrows.



Now adjust the parameters to suite the building:

- the number of ridge lines
- the tilt of the roof [°], respective the ratio of roof areas or the orientation of the ridges
- height of the roof ridge above the eve height in [m]

Please also observe that these parameters can influence each other and therefore entering one parameter may change others.

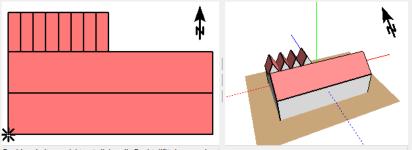
|             | Roof form                          |                                                                                                                               |                                                                                                                                                 |
|-------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| ~           | Shed roof                          |                                                                                                                               | ~                                                                                                                                               |
|             | Parameter                          |                                                                                                                               |                                                                                                                                                 |
| 1           | Count of ridge lines               |                                                                                                                               | 1                                                                                                                                               |
| 30 30       | Ridge orientation                  | <ul> <li>Left</li> </ul>                                                                                                      | ◯ Right                                                                                                                                         |
| 1,00 : 1,00 | Roof tilt [*]                      | 90                                                                                                                            | 10                                                                                                                                              |
| 13,29       | Ridge height above eave height [m] |                                                                                                                               | 8,12                                                                                                                                            |
|             | 1,00 : 1,00                        | Shed roof           Parameter           1         Count of ridge lines           30         30           1,00         : [1,00 | Shed roof           Parameter           1         Count of ridge lines           30         30           1,00         Roof tik [*]           90 |

For flat roofs you can also enter the extra height of the partial roof above the eves (for a building with 4 coordinates the parameter in the field **EVE HEIGHT-/ROOM HEIGHT** will change).

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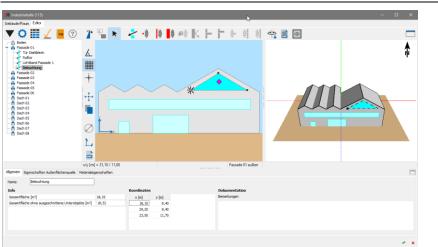
Click on the icon **GENERATE ROOF PART**, before editing the next section of the roof. Once the roof surfaces have been generated, the lines are switching from red to black and the 3D view will show the roof in the new form.



Dachbearbeitung nicht möglich - alle Dachteilflächen werden

It is not possible to delete individual components of the roof, i.e. if you need to edit part of the new roof, you first need to delete the entire roof.

For complicated roof forms, you can insert a control bitmap. This bitmap must have the same orientation as the buildings floor plan, the bitmap is always aligned with the first facade of the building, see "Bitmap operations".



### Industry building editor

The top left window shows the tree structure of all objects and sub-objects of the industrial building, to the right of it is the 2D- and 3D-view of the geometry.

In the lower part you define the properties for each object.

Between the windows you can see a splitter (visible by 3 short line segments) so that you can customize the size of each window to suite your needs.

A click on the 3D window (DETACH WINDOW) and properties symbol will take

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this window out of the normal editor and keep it as a separate window so that you can enlarge it and host it on a second screen. If you click on the symbol again (**RESTORE WINDOW**), the window becomes part of the building editor.

In the 2D- and in the 3D-View the view can be best manipulated using the mouse wheel:

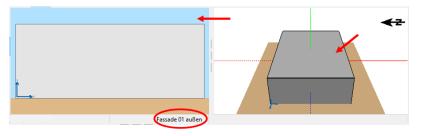
- with the pressed mouse wheel, you move the view
- rotating the mouse wheel will zoom in/out
- only in 3D-view: press the mouse wheel while pressing the <Ctrl>-key of the keyboard (left <-> right movements => rotate around z-axis) and (up and down movements => change the tilt of the model)
- only in 3D-view: press the mouse wheel while keeping the <Alt>-key pressed will move the model up or down when you move the mouse up/down.

In case you have a mouse without a wheel, use the left mouse button. This requires that no object type is active, and the selection mode is deactivated:

- with pressed left mouse button move the view,
- additionally, pressing the <*shift*>-key to enlarge/shrink the view
- in the 3D-view the controls with *<Ctrl>* and *<Alt>*-keys have the same functions as with the mouse wheel.

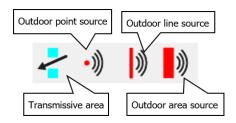
#### View of outside/inside

In the editor all objects of the outside facade, the objects on the inside facade and all inserted components are defined. Toggle between the inside view/outside view with a click on the symbol **SWAP VIEW**. The "blue sky" in the 2D view is an indication that you are in the outside view, the 3D view will present the entire building shell from your view point, additionally the status line for the current object is showing "outside" or "inside".



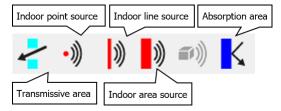
In the **outside view** you enter the objects within or on the outer facades, these are either transmissive areas such as doors and windows or point, line and area sources on the outside façade for example a loudspeaker or a pipe. Complete facades, too, can emit noise, if you activate the check box **ENABLE AS SOURCE**.

The following object types are available in the outside view:

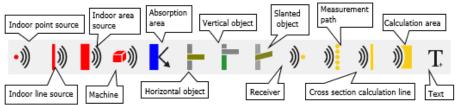


Transmissive areas can have outdoor or transmission properties as well as material properties (absorption spectrum) for the calculation of the indoor noise level [indoor noise]. Outdoor sources have outdoor or transmission properties. The properties are described under "Properties of outside sources and transmissive areas (page 246)".

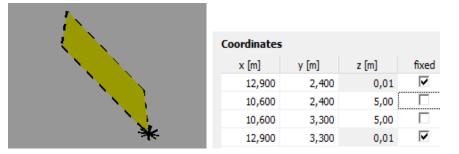
On the **inside** of the facades and other vertical objects (walls) and additional floor slabs you can place transmissive areas which allow you to define a transmission loss from one side to the other side. Point, line and area sources as well as absorption areas can be placed at will and will be used in the indoor noise calculation.



On the floor of the industrial building and along the horizontal walls enter the objects for noise simulation and later visualization in the graphics:



For slanted objects enter the area and the distance from the ground.



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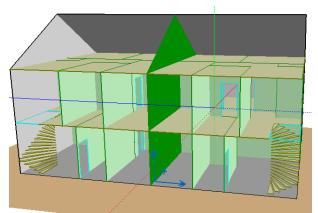
Enter the area and the distance to the ground. In the second step you select two coordinates from the coordinate list so that a plane can be defined. Enter the elevation of an additional coordinate. For a triangle, this coordinate will be the third coordinate, for a rectangle the elevation for the coordinates not marked as fixed will be set. If the object contains more than 4 coordinates or is a shape that is not rectangular, the elevations are interpolated.

It is also possible to uncheck the checkmark "fixed" to raise or lower the entire object. If additional coordinates are inserted, the elevations will be set by the program so that all of the coordinates remain on a plane.

#### **Reference object / Change view**

Initially the floor slab of the hall is the reference position where the objects are placed upon. For additional objects it is also possible to use existing objects as the reference.

In the example below horizontal and vertical elements as well as transmissive areas are used to simulate a duplex building with its spiral staircase and partially covering floor slabs:



For example enter a horizontal object as the floor slab. In order to enter objects on the floor above the floor slab, the floor slab must become the reference object. Click on the horizontal object and then on the symbol **RESET REFERENCE AREA** to reference the next objects to the floor slab. The referenced object presented in its enlarged form in the 2D view.

The symbol remains active as long as you enter objects that are referenced to the floor slab. If you want to return to the initial reference, click on the symbol **RESET REFERENCE AREA** again.

When a horizontal object is the reference object, you can generate additional objects above/below or left/right of these reference objects. Use **SWAP VIEW** to change the view. In the status line of the 2D view and the 3D view you can see which side (up/down or left/right) is currently active.

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#### Entering a new object

Initially you are in the **SELECTION MODE**, the arrow symbol is pressed and in the 2D view you see the arrow cursor. When you are in the selection mode and the cursor is on another object, the cursor changes into a hand cursor. With the hand cursor select the object and edit the objects properties.

To enter a new object, first select the object type, this deactivates the selection mode and activates the ENTRY MODE. The cursor now appears as crosshair cursor.

When your cursor gets close to an object, the cursor changes into **CAPTURE CURSOR** and you can position the cursor precisely on the point of coordinate or on the line of another object. In the **SETTINGS** you determine how close you have to be to the object in order to have the capture capabilities.

If the mode to align along the grid or to enter with fixed angular increments is active, press the <*Ctrl*>-key to capture a coordinate.

Enter objects in the 2D-view. For entering new objects in this mode, you have 3 different modes:

**Free entry** places the new coordinate at the exact position where the cursor currently is.

**Fixed angular increment** is very useful to enter new coordinates on an existing line. New coordinates can only be generated in a way where the angle at your last coordinate is either the angle defined in the settings or a multitude thereof. If your coordinate is the second in a line, the angles are in reference to the x-axis.

**Align on the grid**: the entered new coordinate is moved to the closest grid point. From a certain zoom factor on, the grid is shown on screen.

Angular increment and grid spacing is defined in the settings. Both modes are mutually exclusive. When one of the modes is active, it can be temporarily deactivated for the next coordinate by pressing the <*Ctrl*>-key, i.e. you can place a free coordinate of capture another coordinate or a line. For lines and area entry the status line shows the distance to the previous coordinate in X and Y (dx, dy) and the current distance and angle.

For the support of the data entry you can add a crosshair cursor.

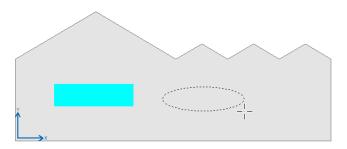
Except for the entry of point objects, either finish the entry with a double click or with <**F2**> on the keyboard or by changing to the selection mode. If you end the entry in the selection mode, you cannot right away enter another object, you first need to select the object type.

If the object requires additional geometry parameters, this for example is needed for points with a distance to a reference line of with a vertical object the height, the needed dialogs are opened automatically.

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For a rectangular area type object aligned to the x-axis for example a window on a facade, you can generate this object by pulling open the rectangle with the left mouse button pressed.

Click on the tool **GENERATE CIRCLE**, analog to the rectangle you generate a circular object with the left mouse button. The circle is generated ist diameter in x- or y-direction. If you click on the *Ctrl*> key, you will generate a ellipsoid instead of the circle.



#### **Object hierarchy**

The highest hierarchy is the buildings envelope, i.e. the facades, the roof surfaces and the floor for interior calculations.

From the second level of hierarchy it is possible to overlap the different objects and nest them. If an object is completely within another object, the object is one level below this element in the hierarchy, if they overlap, both objects are on the same level.

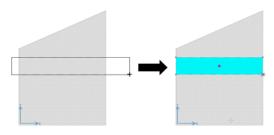
On the outside building shell, it is possible to define transmissive objects (e.g. windows and doors) and point, line and area sources that have different acoustical properties. Within inserted objects it is possible to have others nested on the same surface. For example, the door with an open window inserted.

If parts of an object that is referenced to the buildings shell exceeds the dimensions of the parent element, the sub area (often called the child element) is clipped so that it does not exceed the dimensions of the hull. This simplifies the entry of the object as it is possible to pull open areas from the outside of the building for example.

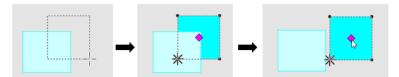
If a band of windows is stretching over the entire facade, it is very easy, simply start the rectangle of the window outside the parent element on one side and pull it to the outside on the side of the object. SoundPLAN automatically will clip the band of windows to their maximal dimensions.

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When you have objects overlapping, both objects will retain their coordinates, so if you move one of the objects, the part that was covered will re-appear.



The area being covered by another area will be clipped later on when the data are loaded for the calculation. The information concerning the total area of the object and of the part that is not covered up by another object are both visible under the register tab *General*. Transmissive areas are always showing higher in the hierarchy than area sources. For sources of the same object type the rule is that the area first entered will remain while areas entered later on will be placed under the first areas.

When you have a situation where one object needs to be inserted on top of another object, start by entering the larger area which will be the base for the other areas that will be placed on top. You can also start pulling open the area in a manner that the first coordinate of the new area lays inside the area it will be cutting out. Excessive area overlapping the parent area will be trimmed.



The child object (small square) will be cut out of the parent object which will reduce the size of the parent area, which will be diminished by the size of the child object.

#### **Object groups and Machines**

Vertical objects with more than 2 coordinates are gathered to form object groups. This way you can quickly enter the enclosure for a source or a closet.

If object groups are not as high as the building or the room, you can check mark **AS BODY**. In this case the object group has a horizontal object as top and – if the object

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group is not directly located on its reference object (another horizontal object or the ground) – a horizontal object as base plate.

Machines are groups of horizontal and vertical area sources, they always have a top and a bottom and four sides. As long as machines are not sitting directly of the floor, they will radiate to all six sides.

It is not possible to insert extra coordinates into machines and object groups, existing coordinates however can be grabbed and moved. Moving one coordinate will automatically move the coordinates for all three surfaces where this coordinate is part of. If you have already inserted child objects that are referenced to these object group or machines, they must be checked by hand as the program is not clipping the child objects when the coordinates of the parent object are moved.

Object groups and machines are moved or duplicated with all sides.

| Ύ        | ſ |    |   |
|----------|---|----|---|
| $\Gamma$ |   |    |   |
|          |   |    |   |
|          |   | ⇒x | · |

#### Select one or multiple objects

Select the objects on the tree structure, the 2D view or the 3D-view. In the 2D-view mode, the **SELECTION MODE** must be activated.

In the tree click on the desired object to activate it. In the 2D-view the cursor changes to the **POINTING HAND**, when you are moving over a coordinate or an edge of the object, in the 3D-view the pointing hand appear when your cursor is on top of the object

If there already is a selected object, it will be de-selected. To avoid this, keep the <*Ctrl*>-key pressed before activating other objects.

In the 2D-view you can select objects close to each other by pulling open a rectangle with the right mouse button pressed. As long as a coordinate of an object falls inside the rectangle, the object will be marked. Object groups and machines can only be selected from the tree structure.

You can always move objects when the object has the purple diamond and you move the cursor onto this diamond, keep the left mouse button pressed and then move the mouse.

If you want to move an object by a fixed margin in x-, y- and / or z-direction, or rotate objects by a known angle use the tool **MOVE OR ROTATE MARKED OBJECTS**. Positive values will move the object to the right/top, negative values will move them left or down.

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| Move / rotate selected objects | ?    | × |
|--------------------------------|------|---|
| Distance in x-direction [m]    | 0,00 |   |
| Distance in y-direction [m]    | 0,00 |   |
| Distance in z-direction [m]    | 0,00 |   |
| Rotation [deg]                 | 0,0  |   |
|                                |      | × |

For a free geometrical rotation, press the *Ctrl*-key and move the mouse to the red diamond. As soon as the cursor changes into the "rotation symbol" keep the left mouse button pressed and rotate the object with movements of the mouse.

The tool **DUPLICATE MULTIPLE OBJECTS** functions in a similar way. Enter the distance in x- and / or y-direction and the number of copies you want to generate. Duplicates with positive values will be generated to the right/top while a negative value for duplicates will generate them to the left/bottom.

| Duplicate selected objects                                 | ×    |
|------------------------------------------------------------|------|
| Distance in x-direction [m]<br>Distance in y-direction [m] | 0,00 |
| Count of copies                                            | 4    |
|                                                            | 🗸 🗶  |

#### Insert coordinates / modify

If a single line or area object is selected, you can insert new coordinates on the line/edge when the arrow cursor with the plus sign is active. Left click with the mouse on the position where you want to generate a new coordinate (this does not work for object groups and machines).

If you are positioned on a coordinate, the movement cursor appears (arrow cursor with cross). With pressed left mouse button move the coordinate.

When you move the mouse with the pressed <*Shift*>-key on a coordinate, the arrow cursor with a minus sign appears. Clicking on the coordinate will delete the coordinate (this is not working for object groups and machines).

**Hint**: If the movement of a coordinate would cause the area to change the direction of the surface normal vector or if the boundary of the area would cross itself, the program will ignore your entry.

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You can modify the coordinates manually under the register tab *general* in the section **COORDINATES**. If you enter a value that is not in valid range, the program corrects it (if a child object for example would exceed the boundaries of ist parent) or ignores it (if the surface normal is reversed).

| Koordinaten |       |  |  |  |  |
|-------------|-------|--|--|--|--|
| x [m]       | y [m] |  |  |  |  |
| 6,22        | 0,00  |  |  |  |  |
| 15,68       | 0,00  |  |  |  |  |
| 15,68       | 5,50  |  |  |  |  |
| 6,22        | 5,50  |  |  |  |  |

As vertical and horizontal objects must be either vertical or horizontal, you can only edit the xy coordinates for the first 2 coordinates of a vertical object or the first z coordinate of horizontal objects.

#### Move the origin

With the tool Move the Origin select a different edge upon which to reference the X-axis. This can become necessary if you want to have a bitmap as the background for the object. Bitmaps cannot be rotated, which means that you must select the origin in such a way that the hall and the bitmap are oriented the same way.

Activate the function to move the origin. The blue cross will change into a red coordinate frame. Select the corner by moving the mouse on top of the edge to be fitted to the X-axis. Select with the left mouse button, abort with <*Esc*>.

The last tool will load a bitmap, fit it or removes it -> Background bitmap.

#### Enter Bitmap

One or more background graphics can be assigned to the facades, the hall floor and the roof areas. The graphic can also come from a pdf file, which is automatically converted into a bitmap, see "PDF as background graphic" in the Geodatabase chapter. The bitmap must be oriented in the same way as the building outline. This depends on the first entered edge.

With **BITMAP LOAD / FIT IN OR REMOVE** you select the desired bitmap. If you fetch it from another folder, it will be copied into the project. The bitmap is first fitted so that it lies exactly in the rectangle surrounding the building. But you are still in "Fit Bitmap" mode. Press the left mouse button at the lower left corner of the bitmap. Hold down the mouse button and drag the bitmap to the corresponding corner of your building envelope. Do the same with the upper right corner.

With this the mode "fit bitmap" is finished. In case you are not satisfied with your fit, you can repeat this procedure by selecting **BITMAP LOAD / FIT IN OR REMOVE** again. You are immediately in the mode "fit bitmap", there is no need to select a new bitmap. If you want to select a different bitmap, you need to first delete the first one with a click on the *<Del>*-key.

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If you have accidentally clicked on the button, you can cancel the action with <ESC>.

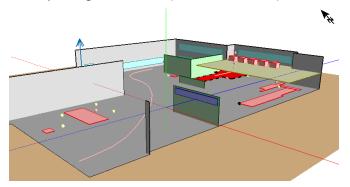
The bitmaps can be exchanged via the selection list.

| Bi | itmaps       |       |
|----|--------------|-------|
|    | Kataster.jpg | ~ 🕈 = |
|    |              |       |
|    |              |       |

With + further background images can be loaded or with - removed from the assignment list.

#### The 3D-view

The view direction "from outside" or "from inside" is linked between 2D view and 3D view. If the industrial building is viewed from outside in the 2 D view, it is also viewed from outside in the 3D View and vice versa. If you have a look from the outside to the inside, all outside surfaces are hidden that have a surface normal vector pointing at the viewer (floor, facades, roof).



With the left mouse button select an object. If the *Crtl*>-key is pressed along, objects already selected are staying marked.

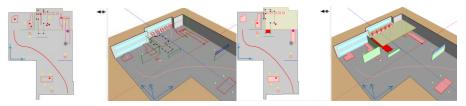
When **KEEP VIEW DIRECTION** is not active, the building is rotated in a way that the selected object is pointing to the viewer.

Additional options that also affect the 2D view.

With the switch **HIDE BITMAP / SHOW BITMAP** toggle the bitmap presentation.

The switch will toggle between the wire frame model and the hidden surface model: Sometimes it has advantages to see all boundary lines of surfaces of all objects instead of hiding objects below others.

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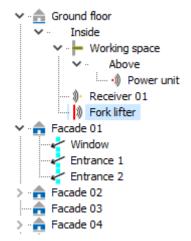
When the mode **SHOW OBJECTS TIL HEIGHT**, the slider to its right is active. By clicking on the slider, you set the height from which on the objects are cut away. After letting go of the mouse button, the 2D and 3D views are redrawn.

If you want finer height spitting, use the divider to the right of the slider to make the slider more sensitive.

Click on the height symbol again to deactivate this mode and SHOW ALL OBJECTS.

#### The object tree

The object tree depicts the hierarchy of all objects for the industrial building. The top level represents the buildings shell with floor, facades and all surfaces for the roof structure. If present, you will find all transmissive objects below this with the group definitions for outside / inside. This structure may repeat itself for multiple horizontal and vertical objects.



Object groups and machines only consist of a single reference coordinate; the surfaces are located in a separate branch of the tree.



If the object tree is closed, only the top level is shown. The triangles in front of the shells object indicate that the object contains other objects.

The command **OPEN TREE** opens the tree with all branches and sub branches. Via the small triangles in front of the objects in the tree you can expand the individual branches.

In case you activated in multiple objects either in the object tree or the 3D-view that are not in the same level of hierarchy, the 2D-view will show a gray empty area.

In the **SETTINGS** define the parameter for the entry of the objects. Change the default values only if really needed as courser settings often will lead to difficulties in the 2D-view. To make it easier to document the situation, you can also have the program present the unique object numbers in the tree.

| Settings                             | ?     | × |
|--------------------------------------|-------|---|
| Grid size [cm]                       | 10    |   |
| Angle step [deg]                     | 15    |   |
| No. of edges for circles or ellipses | 12    |   |
| Capture radius [pixel]               | 10    |   |
| Show object keys in tree             | False |   |

With the **PREFLIGHT** button ask the program to check the data if nothing important was forgotten for the calculation. The logbook will contain the results of the check.

The logbook-icon will change in color if hints, warnings and errors are found.

In the properties table, you will see the properties of all absorption and noise transmission definition for all objects along with the definition of all sources associated with the industrial building. Select the objects by their properties from the pick list.

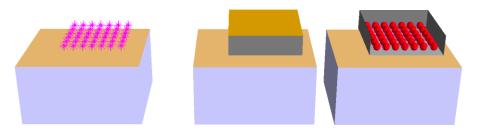
In the *General* tab, you can enter any information about the individual objects under **NOTES**. In the case of sources, the first row of comments is documented in the results tables in the **COMMENTS** column.

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Ground floor
 Facade 01
 Facade 02
 Facade 03
 Facade 04
 Facade 05
 Facade 06
 Roof 01
 Roof 02

#### Import outside geometry into an industrial building

If your project requires a containment of fans/air conditioners in front of the facade or on the roof, you can import the outside geometry with the sources into a building itself. Open up a new industrial building that fully contains the sources. Adjust the elevations so that all outside objects are higher than the floor of the new industrial building. Change from the tab *general properties/room* to the tab *editor*. Click on the symbol **IMPORT** *i*. All point, line and area sources as well as buildings, walls and floating screens that are completely within the new industrial building will be imported.



For sources the spectra and day history will be transferred. Buildings are converted into horizontal and vertical objects. The reflective and transmissive properties must be defined later on for all the new objects.

# Properties of the building and the objects

In addition to the geometry of solid objects and the positions of sources and receivers, you will need to define the emission spectra for all the sources, along with absorption spectra for all surfaces and sub-surfaces. Bear in mind that the frequency spectra that we perform the calculations with takes the lowest common denominator from your input – the source or surface with the least detail in terms of frequency definitions decides the detail level for the calculation as a whole. If, say, you have one surface which defines absorption only in the bands 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz, these are the only bands we will use for the calculation, even if you have defined everything else in third-octave bands from 1 Hz to 20000 Hz.

We take a slightly more relaxed attitude with transmission. You are free to leave it undefined (in which case we assume no transmission whatsoever), or you may define a limited number of bands. In the latter case, if the calculation wants to use a frequency band which is not defined by a transmission spectrum, we either take the lowest or highest available band if the frequency lies outside the defined range, or, if the frequency lies between two defined transmission bands, we interpolate between the two.

An important point to reiterate is that while it is tempting to try and improve the quality of results by increasing the input detail, there is usually little to be gained beyond a certain point – excessive detail can even lead to additional difficulties. Six

Industrial building / office

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or seven octave frequency bands may well be sufficient and geometrical features smaller than about 50 cm can often be safely neglected. Absorption coefficients are rarely known within an accuracy of  $\pm 0.1$ . Even the best measurements can struggle to get accuracy below 0.5 dB in certain circumstances and calculation methods come with systematic errors – discrepancies of several decibels are seen regularly in realistic noise control situations in general. It therefore makes sense to start with a relatively crude model and then possibly explore what difference further detail might make.

It's worth bearing these things in mind when you set up you SPD situation.

| Inside pro          | perties of the building          |            |
|---------------------|----------------------------------|------------|
| Properties i        | inside                           |            |
| Mean room h         | eight inside (VDI 3760 only) [m] | 0,00       |
| Scattering ob       | jects:                           |            |
| Density [1/m]       | ]                                | 0,0000     |
| Absorption:         | undefined                        | ~ <u>N</u> |
| Absorption coeffici |                                  |            |

#### Frequency [Hz]

The mean room height is only valid for calculations according to VDI 3760, because this model can only calculate horizontal ceilings. Enter a mean room height in case of suspended ceilings, saddle roofs or shed roofs. The actually bigger surface of the roof must be considered by a higher scattering object density.

Please note that further restrictions apply to calculations according to VDI 3760, e.g. no intermediate ceilings may be entered.

#### Definition of the scattering objects

Scattering objects are not explicitly modeled elements inside a room, leading to screening and scattering of the incident sound. Scattering objects are all kinds of structures inside of the factory, (e.g. machines, installations or pipes), but only if they are large with respect to the wave length. It is therefore recommended to only take those structures into account which are balls with a diameter of at least 1 m or cuboids with a side length of at least 1m. Smaller elements only minimally act as scattering object; larger structures divide the room and should be considered as walls.

Facades and ceiling are no scattering objects.

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The **SCATTERING OBJECT DENSITY** q can be described as the mean free path length Lm. (q = 1/Lm, Lm = mean free distance between scattering objects). This can be traced back to the relation of the surface S<sub>1</sub> of all structures in the room (except boundary surfaces) to the room volume V.

$$q = \frac{1}{Lm} = \frac{\sum S_l}{4 \times V}$$

The free path length can be assumed to be 30 m for a hall with few machines and 10 m for dense fill with machines.

The density of scattering objects increases with increased grade of filling the hall with machines. Here some guidance values for

| Dense fill with machines     | 0.1 m⁻¹              |
|------------------------------|----------------------|
| Middle fill with machines    | 0.08 m⁻¹             |
| Scattered fill with machines | 0.03 m⁻¹             |
| Hall with very few machines  | 0.01 m <sup>-1</sup> |

The only other source for absorption spectra we know is the book "Technischer Lärmschutz (technical noise protection)" (Springer Verlag, ISBN-10: 3-540-25507-9) with the following suggestion:

Room with flat roof, scarce scattering object allocation (e.g. machine room in a power plant): q = 0.015 - 0.03 m - 1

Room with flat roof, middle scattering object allocation (e.g. room with machine tools): q = 0,03 - 0,06 m-1

Room with shed roof, dense scattering object allocation (e.g. shed hall with textile machines): q = 0,06 - 0,12 m - 1

Inaccuracies in the estimation of the scattering object density is only scarcely noticeable in low and middle distances to a source but fairly noticeable in big distances.

#### Definition of the absorption of scattering objects as

The absorption of the scattering objects is frequency dependent. The VDI 3760 proposes the following absorption spectra that are included in the system library:

Scattering objects metal (machinery)

Scattering objects wood (other installation)

The only other source for absorption spectra we know is the book "Technischer Lärmschutz (technical noise protection)" (Springer Verlag, ISBN-10: 3-540-25507-9) with the following suggestion:

| All kind of machinery (except textile machines), pillars, sheds, material piles: | as = 0,05 – 0,15 |
|----------------------------------------------------------------------------------|------------------|
| Textile machines:                                                                | as = 0,2– 0,25   |
| Sound absorbing partition walls (e.g. in an open-plan office):                   | as = 0,7– 0,9    |

Industrial building / office

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### Properties of outside sources and transmissive areas

You can assign an **OBJECT NUMBER** in the *General* tab (see "Object numbering" on page 25), which is used to label the sources in the Result Tables and can be output as label text in the Graphics.

Once you entered a source, transmissive area or a complete façade is enabled as source (tab *General*), a tab index card for the properties of the outside sources is shown.

| up:   | 120    | Industria | i hal        |   | ~ 🍨 🖛 🔺                              |               |                |    |                               |            |
|-------|--------|-----------|--------------|---|--------------------------------------|---------------|----------------|----|-------------------------------|------------|
| Emiss | lion   | Direct    | bvity        |   |                                      |               |                |    |                               |            |
| £'w   | r = Li | (calc)+C  | d-R          | ~ | Cd [dB] -5,0                         |               |                |    | LwA=42,0 dB/m, m <sup>2</sup> | 100% / 24h |
|       |        | Sum       | Lw Ref.      |   | Emission/Transmission library        | CF/Range [Hz] | Time histogram |    | 80                            | 100        |
|       | U      | 67,9      | Lplevel      |   | 5351_Industrial hall window West 1   | 63-8000       |                | 10 | 80                            | ao -       |
|       | R      | 29,0      |              |   | Single sheet window d = 4mm          | 63-8000       |                | 10 | 2                             | 10         |
| 1     | Cw     | 42,0      | Lw/m, m³     |   |                                      | 63-8000       | 100%/24h 👻     | 11 | 8 2 2                         | 60 -       |
|       |        | _         |              |   |                                      |               |                |    | 2                             | #0<br>30   |
| Cor   | rrect  | tion [dB  | 1            |   | DQ-Wall 3,0                          | kI 0,0        | kT 0,0         |    |                               | 20         |
|       |        |           | source Leg e |   | Standard deviation for Lw Sigma [dB] |               | 0,0            |    |                               | 10         |

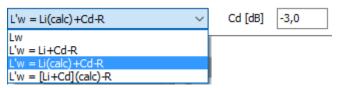
The organization unit **GROUP** gathers the results of multiple sources under a single label for the result tables. The selection list shows already existing groups (or "not defined" in a new project).

|        |          | Delete group assignment |
|--------|----------|-------------------------|
| Group: | Car wash | × 🛉 = 🔺                 |
|        |          | Add group Rename group  |

The lower area contains the core of the object settings with the definition of the emission, the corrections, standard deviation and the max noise level are entered. On the right-hand side, the spectral data and day histogram are visualized. If a directivity is associated with a source, it can be selected and viewed on the second tab.

#### **Emission definition**

Select how the emission shall be defined.



Select LW, if you want to enter the sound power directly. The sound power can either be entered as a mean frequency in the left field or selected as a spectrum from the library. The spectrum can contain the final values or can be used as a reference spectrum which will be converted into a full spectrum with the sum level

```
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```

that the spectrum is supposed to represent. In this case all levels of the reference spectrum are only relative levels.

| Emissio | n    |            |   |                               |               |                 |
|---------|------|------------|---|-------------------------------|---------------|-----------------|
| Lw      |      |            | Ŧ | ]                             |               |                 |
|         | Sum  | Lw Ref.    |   | Emission/Transmission Library | CF/Range [Hz] | Time histogram  |
| L"w     | 95,0 | Lw/m, m² 🔻 |   | -                             | 500           | working hours 💌 |

With the entry as a mean frequency select the desired mean frequency in the filed **CF/RANGE [HZ]**. In general the **LW REFERENCE** is set to "Lw/m,m<sup>2</sup>" (the sound power is referenced to a meter/ square meter of the source)

As soon as you select an emission spectrum from the library, the first spectrum in the field is presented and the frequency sum (total sound power over all frequencies) from the library is entered. If you change the frequency sum, all values of the spectrum will automatically adjust up or down.

Select L'W = Li+Cd-R as the entry type to calculate the L"w from the interior noise level and the noise transmission through the wall. You can enter the interior noise level and the noise transmission as a single value (equation 7b of the VDI 2571) or as a spectrum from the library. If Li and R have different ranges of definition, only the frequencies that are part of the Li and the R will be used. It is recommended that the frequency range in the library should be adjusted.

| Emissio | on Direc  | tivity     |          |                                         |               |                 |
|---------|-----------|------------|----------|-----------------------------------------|---------------|-----------------|
| L'w :   | = Li+Cd-R |            |          | ▼ Cd [dB] -5,0                          |               |                 |
|         | Sum       | Lw Ref.    |          | Emission/Transmission Library           | CF/Range [Hz] | Time histogram  |
| Li      | 82,8      | Lp level 👻 | <b>V</b> | forklift, electric, P<1.6 kW, driving 💌 | 63-8000       | <b>•</b>        |
| R       | 12,0      | •          |          | Door made of Aluminium 👻                | 63-8000       |                 |
| L"w     | 65,9      | Lw/m, m² 🔫 |          | <b>•</b>                                | 63-8000       | working hours 👻 |

With L'W = Li(CALC)+Cd-R the interior noise level of the industrial building is calculated with the module Indoor Factory Noise. The calculation saves the spectral data in the Li(Calc) day histogram spectra library. This means that when you calculate the interior levels the definition of the Li in the industrial building is only complete after a Hallout (in->out) calculation is done.

In addition, enter the diffusion parameter Cd. According to EN DIN 12354 this term is dependent on the room properties and on the surface properties of the inner side of the building.

| Situation                                                                                               | C <sub>d</sub> in dB |   |
|---------------------------------------------------------------------------------------------------------|----------------------|---|
| Relatively small, uniform rooms (diffuse field) in front of reflective surface                          | -6                   |   |
| Relatively small uniform rooms (diffuse field) in front of absorptive surface                           | -3                   |   |
| Big flat or long halls, many sound sources (average industrial building) in front of reflective surface | -5                   |   |
| Industrial building, few dominant and directed emitting sources in front of reflective surface          | -3                   |   |
| Industrial building, few dominant and directed emitting sources in front of absorptive surface          | 0                    |   |
|                                                                                                         |                      | • |

Industrial building / office

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In the equation 7a of the German VDI 2571 the diffusion term Cd is -6.

By selecting **[Li+Cd](calc)-R** in the properties of outside sources and transmissive areas, you can automatically calculate the diffusivity term Cd for "hallout" simulations according to ISO 12354-4 (not for VDI 3670). Cd is included in the calculation of the internal level and is not shown separately.

The correction for **D**  $\Omega$ -WALL is automatically set for the surfaces of the industrial building to 3 dB. In case you use a directivity from the library it is assumed that the half spherical propagation is set via the directivity and D-Omega Wall is set to 0. The directivity is selected in an additional tab and already has the main direction of the sources set to the surface normal of the wall, see <u>"Assignment of directivity to</u> sources (page 224)".

It is also possible to assign a day history to the sound power radiated from the building.

## Multiple emission definitions

An emission definition for the environmental noise (not the noise inside the factory building) can be assigned up to 3 emission definitions, to model different configurations of the source for example to simulate the different breakout for "door open" - "door closed" correctly with the correct amount of time where the door is open versus closed and with a different transmission loss.

Hint: The day histogram library includes a function to invert a day histogram.

#### Procedures with a calculated in factory noise level

Use the red plus sign to generate a new state of the source, the geometry remains unchanged but the source description will allow the change of the transmission index R. Each source has a day history where each state of the source needs to be assigned a percentage of the time this state will be active, the total needs to sum up to 100%. This means that when a gate is open 18 minutes of a certain hour, the time history for this state needs to be set to 30%, the closed state = 42 minutes will be the other 70%.

#### Procedures with an indoor level selected from the library

With the red plus-symbol request a new source definition with a different noise transmission. The day history for this operation can only be resolved for the number of hours when this source definition shall be active rather than the detailed information which hour had what source definition. For example, a gate that is open between 9:00 and 12:00 but is closed the rest of the time. If the operations time of the factory is between 6:00 and 22:00, then the day history for the closed gate is 100% for 6:00 to 9:00 and from 12:00 to 22:00, the time from 9:00 to 12:00 the closed gate is active by 0%. This means that

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at night time where the noise limits are stricter, the closed gate is active and not the open gate, thus it is much quieter in the environment.

#### Interpretation of inserted point and line sources as an area

Often the geometric form and exact location of a source is not determined at the time the noise study is made. To accommodate this, point and line sources can be assigned an area, this area will be subtracted from the higher instance source to correct the number of square meters this source is radiating noise. This is helping with sources that have the sound power defined as per meter, for example when calculating the noise breakout from the internal noise of the factory to the environmental noise.

#### Indoor source properties

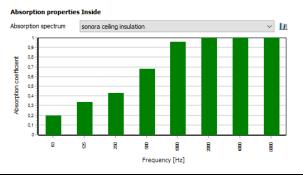
The organization unit **GROUP** gathers the results of multiple sources under a single label for the result tables. The selection list shows already existing groups (or "not defined" in a new project).



The lower area contains the core of the object settings with the definition of the emission and the day histogram. If a directivity is associated with a source, it can be selected and viewed on the second tab. Below the spectrum and the and the day histogram are visualized.

Single values are not possible for indoor sources, always select a spectrum from the library. You can apply the settings from the library or use the spectrum as reference spectrum. In this case define the dB-weighting and the reference (emission per 1 m<sup>2</sup> area size, or per 1 m line length or in relation to the total source). On the right side, select the daily histogram from the library (important only for Leq calculations, not for room acoustics).

#### Absorption properties



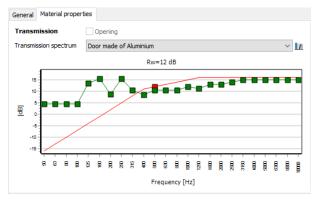
Industrial building / office

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For indoor calculations all facades, ceilings inner walls and inner ceilings etc. mandatorily need an absorption spectrum. Therefore, select a spectrum from the library.

The button "Library" takes you to the library (either to select an element from the system library or to edit a selected element).

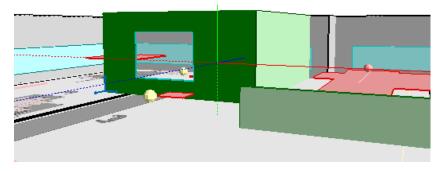
**Transmission properties** 



Horizontal objects (intermediate ceilings), vertical objects (walls) and transmissive areas can be treated as sound-permeable for calculations according to the sound particle model SPD. Select a transmission spectrum from the library. Select the transmission spectrum for horizontal and vertical objects as well as for transmissive objects at horizontal and vertical objects in the tab *Material properties* and for transmissive areas at facades (doors, windows) in the tab *Outdoor source properties*.

The button "Library" takes you to the library (either to select an element from the system library or to edit a selected element).

Interior transmission areas inside the building can also be considered as an opening. In this case, activate the check box **OPENING**.



In the 3D view, objects lying behind the opening are visible.

### Edit properties of multiple objects

If you want to edit the properties of multiple objects, select them in the tree (with *Ctrl* + left mouse button). All changes you make in the property dialogs are valid for all selected objects.

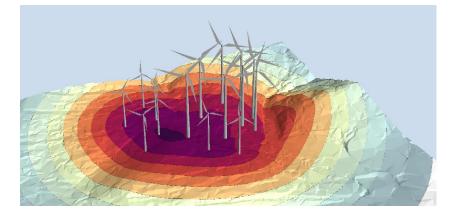
The property table is another possibility to quickly edit the properties of multiple objects as well as to get an overview of the properties.

| I Property table - 🗆 |          |                               |                              |   |   |  |
|----------------------|----------|-------------------------------|------------------------------|---|---|--|
| Pr                   | operty   | Absorption inside / left      | ✓ <u>In</u>                  | ( | ? |  |
|                      | Obj. key | Name                          | Absorption                   |   | ^ |  |
| 4                    | 5350     | Industrial hall window West 2 | Glass                        | Ŧ |   |  |
| in i                 | 5028     | partition wall 2              | Plain plaster                | • |   |  |
| in i                 | 5027     | partition wall 1              | Plain plaster                | Ŧ |   |  |
| in.                  | 5029     | partition wall 3              | Plain plaster                | • |   |  |
|                      | 5332     | Roof                          | VB-1 vertical ceiling baffle | Ŧ |   |  |
|                      | 5339     | Facade 6                      | concrete                     | • |   |  |
|                      | 5333     | Ground                        | concrete                     | • |   |  |
|                      | 5336     | Facade 3                      | concrete                     | • | ~ |  |

Select the property you want to edit or view. You will see a table with all objects with this property (e.g. absorption inside / left). A click on the column header sorts the table accordingly. Properties can be transferred from one object to another. Place the cursor on the lower right corner of an entry field and pull it with pressed left mouse key downwards.

# **Wind Turbine**

Wind Turbines can be evaluated in accordance to the standards ISO 9613-2, ÖNORM ISO 9613-2, IoA Windturbines and the Danish Status Order No. 1284.



Wind Turbine

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With the group assignment (see "<u>Using the group assignment of sources</u> (page 253)") wind turbines can be assigned to groups.

| General Additional     | Notes Debug          |            |  |  |  |  |  |  |
|------------------------|----------------------|------------|--|--|--|--|--|--|
| Group:                 | Wind park scenario 2 | + = 🔺      |  |  |  |  |  |  |
| Comment:               |                      |            |  |  |  |  |  |  |
| Time histogram:        | 100% / 24 h          | ~ 🔟        |  |  |  |  |  |  |
| Calculation method     |                      | .00% / 24h |  |  |  |  |  |  |
| O Center frequency     | 500,00 Hz 120        |            |  |  |  |  |  |  |
| Sound power spec       | 80 -                 |            |  |  |  |  |  |  |
| Wind Energy Pl         |                      |            |  |  |  |  |  |  |
|                        | 20                   |            |  |  |  |  |  |  |
|                        |                      | 0371320    |  |  |  |  |  |  |
| Lw                     | Frequency [Hz]       | h          |  |  |  |  |  |  |
| use library definit    | ion                  |            |  |  |  |  |  |  |
|                        |                      |            |  |  |  |  |  |  |
| Lw 106,0 dB(A) ~       |                      |            |  |  |  |  |  |  |
|                        |                      |            |  |  |  |  |  |  |
|                        |                      |            |  |  |  |  |  |  |
| Terrain reference      |                      |            |  |  |  |  |  |  |
| use library definition |                      |            |  |  |  |  |  |  |

For the source of a wind turbine, place the source at the height of the hub. The wind turbines included in the system library already contain the height above the terrain from the manufacturer's data. This value is taken over to the source element as Delta h if you activate the check box **USE LIBRARY DEFINITION** under **TERRAIN REFERENCE**. In this case, the height definition is set to relative.

Under the tab *Additional* enter the diameter of the rotor (for the calculation in accordance to the IoA Windturbines respectively for the presentation).

To get a realistic visualization in 3D you can use the object type "Wind energy" to set the direction of the rotor.

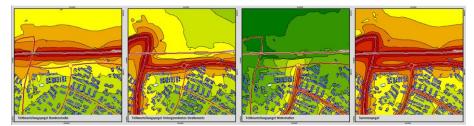
| Wind turbine                   |                                              |   |  |  |  |  |  |
|--------------------------------|----------------------------------------------|---|--|--|--|--|--|
| Rotation direction of wind tub | 0                                            |   |  |  |  |  |  |
| 📝 always in view direction     |                                              |   |  |  |  |  |  |
| Position of the rotor blades   |                                              |   |  |  |  |  |  |
| randomized                     | $\bigcirc$ fix, with a rotation angle of [°] | 0 |  |  |  |  |  |

As a nice add on, you can let the wind turbines rotate with *Ctrl+T* in the 3D View, (*Ctrl+1 - Ctrl+9* will change the rpm of the wind turbine in 9 steps).

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Wind Turbine

# Using the group assignment of sources



All sources (roads, railways, parking lots, industrial sources, wind farms and sources associated with an industrial building) can be assigned to groups. Results for individual groups can be saved separately in the calculation. In the Documentation (Result Tables and Spreadsheet) and the Graphics can present the results of the groups separately from the documentation of all individual results.

In the Geo-Database assign the sources to a GROUP.

|        |          | Delete group assignmen | t            |
|--------|----------|------------------------|--------------|
| Group: | Car wash | × •                    | -            |
|        |          | Add group              | Rename group |

In the **Calculation core** in the definition of the calculation run for single receivers and Facade Noise Maps check the box for **GROUP-RESULTS**.

Group results

For Grid Noise Maps use the double arrow to select groups for the calculation.

The ALLOWED TOLERANCE in the tab *Settings* in any case needs to be set VALID FOR EACH GROUP CONTRIBUTION LEVEL, in order to have the levels of groups stay constant when other groups are added or taken out of the calculation. If detail tables are activated, the tolerance is calculated on the basis of each source partial noise level.

For the table type (Result Tables and Spreadsheet) and the graphical documentation of the results, the results can be presented either based upon Group Contribution levels or on total results.

In the **Result Tables** the group contribution levels at the receiver are presented for single receivers and Facade Noise Maps under *Details* + *Graphics* in the detail table *Groups*.

Using the group assignment of sources



| l                         | un info   Single I | Recei  | ver Details + g    | graphics Source | es                 |                             |                      |  |          |  |
|---------------------------|--------------------|--------|--------------------|-----------------|--------------------|-----------------------------|----------------------|--|----------|--|
|                           | Receiver           | FI     | IGW,T/dB(A)        | IGW,N/dB(A)     | LrT/dB(            | A) LrN/d                    | IB(A)                |  | ,        |  |
|                           | Kalchsreuth        | EG     | 64                 | 54              | 48,3               | 48,3                        |                      |  |          |  |
| >                         | Kümreuth           | EG     | 59                 | 49              | 48,2               | 48,2                        |                      |  |          |  |
| Spectrum 24h distribution |                    |        |                    | 5               | Gource contributio | n M                         | lean propagation Leq |  |          |  |
|                           | Source co          | ontrib | ution - 24h distri | bution          | C                  | Contribution spectra Groups |                      |  | Diagrams |  |
| Group                     |                    |        |                    | LrT<br>dB(A)    | LrN<br>dB(A)       |                             | ^                    |  |          |  |
| )                         | Wind park s        | cen    | ario 1             |                 |                    | 45,6                        | 45,6                 |  |          |  |
| Wind park scenario 2      |                    |        |                    | 43,4            | 43,4               |                             |                      |  |          |  |
|                           | Wind park s        | cen    | ario 3             |                 |                    | 38,7                        | 38,7                 |  |          |  |

In the **Spreadsheet** (Receiver table) -in the column selection- select if group contribution levels should be part of the spreadsheet and if desired, which ones. Depending on the selection there are additional columns.

| Project Wind Farms<br>Sum level and group contribution levels |                                                                                          |       |        |      |       |      |         |      |         |          |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------|-------|--------|------|-------|------|---------|------|---------|----------|
|                                                               | Limit Sum level Wind park Wind park scenario 1 Wind park scenario 2 Wind park scenario 3 |       |        |      |       |      |         |      |         | enario 3 |
| Name                                                          | Day                                                                                      | Night | LrD    | LrN  | LrD   | LrN  | LrD     | LrN  | LrD     | LrN      |
|                                                               | [dB(A                                                                                    | ]     | [dB(A) |      | [dB(A | )]   | [dB(A)] |      | [dB(A)] |          |
| Agriculture 1                                                 | 64                                                                                       | 54    | 43,6   | 43,6 | 36,8  | 36,8 | 40,7    | 40,7 | 38,2    | 38,2     |
| Agriculture 2                                                 | 64                                                                                       | 54    | 50,8   | 50,8 | 44,3  | 44,3 | 44,0    | 44,0 | 48,4    | 48,4     |
| Hannesreuth                                                   | 59                                                                                       | 49    | 47,5   | 47,5 | 44,8  | 44,8 | 43,2    | 43,2 | 36,9    | 36,9     |
| Kalchsreuth                                                   | 64                                                                                       | 54    | 48,3   | 48,3 | 45,6  | 45,6 | 41,6    | 41,6 | 42,5    | 42,5     |
| Kümreuth                                                      | 59                                                                                       | 49    | 48,2   | 48,2 | 45,6  | 45,6 | 43,4    | 43,4 | 38,7    | 38,7     |
| Schmalnohe                                                    | 64                                                                                       | 54    | 44,7   | 44,7 | 37,1  | 37,1 | 42,0    | 42,0 | 39,3    | 39,3     |
| Sigl                                                          | 59                                                                                       | 49    | 37,7   | 37,7 | 33,7  | 33,7 | 33,5    | 33,5 | 31,1    | 31,1     |
| Sigras 1                                                      | 64                                                                                       | 54    | 47,0   | 47,0 | 40,5  | 40,5 | 44,7    | 44,7 | 39,7    | 39,7     |
| Sigras 2                                                      | 64                                                                                       | 54    | 48,4   | 48,4 | 41,9  | 41,9 | 46,6    | 46,6 | 39,1    | 39,1     |
| Wickenricht                                                   | 59                                                                                       | 49    | 41,5   | 41,5 | 36,0  | 36,0 | 39,1    | 39,1 | 33,1    | 33,1     |

The groups can be used in the area table for the statistical evaluation.

| Name       | Größe   | Intervalle | Sum level<br>Size [km²] |      | Federal h<br>Size [ |      | Municipa<br>Size [l |      | Local re<br>Size [k |      |
|------------|---------|------------|-------------------------|------|---------------------|------|---------------------|------|---------------------|------|
|            | [m²]    |            | LrD                     | LrN  | LrD                 | LrN  | LrD                 | LrN  | LrD                 | LrN  |
| Total area | 1408271 | > 55       | 0,70                    | 0,24 | 0,34                | 0,12 | 0,24                | 0,09 | 0,14                | 0,02 |
|            |         | > 65       | 0,20                    | 0,05 | 0,09                | 0,04 | 0,08                | 0,01 | 0,02                | -    |
|            |         | > 75       | 0,04                    | 0,00 | 0,02                | 0,00 | 0,01                | -    | -                   | -    |

In the **Graphics** during the file selection menu, choose if sum levels or contribution levels are to be used in the plan.

| _  |                      |                       |        |
|----|----------------------|-----------------------|--------|
| G  | id Noise Map         |                       | ×      |
| Ę  | elect value          |                       |        |
| (  | 🗩 select time slice  | Show ground elevation |        |
| -1 | /alue                |                       |        |
|    | Sum level            |                       | $\sim$ |
|    | Sum level            |                       |        |
|    | Wind park scenario 1 |                       |        |
|    | Wind park scenario 2 |                       |        |
| 1  | Wind park scenario 3 |                       |        |

Accordingly, also the grid operations and the operations in the Facade Noise Map can be performed for groups.

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Using the group assignment of sources

### Measurement point

[Expert Industry] The measurement point is an object to calculate the sound power level from measured spectra. See "<u>Calculate sound power from measured data</u> (page 735)".

# Stage

The environmental noise at a festival created by one or multiple stages can be calculated in SoundPLAN in accordance to either the Nord2000 or ISO 9613-2.

Calculations with the Nord2000 offer higher accuracy because the formulae used in the propagation are closer to the propagation of a wave that what the ISO 9613-2 offers. The ground effect is using Fresnel zones to calculate the reflection of the wave on the ground, the ISO 9613 only regards a single reflection point. The ISO 9613-2 also calculates the scenario as a downwind case which automatically means that you are assessing the worst-case scenario with downwind in all directions. The Nord2000 allows for more detailed modeling of the meteorological conditions with wind velocity, wind direction or alternatively with downwind conditions.

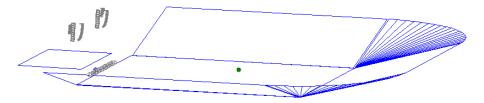
A stage is a combination of the position of the noise sources, the properties of the loudspeaker array and the area for the spectators. The data are defined in the ArrayCalc file.

ArrayCalc is a software product from d&b audiotechnik GmbH, in which all properties and settings of the d&b speaker arrays. For example, the number of arrays, the directivity and the tilt of individual speakers as well as the location of the concert attendees.

You can download the software for free from the website of d&b audiotechnik under

http://www.dbaudio.com/en/support/downloads/category/detail/software/simulation.html

In SoundPLAN the entire stage from the ArrayCalc file is defined as a point object.



ArrayCalc must be installed, in order that the object type stage is visible in the Geo-Database.

Select the symbol stage from the object bar and with the mouse place the stage on the canvas. When you open the object settings, you not only see the

**Measurement point** 

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object as a point symbol but can view the entire stage with all sub-objects as they were defined in ArrayCalc.

| 💶 Stage (12999)    | 7)                                                        | - 0                                   | ×  |
|--------------------|-----------------------------------------------------------|---------------------------------------|----|
| Name:              | Open air venue                                            |                                       | ?  |
| Geo-File:          | 004_New Residential Area                                  | ~                                     |    |
| ➢ Properties       |                                                           |                                       |    |
| File name:         | Example live club.dbac2                                   | <b>≧</b>                              |    |
| Direction [deg]    | 90                                                        |                                       |    |
| Sound pressure lev | rel at front of house                                     |                                       |    |
| Pop music          |                                                           | ~                                     | M  |
| Sum Level [dB(_)]  | = 100,0 Level correction                                  | on [dB] -8,5                          |    |
| Time histogram     |                                                           |                                       |    |
| Open air concert   |                                                           | ~                                     | М  |
|                    | Lw_=100,0 dB                                              | Open air concert                      |    |
| 100                |                                                           | 100                                   |    |
| 응<br>명 60          |                                                           | 80                                    |    |
| 40<br>20           |                                                           | \$ 50<br>50                           |    |
|                    |                                                           | 40                                    |    |
| <sup>≷</sup> 4 8   | 00<br>315<br>630<br>1250<br>22500<br>5000<br>5000<br>2000 | 20                                    |    |
| _                  | 6 9 9 9 7                                                 | 0 1 2 3 4 5 6 7 8 9 11 13 15 17 19 21 | 23 |
|                    |                                                           |                                       |    |
| » Geometry         |                                                           |                                       | _  |

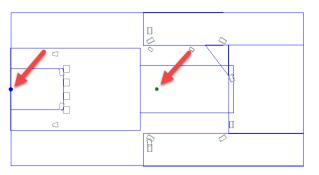
In the object dialog click the symbol **OPEN** to open the ArrayCalc file. Depending on the complexity of the stage, this can take a moment. With the symbol ArrayCalc open the program ArrayCalc if you need to make changes to the stage or to customize the "NoizCalc Reference point" (see below).

To explore all settings and definitions for the stage. I SoundPLAN the stage is represented only as a point object, in reality there are many sub objects that are defined in ArrayCalc itself.

Customize the **DIRECTION** of the venue.

Via the library symbol select a frequency spectrum. As the spectra often are relative spectra with the sound power of LAeq =0 dB, use the field for **LEVEL CORRECTION** to set the level selected at the sound mixing booth. A non-standardized spectrum that was measured with a sound level meter can also be set to the level defined at the sound mixing booth.

#### Calibrate the stage



In the picture above, you see the venue with the loudspeakers and additionally a blue and a green dot. The blue dot represents the position that you see in SoundPLAN, the green dot is the green dot is the position of the sound mixing booth or respectively the location used to calibrate the stage to, this point is called the "NoizCalc reference point".

In ArrayCalc under "settings -> advanced features", the "NoizCalc reference point" must be activated for SoundPLAN to be able to calculate the stage. You can customize the "NoizCalc reference point" in ArrayCalc in the "3D plot". SoundPLAN uses this location to calibrate the noise level to the total sound pressure of all loudspeakers. Usually this calibration point is positioned at ear level at the sound mixing booth. The calibration point must be at least 0.1 meters above the ground. The calibration is done in a pre-calculation of the SoundPLAN calculation core.

## 🗂 Buildings

Buildings are an important factor in the outdoor noise propagation. For this reason, the elevations of the building, the building height (diffraction edge) and the reflection properties are important parameters.

For aircraft noise calculations, buildings are used for display purposes only.

Some of the properties that are assigned to buildings can later be inherited to receivers to reduce the effort of the definition of manually assigned and automatically generated receivers (Single point calculations and Façade Noise Maps).

Statistical data such as the number of occupants and the number of dwellings is necessary for the evaluation of occupants affected by noise, for example for the statistics in connection with the EU noise mapping and noise action planning as well as for conflict and annoyance analyses.

A building is described with the ground floor elevation (normally the elevation of the entrance above sea level) and the building height above the ground floor. The building edge points are derived from the DGM.

Buildings

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The ground floor elevation is the same for all building coordinates. The first entered coordinate is defining the ground floor elevation for the whole building. If buildings are placed on a before calculated DGM, you can select whether the ground floor elevation is derived from the building corners as the highest/lowest elevation or if it shall be averaged from all coordinates of the building.

The positions of receivers and the building height are measured from the ground floor elevation.

The difference between the ground floor elevation and the terrain defines the building base, which is used as extended reflecting façade area. Buildings situated on a hillside can be assigned receivers in basement floors.

Enter the coordinates of the building; double click, F2, or **FINISH**) closes the building. Main buildings are displayed with green hatches, auxiliary buildings with blue hatches.

### **Building Properties**

Each building has only a single set of property information. For building complexes with different wall heights, the building needs to be split up in several buildings.

| n Building (710)                      |                          |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    | ×      |
|---------------------------------------|--------------------------|------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| Name: Bla                             | ackbird Lane 70          |            | I  | <ul> <li>Image: A second s</li></ul> |    | ?      |
| Geo-File: 🔟                           | 04_Residential Buildings | ✓ Obj. No. | 13 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    | 1      |
| ➢ Properties                          |                          |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| General Facade Noi                    | ise Map Additional       |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Description                           |                          |            | _  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Road name:                            | Blackbird Lane           |            |    | No.:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 70 |        |
| Building type:                        | Main building            | ~          | •  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Building height [m]:                  | [                        | 5,80       |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Reflection loss (facad                | les only) [dB]:          | 1,00       |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Building floats abo                   | ove ground               |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Receiver related info                 | rmation                  |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Height of 1. receiver                 | above GF (m):            | 2,40       |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Height of floors [m]:                 | [                        | 2,80       |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Number of floors:                     | [                        | 2 🚔        |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Label for the first floor             | GF 🖨                     |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Number of additional basement floors: |                          |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |        |
| Area usage:                           | Mixed area               |            |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    | $\sim$ |

Building properties

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When you assign receivers to a building, the BUILDING NAME is proposed as receiver name. For Façade Noise Map calculations, the building name is automatically used as receiver name. We recommend not filling in the building name manually but to define the entry fields ROAD NAME and NO and then assign both entries with a double click on the field BUILDING NAME. Use the GeoTool PREPARE BUILDINGS to define several building names at the same time. The order of road name and house number is selected via **OPTIONS -> PRESETTINGS**, branch Geo-Database.

Use the object number (page 55) for individual numbering of the Façade Noise Map receivers, if the automatically assigned serial number (alpha-numerical numbering according to the receiver name) is not sufficient.

Select whether the BUILDING TYPE is "main building" (residential building) or "auxiliary building" (garage, industrial building) for a different display in the graphics. For the evaluation according to the EU directive on environmental noise you can also assign the building types "school", "hospital", "kindergarten" and "unknown".

If you want to determine the building type in the Property Explorer via a formula you need to know the number, the building type is stored with in the selection list:

- 0 Main building
- 1 Auxiliary building
- -1 Unknown
- -2 School
- -3 Hospital
- -4 Kindergarten

 ${}^{\it O}$  You can add further display types if the module Cartography is licensed, see "define your own object types".

| Signs and Symbols |                                                                                                                    |  |  |  |  |  |
|-------------------|--------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
|                   | Buildings in residential areas<br>Buildings in mixed areas<br>Industry buildings with dwellings<br>Garages / sheds |  |  |  |  |  |

The new layout has no influence on the appearance of the buildings in the Geo-Database but only in the Graphics. You can check the Layout in the Geo-Database, if you open the 3D map with Ctrl+ F10 [module 3D Graphics] and select the site map in the selection list.

The **BUILDING HEIGHT** is relevant for screening and reflection during the propagation calculation. It is entered relative to the ground floor elevation. If gutter elevations are available from laser scan data, the building height can be calculated with the GeoTool "Evaluate points for mean building heights (page 169)".

The form of the roof is usually not relevant for the propagation calculation. In most calculations it is sufficient to set the building height in the middle between gutter and ridge. Only for special problems or to show the roof in cross sections and in the 3D-Grapics it might be useful to enter the ridge as a noise protection wall. The base line is entered at the position of the ridge in m above sea level with a wall height of 0. Assign the graphics-object type "ridge" for the display in cross sections and 3D-Graphics.

The **REFLECTION LOSS** describes the loss of energy occurring at each reflection of sound waves off an object. The magnitude of the loss depends on the material of the wall, the impact angle, the frequency, and the size of the wall. For normal noise assessments, the reflection losses are estimated with the following table.

| Facade type                             | Reflection loss<br>in dB | Absorption coefficient $\alpha$ (fyi) |
|-----------------------------------------|--------------------------|---------------------------------------|
| smooth facade of a building             | 1                        | 0,21                                  |
| facade with balconies and uneven fronts | 2                        | 0,37                                  |

The reflection loss is entered in dB.

Activate the check box **BUILDING FLOATS ABOVE GROUND**, if the difference between the ground floor elevation and the terrain should not be considered as reflecting pedestal. See "Floating buildings and industrial buildings (page 263)".

### Settings for Receivers in the Building Properties

If receivers are assigned to a building (single point receivers or Façade Noise Map receivers), all relevant data is entered with the building. When referencing the receiver, the parameters are reused for the receivers. This way parameters such as number of floor or area usage are defined only once per building.

The field **HEIGHT OF 1. RECEIVER ABOVE GROUND FLOOR** defines the calculation height of the first receiver (this is **not** the floor height of the first floor). Depending on the standard, this might be for example in the center of a floor (e.g. 1.5 m) or the ceiling of a floor (e.g. 2.4 m). The height is entered relative to the ground floor elevation.

The **HEIGHT OF FLOORS** defines the position of additional receivers above the first receiver.

The **NUMBER OF FLOORS** defines the number of calculated receivers lying on top of each other.

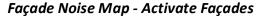
The parameter **NUMBER OF BASEMENT FLOORS** is used to take into account receivers below the ground floor for buildings on a hillside.

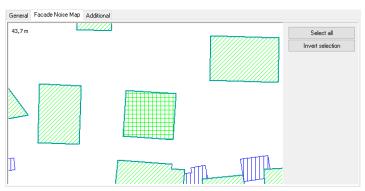
The label of the first floor for floating buildings makes it possible to correctly label the floors for nested buildings. See "<u>Floating buildings and industrial buildings</u> (page 263)".

The **AREA USAGE** is used to compare the resulting noise levels (assessment levels) with the noise limits and to map the noise excess as a conflict in the tabular documentation (Result Tables and Spreadsheet), for dimensioning noise protection walls (Wall Design) and in the Graphics (Façade Noise Map and level tables). The rest period additions according to the German TA Lärm are area usage dependent. The area usage definition entered in a building is transferred to the receivers assigned to the building. When optimizing a noise protection wall, the target level is proposed according to the area usage.

#### Assignment of the area usage to buildings

Use **GEOTOOLS** -> **MORE BUILDING TOOLS** -> **ASSIGN AREA USAGE TO BUILDINGS** in case the area usage is provided in the object type "area usage".





The module Facade Noise Map allows calculating automated single points without the need to enter single receivers. All facades where receivers should be placed need to be marked. The position of the receivers (in the center of the façade, distance in meters ...) is later defined in the calculation properties. In the preview window in the tab index card "Façade Noise Map" you see the building and its surroundings. The cursor marking the facades is a small cross. Click on all sides of the buildings you want included in the calculation.

**SELECT ALL** activates all facades of the building, **INVERT SELECTION** deactivates the previously activated facades and vice versa.

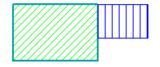
As the facades will usually be activated at one time for several selected buildings, use the Geo-Tool **PREPARE BUILDINGS** to prepare the façade receivers. You can define a minimum length so that small facades such as balconies are excluded. In **PREPARE BUILDINGS** you can also deactivate all facades for the Façade Noise Map.

Buildings

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Activate the object properties of the buildings to see the activated facades with a thick turquoise line.



If two buildings have a common façade or if a receiver is below the terrain, the receivers within this façade will not be calculated. Receivers are only calculated if they are located 0.5 m above the lower building.

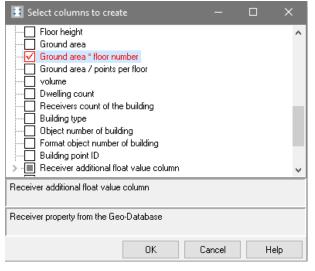
#### Property number, owner, inhabitants

Each building can be assigned further properties such as **PROPERTY NUMBER**, **OWNER** or the number of **INHABITANTS** per building in the tab index card *Additional*.

The number of inhabitants / dwellings is needed to show the affected people in a noise interval for annoyance analyses, strategic noise maps and action plans according to the European directive on environmental noise. Without exact knowledge of the number of inhabitants, you can roughly estimate the inhabitants with the option "m<sup>2</sup> per inhabitant" in the Geo-Tool **PREPARE BUILDINGS**.

If information on inhabitants is available in an area (object type "area usage") or in a grid, you can use the Geo-Tool <u>Distribute occupants</u> (page 168).

Building information as well as settings resulting from the building geometry (e.g. area \* number of floors) can be inserted in the Spreadsheet to evaluate annoyance analyses.



For investigations according to the EU directive on environmental noise, use the check box **SPECIAL NOISE PROTECTION MEASURES** to distinguish buildings, which, for example have already got noise protection windows.

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**IGNORE THIS BUILDING IN THE PROPAGATION CALCULATION CONCERNING REFLECTION AND SCREENING:** In some cases, it is demanded that shielding and reflections from buildings are suppressed. For the location of the receiver on a building and the references to the Façade Noise Map the buildings are vital, so it is not possible to simply ignore the buildings in the calculation. This procedure might also be useful in urban land use planning, when the exact position of the buildings is not yet known.

In order to supply the calculation core with the required information and to facilitate this, some extra controls are introduced:

Check the box **SEARCH RANGE DEFINED BY FACADE** and also check the box **IGNORE BUILDINGS FOR PROPAGATION CALCULATION WHICH HAVE APPROPRIATE FLAG IN THE BUILDING PROPERTIES** in the **Calculation settings** Facade Noise Map.

With the check box BUILDING FLOATS ABOVE GROUND (NOISE CAN PASS UNDERNEATH)

### Floating buildings and industrial buildings

the base of the building is not connected to the ground.

For the calculation only the screening is regarded not the reflections between the ground and the bottom of the buildings! If you want to regard the reflections between the ground and the bottom of the buildings correctly, you need to simulate the interaction with an Indoor Noise Calculation and manually generate an area source at the bottom of the building and assign it the sound power that is equal to the reflected noise components between the ground and bottom of the building. Please also observe that any floating structure will significantly increase the calculation time. For that reason, floating objects should be used sparingly for detail calculations.

With this switch several new modeling options become possible:

- Buildings where higher floors are bigger than the ground floor
- Modelling of passageways under buildings and entries to courtyards
- Buildings that have different usages, floor heights and reflection losses
- Industrial buildings with multiple floors (parking garages)
- Aggregates in (compressors, engines...) in containers on industrial racks (the noise radiation of the bottom of the box will be available shortly)

Buildings

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In order to allow receivers in stacked buildings to be labeled continuously, the label for the lowest floor was amended.

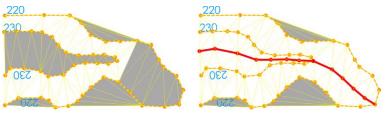


# Elevation Lines and Spot Heights (Terrain Points)

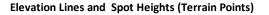
Elevation lines and spot heights form the base data for the supply of elevation for the 3-dimensional calculation model. A digital ground model (DGM) is calculated out of elevation lines and spot heights and is later used to determine the elevations of the model data (roads, buildings ...). The DGM edges are evaluated to calculate the ground effect and the screening (if applicable). The particular functions depend on the calculation standard. Some standards tie the ground effect to the average height of the line of sight above the terrain, whereas others calculate the ground reflection position in great detail. Please read the chapters detailing the ground effect in the SoundPLAN reference handbook. Although the screening does depend on the standard, please remember an effect which may not seem so obvious: Most calculation standards require the screening to be evaluated not only in the shadow zone but also in the illuminated zone.

The object type **elevation line applies** to ISO elevation lines in the cartographic sense and to lines following a terrain. The first type represents lines of the same elevation, whereas the second type models elevation profiles and cutting edges. Elevation lines are also generated with the Geo-Tool **CREATE EMBANKMENTS**.

If a DGM is calculated only out of ISO elevation lines, it might have the tendency to form plates. The screening effect will not be taken into account correctly. In this case, extra profile lines describing the elevation course will help:



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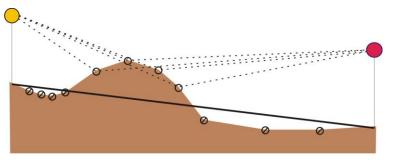


The object type **spot height describes** singular elevation information. Elevation grids or point sets (point clouds) from laser scanning, which ensure the supply of elevation information in the investigation area, are imported as object type spot heights (**FILE -> IMPORT -> ELEVATION DATA**). These spot heights are normally thinned out before import in order to minimize the number of points and the size of the DGM, see "Import and filter elevation data (page 114)".

Terrain points which are available in a DXF file as a text can be converted to spot heights, see <u>DXF Import</u> (page 97). It is sensible to use the option **IGNORE COORDINATES WITH Z=0** during the DXF import of elevation lines or spot heights.

#### Calculation of the negative extra path length / terrain edge

As soon as a calculation standard demands the calculation of the negative extra path length (screening in the illuminated zone), SoundPLAN automatically calculates this value. In projects modeled with a pre-7.0 version SoundPLAN replaces the terrain edge with 2 elevation lines.



Terrain base line

If between source and receiver no obstacle is found that would result in a positive extra path length, SoundPLAN defines a line between the ground at source and receiver labeled the terrain base line. All elevation lines and DGM triangle edges above below this terrain base line are checked if negative extra path length needs to be considered. The point delivering the highest value of extra path length for the terrain base line is chosen for the calculation of the negative screening.

### Noise Protection Walls

Walls are used to describe noise control walls and retaining walls for the noise calculation. Sometimes they are also used to define the ridge of a roof.

The wall height refers to the base line (example: with a wall height of 4 m the screening edge is 4 m above the base line). A wall with the wall height "0" is taken into account for the screening effect. The elevation of the screening edge is the elevation of the base line.

**Noise Protection Walls** 

### Wall Properties

| Base element                                                             | Additional elem                                 | ents              |                   |  |  |  |  |  |
|--------------------------------------------------------------------------|-------------------------------------------------|-------------------|-------------------|--|--|--|--|--|
| Use for Wall Design<br>Height                                            |                                                 |                   |                   |  |  |  |  |  |
| Wall floats abo                                                          | Wall floats above ground                        |                   |                   |  |  |  |  |  |
| Wall height [m                                                           | Wall height [m]: 3,00 Constant element height 🖂 |                   |                   |  |  |  |  |  |
| Reflection pro                                                           | perties                                         |                   |                   |  |  |  |  |  |
| ) Single valu                                                            |                                                 |                   |                   |  |  |  |  |  |
|                                                                          | Reflection loss<br>[dB]                         | Absorption coeff. | Reflection coeff. |  |  |  |  |  |
| Left                                                                     | 1,0                                             | 0,206             | 0,794             |  |  |  |  |  |
| Right                                                                    | 1,0                                             | 0,206             | 0,794             |  |  |  |  |  |
| Area of the bas                                                          | e element                                       |                   |                   |  |  |  |  |  |
| Segment area [m²]:         29,99         Total area [m²]:         429,85 |                                                 |                   |                   |  |  |  |  |  |

#### Wall properties

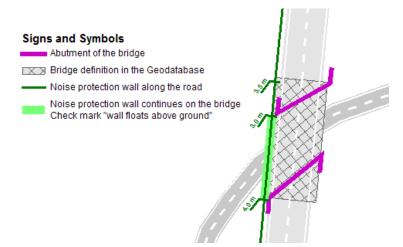
Activate the check box **OPTIMIZATION** to use a wall for the pre-calculation for Wall Design, see <u>Wall Design</u> (page 461). The optimization walls must be stored in a separate Geo-File. This means, only walls to be optimized may be in this Geo-File. Walls with additional elements are already finally defined and therefore cannot be used for a wall design calculation.

Check mark **WALL FLOATS ABOVE GROUND**, in order not to extend the bottom of the wall to the ground, but to use the object elevation as the bottom. If there is a gap between terrain and bottom of the noise protection wall, noise can propagate under the noise protection wall.

With this feature noise protection walls on bridges can be modeled better. Roads and Railway lines should still be marked to be on a bridge in order to prevent the propagation through the bottom of the bridge. This way it is also possible to graphically document the height and reference kilometer of walls on bridges.

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**Noise Protection Walls** 



Please make sure that all entry points of the wall sections on the bridge must be on the bridge plate. In case of doubt define the bridge plate a bit wider.

When a search ray intercepts a line element, the elevation is calculated from the elevations of the previous and next points, and the distances to these coordinates. For a noise control wall, the interpolated position is the base of the wall. An interpolation of the wall height for the intersection position is used to calculate the top of the wall.

Noise control walls often have sudden changes of height. For example, there may be a 5 meter noise control wall which at one point changes to 3 meters. In this case the wall height should not be interpolated. To prevent interpolation, activate the checkbox **CONSTANT ELEMENT HEIGHT.** 



Definition of wall elements with constant height for sudden changes in the wall height

For constant wall height, the wall is parallel to the ground and the height remains constant within a wall section. If the checkbox is not marked, the wall top is adjusted to the height of the next point. This means that the height of the wall elements changes within the element. Check the data with **F8** or **VIEW** -> **FRONT ELEVATION**.

### Reflection loss for noise protection walls

In the wall properties the reflective properties of the wall are listed, as walls have two sides, the properties are listed for the left and the right side (left and right side as seen in data entry direction).

The reflection loss can be defined either as a single value or as an absorption spectrum from the SoundPLAN library.

**Noise Protection Walls** 

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| Reflection properties         |                         |                      |                      |  |  |  |  |
|-------------------------------|-------------------------|----------------------|----------------------|--|--|--|--|
| <ul> <li>Single va</li> </ul> | ۲                       |                      |                      |  |  |  |  |
|                               | Reflection loss<br>[dB] | Absorption<br>coeff. | Reflection<br>coeff. |  |  |  |  |
| Left side                     | 8,0                     | 0,842                | 0,158                |  |  |  |  |
| Right side                    | 8,0                     | 0,842                | 0,158                |  |  |  |  |
|                               |                         |                      |                      |  |  |  |  |

#### Reflection properties as a single value

The reflection properties are dependent on the material of the wall. You can enter the reflection loss in dB or the absorption coefficient or the reflection coefficient. When you enter a value, SoundPLAN calculates the other two from your entry.

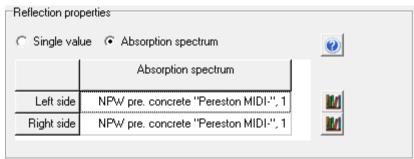
To ignore any reflections, use a reflection loss of 200 dB.

For traffic noise you normally do not need a spectral calculation of the reflection, you can use the following reflection loss settings that the German RLS 90 defines:

| Wall type                                 | Reflection<br>loss in dB | Absorption<br>coefficient α | Reflection<br>coefficient |
|-------------------------------------------|--------------------------|-----------------------------|---------------------------|
| Hard (fully) reflective (concrete, glass) | 1                        | 0,206                       | 0,794                     |
| Absorbent noise protection wall           | 4                        | 0,602                       | 0,398                     |
| Highly absorbent noise protection wall    | 8 - 11                   | 0,842 - 0,921               | 0,158 - 0,079             |

#### Reflection properties from the absorption library

For the spectral calculation of reflection losses (only possible for standards with calculation frequency by frequency) the program will use the data from the absorption coefficient library. Open the absorption library with the symbol button.



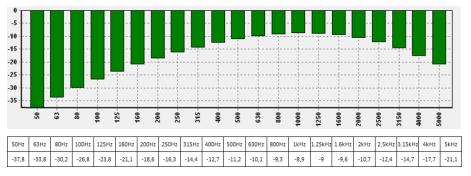
The program will either use a single value or use the entire spectrum. When you activate the spectral calculation, the single value will be ignored!

For calculations that contain spectral and non-spectral sources, SoundPLAN applies the following logic: If a wall contains an absorption spectrum, it will be used directly for all sources that are entered with a spectrum. Sources without a spectrum will use a mean absorption value which has been derived from a

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**Noise Protection Walls** 

reference spectrum for traffic noise. The reference spectrum for traffic noise has been taken from the Japanese road standard ASJ 2008 (Third octaves in dB(A)):



### Additional Wall Elements (Slanted Walls)

Open the tab Additional elements and use the + to request new elements.

| Base element | Additional elements |  |
|--------------|---------------------|--|
|--------------|---------------------|--|

| No. of additional elements:                   | 1 🔮 🚥               |
|-----------------------------------------------|---------------------|
| Element 2                                     |                     |
| No. of similar elements on top of each other: | 1                   |
| Slope based on previous element [*]:          | -60,00 dX [m] -1,30 |
| Segment length / height [m]:                  | 1,50 dY [m] 0,75    |
| Transparent                                   |                     |

As soon as an element is no longer vertical, the reflection properties are discarded, no reflection is calculated in this case.

The **SLANT BASED ON PREVIOUS ELEMENT** tilts the noise protection wall. A positive value will tilt it to the right (in the direction of entry of the object); a negative value will tilt it to the left. **HEIGHT/WIDTH** defines the size of an element in meters.

If only one additional element is present, you can define the slanted element with the parameters dx and dy.

|    | dY |
|----|----|
| dX | _  |
|    |    |
|    |    |
|    |    |
|    |    |

The data is automatically calculated to the angle and height / width.

**Noise Protection Walls** 

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Via the **NO. OF SIMILAR ELEMENTS ON TOP OF EACH OTHER** you can request that a number of elements are stacked. If for example you entered a slant of 10 degrees and requested 9 elements, you have created a quarter pipe as a noise protection wall.

#### Example:

| • |
|---|
| _ |
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|   |
| _ |
|   |
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|   |
|   |

Galleries or wall combinations as printed in the image to the left should be defined as **floating screens** so that the reflection on the top vertical element still can be calculated.

### Ridges

You can enter a ridge as a noise protection wall. The base line is entered at the position of the ridge in m above sea level with a wall height of 0. Assign the graphics-object type "ridge" for the display in cross sections and 3D-Graphics.

### Useful Geo-Tools for Walls

Generate a wall which is parallel to a road with **GEOTOOLS -> CREATE PARALLEL OBJECTS.** 

Use **GEOTOOLS** -> **MORE GEOMETRY TOOLS** -> **DIVIDE SECTIONS** to create a wall with constant wall segments for Wall Design. Nevertheless, it is better to divide the roads or railways in beforehand.

**Noise Protection Walls** 

### 😹 Berms

For berms constructed as noise abatement facilities, the foot of the wall is digitized. The screening edges of the berm are automatically constructed from the height, tilt and top width.

### **Berm Properties**

| 🔺 Noise protect |                                        |      | ×    |        |
|-----------------|----------------------------------------|------|------|--------|
| Name:           | Noise protection berm at railway (2 m) | ⊲    | ∢ ⊳  | (?) ।⊲ |
| Geo-File:       | 007_Berm at railway 🗸 🗸 🗸              |      |      |        |
| ➢ Properties    |                                        |      |      |        |
| Use for Wall De | esign                                  |      |      |        |
| Height [m]:     | 2,00                                   |      |      |        |
| Slope 1:        | 1,50 Slope rear side                   | e 1: | 1,50 |        |
| Top width [m]:  | 2,00                                   |      |      |        |

Activate the check box **OPTIMIZATION** to use a berm for the pre-calculation for Wall Design, see <u>Wall Design</u> (page 461). The optimization berms must be stored in a separate Geo-File. When a berm with different element heights is stored back to the Geo-Database after the optimization, the height differences are smoothed.

Enter the height of the berm, the tilt and the top width. The tilt of the back side is irrelevant for noise control calculations but is used for assessing the mass to be moved when constructing the berm.

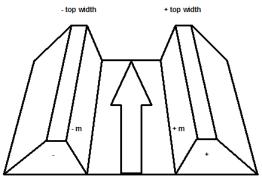
The berm tilt is calculated using the factor of 1:m:

Principle sketch of the berm tilt

The factor for the wall tilt and the top width are always entered in regard to the data entry direction. Positive values will cause the berm (and top) to be constructed to the right of the entered line; negative values will construct them to the left of the line.

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Berms



Data entry of a berm with tilt and top width

Use **VIEW** -> **REFRESH** (Ctrl+ R) to show the calculated berm lines.



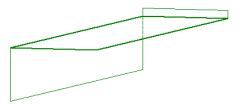
You can click on the berm lines calculated from slope, height and top width with the right mouse button (**CAPTURE COORDINATE**) or in the digitizing mode to place a wall on top of the berm.

## Floating Screens

Floating screens can be used define a horizontal or slanted diffraction edge with a defined height above ground, for example the roof of a petrol station or a noise protection gallery.

# The floating screen is not reflective. No ground to ceiling reflections are calculated.

You can define a wall height for the floating screen which may change within the object, e.g. if you want to define a wall only at one edge of the floating screen. The wall height can be negative to model, for example, the backside of a gallery.



The properties of walls on a floating screen are similar to the <u>properties of a noise</u> <u>protection wall</u> (page 266). Enter the reflective properties, even with different properties for the inside and outside. **The reflection properties apply only to the** 

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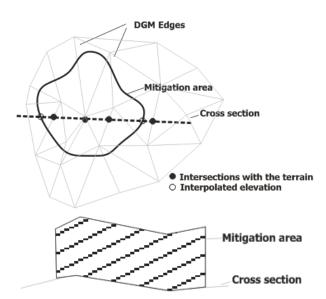
**Floating Screens** 

walls, not to the screen itself. You can also declare the wall elements to be of a CONSTANT or a varying height.

The reflection loss is defined the same way as for noise protection walls, see "Reflection loss for noise protection walls (page 267)".

### Volume attenuation area

Enter the polygon enclosing the area. Volume attenuation areas are referenced to the DGM:



This means, the exact course is evaluated from the profile. In the Geo-database graphic, the evaluation is done only for the entered points of the volume attenuation area. Local terrain unevennesses are therefore not always displayed.

The first line of buildings, as viewed from the receiver, should be modeled as buildings for the attenuation types "industrial site" and "built-up area", for "forest" the whole area is defined as volume attenuation area. Volume type areas can be inserted in each other if the top height of the area or the absorption coefficient differs. In the Graphics inserted volume attenuation areas are presented as "holes", if the volume attenuation areas are defined with an effective height of 0 meters.

Principally there are three types of volume attenuation areas:

- Foliage (forest, brushwood): Afol
- Built-up areas (buildings that are not defined explicitly and are only included in the average attenuation effect): Ahouse
- Industrial area: Asite

The name, the effective height above the DGM and the type of volume attenuation area are defined in the volume attenuation area properties of the Geo-Database.

| Volume attenuation area (507)     -     × |           |         |        |               |   |  |  |  |
|-------------------------------------------|-----------|---------|--------|---------------|---|--|--|--|
| Name:                                     | Woodland  |         |        | 9 14 4 5 51 7 | ) |  |  |  |
| Geo-File:                                 | 002_Trees |         | ~      |               |   |  |  |  |
| ➢ Properties                              |           |         |        |               |   |  |  |  |
| Volume attenuat                           | ion type: | Foliage | $\sim$ |               |   |  |  |  |
| Effective height                          | [m]:      | 4,50    |        | Show details  |   |  |  |  |

How volume attenuation areas shall be calculated is only defined in a few standards and not all of the possible volume attenuation standards are mentioned in all of the propagation standards. For this reason, the properties for each standard include - for each type of attenuation – a list of available standards (Calculation Kernel -> run properties, tab index card *Standards*).

| eneral                                                                                                              | Settin                                                                                                                       | gs                                                         | Standar                                                                         | ds As                                                                                                              | sessme                                                                  | nt !        | SPS    | St    | atistics         | Description    |    |   |         |
|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------|--------|-------|------------------|----------------|----|---|---------|
| Road no                                                                                                             | oise                                                                                                                         |                                                            | A                                                                               | SJRTN                                                                                                              | -Model                                                                  | 2013        |        |       |                  |                |    | ~ | >>      |
|                                                                                                                     |                                                                                                                              |                                                            | Emissi                                                                          | ion AS                                                                                                             | J RTN :                                                                 | 2013        |        |       |                  |                |    | ~ |         |
| Railway                                                                                                             | noise                                                                                                                        |                                                            | C                                                                               | NR 305                                                                                                             | 5011: 2                                                                 | 009         |        |       |                  |                |    | ~ | >>      |
|                                                                                                                     |                                                                                                                              |                                                            | Emissi                                                                          | ion Of                                                                                                             | NR 3050                                                                 | )11: 2      | 2009   |       |                  |                |    | ~ |         |
| Industr                                                                                                             | y noise                                                                                                                      |                                                            | I                                                                               | SO 961                                                                                                             | 3-2: 19                                                                 | 96          |        |       |                  |                |    | ~ | >>      |
| Parking                                                                                                             | lots                                                                                                                         |                                                            | I                                                                               | SO 961                                                                                                             | 3-2: 19                                                                 | 96          |        |       |                  |                |    | ~ | >>      |
|                                                                                                                     |                                                                                                                              |                                                            | Emissi                                                                          | ion Pa                                                                                                             | rkplatzl                                                                | ärmst       | udie 2 | 2007  |                  |                |    | ~ |         |
|                                                                                                                     |                                                                                                                              |                                                            | LIIII33                                                                         |                                                                                                                    |                                                                         |             |        |       |                  |                |    |   | _       |
| Windtur                                                                                                             | rbine no                                                                                                                     | oise                                                       | _                                                                               | anish S                                                                                                            | tatutor                                                                 | y Ord       | ler no | . 128 | 4                |                |    | ~ | >>      |
|                                                                                                                     |                                                                                                                              |                                                            | C                                                                               |                                                                                                                    |                                                                         | y Ord       | ler no | . 128 | 4                |                |    | ~ | >><br>× |
|                                                                                                                     | of "ISO 9                                                                                                                    | 9613-<br>n Dis                                             | 2: 1996"<br>section                                                             | standar<br>Environr                                                                                                | d                                                                       |             |        |       | 4<br>Emission    | Attenuation lo | 55 | ~ | >>      |
| finition<br>nfo D<br>Foliage                                                                                        | of "ISO 9<br>iffraction<br>Built-Up i<br>te attenu                                                                           | 9613-<br>Dis<br>area                                       | C<br>2: 1996"<br>section<br>Industri                                            | standaro<br>Environr<br>al site                                                                                    | d<br>ment Si                                                            | tandar      |        |       |                  | Attenuation lo | 55 | ~ | >><br>× |
| finition<br>nfo D<br>Foliage<br>Calculat<br>ISO 96<br>No atte<br>User de<br>ISO 96<br>20 m <=                       | of "ISO 9<br>iffraction<br>Built-Up ;<br>te attenu<br>i13-2<br>enuation<br>efined<br>13-2<br>= d < 200                       | 9613<br>n Dis<br>area<br>ation                             | 2: 1996"<br>section<br>Industri<br>loss acco                                    | standard<br>Environr<br>al site<br>rding to :<br>dB] = 0<br>dB] = A 10<br>dB] = A 10<br>dB] = d *                  | d<br>ment Si<br>standard<br>0-20<br>i a(f)                              | tandar      |        |       |                  | Attenuation lo | 55 | ~ | ×       |
| finition<br>fo D<br>calculat<br>ISO 96<br>No atte<br>User de<br>ISO 95<br>20 m <=<br>d >= 20                        | of "ISO S<br>iffraction<br>Built-Up :<br>te attenu<br>i13-2<br>enuation<br>efined<br>13-2<br>= d < 200<br>00 m<br>bath lengt | 9613-<br>1 Dis<br>area<br>aation 1<br>0 m                  | 2: 1996"<br>section<br>Industri<br>loss acco<br>Afol [c<br>Afol [c<br>ough atte | Standar<br>Environ<br>al site<br>rding to :<br>dB] = 0<br>dB] = A 10<br>dB] = d *<br>dB] = 200<br>enuation         | d<br>standard<br>0-20<br>5 a(f)<br>0 m * a(f)                           | tandar<br>) | d Cm   | net   | Emission         | Attenuation lo | 55 |   | ×       |
| finition<br>fo D<br>foliage<br>Calculat<br>ISO 96<br>No atte<br>User de<br>ISO 95<br>20 m <<<br>d >= 20<br>d [m]: p | of "ISO S<br>iffraction<br>Built-Up :<br>te attenu<br>i13-2<br>enuation<br>efined<br>13-2<br>= d < 200<br>00 m<br>bath lengt | 9613-<br>1 Dis<br>area<br>lation<br>0 m<br>th thro<br>63Hz | 2: 1996<br>section<br>Industri<br>loss acco<br>Afol [c<br>Afol [c<br>ough atte  | standar<br>Environ<br>al site<br>rding to :<br>dB] = 0<br>dB] = A 1<br>dB] = d *<br>dB] = 200<br>enuation<br>250Hz | d<br>ment Si<br>standard<br>0-20<br>a(f)<br>0 m * a(f)<br>area<br>500Hz | )<br>1kHz   | d Cm   | 4kHz  | Emission<br>8kHz | Attenuation lo | 55 | ~ | ×       |

Depending on the selection of the standard for road, railway, industry and parking lots and the selection of the standard for the assessment of the volume attenuation areas, the parameters of the volume attenuation areas are shown when the box **SHOW DETAILS** is checked.

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| 🛃 Volume atter                                                                              | nuatio                               | on area (                                       | (507)                                            |                                     |                                           |                                         |                                         |                                               |                                  | -                                          |           | ×       |
|---------------------------------------------------------------------------------------------|--------------------------------------|-------------------------------------------------|--------------------------------------------------|-------------------------------------|-------------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------------|----------------------------------|--------------------------------------------|-----------|---------|
| Name:                                                                                       | Woo                                  | dland                                           |                                                  |                                     |                                           |                                         |                                         |                                               |                                  | ∢                                          |           | >∣ (?)  |
| Geo-File:                                                                                   | 002_                                 | Trees                                           |                                                  |                                     |                                           |                                         |                                         | ~                                             |                                  | _                                          |           |         |
| ➢ Properties                                                                                |                                      |                                                 |                                                  |                                     |                                           |                                         |                                         |                                               |                                  |                                            |           |         |
| Volume attenua                                                                              | tion typ                             | pe:                                             | Foli                                             | age                                 |                                           |                                         |                                         | $\sim$                                        |                                  |                                            |           |         |
| Effective height                                                                            | [m]:                                 |                                                 | 4,50                                             | )                                   |                                           |                                         |                                         |                                               | 🗹 SI                             | now del                                    | tails     |         |
| Road stan<br>Railway st.<br>Industry st.<br>Parking lot<br>Wind turbir<br>User defined (Rai | andard<br>andard<br>stand<br>ne star | t: "Schal<br>t: "Nord2<br>ard: "RL<br>hdard: "H | 1 03''; vo<br>2000''; vo<br>S-90''; v<br>oA Wind | lume atte<br>olume att<br>olume att | enuatio<br>enuatio<br>tenuati<br>'; volur | n acco<br>on acco<br>on acco<br>ne atte | ording t<br>ording<br>ording<br>nuation | to standa<br>to stand<br>to stand<br>n accord | ard "Use<br>lard "No<br>dard "Us | er define<br>rd2000<br>er defir<br>tandard | "<br>ned" | 313-2'' |
| d < 10 m<br>10 m <= d < 20 m<br>20 m <= d < 200 m<br>d >= 200 m                             | ı                                    | Afol (dB                                        | [] = 0<br>[] = A10-<br>[] = d * a<br>[] = 200 i  | (f)                                 |                                           |                                         |                                         |                                               |                                  |                                            |           |         |
| d [m]: Path length                                                                          | throug                               | h volum                                         | e attenua                                        | ation area                          | a                                         |                                         |                                         |                                               |                                  |                                            |           |         |
|                                                                                             | 63Hz                                 | 125Hz                                           | 250Hz                                            | 500Hz                               | 1kHz                                      | 2kHz                                    | 4kHz                                    | 8kHz                                          |                                  |                                            |           |         |
| A10-20 [dB]                                                                                 | 0,00                                 | 0,00                                            | 1,00                                             | 1,00                                | 1,00                                      | 1,00                                    | 2,00                                    | 3,00                                          |                                  |                                            |           |         |
| a(f) [dB/m]                                                                                 | 0,02                                 | 0,03                                            | 0,04                                             | 0,05                                | 0,06                                      | 0,08                                    | 0,09                                    | 0,12                                          |                                  |                                            |           |         |

In principal the attenuation is calculated as the product of the length of the transmission path through the volume attenuation area and the attenuation per distance a. Here the attenuation per distance can be set as a fixed value (values between 0.05 and 0.1 dB/m are found in the literature) or be calculated from other parameters.

The absorbing distance  $S_G$  is the length of a specific arc (standard dependent) positioned between source and receiver. If screens, buildings and other impermeable objects are found between source and receiver, all distances between the tops of the objects are connected with arcs.

Possible standards for the calculation of the attenuation:

#### Foliage:

- No attenuation (Afol=0) Attenuation due to foliage is ignored.
- User defined
   Afol [dB] = d \* a(f) <=Amax</li>

a(f) is a user specified mitigation value that can be defined as spectral values in octaves. If the calculation standard only calculated broad band values, the mitigation for 500 [Hz] will be used.

Amax can be adjusted in the settings of the standard.

ISO9613-2

- ÖAL28 Afol [dB] = Min(4, Trunc(d/50)) \* a(f) a(f) is fixed.
- Nord2000

Afol [dB] = d \* a(f)

a(f) is calculated from the average tree density, the mean tree trunk diameter and a mean absorption coefficient. Default values are selected for best fit with the ISO9613-2.

NTAcou099

Afol [dB] = d \* (4 \* a(f) + 5) / 200 a(f) is fixed.

### **Built-up areas**

• No attenuation (Ahouse=0)

Volume attenuation areas for buildings are ignored.

• User defined

Ahouse  $[dB] = d * a(f) \leq Amax$ 

a(f) is a user specified attenuation value that can be entered for an octave band. If the calculation is broad band the value for 500 [Hz] is used.

Amax can be adjusted in the settings of the standard.

• ISO 9613-2

Ahouse [dB] = d \* a(f) - Agr

a(f) is a user specified mitigation value that can be entered for an octave band. If the calculation is broad band the value for 500 [Hz] is used

Amax can be adjusted in the settings of the standard

Agr is the dampening due to the ground effect.

• Nord 2000

Ahouse [dB] = d \* a(f)

a(f) is calculated from various parameters to set the properties of the volume attenuation area.

#### Industrial site

• No attenuation (Asite=0)

Industrial site volume attenuation areas are ignored.

• User defined

Asite [dB] = d \* a(f) <=Amax

a(f) is a user specified attenuation value that can be defined as spectral values in octaves. If the calculation standard only calculated broad band values, the mitigation for 500 [Hz] will be used.

Amax can be adjusted in the settings of the standard.

ISO 9613-2
 Asite [dB] = d \* a(f) <=10 dB</li>

a(f) is fixed.

- Nord 2000
  - Asite [dB] = d \* a(f)

a(f) is calculated from various parameters to set the properties of the volume attenuation area.

# Ground Absorption Areas (Ground Effect)

Ground effect areas describe the acoustic ground properties (absorbing - reflecting). They are important for the acoustic model, because they influence the sound propagation particularly near the source and the receiver.

| 😴 Ground ab:      | -                                                     |   | × |       |          |
|-------------------|-------------------------------------------------------|---|---|-------|----------|
| Name:             | Mixed ground total area                               |   |   | < > > | •        |
| Geo-File:         | 014_Ground effects                                    | ~ |   |       |          |
| ➢ Properties      |                                                       |   |   |       |          |
| Ground factor G   | (0 = hard, 1 = soft):                                 |   |   | 0,600 | <b>A</b> |
| Effective flow re | sistivity Sigma = 200,0 [kNs/m^4]                     |   |   |       |          |
| N2k: D: norr      | nal uncompacted ground (forest floors, pasture field) |   |   |       | $\sim$   |
| Roughness clas    | 5                                                     |   |   |       |          |
| N: Nil +/-0.2     | 5 m                                                   |   |   |       | $\sim$   |

Ground absorption properties

Nearly all standards evaluate different ground properties of acoustically hard or soft ground for the propagation calculation; most of them use the ground factor. TNM (USA), ASJ (Japan) and Nord2000 describe the ground effect by the "effective flow resistivity", Nord2000 additionally uses the parameter "roughness class".

Ground Absorption Areas (Ground Effect)

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Below is a list of the settings of the different standards, with the default values used when no ground absorption area has been entered, highlighted in gray. So you only need to enter ground absorption areas where the ground properties deviate from the default values.

The ground factor G is accordingly defined

G = 0: 100 % hard ground. Asphalt, concrete, pavement, water, rough scattering area, industry site.

G = 1: 100 % soft ground. All with possible or present growth (agricultural, forest, grass, garden).

G = p/100: Partially soft and hard ground. Percentage p of soft to total ground.

The effective flow resistivity has the following selection possibilities (the respective Sigma value is displayed in the selection list)

ASJ: Concrete, asphalt ASJ: Hard ground surface such as sports ground ASJ: Soft ground surface: farmland, cultivated rice field ASJ: Lawn, rice field, grass TNM: Field grass TNM: Granular snow TNM: Hard soil TNM: Lawn TNM: Loose soil TNM: Pavement, water TNM: Powder snow N2k: A: very soft (snow, moss-like) N2k: B: soft forest floor (short, dense heather like or thick moss) N2k: C: uncompacted, loose ground (turf, grass, loose soil) N2k: D: normal uncompacted ground (forest floors, pasture field) N2k: E: compacted field and gravel (compacted lawns, park area) N2k: F: compacted dense ground (gravel road, parking lot) N2k: G: hard surface (most normal asphalt, concrete) N2k: H: very hard and dense surface (dense asphalt, concrete, water) Roughness class Nk2: N: Nil ± 0.25 m S: Small ± 0.5 m M: Medium ± 1 m L: Large ± 2 m

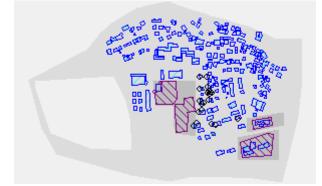
The ground factor G and the effective flow resistivity are not linked, that is, for ASJ, TNM and Nord 2000 calculations, the input of the ground factor is not relevant.

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Ground Absorption Areas (Ground Effect)

Use the setting **CREATE GROUND AREAS FROM ROAD SURFACES** in the run properties under the tab *settings* in order to set all roads to acoustically hard surfaces for the calculation, unless all roads are within a hard surface area (e.g. within a town).

Ground effect areas with different ground properties may be nested into each other but must not cut (this leads to a calculation abortion). To check the ground areas, they can be displayed in the Calculation Kernel in different shades of gray (VIEW -> GROUND EFFECT AREAS).



In the Graphics inserted ground effect absorption areas are presented as "holes", if the ground absorption areas are defined with a ground factor of 1.

### **z** Area usage

Use the object type area usage to derive noise limit exceedance for conflict maps and to take penalties for the rest hours for the assessment according to TA Lärm for Grid Noise Maps and Meshed Noise Maps into account.

In SoundPLAN you can define different usage types which may be assigned different limit levels depending on the used assessment. To change usage names, go to the SoundPLAN Manager **OPTIONS** -> **SETTINGS**, branch *usages*. The time slices, noise limits and penalties are defined in the assessment library.

| 牙 Area usage (8    | 389)                                  |   |       | ×   |
|--------------------|---------------------------------------|---|-------|-----|
| Name:              | Residential Th. More St. / Plough Way | ⊲ | ⊲ ► I | ▶ ? |
| Geo-File:          | 011_Area Usages V                     |   |       |     |
| ➢ Properties       |                                       |   |       |     |
| Area usage:        | General residential area $\sim$       |   |       |     |
| Inhabitants:       | 560 Dwellings: 241                    |   |       |     |
| Number of floors:  | 0                                     |   |       |     |
| Floor-space index: | 0,00                                  |   |       |     |
|                    |                                       |   |       |     |
|                    |                                       |   |       |     |

Area usage

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In addition, you can use the area usage to enter or import the number of inhabitants per area or block for evaluation and annoyance analyses.

For evaluation and statistics, the number of inhabitants can be transferred with the GeoTool <u>Distribute occupants</u> (page 168).

The number of inhabitants can be inserted in an area table (Spreadsheet) and used as evaluation criterion.

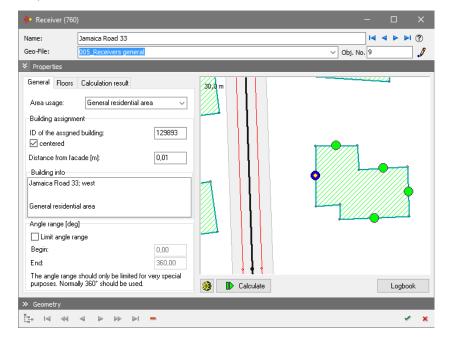
The Swiss cost / benefit index evaluates the fields **NUMBER OF FLOORs** and **FLOOR-SPACE INDEX**, see "<u>Calculation of the Swiss cost benefit index</u> (page 454)".

To make the area usage available for buildings and receivers it need to be transferred to the buildings, see <u>building properties</u> (page 258).

# Single Point Receivers

Single point receivers are used for single point calculations and for the Wall Design pre-calculation with single points. A receiver can either be a measurement point or a receiver in the garden or it can directly be assigned to a building. Assigned receivers inherit the relevant properties of the building.

One receiver can have any number of floors. This means that one receiver definition represents receivers in different elevations which is defined with the distance between the floors (no matter if a receiver is assigned to a building or not).



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**Single Point Receivers** 

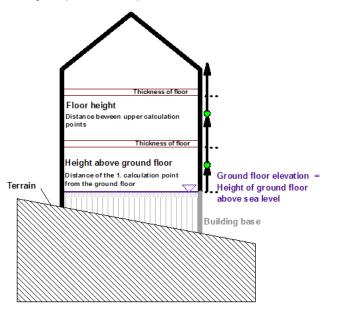
#### **Receivers assigned to buildings**

SoundPLAN uses the building reference to recognize that a receiver is connected to a building. This is necessary to correctly consider the reflection at the assigned façade according to the used standard (no reflection or façade correction).

Activate the object type "receiver" and left click near the building side where you want it attached. In the properties dialog a zoomed window of the area around the receiver is displayed. To assign the receiver to a building, click on the desired façade in the preview picture. If you specifically want to consider only the noise intake in the sector that is not screened by the building, assign the receiver to the façade with the *shift* key pressed (not recommended!). If the check mark **CENTERED** is active, the receiver is placed on the center of the façade, otherwise the position where you place the cursor on the façade is used.

The properties of the building are transferred as a default to the receiver: The building name as receiver name, the area usage and the information on the floors.

The standards specify the position where the noise should be calculated, for example beneath the floor ceiling or in the middle of the window. The distance to the façade (**DIST. FACADE**) is defined in the standards, too.

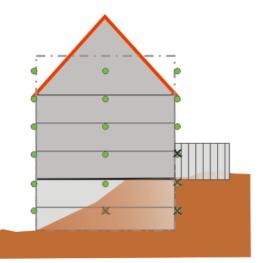


When assigning the receiver, the distance of the first calculation point from the ground floor elevation (**RECEIVER HEIGHT ABV. GF**) and the position of additional calculation points (**FLOOR HEIGHT**) are transferred from the building properties to the tab index card floors as well as the number of floors and basement floors. This information defines how many calculation points are automatically positioned on top of each other.

**Single Point Receivers** 

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Receivers at a dormer are not moved inwards. In order to have correct calculations for these receivers, half the roof height above the gutters should be added.



### Assign receivers without transferring the building properties

A receiver can be assigned to a building without assigning the building properties, for example to process imported measurement points if you keep the *Ctrl-key* pressed. It is important to deactivate the check box **CENT.** (centered). The elevation of the receiver is used as calculation height; the height above ground floor is set to 0 and the number of floors to 1.

#### **Receivers at basement floors**

If a building has the front even to the ground but is located on a slope, the backside of the building may still be exposed to noise albeit it is a basement room and needs addressing with SoundPLAN. For the location of basement floors, the floor height is subtracted from the ground floor slab elevation. Receivers below grade will not be calculated. This is the same for receivers at positions where a neighboring building will prevent the intake of noise. They will only be calculated if they are 0.5 m above the neighboring building.

#### **Free field receivers**

The object elevation is the elevation of the first calculation point above sea level. Define the number of floors and the vertical distance of the calculation points (**HEIGHT OF FLOORS**) in the tab index card *floor*.

If a receiver is placed on a balcony in front of the main facade, the influx of noise is to 360 degrees including the reflection on the facade.

To transfer the building properties for a receiver on a balcony you can reference the receiver to the building with the needed distance from the façade and delete the building number in the field **BUILDING REF.** later.

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**Single Point Receivers** 

### Limit the angle range

Most often the noise is assessed for 360° to include the noise from the other side of the building. However, some standards or assessments require a limited segment for noise intake. A limitation of the angle segment might also be used if you want to examine one single angle segment for the detailed calculation protocol.

Activate the check box **LIMIT ANGLE RANGE**, then click on the angle beginning (counterclockwise) and then on the end of the angle.

# Calculate the noise for a receiver (attached to a building or free field) in the receiver properties

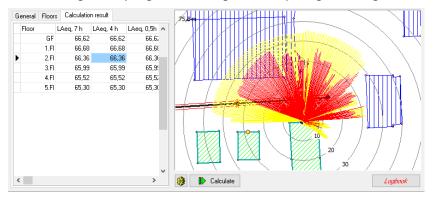
Open the receiver properties and click on the button **CALCULATE**. If a receiver has just been generated or if there are changes in the properties, the dialog must be closed and reopened for the changes to take effect.

The first call to this facility will open the calculation settings so that you can check them.

When you calculate receivers from the Geo-Database next time, the parameters from the last run will be used, check or modify them by clicking on the wheel symbol.

The calculation kernel is opened in the background and calculates the current receiver. The calculation results and the level chart are displayed so that you can check quickly if a planned noise protection wall is sufficient to keep the noise below the limit or if the noise from a road carries further requiring you to model additional geometry.

The values are only temporary, they are only visible as long as the receiver properties dialog is open; the values are discarded when this dialog is closed because the geometry might have changed when opening the dialog, the next time.



The logbook for the calculation is opened with a button. When hints, warnings and errors were found in the calculation the font of the text "Logbook" changes to bluecursive for hints, red-cursive for warnings and red-bold for errors.

**Single Point Receivers** 

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### **Receiver representation in the Geo-Database**

The colors of assigned and not assigned receivers differ. A yellow circle displays a not-attached receiver, a green circle shows that a receiver is assigned to a building and a red circle shows that the receiver was originally assigned to a building, but the assignment got lost.



The assignment of a receiver to a building might get lost if the buildings were copied. If you see red receivers in the Situation or if the calculation kernel or the preflight displays the warning message "*receiver name" assigned building not found*" update the building reference with the Geo-Tool "<u>Reassign receivers to buildings</u> (page 165)".



Display the receiver properties to see the entered angle range: Receiver with 360° (on the right), 180° (in the middle) and 5° (on the left).

### Cross section

Cross sections are used to define the cross section for cross sectional grid noise map calculations.

Enter the two coordinates for the cross section. Elevation lines, spot heights, roads, railways and berms are used to define the terrain. The ground relief is automatically calculated out of the highest and the lowest point of the relief.

A cross section of the input data can also be defined in the graphics.

#### **Display of Objects in the Cross Section**

Point objects are displayed and used for the calculation if the distance between the point and the cross section is smaller than a defined maximum distance. The maximum distance for the calculation is defined in the run kernel. For the display of point objects, the distance can be entered in the graphics.

There are two types of line objects. One has a wall height, such as walls, the other is only available as a line, such as line sources, emission bands and so on. Walls are displayed as a vertical line, the others as horizontal lines with a length of 10 cm.

There is also a difference in the definition of areas. Areas with height (buildings, volume absorption areas) are displayed as a cross section through the area; areas without height (road and railway bands) are displayed with a thickness of 10 cm.

**Cross section** 

# Calculation Area

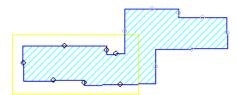
Calculation areas are used to define the area for grid type calculations for noise. The calculation area can be any form or shape, convex or concave.

The calculation area polygon itself does not require elevation information. The calculation area must therefore be within the area where elevation information is available unless the whole project is referenced to 0.

For Grid Noise Maps a receiver grid is generated using a digital ground model according to the selected height above ground and the grid size which defines the position and calculation height of the grid receivers.

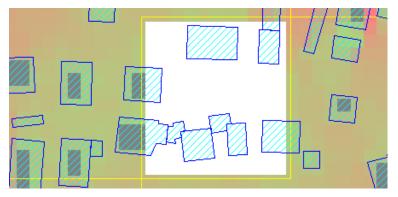
The calculation area limits the area for Meshed Noise Maps in which succeeding triangulations define the receivers.

Use the calculation area for Façade Noise Maps and single point calculations to limit the area in which the receivers are calculated. Receivers outside the calculation area are displayed in gray in the *graphics* tab index card of the calculation kernel.



A grid of receivers is generated within the calculation area with all receivers at a user defined height above the ground. The noise or air pollution values are either calculated or interpolated for each of the grid points.

Except for Meshed Noise Maps more than one calculation area may be included in the calculation data. If a calculation area is inside of another the overlapping area is not calculated.



**Calculation Area** 

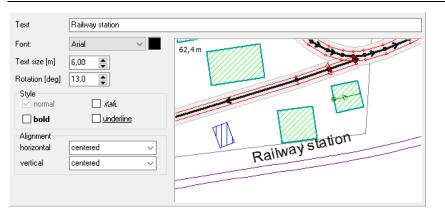
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# 🖅 Geometry Texts

Enter geometry referenced texts such as road names, house numbers and other describing texts as geometry texts. They are positioned at a location fixed in world coordinates and adjusted to the map in the graphical presentation (length scale and rotation). Texts describing particular elements of a plot are entered in the Graphics in sheet coordinates.

If many geometry texts are part of the data, the drawing speed is greatly reduced. Click on the symbol selection list to display only the text position cross but not the text itself.

### **Text properties**



Enter the text and look at the text in the graphics window. The cross marks the text coordinates. The text size is shown in [m]. Define the text font, character size, color and attributes (normal, bold, italic, underlined). Click the appropriate field. Clicking the color selection field opens the color palette.

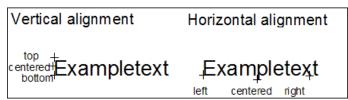
The **ROTATION** can be entered manually in degrees or by dragging it with the mouse. Move the mouse with the right button depressed until the text is suitably aligned. The dotted line helps with the alignment of the text.



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**Geometry Texts** 

The **ALIGNMENT** determines the text direction from the text anchor:



The position of the little cross at the text is the anchor for rotating text. The angle of rotation is entered in degrees.

You can reposition the text with the little cross cursor. Move the cross to a new location and the text is anchored at the new location.

If there are many geometry texts in the data, the speed of drawing the objects on the screen decreases sharply. Click on the "Hide properties" icon next to the object selection list, to display only the cross but not the text.

# 🖃 🖻 💓 Point, Polyline, Area

Points, polylines and areas are general objects without calculation relevant properties, but they can have elevations. The layers from DXF files are always imported as points, lines and areas and afterwards transformed to SoundPLAN objects with the relevant acoustical properties.

You can use these general objects to display additional objects in the graphics if you assign a <u>graphics object type</u> (page 150) such as the boundary of the investigation area, a river or trees for the 3D-view.

### 運 Photo Point

[Module Cartography] Photo points describe the location of the photos you took for example during a site inspection. Aside from the link to the picture file you can enter a description, a name, an <u>object number</u> (page 52) and the direction. Photos with GPS data can be imported, see "<u>Import of photo points with GPS data"</u> (page 112).

Point, Polyline, Area

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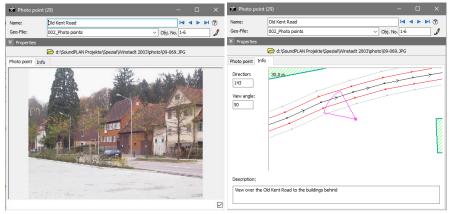


Photo point definition in the Geo-Database

The photo documentation in the Geo-Database enables you to document the situation with photos taken with a digital camera. The dataflow is complete from the entry in the Geo-Database over the display of the photo locations in the Graphics to the printout of the photos. As you can use the page layout you can easily create the photo documentation for the annex of your report.

### Photo documentation

The pictures you have defined as photo locations in the Geo-Database are automatically transferred into the folder "Photo" in your current project. In the properties of the photo define the view direction and angle and under the tab **INFO** write your description of the photo. Enter an object number for the photos to ensure that you can identify the photo locations in the Graphics sheet in the printout.

Open the photo documentation in the Geo-Database with **DOCUMENTATION** -> **PHOTO**.

Customize the layout of the printout. The place holder shows the placement of portrait and landscape pictures within the frame and adjusts with modifying the number of pictures on the page. The actual layout on the page is visible in the preview section.

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Photo Point

| Picture documentation                                | ×                             |
|------------------------------------------------------|-------------------------------|
| Page partition Show / Font Part partition            |                               |
| Page layout                                          |                               |
| d:\SoundPLAN Projekte\DemoProjekte\Wincity 2002\Phot | to\>                          |
|                                                      |                               |
| Number pictures                                      | Page layout                   |
| Side by side                                         | Page layout                   |
| Beneath 2 🛃                                          |                               |
|                                                      | Width 0,5 🗲                   |
|                                                      |                               |
| No. <b>Title</b><br>File name                        | No. <b>Title</b><br>File name |
| Description                                          | Description                   |
| Preview 🔽 keep graphics in memory                    | Print Cancel Help             |

4

Above the photo you can enter the photo number and the title (name) from the photo point definition as well as the file name. The description from the photo definition can be placed. Customize content and layout under *show/font* below the picture.

The **WIDTH OF THE SEPARATION LINE** determines the line width around the picture with all information.

| Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$       | Font            |                            |              |      |                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------|----------------------------|--------------|------|----------------------------------|
| The This is a second seco |          | <u>&gt;&gt;</u> | Space for number           |              | 16,0 | •                                |
| ✓ Title     14       □ File name     12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | \$<br>\$ | >><br>>>        | Title<br>File name         | Left<br>Left |      | <ul> <li>▼</li> <li>▼</li> </ul> |
| Description 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | •        | >>              | Number of description rows |              | 3    | •                                |

Define which information with which layout shall be included in the photo documentation. View the changes in the layout in the layout preview.

Photo Point

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Define the spacing of texts and pictures and the size of frames and lines under the tab *picture area*.

Define the page layout with the customary header and footer sections.

### <table-of-contents> Tree

The object type Tree with the selection of the tree type and the height of the tree. The additional properties for the configuration as a rotational symmetrical object and to define the thickness of the tree trunk are defined in the object types of the Graphics. The height of the tree is used to relate to the thickness of the tree trunk.

### Map section

New object type map section: With this new object you can enter map sections in the Geo-Database or store the current map section in the Graphics as a Geo-File. See <u>Map section, overview map and sheet tools</u> (page 657).

### **E** Camera track / Animation track

[Module "3D Animation"] With the object type camera track you can define a free animation track for the 3D graphics, for example a flight over an investigation area. Use the GeoTools for the spline interpolation to generate a smooth flight from a few sampling points. There is an example in the demo project "Wincity", Graphics sheet 7-1.

### 🖽 Value grid (Scandinavia)

(Module "Tools NMP") A new object type "value grid" is introduced for the layout. In some countries the population numbers are available in a grid of 100 by 100 meters. The ASCII file containing this information has the fixed format:

| municipality code | gridID     | households | persons |
|-------------------|------------|------------|---------|
| 157               | 7197 61835 | 12         | 31      |
| 157               | 7197 61836 | 10         | 23      |
| 157               | 7197 61837 | 8          | 26      |
| 157               | 7197 61838 | 8          | 22      |

The GridID is the yx Coordinate of the lower left-hand side divided by 100. In SoundPLAN the fixed format was extended to allow values from a general value grid to be entered.

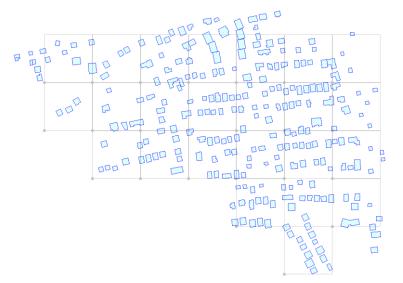
For the adaptation of the specialized table a convert program is available, which resolves the GridID into x and y coordinate components (jklconvert.exe).

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After converting the data, they can be imported via the ASCII data import.

In the standard properties of the value grid you can enter the grid spacing, the reference for the value grid (lower left-hand side or middle of the grid) and a description of the value.

The population figures are distributed to individual buildings with the Geo-Tool <u>Distribute occupants</u> (page 168).



Buildings that are located in multiple grid cells are assigned to belong to the grid cell where the center of gravity of the building is located.

Value grid (Scandinavia)

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## **5** Libraries

In SoundPLAN, basis data such as emission spectra, transmission loss spectra, directivities or train tables is managed in libraries.

There are three library hierarchies. The system libraries delivered with SoundPLAN and updated and extended with new updates, the global libraries to host your own reusable information and the project libraries containing only the data needed in a project.

The system libraries contain many elements coming from very different sources. The different standards and publications are evaluated as well as manufacturer's data e.g. for transmission losses of noise protection walls or directivity characteristics of loud speakers. The source and, if needed, comments how to use the data are described in detail.

Standard dependent data, for example the train tables or the meteorological parameters for Nord2000, originate from the standards.

In most of the cases you won't open the libraries from the SoundPLAN Manager but click on the library symbol in the different objects of the Geo-Database. This button directly opens the library you need. A click on the button behind the emission spectrum of a noise source immediately opens the system and the project emission library. Moreover, intelligent filter functions and the assignment of elements to groups help to quickly find the needed spectrum in the system library.

### Data organization of the libraries

The system libraries are installed in the SoundPLAN program sub directory under the path **"language"\System\libs.** "en\system\libs" is the default for the English libraries, but there are some amended libraries available for different countries (especially the assessment library).

You can toggle between several installed system libraries in the SoundPLAN Manager, **OPTIONS -> COUNTRY AND LANGUAGE SETTINGS**.

Data organization of the libraries

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By default the path for the global libraries is "..\Documents\SoundPLAN Globdata x.x\ libs" as soon as you store own library elements globally.

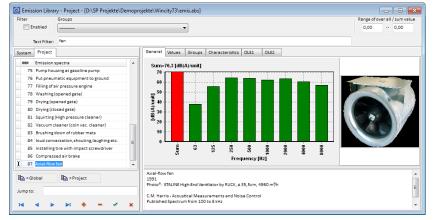
You can change this path in the library via **LIBRARY** -> **GLOBAL PATH**. The global path may also be on a network drive to enable the access to the same system library to all SoundPLAN users.

As a common approach means that data on the server may be changed, it is mandatory that a local copy of the data is available that cannot be changed by someone else. Therefore, SoundPLAN creates a local empty copy of the library in the project folder when the library is opened for the first time in a project. You can then copy the required library elements to the project library. If no library data is accessed in your project, no local libraries are cluttering your hard disk.

### Working with the Libraries

The libraries are automatically opened when data from the libraries is required in the properties of an object. This is the case for example for day histograms and spectral data describing sources or the absorptive characteristics of reflective walls.

According to the needs of the respective library, the number and content of the index cards may vary. The next section describes the general features of the library and the special requirements of the libraries.



The libraries with the example of the emission library

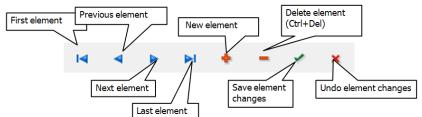
The libraries consist of two parts. A list of all elements is shown in the left window. New entries are inserted in this list. The right window is fitted with several index cards that are specific to the library type. The index cards contain spectra, numerical values, group definitions, noise limits, diagrams, etc...

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Working with the Libraries

### **Edit Library Elements**

The library elements are managed in a database. Each element is a record which can be edited, generated and deleted. The symbol bar is used to control the records:



When you are editing a library element and want to move to the next element, SoundPLAN asks if you want to store the changes in the library or continue editing. If you do not want to permanently store the data in the library, press undo the changes, otherwise you will not be able to leave the edit mode.

**Deleting multiple elements** from a library: With *Ctrl*+ left click on the elements you want to delete and then use the red "minus" sign in the navigation bar to delete them. Multiple consecutive elements can also be marked with *shift* and the arrow keys, all elements are marked with *Ctrl+A*.

### **Copy Library Elements**

Records can be copied from the global to the project library and vice versa, from the system library to the project library, from the library of a different project or within one library.

To copy one selected element from the system to the project library, click on **ACCEPT** in the system library. It is copied and assigned to the source after you clicked **ACCEPT** in the project library.

To copy several elements or elements from another library select the records to be copied (*Ctrl*+ left mouse click for single elements and *Shift*+ arrow keys for an element block) and click on > **PROJECT OR** > **GLOBAL**.

| <u>  </u> | Global | ₿ <mark>2)</mark> > Pi | oject |   |   |   |
|-----------|--------|------------------------|-------|---|---|---|
| Jump      | to:    |                        |       |   |   |   |
| I         | <      |                        | +     | - | s | × |

If one of the elements already exists in the target library, there are several options how to handle it:

Working with the Libraries

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| Element "Power station" | already exists |
|-------------------------|----------------|
| C 00 00                 |                |
| Overwrite               |                |
| 🔿 Overwrite all         |                |
| 🔿 Skip                  |                |
| C Skip all              |                |
| C Enter new name        | >>             |

The global library is only generated after you copied an element to global.

### **Copy values**

You can use the clipboard to paste hourly values from external software (e.g. an Excel spreadsheet).

Make sure the cursor is placed in the table and not in the section of the element name (the element name may not be highlighted) and press *Ctrl+ C*.

| Copy to clipboard                                                                                                          | × |
|----------------------------------------------------------------------------------------------------------------------------|---|
| <ul> <li>Whole grid with header</li> <li>Whole grid without header</li> <li>Current row</li> <li>Current column</li> </ul> |   |
| O Current cell                                                                                                             |   |
| OK Cancel                                                                                                                  |   |

Select from the list what you want to copy. The menu item **TOTAL GRID WITH HEADER** is only possible for copying to an external program.

Then select the element to copy the values to, make sure that the table is active, and press *Ctrl* + *V*.

You can copy the definition of a complete element if you click right on the element name, copy it to the same library and give it a new name.

### **Enter Comments and Numeric Values**

For each record you can enter a comment of any length and descriptive parameters. It is often useful to document the origin of the data, the literature where information was found, the reliability of the data and any special knowledge about the elements.

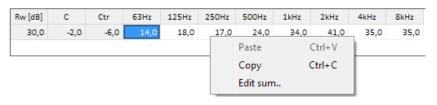
Working with the Libraries

| Regional Institute for Environment, Hessen<br>Technical Report No. L4054<br>Investigation of noise emission and immission at petrol stations | <b>^</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------|
| [Hessische Landesanstalt für Umwelt<br>Technischer Bericht Nr. L 4054                                                                        | ~        |

Up to 4 **CHARACTERISTIC VALUES** for example for size, weight or speed can be set in the tab index card *Characteristics*.

### **Edit Sum**

The sum level of a frequency spectrum can be modified for all octaves / third octaves by a fixed value. Click on the right mouse button in the tab *value* and select **EDIT SUM**. Enter the new sum or enter a value with + / - by which the spectrum needs to be adjusted. The difference between original and new sum is added up to each frequency.



### **Group Reference**

A library element can be assigned up to four groups. The groups function as search criteria and will appear in the source documentation.

| General Values Gro        | ups Characteristics | OLE1 OLE2 |    |   |   |          |
|---------------------------|---------------------|-----------|----|---|---|----------|
| Selected groups<br>People |                     |           |    |   |   |          |
| Sport                     |                     |           |    |   |   |          |
| leisure time              |                     |           |    |   |   |          |
|                           |                     |           |    |   |   |          |
|                           |                     |           |    |   |   |          |
|                           |                     | <b>+</b>  |    | + |   |          |
| Available groups          |                     |           |    | - |   |          |
| Group name                |                     |           |    |   |   | ^        |
| Reference spectra         |                     |           |    |   |   |          |
| Road construction         | vorks               |           |    |   |   |          |
| Site Preparation          |                     |           |    |   |   |          |
| Sport                     |                     |           |    |   |   | <b>~</b> |
| 14                        | <                   | •         | ÞI | + | - | ×        |

To assign a record to a group, open the index card for **groups**. The four empty fields can now be assigned a group by opening the selection arrow. If none of the present groups fit your needs, a new group can be created using the navigation keys

If several people in your office use SoundPLAN, coordinate the nomenclature so the group will not lose its usefulness quickly.

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**Delete** (the minus in the navigation bar) removes a group definition. **Caution!!** All records belonging to this group will lose the membership to the group! Please think first and delete later!

### Scale of the Y Axis

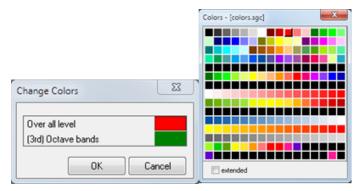
For the graphical presentation of spectra (source, absorption, transmission and attenuation) the Y axis default is set to the auto scale mode and is filling the entire available area optimally. If you want to browse and compare spectra quickly, it may be advisable to disable the auto scale function and assign a value range. To do this, open **"View"** and disable the **"Auto Scale"** mode in the **"Y-Scale"** entry. The fields **Min** and **Max** indicate the range you will see from the spectral data in the graphical form.



### **Color definition**

Colors can be customized for the printout of the libraries and graphics within the documentation.

Select **VIEW** -> **COLORS**. If selection positions are not available, then they do not apply to the library currently open (assessment library). Double clicking color modifies the colors.



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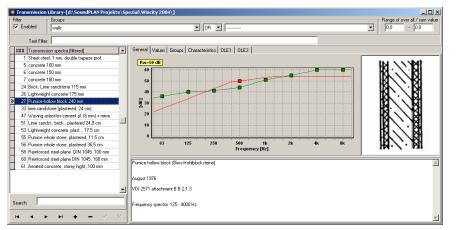
Working with the Libraries

### **Backup copy of libraries**

The libraries offer the possibility to save the library as a backup (FILE -> BACKUP). The numbers of the library elements are kept intact so that the references between the library elements and the sources etc. will not get corrupted. The backup of the library is hosted in the folder "Backup". This backup copy can also be used to convert a project library by copying the project library from the backup folder into the project.

### **Emission, Absorption, Transmission, Attenuation Libraries - General**

On the first tab you see the graphics with the diagram and the sum level, a picture of the element (if one exists) and a comment to the origin of the spectrum.



#### **Filter functions**

You have filter functions at your disposal to filter the library elements according to the membership in groups (in addition you can use AND or OR to filter according to 2 groups), within a certain value range, or according to a text which is included in the element name or the description.

#### **Insert pictures**

In the picture area you can assign your own pictures or sketches to each element. As the pictures are stored directly in the library, the size of the image files should be as small as possible. Without resizing the picture area, graphics of  $250 \times 250$  pixels are displayed in total, this for practical means should be the max size for the pictures. The frames can be resized by grabbing and moving them.

Press the right mouse button and select LOAD to select a picture file or select INSERT to enter a picture from the clipboard. If you want to remove the picture, select CLEAR.

#### **Insert OLE links**

In addition to the direct storage the program offers 2 OLE connections to connect library elements with any information such as a recording of the sound of the source, a measurement protocol in a word file or an Excel spreadsheet.

The files you are connecting via OLE will be copied into the project respectively the Globdata area. This ensures that the data will be copied with the project. The library only contains the reference and this way does not get too bloated.

With a double click or via the right mouse button you can start the program behind the OLE connection. If you copy the library element to a different project, the background files are copied along with it.

### **Emission Library**

| Z50Hz         S00Hz         1kHz         2kHz         4kHz         8kHz           90,03         90,03         90,00         85,00         85,03         85,01           81,40         86,80         90,00         86,20         86,00         83,90 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                     |
| 81.40 86.80 90.00 86.20 86.00 83.90                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                                                     |

Select whether the values are available as **OCTAVE** or **THIRD OCTAVE SPECTRUM** or as **CENTER FREQUENCY** and determine the lower and upper boundary of the frequency range respectively the center frequency.

Enter the values in the table or use copy & paste if values are available e.g. in an Excel sheet.

Check your data to see if it is linear or weighted with an A..D filter, and select the filter type accordingly.

If your data is available in [dB] but you want to keep it in the library as an A weighted spectrum, enter the data as a linear spectrum and change the weighting to [dB(A)] after the data is typed in. SoundPLAN will ask you whether you want to convert the spectrum. Click "yes" to convert the spectrum. "No" only changes the display, the linear spectrum remains unchanged.

Above the emission spectrum with the selected frequency filter the spectrum is shown with a linear filter. The user defined spectrum and the selected filter are

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Emission, Absorption, Transmission, Attenuation Libraries - General

displayed in blue. You can modify values in the filtered or the linear spectrum. Either way, the values of the other spectrum are immediately calculated to reflect the modification.

Select whether the spectrum is a sound pressure level for transmission purposes (Lp level), a total sound power level (Lw/unit) or a length- / area-related sound power level (Lw/m, $m^2$ ).

**HEIGHT ABOVE GROUND:** If the emission of a source is always in the same height above ground, you can determine the source height relative to the ground already in the library. When the spectrum is transferred to a source the source height is transferred, too. In the property dialog of the source the check box **USE LIBRARY DEFINITION** in the group box **TERRAIN REFERENCE** must be activated.

**STANDARD DEVIATION:** For some sources the measurement uncertainty can be assigned to the library element. If assigned, the standard deviation is transferred to the source together with the spectrum.

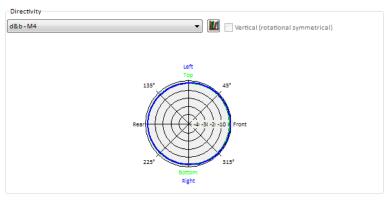
#### Low frequency noise

The wave length is the only parameter for the screening, it can be calculated for any frequency. The air absorption in accordance to the ISO 9613 / 1 also can be calculated for any frequency.

Ground effect: For standards such as the Nord2000, the ground effect is calculated explicitly as a function of the frequency, therefore the ground effect is valid for any frequency. For standards based on the ISO 9613 or CONCAWE where the ground effect is only defined for certain octave middle frequencies, the value of the lowest defined frequency is used, because the ground effect changes only insignificantly below this lowest octave band.

### Assignment of a directivity

You can assign 2D or 3D directivity adjustments from the directivity library to the source. Select an already in this project stored element from the selection list or click on the library symbol to open the <u>directivity library</u> (page 304).



Emission, Absorption, Transmission, Attenuation Libraries - General

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### Conversion of sound pressure spectra into sound power spectra

When a frequency spectrum is only available as a sound pressure spectrum in the emission library and the situation is sufficiently simple (assumption source is a point source) the spectrum can be converted to a sound power spectrum.

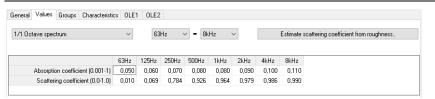
Open EDIT -> CONVERT SOUND PRESSURE TO SOUND POWER (or click right mouse button while the cursor is on the spectrum).

**Hint:** The reference must be set to "Lp/level, before, afterwards it will be referenced per "Lw/unit".

| Onvert sound pressure to sound power                                  | _ 🗆 🛛  |
|-----------------------------------------------------------------------|--------|
| -Measurement surface type                                             |        |
| <ul> <li>Full sphere: point source radiating in full space</li> </ul> |        |
| O Half sphere: point source radiating in half space (on ground)       |        |
| O Box shaped machine radiating in full space                          |        |
| O Box shaped machine radiating in half sphere (on ground)             |        |
|                                                                       |        |
| Measurement distance D [m]                                            | 3.0 🕞  |
| A = 113,1 [m <sup>2</sup> ] Lw = Lp + 10 log(A) = Lp + 20,5 dB        |        |
| ОК                                                                    | Cancel |

Select the surface type that was the basis of your measurement of the sound pressure level. Enter the distance D in meters at which the measurement was taken and enter the width, length and height in meters for machines the equivalent size of a box. By clicking the OK button, the sound pressure spectrum is converted into a sound power spectrum and the reference is set to per unit.

### Absorption library



Select either **OCTAVE** or **THIRD OCTAVE SPECTRA** and determine the lower and upper boundary of the frequency range.

Enter the **ABSORPTION COEFFICIENTS** (vales between 0.001 and 1) in the table or use copy & paste if values are available e.g. in an Excel sheet.

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Emission, Absorption, Transmission, Attenuation Libraries - General

The **SCATTERING COEFFICIENT** is used in SPD calculations and describes the diffuse scattering of particles after impact with the absorption surface. The scattering coefficient depends on the roughness length and the frequency. Selecting a surface profile depth from the button **ESTIMATE SCATTERING COEFFICIENT FROM ROUGHNESS** provides an educated guess for suitable values. If you can obtain more accurate values, enter the scattering coefficient manually.

If the scattering isn't high enough, unphysical structures can emerge in the sound field; zero scattering is for academic purposes only.

For fibrous absorber materials, the effective flow resistivity is often given instead of the absorption coefficients. The absorption coefficients can be calculated from the effective flow resistivity.

Right-click on the values and select **CALCULATE ALPHA VALUES FROM FLOW RESISTANCE**. First, frequency-dependent complex impedances are calculated from the effective flow resistivity ("M.E.Delany and E.N. Bazley: Acoustic properties of fibrous absorbent materials, Appl. Acoust. 3, 105-116, 1970"). Subsequently, the absorption coefficient is calculated from the complex impedances ("P.M. Morse and K. Uno Ingard, Theoretical Acoustics, ISBN 0-691-08425-4, page 580").

### **Transmission library**

| General Va | lues G       | iroups    | Character | istics OI | .E1 0 | LE2   |      |      |      |      |
|------------|--------------|-----------|-----------|-----------|-------|-------|------|------|------|------|
| 1/1 Octave | spectrum     | 1         |           | •         | 6     | 3Hz   | - 8  | kHz  | •    |      |
| Normalized | l level diff | erence Di | n,e       | •         |       |       |      |      |      |      |
| Dn,e [dB]  | С            | Ctr       | 63Hz      | 125Hz     | 250Hz | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |
|            |              |           |           |           | 36,0  | 41,0  | 51.0 | 59,0 | 65,0 | 65,0 |

Select whether the values are available in an OCTAVE or THIRD OCTAVE spectrum or as a SINGLE VALUE and determine the lower and upper boundary of the frequency range for frequency dependent transmission loss. Select whether the values refer to the SOUND REDUCTION INDEX R or to the NORMALIZED LEVEL DIFFERENCE DN,E (EN 12354).

Enter the values in the table or use copy & paste if values are available e.g. in an Excel sheet.

The correction factors C and Ctr are used calculations according to EN 12354.

### **Attenuation library**

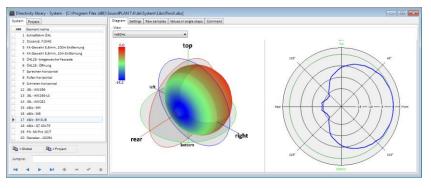
| ieneral  | Values     | Groups | Charact | eristics | OLE1 | OLE2 |      |      |   |
|----------|------------|--------|---------|----------|------|------|------|------|---|
| 1/1 Octa | eve spectr | um     |         |          | •    | 63Hz | -    | 8kHz | • |
|          |            |        |         |          |      |      |      |      |   |
| dB       | 63Hz       | 125Hz  | 250Hz   | 500Hz    | 1kHz | 2kHz | 4kHz | 8kHz |   |

The attenuation library is used with the module Expert System Industry. Select either **octave** or **third octave** spectra and determine the lower and upper boundary of the frequency range.

Enter the values in the table or use copy & paste if values are available e.g. in an Excel sheet.

### **Directivity library**

The directivity library stores the directivities in different variants horizontal, with rotational symmetry, 3D and full-3D. The directivity elements are assigned to a source via the emission library. Broadband sources with only a mean frequency and those with an emission spectrum can be associated with directivities.



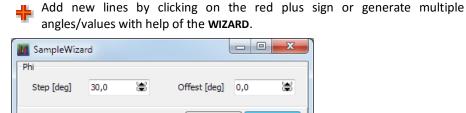
### **Enter directivity**

Under the tab *settings* select the directivity type, the rate of angular increment and the frequency resolution.

**Directivity library** 

| Diagram                | Settings     | Raw samples | Values in angle steps | Comment |  |  |  |  |
|------------------------|--------------|-------------|-----------------------|---------|--|--|--|--|
| Directivit             | ty type      |             |                       |         |  |  |  |  |
| Horiz                  | ontal        |             |                       |         |  |  |  |  |
| Rotational symmetrical |              |             |                       |         |  |  |  |  |
| Full 3                 | D            |             |                       |         |  |  |  |  |
| Angle Ste              | p            |             |                       |         |  |  |  |  |
| 🔘 5 [de                | g]           |             |                       |         |  |  |  |  |
| 🔘 10 [d                | eg]          |             |                       |         |  |  |  |  |
| Frequen                | cy resolutio | n           |                       |         |  |  |  |  |
| 1/30                   | ctaves       |             |                       |         |  |  |  |  |
| 1/10                   | ctaves       |             |                       |         |  |  |  |  |
| 🔘 Frequ                | iency inde   | pendent     |                       |         |  |  |  |  |
| Frequen                | cyrange      |             |                       |         |  |  |  |  |
| <=                     | 63Hz         | - >         | ■ 16kHz ▼             |         |  |  |  |  |

If all angles and values are available in the selected angular step size ( $5^{\circ}$  or  $10^{\circ}$ ) enter them in or copy them to the tab *values in angle step*. If angles and values are provided in another step sizes you can have the program interpolate the values for  $5^{\circ}$  or  $10^{\circ}$  steps from the available values. To interpolate, open the tab *raw data* and process them under this tab.



Enter the **STEP SIZE** of the pairs to be generated and if needed an **OFFSET** of the first pair against the 0°.

Cancel

OK

Diagram Settings Raw samples Va Wizard All Frequencies 0.360° 0,0 1,0 30,0 2,0 60,0 3,0 90,0 4,0 120,0 5,0 150,0 6,0 180,0 7,0 210,0 6,0 240,0 2,0 270,0 4,0 300,0 3,0 330,0 2,0

Depending on the directivity type that you have selected, enter the values for the angles Phi and/or Theta. For frequency dependent directivities you need one value for each frequency. The pairs are entered in a way that for each direction where values are known the angle and the level difference to the neutral in dB is entered in the table. The raw data are immediately converted into the requested angular steps. The raw data are still saved so that it is possible later on to understand the relationship of the raw information and the derived directivity pattern.

#### Interpolation

Under the tab *diagram* you find three different spline functions for the interpolation.

| Diagram    | Settings    | Raw samples | Values in ang | Comment |  |  |
|------------|-------------|-------------|---------------|---------|--|--|
| Interpolat | tion of raw | data        |               |         |  |  |
| Cub        | ic          |             |               |         |  |  |
| C Expe     | Exponential |             | on parameter  | З       |  |  |
| Fourier    |             | Fouri       | er order      | З       |  |  |

The tension factors respective the Fourier order can be set between 1 and 30, it will influence the smoothness of the spline. The tensions factor/Fourier order 1 is equivalent to the cubic spline. The interpolation line is marked in color.

0° is the axis of the noise sources. For the assignment of sources to the facades it is the normal to the building's facade pointing away from the building.

#### Double or quadruple symmetry

Certain symmetries (quadruple and double) the program will recognize automatically if data are only made available for angles between 0° and 90° or between 0° and 180°.

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**Directivity library** 

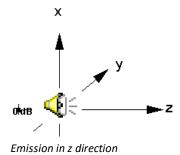
| Data entry examp | ble for double symmetry | Data entry example for quad symmetry |            |  |  |  |
|------------------|-------------------------|--------------------------------------|------------|--|--|--|
| angle            | delta [dB]              | angle                                | delta [dB] |  |  |  |
| 30               | 5                       | 20                                   | 5          |  |  |  |
| 60               | 5                       | 40                                   | 3          |  |  |  |
| 90               | 4                       | 60                                   | 1          |  |  |  |
| 120              | 3                       | 80                                   | -1         |  |  |  |
| 150              | 2                       | 90                                   | -2         |  |  |  |
| 180              | 1                       |                                      |            |  |  |  |

Change to the tab *Diagram* – the values will be filled in for all quadrants.

#### **3D-directivity**

The full-3D-directivity most of the time will be describing a loudspeaker or a signal horn and the directivity pattern most often can be imported from the manufacturers data. When you import the spectrum of a loudspeaker, the 3D directivity is automatically imported at the same time and stored in the directivity library, see "<u>CLF Import</u> (page 316)".

The delivered 3D directivities are loudspeakers, normalized to 0 dB. This means, that the loudspeaker emits to the z direction. The directivity must in any case be adapted when you assign a directivity to a source.



In case you want to compile your own 3D-directivity, SoundPLAN has a wizard to generate the values for phi and theta.

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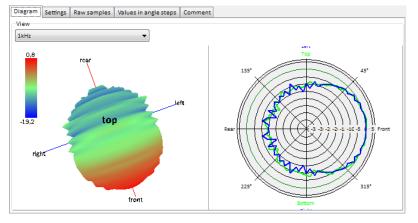
### 3D of horizontal and vertical directivity

If you get information about a horizontal and a vertical directivity for a source, you can use this information to construct a 3D directivity.

In the tab *Settings*, **FULL 3D** must be selected as the directivity type. Click on the **WIZZARD** in the tab *Raw data* and check mark **HORIZONTAL AND VERTICAL CUT**. Enter the horizontal directivity values in the front, left, rear, and right areas, and the vertical directivity values in the front, top, rear, and bottom areas. At the points of intersection of the two directivities (front / rear), the entered value must be identical.

#### 3D-presentation under the tab Diagram

For rotational symmetry and full-3D-directivity under the tab *Diagram* you find the cross section and additionally a 3D-representation for each frequency available.



With the *left mouse button,* you can rotate the 3D-view into the horizontal *shift+left mouse button* rotates around the vertical axis and *Ctrl+ left mouse button* has all degrees of movement active.

With the right mouse button toggle between the displays:

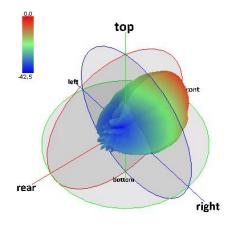


**AS SPHERE** shows the values of the directivity as a color-coded sphere. The coloring indicates the addition to the average that makes up the directivity. The display tools **SHOW RASTER, SHOW CIRCLES** and **PLANES** help with the checking of the data for the directivity.

**Directivity library** 

5

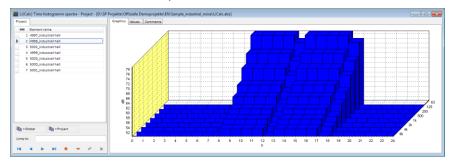
SoundPLAN Manual 8.1 Libraries



### Li(Calc) day history frequencies

When there are multiple sources present in an industrial building, each with a spectrum and a day history, each receiver in the factory hall has a frequency spectrum of its own that can vary by the hour. For Grid Noise Maps this is not relevant, but it is for receivers close to the halls walls that are used to drive the Hallin/Hallout calculation. For the calculation of the indoors noise levels for the sake of calculating transmission through the wall and calculating the propagation into the environment, these data are stored in the Li(Calc) day histogram spectra library.

When selecting the calculation type LI(CALC)+CD -R in the industrial building an (empty) element is generated for each component in the Li(Calc) library. After executing an indoor - outdoor calculation the elements are assigned the respective value for each hour of the day.



This lib contains the day history frequencies as a calculation result of an indoor simulation. You cannot enter own elements.

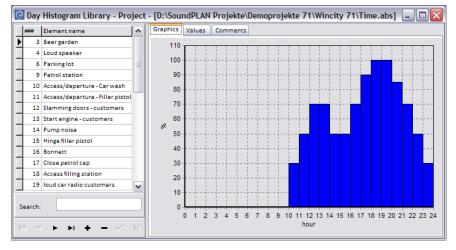
Li(Calc) day history frequencies

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### **Day Histogram Library**

The day histogram or times of operation are needed for sources not transmitting a constant sound power over 24 hours. Often the noise assessments prescribe a quiet time during the day where a penalty is added to the noise level of quiet hours. Single descriptors similar to SEL, LDN and others can be created and customized only if the sound power is known for the entire day.

For each hour of the day the information on the status of the source is needed. The source can be active 100% or a fraction of it. The definitions of the fraction can be either the number of noise events during the hour or the fraction of time during which the source is active (either so many minutes or seconds per hour or as a percentage). If the selected base data is events per hour, the sound power needs to represent a single event.



Example: A fork lifter drives between the store and the production hall 20 times an hour. In this case the sound power of the source should be set to cover a single event and the day histogram should be for 20 events per hour.

Use the + to request a new element and click on the index card for **VALUES.** Enter the duration of the event.

You can define the hours of operation in one of the following modes:

- minutes / hour
- seconds / hour
- events / hour
- %
- dB

The values in a dB day histogram are always added to the sound power level of the source. When you enter measurement values in the dB day histogram that

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Day Histogram Library

refer to the total sound power level the sound power level of the source must be set to 0 dB.

The value in the dB day histogram must be -1000 dB for hours in which a source does not operate.

The **day history** with the units %/h, min/h and sec/h can now be **INVERTED** with the click of a button. This is particular helpful to generate for example "door closed" from the day history of "door open".

### The Road Day Histogram Library

For different road types, the number of vehicles or factors for each hour is entered in the road day histogram library. The library manages the vehicle types defined in the appropriate standard. Therefore, SoundPLAN divides the vehicle types into cars / trucks or cars, noise reduced / normal heavy and light trucks.

Assign the road types in the road properties of the Geo-Database, according to the entry type of the emission calculation.

You can either enter the number of vehicles of an actual traffic count or the factors of a characteristic time distribution for a specific road type.

| 🐫 Road day histogram-[D:\SoundPLAN Projekte \Projekte Version 6\gb 0396f Yerkehr\] 📃 🔀 |   |                          |                                       |        |           |        |        |        |        | - 🗆 🗵  |        |        |
|----------------------------------------------------------------------------------------|---|--------------------------|---------------------------------------|--------|-----------|--------|--------|--------|--------|--------|--------|--------|
| Element name                                                                           | G | Graphics Values Comments |                                       |        |           |        |        |        |        |        |        |        |
| Small city near shopping mall                                                          |   | 1                        | 0.0000                                |        | Do not no | 200    |        |        |        |        |        |        |
| Middle center rural area                                                               |   | Display value            | 0.0000                                |        | Donoria   |        |        |        |        |        |        |        |
| Regional road urban area                                                               |   | Standard                 | 1: RLS90; DIN18005; CRTN; StL85/96/97 |        |           |        |        |        |        |        | •      |        |
| Tab 3 RLS-90 motorway                                                                  | L |                          |                                       |        |           |        |        |        |        |        |        |        |
| Tab 3 RLS-90 highway                                                                   | # | Vehicle type             | Total                                 | 0-1h   | 1-2h      | 2-3h   | 3-4h   | 4-5h   | 5-6h   | 6-7h   | 7-8h   | 8-9h   |
|                                                                                        | 1 | Cars                     | 0,6920                                | 0,0077 | 0,0077    | 0,0077 | 0,0077 | 0,0077 | 0,0077 | 0,0077 | 0,0077 | 0,0077 |
|                                                                                        | 2 | Trucks                   | 0,2904                                | 0,0063 | 0,0063    | 0,0063 | 0,0063 | 0,0063 | 0,0063 | 0,0150 | 0,0150 | 0,0150 |
| Search:                                                                                |   | Total                    | 0,9824                                | 0,0140 | 0,0140    | 0,0140 | 0,0140 | 0,0140 | 0,0140 | 0,0227 | 0,0227 | 0,0227 |
|                                                                                        |   |                          |                                       |        |           |        |        |        |        |        |        |        |
| н ч н н н                                                                              | 1 |                          |                                       |        |           |        |        |        |        |        |        | F      |

Use the **DISPLAY FORMAT** to select if decimal places should be displayed and how many to display. The display format is necessary because the elements may contain factors of the average daily traffic (ADT) (e.g. 0.008 \* ADT) or vehicles per hour (e.g. 12,500).

You can choose to display "-" for values equal 0, to get better clarity. The definition of the display format is fixed, so you have to define negative values (in the middle range), too, even if it doesn't make sense in this case.

| +;-;0    | Definition of the value range                               |
|----------|-------------------------------------------------------------|
| 0.00;-;- | Shows positive values with two decimal places and 0 as "-". |
| 0        | Shows all values without decimal places.                    |

A semicolon separates the ranges; a point separates a decimal.

Select the appropriate standard from the selection list **STANDARD**. SoundPLAN summarizes standards with the same vehicle types.

The Road Day Histogram Library

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Activate **DO NOT NORM** if the sum of all 24 values is not 100%, as for the table 3 of the RLS-90.

### **Assessment Library**

The assessment library contains noise limits for defined usage areas and procedures for evaluating the level. SoundPLAN is delivered with a number of assessment standards, but the library can be amended with your procedures and noise limits.

The noise limits vary depending on the type of noise, the assessment procedure and the characteristic of the area (area usage). The area usage abbreviations and the name are adapted in **OPTIONS** -> **SETTINGS** in the SoundPLAN Manager, branch area usage.

### **Creating a New Assessment Record**

Create a new element. In the index card **DEFINE** set the time slices for which the assessed noise levels shall be calculated from the 24 hours of the day. A single time slice is the minimum requirement.

| Define Limits Additions Usage | e areas (for all assessments) |  |  |  |  |
|-------------------------------|-------------------------------|--|--|--|--|
| LAeq, 8h LAeq,1h LAeq, 0,5h   |                               |  |  |  |  |
|                               |                               |  |  |  |  |
| Assessment type               | Leq ~                         |  |  |  |  |
| Names, Shorts                 |                               |  |  |  |  |
| Short                         | LAeq, 8h                      |  |  |  |  |
| Name, Legend                  | Day                           |  |  |  |  |
| Limit Short                   |                               |  |  |  |  |
| Limit Name, Legend            |                               |  |  |  |  |
| Definition                    |                               |  |  |  |  |
| Dennikori                     |                               |  |  |  |  |
| Hours                         | 7-18                          |  |  |  |  |
| Ta [h]                        | 8,0                           |  |  |  |  |
| N loudest [h]                 | 8                             |  |  |  |  |
| Take additions into account   |                               |  |  |  |  |
| Add Delete                    |                               |  |  |  |  |

Define the assessment type for the time slice, Leq or one of the Lmax types. Enter the name of time slice and identifier in the appropriate fields and define the hours

Assessment Library

assigned to a specific time slice. The identifier is used to characterize the time slice in the documentation.

**TA** is the number of hours for averaging the time slice in the assessment level. SoundPLAN calculates the assessment level using the formula *sum over the hours x* 1/Ta. Ta may cover the all hours of the time slice or only specific hours.

The assignment of hours to a time slices can overlap. For example, the overall  $L_{eq}$  and the loudest hour at night time can form individual time slices.

Some assessment procedures demand only the noisier hours within a time period. In this case enter the number of hours in the field **N LOUDEST.** For the single loudest hour at night, enter the value "1". The loudest hour will be used from the hours assigned to the time slice night time.

**ADD** is used to define new time slots. The number of time slots is not limited. If you want to delete a time slot, make sure the index card you want to delete is active before you click **DELETE**.

Enter the noise limit for each time slot in the index card *Limits*. The values are preset with "0" and only the time slots associated with a limiting value need to be set.

The index card *Additions* (penalties) is used to define penalty times for certain area usages and hours. In the table you can assign the same value to multiple fields by clicking on a field and moving the mouse with the left button pressed. All marked fields will be set to the value of the base cell.

Select whether the defined additions shall be used in each of the time slots with the check box **TAKE PENALTIES INTO ACCOUNT**. For the Lden, assessment the additions are only taken into account for the Lden but not for Lday, Levening and Lnight.

#### Time slices for maximum noise levels

The maximum levels are administered the same way as the Leq time slices.

LMAX-ROAD: This represents a maximum noise level of a single vehicle pass by (in general a truck). Depending on the receiver location the maximum noise level can be caused by different roads. At the moment the Lmax-road is only used in the standards "Statens planverk report no. 48; 1980" and "Road Traffic Noise – Nordic Pred. Method; 1996".

**LMAX-RAILWAY:** SoundPLAN first calculates a time history of a passing by train and then calculates the maximum noise level and the SEL from the data.

The calculation of the Lmax-rail is possible with any of the following standards:

"Schall 03", "ÖNorm S5011", "Kilde Rep. 130", "NMT96", "Japan Narrow-Gauge Railways".

The level-time chart can be opened in the Documentation under the tab graphics.

Assessment Library

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**LMAX-INDUSTRY:** Here the peak noise level that is caused by one or by multiple sources is calculated. If multiple sources are involved, the contribution levels of these sources at the receiver are considered as not coincided.

### **Importing Libraries**

If spectra have already been stored as ASCII files or in Excel, you can easily use them in SoundPLAN. This import is also used to import SoundPLAN libraries from older versions. A special import for point sources with spectra is available in the Geo-Database, see "Import of point sources (ASCII) (page 111)".

After you opened the library, select the path, from which you want to import the data. Open the import via **FILE -> IMPORT** and select the desired file format.

| Excel fil                                                                                                                                                                | e import definition [C:\Users\corinna                | a.kurz\Desk | top\Import Emission Octave.xls-Excel 97]       |     |      |                | - 0                                                                | ×     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------|------------------------------------------------|-----|------|----------------|--------------------------------------------------------------------|-------|
|                                                                                                                                                                          | A                                                    |             | В                                              |     | с    | D              | E                                                                  | F     |
| 1                                                                                                                                                                        | Element name                                         |             | Comment                                        | Com | ment | Comment        | Comment                                                            | Comme |
| •                                                                                                                                                                        |                                                      |             |                                                |     |      |                |                                                                    | Þ     |
|                                                                                                                                                                          | A                                                    |             | В                                              |     | с    | D              | E                                                                  | -     |
| 2                                                                                                                                                                        | Metal Shop (Sanding, Hammering)                      |             | Metal Shop (Sanding, Hammering)                |     |      |                |                                                                    |       |
| 3                                                                                                                                                                        | Rolling Mill (Wire) - large room                     |             | Rolling Mill (-> Wire) - large production room |     |      |                |                                                                    |       |
| 4                                                                                                                                                                        | Wire Manufacturing (Drawing)                         |             | Wire Manufacturing (Drawing)                   |     |      |                |                                                                    |       |
| 5                                                                                                                                                                        | Wire Manufacturing (                                 |             | Wire Manufacturing                             |     |      |                |                                                                    |       |
| ۰ <b>۲</b>                                                                                                                                                               | Printing Company (Rotating Printer Sy                | e )         | Printing Company (Rotating Printer System)     |     |      |                |                                                                    |       |
|                                                                                                                                                                          | Import From Line #<br>op Import at Line#             | 2           | 8                                              |     |      |                |                                                                    |       |
| Element na<br>Comment <<br>Comment <<br>Comment <<br>Comment <<br>Comment <<br>Comment <<br>Comment <<br>Comment <<br>31Hz <- J<br>63Hz <- K<br>125Hz <- L<br>250Hz <- N | me <-A<br>-B<br>-B<br>-B<br>-C<br>-C<br>-C<br>-F<br> |             |                                                | E   |      | C<br>Ar<br>Sta | fine Link<br>lear link<br>uto Link<br>art Import<br>Cancel<br>Help |       |

Import definition for an Excel or ASCII file

The columns of the Excel or ASCII file have to be assigned to the fields in the library. SoundPLAN offers an **AUTOMATIC LINK** to compare the column headers with the library fields. The automatic link only works properly if the column headers correspond to the library field names. The list of assigned columns is displayed in the field on the left side of the import dialog.

**Hint:** Import templates for Excel files are included in the SoundPLAN installation folder (..\en\System\Libs\). If you arrange your Excel libraries in the format of the templates, you only have to select **AUTOMATIC LINK**, check the result and then **START IMPORT** in the Excel import dialog.

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**Importing Libraries** 

| Start import from line #                  |   | 2 💽             |
|-------------------------------------------|---|-----------------|
| Element name <- A<br>2Hz <- B<br>4Hz <- C | ^ | Define link     |
| 8Hz <- D                                  |   | Clear all links |
| 16Hz <- E<br>31Hz <- F                    |   | Automatic link  |
| 63Hz <- G<br>125Hz <- H                   |   |                 |
| 250Hz <- I                                |   | Start import    |
| 500Hz <- J<br>1kHz <- K                   |   | Cancel          |
| 2kHz <- L                                 |   | Help            |
| 4kHz <- M<br>8kHz <- N                    | ¥ |                 |

Column assignment via the automatic link

Check the links. If not, all columns are assigned correctly, you can define further assignments manually.

Click **DEFINE LINK** to define a new assignment or double click on an automatic link to change it. Define the assignment of single columns with the library fields or a text which is automatically added to all imported library elements in a defined field.

| 🚺 Define lir | nk           |     |       | ×      |
|--------------|--------------|-----|-------|--------|
| ● Col        | A V O fix    |     |       |        |
| >            | Element name |     |       | $\sim$ |
|              | OK Can       | cel | Apply |        |

Manual column assignment

Select the desired column and assign a library field from the lower selection list.

You can add a text or a value to a defined column. This is useful, if you want to add an "A" to the library field "filter", because the imported spectra are A-weighted. Activate the field **FIX** and enter the text or value.

**APPLY** adds the link to the list of links without leaving the dialog. If you want to define several links, it is faster to use apply instead of OK.

Remove existing links with CLEAR ALL LINKS.

Enter the data range for the new library elements with **START IMPORT FROM LINE NO.** The column definition (field names from the library) is displayed in the first header row, the data from the Excel or ASCII file in the following rows.

If necessary, activate the check box **STOP IMPORT IN LINE NO.**, e.g. if additional information is part of the file or if you only want to import some of the elements in the file.

**Importing Libraries** 

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After all assignments are correct, import the library elements with **START IMPORT**.

### CLF Import (Common Loudspeaker Format)

Call **FILE** -> **IMPORT** in the **emission library** and select the file format "Common Loudspeaker Format" from the selection list. The frequencies of the loudspeaker are imported and a directivity element (with the same name) is generated for the directivity library.

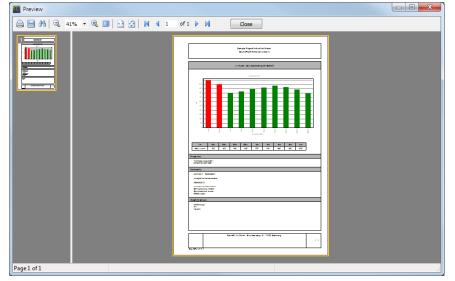
### **Print and Export Libraries**

You can print the element list of the selected library as well as the detail data of the elements.

The element lists are a tabular output of all elements with the assigned values of the selected library. If you select element data, the selected element is printed with all details (charts, values, comments ...).

Open first **FILE** -> **PAGE LAYOUT** for the **ELEMENT LIST** or **THE ELEMENT DATA** and select to customize the appearance of the headers and footers, see page layout.

Via **FILE** -> **PRINT**, also separate entries for the element data and the element list, the print preview opens.



Example: Preview element data from the emission library

Here you can print the data or export them with the "floppy disk symbol" in different formats.

**Print and Export Libraries** 

## 6 Calculations

Open the **Calculation** from the SoundPLAN Manager. The user interface of the calculation core is a table, so that you always have an overview of all calculations in the project and you can quickly re-run a calculation in case the model data changed.

### **Run file and calculations**

Each line in the run file is defining a calculation of its own. In the calculation definition you select the basic data to be calculated, select the function that should be run, define additional parameters for the calculation and request the type, amount and location of the results from the calculation. Calculation settings that were defined globally or for the project through the SoundPLAN Manager can be modified here to suite the need of a particular calculation run.

| Edit Calcul                    | rtion          | Options View Help                         |              |                    |        |                                                                        |                     |                     |  |
|--------------------------------|----------------|-------------------------------------------|--------------|--------------------|--------|------------------------------------------------------------------------|---------------------|---------------------|--|
| <ul> <li>II (\$</li> </ul>     | 1              |                                           |              |                    |        |                                                                        |                     |                     |  |
| file Logbook                   | Graphic        | a                                         |              |                    |        |                                                                        |                     |                     |  |
| SP Projekte Den                | consiel        | tellafocita 711                           |              |                    |        |                                                                        |                     |                     |  |
| ter Settings                   |                |                                           |              |                    |        |                                                                        |                     |                     |  |
|                                |                | c Stered - Fiter type Test                | •            |                    |        |                                                                        |                     |                     |  |
| Filter active (0 o             | f 48 run       | s filtered) 5 Filter type Test            | -            |                    |        |                                                                        |                     |                     |  |
| A D Co                         | stirue         | Name                                      | Group        | Calc Type          | Result | Data                                                                   | Last Edit           | Last Run            |  |
|                                |                | ·Present situation                        | winCity.runx |                    | 0      |                                                                        | 16.06.2011 17:46:01 |                     |  |
| 2 🗆 🗖                          |                | Road noise - present situation (GNM)      | winCity.nunx | Grid Noise Map     | 1      | "02 - Road Analysis.sk" "005_Calculation Area.geo" "RD GM9999.DGM"     | 16.06.2011 17:46:01 | 13.06.2011 11:31:06 |  |
|                                |                | Rail noise - present situation (GNM)      | winCity.runx | Grid Noise Map     | 2      | "04 - Rail 1.sit" "005_Calculation area 0ak Street.geo" "RDGM9999.dgm" | 16.06.2011 17:46:01 | 13.06.2011 11:33:30 |  |
| 4 🗆 🗖                          |                | Industry noise - present situation (GNM)  | winCity.runx | Grid Noise Map     | 3      | "06 - Industry.sk" "005_Calculation Area.geo" "RD GM9999.dgm"          | 16.06.2011 17:46:01 | 13.06.2011 13.51:38 |  |
| 5 🗆 🗖                          |                | Road noise · Present situation (FNM)      | winCity.runx | Facade Noise Map   | 11     | "02 - Road analysis.sk" "RDGM9999.dgm"                                 | 16.06.2011 17:46:01 | 13.06.2011 11:41:10 |  |
|                                |                |                                           | winCity.runx | Facade Noise Map   | 12     | "04 - Rail 1.sk" "RDGM9999.dgm"                                        | 16.06.2011 17:46:01 | 13.06.2011 11:46:58 |  |
|                                |                | Industry noise - present situation (FNM)  | winCity.runx | Facade Noise Map   | 13     | "06 - Industry.sk" "RDGM9999.dgm"                                      | 17.06.2011 12:03:08 | 17.06.2011 13:11:44 |  |
|                                |                | Road noise - present situation [SPS]      | winCity.runx | Single Point Sound | 21     | "02 - Road Analysis.sit" "005_Receivers general.geo" "RDGM9999.dgm"    | 16.06.2011 17:46:01 | 16.06.2011 18:18:14 |  |
|                                |                | Rall noise - present situation (SPS)      | winCity.runx | Single Point Sound | 22     | "04 - Rail 1.sk" "005_Receivers general geo" "RDGM9999.dgm"            | 16.06.2011 17:46:01 | 16.06.2011 18:18:22 |  |
|                                |                | Industry noise - present situation (SPS)  | winCity.runx | Single Point Sound |        | "06 - Industry.sit" "005_Receivers general.geo" "RDGM9999.dgm"         | 16.06.2011 17:46:01 | 16.06.2011 18:25:04 |  |
| 1 🗆 🗖                          |                | Single receiver                           | winCity.nunx | Single Point Sound | 24     | "005_Single Receiver.geo" "02 - Road Analysis.sit" "RDGM9999.dgm"      | 16.06.2011 17:46:01 | 13.06.2011 14:28:20 |  |
| n info Descriptio              | n Loj          | jbook.                                    |              |                    |        |                                                                        |                     |                     |  |
| moteluc                        | acade          | Noise Map<br>se - present situation (FNM) |              |                    |        |                                                                        |                     |                     |  |
| UD:                            |                |                                           |              |                    |        |                                                                        |                     |                     |  |
|                                | vinCity.<br>12 | runx .                                    |              |                    |        |                                                                        |                     |                     |  |
| al Calculation (TR             | readCo         | unt=0)                                    |              |                    |        |                                                                        |                     |                     |  |
| culation start:                | 13.06.2        | 011 10:41:11<br>011 10:46:59              |              |                    |        |                                                                        |                     |                     |  |
| culation time:                 |                | 16 [m.c.ms]                               |              |                    |        |                                                                        |                     |                     |  |
| of points:<br>of calculated po | 376            | 876                                       |              |                    |        |                                                                        |                     |                     |  |
|                                |                | 070                                       |              |                    |        |                                                                        |                     |                     |  |

You see in one glimpse what type of calculations, what result file number and which geometry information was sent to the calculations and when the data was last edited and when the calculation was run last.

With a click on the column header the calculation runs can be sorted ascending or descending (e.g. according to the calculation type or according to "last run").

Run file and calculations

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Calculation runs can be blocked from executing again, this way unintended destruction of already performed calculations can be prevented. When performing a batch-run the grayed out blocked runs are ignored, if you want to perform a single calculation on a blocked run, you are asked for a confirmation.

An additional benefit of the table type arrangement is that multiple calculations can be chained easily via the green triangle to be processed one after the other. This is especially helpful if you want to have multiple jobs done overnight or on the weekend.

**CONTINUE** is useful if you calculate several calculation runs one after the other in order to not loose already calculated parts of a result, see "<u>Start or terminate a calculation run</u> (page 324)".

An in-depth log book informs you of warnings and error messages that happened during the calculation and also logs events that might have an influence on the calculation results. Security settings that define when the calculation will be aborted are user defined. This way you are always in charge of the calculation and the overseer of the quality assurance.

With the right mouse button -> **DELETE RESULT FILES** you can delete the result files of all selected calculation run lines. The calculation runs remain.

### Generate calculations runs and edit the properties

When you open the calculation core for the first time in a new project the run properties are opened. In the course of project work you will generate multiple more calculations, to request a new one click on the icon + on the navigation bar.

Select the calculation run properties of an existing calculation by double click on the fields **NAME** or **CALC TYPE** or open the properties via the menu **EDIT -> RUN PROPERTIES**.

### **Calculation run properties**

Every calculation run needs certain parameters and a unique number. When you generate a new calculation run all parameters are set to default conditions.

If you change certain parameters each time, it is sensible to change the defaults via **OPTIONS** -> **DEFAULT STANDARDS** and **OPTIONS** -> **DEFAULT CALCULATION SETTINGS** globally for the future.

The option SET THE DEFAULTS OF THE CALCULATION PARAMETERS FOR THIS RUN overwrites the parameters of this run with the parameters defined in DEFAULT CALCULATION SETTINGS.

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Generate calculations runs and edit the properties

6

| Run properties                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|
| General Settings Standards Assessment SPS Statistics Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |  |  |  |  |  |
| Run name:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| Road noise Prognosis 2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| Group:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |  |  |
| Prognosis toal investigation area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  |  |  |  |
| Calculation type:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  |  |  |  |
| Outdoor Noise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |  |  |
| Data:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |  |  |
| "03 - Road Prognosis.sit"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| DGM:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  |  |  |
| "RDGM9999.dgm"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |  |  |  |
| Assigning a DGM is absolutely necessary for certain calculation types, otherwise recommended. For detailed information please press "?"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |  |  |
| and have the same and the property of the ball of the start of the sta |  |  |  |  |  |  |  |
| Number for result files 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |  |  |  |
| Set the defaults of the calculation parameters for this run                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |  |  |

The different parameters are provided in several tab index cards. Under the tab "General" you enter the name of the calculation run, select the calculation type, the data and the DGM to be processed and a unique number that will identify the results afterwards.

For grid noise maps and façade noise maps in tile projects, you can additionally define the tiles to be calculated. See <u>Calculate tiled projects</u> (page 652).

The settings in the run properties cannot be edited as soon as results are available. Changes in the properties require that the result files are deleted first. This guarantee, that calculation info and calculation result have the same parameter settings.

Editing disabled, to enable:

Delete Result files..

### Calculation types

Select a calculation category and a calculation type from the selection lists. Depending on the selected type of calculation the definition box will have a number of extra tabs to host the calculation type specific information:

#### Geometry

### Digital ground model (page 339)

The DGM calculation can be executed either in the Geo-Database or in the calculation kernel. Spot heights, elevation lines and if necessary,

Generate calculations runs and edit the properties

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additional elevation information from roads and tunnel openings are triangulated as a basis for the 3D model and the noise calculations.

- Clip DGM (page 341)
- → <u>Calculate Objects in DGM</u> (page 341)
- Import DGM (page 343)

#### **Outdoor noise**

- Single points sound (SPS): (page 343) Calculates manually entered single receivers (free field or assigned to buildings) for any number of floors.
- Grid Noise Map (GNM): (page 345) The grid noise map calculates a receiver grid within a calculation area in a specified height above ground.
- → Façade Noise Map (FNM): (page 351) The Façade Noise Map is an automated single receiver calculation for facades marked in the Geo-Database for the calculation (Geo-Tool "prepare buildings"). Receivers can either be calculated for all floors or in a specified height above ground (e.g. for the EU directive).
- Meshed Noise Map (page 356) The Meshed Noise Map combines DGM calculations with single point calculations. For detail investigations and especially for industry noise this calculation procedure has distinct advantages over the Grid Noise Map.
- Cross-sectional Noise Map: (page 350) The Cross-sectional Noise Map is a vertical Grid Noise Map.
- Noise Allotment: (page 769) Pre-calculation of the decisive receivers for the evaluation of emission and additional allotments (calculation takes only the distance correction into account, no additional propagation influences).
- → <u>Wall Dimensioning:</u> (page 468) Pre-calculation of a wall matrix with information of the efficiency of each wall element.

#### Indoor

- → Single Points, Grid Map, Sound Propagation Curve, Cross Section Map (page 358): Calculates the levels and room acoustical parameters in industrial buildings from indoor noise sources and the properties of the industrial building
- ➔ Hallout (In -> Out): From the noise level inside the industrial building and the transmission loss of walls and roof, the sound power level emitting to the environment is calculated.

#### Aircraft noise

→ Single points, Cross Section Map and Grid Noise Map (page 701)

#### Tools:

Grid-Operations and Façade-Operations: (page 367) Differences, superimposing several calculation results (for example road and railway) or adding a constant value. File operations can be executed either in the Graphics and in the Spreadsheet or in the calculation core. If you want to

Generate calculations runs and edit the properties

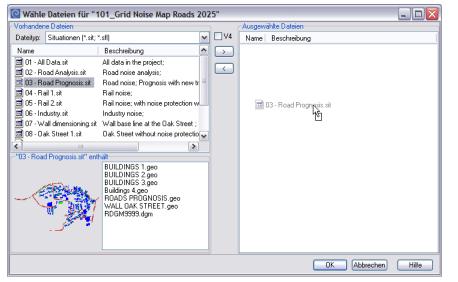
store the result of a file operation, it is mandatory to use the calculation core.

- Grid map import: (page 372) Import of ASCII data from grid noise maps for example to overlay different noise types.
- → <u>Hotspots</u>: (page 369) Determines the density of people annoyed by noise on the basis of grid noise maps and façade noise maps.

### Selection and assignment of Situations and Geo-Files

Assign the geometry data that shall be used in the calculations. In general, this will be done with the situations created and stored in the Geo-Database. It is also possible to connect Geo-Files.

By clicking the double arrow M for the calculation data, you open the window for the file selection where the data are selected and assigned to the calculation run.



Selection of the geometry

The left-hand side shows the available Situations, the right side the files selected for the calculation run. As soon as you click on a Situation the contained Geo-Files and a pictogram of the Situation are displayed below the Situation listing. To include one or multiple Situations, mark them (for a single just click on it, for multiple ones use the Shift and Ctrl keys and click) and click on the  $\rightarrow$  icon or pull them across to the right with "Drag & Drop". A DGM which is part of a Situation is automatically selected.

In some cases, it is sensible to include singular Geo-Files in the calculation, for example to include a Geo-File with a calculation area in calculation run or a Geo-File with single receivers. Before selecting the files switch the **FILE TYPE** to "Geo-Files (\*.geo)".

Generate calculations runs and edit the properties

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In the same way you can select DGM's, attenuation files from Expert Industry or GausBeam Script files that are the result of a calculation of complex meteorology (wind and temperature inversions) for industry noise. All different file types can be used in one calculation.

If you want to exclude a Situation or Geo-File from the calculations, mark the files and either by clicking on the icon 🔣 or with "Drag & Drop" transfer the files from the right side back into the left side.

### File number of the results

All results of a calculation run contain the same unique number as part of the file name. This number was entered in the general tab of the calculation run definitions under the label NUMBER OF RESULT FILES.

The result file number can have up to 4 digits and can only be used once to give the result files a unique identifier. In case you are assigning a number to the calculation run that is already in use in another calculation run, SoundPLAN will warn you. The result files have a fixed format and follow the naming convention as listed in the annex.

Depending on the degree of detail you request for the storage of results, result tables, level charts and detail tables are stored using the same unique number as part of the file name (for example RPGDxxxx.\* for level charts and RROAxxxx.\* for the road emission table for roads.) The Result Tables, Spreadsheets and the Graphics all can read the result database when the result files are opened. When you delete one or more calculation run entries from the table, you are asked whether want to delete the result files, too.

Calculation results are saved in sub-folders of the project folder so that you can find all files related to a calculation at the same location. The RES-files are saved directly to the project folder so that the results can be opened by the different program parts.

### Group the run file and filter settings

It is often useful to group the calculations in a project. To do so, generate groups in the calculation run properties. Create for example one group for calculations referring to the elevation model and one group for each variant.

Group:







+ - -Ŧ

The run file can be filtered sorted according to these groups (amongst other criteria).

Generate calculations runs and edit the properties

### Filter settings

The filter settings are stored. As soon as a filter is active you are informed how many calculation runs are not visible because of the filter.

| Filter Settings                      |            |             |      |   |      |
|--------------------------------------|------------|-------------|------|---|------|
| Filter active (2 of 7 runs filtered) | <b>4</b> 7 | Filter type | Calc | • | No 🔻 |

Click on filter active and select the filter option:

- Group name
- Calculation type
- Calculate selected yes / no
- Text filter

When a filter is active and you change a setting, the filter is not automatically updated, so that a calculation run does not disappear because of the change. Click the update button to refresh the filter.

### Duplicate a calculation run

Another handy possibility to create new calculations is to right click on an existing calculation and duplicate it with all settings and used data using **COPY + PASTE IN NEW ROW(S)** (*Ctrl + Alt + V*). The cursor jumps to the column **RESULT** to enter a result number that have not been used in other calculations. You can also highlight several rows with *Shift+ arrow keys* or *Ctrl+ left mouse key*.

# 6

### Reconstruct the calculation run from the result file

In case by accident you have deleted a calculation run entry and already have stored the run file, you can reconstruct the entry in the run file from the result files. Click on **EDIT** -> **IMPORT RESULT FILE** from the list of results select the one you want to reconstruct and click on the **OK** button. If you want to import more than one file, press the shift or Ctrl key and select the result files with the left mouse button.

### Append run file from another project

It is possible to calculate several run files from different projects successively. This is useful if you work on different projects and your PC could deliver more than one result over night or over the weekend. Or if different colleagues use a joint computer pool for example for distributed computing. Each run file is displayed in a separate tab index card.

Go to FILE -> ADD RUN FILE FROM ANOTHER PROJECT (F12) and select the corresponding project. All run file rows selected for the calculation are calculated. If a calculation runs, it must be aborted.

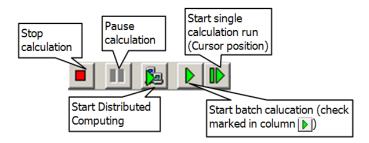
Generate calculations runs and edit the properties

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You can remove completed run files from the project with **FILE** -> **CLOSE RUN FILE**; a running calculation must be paused (**CALCULATION** -> **PAUSE CALCULATION**).

### Start or terminate a calculation run

With the symbols below the calculations are controlled:



These functions are also accessible via the menu **CALCULATION** or via the function keys listed in the menu.

With **F7** a calculation run can be processed **STEP BY STEP** in a way that the program calculates a receiver and then pauses until you hit F7 to calculate the next receiver.

All calculations can be stopped and resumed later. When you call the calculation the next time the following screen is displayed:

| Result exists                              | ×  |
|--------------------------------------------|----|
| Please select from the following options   |    |
| <ul> <li>Restart / overwrite</li> </ul>    |    |
| ○ Continue                                 | ок |
| ◯ Terminate                                |    |
| Do not display again during this batch run |    |
| (******                                    |    |

Restart/Overwrite/Continue/Cancel a calculation run

Select the option **RESTART / OVERWRITE** to start the calculation from the beginning, **CONTINUE** to resume a calculation that had been interrupted and **CANCEL** to exit from the calculation. With the continue option the program resumes exactly where it was terminated, therefore this is a very handy way to quit a pause the calculation, do some other work and then continue without having lost the calculation. Make the choice while the pause progression bar on the bottom of the box is active. The time for this bar is set in **OPTIONS -> RUN SETTINGS -> DURATION OF WAITING LOOPS**.

If you select **CONTINUE** in the table, **CONTINUE** is the default setting as soon as results are available.

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Start or terminate a calculation run

For details on Distributed Computing please read section "Distributed Computing (page 373)".

### Calculate calculation runs successively (batch run)

A batch run calculates all calculation runs that are marked in the second column (green triangle) with a check mark. Start the calculation with the green triangle.

If a calculation has been executed before, you can select that the query for existing results (overwrite or continue) is only shown at calculation start. Set the check mark **DO NOT DISPLAY AGAIN DURING THIS BATCH RUN.** The setting you select is used for all calculations during the batch run.

# Logbook, Error messages and Default settings

The logbook keeps track of all actions that occur during a calculation run. For example, which files are loaded, what is calculated and if there are warnings and error messages. The logbook is stored in each project under the name "Lastlog.rtf", if the file grows to a bigger size than 300 kB, the display in the logbook is emptied and the data stored under the name Logbk0.rtf. You do not have to wait for this to happen, you can manually empty the logbook or store it or print its content.

Calculations can produce errors! Most errors are caused by faulty data or missing parameters and properties, some occur at special conditions for a particular geometry and some occur because SoundPLAN simply has made a mistake (unfortunately no program is completely free of bugs).

In general, SoundPLAN distinguishes between hints, warnings, exceptions and fatal errors. Warnings are logged with red italic writing, exceptions are printed in magenta and fatal errors are in bold red writing. In addition, blue text is used to indicate that the user has aborted the calculation.

**HINTS** are displayed to call your attention to certain conditions during the calculation. If desired these conditions do not cause problems. For example, the hint "There are sources without a spectrum, for these sources ground effect is calculated according to alternative method of ISO 9613/2!", But if you only want to calculate source with frequency spectra, you should pursue the information.

When **WARNINGS** are given, the calculations are continued as normal and for the most part the results are reliable. For example, the warning message "Grid elevations could not be calculated for all receivers, x receivers were not calculated" means that the elevation data did not make it possible to securely interpolate the elevations for all receivers of a Grid Noise Map. A warning message "K0-Wall >=0.1, but no wall found in the vicinity of the source" – is hinting that a data entry error is present, either K0-Wall is set to the wrong value or a wall should be present but is not because it was deleted or is in a Geo-File that is no longer part of the situation

that is assigned to the calculation. The examples show that you should always look into the logbook after a calculation, there might be warnings that something in the data was not correct and if this is the case corrections should be made in the Geo-Database.

**EXCEPTIONS** do not necessarily lead to an exit from the calculations. SoundPLAN can handle certain exceptions and still continue with the calculations. The number of possible exceptions is set in the "run settings". For example, exceptions can occur resulting in one receiver not having been calculated, but the rest of the Grid Noise Map would be calculated correctly. If exceptions occur, something unexpected happened in the calculation core and you should pack the project and send us the data along with the description so that we can research what happened and fix the problem. "Division by zero" for example is indicating that a certain geometrical constellation has not been correctly handled. Problems like this need to be fixed and the program authors do this, but in order to reproduce the error they need the data.

**ERROR** will immediately terminate the calculation. Errors can have various roots but very often are caused by the geometry data. For example, "No calculation area in the data" or "Building xxx, No. yyy has no properties". Use **TOOLS** -> **PREFLIGHT** in the Geo-Database to find conflicts in beforehand.

# **Run Settings**

| Run Settings                                                                                                                                                                                                   |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| Terminate single run after # of exceptions                                                                                                                                                                     | 10   |
| Terminate grid map calculation after # of single point terminations                                                                                                                                            | 10   |
| Cancel batch run on single run termination                                                                                                                                                                     |      |
| Save runfile before each calculation                                                                                                                                                                           |      |
| Backup previous results before each calculation                                                                                                                                                                |      |
| Number of threads                                                                                                                                                                                              |      |
| CPU =Intel(R) Core(TM)2 Duo CPU T7500 @ 2.20GHz (Ge<br>type 0, family 6, model F, stepping B), 2194,5 MHz, 2 logical<br>physical CPUs:                                                                         |      |
| This PC has 2 logical CPU(s), we advise to use exactly this va<br>number of threads to utilize max. calculation speed. Reduce<br>number in order to allow to do something else with this PC du<br>calculation. | this |
| Number of threads                                                                                                                                                                                              | 4    |
| Duration for waiting loops [sec]                                                                                                                                                                               | 10   |

In **OPTIONS** -> **RUN SETTINGS** define general pre-settings for all projects and all calculation runs.

Calculations can be finished even if problems have occurred. The number of such exceptions can be set for single point receivers and for Grid Noise Maps. By default, up to 10 exceptions are allowed. Please always look in the logbook if an exception has caused a receiver not to be calculated.

With Grid Noise Maps exceptions will mark the receiver that has not been calculated properly, the receivers with the exceptions can be processed later. Define how many grid points can be skipped until the program terminates.

**CANCLE BATCH RUN ON SINGLE RUN TERMINATION**: Determines if the entire batch run of multiple calculations shall be terminated if one of the runs is reporting unrecoverable errors.

**Hint:** To avoid a failure of the batch calculation due to errors in the input data, check the Situations with the **PREFLIGHT** in the Geo-Database before you start the batch calculation.

The checkbox **SAVE RUNFILE BEFORE EACH CALCULATION** stores the run file so that no data loss will occur. By default, this setting is active.

**BACKUP PREVIOUS RESULT BEFORE EACH CALCULATION** stores the previous result files in a sub folder of the project.

**Multithreading**: The calculation kernel automatically recognizes how many cores the PC has (**NUMBER OF THREADS**). By default, the full number of cores are used for calculations but if you want to use the PC for other tasks while a SoundPLAN calculation is in progress, it is wise to reduce the number of cores used in the calculation (normally by one).

**DURATION OF WAITING LOOPS** sets the time available to select between different options. In the batch run the calculation always goes to the next step, so if you need to intervene or have the data presented a different way, there is only a limited time until the automatic process continues.

#### **Statistics**

After you started a calculation run, SoundPLAN displays status information about the calculation that is running.



| <b>Q</b> Statistics | $\mathbf{X}$     |
|---------------------|------------------|
| Number of po        | <u>ints</u>      |
| Total:              | 18035            |
| Calculated:         | 2133             |
| interpolated:       | 2559             |
| Calculation tir     | ne about         |
| Total:              | 00:14:26 [h:m:s] |
| So far:             | 00:01:43 [h:m:s] |
| remaining:          | 00:12:43 [h:m:s] |

The statistics shows the coordinate of the receiver currently calculated the number of total receivers and how many are already done. The calculation times are only estimates based on the time of the first receivers. The times can vary during the calculation, often with Grid Noise Maps SoundPLAN is under predicting at first, then over predicting slightly in the middle of a big area. Often the edges of the Grid Noise Map contain more interpolated coordinates than the average, thus the program thinks at first that the calculation is faster than it actually is. For Grid Noise Maps the timer is updated after each calculation block for all other calculations it is updated after each receiver.

#### Calculation run-info

The calculation run-info writes a protocol of all parameters relevant to the calculation, the files that were activated for the calculation and the version of the calculation program. This assures a complete documentation of the entire calculation run. The run info is displayed below the list of calculation runs. This way you can check the used calculation settings and data without the need to load the data.

The calculation run-info is copied into each result table and can be printed from there as well.

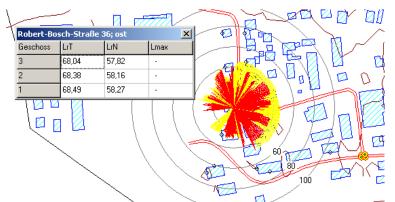
### Graphical presentation of geometry in calculations

To graphically check the calculation results you can click on the tab *Graphics* while the calculation is running. For single receivers, Façade Noise Maps and Meshed Noise Maps the level chart is presented along with a table of the calculation results for each floor. For Grid Noise Map and Cross-sectional Noise Maps the results are presented as squares painted in accordance to a color scale. If you want to know which of the receivers was interpolated, right click on the map and select the option **GRID POINT TYPE**.

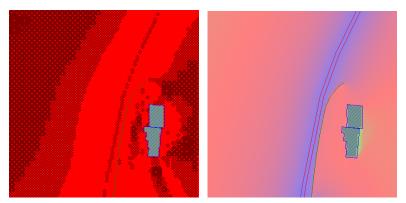
Bright red squares are calculated receivers, dark red squares indicate interpolations and gray squares are indicating the square is completely inside a building.

A print function is not planned for the graphics in the calculations; this is the domain of the Graphics modules themselves.

Hint: The graphical display increases the calculation time considerably, also for distributed computing!



Display of level chart and the results from single point receivers, Façade Noise Maps and Meshed Noise Map



Display of a Grid Noise Map with the color scale and the presentation of calculated/interpolated receivers

Even when the calculation is finished, the results are available in the calculation core. Click on the calculation run; activate the graphics by clicking on the *Graphics* tab. If the noise map has been calculated, you can right click on the map area and select **LOAD GRID MAP**. Right click on a point on the map and get the information:

Logbook, Error messages and Default settings

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| X [m]             | 36097,00 |
|-------------------|----------|
| Y [m]             | 29607,00 |
| Grid point type   |          |
| Ground height [m] | 264,11   |
| ✓ Day [dB(A)]     | 61,06    |
| Night [dB(A)]     | 50,61    |

To present the entire map for a different time slot or to present the terrain elevations instead of the noise levels, activate the correct selection. If you want to change to display the terrain elevations, you probably need to correct the color scale. To change the colors, click on the **EDIT** button on the color scale.

For single point receivers and Facade Noise Maps the level charts can be called back on screen if the option **LEVEL CHART** has been activated in the run parameters, if this option was not clicked only the noise levels are shown in tabular form.

When opening the graphics tab of a calculation run, loading and drawing the DGM can be suppressed by deactivating it in **VIEW -> DGM TRIANGLES**.

# **Calculation settings for noise calculations**

| General Settings Standards As    | sessment SP: | S Statistics Description   |         |
|----------------------------------|--------------|----------------------------|---------|
| Reflection order                 | 3            | Weighting                  | dB(A) 💌 |
| Max Search Radius [m]            | 5000 🕃       | Set 5 dB rail bonus        |         |
| Max Reflection Distance Rec [m]  | 200 🕃        | Create ground effect areas | from    |
| Max. Reflection Distance Src [m] | 50 🕃         | road surfaces              |         |
| Allowed Tolerance [dB]           | 0,1 🕃        |                            |         |
| Allowed Tolerance holds for      |              |                            |         |
| each source contribution level   | ~            |                            |         |

Calculation settings for noise calculations

The calculation settings are preset with defaults, available for the current project and as global setting under **OPTIONS- > DEFAULT CALCULATION PARAMETERS**.

The default settings are on the safe side; you can change them in the tab index card *Settings*. To get a feeling on the effect of the parameters on calculation time and accuracy it may be wise to calculate statistic runs, see "<u>Statistical accuracy</u> (page 378)".

Use the button **SET DEFAULTS** to reset your changes to the default settings of the project.

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Calculation settings for noise calculations

The parameter **REFLECTION ORDER** determines how many reflections shall be calculated. For calculations "Strictly according to RLS-90" only the first order reflection is evaluated, "Strictly according to Schall 03" calculates without reflections, no matter what you entered. All other objects (industrial, parking lots) present in the calculation will be calculated using the defined number of reflections.

During the calculation SoundPLAN searches for sources in a set distance around the receiver. The **MAXIMUM SEARCH RADIUS** sets how far a source can be from the receiver and still contribute to the noise level at the receiver. This restriction is mostly effective for big noise mapping projects. The accuracy for line type sources is only sufficient if the search radius is higher than 5 times the orthogonal distance to the source.

The **DB-WEIGHTING** filter can be switched between dB(A), dB(B), dB(C), dB(D), dB(G) or dB (linear). In the calculation, sources with a frequency spectrum that do not correspond to the weighting filter set here are converted to this filter.

Sources to which a center frequency has been assigned in the Geo-Database cannot be converted. This means that for these sources the weighting filter in the Geo-Database and in the Calculation Core must match, otherwise the calculation will be aborted.

Railway noise has been assessed as being less annoying so there is the possibility to set a **RAILWAY BONUS** that subtracts 5 dB to compensate for this difference.

**CREATE GROUND EFFECT AREAS FROM ROAD SURFACES** automatically generates hard ground areas according to road width. Activate this check box for all standards that use this option (e.g. NMPB 86 und 2008).

**MAX. REFLECTION DISTANCE TO THE RECEIVER [M]** (default value 200 m) and **MAX. REFLECTION DISTANCE TO THE SOURCE [M]** (default value 50 m):

The program only calculates reflections for reflecting surfaces that are either closer to the receiver than the first parameter entered or closer to the source than the second parameter. The default settings in general produce sensible results. Reflection edges that are far away from the source and far away from the receiver do normally not contribute to the immission level.

**ALLOWED TOLERANCE**: This parameter is designed to increase the calculation speed. With high values of tolerance, the results are overestimated rather than underestimated. The value for the tolerance depends on the task to be calculated.

The tolerance either holds for the **total result**, for each **group contribution level** or each **source contribution level**.

If the tolerance holds for the **TOTAL RESULT**, only the most important sources are calculated in detail so that for the total result the deviation is less than defined by the allowed tolerance. This setting has the disadvantage that less important sources are not calculated in detail or for area and line sources to a smaller extent. For sources not calculated in detail no contribution level will be calculated and

Calculation settings for noise calculations

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displayed in the result tables. So, if you do a recalculation and remove or add an important source the relative importance of sources might change and therefore their contribution levels.

If the tolerance holds for each **GROUP CONTRIBUTION LEVEL** or **EACH SOURCE CONTRIBUTION LEVEL** the calculation is done group by group or source by source, so that the allowed tolerance holds with respect to the contribution level of each group or each source, therefore the contribution levels for the other groups or sources do not change when adding or removing important sources.

Principles of the method:

In the first place all sources are calculated in free field. This means that basically only the geometrical spreading will be used. Now only so many sources - from high to low free field contribution - are calculated correctly with all spreading parameters which are necessary to guarantee the allowed tolerance. This is made sure for every hour of the day. The sum the free field contribution of the remaining sources makes up a remaining level which will be added to the receiver level so that it is guaranteed that the receiver level is rather over estimated than under estimated. This remaining level is listed in the result tables, table *source contribution* " as "remaining sources".

There it holds

10\*log((10^(0.1\*R)+10^(0.1\*F))/ 10^(0.1\*R))<T

where

R: sum of the correctly calculated contribution levels [dB]

F: sum of the remaining free field contribution levels (remaining level) [dB]

T: allowed tolerance

**Recommended values:** 

0.5 - 0.8 dB + TOTAL RESULT (GROUP CONTRIBUTION LEVEL): Noise mapping projects, calculations in accordance to the END.

< 0.2 dB + TOTAL RESULT (GROUP CONTRIBUTION LEVEL): Road, railway and industrial projects where only the total level or group contribution level is of interest (e.g. Grid Noise Maps).

< 0.2 dB + EACH SOURCE CONTRIBUTION LEVEL: Sensitive industrial projects where the group or source contribution level is of interest.

# Standards

Check the standards, selected in the calculation run. As a pre-setting the standards selected in the SoundPLAN Manager are presented here.

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| General Settings | Standards Assessment Facade Noise Map Statistics Description |
|------------------|--------------------------------------------------------------|
|                  |                                                              |
| Road Noise       | NMPB - Routes - 96                                           |
|                  | Emission Guide du Bruit                                      |
|                  |                                                              |
| Railroad Noise   | RMR 2002 (EU) ≥>                                             |
|                  | Emission RMR 2002                                            |
| Industry Noise   | ISO 9613-2 : 1996 🗸 🗸                                        |
| , i              |                                                              |
| Parking lots     | ISO 9613-2 : 1996 📀                                          |
|                  | Emission Parkplatzlärmstudie 2007                            |
|                  |                                                              |

If necessary, you can change the standards for the propagation calculation and the emission calculation, here.

The calculation can only be successful, if the correct emissions have been entered in the properties of road, railway or parking lot in the Geo-Database.

## **Standard details**

Check the standard details with the double arrow. Depending on the standard some options will be available or not.

#### Tab index card "Diffraction"

| Info Diffraction Dissection Environment Standard Cmet Attenuation loss                            |
|---------------------------------------------------------------------------------------------------|
| Side diffraction                                                                                  |
| Odisabled                                                                                         |
| <ul> <li>Outdated method (side paths also around terrain)</li> </ul>                              |
| Improved method (no side diffraction if terrain blocks line of sight) - ISO17534-3 compliant      |
| Improved method (side diffraction also around terrain)                                            |
| Limitation of diffraction [dB]                                                                    |
| Single 20 Multiple 25                                                                             |
| Constant for diffraction                                                                          |
| C2 20                                                                                             |
| Abar calculation                                                                                  |
| ○ Use Eqn (12) (Abar =Dz-Agr) acccording to standard                                              |
| Use Eqn (Abar =Dz-Max(Agr,0)) instead of Eqn (12) (Abar =Dz-Agr) for insertion loss (recommended) |
| $\bigcirc$ Use Eqn(13) (Abar=Dz) instead of Eqn (12) (Abar=Dz-Agr) for insertion loss             |

**SIDE DIFFRACTION** can be used with all standards, regardless if side diffraction is required in the standard or not. For standards that by default do not use side diffraction, the checkbox by default has the setting "off".

As the calculation of the side diffraction is very computation intensive, this feature should be deactivated in a draft type calculation. Do not forget to re-enable this feature later on for the final calculation.

Buildings that are connected to each other and walls that are connected to buildings are recognized, the screening will use the entire block for side diffraction around the objects.

**LIMITATION OF DIFFRACTION:** A certain maximum screening loss can be entered for single and multiple diffraction. These values refer to vertical screening loss only.

**DIFFRACTION CONSTANT:** According to VDI 2720 / ISO 9613-2 the screening loss Dz is calculated with following equation:

 $D_z=10lg[3 + (C_2/\lambda) C_3 z K_{met}]$ 

C2 equals 20 and includes the effect of ground reflection; in rare cases if the ground reflection is taken into account separately with mirror sources, C2 equals 40 (citation from ISO 9613-2).

ABAR CALCULATION: There are three options for the calculation of the insertion loss

(1) Abar=Dz-Agr equaling eqn. (12) of ISO 9613-2

- (2) Abar=Dz-Max(0,Agr) a modified version of eqn Gl. (12) of ISO 9613-2
- (3) Abar=Dz equaling eqn. (13) of ISO 9613-2

Remarks to (2)

There are two different versions of the ground effect in ISO 9613, the regular method and the alternative method. In the alternative method there is a k0, describing the effect of a constructive reflection on ground, leading always to a rise in level in the range of 0...3 dB. Furthermore, there is a destructive reflection on ground leading to a reduction in receiver level in the order of 0...4.8 dB. In the regular method we have a spectrally resolved ground effect combining constructive and destructive reflections, so positive as well as negative values for the ground effect can occur.

From the historical development the insertion loss was developed for the alternative method (being the regular method at that time). Due to the separation between k0 and Agr, Agr was always a positive number. The equation Abar=Dz-Agr does not make sense if Agr is negative, which is possible in the regular method. To ease this problem, we propose option 2. This workaround delivers results which are more comparable with the alternative method.

Remarks to (3)

Option 3 has been implemented to satisfy remark 15 of ISO 9613-2 but we do not advise to use it.

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#### Tab index card "Dissection"

| Info   | Diffraction                | Dissection    | Environ  | ment   | Standard | Cmet    | Mitigation loss      |   |  |
|--------|----------------------------|---------------|----------|--------|----------|---------|----------------------|---|--|
| Parame | eters for the              | dissection of | line and | area s | ources   |         |                      |   |  |
| Factor | distance / di              | ameter        |          | 8      |          | Minimum | distance             | 1 |  |
|        | um difference<br>tion [dB] | e ground effe | ct +     | 1      |          | Maximum | number of iterations | 4 |  |

These parameters define how line and area sources are dissected in a number of point sources.

After dissection due to screens and buildings, etc. further conditions are checked. The first is the **DISTANCE TO DIAMETER FACTOR**. If this value is e.g. 8 the distance to a source segment must at least 8 times its diameter respectively length. If this is not the case, the source segment will be divided, and the check is repeated for both sub segments until the condition is fulfilled or the distance is less than the **MINIMAL DISTANCE [M]**.

Next the ground effect and screening loss for the extremal points of the source segment are calculated. Is the maximal difference of ground effect + screening loss of these extremal points larger than **MAXIMUM DIFFERENCE GROUND EFFECT** + **DIFFRACTION** the source segment will be divided and the check repeated for both sub segments until the condition is fulfilled or the iteration depth is larger than the **MAX. NO. OF ITERATIONS**.

# 6

#### Tab index card "Environment"

| Info Diffraction Dissection | Environment | Standard Cmet       |         |
|-----------------------------|-------------|---------------------|---------|
| Environment                 | -           |                     |         |
| Humidity [%]                | 70          | Air pressure [mbar] | 1013,25 |
| Temperature [°C]            | 10          |                     |         |

**HUMIDITY, AIR PRESSURE, TEMPERATURE:** The environment parameters are important to calculate the air absorption. Furthermore, is the sound speed a function of temperature, influencing the wave length and therefore the screening calculation.

Standards

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#### Tab index card "Standard"

| info   | Diffraction               | Dissection      | Environment          | Standard        | Cmet      | Mitigation loss                    |              |
|--------|---------------------------|-----------------|----------------------|-----------------|-----------|------------------------------------|--------------|
| Air ab | sorption                  |                 |                      |                 |           |                                    |              |
| ISO 9  | 9613-1                    |                 |                      |                 |           |                                    | ~            |
| Groun  | d absorption              |                 |                      |                 |           |                                    |              |
| () rec | ular ground e             | effect (chapt   | er 7.3.1), for s     | ources with     | out a spe | ectrum automatically alternative o | round effect |
|        | galar groana (            | incer (chapt    |                      | ources man      | outusp    |                                    | ground encee |
| ) alt  | ernative grou             | nd effect (ch   | apter 7.3.2)         |                 |           |                                    |              |
| Source | es ground hei             | aht correctio   | n                    |                 |           |                                    |              |
|        | -                         | -               | ove buildings to     | o roof top      |           |                                    |              |
|        | R 17534-3:20              | 14 conformit    | у                    |                 |           |                                    |              |
| -      | d speed<br>Iculate as fue | ction of tom    | erature (recon       | mondod          |           |                                    |              |
| _      |                           |                 | @14.4 °C) (IS        |                 |           |                                    |              |
| Ŭ      | iencies [Hz]              | 101 340 11/3    | (@11.1 C) (15)       | 5 1755 1)       |           |                                    |              |
|        |                           | band numbe      | rs f [Hz] = 10^      | b/10 (recon     | mended    | )                                  |              |
| Oro    | unded freque              | ncies (ISO 1    | 7534)                |                 |           |                                    |              |
| Diffra | ction by terra            | in (DGM)        |                      |                 |           |                                    |              |
| 🖲 😋    | lculate diffrac           | tion always i   | fline of sight is    | not blocked     | l (recom  | mended)                            |              |
| () igr | nore diffractio           | n by terrain    | fline of sight is    | not blocker     | d (ISO 1  | 7534)                              |              |
|        | nore diffractio           | القارب ويتعادده | and a feature in the | A L L A A A A A |           | ul ree este el                     |              |

AIR ABSORPTION: Select the standard to calculate air absorption with.

**ALTERNATIVE GROUND EFFECT:** If you select this option, the ground effect of ISO 9613-2 is not going to be calculated by the frequency dependent regular method, but by the in chapter 7.3.2 described alternative method.

For sources which do not have a spectrum the calculation according to the regular method doesn't make sense. Therefore, SoundPLAN always uses the alternative method for these sources.

Following the recommendation of the DIN/VDI standardization group NA 001 BR-02 SO, the calculation of the average height of the line of sight above ground hm for the alternate calculation procedure of the ISO 9613-2 was changed from SoundPLAN 8.1. This change can lead to slight changes in the results, especially if the terrain elevation for source and receiver are very divergent.

For the noise propagation calculation two options are available for the CoRTN:

| Definition          | n of "Calcul          | ation of Ro | ad Traffic | : Noise (UK)"-standard | × |
|---------------------|-----------------------|-------------|------------|------------------------|---|
| Info                | Diffraction           | Standard    | Emission   | Attenuation loss       |   |
| L 10 to L<br>TRL    | .eq-Convers<br>Method | ion         |            | © Leq = L10 - 3 dB     |   |
| Low flow<br>Disable | w correction          |             |            |                        |   |

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In the run properties you can choose between two methods to convert the L10-values to Leq. The first option is the original method from TRL (the UK's Transport Research Laboratory). The second is preferred in Australia (North South Wales) and uses the simple formula L10 - 3 dB for the conversion. If you choose this option, you have the option to disable the low flow correction at the same time.

Tab index card "Cmet"

| Info       | Diffraction        | Dissection         | Environment | Standard | Cmet | Mitigation loss                                                                                                 |
|------------|--------------------|--------------------|-------------|----------|------|-----------------------------------------------------------------------------------------------------------------|
| ) Sir      | ngle value         |                    |             |          |      |                                                                                                                 |
|            | C0(d)[dB]<br>6-22h | C0(n)[dB]<br>22-6h |             |          |      |                                                                                                                 |
|            | 0,0                | 0,0                |             |          |      |                                                                                                                 |
| Ow         | ind statistics     |                    |             |          |      |                                                                                                                 |
|            |                    |                    |             |          | >>   |                                                                                                                 |
|            | -                  |                    |             | ر.<br>م  |      | and a set of the set of |
| Only       | for Lmax indu      | stry               |             |          |      |                                                                                                                 |
| • <b>C</b> | onsider Cmet (     | (yearly avera      | ge)         |          |      |                                                                                                                 |
|            | nore Cmet          |                    |             |          |      |                                                                                                                 |

The calculation of the meteorological correction Cmet to derive the long term mean value is described e.g. in ISO 9613-2

Cmet=Max(0, C0[1-10(hs+hr)/dp])

The factor CO can either be set fixed for certain time slices (definition in the SoundPLAN Manger **OPTIONS -> EMISSION TIME SLICES**) or calculated from a wind statistics.

Methods to calculate CO, if a wind statistics is used:

| Method to calculate CO                |             |            |         |     |         |    |  |  |
|---------------------------------------|-------------|------------|---------|-----|---------|----|--|--|
| ⊙ Km,Kq,Kg                            | Km [dB]     | 0          | Kq [dB] | 1,5 | Kg [dB] | 10 |  |  |
| ○ 5-5*cos(E-45*sin(E))                |             |            |         |     |         |    |  |  |
| ◯ take over C0-values                 | from wind s | statistics |         |     |         |    |  |  |
| · · · · · · · · · · · · · · · · · · · |             |            |         |     |         |    |  |  |

Depending on the county in Germany basically two methods are used to calculate C0. Furthermore, is it possible in SoundPLAN to enter C0 values directly per wind direction.

The time slices for Cmet are determined in the SoundPLAN Manager, **OPTIONS** -> **SETTINGS**, node "time slices for road / railway emission and Cmet"

#### Tab index card "Attenuation loss"

| Info                                                              | Diffraction                                                                                                                                    | Dissection | Environment | Standard | Cmet | Attenu | uation loss |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|----------|------|--------|-------------|
| Foliage Built-up area Industrial site                             |                                                                                                                                                |            |             |          |      |        |             |
| Calculate attenuation loss according to User defined Amax [dB] 10 |                                                                                                                                                |            |             |          |      |        |             |
| Afol [dB] = $d * a(f) \le Amax$                                   |                                                                                                                                                |            |             |          |      |        |             |
| defin                                                             | a(f) [dB/m]: damping value as defined in attenuation area object; f=500Hz if frequency not defined d [m]: path length through attenuation area |            |             |          |      |        |             |

How volume attenuation areas shall be calculated is only defined in a few standards and not all of the possible volume attenuation areas are mentioned in these standards. For this reason, the settings for each standard now allow you to select how the volume attenuation areas –for each type of area- shall be treated by the program. Select from the standard options.

See object type Volume absorption area (Mitigation Areas)

#### Tab index card "Emission" in the road standards

| Info   | Diffraction Dissec   | tion Emission | Attenuation loss |   |  |  |
|--------|----------------------|---------------|------------------|---|--|--|
| Calcu  | late Emission accord | ling to       | RLS90            |   |  |  |
| Road g | Road gradient        |               |                  |   |  |  |
| Limit  | [%]                  |               | 100              | - |  |  |
| Leng   | th of smoothing line | [m]           | 15               |   |  |  |
|        |                      |               |                  |   |  |  |

As sometimes 2 close coordinates are having an elevation difference that leads to excessive inclines, the program allows averaging of the incline over a user defined distance in the properties of the road standard, tab *Emission*. Whatever was used will be found in the logbook. **The default setting for the averaging is taking the average for a section of 15 m of road length.** The incline can also be limited to a specific value to prevent unrealistic local level spikes when the DGM is not quite good.

### **Calculation of the frequencies**

Up to and including version 7.3 for most of the standards calculations were performed on rounded third octave band frequencies. Due to the extension to low frequencies and a harmonization SoundPLAN version 7.4 switches to frequencies calculated by band numbers.

Hereby applies for the frequency f  $[Hz] = 10^{(0.1*b)}$ , with band number b.

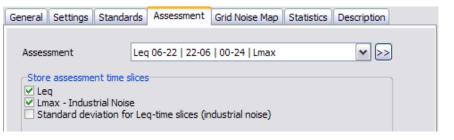
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| b               | 13    | 14    | 15    | 16    | 17    | 18    | 19    | 20     | 21     | 22     | 23     | 24     | 25     | 26     |
|-----------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|
| Nominalfrequenz | 20    | 25    | 31    | 40    | 50    | 63    | 80    | 100    | 125    | 160    | 200    | 250    | 315    | 400    |
| 10^(0.1*b)      | 19.95 | 25.12 | 31.62 | 39.81 | 50.12 | 63.10 | 79.43 | 100.00 | 125.89 | 158.49 | 199.53 | 251.19 | 316.23 | 398.11 |
|                 |       |       |       |       |       |       |       |        |        |        |        |        |        |        |
| b               | 27    | 28    | 29    | 30    | 31    | 32    | 33    | 34     | 35     | 36     | 37     | 38     | 39     | 40     |
|                 |       |       |       |       |       |       |       |        |        |        |        |        |        |        |
| Nominalfrequenz | 500   | 630   | 800   | 1000  | 1250  | 1600  | 2000  | 2500   | 3150   | 4000   | 5000   | 6300   | 8000   | 10000  |

This has effects especially on air absorption and on weighting filters dB(A)..dB(D) and may lead to slight deviations in the results compared to previous versions of SoundPLAN. The weighting filters have been calculated from complex transfer functions and tabularized with three decimals.

# Assessment

Select the assessment from the Library. As a default the assessment selected at project setup is entered.



Below the assessment list there is a selection for the assessment type. There you can select certain assessment types. An assessment type can only be calculated if it's also included in the time slices defined in the assessment library. If a time slice is not defined, it is crossed out. The possibility to deselect certain assessment types was introduced to reduce calculation time and to make the results more compact. Especially the calculation of Lmax is more time consuming than pure Leq-calculation.

If you entered a standard deviation for industrial sources for the calculation of the prognostic uncertainty, activate the checkbox for the time slices of the standard deviation to document them in the Result Tables.

# **Calculation Types**

# **Digital ground model**

All calculations using a 3-dimensional model mandatorily require a DGM as the base. A DGM loaded in a situation automatically taken over to the calculation run.

If anyway no DGM is entered, SoundPLAN calculates with a constant ground elevation of 0 m. Unless all objects are located on the 0.0 m plane, the calculation results will be wrong! To warn the user, in this case a warning message will appear.

Assessment

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Elevation lines and elevation points that are part of a situation but not included in the DGM are ignored!

| 📱 Run Command Editor 🛛 💦                                                                                                                                                                                                          |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| General Description                                                                                                                                                                                                               |  |  |  |  |  |  |
| Run name :                                                                                                                                                                                                                        |  |  |  |  |  |  |
| dgm                                                                                                                                                                                                                               |  |  |  |  |  |  |
| Group:                                                                                                                                                                                                                            |  |  |  |  |  |  |
|                                                                                                                                                                                                                                   |  |  |  |  |  |  |
| Calculation type:                                                                                                                                                                                                                 |  |  |  |  |  |  |
| Geometry $\checkmark$ Digital Ground Model $\checkmark$                                                                                                                                                                           |  |  |  |  |  |  |
| Data:                                                                                                                                                                                                                             |  |  |  |  |  |  |
| "008_Terrain elevation.geo" "009_Industrial Sources.geo" "003_Roads Prognosis.geo"                                                                                                                                                |  |  |  |  |  |  |
|                                                                                                                                                                                                                                   |  |  |  |  |  |  |
| Calculation in tiles (only for huge amount of dat<br>Tile size [m] 10000                                                                                                                                                          |  |  |  |  |  |  |
|                                                                                                                                                                                                                                   |  |  |  |  |  |  |
|                                                                                                                                                                                                                                   |  |  |  |  |  |  |
| Object types to be used for DGM calculation       Spothelpits       Bevation lines       Center reservation       Center reservation       Tunnel portals (not for air pollution)       Parking lot       Area source       Derms |  |  |  |  |  |  |
| Number for result files 5                                                                                                                                                                                                         |  |  |  |  |  |  |
| II V DI A                                                                                                                                                                                                                         |  |  |  |  |  |  |

Select which object types shall influence the DGM calculation. Next, to spot elevations and elevation lines, it may be sensible to also use the edges of the roads and railways to deliver input to the DGM (see "Embankment alignment for road and railway in the DGM (page 124)").

In the lower part, select which object types shall influence the DGM calculation. Next, to spot elevations and elevation lines, it may be sensible to also use the edges of the roads and railways to deliver input to the DGM. This ignores the elevation information within the bands.

The following geometry is calculated into the DGM (only objects entered with absolute elevations):

| Roads                      | The carriageway resulting from the road cross section                        |
|----------------------------|------------------------------------------------------------------------------|
| Railways                   | Edges and delta Hof the track bed (DGM parameters in the object dialog)      |
| Tunnel openings            | Tunnel width and height                                                      |
| Parking lots/ Area sources | The input points of the edge lines                                           |
| Berms                      | The calculated lines of the berm top and the calculated backwards wall line. |

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Additionally, you can check the box "Central reservation", if the elevations within the central reservation shall be incorporated into the DGM or not.

If the plan contains tunnels, it is wise to generate a new DGM after the tunnel portals are defined so the DGM can correctly model the area around the tunnel.

For huge amounts of spot elevation data which have been processed via "<u>Preprocess elevation data for the calculation kernel</u> (page 654)" select one file from the files stored in the subfolder "ElevData"; all \*.elv files in this folder will be used for the DGM calculation.

Activate **CALCULATE IN TILES** for large DGMs (complete urban areas or counties) and select the tile size in [m].

If the data contains tunnels, it is wise to generate a new DGM after the tunnel portals are defined so the DGM can correctly model the area around the tunnel.

#### Extract DGM via an area

When a DGM for the entire project is already present and you want to restrict the DGM to cover only a portion of the entire DGM, you can clip the DGM. In the Geo-Database define an area (calculation area or general area) and save this area in a Geo-File of its own. In the Calculation Core select **CLIP DGM** from the category **GEOMETRY**.

| Geometry  Clip DGM                  | ▼   |
|-------------------------------------|-----|
| Data:                               |     |
| "create buffer + interpolation.geo" | >>  |
| DGM:                                |     |
| "RDGM9999.dgm"                      | >>  |
| Clip area buffer size [m]           | 100 |

Enter the Geo-File with the area functioning as the clipping template and the existing DGM and in the bottom of the definition box the number for the part DGM to be created. Additionally, you can add a buffer around the selected clipping area in order to assure the elevation provision for the part DGM.

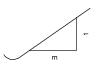
#### Calculate Objects in DGM

With the calculation run "Calculate objects in DGM" you can modify an existing DGM with the information of additional objects (road edges, railway edges, parking lots, area noise sources and berms).

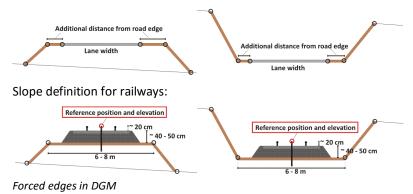
| Calculation type:                                                                        |               |        |  |  |  |
|------------------------------------------------------------------------------------------|---------------|--------|--|--|--|
| Geometry $\checkmark$ Calculate obje                                                     | ects into DGM | $\sim$ |  |  |  |
| Data:                                                                                    |               |        |  |  |  |
| "007_Berm at railway.geo" "003_Roads Prognosis.geo"                                      |               |        |  |  |  |
| DGM:                                                                                     |               |        |  |  |  |
| "RDGM0004.dgm"                                                                           |               | >>     |  |  |  |
| Calculate embankments                                                                    |               |        |  |  |  |
| Slope downwards / upwards: 1:                                                            | 1,5           | 1,5    |  |  |  |
| Additional distance to object edges [m]:                                                 | 1,50          | 1,50   |  |  |  |
| Object types to be used for DGM calculation                                              |               |        |  |  |  |
| ✓ Road edges       ✓ Railway edges       ✓ Parking lot       ✓ Area source       ✓ Berms |               |        |  |  |  |

Additionally, embankments can be incorporated into the DGM. The program will search for embankments up to a distance of 100 m from the road/railway edge. In order to create the embankments, the height of the fill/depth of the cutting must be greater than 0.5 meters for a distance of 5 meters along the road/rail edge. This calculation run replaces the Geo-Tool "Create embankments" and also can be started from the Geo-Database via **FUNDAMENTALS -> DGM -> CALCULATE OBJECTS INTO DGM (***Alt+Ctrl+D*).

Cutting and embankment slopes can have different inclinations. The inclination is calculated from the factor 1:m.



#### Embankment definition for roads:

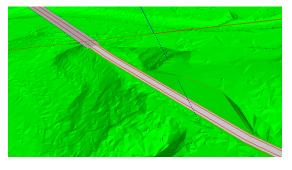


Since the embankments usually do not start immediately at the edge of the road, specify an **ADDITIONAL DISTANCE TO THE OBJECT EDGE**, for roads for example for a ditch. For railways, the DGM parameters from the object dialog are used.

This calculation run can also be started from the Geo-Database via **FUNDAMENTALS** - > DGM -> CALCULATE OBJECTS INTO DGM (*Shift+Ctrl+D*).

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3D check of the resulting DGM in the Geo-Database (Ctrl+F10):



#### Import DGM

Choose from the category **GEOMETRY** the calculation type **DGM IMPORT**.

In SoundPLAN you can import DGMs in the ITF format. ITF (Intermediate TIN Format) is a format to exchange DGMs which is described in the internet.

### Single point receivers sound (SPS)

A single point calculation calculates the levels at the manually entered receivers (free field points or assigned to a building). Single points are documented in the Result Tables. Results from different variants can be compared in the Spreadsheet. Single points can be displayed in the Graphics as small level tables [module Cartography] or with a colored scale as small symbols at the buildings [module Façade Noise Map].

6

Click on the tab "SPS" (Single Point Sound) to set additional parameters:

| General  | Settings      | Standards    | Assessment    | SPS  | Statistics | Description |     |
|----------|---------------|--------------|---------------|------|------------|-------------|-----|
|          | ection        | -            | ned facade an | -    |            |             | ade |
| Save res | sult tables   | for          |               |      |            |             |     |
| 🗹 Plain  | results       |              |               |      |            |             |     |
| Leve     | el charts     |              |               |      |            |             |     |
| Grou     | up results    |              |               |      |            |             |     |
| 🗹 Deta   | ailed results | 5            |               |      |            |             |     |
| Expe     | ert Industr   | у            |               |      |            |             |     |
| Prot     | ocol tables   |              |               |      |            |             |     |
| Settinas | for a sinc    | ale noint so | und calcula   | tion |            |             |     |

**Calculation Types** 

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The checkbox **CALCULATE REFECTIONS OF THE ASSIGNED FACADE AND IGNORE STANDARD DEPENDENT FAÇADE CORRECTIONS** means that regardless of the terms in the standard the reflection at the façade is calculated (default: unchecked).

Some standards suppress the reflection for the façade levels other use specially described corrections and yet others calculate the assigned façade. If a calculation area is contained in the data, receivers are only calculated within the calculation area.

A Nordic acoustics standard demands that reflections on objects on the "own" property shall not be part of the noise evaluation. The properties are entered as an area usage object. For single receiver calculations and Facade Noise Maps the calculation core in the calculation settings for /SPs or /Facade Noise Map contain a new checkbox **SUPPRESS REFLECTIONS OF OBJECTS ON OWN PROPERTY (NORDIC REGULATION)**. With this setting the area usages are evaluated and where needed the reflections are suppressed.

If a calculation area is in the data, only the receivers inside the calculation area are calculated.

#### **Tables for Single Point Calculations**

Select, which calculation results should be stored for the tabular and graphical documentation of the results.

#### Plain result tables:

- Receiver list
- Road emission table (if roads are contained in the data)
- Railway emission table (if railways are in the data)
- Source table (if industrial sources are in the data)
- Day histogram of the noise level at the receiver
- Emission frequency tale (if industrial sources are in the data)
- Emission day histograms (if industrial sources are in the data)
- Result table with frequencies (if industrial sources are in the data)

#### Level Charts:

• Level charts and pass-by level for railways (for presentation in the calculation core, the Result Tables and to include in the Graphics in a map)

#### **Group Result Tables:**

• Result tables of groups of sources

#### Detail-Result Tables:

- Result table for mean propagation and partial noise levels.
- Result table of assessed noise level contributions (if industrial sources are in the data)

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#### **Tables for Industry Expert**

Result tables for the Industry Expert Spreadsheet (generates vast amount of data!)

#### **Protocol Tables**

Protocol tables detailing the intermediate values for each standard. The
protocol tables generate huge files and will slow down any calculation,
therefore this option should be used only for selected receivers where every
detail of the calculation needs to be checked. For answers that look
implausible the protocol can be even used on a limited angular range to
check the details in the section where the user has doubts.

# **Grid Noise Map Calculations**

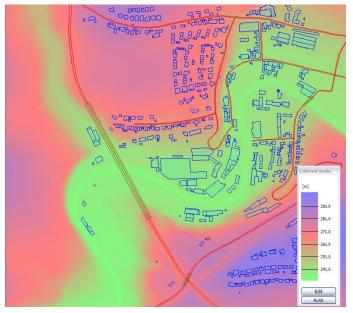
Grid Maps and the derived contour maps are the tools to visualize the noise at street level outside buildings and in nature. As the Grid Noise Map calculates reflections from all buildings, the levels can be up to 3 dB higher than Single Point Receivers Sound at the buildings. SPS receivers often suppress reflections at the "own façade" (exception is CoRTN). Comparing SPS receivers and Grid Noise Map receivers is only possible if the SPS receiver is located in front of the building and is not attached to the building. The angular area must be set to contain all 360 degrees.

The Grid Noise Map generates a grid of receivers over the calculation area defined in the Geo-Database. The seed address for the grid depends on the grid spacing and is always set in a manner that adjacent grids would have the same pattern of grid points. For the middle of each grid cell the noise level is either calculated or interpolated from the receivers around it.

The receiver grid can only be calculated within the elevation supply due to a DGM. If you activate the tab index card <u>graphics</u> (page 328) display in the beginning of the calculations, the terrain elevations are mapped according to a color scale for all grid points in the calculation area. This is helpful to inspect whether the DGM is smaller than the calculation area.

**Calculation Types** 

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Display of the terrain elevations before the noise calculation

As a correct elevation model is paramount for the noise propagation calculation, the colored elevation plot helps pinpoint problems in the model before the calculation actually starts. Errors can only be fixed in the Geo-Database.

Define the parameters under the Tab Grid Noise Map.

| General                                                                                 | Settings     | Standards          | Assessment   | Grid Noise Map        | Statistics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Description    |              |  |
|-----------------------------------------------------------------------------------------|--------------|--------------------|--------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------------|--|
| Calculate new Grid Noise Map     Grid space [m]     5     Height above ground [m]     2 |              |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
| ○ Recalculate Grid Noise Map                                                            |              |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
| Calculation area for recalculation:                                                     |              |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
|                                                                                         |              | أتار فسينا لياليني |              | and the second second | and the second s | and the second | and the last |  |
| -Grid inte                                                                              | rpolation    |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
| Min/Max                                                                                 | (dB) 1       | .0                 | Difference [ | dB] 0,15              | Field                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | size 9         | e ~          |  |
| Always interpolate below a threshold value [dB] of                                      |              |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                | )            |  |
| Save res                                                                                | sults additi | onally for         |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
| Anim                                                                                    | ated Grid N  | Noise Map (m       | oving train) |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |
| Grou                                                                                    | p results    |                    |              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                | >>           |  |
| Resu                                                                                    | lts of singl | e frequencies      | s [Hz]       |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |              |  |

Parameter definition for Grid Noise Maps

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**CALCULATE NEW GRID NOISE MAP** is used to calculate a Grid Noise Map for the entire calculation area, continue a Grid Noise Map that is already partially calculated or recalculate the Grid Noise Map after the geometry was altered. **RECALCULATE GRID NOISE MAP** (See "Correct or recalculate a Grid Noise Map" page 349) is used to recalculate a part of the noise map after a local correction to the date model has been made. The choice of **GRID SPACING** depends on considerations of accuracy, calculation time and memory/file size. In un-congested landscape a grid spacing of 20 to 50 meters (aircraft noise) is sufficient whereas in a city environment the spacing should be between 5 and 15 meters. The **RECEIVER HEIGHT ABOVE TERRAIN** sets the elevation of the receivers as the elevation interpolated from the DGM + the height entered. The default height above the terrain is defined through the options in the SoundPLAN Manager.

#### Interpolation during the Grid Noise Map Calculation

The calculation of the Grid Noise Map is organized in blocks of 9 by 9 receivers. From the entire map a sub-grid of 81 receivers is read into memory, calculated and then stored. The Distributed Computing distributes those sub-grids to the participating servers. The 4 corners of the blocks and the middle receiver are always calculated. Other receivers of the block are interpolated if the following conditions are fulfilled:

- The corners of the block and the middle are within the calculation area,
- the level of the middle of the block is between the minimum and maximum found in the block,
- all corners and the middle do not exceed the maximum spread allowed for the block defined in the field **MIN/MAX**,
- the deviation for the interpolation of the block middle does not exceed the maximal **DIFFERENCE**.

SoundPLAN averages the values of opposite corners and compares the result to the calculated value. For the middle of the block there are 3 values to compare, one calculated one and 2 interpolated ones. If the difference between the calculated and the interpolated one is smaller than the value entered in the field **DIFFERENCE** the rest of the block is interpolated. The default setting of 0.15 dB is conservative. Higher values will accelerate the calculations as the interpolation is less likely to be suppressed, however the accuracy will be reduced with higher settings.

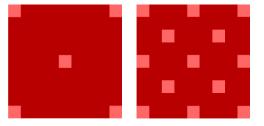
The **FIELD SIZE** defines the maximal size of blocks for the interpolation. Field size 1x1 entirely suppresses the interpolation of receivers. The following settings are possible:

- 1x1 no interpolation
- 3x3 interpolation block maximal with 9 receivers
- 5x5 interpolation block maximal with 25 receivers
- 9x9 interpolation block maximal with 81 receivers

**Calculation Types** 

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If all criteria are satisfied, all receivers in the block not already calculated will be interpolated. If not, the block is subdivided into 4 blocks and the same procedure starts again until all receivers of the block are either calculated or interpolated.



Interpolation, to the left all criteria are satisfied in the block of 81 points, to the right the criteria are satisfied after the dissection in 4 smaller blocks (dark red interpolated, light red calculated).

Depending on the settings of the interpolation criteria, the geometry and the terrain, the interpolated values may diverge from the calculated values.

To accelerate the calculation of Grid Noise Maps you can now opt to interpolate all results that are below a threshold value of xx dB. By default, all new calculations will now have the setting to always interpolate if the neighboring values are below 40 dB.

#### Store additional results

#### **Results for individual groups**

Activate the check box group results and select via the double arrow the groups that are used for this calculation.

The ALLOWED TOLERANCE in the tab *Settings* in any case needs to be set VALID FOR EACH GROUP CONTRIBUTION LEVEL, in order to have the levels of groups stay constant when other groups are added or taken out of the calculation. If detail tables are activated, the tolerance is calculated on the basis of each source partial noise level.

For the table type (Result Tables and Spreadsheet) and the graphical documentation of the results, the results can be presented either based upon group contribution levels or the sum level.

#### **Results for individual frequencies**

The results can be saved for **selected frequencies** and presented in the Graphics. In the tab *Grid Noise Map* in the section *save results additionally for* check **RESULTS OF SINGLE FREQUENCIES [HZ]**.

When you load the data in the Graphics, the graphics file manager checks if there are results frequency by frequency and will prompt you to select either the sum of all frequencies or an individual frequency.

#### Animated noise map

[D Graphics Animation] Only for railway noise calculations, the grid noise map can be displayed as a 2D or 3D animated noise map if **ANIMATED NOISE MAP (MOVING TRAIN)** is checked. Read "<u>Train animation</u> (page 642)" for details.

The animated noise map generates a level-time diagram for each grid point which leads to very big files. Because the interpolation of the results is disabled, the calculation time will be much more than for a normal Grid Noise Map.

#### Possibilities for the acceleration of Grid Noise Map calculations

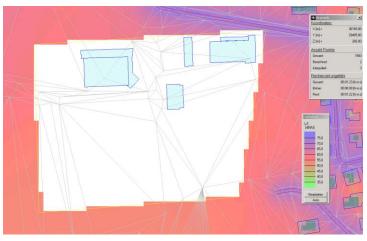
Depending on the area, the topographical conditions and accuracy requirements, the calculation of the Grid Noise Map can be accelerated by the following means:

- Check and maximize the interpolation criteria for the accuracy desired
- Decrease the reflection order
- Reduce refection distance at source and receiver
- Decrease the maximal search radius
- Increase the allowed tolerance

#### Correct or recalculate a Grid Noise Map

6

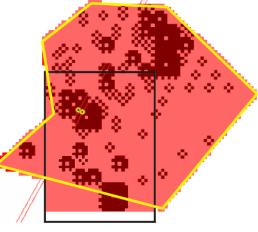
If you only want to recalculate part of the calculation area because in a section of the map the base data have changed but the change will not affect the entire map, activate the option **RECALCULATE GRID MAP**. Assign the Situation or Geo-File which includes the partial calculation area. The settings of grid spacing and height of the receivers above the ground are disabled for the correction calculations, these parameters are taken from the existing grid file. Click OK and start the calculation with New/Overwrite. The existing grid map is loaded; the grid cells within the recalculation area have been deleted.



**Calculation Types** 

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The results are re-calculated in a rectangle within the original calculation area. In the graphic below, the original calculation area is depicted with a thin yellow line. The calculation area for the re-calculation is shown with a thin black line. In the lower section of the noise map you can see the re-calculation area contains grid points outside the original calculation area which will be ignored in the re-calculation.



# Tables s

# Tables stored for Grid Map calculations

The results of Grid Noise Maps are only documented in graphical form, not in the format of single receivers. However, to check the calculation tables detailing the emission of the different noise types are generated:

- Road emission table (if roads are in the data)
- Railway emission table (if railways are in the data)
- Source table (if industrial sources are in the data)
- Emission day histograms (if industrial sources are in the data)

In the graphics the grid values and the contour lines can be exported in various file formats.

### **Cross-sectional Noise Map**

For the Cross-sectional Noise Map a vertical noise map is generated along the Cross-section line entered in the Geo-Database as the line type receiver. The elevation supply along this line must be assured. It is impossible to extrapolate elevations in areas without sufficient elevation data.

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| General Settings Standards Assessment Cross Section Map Description                                                                                                                   |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| Grid space [m] 2,5 Calculation height [m] 20                                                                                                                                          |  |  |  |  |  |
| Grid interpolation         Min/Max [dB]       10       Difference [dB]       0, 15       Field size       9x9 ∨         ✓ Always interpolate below a threshold value [dB] of       40 |  |  |  |  |  |
| Save results additionally for                                                                                                                                                         |  |  |  |  |  |
| Group results                                                                                                                                                                         |  |  |  |  |  |

With the **GRID SPACING** the spacing of the receivers is defined, the spacing is the same in height and along the Cross-sectional line. The spacing has big influence on the calculation time and the accuracy of the results. The **CALCULATION HEIGHT** determines the number if receivers in vertical direction relative to the receiver with the lowest elevation. Receivers are placed and calculated in an equidistant grid between the lowest terrain coordinate along the cross-sectional line to the top of the calculation area.

For Cross-sectional Noise Maps the same interpolation criteria apply as for the Grid Noise Map. Please read the paragraph "Interpolation during the Grid Noise Map Calculation (page 347)".

For Cross-Sectional Maps, too, you can additionally store the group results and the frequencies for individual results, see "<u>Store additional results</u> (page 348)". Checkmark the desired results.

#### Tables stored for a cross section map

- Road emission table (if roads are in the data)
- Railway emission table (if railways are in the data)
- Source table (if industrial sources are in the data)
- Emission day histograms (if industrial sources are in the data)

In the graphics the grid values and the contour lines can be exported in various file formats.

#### **Facade Noise Map Calculations**

The Façade Noise Map is featuring an automated single point receiver calculation where the receivers are generated for all facades enabled for the calculation and the calculation settings. As the receivers are generated automatically this mapping module is especially useful for big calculation areas. The result of a Façade Noise

**Calculation Types** 

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Map can be documented in tables or graphically as colored symbols at the buildings.

Manually entered single receivers (e.g. for free field points) can be calculated together with the Façade Noise Map. If a calculation area is included in the data, receivers for the Façade Noise Maps are only calculated in the area inside the calculation area, receivers on the outside are suppressed.

Facades of buildings connected to each other are recognized and skipped in the calculation. If one of the facades is higher than the other, the higher one will have receivers calculated only in the section that is 0.5 m above the adjacent building.

Define the parameters under the Tab Façade Noise Map.

| General Settings Standard                                                                                                                      | s Assessment     | Facade Noise Map        | Statistics | Description |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------|------------|-------------|--|--|--|--|
| Calculate new Facade No                                                                                                                        |                  |                         |            |             |  |  |  |  |
| Recalculate Facade Noise Map     Calculation area for recalculation:                                                                           |                  |                         |            |             |  |  |  |  |
|                                                                                                                                                |                  |                         |            | ~~          |  |  |  |  |
| • One receiver in center of                                                                                                                    | facade           |                         |            |             |  |  |  |  |
| O Two receivers at the corr<br>Indention in                                                                                                    | ers of the facad | le with an indention of | f 1        |             |  |  |  |  |
| O Receivers with spacing [n                                                                                                                    | ]                |                         | 2          | ,5          |  |  |  |  |
| O Receivers with spacing a                                                                                                                     | c. to VBEB       |                         |            |             |  |  |  |  |
| additional receivers 2 m ir                                                                                                                    | front of facade  | e (EU-Directive         |            |             |  |  |  |  |
| Distance to facade [m]                                                                                                                         |                  |                         | 0          | ,01         |  |  |  |  |
| Receivers in height above                                                                                                                      | ground [m]       |                         | 4          |             |  |  |  |  |
| Search range defined by                                                                                                                        | facade           |                         |            |             |  |  |  |  |
| Calculate reflection of as<br>correction                                                                                                       | igned facade ar  | nd ignore standard de   | pendent fa | cade        |  |  |  |  |
| Suppress reflections of o                                                                                                                      | jects on own pr  | operty (Nordic regula   | tion)      |             |  |  |  |  |
| Ignore buildings for the propagation calculation which have the appropriate flag in the "additional" tab index card of the building properties |                  |                         |            |             |  |  |  |  |
| Save result tables for                                                                                                                         |                  |                         |            |             |  |  |  |  |
| ✓ Plain results                                                                                                                                |                  |                         |            |             |  |  |  |  |
| Level charts                                                                                                                                   |                  |                         |            |             |  |  |  |  |
| Group results                                                                                                                                  |                  |                         |            |             |  |  |  |  |
| Detailed results                                                                                                                               |                  |                         |            |             |  |  |  |  |
|                                                                                                                                                |                  |                         |            |             |  |  |  |  |

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With checking the click-box **ONE RECEIVER INT HE MIDDLE OF EACH FACADE** each facade will have one receiver in the middle. For aircraft noise calculations, you can select to calculate only one receiver per building.

One receiver in center of facade

🦳 Only first facade per building

You can request **TWO RECEIVERS AT THE END OF EACH FACADE** with a defined spacing in [m] or [%] from the corner. This might be sensible when the building is very close to a congested road where a single receiver would not represent the noise levels on the façade correctly. The entry in [%] is used when receivers should be moved in from the corner by a defined percentage of the façade length.

| Two receivers at | 16,7  |   |
|------------------|-------|---|
| Indention in     | ○ [m] | , |

Place the receivers in a defined distance to each other in [m] with **RECEIVER WITH SPACING OF**. If you want to have a 3D presentation of the Façade Noise Map, a close spacing (1 meter spacing) of the receivers is producing a nice presentation, however the calculation time will be by magnitudes longer than with only a single receiver per facade:

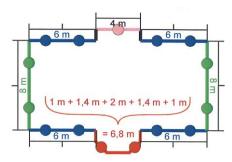


The VBEB (Germany - Preliminary standard for the evaluation of affected people according to the EU Directive) defines how to generate the receivers at the buildings for projects according to the EU directive in Germany. But the distribution of the receivers has proven to be very useful also for other types of investigations and non-German areas, as it generates a sensible distribution of inhabitants and dwelling units as long as the accounting does not require setting the loudest level as default for the entire building (in this case this procedure generates too many receivers and unnecessary long calculation times).

Select **RECEIVERS ACCORDING TO VBEB** to automatically generate the receivers according to VBEB:

**Calculation Types** 

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- Facades longer that 5 meters are divided into smaller segments for which a single receiver is calculated.
- Facades with a length between 2.5 meters and 5 m are represented by a single receiver
- Smaller facades are ignored except if multiple subsequent facade segments reach the combined length of more than 5 meters. In this case the combined façade is then treated as a façade longer than 5 meters and if needed subdivided into 5-meter sections.

Receivers are generated as soon as one facade is highlighted for the Facade Noise Map.

The **DISTANCE TO THE FACADE** defines how far in front of the facade the receivers shall be located. Some standards have specific requirements for this (CoRTN, for example, locates the receiver 1 meter in front).

Click **RECEIVERS IN HEIGHT ABOVE GROUND** if you want to calculate one receiver in a defined height above ground instead of calculating receivers for each floor (e.g. for calculations according to the EU Directive).

The checkbox **CALCULATE REFECTIONS OF THE ASSIGNED FACADE AND IGNORE STANDARD DEPENDENT FAÇADE CORRECTIONS** means that regardless of the terms in the standard the reflection at the façade is calculated (default: unchecked). Some standards suppress the reflection for the façade levels other use specially described corrections and yet others calculate the assigned façade.

In urban land use planning, when the exact position of the buildings is not yet known the property boundaries might be regarded as buildings without height. In this case only the noise in front of the façade is to be taken into account. Activate the checkbox LIMIT SEARCH ANGLE BY OWN FACADE (180°). You should not use this check box for other correct geometries.

In some cases shielding and reflections from buildings must to be suppressed for buildings specially marked in the building properties. You can do so with the checkbox **IGNORE BUILDINGS FOR PROPAGATION CALCULATION WHICH**...

A Nordic acoustics standard demands that reflections on objects on the "own" property shall not be part of the noise evaluation. The properties are entered as an area usage object. For Single Receiver Calculations and Facade Noise Maps the

calculation core in the calculation settings for /SPs or /Facade Noise Map contain a new checkbox **SUPPRESS REFLECTIONS OF OBJECTS ON OWN PROPERTY (NORDIC REGULATION)**. With this setting the area usages are evaluated and where needed the reflections are suppressed.

#### Reset building IDs

If the presentation of the **Facade Noise Map** does not present the facades or does not fill the building, often this is due to the fact that buildings have been copied and thus the building ID from the Façade Noise Map no longer matches the building ID of the geometry from the situation or Geo-File. To rectify this problem, open the calculation core, *right click* on the calculation run in question and select the action **RESET BUILDING ID** from the menu. After the confirmation, all building IDs in the Facade Noise Map will be reset to the value found in the building geometry.

#### Tables for the Façade Noise Map

Define what **RESULT TYPES** for table type and graphical presentation you want to generate. Normally the **SIMPLE RESULT TABLE** is sufficient for the Facade Noise Map.

#### Simple result tables

- Receiver table
- Road emission table (if roads are in the data)
- Railway emission table (if railways are in the data)
- Source table (if industrial sources are in the data)
- Receiver day history
- Emission day histograms (if industrial sources are in the data)
- Emission frequency table (if industrial sources are in the data)
- Receiver frequency table (if industrial sources are in the data)

#### Level charts:

• Level charts (for the display in the calculation core, the Results Tables detail table under "Details + Graphics" and in the Graphics)

#### Group results:

• Result table of groups

#### Detailed result tables:

- Result table of groups
- Result table of the mean propagation conditions and partial noise levels
- Result tables of assessed partial noise levels (if industrial sources are in the data)

# It is not recommended to store level charts and detailed result tables. This option will create vast amounts of data and extend the calculation time!

**Calculation Types** 

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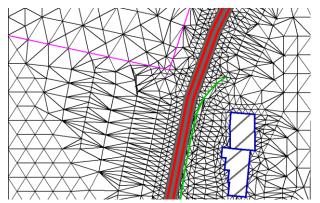
# **Meshed Noise Map**

[Modules Grid Noise Map + Façade Noise Map] The Meshed Noise Map is a series of single point receiver calculations where the location of the receivers is determined by an iterative triangulation analog to the DGM. For the graphical results the wire mesh of the triangulation is used to interpolate the location of the noise contour lines. Contour lines then are drawn using color scales.

For detailed investigations and especially for industry noise, the Meshed Noise Map offers a better accuracy than the Grid Noise Map. The Meshed Noise Map achieves the better mapping quality by using more receivers where the noise levels are changing and having a coarser wire-mesh where the noise levels are only changing gradually. If the detail tables have been stored, you can display single frequencies or frequency bands in the Graphics.

The Meshed Noise Map only calculates receivers in one elevation that is calculated from the terrain elevation of the elevation DGM and the relative height of the wiremesh above ground.

Please do not use Meshed Noise Maps for large areas such as noise maps for whole cities or districts! You will probably run into problems regarding memory and file size! For these types of investigation, the Grid Noise Map is always the better choice.



Triangulation in the Meshed Noise Map

The picture above shows the different density of receivers in the free field and around buildings, barriers and the source lines.

Receivers are generated along the following objects:

- Road edges
- Railway lines, industrial line sources (left and right at a distance of 1.25 meters)
- Facades
- Noise protection walls

- Front and back side of the plateau of berms
- Area usages
- Around point sources, the program sets 4 receivers one meter from the point source
- The points of an area source are used as receivers for area sources.

Free field points lying on road bands, railway bands or within area sources are not included in the list of receivers.

| General                                                                                                 | Settings     | Standards | Assessment | Meshed Noise Map | Descriptio | n |  |
|---------------------------------------------------------------------------------------------------------|--------------|-----------|------------|------------------|------------|---|--|
| Receiver spacing [m]     10     Height above ground [m]     2       Free field grid size factor     1,5 |              |           |            |                  |            |   |  |
| Save result tables for                                                                                  |              |           |            |                  |            |   |  |
| ✓ Plain results                                                                                         |              |           |            |                  |            |   |  |
| Level charts                                                                                            |              |           |            |                  |            |   |  |
| Group results                                                                                           |              |           |            |                  |            |   |  |
| Deta                                                                                                    | iled results | S         |            |                  |            |   |  |

In the first step the Meshed Noise Map is setting receivers along the mandatory line elements of the table above. The position of the receivers is determined by following the line elements and placing receivers in the set **RECEIVER SPACING**, the elevation of the receiver is calculated from an interpolation of the DGM and the **HEIGHT ABOVE GROUND** parameter. After this initial placement the receivers are iteratively triangulated and if the triangles proved bigger than the receiver spacing around the original line elements and bigger than the receiver spacing **\* FREE FIELD FACTOR**, receivers are inserted in the middle of the triangles and the procedure starts anew until all placement criteria are met.

Terrain checking: Within the iterative distance checking, the program interpolates and uses the DGM to check the height of the middle between 2 receivers. If the interpolated and actual elevation varies by more than the set height of the map above the ground, the program includes the point in the list of receivers.

This allows more thinning of receivers in the free field than before (bigger grid size factor in the free field).

#### Tables for the Meshed Noise Map

#### Plain result tables:

- Receiver table
- Road emission table (if roads are contained in the data)
- Railway emission table (if railways are in the data)
- Source table (if industrial sources are in the data)

• Emission day histogram table (if industrial sources are in the data)

#### Group results:

• Result tables for groups

#### Detail tables:

• Contribution noise levels. For Meshed Noise Maps based on octave or 1/3 octave band calculations, you can show single frequencies or a special frequency band, if you activate the detail tables.

### **Indoor calculations**

Use the Indoor Noise module to execute the following calculations:

- Single point sound. Day histograms and assessments are considered.
- SPC calculation (sound propagation curve). Enter a sound propagation curve with 2 points (VDI 3760)
- Measurement path (SPD)
- Indoor Noise + Grid Noise Map: If no calculation area is part of the Situation (smaller than the industrial building), select the industrial building as calculation area.
- Calculation from inside the industrial building to the outside. All components, defined as sound sources must have the setting "Li(Calc)+c-R". Day histograms of the indoor sound sources are not taken into account!
- Indoor Noise + Cross Section Map: Calculation of a cross section within the industrial building.

SoundPLAN automatically creates result tables for indoor to outdoor calculations and for sound propagation curves. For the other calculation types, define the stored results (indoor noise single points) or grid distance and interpolation criteria (grid noise map / grid cross sectional map) in separate tab index cards.

#### Calculation according to VDI 3760

The calculation method used in the SoundPLAN Indoor Factory Noise Model is extending the concept of the of "Spiegelquellenverfahren mit Streuung" = "Mirror Source Method with Scattering" (according to Kutruff & Jovicic) as it is described in the German VDI 3760. The calculation of the sound pressure level is considering the room parameters sound power of the source, density of scattering objects, and absorptive properties of scattering objects and all other surfaces in the building. The calculation is split into a direct component and a scattered component.

#### **Direct Noise Component**

$$E_D = \left(\frac{P}{4\pi cr^2}\right)e^{-(q+m)r}$$

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- P = sound power of the source
- q = scattering object density
- c = speed of sound
- r = distance source to receiver

m = air absorption coefficient

#### **Scattered Noise Component**

$$E_S = (\frac{3qP}{4\pi cr})e^{-r\sqrt{3qa}}$$

P = sound power of the source

q = scattering object density

c = speed of sound

- r = distance source to receiver
- a = absorption coefficient (contains the absorption of scattering objects and the absorption of ceiling and floor)

The noise level is the sum of the direct and the scattered component summed up with direct and reflects paths.

$$E_{Ges} = \sum_{nx=-\infty}^{nx=+\infty} \sum_{ny=-\infty}^{ny=+\infty} \sum_{nz=-\infty}^{nz=+\infty} \rho_{nx} \rho_{ny} \rho_{nz} E_D + \sum_{nx=-\infty}^{nx=+\infty} \sum_{ny=-\infty}^{ny=+\infty} \rho_{nx} \rho_{ny} E_S$$

 $\rho$  = absorption coefficient of the walls

The standard procedure is extended by the evaluation of mitigation effects:

$$E_{Ges} = f_D * E_D + f_S * E_S$$

The screening objects in the factory building cause a mitigating effect that for the direct noise is calculated from the extra path length the noise has to travel over the obstacle and for the scattered noise component the ratio of the areas permitting transmission versus the areas blocking the transmission.

#### Calculation parameter VDI 3760 in the Calculation Kernel

| General Indoor No     | se SPS Description                                                                                              |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|
| Tolerance [dB]        | 0,50 🕃 Weighting dB(A) 💌                                                                                        |
| and the second second | المحادث |
| Assessment            | Leq 06-22   22-06   00-24                                                                                       |

**Calculation Types** 

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Enter the tolerance and the weighting filter in the tab index card *Indoor Noise*.

The **TOLERANCE** determines the number of calculated reflection orders. The level increase at the receiver gets smaller from one reflection order to the next. The expected total level can be estimated from the history of the level increase. The calculation is cancelled when the expected level increase for all further reflection orders is less than the entered tolerance.

Use the double arrow to open the properties of VDI 3760 (humidity, air pressure and temperature).

# Calculation according to a Sound Particle Model with Diffraction (SPD)

#### Introduction

Sound Particle Diffraction is a method of simulating sound propagation and may be used to make a prediction of sound levels and acoustic parameters at a chosen point in the vicinity of one or more sound sources. It belongs to a family of methods known as "geometrical acoustics" and is strongly related to ray tracing methods. A feature of all geometrical acoustics methods is that they do not implicitly include wave effects such as interference and diffraction – approximate procedures must be added to recreate this physics. However, by taking a more approximate approach, the geometrical methods make themselves much more practical for use in room and environmental acoustics than fuller wave-based methods. These often take too long to perform the necessary calculations, even if the heavy memory requirements allow them to be performed on a normal computer in the first place.

Sound Particle Diffraction is an extension of Sound Particle Simulation Methods, which, along with their algorithmic relatives, have been in use for many years in indoor acoustics. The basic sound particle method looks rather like someone throwing bouncy balls around a room in various directions. The particles bounce off the walls and objects in the room (specularly or diffusely). The method is better suited to reverberant situations than the mirror-source techniques typically used for outdoor noise. The simulation checks each deflection to see if the particle's path would take it through a receiver, represented by some finite volume. If there is an intersect, energy is added to the receiver. Effects such as averaged room scattering and transmission may be considered. However, a suitable method of recreating diffraction effects has proved to be a challenging problem.

The SoundPLAN Sound Particle Diffraction module is based on recipes developed and tested over many years by Prof. Uwe Stephenson and co-workers at the HafenCity University in Hamburg, known as "Uncertainty-based diffraction". Although an approximation, it has been shown to compare favorably with more time-consuming wave-based diffraction procedures and represents a considerable improvement over the "detour" methods that have been traditionally used in noise standards. The method works by noting when a particle flies past a diffraction edge

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("virtual walls" are extended out from the edge to check for intersections) and the particle is assigned a new angle based on how closely it bypasses the edge.

#### Some general points to watch out for

Sound Particle Diffraction (SPD) simulations operate with a slightly different calculation philosophy than users may be used to from other calculation methods. We therefore start by making a few points and recommendations to help avoid confusion and annoyance.

SPD is designed to work at relatively short range, so we restrict the situation area radius. Please don't try and input anything intended for an SPD simulation that's larger than 1 km.

When setting up your situation, it's worth starting with a very crude model and then progressively adding detail, testing with each new addition

A common mistake made by inexperienced users of noise control software in general is to assume that greater input detail gives more accurate results – the critical factor is often lack of knowledge of the absorption properties of surfaces, not the lack of centimeter geometrical precision.

SPD goes through a range of involved geometrical procedures to enable diffraction and increase simulation efficiency – situations with more than a few hundred polygons may experience issues with computer memory shortages.

Due to the nature of the procedures that set up the diffraction during the preparation phase, it is possible the algorithms may reach a point where they are unable to decide how to best to proceed and issue an error report – in these cases, please contact support. More complicated situations have a higher probability of running into trouble here.

Run times increase with the number of frequencies. Don't use more than you need, six or seven bands are often sufficient (bear in mind, however, that the calculations work out which frequency bands to use based on the source or surface with the lowest level of definition).

Run times increase with the number of sources – if insignificant sources can be identified and deleted, this will save time.

When setting up the situation in the editor, do use the "duplicate" function with its transformation capabilities instead of putting in similar objects individually by hand. Duplication often allows us to make some efficiency-gaining simplifications.

SPD simulations are "statistical" and don't necessarily have a well-defined end point, they fluctuate and progressively converge towards stable results

The simulations naturally come with random fluctuations which reduce the longer the calculation is run for. These vary from receiver to receiver, from location to location, and between repeat runs – don't be surprised if you repeat a run and the results come out slightly different, this is normal. Areas with higher sound levels have lower fluctuations than those with lower sound levels.

**Calculation Types** 

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The simulations define a "tolerance", the minimum level of fluctuations that the results should exhibit before the simulation pronounces itself satisfied and stops automatically.

We give the user greater responsibility for inspecting the results as they progress and decide when they want to stop.

Some receivers may converge very slowly, even if all others converge quickly. The calculation only stops automatically when ALL receivers have either converged or have received no signal at all.

Regarding the previous point: it can happen (especially for loose tolerances and multiple sources) that some receivers register no signal when something would be expected. If this appears to be the case, try reducing the tolerance and repeating the run.

Receivers close to walls require extra effort to converge – don't be surprised if the fluctuations here are large and the convergence slow.

Receivers close to diffracting edges and corners require even more effort.

Well-shielded receivers that are hard to reach with reflected sound (e.g. those in sealed rooms or shielded in a free field situation) also tend to converge slowly.

Receivers that are far away from all the sources converge more slowly, especially in free-field.

A noise map or cross section is likely to put receivers in "harder-to-reach" places. Please bear this in mind, monitor the results, and end the calculation as appropriate to your circumstances – if you are checking for legal noise thresholds, you may find the relevant areas have all sufficiently converged and the calculation is being held up by some irrelevant, quiet areas.

Please note that neither the tolerance nor the statistical fluctuations represent the total error/uncertainty in the results, they merely provide an estimate of the statistical error. Uncertainties due to input parameters can create errors/uncertainties that greatly exceed this statistical error. Furthermore, the mathematical models use approximations that contribute to systematic errors.

Even the best measurement systems can have trouble with reproducibility below a few tenths of a decibel. Our 0.1 dB minimum tolerance setting is therefore unlikely to serve any purpose beyond making noise maps look more aesthetically pleasing due to increased smoothness.

There's no point in spending time nailing down accuracy below a situation's natural noise floor (even a very quiet room has a background level of around 20-30 dB).

Remember that the larger the level drop you are trying to simulate, the longer it will take – if it looks like a receiver will have a level 30-40 dB below the sound power of the sources, this is unlikely to go quickly.

When using grid maps, keep receiver grid spacings as large as you can. Remember that large numbers of receivers can noticeably slow down both the preparation stage and the sound particle run itself.

SoundPLAN graphics routines provide smoothing of grid maps, so it's worth starting with a relatively low resolution and later dialing it up to what you need.

(For those with Room Acoustics licenses) If you're interested in doing speech intelligibility with STI, don't forget to define all sources and absorption spectra with the 7 octave bands 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz.

#### SPD calculation properties

| General                                                                                                         | Indoor noise       | Assessment  | SPS      | Description                    |
|-----------------------------------------------------------------------------------------------------------------|--------------------|-------------|----------|--------------------------------|
| _                                                                                                               |                    |             |          |                                |
| Sound                                                                                                           | l Particle Diffrac | tion        |          | ~ >>                           |
| dB-we                                                                                                           | ighting            | dB(A)       | $\sim$   |                                |
| Allowe                                                                                                          | d tolerance [dB]   | I           |          |                                |
| 1,00                                                                                                            | holds fo           | r Total lev | el of ea | ch Leq-time slice $\checkmark$ |
| Allowe<br>30,0                                                                                                  | d room acoustic    |             |          | %]<br>om all sources ~         |
| Receiv                                                                                                          | er radius [m]      | 0,50        |          |                                |
| Enable near-field corrections (useful for situations with low reverberance)                                     |                    |             |          |                                |
| $\bigtriangledown$ Deactivate receivers with a signal below the background noise and set the level to the noise |                    |             |          |                                |
| Ignore receivers with no airborne route to sources                                                              |                    |             |          |                                |
| 🗹 Diff                                                                                                          | fraction enabled   |             |          |                                |
| Max. r                                                                                                          | un time (minute:   | s] 30       | •        |                                |

Click the "Indoor noise" tab – this will take you to the SPD calculation properties. These are normally displayed by default; if they are not, please select "Sound Particle Diffraction" from the uppermost drop-down menu.

At the top of the SPD Indoor Noise panel, you can specify your **DB-WEIGHTING** (dB, dB(A) etc.) as usual.

We recommend that you accept the defaults for "Tolerance", "Receiver size" and "Diffraction enabled" at least for getting started.

An important control is the **TOLERANCE** setting - it is worth taking a bit of time to understand what this does. We implement our sound particle method as a socalled "statistical" procedure. This means that if you were to send off infinitely many sound particles, the results would look smooth and the same every time. Using a finite number of particles means the results have fluctuations and

**Calculation Types** 

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variations between runs. The longer you run for and the more particles you send off, the smaller these fluctuations become – we say that the results "converge".

The **TOLERANCE** setting specifies how much the results should converge before the calculation stops. If you halve the tolerance from 1.0 dB to 0.5 dB, the calculation will take about 4 times as long, the number of particles received by the receivers will go up roughly by a factor of 4, and the level of fluctuation in the results will go down by about one half.

For those familiar with statistical errors – the tolerance and the statistical fluctuations seen in the results do not map one-to-one with the standard deviation (this is because we do not necessarily always deal with normal distributions) but in many situations, they will be similar. As is also the case with standard deviations, the spread of results from repeat calculations will almost certainly include results outside the tolerance range.

You can decide if the **TOLERANCE** should apply to the **SOUND LEVEL AS A WHOLE** (default) or if you wish to aim for the tolerance level of uncertainty for **ALL INDIVIDUAL FREQUENCY LEVELS** (normally takes longer). Bear in mind that if a receiver is reliant on diffraction for sound contributions, the high frequencies may be extremely reluctant to converge.

With the **RECEIVER RADIUS** you define the size of the receiver sphere. Sound particles must work with finite-sized receivers (we use spheres) and the general rule is to go as big as you can justify. If you halve the receiver radius, the calculation can take up to 8 times as long because the receiver must "catch" particles as they fly by in 3D. The disadvantage of large receivers is that the sound level you calculate lacks spatial precision – you get an average of the field across the volume of the receiver.

The receiver radius you set on the panel sets the default maximum size for a receiver. However, in some cases it is necessary for us to automatically reduce the receiver size to enable accurate results. This is especially true when a receiver lies close to a diffracting edge so don't be surprised if receivers close to edges take longer to converge.

When automatically adjusting the receiver size, we do not go below 0.1 m radius. It is therefore possible that anomalies can occur on this length scale close to diffraction edges; our experience suggests this is an acceptable compromise for our users.

In order to speed up the calculation, the **NEAR FIELD CORRECTION** can be switched off, in addition, **QUIET RECEIVERS** that fall below the level of background noise and immission points **WITHOUT AIRBORNE ROUTE TO A SOURCE** can be ignored.

elect which **INDUSTRIAL BUILDING** to use - the "Select Industrial Building" drop-down menu in the panel allows you select which industrial building you want to use. SPD calculates only one building per run so if there is more than one building in the situation, please select the you want to calculate. Otherwise, the first building in the list is chosen automatically.

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Select the calculation area – if you have more than one calculation area defined in the situation in the data, you can choose which to use with the corresponding drop-down menu on the panel.

Set grid map properties, if relevant. If you are calculating a noise map or crosssection, you have the opportunity to specify the resolution (and height) in the separate "Grid" tab.

Select the ASSESSMENT TYPES you wish to use.

Start the calculation: Close the Run Command Editor (it will save your settings automatically). Select the run you want to start and hit "**START SINGLE CALCULATION**" (you can, of course, click "Start all runs checked for calculation" to run the entire list of calculations). Assuming no errors, the calculation will process the geometry and then begin launching sound particles. If you have forgotten to define necessary properties in the situation, an appropriate error message will be displayed.

Monitor your run: Click on the graphics tab – this provides a color-coded display of your receivers.

Right-clicking on a receiver gives the current estimate of its level and the associated statistical error along with any other specified assessment types. Stop the calculation and save the current results by clicking the red square "CANCEL CALCULATION" button".

You can always pick up where you left off by restarting the calculation and selecting "Continue" when the "Result exist" window appears.

With the check box **DIFFRACTION ENABLED** you can optionally turn the diffraction on and off. Sound Particle Diffraction uses an innovative procedure to calculate sound diffraction with better accuracy than with the traditional noise standards. It is, however, possible to turn diffraction off (e.g. for comparison purposes) using the "Diffraction enabled" checkbox on the "Indoor noise" tab of the "Run Command Editor". In these circumstances, a calculation may run faster.

**METEOROLOGICAL CONDITIONS:** Relevant air conditions can be edited by clicking the double arrow >> button next to "Sound Particle Diffraction" at the top of the indoor noise tab in the run properties. Humidity, air temperature and air pressure can be specified under the "Environment" tab, while the method used for air absorption can be specified under the "Standard" tab.

### Calculation of room acoustics parameters

Users with a room acoustics license can ask SoundPLAN calculations that use the Sound Particle Diffraction method to estimate room acoustic parameters. The current list of available parameters is:

- Reverberation time (T60, calculated using either a T20 or T30 procedure)
- Speech Transmission Index (STI) male voice, female voice, and average
- Early Decay Time (EDT)

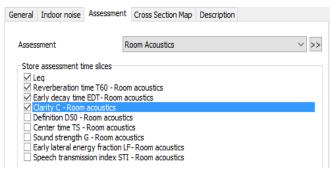
- Clarity (C80, C50)
- Definition (D50)
- Centre Time (TS/CT)
- Sound Strength (G)
- Early lateral energy fraction (LF)

Furthermore, SoundPLAN calculates the parameters required to assess buildings and rooms according to the standards ISO 3382-3, E VDI 2569 and DIN 18041.

Room acoustics are available in the calculation types "Single Points" and "Indoor Measurement Path".

### Single Point Calculations

In the tile rating via the double arrow, select the room acoustics rating element. (If this item does not yet exist in your system library, perform a system update through the SoundPLAN Manager **HELP** -> **UPDATES & DOWNLOADS**.) Select the parameters you want to calculate:



### Measurement Path Calculations

Measurement path calculations are tailored to the requirements of the guidelines ISO 3382-3, E VDI 2569 and DIN 18041. The required types are automatically activated; hence no "Assessment" tab sheet appears in the Run Command Editor for this calculation type.

Reverberation times are estimated using T20.

### **IMPORTANT NOTES**

As of SoundPLAN version 8.1, the default method for calculating room acoustic parameters is a linear regression analysis of the level decay curve, which is done without storing the echogram. This drastically reduces the memory requirements, and, in our experience, converges with less computational effort.

A portion of the early sound field is ignored since this can bias the analysis. The Schroeder method is still available (for single point and measurement path calculations, not grid calculations) and may be selected in the *SPS* tab index card of the Run Settings. If selected, the program will calculate room acoustics using stored

echograms and backward integration. In addition, it will output the echograms to the results tables, and as text files in the results folder.

Please note that although widely used, the Schroeder method can have issues in a sound particle context. In particular, if the late "tail" of the echogram is sparsely described with only a few particles, there is tendency for the method to overestimate reverb times, even if the estimated statistical uncertainty is low. A warning is given in these cases. We recommend running calculations several times with different tolerance levels to gain a feel for how the results are responding (lower tolerances result in longer run times and hence better results statistics).

For the DIN 18041 we do not explicitly issue an "A" classification for the result tables. This is because the category "A" is not defined by strict limits, but by recommended values that depend on the intended use of space. However, the reverberation times are available to the users in order to be able to make an appropriate assessment here.

The calculation results are documented in the result tables.

### File operations as calculation run

File operations can be executed either in the Graphics and in the Spreadsheet or in the calculation core. If you want to store the result of a file operation, it is mandatory to use the calculation core.

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If you have for example calculated road and railway noise independently and want to further evaluate the overall noise level, it is mandatory to store the file operation. Only this way the Spreadsheet and the Graphics can further process the result of the operation. By this it is possible to generate inhabitant or area statistics for summed-up results.

Calculation type:

| Tools | Grid operation                                                                     | . <b>~</b> |
|-------|------------------------------------------------------------------------------------|------------|
|       | Grid operation<br>Facade map operation<br>Grid noise hotspots<br>Grid noise import | €.         |

Go to the calculation core and add a new calculation run. In the tab index card *General* enter a run title and select from the calculation type **TOOLS** the **GRID OPERATIONS** or the **FAÇADE MAP OPERATIONS**.

For façade map operations the data entry as well as the DGM selection is invisible. For grid operations you can optionally assign a DGM. This is not necessary, if you use SoundPLAN grid noise maps as base files, because the elevations are automatically taken from the grid noise map. If you anyway assign a DGM the grid elevations are newly determined. The selection of a DGM is sensible, if you use ESRI-ASCII grids (which don't have elevations) as base files. This way ESRI-ASCII grids are supplied with elevations during the grid operation.

**Calculation Types** 

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Go to the tab index card *File operation* and enter a new file operation with •.

A calculation run can host several time slices or different operations.

| neral File operation | Description |                        |
|----------------------|-------------|------------------------|
| ormula               |             |                        |
|                      | • • •       |                        |
| Time slice ID        | Unit        | Time slice name        |
| LrD                  | dB(A)       | Assessment level day   |
|                      | dB(A)       | Assessment level night |

The dialog to define the file operation is opened automatically. Fill in the file operation as described in "<u>Procedure for the file operations</u> (page 606)" in the Graphics chapter.

If you define file operations with several time slices, the grid map(s) used as base file(s) must cover the same (calculation) area for grid operations; for façade map operation(s) the façade noise maps used as base map(s) must contain the same receivers.

Enter a time slice ID and a time slice name and change the unit if necessary. This information is displayed in the Spreadsheet and Graphics file selection manager and can be used as text variables in the Graphics.

Optionally you can use the formula of the file operation as time slice name, for example to document the selected operation. To do so activate the check box **USE FORMULA AS TIME SLICE NAME** in the file operation dialog.

📝 use formula as time slice name

Time slice name BKL1:1 ++ BKL2:1;

Use  $\square$  to edit the file operation of the current time slice. With  $\blacksquare$  you add a new time slice and access the dialog to define additional operations.

Use — to delete a file operation.

When calculating a facade map operation all information for the receivers is taken from the base file(s). The limits are only filled in if the number of time slices in the file operation definition is the same as number of time slices in the base file(s).

Grid and facade map operations are stored with the file names RROPxxxx.RES (grid operation) or RGOPxxxx.RES (façade map operation).

*Hints: If you received ESRI-ASCII grids for different time slices you can import them with the file operations to the SoundPLAN grid structure.* 

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### **Hotspot-Calculation**

Hotspot maps are used to visualize areas with high noise pollution. They are very clear to read and are therefore often provided for public relation work.

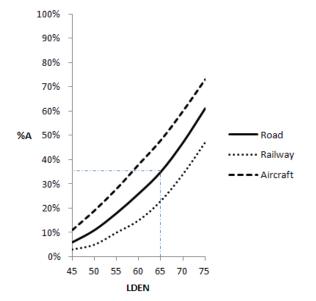
If the basis is a Façade Noise Map the inhabitants are distributed to the calculation points at the building. If a Grid Noise Map is used instead, VBEB points are generated at all buildings with inhabitants and the inhabitants are distributed to the generated points.

Normally the Façade Noise Map should be used as basis for hotspots. The result of a hotspot calculation with a Grid Noise Map shows a higher number of annoyed people because of the reflection at the building.

For the hotspot calculation the whole area is divided into grids of  $10 \times 10$  m. It is then evaluated for each grid cell how many inhabitants are affected by noise within a perimeter of 100 m.

The calculation of the annoyance from the levels of the grid is done on the basis of the Medima curves from the "Good Practice Guide on Noise Exposure and Potential Health Effects" (Technical Report 11/2010) or by using threshold values. Afterwards the annoyed inhabitants are normalized to "inhabitants/km<sup>2</sup>".

Example curve for Lden according to the "good practice guide":



The number of how many people (in %) feel annoyed when the certain Lden level is exceeded is different for road noise, railway noise and aircraft noise.

For road noise the curve refers to the formula

% A = 1,795 \* 10  $^{-4}$  (L<sub>den</sub> -37)<sup>3</sup> + 2,110 \* 10  $^{-2}$  (L<sub>den</sub> -37)<sup>2</sup> + 0,5353 (L<sub>den</sub> -37)

**Calculation Types** 

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Example (thin blue line in the picture above): If a receiver has the level 65 dB and 0.7 inhabitants are assigned to this receiver, the curve shows that 35 % of the inhabitants feel annoyed, which results to 0.24 annoyed for this receiver.

### **Calculate Hotspots**

For the hotspot calculation you need:

- Calculated Façade Noise Map or Grid Noise Map
- Situation (or Geo-File) with buildings and assigned inhabitants
- Calculation area
- DGM (for the 3D presentation)

Select in the run properties the  $\ensuremath{\mathsf{CALCULATION\ TYPE}}$  "Grid Noise Hotspots" in the category "Tools".

| Calculation type: |   |                     |   |
|-------------------|---|---------------------|---|
| Tools             | • | Grid noise hotspots | - |

Under **DATA** enter the situation with the buildings and the inhabitants, a calculation area and the already calculated Façade Noise Map or Grid Noise Map.

Define the parameters for the calculation in the tab index card "hotspots":

| rid definition |               |                        |   |                        |
|----------------|---------------|------------------------|---|------------------------|
| Grid space [r  | n]            | 10                     |   |                        |
| otspots defin  | ition         |                        |   |                        |
| Calculation    | method        |                        |   |                        |
| Within         | radius        |                        |   |                        |
| Sear           | ch radius [m] | 100                    |   |                        |
| 🔘 Within       | grid cell     |                        |   |                        |
|                |               |                        |   |                        |
|                |               |                        |   |                        |
| Time s         | lice          | Method                 |   | Threshold [dB]         |
| Time s         | lice          |                        | - | Threshold [dB]<br>70,0 |
| Time s         | lice          | Method                 | • |                        |
| Time s         | lice<br>Abov  | Method<br>ve threshold |   | 70,0                   |

The **GRID SPACE** is set by default to 10 m and should remain like this for traffic noise. A smaller grid spacing only increases the calculation time but would not result in higher accuracy. For aircraft noise it may be wise to increase the grid spacing.

Select whether you want to use the calculation method **WITH RADIUS** or **WITHIN GRID CELL**. The **SEARCH RADIUS** of 100 m is a sensible default for action planning,

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because the result is normalized to inhabitants/km<sup>2</sup>. As the calculation run type for hotspots is useful for other projects too, the search radius may be adjusted to different settings in these projects. With the hotspot calculation within each grid cell, the inhabitants are not spread over the search radius but summed-up per grid cell, see "Total Noise Assessment according to VDI 3722-2 (page 680)".

One calculation may include several methods for the hotspot calculation which you can add with the + in the navigation bar. Select the time slice and the method (the selection list opens with a double click on the fields).

Implemented methods

- above threshold
- LA little annoyed
- A annoyed
- HA highly annoyed
- LSD little sleep disturbance
- SD sleep disturbance
- HSD high sleep disturbance

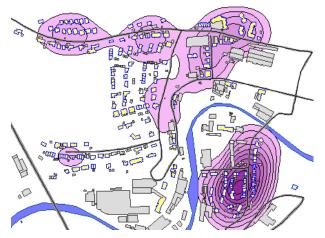
Whereby "LA" contains all inhabitants of the categories "A" and "HA" as well as "LSD" contains all inhabitants of the categories "SD" and "HSD". "Little annoyed" also contains the figures from the "annoyed" and the "highly annoyed" tally.

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Additionally, enter the threshold for the calculation method "above threshold".

### Graphically present hotspots

In the file selection select the situation and choose the calculated hotspot map via the **FILE TYPE General Grid Map**. If the calculation contained several methods, select the method you want to display in the next dialog.



Hotspots of different noise types can be superimposed with the Grid Operations.

**Calculation Types** 

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## **Import of Grid Noise Maps**

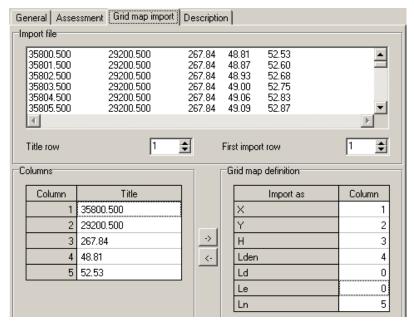
If you have received Grid Noise Maps calculated by other software products than SoundPLAN (for example from an aircraft noise model) and the data is given as a text file (TXT file), it is possible to import the data directly into the calculation core of SoundPLAN and convert the data into the SoundPLAN format; Grid Noise Maps generated this way can be overlaid with other SoundPLAN data.

To trigger the import function, select the calculation type "tools" and the select the sub-type "Grid Noise Import".

| Calculation type: |                   |   |
|-------------------|-------------------|---|
| Tools             | Grid noise import | • |

Select the TXT file in the **DATA** section (select the "text files" in the selection list for the file types.

Under the tab Grid-Noise-Map-Import the structure of the import file is visible in the top portion. Select if a title line is present and from which line the regular data shall begin.



In the lower section the columns from the import file are assigned to the columns of the grid noise map. Depending on the selected noise assessment the time slices are displayed for the assignment.

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# **Distributed Computing**

With Distributed Computing SoundPLAN starts a calculation mode where the process of calculation is distributed to any number of PCs in a network. Multithreading for any number of cores is also supported.

Because Distributed Computing is very easy to use it is worth to use it also for smaller calculations.

The calculation is controlled by a master computer that distributes parts of the calculation to calculation slaves available in the network.

In order for SoundPLAN to find the other computers and see that the users have given the permission to use the resource, a communications kernel must be running on all participating PCs.

SoundPLAN must be installed at least as a demo version and **with the same update date** on all participating PCs. The TPC/IP protocol must be active.

**Hint:** Updates can be installed from one PC to any number of other PCs at the same time, see "<u>Install updates simultaneously on several computers</u> (page 32)". If you use PCs for distributed computing that are normally not used for working with SoundPLAN it is sensible to install the SoundPLAN demo version. This has the advantage that the license file cannot expire and that no hardlock is needed for the manual update installation.

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# Control program "Socket Server" on the slave

In order that the master PC finds the other PCs in the network and to make sure that the users of these PC agree in the use of their PC for distributed computing, a control program must run **on all participating PCs**. Open the control program in the start menu with **ALL PROGRAMS** -> **SOUNDPLAN XX** -> **SOCKET SERVER** or in the SoundPLAN Manager through **EXECUTE** -> **SOCKET SERVER**. If you often work with distributed computing, it is the best to start the socket server automatically on booting the computer.

When the socket server is running the SoundPLAN icon is visible in the task bar.

### Properties and settings for the Socket Server

Click right on the symbol for the Socket Server in the task bar and open the **PROPERTIES**.

| Terminate  |  |
|------------|--|
| Properties |  |
| Settings   |  |
| - i en 📀 D |  |

**Distributed Computing** 

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In order that a computer can be connected the Socket Server must be enabled for distributed computing. Via a timer you can activate PCs for certain time periods (PCs that for example at night would be idling). You can select here whether the Socket Server should be launched on Windows startup. A third option (restart DC server on every disconnection) tries to reactivate the Socket Server after unexpected malfunctions during a calculation.

| SoundPLAN DC Server 7.4 [SP7.4; 27.02.2015]                                                                                                                                                                           | ×     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Settings                                                                                                                                                                                                              |       |
| Enable remote computing for this socket server                                                                                                                                                                        |       |
| Always                                                                                                                                                                                                                |       |
| ○ Only between 00:00:00  … 00:00:00  …                                                                                                                                                                                |       |
| Launch DC Server on Windows Startup                                                                                                                                                                                   |       |
| ☑ Restart DC Server on every disconnection                                                                                                                                                                            |       |
| No. of threads = 8<br>Path for global data "C:\Users\corinna.kurz\Documents\SoundPLAN Globdata 7.4\"<br>Distrib Path "C:\Users\corinna.kurz\Documents\SoundPLAN Globdata 7.4\distrib\"<br>Current Port Number = 57457 |       |
| Debug                                                                                                                                                                                                                 |       |
| Enable Open Debug Protocol.                                                                                                                                                                                           |       |
|                                                                                                                                                                                                                       | *     |
| Not connected                                                                                                                                                                                                         |       |
| Settings                                                                                                                                                                                                              | inate |

The lower section of the properties hosts the option to activate a debug protocol (checkbox **ENABLE**). This protocol might help the hotline to find a solution to possible malfunctions. Normally the checkbox should be deactivated.

Use the button settings to change the used port numbers (see "<u>Use "Distributed</u> <u>Computing" for different SoundPLAN versions</u>" on page **Fehler! Textmarke nicht definiert.**), the path to which the calculation data are stored during the calculation and the used number of threads of multi kernel PCs.

| SP Settings                                            |                                                                                                                                                       |                |       |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------|
| Program     Distributed Computing                      | Distributed Computing                                                                                                                                 |                |       |
| System<br>Internet update<br>Global<br>Current project | Client Socket<br>Socket Server Socket                                                                                                                 | 58131<br>58132 |       |
|                                                        | Socket server instances<br>Socket server threads                                                                                                      | 4<br>8         | <br>• |
|                                                        | Path for distributed computing data<br>C:\Users\admintpDocuments\SoundPLAN Globdata 8.1\distrib\<br>Retrieve Socket Server information (memory usage) | No             |       |

Set the number of **SOCKET SERVER THREADS** equal to the number of threads of the computer as long as it is only used for calculation. If the computer is used for other tasks, too, reduce the number of threads (it is often sufficient to reduce the number by 1).

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**Distributed Computing** 

In addition to the number of threads, you can specify the number of instances. The number of **SOCKET SERVER INSTANCES** indicates how often the VR control is started.

For computers with many cores (about 8 cores or more with hyperthreading, that is, 16 threads), the existing threads should be divided among several instances, since otherwise the memory may run out.

Set the number of instances so that the threads can be evenly distributed. For example, 2 instances with 8 threads each.

Exit the control VR (right mouse button on the icon in the taskbar -> **TERMINATE**) and start it again (**EXECUTE** -> **SOCKET SERVER** in the SoundPLAN Manager). The VR control is then opened twice with different port numbers on a computer with 2 instances, for example.

The **PATH FOR DISTRIBUTED COMPUTING DATA** is the path where the project data are stored. This is by default the Globdata path. You may change this location for example, if there is not enough disk space available.

**RETRIEVE SOCKET SERVER INFORMATION** may help you or the hotline with memory problems and should normally be set to "no".

### Setup of the communication between the PCs

6

Click on the symbol button or open **CALCULATION** -> **DISTRIBUTED COMPUTING** in the calculation kernel.

| Oistributed Computing     | g                      |     |        |           | _ 🗆 🔀 |
|---------------------------|------------------------|-----|--------|-----------|-------|
| -Network PCs              | Available/Connected    |     |        |           |       |
|                           | Name                   | C   | R      | #JobsDone |       |
| Edit PC-List              |                        | С   | onnect |           |       |
| Try to reconnect every [m | n]:                    |     |        |           | 10 😭  |
| Start calculation of all  | runs marked with "yes" | Car | ncel   |           | Help  |
|                           |                        |     |        |           | .:    |

Edit PC list

Click on **EDIT PC LIST** below the empty left field and enter the names of the PCs you want to use for the calculation. The computer names are displayed in the Windows Explorer if you select Network -> complete network.

**Distributed Computing** 

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| C Edit PC-List [D                                                 | :\Eigene Dateien\Soun 🖃 🗖 🔀 |
|-------------------------------------------------------------------|-----------------------------|
| File                                                              |                             |
| SP-Master<br>SP-Slave1<br>SP-Slave2<br>SP-Slave3<br>SP-Slave4<br> |                             |
| Search                                                            | OK Cancel Help              |

Use the **SEARCH** button to browse through the network. All PCs available in the network are displayed no matter if the Socket Server is running or not. Depending on the network it might take quite some time. To keep the PC list clear, you can delete not needed PCs from the list. The PC list is stored in the Globdata folder and is displayed the next time you start Distributed Computing.

### Select PCs

PCs that shall participate in the SoundPLAN calculation need to be activated and then with the arrow to the right or Drag&Drop transferred to the list of PCs that are participating in the calculations. The DC master immediately is trying to establish communication with the servers that are in the field of the PCs participating in the calculation. The slaves for which the connection was successful are displayed with OK in the columns "C" (connected) and R (reconnection successful).

If you use multiple instances, each computer has to be transferred multiple times to the right (according to the number of instances).

The connected computers are displayed with computer name, IP address and port address.

#### Common trouble with the connection

- If a computer has not been recognized correctly, for example because the name conversion in the network has not been successful try to establish the connection using the IP address in the PC list.
- If the cell "C" states "version mismatch" the SoundPLAN update on the slave has another date than on the master.
- If the cell "C" states OK but the cell "R" still states "nc" (not connected), first click on the computer name. If the text then changes to "OK" everything is correct, if not the reconnection could not be established. In this case check the Windows Firewall of the slaves. "SPCalc.exe" and SPSktSrv.exe" must be enabled as exceptions.

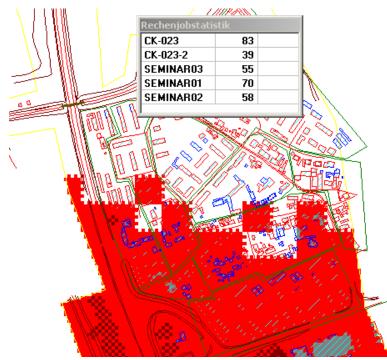
The master computer can try to reconnect a slave automatically for which the connection broke down for any reason. Activate the checkbox **TRY TO RECONNECT EVERY [MIN]** and select the time interval.

**Distributed Computing** 

# Start calculation

To start the calculation, click on the field **START CALCULATION OF ALL RUNS MARKED WITH "YES"**. SoundPLAN will now pack the project and send it to all slaves. The socket server icon in the task bar is now displayed with a red arrow and when you move the mouse over the icon you will see "status: connected to *master*."

Each slave unpacks the data, tells the master computer that it is ready to work and receives a calculation job from the master computer. For single receivers, Façade Noise Maps and Meshed Noise Maps each slave will receive one receiver at a time, calculate the noise levels and send the results back to the client. For Grid Noise Maps the master computer will send the slave a field of 9 x 9 receivers to do the calculations.



The calculation job statistics shows the number of jobs done by each computer.

**The graphics display during the calculation considerably extends the calculation time!** It is therefore wise to only take a brief look to see how far the calculation is completed and then switch back to the *run file* tab. Use **VIEW** -> **TILES** in tile calculations to see the tiles already calculated.

If the communication breaks down, a client is shut down or a server does not respond with result data, the client will eventually reassign the missing receivers to another server to make sure none of the receivers is left without calculations.

**Distributed Computing** 

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### Add or exclude computers

It is easily possible to exclude a slave or to add another during the calculation.



Call **CALCULATION** -> **PAUSE CALCULATION** or click on the symbol button. It is then possible to add or exclude PCs or to edit the PC list.

As soon as you are ready to continue the calculation click on **CLOSE**. In case new PCs have been added to the calculation, the needed project data are copied to the additional PCs before they get calculation blocks.

# Use "Distributed Computing" for different SoundPLAN versions and 32 Bit / 64 Bit

To use Distributed Computing parallel for different SoundPLAN versions, the port numbers in the distributed computing settings must be different for **each version** (version number and 32 bit / 64 bit). For exactly one version, the port numbers must be the same for all participating computers. The port number must not be higher than 65635.

By default, the version number is used as an identifier in the port number.

V 8.1 32 Bit Port job manager: 58131 Port VR control: 58132

V 8.1 64 Bit Port job manager: 58163

# **Statistical accuracy**

The German DIN 45687 in its annex F demands that the accuracy of the noise level simulation is to be classed and different parameters influencing the balance between calculation speed and accuracy can be disclosed.

Via a statistics calculation run the program first draws a sample with highly accurate reference settings; the results of this run later are compared with results from calculations with different calculation settings or abbreviated geometry.

The samples can be taken up front in order to determine the calculation settings needed in order to attain a desired accuracy or as a post calculation check to verify that the calculations were done correctly. The following options are available:

- Single Receivers (up front)
- Façade Noise (up front)
- Grid Noise Map without interpolation of grid values (up front)
- Grid Noise Map with interpolation (already calculated maps)

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Statistical accuracy

# Draw a sample in the Calculation Core

(Statistics up front)

Like normal generate the entries for a normal calculation run with the reference settings and the data you want to check with the accuracy statistics. Under the tab statistics select the option **DRAW STATISTICS (NUMBER OF RECEIVERS)** and select the size of your sample. According to DIN 45687 the minimum is to evaluate a sample of 20 but the recommendation is to draw a sample of 1%. For very large calculations with big areas and thus a very high number of receivers the number sampled will certainly be between the 2 values.

In the calculation core you can calculate the samples for single receivers, Façade Noise Maps or Grid Noise Maps.

| General Settings Standards Assessment Grid Map Statistics Description |
|-----------------------------------------------------------------------|
|                                                                       |
| O No sample run                                                       |
| Statistics calculation run: compare to the samples from run #.        |
| 1                                                                     |
| <ul> <li>Draw sample of size (No. of calculation points)</li> </ul>   |
| 500                                                                   |
|                                                                       |

The samples are calculated with the settings you define, however for the grid noise map the criteria for interpolation will be ignored, the receivers are always calculated in the statistics calculation run.

### Draw a sample in the Graphics

(Statistics of maps already finished)

The samples from grid calculations can be drawn either in the Calculation Core or the Graphics. Reference receivers can only be generated if a DGM was used in the calculation.

If you generate the statistical sample for a Grid Noise Map from within the graphics also interpolated grid points are selected as reference points. If a sample is drawn in the calculation core, all reference points are calculated.

First calculate the Grid Noise Map and load all data into the Graphics.

Open EDIT MAP and open EDIT -> GENERATE STATISTICAL SAMPLE FROM GRID MAP.

In the following dialog define the number of reference receivers. The recommendation is to use 1% of the map you want to generate the statistics for – for large areas this is probably too much.

Statistical accuracy

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| Create sample points    | ×              |
|-------------------------|----------------|
| Settings                |                |
| Number of grid points   | 8119           |
| Grid distance [m]       | 5.0            |
| Number of sample points | 81             |
|                         |                |
|                         | OK Cancel Help |

# Statistics run and processing

Generate a calculation run with different calculation settings or different geometry (for example tolerance, search radius, smoothed buildings, rougher DGM) and select the tab statistics for a statistic run: **COMPARE WITH STATISTICAL SAMPLE FROM CALCULATION RUN NO.** Enter the number under which the reference calculation results were saved.

| General | Settings     | Standards       | Assessment     | Grid Map   | Statistics  | Description |  |
|---------|--------------|-----------------|----------------|------------|-------------|-------------|--|
|         |              |                 |                |            |             |             |  |
| ON      | lo sample r  | run             |                |            |             |             |  |
| œ s     | tatistics ca | alculation run: | compare to th  | ne samples | from run #. |             |  |
|         |              | 201             | \$             |            |             |             |  |
| 0.0     | )raw sampl   | e of size (No.  | of calculation | points)    |             |             |  |
|         |              | 100             | \$             |            |             |             |  |

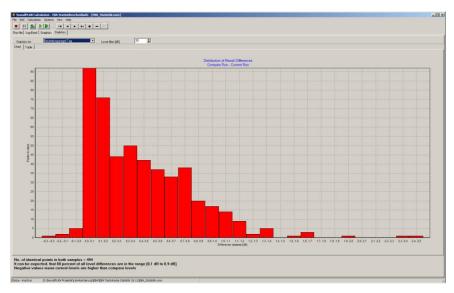
For statistical samples from the Calculation Core enter the number under which you saved the reference statistics results, for samples in the Graphics the results are saved under the same number as the original results.

To compare contour line samples, a calculation run with the calculation type "single points" is needed.

After the statistics run finished successfully, the run file receives an extra tab for the statistics.

To analyze here results, a diagram and a table is for your disposal. The differences for the receiver locations and the elevation of the receiver and the elevation of the terrain at the receiver as well –of course- the noise levels of all time slices contained in the noise assessment is contained (for contour lines only the time slice of the loaded data is processed). Via the **LEVEL FILTER** receivers with a value < then the threshold value will be ignored in the processing.

Statistical accuracy



The processing of the statistics is done in accordance to DIN 45687. As the result you will get the confidence interval (deviations up or down) in which 80% of all results will lay.

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Statistical accuracy

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# 7 Result Tables

# **Overview**

Single receiver results (single point calculations or façade noise maps) as well as the propagation parameters are clearly presented in the freely formatted Result Tables

Aside from plain result tables there are so-called ma detail tables, for which the upper part of the screen shows the receivers and the assessment levels and the lower part presents detail information for each of the receivers.

To compare the propagation parameters of different calculations multiple tables can be clearly arranged vertically or horizontally on the screen.

Each calculation result is accompanied with an extensive run info, which documents all calculation parameters, standards and geometry data used in a calculation. This assures a high level of quality control.

The run info as well as the documentation of the calculated sources (road, railway. industrial sources, and parking lots) is the basis information for all calculations (also for grid noise maps).

The displayed columns with headers and legend texts as well as the page layout which contains the possibility to use text variables in the header and footer sections can be defined as desired.

# Getting started with the Result Tables

All information regarding the sources and the results are stored in different database tables. The result number manages that these tables are identified to belong together. When you open a result file "Rxxx0000.res" in the Result Tables (*xxx is the identifier for the calculation type, 0000 is the result number*) the program recognizes automatically which tables are to be loaded.

Depending on the calculation type, the calculated sources and the documentation depth selected in the calculation run different tables are present.

Overview

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- Plain result tables: only final results
- Detail result tables: intermediate and final results
- Protocol tables: calculation protocol with all calculation steps
- Tables for Expert Industry: Expert industry results
- Level charts: graphical presentation of results (level chart, spectrum, day histogram, railway pass-by level)

For a single point or FNM calculation with roads and plain result tables, for example, the following tables are generated during the calculation and presented here in different tab index cards:

- o Run-Info
- Receiver table
- Road emission table

For a single point or FNM calculation with industrial sources and plain result tables the following tables are displayed:

- o Run-Info
- o Receiver table
- Source spectrum and source day histogram

If you stored the detail result tables, additionally the intermediate results for each receiver are displayed:

- o Day histogram at the receiver
- $\circ$   $\,$  Contribution level of each of the sources at the receiver
- Day histograms of the contribution levels at the receiver
- Spectra of the contribution levels at the receiver
- Table with all propagation parameters for each time slice for the Leq levels (mean propagation table)
- $\circ\;$  Table with all propagation parameters for each time slice for the Lmax levels
- o Group table
- Charts of the day histogram and the spectrum at the receiver

To compare the propagation parameters of different calculations, press the shift or the control key in the file selection to load several result files at the same time. Use **WINDOW** -> **HORIZONTALLY** or **WINDOW** -> **VERTICALLY** to arrange the files on the screen.

A presetting for the table and page layout for each of the tables is delivered in the SoundPLAN system directory. Changes you make for layouts and texts are provided in the global format file "Tab\_Layout.fmt" and assigned to a result file as soon as it is opened for the first time.

When you close a result file, a format file containing the layouts, headers and legend texts of all tables belonging to the result is stored under the name "*result* 

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Getting started with the Result Tables

*file.fmt*". This format file is used instead of the global settings when you open the result file for the next time.

For the result documentation in the report, the needed tables are printed. The definition of header and footer sections with text variables (e.g. project title or project number) and own texts and logos, helps you to easily provide a standardized and professional documentation.

# The different table types

Depending on the selected documentation depth in the calculation properties, the calculation type and the sources included in the calculation, different table types and tab index cards are available in the Result Tables.

### **Run Info**

The run info is extremely helpful for the consistency of long-lasting projects. Even after years you can exactly ascertain the parameters used in the calculation: SoundPLAN version, kernel version, calculation parameters and geometry data. The project description is also part of the run info.

| Run Info       Single Receiver       Details + Graphics       Roads         Run description       Single Point Sound       Title:       Dak Street - without noise protection (SPS)         Run file:       WinCligurum       WinCligurum       Based number:       301         Local Calculation (ThreadCount-2)       Z7.06.2011 10.48.22       Calculation end:       27.06.2011 10.48.27         Calculation end:       27.06.2011 10.48.27       Calculation inte:       00.03.781 [m:sms]       No. of calculated points:       6         No. of points:       6       6       Kernel version:       21.06.2011 (R.Kernel7.dll) <b>Bun parameterss</b> Reflection order       3       Standards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       RLS 90       Difwing on right side       Envision according to:       Envision according to:       Envision according to:       RLS 90       Limatkin of screering loss:       single/multiple       100 dB /100 dB       Assessment:       Leg 06-22/22.06/02.44 Lmax       Reflection of stone streering loss:       single/multiple       100 dB /20.24.24       Contains:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondards:       Stondard | 🙋 Wincity 71 - RSPS0301.res: Oak Street - without noise protection (SPS) 🛛 🗖 🖾                                                                                   |                                                                                                                                                |   |  |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---|--|--|--|--|--|
| Bun description         Calculation:       Single Point Sound         Title:       Oak Street - without noise protection (SPS)         Run file:       winCity.runx         Run file:       winCity.runx         Doal Calculation (ThreadCount=2)       27.06.2011 10.48.22         Calculation att       27.06.2011 10.48.27         Calculation end:       27.06.2011 10.48.27         Calculation ine:       000.3781 [m:s:ms]         No. of points:       6         Kernel version:       21.06.2011 [RKernel7.dll]         Run parameters       8         Reflection distance to receiver       20 m         Maximal reflection distance to source       50 m         Standards:       RLS 90         Diving on right side       RLS 90         Diving on right side       RLS 90         Emission according to:       RLS 90         Simily for data       100 dB /100 dB         Assessment:       Leg 06-22122.06100-241 Lmax         Reflection of Street.geo       16.06.2011 16.58:10         004_New Residential Areages       24.06.2011 10.93.242         -contains:       004_New Residential Areages         004_New Residential Areages       24.06.2011 16.58:12         004_New Residential Areages                                                                                                                                                                   | Run Info Single Receiver Details + Graphics Roads                                                                                                                |                                                                                                                                                |   |  |  |  |  |  |
| Tite:       Oak Street - without noise protection (SPS)         Run file:       without noise protection (SPS)         Result number:       301         Local Calculation (ThreadCount=2)       27.06.2011 10.48.22         Calculation stat:       27.06.2011 10.48.27         Calculation inte:       000.3781 [m:sms]         No. of points:       6         Kernel version:       21.06.2011 (RKernel7.dll) <b>Run parameters</b> Reflection ofder         Maximal reflection distance to receiver       20 m         Maximal reflection distance to source       50 m         Search radius       5000 m         Weighting:       db(A)         Tolerance:       0.001 dB         Standards:       RLS 90         Driving on right side       RLS 90         Driving on right side       Rls.50         Emission according to:       Leg 06:22(2:2:06)(0:24) Lmax         Reflection of "own" facade is suppressed       Geometry data         G05. Receivers 0ak Street geo       16:06:2011 16:58:12         004_Ner Buildings geo       16:06:2011 16:58:12         004_Ner Buildings geo       16:06:2011 12:34:38         004_Presidential Analysis geo       16:06:2011 12:35:40         004_Presidential Analysis geo                                                                                                                                                         | Run description                                                                                                                                                  | e e e e e e e e e e e e e e e e e e e                                                                                                          | ^ |  |  |  |  |  |
| Reflection order       3         Maximal reflection distance to receiver       200 m         Maximal reflection distance to source       500 m         Search radius       5000 m         Weighling:       dB(A)         Jolerance:       0.001 dB         Standards:       RLS 90         Driving on right side       RLS 90         LimiNation of screening loss:       single/multiple         single/multiple       100 dB /100 dB         Assessment:       Leq 06-2212-06(00-24) Lmax         Reflection of "own" facade is suppressed         Geometry data       13.06.2011 16.58:12         005. Receivers 0ak Street.geo       16.06.2011 16.58:12         004_New Residential Area geo       24.06.2011 112.34:33         004_Detre Buildings.geo       14.06.2011 20.25:40         004_Residential Buildings.geo       10.06.2011 12.02:54.0         004_Residential Buildings.geo       08.06.2011 12.02:42.6                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Calculation:<br>Title:<br>Run file:<br>Local Calculation (ThreadCount=2)<br>Calculation stat:<br>Calculation stat:<br>Calculation itme:<br>No. of points:        | Dak Street - without noise protection (SPS)<br>winCity.runx<br>301<br>27.06.2011 10:48:22<br>27.06.2011 10:48:27<br>00:03781 [ms:ms]<br>6<br>5 |   |  |  |  |  |  |
| Maximal reflection distance to source 200 m<br>Maximal reflection distance to source 500 m<br>Search radius 5000 m<br>Weighting: dB(A)<br>Tolerance: 0,001 dB<br>Standards: RLS 90<br>Driving on right side Emission according to: RLS 90<br>Limitation of screening loss:<br>single/multiple 100 dB /100 dB<br>Assessment: Leq 06-22 22-06 00-24  Lmax<br>Reflection of "own" facade is suppressed<br><b>Geometry data</b><br>005. Receivers 0ak Street.geo 16.06.2011 16:58:12<br>003. Poads Street 1.sit 13.06.2011 16:58:12<br>004_New Residential Area geo 24.06.2011 16:56:12<br>004_New Residential Area geo 14.06.2011 12:34:38<br>004_Other Buildings.geo 15.06.2011 12:35:40<br>004.Residential Buildings.geo 18.06.2011 12:05:540<br>08.06.2011 20:24:26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Run parameters                                                                                                                                                   |                                                                                                                                                |   |  |  |  |  |  |
| Roads:         RLS 90           Driving on right side         RLS90           Limitation according to:         RLS90           singler/multiple         100 dB /100 dB           Assessment:         Leq 06-22122-06100-241 Lmax           Reflection of "own" facade is suppressed         6           Geometry data         13.06.2011 16:58:50           005. Receivers Dak Street.geo         16.06.2011 16:58:12           004_New Residential Area.geo         24.06.2011 12:34:38           004_New Residential Area.geo         14.06.2011 20:55:40           004_Residential Buildings.geo         14.06.2011 20:55:40           004_Residential Area.geo         08.06.2011 20:24:26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Maximal reflection distance to receiver<br>Maximal reflection distance to source<br>Search radius<br>Weighting:                                                  | 200 m<br>50 m<br>5000 m<br>dB(A)                                                                                                               |   |  |  |  |  |  |
| Limitation of screening loss:         single/multiple         100 dB /100 dB           Assessment:         Leq 06-22122-06[00-24] Lmax           Reflection of "own" facade is suppressed <b>Geometry data</b> 005_Receivers Dak Street.geo         16.06.2011 16:58:50           08 - Dak Street 1.sit         13.06.2011 09:32:42           - contains:         003_Roads Analysis.geo           004_Uew Residential Area geo         15.06.2011 12:34:33           004_Residential Buildings.geo         14.06.2011 20:55:40           RDGM9393.dgm         08.06.2011 20:24:26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Roads:<br>Driving on right side                                                                                                                                  |                                                                                                                                                |   |  |  |  |  |  |
| Reflection of "own" facade is suppressed         Geometry data         005_Receivers Dak Street.geo       16.06.2011 16.58.50         08 - Oak Street 1.sit       13.06.2011 09.32.42         - contains:       16.06.2011 16.58.12         004_Dads Analysis geo       16.06.2011 12.34.38         004_Dither Buildings.geo       15.06.2011 12.34.38         004_Residential Buildings.geo       15.06.2011 12.35.40         RDGM 9393.dgm       08.05.2011 20.24.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Limitation of screening loss:                                                                                                                                    | 100 dB /100 dB                                                                                                                                 |   |  |  |  |  |  |
| 005_Receivers Oak Street.geo         16.06.2011 16.58.50           08 - Oak Street 1.st         13.06.2011 09.32.42           - contains:         003_Roads Analysis.geo           004_Uew Residential Area.geo         24.06.2011 12.34.38           004_Uew Residential Area.geo         14.06.2011 12.34.38           004_Residential Buildings.geo         14.06.2011 12.35.40           004_Besidential Buildings.geo         08.06.2011 20.24.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                  | Leq 06-22 22-06 00-24  Lmax<br>pressed                                                                                                         |   |  |  |  |  |  |
| 08 - Oak Street 1.st 13.06.2011 09.32.42<br>contains: 13.06.2011 09.32.42<br>002 Roads Analysis geo 16.06.2011 16.58.12<br>004 New Residential Area geo 24.06.2011 12.34.38<br>004 Other Buildings.geo 15.06.2011 10.30.02<br>004 Residential Buildings.geo 14.06.2011 20.254.00<br>RDGM3939.dgm 08.06.2011 20.24.26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <u>Geometry data</u>                                                                                                                                             |                                                                                                                                                |   |  |  |  |  |  |
| RDGM9993.dgm 08.06.2011 20:24:26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 08 - Oak Street 1.sit<br>contains:<br>003 - Roads Analysis.geo<br>004 - New Residential Area.geo<br>004 - Other Buildings.geo<br>004 - Residential Buildings.geo | 13.06.2011 09:32:42<br>16.06.2011 16:58:12<br>24.06.2011 10:30:02<br>15.06.2011 10:30:02<br>14.06.2011 20:55:40                                |   |  |  |  |  |  |
| Run Info                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                  | 08.06.2011 20:24:26                                                                                                                            | ~ |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Bun Info                                                                                                                                                         |                                                                                                                                                |   |  |  |  |  |  |

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The different table types

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Depending on the settings in the table settings for the run info (right mouse button -> TABLE SETTINGS) the different parts of the run info can be printed for your records. Use the TAB WIDTH to define the width of the first column.

| Table settings: Run Info          |                |                                   |       |              |
|-----------------------------------|----------------|-----------------------------------|-------|--------------|
| Table layout Page format Header a | nd footer text |                                   |       |              |
| Font settings                     |                |                                   |       | Save         |
| Arial                             | Size 8 💌 Lin   | e spacing 1,00                    |       | Load         |
| Options<br>Project description    |                | Short info                        |       | Transfer     |
| Run description                   |                | <ul> <li>Detailed info</li> </ul> |       | Reset titles |
| ✓ Run parameters ✓ Geometry data  |                | Tab width                         | 125 💽 | Preview      |
| Orientation                       | Portrait       | <b>v</b>                          |       |              |
| Page numbering starts with        | 1              |                                   |       |              |
| Text for header/footer variables  |                |                                   | ]     |              |
| Table title:                      | Run Info       |                                   |       | ОК           |
| Text 1:                           |                |                                   |       |              |
| Text 2:                           |                |                                   |       | Cancel       |
|                                   |                |                                   | ]     | Help         |

As for all other tables, you can also enter the table title and if needed additional texts.

### Single receivers

The single receiver table is stored for all calculations.

Run Info Single Receiver Details + Graphics Roads

| Name            | Usage | Floor    | Dir | LrD,lim | LrN,lim | LrD   | LrN   | LrD,diff | LrN,diff |
|-----------------|-------|----------|-----|---------|---------|-------|-------|----------|----------|
|                 |       |          |     | dB(A)   | dB(A)   | dB(A) | dB(A) | dB(A)    | dB(A)    |
| Jamaica Road 26 | MI    | 2. Floor | W   | 64      | 54      | 57,9  | 47,6  | -        | -        |
| Jamaica Road 27 | GR    | 1. Floor | W   | 59      | 49      | 67,6  | 57,3  | 8,6      | 8,3      |
| Jamaica Road 30 | MI    | 3. Floor | W   | 64      | 54      | 56,2  | 45,9  | -        | -        |
| Jamaica Road 31 | GR    | 2. Floor | W   | 59      | 49      | 67,5  | 57,3  | 8,5      | 8,3      |
| Jamaica Road 33 | GR    | 2. Floor | 0   | 59      | 49      | 56,2  | 45,9  | -        | -        |
| Jamaica Road 33 | GR    | 2. Floor | Ν   | 59      | 49      | 63,8  | 53,6  | 4,8      | 4,6      |
| Jamaica Road 33 | GR    | 2. Floor | Ν   | 59      | 49      | 56,9  | 46,7  | -        | -        |
| Jamaica Road 33 | GR    | 2. Floor | S   | 59      | 49      | 62,0  | 51,8  | 3,0      | 2,8      |
| Jamaica Road 33 | GR    | 2. Floor | W   | 59      | 49      | 68,0  | 57,8  | 9,0      | 8,8      |
| Jamaica Road 35 | GR    | 3. Floor | W   | 59      | 49      | 66,8  | 56,6  | 7,8      | 7,6      |
| Jamaica Road 36 | MI    | 3. Floor | 0   | 64      | 54      | 67,8  | 57,6  | 3,8      | 3,6      |
| Jamaica Road 36 | MI    | 3. Floor | S   | 64      | 54      | 62,8  | 52,5  | -        | -        |
| Jamaica Road 36 | MI    | 3. Floor | W   | 64      | 54      | 53,8  | 43,5  | -        | -        |

Select whether you want to display all floors or filter on the highest level exceedance or the loudest level per facade. You can also select the rows to be displayed yourself in the filter column (see below). With the right mouse button activate **SELECT FILTER** and select the **HIGHEST LIMIT EXCEEDANCE PER RECEIVER**, the

HIGHEST LEVEL PER RECEIVER or OWN SELECTION. With the right mouse button -> USE FILTER respective SHOW ALL you switch the view.

If a filter is used for the table of single receivers this setting is documented with a small triangle in the header of the single receiver table.



### Filter to own selection

If a filter is used, the corresponding rows are marked with an x in the filter column. You can set the markers in the filter column yourself. Make the filter column visible in the table settings.

| lumn setup                        | Table layout               | Page format | Header and footer |               |              |
|-----------------------------------|----------------------------|-------------|-------------------|---------------|--------------|
| olumns                            |                            |             | Properties        |               | Save         |
| Preselect<br>Noise le<br>Noise le |                            |             | Visible           |               | Load         |
|                                   | vel Night<br>vel Day/Night |             | Original title    | Filter column | Transfer     |
| RNo                               | string ObjNo.              | ^           | Title 1           | Filter column |              |
| Receive                           | r                          |             | Title 2           |               | Reset titles |
| ObjNo<br>✓ Usage                  |                            |             | Unit              |               | Preview      |
| Rec Obj                           |                            |             | Title alignment   |               | Preview      |
| House-I                           |                            |             | Column alignment  |               |              |
| X<br>Y<br>Z                       |                            |             | Column width      | 11 🖨 Rest -30 |              |

# **Details and Graphics**

Under the tab "*Details and Graphics*" the bottom table presents different details for the receiver selected in the top list.

| un Info Single Receiver So | 1             | s + Graph |          |          |              |               |              |                           |              |
|----------------------------|---------------|-----------|----------|----------|--------------|---------------|--------------|---------------------------|--------------|
|                            |               |           |          |          | A) LrN/d     | B(A)          |              |                           |              |
| Kingsland Road 101         | 1. Floor      | 60        | 45       | 49,2     | 47,0         |               |              |                           |              |
| Kingsland Road 101         | 2. Floor      | 60        | 45       | 49,4     | 47,3         |               |              |                           |              |
| Kingsland Road 101         | 3. Floor      | 60        | 45       | 49,5     | 47,3         |               |              |                           |              |
| Kingsland Road 101         | 1. Floor      | 60        | 45       | 49,2     | 47,0         |               |              |                           |              |
| Kingsland Road 101         | 2. Floor      | 60        | 45       | 49,4     | 47,3         |               |              |                           |              |
| Kingsland Road 101         | 3. Floor      | 60        | 45       | 49,5     | 47,3         |               |              |                           |              |
| pectrum 24h Distribution S | ource Contrib | ution Me  | an Propa | gation S | ource Contr  | ibution - 24ł | Distribution | Contribution Spectra Grou | ups Diagrams |
| Source                     |               |           | SrcT     | Туре     | LrD<br>dB(A) | LrN<br>dB(A)  | A<br>dB(A)   |                           | l            |
| Window 2 - Garage          |               |           | Area     |          | -7,0         |               | 0,0          |                           |              |
| Window 3 - Garage          |               |           | Area     |          | -7,3         |               | 0,0          |                           |              |
| Door - Garage              |               |           | Area     |          | 34,4         |               | 0,0          |                           |              |
| Fan - Garage               |               |           | Point    |          | 6,2          |               | 0,0          |                           |              |
| Departure petrol station   |               |           | Line     |          | 40,6         | 41,0          | 0,0          |                           |              |
| Horns                      |               |           | Line     |          | 32,9         | 30,3          | 0,0          |                           |              |
| Racing start               |               |           | Line     |          | 38,5         | 37,7          | 0,0          |                           |              |
| Vacuum cleaner             |               |           | Point    |          | 9.0          | -16.0         | 0.0          |                           |              |



For the printout, the receiver table and the detail information are combined to one table, thus delivering a structured, readable document. The content of the upper table is displayed in a header column.

| Source               | Group                | Source        | Contribution level<br>day<br>dB(A) | Contribution level<br>night<br>dB(A) | Attenuation<br>dB(A) |
|----------------------|----------------------|---------------|------------------------------------|--------------------------------------|----------------------|
|                      |                      |               | UD(A)                              | ub(A)                                | ub(n)                |
| 4a, Jefferson Street | LrD,lim 52 dB(A) Lrl | N,Iim 40 dB(A | A) LrD 49,5 dE                     | 3(A) LrN 39,3                        | dB(A)                |
| East parking lot     | Parking lot noise    | Parking lot   | 49,2                               |                                      | 5,0                  |
| Approach trucks      | super market         | Line          | 36,3                               | 39,3                                 | 0,0                  |
| West parking lot     | Parking lot noise    | Parking lot   | 29,7                               |                                      | 5,0                  |
| Uploading zone       | super market         | Area          | 13,7                               | 16,8                                 | 0,0                  |
| Air condition        | super market         | Point         | 11,3                               | 9,4                                  | 0,0                  |
| 4, Pine tree lane    | LrD,lim 60 dB(A) Lrl | N,Iim 50 dB(A | A) LrD 51,5 dE                     | 3(A) LrN 55,4                        | dB(A)                |
| Approach trucks      | super market         | Line          | 50,3                               | 55,4                                 | 0,0                  |
| West parking lot     | Parking lot noise    | Parking lot   | 44,0                               |                                      | 5,0                  |
| East parking lot     | Parking lot noise    | Parking lot   | 38,0                               |                                      | 5,0                  |
| Uploading zone       | super market         | Area          | 26,6                               | 31,6                                 | 0,0                  |
| Air condition        | super market         | Point         | 7,0                                | 7,0                                  | 0,0                  |

The columns of the top list look so squeezed on the screen, because they are formatted for the header rows in the printed table. The column widths refer to the distances of the column contents in the header row. The texts "title 1" and "Unit" are considered as "text before" and "text after" the column contents. Delete the text in "title 1" for columns in which the contents don't need further explanation, e.g. "receiver name" The formatting for the header row is the same for all detail tables.

**Hint**: The sort order of the receiver table cannot be changed in the upper table. Please go to the single receiver tab index card and click the right mouse button to change the sort order.

You can toggle between different views on the data in the detail tables.

#### dB filter weighting

In the spectra and contribution spectra you can change or switch off the dB filter weighting. The selected setting is stored in the table format.

| dB-Filter = dB(A) | not assessed |
|-------------------|--------------|
| Sort              | ✓ dB(A)      |
| DURUM             | dB(B)        |
|                   | dB(C)        |
|                   | dB(D)        |

#### Toggle between 1/3 octaves and octaves

Click right on the spectra or contribution spectra tables to toggle between the display of octaves or third octaves.

### Show time slices

The propagation parameters in the mean propagation table Leq can be presented for all time slices in a single line or with a line for each time slice.

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Right click on **TIME SLICES** to change the selection of the time slices and to change the display type.

| Display time slices                  | X      |
|--------------------------------------|--------|
| Time slices by lines     IrT     LrN |        |
|                                      | ОК     |
|                                      | Cancel |
| O Time slices by columns             | Help   |

If all time slices are displayed in one row, the time slice dependent parameters are displayed in separate columns for each time slice.

The maximum noise levels are documented in a second mean propagation table; here the time slices are always using a line per time slice.

For the contribution spectra, too, you can select the time slices to be displayed.

#### Show remaining sources

If you calculated with an allowed tolerance, sources with a low contribution at the receiver are not calculated in detail. Select whether you want to display or hide the remaining sources in the tables.

### Enter attenuations to source contribution levels

The source contribution table allows adding attenuations for individual sources. The attenuations are deducted from the source contribution and the assessment level is corrected accordingly.

Sort the receivers in the single receiver table descending according to the noise limit violation and the source contributions descending according to the contribution level for the desired time slice.

Store the attenuations to assign them again after a new calculation. If you load the attenuations again, you will see the attenuations stored in the file.

The different table types

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To reset the attenuations for all sources, select **RESET ATTENUATION** from the right mouse menu.

Attention: If you use an assessment type, which considers the loudest night hour, the decisive night hour might change due to the attenuation for individual sources.

This is not taken into account in the Result Tables. The changed levels are always displayed for the initially decisive hour.

#### Charts / Diagrams

The charts can be stored in different graphics formats to a file on the hard disk or copied to the clipboard to use them in other programs. Click the right mouse button.

### Roads, railways, sources, parking lots

Depending on the sources contained in the calculation the entry data that are the basis for the calculation are documented.

For roads and railways formatted emission documentation is additionally available in the Geo-Database.

Select the settings for the road inclination in **the road table**.

**WITHOUT GRADIENT ADDITION** shows the road coordinates with changes in the emission level but without taking the road inclination into account.

**WITH GRADIANT ADDITION** additionally shows road coordinates with changes in the emission level because of the gradient addition.

**ALL GRADIENTS** additionally shows road coordinates with changes in the road inclination even if the emission level does not change.

The **table of the industrial noise sources** is divided into the source spectra table and the source day histogram table.

You can toggle between Lw spectrum / L'w spectrum and octaves / third octaves in the upper table and between Lw 24h distribution and L'w 24h distribution in the lower table.

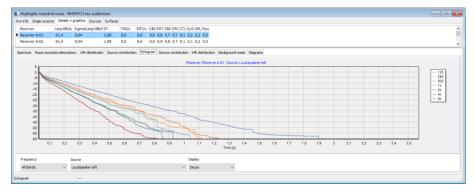
The source spectra can be displayed in third octaves or octaves and in different dB filter weightings.

# **Tables for room acoustics**

For room acoustics calculations, the indoor sources are offered as a source table and a separate table for the documentation of the surfaces.

Depending on the room acoustic parameters contained in the calculation, additional tabs are created to document the measurement paths, reverberation times (table and diagram), user-defined and source-defined noises and signals and auralization.

The echogram of the room impulse response is available as a diagram in the result table. You can select whether you want to see the raw data, the decay time or an additional regression line. Additionally, choose single frequency / single source or all frequencies all sources.



The different table types

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| No. | Receiver        | Usage | Floor                | Dir | LrD,lim<br>dB(A) | LrN,lim<br>dB(A) | LrD<br>dB(A)         | LrN<br>dB(A)         | LrD,diff<br>dB(A) | LrN,diff<br>dB(A) |
|-----|-----------------|-------|----------------------|-----|------------------|------------------|----------------------|----------------------|-------------------|-------------------|
| 1   | Jamaica Road 26 | MI    | GF<br>1. Fl          | W   | 64<br>64         | 54<br>54         | 57,3<br>58,8         | 47,3<br>48,9         |                   |                   |
| 2   | Jamaica Road 27 | GR    | GF                   | w   | 59               | 49               | 66,6                 | 56,1                 | 7,6               | 7.1               |
| 3   | Jamaica Road 30 | MI    | GF<br>1. Fl<br>2. Fl | w   | 64<br>64<br>64   | 54<br>54<br>54   | 52,7<br>53,4<br>54,8 | 44,0<br>44,6<br>45,9 |                   | <br><br>          |
| 4   | Jamaica Road 31 | GR    | GF<br>1. Fl          | w   | 59<br>59         | 49<br>49         | 66,4<br>66,6         | 55,9<br>56,1         | 7,4<br>7,6        | 6,9<br>7,1        |
| 6   | Jamaica Road 33 | GR    | GF<br>1. Fl          | N   | 59<br>59         | 49<br>49         | 62,6<br>63,3         | 52,1<br>53,0         | 3,6<br>4,3        | 3,1<br>4,0        |
| 8   | Jamaica Road 33 | GR    | GF<br>1. Fl          | S   | 59<br>59         | 49<br>49         | 60,8<br>62,0         | 50,3<br>51,6         | 1,8<br>3,0        | 1,3<br>2,6        |

# Table settings and page layout

Depending on the calculation type, calculation settings, noise types and source types, the Result Tables offer different tables for the result data. Each tab in the Result Tables represents a single database table. Each database table saves its own format and layout settings so content and appearance can be controlled and saved independently.

In the global format file (Tab\_Layout.fmt in the SoundPLAN Globdata-folder), all pre-settings for the SoundPLAN tables are defined.

When you open the result in the Result Tables, the program saves a format file in the project folder (for example, RSPS0001.fmt). This format file contains all settings made for these results. When a format file does not exist, it will be generated from information defined in the global format file.

You can individually customize the selection of columns, their titles and units, and all settings for the table layout such as the font, size and color, and also set the texts for the table headers and footers. These settings can be saved globally to serve as templates for future tables.

As the appearance of all headers and footers should be uniform, there is a possibility to extend this table format to all types of tables. Header and footer texts are constructed with text variables (project title, project number, date...). When these building-blocks are customized and saved in the global format file, they can be used in other tables.

Table settings and page layout

# Table settings

# Column Setup

Open the column setup via the right mouse button -> **TABLE SETTINGS**. In the first tab index card select the columns you want to display and the format.

| Column setup Table layout Page format                                     | Header and footer text    |               |
|---------------------------------------------------------------------------|---------------------------|---------------|
| Columns                                                                   | Properties                |               |
| Preselect<br>✔ Noise level Day<br>✔ Noise level Night<br>✔ Noise level DN | Visible                   |               |
| E Format string ObjNo.                                                    | Title 1                   | LrD           |
| ✓ Receiver ObjNo.                                                         | Title 2                   |               |
| ✓ Usage Rec ObjID ✓ FI                                                    | Unit                      | dB(A)         |
| Sel.<br>House-ID                                                          | Title alignment           |               |
|                                                                           | Column alignment          |               |
| ☐ Ż = =                                                                   | Column width              | 15 😭 Rest -46 |
| 🗹 Lim,D                                                                   | Display format            | 0.0           |
| ✓ Lim,N<br>✓ LrDN,lim<br>✓ LrD                                            | Rounding addition         | 5,000         |
| ✓ LrN<br>✓ LrDN<br>✓ LrD.diff                                             | Legend<br>Noise level Day |               |
| ✓ LrN,diff<br>✓ LrDN,diff                                                 |                           |               |
| Select all                                                                |                           |               |

The list on the left-hand side of the dialog shows all the available columns of the table. The column settings for the highlighted column can be viewed to the right.

The checkbox in front of the column name shows whether the column should be displayed and printed. Change the setting with a double click on this checkbox or the checkbox **VISIBLE**, for several columns at one time (*Shift + arrow key*) only via the checkbox **VISIBLE**.

The fields for TITLE1, TITLE 2 and UNIT define the texts in the column headers.

The alignment of the column headers and the column contents can be justified left, right or centered.

The **COLUMN WIDTH** is set in [mm]. The field **REST** next to the column width shows the remaining print width for the chosen layout and paper size. The numbers automatically adjust to changes from landscape to portrait and to the margin size. Positive numbers on the right side indicate the table still has some room. If the number is negative, part of the table is outside the area that will be printed. Extra space in the table is printed as a free column. Use the mouse to change the column width.

Table settings

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### Presentation of Numerical Values in the Columns

The fields **DISPLAY** and **ROUNDING** define the layout of the column and how the numerical values are rounded.

| ;      | The display format can be defined differently for values >0, <0 and =0 (in this order). A semicolon divides the three sections. |  |
|--------|---------------------------------------------------------------------------------------------------------------------------------|--|
| •      | Decimal. Which character is used in your table depends on the Windows country code set in your PC.                              |  |
| ,      | Separator for thousand. Which character is used depends on the Windows country code set in your PC.                             |  |
| 0.#    | Acts as a place holder for digits. 0 is always displayed; # only if a digit is contained in the place of the place holder.      |  |
|        | 0.# shows 45 as 45 and 45.3 as 45.3.                                                                                            |  |
|        | 0.0 shows 45 as 45.0 and 45.3 as 45.3                                                                                           |  |
|        | ### shows 45 as 45                                                                                                              |  |
|        | 000 shows 45 as 045                                                                                                             |  |
| "Text" | Hyphenated characters are output as they are.                                                                                   |  |

The **DISPLAY FORMAT** of a table column can be configured individually.

**ROUNDING** the numbers can be accomplished in many different ways. The value for the rounding addition can be between 0 and 9.999.

The numerical values are always rounded to the number of digits after the decimal delimiter. If your format does not contain any "0" or "#" behind the decimal the values will be rounded to integers.

The rounding addition is added to the first digit not shown after the decimal and the value is truncated after the last digit then. This means that a value of "0" will not round, "5" will cause the program to round the normal way, "9,5" will round according to RLS-90 and "9,999" will always round up to the next value.

#### **Rearranging Columns**

The sequence of columns can be changed. Click on the gray column header to move and drag it with the left mouse button depressed to the new location. A black vertical line will show the new location.

In column layout keep the left mouse button pressed on the line to be moved and drag it to its new location.

### **Column Setup for Diagrams**

Select the charts you want to print. The column width and the diagram height define the size for all diagrams. The size of the diagram is automatically adjusted to keep the ratio of height and width constant. For the diagrams too you see the remaining printable width.

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**Table settings** 

### Detail header setup

The definition of the column width in the setup for the column headers in detail tables differs from other tables. The column width is the length of the field in the column header. **Title 1** is printed before the content, the **unit** after the content. Title 2 is not displayed.

If you don't want to display the text before the column contents e.g. for the receiver name, delete the text in title 1. To see the meaning of the column in the column list anyway, you can enter it in the field title2.

### **Reset titles**

Use **RESET TITLES** to overwrite the settings in the current table with the global settings and the assessment library settings. Please select, whether you want to overwrite the highlighted columns, all columns of the table you are just working on or all columns of the open result file with the default settings

| Reset titles 🛛 🔀                                                                                                                                           |        |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--|--|
| Column titles, units and legends will be reset to program default<br>settings.<br>Level dependent columns will be reset to assessment library<br>settings. |        |  |  |
| Reset titles for                                                                                                                                           |        |  |  |
| Selected columns of the current table                                                                                                                      | ОК     |  |  |
| <ul> <li>All columns of the current table</li> </ul>                                                                                                       | Cancel |  |  |
| <ul> <li>All tables of this result file</li> </ul>                                                                                                         | Help   |  |  |

The assessment used during the calculation is also stored in the format file (\*.fmt). If the assessment columns in the format file and the assessment used during the calculation do not correspond (for example after a recalculation with another assessment); you will get a warning message. Please use reset titles to initialize the column headers from the assessment library.

### Legend

The legend text output in the legend section of the printed sheet can be assigned freely. Enter the legend text in the field **LEGEND** in the **COLUMN SETUP**. The legend is printed with the table according to the definition in the table settings.

To print the legend individually, click the right mouse button in any of the tables and select **LEGEND REPORT**.

Table settings

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# **Table layout**

| olumn setup Table layout Page format                | Header and footer text                                      |
|-----------------------------------------------------|-------------------------------------------------------------|
| Font settings                                       | e 10 V Line spacing 1.00                                    |
| -Display in column header<br>V Title 1<br>V Title 2 | Color of header<br>Master list header<br>Detail list header |
| Print options<br>Print receiver name                | For first floor only                                        |
| Print legend                                        | No legend                                                   |
| Orientation                                         | Portrait                                                    |
| Page numbering starts with                          | 1                                                           |
| Text for header/footer variables                    |                                                             |
| Table title:                                        | Assessed receiver levels                                    |
| Text 1:                                             | 2                                                           |
| Text 2:                                             |                                                             |
|                                                     |                                                             |

The table layout defines the layout of the different tables of a calculation result, because each table has different requirements to the layout. The single point table, for example, will normally be printed with another orientation (portrait) and with another font size than the mean propagation table that contains much more columns.

Select the display in the column headers with the checkboxes **TITLE1**, **TITLE2** and **UNIT**. These settings are used for the display on screen and for the printout. For the printout you can adjust the **COLORS** for the column headers of the master table and for detail tables additionally the color for the header rows of each receiver.

For the receiver table select whether you want to display the receiver name for all floors or only for the first floor. With the selection **FOR FIRST FLOOR ONLY**, object number and serial number are only printed for the first floor, too. This option is only used, if the single receiver table is sorted by the receiver name.

Define for the printout of master/detail tables whether a **PAGE BREAK** is allowed within a block. Otherwise the complete block with the column header will be printed on the next page.

Determine the position and printout of the **LEGEND**. The page number is adjusted automatically.

If you used a filter in the single receiver list, it is also used in the printout.

In the table layout, the report title and two additional texts can be entered to be placed in the headers or footers of the table.

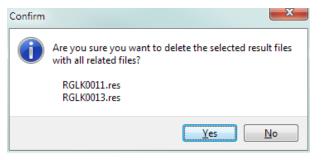
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Table settings

## Delete and store result files

Many different tables are stored during the calculation depending on the calculation type and result documentation depth.

Go to **FILE** -> **OPEN**, click on the result file (\*.res) you want to delete and press the **Delete** key. For security reasons, the selected results are displayed in a message. Please confirm the action.



As a backup copy, you can store all database tables related to a result file under a new name. Go to **FILE -> SAVE AS** and change the number or enter a text instead of the number. The file name must begin with RSPS.

## Sort order

Sort single receiver tables, source tables and detail tables according to the columns in the table.

| Sort order: Single                                                                                           | Receiver |   | ×                                |
|--------------------------------------------------------------------------------------------------------------|----------|---|----------------------------------|
| Available columns                                                                                            |          |   | Sort by                          |
| 1. RNo<br>3. Receiver<br>4. ObjNo.<br>5. Usage<br>6. Rec ObjID<br>7. Fl<br>8. Sel.<br>9. House-ID<br>10. Dir |          | > | 2. Formatted object No.          |
| 11. X<br>12. Y<br>13. Z<br>14. GH<br>15. LrD,lim                                                             | -        |   | Order<br>ascending<br>descending |
|                                                                                                              | ОК       |   | Cancel Help                      |

Select sort from the right mouse menu. Click on the sort column on the left-hand side and click on the arrow. If necessary, select a second sort column that shall be used as a secondary sort criterion. The sort order can be ascending or descending for all selected columns.

Delete and store result files

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## Table formats and layouts of the result tables

Depending on the calculation type, calculation settings, noise types and source types, the result tables offer different tables for result data. Each tab in the result files represents a table, single receivers, sources, source spectra, time history...

Each table saves its own format and layout settings so content and appearance can be controlled and saved independently.

All pre-settings for the SoundPLAN Result Tables are defined in the global format file (Tab\_Layout.fmt in the Globdata folder).

When you open the result in the Documentation, the program saves a format file in the project folder (for example, RSPS0001.fmt). This format file contains all settings made for these results. When a format file does not exist, it will be generated from information defined in the global format file.

You can individually customize the selection of columns, their titles and units, and all settings for the table layout such as the font, size and color, and also set the texts for the table headers and footers. These settings can be saved globally to serve as templates for future tables.

As the appearance of all headers and footers should be uniform, there is a possibility to extend this table format to all types of tables. Header and footer texts are constructed with text variables (project title, project number, date...). When these building-blocks are customized and saved in the global format file, they can be used in other tables.

#### Save, load and transfer formats

With these functions you can save changes in the column setup (visible columns, column width, column headers...) and the changes in the table layout for all loaded tables. You can also change the global format file or generate a new format file.

Generating a new format file may be useful if you work for different clients that require different layouts or if you need different table headers for different purposes.

To transfer the page layout or a header or footer from one table to another, use transfer:

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Table formats and layouts of the result tables

| Fransfer layout                                |                             |           | <b>X</b> |
|------------------------------------------------|-----------------------------|-----------|----------|
| Transfer page layout and hea                   | der + footer text of this t | able to   |          |
| <ul> <li>loaded tables</li> </ul>              | 🔘 Global                    | O Project |          |
|                                                |                             | 6         |          |
| <ul> <li>tables of this result in t</li> </ul> | he selected layout file     |           |          |
| <ul> <li>all tables contained in</li> </ul>    | the selected layout file    |           |          |
| -Include settings for-                         |                             |           |          |
| Paper size                                     |                             |           | ОК       |
| Table font type                                |                             |           | Cancel   |
| Color of header                                |                             |           | Help     |

By default, the settings are transferred to all tables loaded from the selected result file. However, you can opt to transfer the paper format (letter or A4), the table font (but not the font size), or the table header color.

Afterwards, click Save in the column setup or the table settings:

| Save table layout                                                                                                                                                                                         |                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Format file     Global     Project     TAB_LAYOUT.FMT     Column setup of highlighted columns     Column setup and Table layout of the current table     Column setup and Table layout of all open tables | )                    |
| Include settings for Page layout and Header + Footer text Including paper size                                                                                                                            | OK<br>Cancel<br>Help |

If the settings are to be saved in the global format file tab\_layout.fmt, change to column setup and table settings of all loaded files.

Table formats and layouts of the result tables



Page layout, header and footer texts previously transferred to all active tables are saved globally for each of the tables.

If you want to modify a result table for which an fmt already exists, load the appropriate file:

| Load table layout                                                    |        |
|----------------------------------------------------------------------|--------|
| Format file                                                          |        |
| O Global ○ Project                                                   |        |
| TAB_LAYOUT.FMT                                                       |        |
| -Load layout for-                                                    |        |
| O Column setup of highlighted columns                                |        |
| O Column setup and Table layout of the current table                 |        |
| <ul> <li>Column setup and Table layout of all open tables</li> </ul> |        |
| Include settings for                                                 | ОК     |
| Page layout and Header + Footer text                                 | Cancel |
| Including paper size                                                 |        |
|                                                                      | Help   |

# 7

#### Transfer table settings to open results

Transfer column setup, table layout, page format and headers / footers in one step from the active result to all other open results with **FILE -> TRANSFER TABLE SETTINGS TO OPEN RESULTS**.

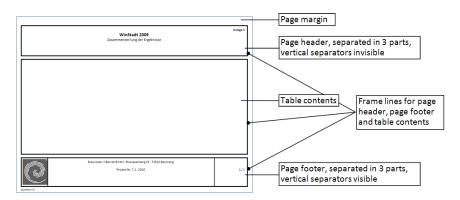
It is therefore sensible to first design all tables of one result as desired, then load further results and transfer the table settings.

### Page Layout

The page layout is used in SoundPLAN for all tabular printouts. It is also used for the Spreadsheet, the printouts from the libraries, the road and railway documentation in the Geo-Database and the photo documentation. Some features of the page formatting is only used in the Result Tables, because special information such as name of the calculation run or table title are only available here.

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Page Layout

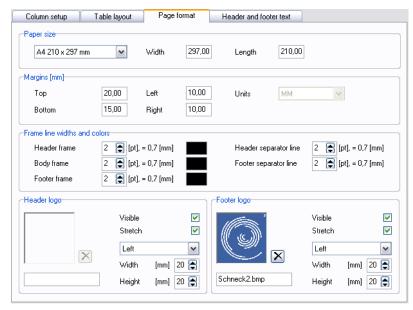


The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

Open the page layout with TABLE -> PAGE LAYOUT or right mouse button -> TABLE SETTINGS.

**Hint for the page layout of the Result Tables:** Just like for the column setup and the table layout the page format and the header and footer text is formatted for each table of a result file separately because the requirements might be different. In order to minimize the effort for formatting the tables it is nevertheless possible to transfer page format and header and footer texts to other tables. The settings in the table layout are not affected; the orientation (portrait / landscape) for example is not changed.

Define the format of the page in the tab index card "page format".



Page Layout

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Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

The header and footer sections have three partitions: Left, middle, right. Texts or logos in the left partition are left aligned, in the middle partition centered and in the right partition right aligned.

A graphics can be inserted in the header as well as the footer, for example your company logo or the logo of the customer. Click on the gray field to select the graphics file. Define the position (left, middle, right partition) the height and the width of the graphics. When you check the logo justification button ("**STRETCH**"), the logo is fitted into the allocated space. The print preview however will decrease its speed because of it and therefore it is advisable to select a logo of proper size.

Format the content and the size of the page frame in the tab index card "*header* and footer texts". The texts can be text variables, automatically updated with information stored in the project or own texts.

| Table settings: Single Recei  | ver                                                                                               |        |                                             | ×            |
|-------------------------------|---------------------------------------------------------------------------------------------------|--------|---------------------------------------------|--------------|
| Column setup Table layout Pag | e format Header and footer text                                                                   |        |                                             |              |
| Text variables >>             | Arial 8                                                                                           | 💌 U:   | se Rich Text format                         | Save         |
| Text page header              | Load                                                                                              |        |                                             |              |
| Left aligned                  | Centered                                                                                          |        | Right aligned                               |              |
|                               | <pn:project title=""></pn:project>                                                                | •      | Annex 2<br><pi:project no.=""></pi:project> | Transfer     |
|                               | <rn:table title=""> - <rt:run td="" tit<=""><td>le&gt;</td><td></td><td></td></rt:run></rn:table> | le>    |                                             |              |
|                               |                                                                                                   |        |                                             | Reset titles |
|                               |                                                                                                   |        |                                             | Preview      |
| Show separator                | Box height [mm] 20 😭                                                                              | Show   | separator                                   |              |
| Distance [mm] 10 😭            |                                                                                                   | Distan | ice [mm] 28 😭                               |              |
| Text page footer              |                                                                                                   | -      |                                             |              |
| Left aligned                  | Centered                                                                                          |        | Right aligned                               |              |
|                               | <cn:company name=""></cn:company>                                                                 |        | ###/ <total></total>                        |              |
|                               |                                                                                                   |        |                                             | ОК           |
| Show separator                | Box height [mm] 20 😭                                                                              | Show   | separator 🗹                                 | Cancel       |
| Distance [mm] 20 😭            |                                                                                                   | Distan | ice [mm] 25 🚍                               | Help         |

Page header and page footer are printed on all pages of the table as well as for the legend. To format the texts, highlight the text or text variable and click on the button **FONT**. Define the width of the left and right partition and the height of the frame. The three sections can be partitioned with vertical **SEPARATOR LINES**.

**USE RICHTEXT FORMAT**: Enables the use of different fonts in one header or footer section.

For the entry the following **TEXT VARIABLES** are prepared for you and will automatically be updated in case the information changes. Click the cursor to the partition where the text should be displayed and select the variable to be displayed:

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Page Layout

| Text variables >>       | <u>ר</u>           |                                                                                                   |                 |             |  |  |  |
|-------------------------|--------------------|---------------------------------------------------------------------------------------------------|-----------------|-------------|--|--|--|
|                         | Company name       | Project No.                                                                                       | File name       | Page No.    |  |  |  |
|                         | Project engineer   | Project path                                                                                      | Result No.      | Total pages |  |  |  |
|                         | Customer           | Run title                                                                                         | Text 1          | Date        |  |  |  |
|                         | Project title      | Table title                                                                                       | Text 2          | Time        |  |  |  |
| Variable name           |                    | Origin                                                                                            |                 |             |  |  |  |
| Company name            |                    | License file                                                                                      |                 |             |  |  |  |
| Project engineer        |                    | Project info                                                                                      |                 |             |  |  |  |
| Customer                |                    | Project info                                                                                      | Project info    |             |  |  |  |
| Project title           |                    | Project info                                                                                      |                 |             |  |  |  |
| Project number          |                    | Project info                                                                                      |                 |             |  |  |  |
| Project path            |                    |                                                                                                   |                 |             |  |  |  |
| calculation run title ( | only Result Table) | Calculation kernel / calculation run                                                              |                 |             |  |  |  |
| Table title             |                    | Text defined in the table layout of a result table, for all other printouts the name of the table |                 |             |  |  |  |
| File name               |                    |                                                                                                   |                 |             |  |  |  |
| Result Number (only     | Result Table)      | Result file                                                                                       |                 |             |  |  |  |
| Page number             |                    |                                                                                                   |                 |             |  |  |  |
| Total number of page    | es                 |                                                                                                   |                 |             |  |  |  |
| Date + Time             |                    |                                                                                                   |                 |             |  |  |  |
| Text 1 + 2 (only Res    | ult Table)         | Text defined in t                                                                                 | he table layout |             |  |  |  |

The variables can also be combined:

<pp:Project path><fn:File name>

will be displayed as

D:\SoundPLAN projects\Demos\Wincity 71\RSPS0001.res

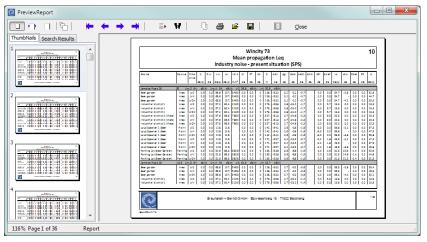
In the tab index card *table layout* (Result Tables) or in the tab index card "*print options*" (all other printouts) you can select the first page number for the printout, so that it is possible to have a consecutive numbering if the annex of a report contains more than one table.

Click on the button **PREVIEW** to check the page layout.

Page Layout

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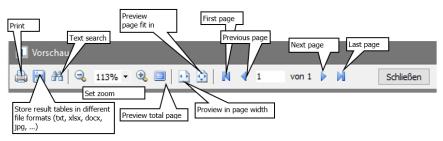
## The Print Preview



Preview

The preview shows you the documentation on screen the way it will look printed later on. The preview can be accessed from the documentation main menu via a or in the table layout with the button review.

The functions of the icons are as follows:



With the text search **W** you can search for any text string contained in the table, for example to search for a specific receiver. Under the tab *search results* you will find all pages where the search string was found. With the check box **MATCH CASE** checked, only texts are found with identical upper/lower case.

Via the symbol  $\square$  the currently active page of the table can be copied to the clipboard as a graphics.

#### Print Result Table

With the icon **PRINT** send the print job to the printer. Select all pages or only a part of the result documentation. Depending on the print options, the legend is printed before the table, after the table or not. You can also start the printout from the main menu of the Result Tables (**TABLE -> PRINT**).

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**The Print Preview** 

## **Export of the Result table**

You can save individual detail tables or receivers in the format xls or csv, or copy it to the Windows clipboard. For this export you can select if you want to see the detail tables only or the detail table along with the information of the receiver. Individuel columns or the raw data can be selected for export.

| Export Source cont | ribution     |           | ×    |
|--------------------|--------------|-----------|------|
| Table name: TCO    | N4001        |           |      |
| Export to          |              |           |      |
| (€) XLS            | ⊖csv         |           | rd   |
| Range              |              |           |      |
| Receiver           | + details    | (1173 rov | vs)  |
| 🔿 Detail tab       | le           | (51 rows) | )    |
| ○ Full table       | (unfiltered) | (1196 rov | vs)  |
| Format             |              |           |      |
| As display         | ved          | ◯ Raw da  | ta   |
| O                  | ĸ            | Cancel    | Help |

If you choose the export as xls file, the table is directly opened in Excel.

In the print preview (TABLE -> PREVIEW) you can export the results to various graphics formats. The tables are stored without header and footer sections.

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## 8 Spreadsheet

## **Overview Spreadsheet**

The SoundPLAN Spreadsheet was developed to load and compare several results (variants), for example to calculate the differences with formulas or to depict the benefit of different variants using statistical functions. Moreover, additional evaluations, for example to determine conflicts or affected inhabitants can be done.

|           |                | Status   | Quo  | Progn | osis | Differ | ence  | Limit ex | ceeded |
|-----------|----------------|----------|------|-------|------|--------|-------|----------|--------|
| Floor     | Direction      | LrD      | LrN  | LrD   | LrN  | Day    | Night | Day      | Night  |
|           |                | [dB(A    | 01   | [dB(  | A)]  | [dB    | (A)]  | [dB(     | (A)]   |
| Oak Str   | reet 1         | Usage    | : GR |       |      |        |       |          |        |
| Limit day | y / night 59 / | 49 dB(A) |      |       |      |        |       |          |        |
| 1         | N              | 57,9     | 50,5 | 59,5  | 53,1 | 1,6    | 2,6   | 0,5      | 4,1    |
| 1         | W              | 51,3     | 46,3 | 55,5  | 51,1 | 4,2    | 4,8   | -        | 2,1    |
| 1         | N              | 61,7     | 52,8 | 62,7  | 54,8 | 0,9    | 2,0   | 3,7      | 5,8    |
| 1         | 0              | 68,0     | 57,7 | 68,4  | 58,3 | 0,4    | 0,6   | 9,4      | 9,3    |
| 1         | S              | 64,2     | 53,8 | 64,5  | 54,3 | 0,3    | 0,4   | 5,5      | 5,3    |
| 1         | W              | 51,9     | 44,6 | 51,6  | 45,0 | -      | 0,4   | -        | -      |

8

0.3

Sample of a receiver table

S

W

56.2

53,8

46.4

45.1

Additional columns are used to enter formulas as in other spreadsheet programs, for example "prognosis day - status quo day" or "level day +3". Conditional formatting is used to highlight special cells.

56.3

55.8

46.7

49.3

0,3

42

0.1

2.0

Because you can load additional information from the properties in the Geo-Database (e.g. the number of inhabitants per building or the façade length per receiver) and use statistical functions nearly each and every evaluation is possible.

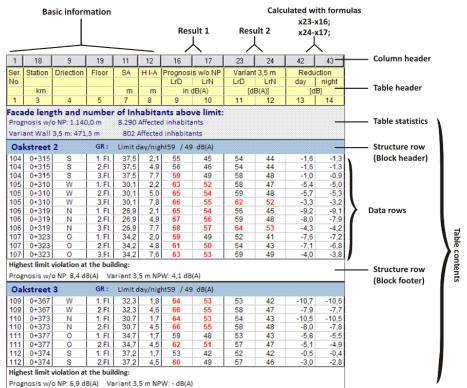
It is not necessary to export the data and after a result has been recalculated you get updated results and evaluations by just pressing a button.

The Spreadsheet executes different table types, which can also be linked together:

**Overview Spreadsheet** 

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- **Receiver table** (\*.ntd) for the receiver related tabular processing of the results of single point and façade noise map calculations.
- **Building table** (\*.bld) for the building related post processing of the results of single point and façade noise map calculations.
- Area table (\*.bfl) for statements referring to areas, also inhabitant and area statistics according to the EU directive for environmental noise.
- **Measurement table** (\*.pli) for the tabular evaluation of measurement results, available as ASCII data (\*.txt)
- Tables, that contain the properties of Shape-file import data (**dBase tables** (\*.dbf)) can be opened, modified and saved (**FILE -> OPEN DBF FILE**).



The **column header** shows the physical order of the columns. Some columns are nearly never displayed in the table (e.g. x, y, z), other columns might have been added later or you changed the position of a column in the table. Therefore, the physical order is not a consecutive number. The formulas use the physical column number.

Use the right mouse button on the column header to access often used functions (formulas, sort order ...).

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**Overview Spreadsheet** 

The **table header** contains the titles of the columns. In the table header cells can be combined to create easy to read headings. The header attributes can be edited when clicking on the **COLUMN LAYOUT** while the cursor is positioned in the header.

The **table content** is created out of the data loaded to the table. The text size and font for the table contents and the header can be changed in the **TABLE LAYOUT** of the **TABLE SETUP**. Once the settings have been made the text size can be shrunk or enlarged in the field text size. All texts are modified proportionally.

In addition to table contents and header, **text rows** can be inserted. The text size and font of the text rows is defined in the section layout for standard text and title on the right-hand side of the tool bar.

One of the main advantages of the Spreadsheet is possibility of creating **formulas** (right mouse click on the column header) for specified columns which can be as complex as in a program such as Excel.

**Structure rows (TABLE -> TABLE STRUCTURE)** allow summarizing columns with the same contents in header and footer rows and to use statistical functions (e.g. highest level exceedance per building).

The **table statistics (TABLE -> TABLE STATISTICS)** allows statistical statements for the whole table, to compare for example costs and efficiency of different noise protection concepts.

Another feature is the **permeability** between tabular and graphical presentation. Depending on the table type the tables can be displayed in the SoundPLAN Graphics as a flag at a receiver, with a colored scale for an area or directly as a Spreadsheet box.

The Spreadsheet uses different column types:

- Value columns contain values as floats with any number of decimals.
- Integer columns contain values as integer (without decimals).
- Text columns contain text.
- Boolean columns (logical columns) differ between true and false.

Due to the exchange of information between area and receiver table, receiver related information, e.g. "number of inhabitants above a certain limit" can be summed up for annoyance analyses (e.g. building blocks or districts of a town).

The delivered sample templates help you to create meaningful tables in a short time. Thus, the concept is very flexible; many documentation tasks can be accomplished. For example, the comparison of different variants of an investigation, the creation of complex formulas definition of header blocks and so on. Check the formulas of the sample tables and if necessary, modify them for your purposes. You can create your **own templates** which contain the information needed for special tasks or special demands.

**Overview Spreadsheet** 

The **page layout** is defined in **FILE** -> **PAGE LAYOUT**. The page layout is only visible in the preview of the page layout. While processing the Spreadsheet the page layout is not visible. The maximum width of the table to fit in the page and the page breaks are displayed as red dotted lines.

## Getting started with the Spreadsheet

Process to create a standard receiver table with the results "prognosis without noise protection" and prognosis with noise protection" and a difference column:

- Open the Spreadsheet from the SoundPLAN Manager. The Spreadsheet file manager is opened.
- Keep the presetting for the table type "receiver table" and the template "new template" to generate a standard table.
- Click the **NEW** button. Select the first calculation result "prognosis without noise protection" and in the next dialog the limit columns and time slices you want to be included.
- Afterwards you can use the filter settings to load only certain receivers (e.g. the loudest receiver per facade).
- Click OK to generate the table.
- Load the second calculation result ("prognosis with noise protection") with FILE -> ADD RESULT COLUMNS.
- Select the desired columns for this result, too. Because the limits are the same as for the first result, deactivate the checkbox "limit".
- The program recognizes identical receivers by checking the coordinates and the building ID and adds the results in additional columns after the first result.
- Create two new value columns with the symbol button
- Combine the two upper and the two lower cells in the table header with the symbol button and fill in the header cells (e.g. "Difference" in the upper line, then the names of the time slices and "[dB]" in the lower line).
- Click right on the column header of the first new column and select FORMULA from the context menu. The table settings are opened which provide the column selection, the legend texts and the formulas for the calculation and for conditional formatting. Enter the difference formula in the section "formula for the calculation": here "x17 x15;" (the Spreadsheet formulas are closed with a semicolon). Mark the formula, copy it with *Ctrl+C*, click on the second difference column in the section "columns" and insert the formula with *Ctrl+V* in the section "formula for the calculation". Adjust the column numbers in the formula and close the table settings with OK. The differences are now calculated.

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- Highlight a data cell of both of the difference columns with the mouse, click right on the column header and select COLUMN LAYOUT DATA:19-20 from the context menu. Change the decimals to 1. In addition, you can insert lines between the columns to the left and to the right.
- The receiver name and the usage shall only be displayed if the receiver name changes. Highlight one cell in both of the columns and open the column layout with a right click on the column header. Activate DO NOT SHOW TEXT IF SAME AS PREVIOUS TEXT and USE REFERENCE COLUMN. Enter the column number of the receiver name as reference column. Furthermore, horizontal lines shall divide the receivers. Check mark SHOW LINE BETWEEN DIFFERENT TEXTS. Close the column layout with OK.
- Use the layout possibilities for the table layout.
- Adjust the page layout. In the header and footer section, you can for example include your company logo and enter own texts and text variables to customize the table.

#### Process to create an area table [module Tools SIP]:

- Open the Spreadsheet from the SoundPLAN Manager, the Spreadsheet file manager is opened.
- Choose the table type "area table (conflict map)".
- Click the **NEW** button.
- Select a Situation or a Geo-File containing areas (object type area usage in the Geo-Database). For the EU statistics it is sufficient if a calculation area is in the data. If area usages are in the data, the statistics are generated for the individual areas, too.
- Click OK to generate the table.
- For the EU statistics, select the desired statistics with FILE -> ADD ADDITIONAL COLUMNS and select a grid noise map for the area statistics or a façade noise map for the inhabitant statistics. See <u>"Post processing in the Spreadsheet"</u> (page 667).
- If you select the result of a grid noise map with FILE -> ADD RESULT COLUMNS, the averaged value per area is added in an additional column. These values can also be used for calculation e.g. conflict maps or annoyance analysis. When you create a <u>conflict map</u> (page 674) in the Graphics, an area map is automatically generated. You can further edit this table, for example to generate summed up conflict maps using the formulas.

## **Table Templates of the Spreadsheet**

Depending on the languages to be installed during the installation, additional localized templates are offered. The default templates (subfolder **en**) are always installed and displayed.

Table Templates of the Spreadsheet

| Template | en\System\NP passive.ntt                          | - |
|----------|---------------------------------------------------|---|
|          | New template                                      |   |
|          | Current template                                  |   |
|          | Spreadsheet with building reference.ntt           |   |
|          | en\System\NP passive.ntt                          |   |
|          | en\System\Simple table.NTT                        |   |
|          | en\System\Spreadsheet with building reference.ntt |   |
|          | en\System\Structured table.NTT                    |   |

Select the template you want to use in the file manager:

**NEW TEMPLATE** generates a table with predefined columns: receiver name, floor, direction, limit levels and level columns.

**CURRENT TEMPLATE** uses the columns and the layout of the currently opened table. When you start the Spreadsheet, the current template is the same as the new template.

DIFFERENT FORMATTED TEMPLATES are supplied as sample tables.

Store your own templates for further use! If you have created a table or customized one of the supplied templates so that you can use them in different projects, store it with File -> save as template in the folder GLOBDATA. A format file including the page layout, logos, fonts and the header and footer definition for the printout is automatically stored to each table template.

## File Manager of the Spreadsheet

Upon opening the spreadsheet, the first program part is the Spreadsheet file manager.

| C Spreadsh                          | eet File Man                                          | ager                                                                                                       |                                                                       |       |                                        |
|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------|----------------------------------------|
| -Create a new t                     | able                                                  |                                                                                                            |                                                                       |       |                                        |
| Table typ                           | Receiver                                              | table (Single points, Fa                                                                                   | cade Noise Map)                                                       |       | ✓ Help                                 |
| Template                            | en\Syste                                              | m\Structured table.NT1                                                                                     | ſ                                                                     |       | Columns                                |
| Description                         |                                                       |                                                                                                            |                                                                       |       |                                        |
| Floor                               | Direction                                             | Status Quo<br>LrD LrN<br>[dB(A)]                                                                           |                                                                       |       | Limit exceeded<br>Day Night<br>[dB(A)] |
|                                     | gs / Filters                                          | show before loading                                                                                        | 1                                                                     |       | New Help                               |
| -Select tables fr                   | rom current proje                                     | ct                                                                                                         |                                                                       |       | Open                                   |
| Open recently                       | used tables                                           |                                                                                                            |                                                                       |       |                                        |
| D:\SoundP<br>D:\SoundP<br>D:\SoundP | 'LAN Projekte\D<br>'LAN Projekte\D<br>'LAN Projekte\D | emos\WINSTADT 200<br>emos\WINSTADT 200<br>emos\WINSTADT 200<br>emos\Kopie von WINS<br>eispiel\WINSTADT 70\ | 9\Immissionsorttabelle<br>9\Receivertable3.ntd<br>TADT 2009\Immissior | 3.ntđ |                                        |

If you want to generate a new spreadsheet, first select the table type. If you want to open one of the spreadsheets you worked on last, go to the bottom of the dialogue and open an existing file.

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File Manager of the Spreadsheet

#### Generate a new Spreadsheet with an existing template

After selecting the table type (receiver table, area table), you are presented with all templates fitting the selected file type. The current template is shown in the preview window. Select the desired template and continue with **NEW**.

The box TABLE CONTENTS opens where you assign all connections simultaneously.

|                |                                             |   |               | Columns |                     |                               |
|----------------|---------------------------------------------|---|---------------|---------|---------------------|-------------------------------|
| Name           | Description                                 | ^ |               | Columns | Title               | File                          |
| 🖬 RCNM1203.res | Industry - Meshed Noise Map                 |   |               | 1-12    | Receiver data       | RGLK0011.res                  |
| 🖬 RGLK0011.res | Road noise - Present situation (FNM)        |   |               | 13-15   | Reference line      | <rglk0011.res></rglk0011.res> |
| 🖬 RGLK0012.res | Rail noise - present situation (FNM)        |   | $\rightarrow$ | 16-17   | Limit               | RGLK0011.res                  |
| 🖬 RGLK0013.res |                                             | ≡ | ←             | 18-19   | Status Quo          | RGLK0011.res                  |
|                | Road noise - Prognosis (FNM)                |   |               | 22-23   | Prognosis w/o NP    |                               |
|                | Rail noise - with noise protection (FNM)    |   |               |         | r logilotio in o ni |                               |
| 🖬 RGLK0321.res | Oak Street - without noise protection (FNM) |   | +             |         |                     |                               |
| 🖻 RGLK0322.res | Oak Street - with noise protection (FNM)    |   |               |         |                     |                               |
| 🖻 RGLK1111.res | Road noise - calculation for 3D             |   |               |         |                     |                               |
| 🖬 RGLK1123.res | EU Directive Facade Noise Map               |   |               |         |                     |                               |
| BSPS0021.res   | Road noise - present situation (SPS)        |   |               |         |                     |                               |
| RSPS0022.res   | Rail noise - present situation (SPS)        |   |               |         |                     |                               |
| 🖬 RSPS0023.res | Industry noise - present situation (SPS)    | V |               |         |                     |                               |
| 2              |                                             |   |               |         |                     |                               |

Activate the results for the different variants contained in the template by double clicking or using the arrow to the right. The reference axis and the limits (receiver table) are automatically selected from the geometry of the first result file. Click on the column labeled reference line in order to select reference axis from a different situation.

When a calculation of one calculation variant was split up in several calculation runs, additional result files can be appended to the end of the table. Click the + sign and attach the result file.

|   |   | Columns |                  |                               |              |
|---|---|---------|------------------|-------------------------------|--------------|
|   |   | Columns | Title            | File                          | File         |
|   |   | 1-12    | Receiver data    | RGLK0011.res                  | RGLK0111.res |
| r |   | 13-15   | Reference line   | <rglk0011.res></rglk0011.res> |              |
| Ľ | 2 | 16-17   | Limit            | RGLK0011.res                  | RGLK0111.res |
| Ŀ | ← | 18-19   | Status Quo       | RGLK0011.res                  | RGLK0111.res |
|   |   | 22-23   | Prognosis w/o NF |                               |              |

The **TABLE CONTENT** is automatically opened when a new table is generated from a template. If you want to open this dialog later, use **FILE > TABLE CONTENT**.

Use **SETTINGS / FILTER** to reduce for example the number of receivers (e.g. only the loudest receiver per building), see "<u>Settings and Filter</u>" on page 415. The document settings are automatically displayed before the table is opened if the template contains customized filter.

File Manager of the Spreadsheet

#### Generate new Table with a new Template

After selecting a spreadsheet type (receiver table, area table) you see the columns that by default are included in the spreadsheet. Result columns are not shown because the number of desired time slots is not known at this point.

With the button **COLUMNS** you get to the column selection where you can activate all possible columns fit for the file type of the current spreadsheet or deactivate not needed columns.

Next select the result columns, the noise limit columns and the time slices for which you want them presented.

Use **SETTINGS / FILTER** to reduce for example the number of receivers (e.g. only the loudest receiver per building), see "<u>Settings and Filter</u>" on page 415.

Click OK to load the table.

#### **dBase Tables**

dBase tables (\*.dbf) can be opened in the SoundPLAN Spreadsheet. Shape-files consist of a dBase-table containing the objects properties and all of their definitions and a file with the coordinates. In any case it is advisable to view this database table before importing the Shape-files. The Spreadsheet makes it possible for example to re-configure traffic data given in a format incompatible to SoundPLAN so that it can be imported. The formula generator in SoundPLAN is a very helpful tool here.

As the Excel spreadsheet from the version 2007 can no longer save the data in the dBase-format, we have generated a possibility here within SoundPLAN to cope with these data.

If the dBase table is stored in the project: Open the Spreadsheet, click on the menu topic **OPEN** in the file selection manager and select the file filter for dBase (\*.dbf).

If the dBase table is stored anywhere on the computer: Open the Spreadsheet, close the file selection manager, invoke **FILE -> OPEN DBF FILE** and select the table.

The functionality was restricted to open Shape-file dBase-tables:

- Load and save (save as is not offered as the dBase-table must have the same name as the rest of the Shape-files, safety copies can be generated using the Windows-Explorer).
- Generation of extra columns.
- Entry and calculation of formulas.

When you save the table, it is saved in the dbf-format rather than in the SoundPLAN format. Formulas and references entered are converted into values.

File Manager of the Spreadsheet

## **Settings and Filter**

There are several options and filters to select the receivers you want to display in the table. This is mainly needed for the results of facade noise maps.

The document settings are automatically displayed before a table is opened if the template contains customized filter. In the Spreadsheet you open the document settings with **OPTIONS -> SETINGS / FILTER.** 

| Settings / Filter                                           | ×             |  |  |
|-------------------------------------------------------------|---------------|--|--|
| Options                                                     |               |  |  |
| Calculate with displayed float values                       |               |  |  |
| Update and add data in new columns only for existing points |               |  |  |
| Consecutive numbering of the automatically generated rec    | ceiver number |  |  |
| Search type to assign receivers                             | x/y/z 🗸       |  |  |
| Filter settings only used for rebuild and for new documents |               |  |  |
| Exclude facades smaller than                                | 1,0 m         |  |  |
| Load only points which also are in                          | É             |  |  |
| Column dependent filter                                     |               |  |  |
| ☐ filter by points ☐ filter by buildin                      | gs            |  |  |
| OK                                                          | Cancel Help   |  |  |

Normally the Spreadsheet performs all calculations without truncating. Because of rounding the numbers if you display a column with only one or without decimal places it may be that differences have unexpected results depending on where in the process the results are rounded.

Activate the setting **CALCULATE WITH DISPLAYED DECIMAL VALUES** to get results consistent with the values displayed in the table.

Example with one digit after the decimal: 51. 5 (51.541) - 51. 5 (51.450) results in

setting is activated: 0.0

setting is not activated: 0.1

When receivers differ between two result files the option **UPDATE AND ADD DATA IN NEW COLUMNS ONLY FOR EXISTING RECEIVERS** assures that the program is not generating extra receiver lines for the second result file but rather amends only the ones already present.

The setting **CONSECUTIVE NUMBERING OF THE AUTOMATICALLY GENERATED RECEIVER NUMBER** fills gaps in the receiver numbering that will occur, for example, when a Facade Noise Map is calculated only within a calculation area. This setting is required if you want to amend results to existing files.

**Settings and Filter** 

With the **SEARCH TYPE** to assign receivers you can compare receivers, for which the receivers do not have the same position. This may be necessary for the total noise assessment, if different standards have different requirements for the position or the calculation height of the receivers.

Choose how the receiver table should find "identical" receivers:

x/y/z

x/y/floor

Object number / floor

Also read "Process receivers with non-identical positions (page 686)".

**DO NOT DISPLAY POINTS ON THE FACADE SMALLER THAN...** [M] loads all receivers but only displays the receivers fitting the filter definition. Receivers blanked out are still included in the table statistics. This filter is used to prepare a Spreadsheet for the Graphics: Receivers at non-relevant facades (balconies, oriels...) shall not be part of the Spreadsheet but shall be loaded and displayed in the Graphics if the limit at the facade is violated.

With the selection **LOAD ONLY POINTS WHICH ALSO ARE IN** you can restrict the loaded receivers to those receivers, included in another receiver table.

#### Column dependent filter

The column dependent filters are dependent of a (or all) level column(s) of a result.

The there is a distinction between 2 filter types, filters depending on buildings and filters depending on coordinates. For the coordinate-wise filtering only the coordinates are loaded whereas the building dependent filtering will load all coordinates of a building as long as the criterion for at least one coordinate of the building is met.

As soon as you change the filter settings for the current document with **OPTIONS** -> **SETTINGS / FILTER**, you are asked if you want to regenerate the table. In this case all coordinates of all results are loaded and sorted building by building, afterwards the filter is applied.

#### Filter column and type of rounding type

| Column dependent filter |                              |                 |                      |        |
|-------------------------|------------------------------|-----------------|----------------------|--------|
| 🗹 filter by points      | 🗌 filb                       | er by buildings | ;                    |        |
| Filter column           | 14: outdoor stage - nord     | 12000 wind fro  | om south LrD [dB(A)] | $\sim$ |
|                         | ☑ use filter for all time sl | ices            |                      |        |
| Conflict column         | 11: Limit LrD, lim [dB(A)]   |                 |                      | $\sim$ |
| Round mode              | do not round                 | $\sim$          | Decimals count       | 0      |
|                         |                              |                 |                      |        |

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**Settings and Filter** 

With the **FILTER COLUMN** you define the column that should be used as filter. These can be all value and Boolean columns contained in the table. You can also specify the column for checking for conflicts. With the check mark **APPLAY FILTER TO ALL TIME SLICES** the filter criteria are applied to all time slices of the results. For example, for the filter "load only receiver points with conflict ", this means that only the receiver point with the highest magnitude of excess to the noise limit is used, regardless of the time slice. Please be aware that this is not necessarily the receiver point with the highest noise level.

For the decision which point has a conflict, the **ROUNDING MODE** is important and also the information to which decimal it shall apply. It is for example possible that a receiver point in accordance to the RLS90 is not a conflict in the un-rounded state but that the rounding lifts it to the criterion to become a conflict. For this you need to define the parameters here.

If due to rounding, multiple values are becoming identical, the value of the highest infringement to the limit is used to set the biggest conflict.

The setting "calculate with displayed float values" is **not** used for the filtering.

#### Filter by buildings

| Load only buildings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                         |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----|
| 🗹 with conflict                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | with level >=                           | 0,0 |
| load only the point with the poin | ne highest conflict or level per facade |     |

In accordance to the checkboxes the program loads either only buildings **WITH CONFLICT**, or buildings **WITH THE LEVEL** >= an entered threshold value. All receiver points are loaded as long as at least one meets the filter criteria. In addition, you can opt to only load a single receiver point per façade.

#### Filter by receiver points

| Point filter                |                         |                            |     |
|-----------------------------|-------------------------|----------------------------|-----|
| Load only points            |                         |                            |     |
| with conflict               | 📃 with lev              | el>=                       | 0,0 |
| Load only points with the h | ighest level / conflict |                            |     |
| 📃 per facade                | 📃 per floor             | 📃 per building             |     |
| Load only floors            |                         |                            |     |
| all affected                | 🗌 only wit              | h highest level / conflict |     |
|                             |                         | 2                          |     |

With the receiver point type filtering criteria on the same line are mutually exclusive whereas criteria below each other can be added. For example, you can select to load only **POINTS WITH CONFLICTS** or to load **POINTS WITH LEVELS GREATER THAN.** You can further refine the selection by checking the box for loading receiver points with the highest level / conflict **PER FAÇADE**, **PER FLOOR** or **PER BUILDING** 

**Settings and Filter** 

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With loading floors **ONLY WITH HIGHEST LEVEL / CONFLICT** only the single floor with the highest values is loaded whereas **ALL AFFECTED** will look at every floor of the building.

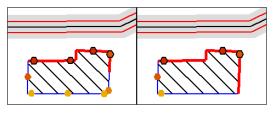
#### Effect of the filtering upon calculations

If for example you are using the point receiver filter to LOAD ONLY POINTS WITH THE HIGHEST LEVEL PER BUILDING and only LOAD FLOORS WITH THE HIGHEST LEVEL, only a single value is loaded per building. This point then all inhabitants of the building are assigned to (the columns "inhabitants" and "inhabitants /façade/floor" will contain identical values). If the filter to show ONLY CONFLICT is active, you can easily generate worst case calculations for an area as all inhabitants of all building are assigned to the point on the building that shows the highest conflict value.

**Additional information:** Hidden rows are calculated and evaluated for the structure lines. They are only omitted for the statistics (Menu Tools).

#### Filter settings in Façade Noise Map and level tables

If multiple receiver points on a façade have been calculated and only some of them are showing a conflict, the display without filtering will only display sections of the facade representing the conflict receiver. If you use the filter to **LOAD ONLY THE POINTS WITH THE HIGHEST LEVEL PER FACADE**, the entire facade is marked as having a conflict.



Similarly, the display of the Facade Noise Map in the object settings will use scale colors to paint the facade either for a single receiver or for the entire facade.

For the level tables the display combination of showing conflict facades in combination with the selection to load only the **POINT WITH THE HIGHEST VALUE FOR THE ENTIRE BUILDING** is not sensible as only a single point is marked even if there are multiple conflicts.

## **Insert Results and Columns**

#### Add new (empty) columns

The quickest way to add value columns, text columns or Boolean columns is to click on one of the symbol buttons. The columns are appended to the end of the table. The less frequently used integer columns are selected with TABLE -> ADD COLUMNS ->. Move the columns afterwards to the

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desired position. To do so, keep the left mouse button pressed on the column header and move the column.

In the cursor is in one specific column, you can insert column before the current column with **TABLE** -> **INSERT COLUMNS** ->. The column is then inserted physically to the selected position. This means that the column numbers of the following columns is incremented. The column reference in formulas is automatically corrected.

#### Add columns with data and results



#### Add result columns

For the documentation of the results of several calculation runs e.g. different noise sources or different states of investigation (analysis, forecast), add columns with **FILE -> ADD RESULT COLUMNS** to the existing table. If the coordinates of the receiver locations are the same as in the previous result file ("same" is specified by the **SEARCH TYPE TO ASSIGN RECEIVERS**, see "<u>Settings and Filter</u> (page 415)"), the results are added in additional columns for the same receiver.

Select the desired result file and define the limit columns and level columns you want to load in the next dialog. It is for example only necessary to insert the limit columns again, if the results use different assessments.

**Insert Results and Columns** 

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| Select result columns                         |                                                                                                                                                                                               |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Column types                                  | Time slices                                                                                                                                                                                   |
| ✓ Limit<br>✓ Level                            | <ul> <li>✓ LrD (Noise level Day)</li> <li>✓ LrN (Noise level Night)</li> <li>□ LD,max (Maximum Level day)</li> <li>□ LN,max (Maximum level night)</li> <li>✓ LrDN (Noise level DN)</li> </ul> |
| Select which time slices shall be created for | the selected column types.                                                                                                                                                                    |
|                                               | OK Cancel                                                                                                                                                                                     |

Receivers that have not been included in the first result file are appended at the end of the table. For these receivers only the new column can be filled in. You are informed about the number of receivers that do not match:

| Warnung |                                                                                                                       |
|---------|-----------------------------------------------------------------------------------------------------------------------|
| ⚠       | Number of additional result points, which are not in the current table: 15<br>These points will be added.             |
|         | Number of points in the current table, for which no result exist in the selected file: 52 These rows are highlighted. |
|         | OK                                                                                                                    |

Click OK to implement the new result columns in your table.

#### Add results

To append a result to an existing column of the receiver table, for example, if the calculation was split up in several calculation runs are processed with FILE -> ADD **RESULTS**. The dialog "table contents" is opened, in which you can assign one or more result files to the different level columns:

| es to select   |                                             |   |               | Columns |               |                 |      |
|----------------|---------------------------------------------|---|---------------|---------|---------------|-----------------|------|
| Name           | Description                                 | ^ |               | Columns | Title         | File            | File |
| RGLK0012.res   | Rail noise - present situation (FNM)        |   |               | 1-13    | Receiver data | RSPS0021.res    |      |
| RGLK0013.res   | Industry noise · present situation (FNM)    |   |               | 14-15   | Limit         | Leg 06-22)22-06 |      |
| BGLK0111.res   | Road noise · Prognosis (FNM)                | = | $\rightarrow$ | 16-17   | Status Quo    | RSPS0021.res    |      |
| d RGLK0112.res | Rail noise - with noise protection (FNM)    |   | ←             | 20.21   | Prognosis     | BSPS0121.BES    |      |
| d RGLK0321.res | Oak Street - without noise protection (FNM) |   |               |         |               |                 |      |
| 🖬 RGLK0322.res | Oak Street - with noise protection (FNM)    |   |               |         |               |                 |      |
| BGLK1111.res   | Road noise - calculation for 3D             |   |               |         |               |                 |      |
| BGLK1123.res   | EU Directive Facade Noise Map               |   |               |         |               |                 |      |
| RSPS0021.res   | Road noise · present situation (SPS)        | ~ |               |         |               |                 |      |
|                |                                             | > |               |         |               |                 |      |

Click on the right-hand side on the variant for which you want to add results and select the file on the left-hand side. Select the file with the right arrow or with a double click. To further add a result to a variant, click on the +.

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#### Add additional columns

#### Add columns with further information

You can load additional information for the documentation and evaluation of the data using **ADD ADDITIONAL COLUMNS** -> **COLUMNS WITH FURTHER INFORMATION.** The origin of the information for the receiver table can be the building properties, the building geometry or a calculated value. The origin of the information for the area table is area usage properties.

| 💽 Select columns to create 📃 🗖                                                                                                                                                                                                                                                                                                                                                                                                                                  | X    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <ul> <li>noise control measures exist</li> <li>Facade length</li> <li>occupants / facade / floor</li> <li>No. of floors</li> <li>floor height</li> <li>Ground area</li> <li>ground area * floor number</li> <li>ground space / points per floor</li> <li>Volume</li> <li>dwelling count</li> <li>receivers count of the building</li> <li>building type</li> <li>ObjNo. building</li> <li>Format string Obj. No. building</li> <li>Building point ID</li> </ul> |      |
| ground area * floor number                                                                                                                                                                                                                                                                                                                                                                                                                                      |      |
| Calculated value depending on geometry and properties of the building Geodatabase                                                                                                                                                                                                                                                                                                                                                                               | g in |
| OK Cancel Help                                                                                                                                                                                                                                                                                                                                                                                                                                                  |      |

When moving the mouse over the column name, the origin of the information is displayed. You can see, for example, whether the column is a calculated value or a property.

These additional columns are used to create any kind of evaluation of the calculation results using the formulas.

Example:

With the information columns "ground area \* number of floors" and "count of receivers at a building" the inhabitants that are assigned to a building can be allocated to a receiver, which means to a level value to determine annoyances according to special criteria.

The calculated columns can be summarized per building or per area in structure rows or in statistics rows as well as used for further calculations, see "<u>Structured</u> <u>Tables and Table Statistics</u>" on page 443.

#### Add columns from receiver tables or area tables

A receiver table can use references from columns of an area table, whereby the information which is available for an area in the area table are added as a column for each receiver.

And vice versa information that is available for each receiver in the receiver table can be summarized in the area table for each of the areas.

#### Reference road or railway

A reference road or railroad can be selected from a Situation in the Geo-Database to show the kilometer post in the table. It is necessary that the field reference line in the road or railroad properties is hooked.



Reference line is check marked in the properties in the Geo-Database

The reference axis is automatically assigned from the geometry data used in the calculation. If you want to use the reference axis from another situation, **OPEN FILE** - **> TABLE CONTENTS** and select the Situation or Geo-File.

#### Check column content

By right clicking on a column header the selection **CONTENT** is showing the origin of the data. For columns tied to time slices, the time slice is presented as additional information. For result columns the time when the results were calculated is presented; with this date you can make the decision if this particular column needs to be updated. Open **FILE -> TABLE CONTENT** to check all file sources simultaneously.



#### Change the content of geometry containing columns

When you generate a new spreadsheet using existing templates, the current result file is always marked as the data source. For the geometry dependent columns, the situation used in the calculation run is used as the data source.

If you have a spreadsheet with 2 variants and do not want to reference the data to the situation contained in the first result file, open **FILE -> TABLE CONTENT** and select another Situation which contains the geometry data.

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## **Update or Rebuild Spreadsheet Content**

During the program session you can access newly calculated results with FILE -> UPDATE TABLE (*Ctrl+ R*) and FILE -> REBUILD TABLE.

A dialogue opens where you can select groups of columns to be updated to new information generated in a more recent calculation. This route was chosen because it is seldom needed to update the geometry columns, which for large tables would consume a lot of on-line time.

| Update point table                               | × |
|--------------------------------------------------|---|
| Select the column types which you want to update |   |
| Results                                          |   |
| Reference road or railroad                       |   |
| Building information                             |   |
| area values                                      |   |
|                                                  |   |
| OK Cancel                                        |   |

Groups are always updated completely. If you are amending a group, the complete group will be updated.

**REBUILD TABLE** completely builds the table, executes the filters in **OPTIONS** -> **SETTINGS / FILTER**, adds new receivers and removes receivers no longer in the data. Manual cell layout, text rows and manual changes are lost. The Spreadsheet will inform you about the number of added and removed receivers.

**UPDATE TABLE** updates only the results already included in the table. No receivers are added or removed and no filters are executed, but manual cell layout and text rows are kept.

Update or Rebuild Spreadsheet Content



## Table Settings

💶 Table Table width S No. Data type Width Ma 179,3 Curren 186,3 
 12,0
 Garden; area;

 15,7
 ; Object No.;

 16,7
 Formatted; Object No.;

 36,6
 Receiver name; ;

 11,2
 Station; ; km

 13,6
 Direction; ;

 8
 Station; :
 20 Boolsche 8 Text 9 Text ader Table contents Table k 10 Text 13 Text 12 Text 12 Text 11 Text 14 Dezimal 15 Dezimal 16 Dezimal 17 Dezimal 18 Dezimal 19 Dezimal 20 Dezimal 23 Dezimal 24 Boolsche 25 Boolsche Font >> 13.6 Direction; ; 8.8 Floor; ; 10.7 Usage; ; 9.8 SA; ; m 8.3 Limit; Day; in dB(A) 8.3 Limit; Day; in dB(A) 9.9 Status Quo; Day; in dB(A) 14.0 Prognosis w(o NP; Day; in dB(A) 14.0 Prognosis w(o NP; Day; in dB(A) 14.0 Prognosis w(o NP; Night; in dB(A) 12.5 (Claim; passive; Day 9.6 (Claim; passive; Night 3,39 Row distance: -0,28 Text distance from cell top End line 0,3 🖨 Color: Width: X X X Legend text Assessment level status quo dav/night Contents (calculation formula or data source) Search + Replace... Formula for conditional formatting (cell layout) RGLK0011.res: Road noise -Time slice 1: Noise level Day Present situation (FNM) If x18-x16 >0 then ^ cell(red,bold) Recalculate all OK Cancel Help

The table setup is accessed via the symbol button or TABLE -> TABLE SETTINGS.

#### Table Settings

All available columns are displayed in the list. The x in the first column shows whether a column is visible in the current table or not. Double click with the left mouse button on the field in the appropriate row to change the mark.

The **column number** is the physical number of the column which is used by the formula interpreter. This field cannot be edited.

The **data type** is helpful for creation of own formulas, if the data type is important for the syntax of the formula.

The **column width** can either be changed in the table itself when the cursor shape changes to a splitter (with a double click to the longest entry in the column), or in the **TABLE SETTINGS** or the **COLUMN LAYOUT** if you want to enter the accurate number.

The **column title** is taken from the header entered in the table. If you want to edit the column headers in the table setup, please make sure that the line break for the headers is defined with a semicolon. The header text for connected columns, the header text is the same for all columns.

Each column can be assigned a legend text, a calculation formula (only for columns that are directly assigned from a result) and a formula for conditional formatting. For columns from a calculation result the origin of the contents is displayed instead of a formula.

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**Table Settings** 

## **Calculating using Formulas**

#### **General Information on the Formula Entry**

Formulas can be entered in **value**, **integer**, **Boolean** or **text** columns which are not generated from a result or as additional information column.

To enter a formula, click right on the column header and select **FORMULA** from the popup menu or invoke **TABLE -> TABLE SETTINGS**.

SoundPLAN formulas are interpreted column by column not cell by cell, so it is not necessary to copy the formula. The commands are more or less the same as in table calculation programs but there are additional SoundPLAN specific commands, for example for the logarithmic level addition (++).

#### Formula Syntax

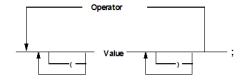
The structure of the formulas is described using syntax charts. Please read these charts always from left to right. If branchings are used in the syntax chart, select the branch needed. If a branch leads back, it is marked with an arrow. When returned to the main branch, read further to the right. Such a construction is called a loop.

The instruction is such a loop (see chart below):

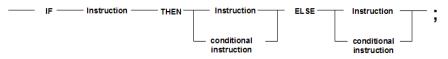
Enter a value in the main branch, e.g. 5, in the backwards branch an operator has to be entered, e.g. +. Back in the main branch a value is needed again, e.g. 4. The instruction therefore is: 5 + 4;

The terms operator and value are place holders for additional syntax charts, which can be further encapsulated by other place holders. In the description the key words are written in capital letters.

#### Instruction:



Conditional Instruction:



The end of a formula should be marked with a semicolon ;.

**Calculating using Formulas** 

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#### Table of the formula commands

A formula is a set of column references values, functions and operators which together form a new value. Formulas must be closed with a semicolon (;). The list below describes the functions available in the Spreadsheet and shows examples. The key words are written in capital letters, optional parameters are shown in square brackets ([]).

The formulas are also used in the property explorer (Geo-Database) and for the file operations (extended formula input calculation kernel / graphics). In the case of file operations, what is here referred to as column X is the result, for example FNM or GNM with parameters.

#### **Column selection**

X1, X3/ Res(1,2), Res (11,2): The columns x1 and x3 are interpreted: Correspondingly for the file operations Result 1 and Result 11.

X1..X3: The columns x1, x2, x3 are interpreted, only Spreadsheet

#### Operators

| Relational<, <=, =, >=, >, <>operatorsAND, OR, AND NOT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Boolean AND, OR, AND NOT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |
| operators                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |
| Assignment :=                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                |
| Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                |
| Simple instruction<br>Value 1 Arithmetic operator Value 2<br>Example: Evaluation of a level exceeding the limit<br>x17-x15;<br>IF, THEN,<br>ELSE<br>Conditional instructions check the truth value of an instruction. If the<br>instruction in the IF branch is true, the result of the THEN branch i<br>displayed otherwise the result of the ELSE branch.<br>Example 1: Evaluation of a level exceeding the limit; values < 0 shall be<br>displayed as 0. Add a value column.<br>IF x17 - x15 > 0 THEN x17 - x15 ELS 0;<br>Example 2: If the limits day and night are kept a dash shall be displayed<br>otherwise the limit exceedance day and night. (The limits are in the<br>columns x14 (day) and x15 (night) and the levels day / night are in the<br>columns x16/x17.) Add a text column.<br>IF (x11 - x7 <=0) AND (x12 - x8 <=0)<br>THEN "-"<br>ELSE TEXT(x11-x7) + "/" + TEXT(x12-x8) ; | is<br>ve<br>vd |

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**Calculating using Formulas** 

CASE

Case branching can be used to assign different cases different results or formulas.

#### CASE result OF value : formula ;

value : formula ;

[ELSE: formula ;]

#### END;

The *result* can be an integer value or a text; therefore, the *value* must also be an integer value or a text.

The ELSE branch is optional. In case no case is true and no else branch was defined, the formula interpreter will terminate with an error condition.

Example:

X9 is the column with the area usage. The formula column is the noise limit column.

CASE X9 OF "GR": 59; "MI": 64; "BD": 69; ELSE: 0; END;

#### **General text functions**

With relations and instructions, VALUE can also be a text. The text has to be marked by "". Text relations do not differ between normal letters and capital letters. As all characters marked by "" are interpreted as text, also slash (/) or dash (-) can be used in text columns. Because text columns can only interpret text and value columns can only interpret values, there are special functions to convert text in values or values in text. The column type cannot be converted.

| TEXT                 | TEXT converts a value in a text, additionally the number of decimal places can be entered |
|----------------------|-------------------------------------------------------------------------------------------|
|                      | TEXT (instruction[, decimal places])                                                      |
|                      | Example: TEXT (x11-x9,1)                                                                  |
| VALUE                | converts a text in a value                                                                |
| RIGHT, LEFT,<br>PART | Function if only a part of a text shall be displayed                                      |
|                      | RIGHT(column, number of characters)                                                       |
|                      | LEFT(column, number of characters)                                                        |
|                      | PART(column, start position, number of characters)                                        |
|                      | Example: x7=SoundPLAN                                                                     |
|                      | LEFT (x7,5) results "Sound"                                                               |
|                      | RIGHT (x7,4) results "PLAN"                                                               |
|                      | PART (x7,4,2) results "nd"                                                                |

**Calculating using Formulas** 

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| LENGTH                                  | Results the number of characters of a text                                                                                                       |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| POS                                     | Results the start position of the first text part, which is included in the text                                                                 |
|                                         | POS("Text part", column complete text) [=P]                                                                                                      |
|                                         | P is the position of the text part within the column. Without the definition of the position, the text part is searched within the whole column. |
|                                         | Example:                                                                                                                                         |
|                                         | IF POS ("G", x9)=1 THEN                                                                                                                          |
|                                         | looks for G only at the first position                                                                                                           |
|                                         | The formula                                                                                                                                      |
|                                         | IF POS ("G", x9) THEN                                                                                                                            |
|                                         | finds all texts that contain a G.                                                                                                                |
| Combination of<br>the text<br>functions | You can combine different text functions for example if you want to extract a set of values from the receiver name.<br>Examples:                 |
|                                         | x7 contains the text "001-road name No."                                                                                                         |
|                                         | LEFT(x7,POS("-",x7)-1); Results "001"                                                                                                            |
|                                         | x7 contains the receiver name:                                                                                                                   |
|                                         | RE1 – road name                                                                                                                                  |
|                                         | RE2 – road name                                                                                                                                  |
|                                         | RE10 – road name                                                                                                                                 |
|                                         | PART(x10,3, POS("-",x7)-3);<br>Extracts the number from the receiver name. The start position of                                                 |
|                                         | the number is the same for all rows (third character).                                                                                           |
|                                         | X7 contains the receiver name:                                                                                                                   |
|                                         | RE-1 road name                                                                                                                                   |
|                                         | REC-2 road name                                                                                                                                  |
|                                         | RE-10 road name<br>REC-100 road name                                                                                                             |
|                                         | PART(x7,(POS(" ", x7)+1),(POS(" ", x7)-1)-(POS("-", x7)-1));                                                                                     |
|                                         | Extracts the number form the receiver name, if the star position of                                                                              |
|                                         | the number differs.                                                                                                                              |
| Statistic functions                     |                                                                                                                                                  |
| COUNT                                   | COUNT (Columns) Relational operator Value                                                                                                        |
|                                         | Counts the specified columns that meet the criterion                                                                                             |
|                                         | Count(x18x22) >55                                                                                                                                |
| MIN                                     | MIN (Columns)                                                                                                                                    |
|                                         | Results the lowest value of the specified columns                                                                                                |
|                                         | MIN(x18, x22)                                                                                                                                    |
| MAX                                     | MAX (Columns)                                                                                                                                    |
|                                         | Results the highest value of the specified columns                                                                                               |
|                                         | MAX(x18 x22)                                                                                                                                     |
| Page • 428/793                          | Calculating using Formulas                                                                                                                       |

#### Arithmetic functions (- Function (instruction) -

| ROUND   | ROUND (column number [,decimal places])<br>Results the arithmetical rounded value. You can optionally determine<br>which decimal should be rounded. Without specifying decimals<br>results the rounded integer value.<br>ROUND(x10,1) |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TRUNC   | TRUNC (column number[,decimals])                                                                                                                                                                                                      |
|         | Truncates the value at the determined decimal and results the truncated value                                                                                                                                                         |
| ROUNDUP | ROUNDUP (column number [,decimals])                                                                                                                                                                                                   |
|         | Results are rounded up to the specified decimal.                                                                                                                                                                                      |
| SQR     | result is x <sup>2</sup>                                                                                                                                                                                                              |
| SQRT    | result is square root of x                                                                                                                                                                                                            |
| EXP     | result is x <sup>y</sup>                                                                                                                                                                                                              |
| LN      | result is the natural logarithm                                                                                                                                                                                                       |
| LOG     | result is the logarithm to the base 10                                                                                                                                                                                                |
| ABS     | result is the absolute of a value                                                                                                                                                                                                     |

#### SoundPLAN specific functions

| RLS90              | Rounded value according to RLS 90 (intermediate values rounded to the first decimal, assessment level rounded up to total dB(A))<br>RLS90(x12);                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| KM                 | Converts the km post calculated in the Geo-Database into km+meter<br>(in GeoDB; 0,665 -> 0+665). KM(x10);                                                                                                                                                                                                                                                                                                         |
| ++<br>(LEVELSUM)   | x17++x18 energetically sums up the levels in the assigned columns.<br>You can also use LEVELSUM (x17x21) for the level addition of more<br>than two columns                                                                                                                                                                                                                                                       |
| <br>(LEVELDIFF)    | x17x18: the result is the energetical difference of the assigned columns.<br>You can also use LEVELDIFF(x17x21) for the level difference of more than two columns                                                                                                                                                                                                                                                 |
| CONFLICT-<br>VALUE | CONFLICTVALUE(x19-x17)         If the result of the instruction is <0, the result is 0 else the difference between level value and limit level. If the instruction includes a limit level column, the spreadsheet checks, if the limit level is 0 (not available). In this case, the result of the instruction is also 0. Example:         Level column x19       Limit column x17       Conflict value (x19-x17) |

59

59

0

60,3

58,7

60,3

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1

0

0

|                            | Example: Are levels exceeding the limits, yes or no. Enter a Boolean                                                                                                                                                                                                                                      |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONFLICT                   | column.<br>CONFLICT(x19-x17)                                                                                                                                                                                                                                                                              |
|                            | If the result of the instruction is <0, the result is "false" (0) else "true" (1) (Boolean values). If the instruction includes a limit level column, the spreadsheet checks, whether the limit level is 0. In this case, the result of the instruction is also 0.                                        |
|                            | x19=60,3, x17(limit)=59, Result "true"<br>x19=58, x17(limit)=59, Result "false"<br>x19=60,3, x17(limit)=0, Result "false"                                                                                                                                                                                 |
| FIRSTROW<br>PR (prior row) | If you want to renumber buildings with consecutive numbers and column 7 is the building ID and the column for the consecutive is 28 (this is also the column where the formula is present), request a new integer column with <b>TABLE -&gt; ADD COLUMN</b> and write the following formula for column 28 |
|                            | If FIRSTROW then 1<br>else if x7 =PR7 then PR28<br>else PR28+1;                                                                                                                                                                                                                                           |
|                            | The first line of the table is set to 1. After setting the first value, the formula checks if the building ID is the same as in the previous line. If it is, the consecutive number is copied from the last line. If not, it is incremented by one.                                                       |
| NEW                        | The keyword NEW <i>column number</i> in the formula makes it easier to pol a column for a changed content.                                                                                                                                                                                                |
|                            | If NEW7 then means "if a values in column 7 differs from the previous line, then"<br>With this new keyword the keywords "Firstrow" and "PR" can often                                                                                                                                                     |
|                            | be replaced.                                                                                                                                                                                                                                                                                              |
| BH                         | Assign fields of structure lines.                                                                                                                                                                                                                                                                         |
| BF                         | BHnumber Block begin- or Header line                                                                                                                                                                                                                                                                      |
| STAT                       | BFnumber Block end- or Footer line                                                                                                                                                                                                                                                                        |
|                            | STATnumber Statistics row                                                                                                                                                                                                                                                                                 |
|                            | " <i>number</i> " refers to the position of the column in the list of block<br>header or block footer; see " <u>Usage of structure fields in formulas</u> " on<br>page 448.                                                                                                                               |
| Area table                 |                                                                                                                                                                                                                                                                                                           |
| GV                         | Grid value: instead of x if the grid value shall be used (Area table)                                                                                                                                                                                                                                     |
| CV                         | Conflict value: instead of x if the conflict value shall be used (Area table)                                                                                                                                                                                                                             |
| GRIDCOUNT                  | Counts the number of grid values                                                                                                                                                                                                                                                                          |
| CONFLICT-<br>COUNT         | Counts the number of conflict values<br>CONFLICTCOUNT( <i>column number</i> )                                                                                                                                                                                                                             |
| SUMX                       | SUMXs <i>tatisticsscolumn</i> (no blanks permitted) in a value column: sums up the contents of a statistics column                                                                                                                                                                                        |

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**Calculating using Formulas** 

| File operation in the table) | ons – extended formula entry (fyi entry with double click on the file                                                                                                                                                                                                                                                            |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GNM - GO                     | P Grid Noise Map– Grid Operation                                                                                                                                                                                                                                                                                                 |
|                              | RGNM(No[,group No.][,frequency No.],time slice No. [,time step])                                                                                                                                                                                                                                                                 |
| CNM                          | Cross sectional Map                                                                                                                                                                                                                                                                                                              |
|                              | RCNM(No[,group No.][,frequency No.],time slice No. [,time step])                                                                                                                                                                                                                                                                 |
| FNM - FMO                    |                                                                                                                                                                                                                                                                                                                                  |
|                              | RFNM(No[,group No.],time slice No.                                                                                                                                                                                                                                                                                               |
| ΜΝΜ                          | Meshed Noise Map                                                                                                                                                                                                                                                                                                                 |
|                              | MNM(No. time slice No.[,group No.][,Type, frequency, dB-weighting])                                                                                                                                                                                                                                                              |
|                              |                                                                                                                                                                                                                                                                                                                                  |
|                              | All results are entered at least with the result number and the numb of the time slice.                                                                                                                                                                                                                                          |
|                              | If the groups and/or frequencies were stored during calculation, the<br>results are entered as optional parameters. The group or frequen<br>number is according to the order in the selection list. As the sum lev<br>is the first entry in the list, the first group / frequency in the selection<br>list is assigned with "2". |
|                              | The number of the time slice is the order, the time slices are defined the assessment library. For example, time slice 1 = day, time slice 2 night, time slice 3 = Lmax.                                                                                                                                                         |
|                              | For grid operations with animations, you can optionally add a tin step for the delay of one of the grid maps. One time step corresponded to approx. 0,125 seconds.                                                                                                                                                               |
|                              | For Meshed Noise Maps the parameter selection is slightly differer<br>The parameters are assigned in brackets. Here you can do operatio<br>with single frequencies or frequency bands and specify the d<br>weighting.                                                                                                            |
|                              | The parameters for extended operations with frequencies are:                                                                                                                                                                                                                                                                     |
|                              | Type: B (band), O (octave), T (third-octave)                                                                                                                                                                                                                                                                                     |
|                              | Frequency: Enter the frequency, e.g. 63 for the types octave and thir octave or the frequency band, e.g. 63-8000                                                                                                                                                                                                                 |
|                              | dB-weighting: _, A, B, C, D                                                                                                                                                                                                                                                                                                      |
| Instructions                 | for conditional formatting (cell layout formulas)                                                                                                                                                                                                                                                                                |
| CELL                         | CELL (Parameter, [Parameter, [Parameter]])                                                                                                                                                                                                                                                                                       |
|                              | Defines text color, text style and the cell background color. It is define using special key words or RGB values.                                                                                                                                                                                                                |
|                              | Example: CELL(red, bold)                                                                                                                                                                                                                                                                                                         |
|                              | Keywords for text and colors:                                                                                                                                                                                                                                                                                                    |
|                              | bold, italic, underline                                                                                                                                                                                                                                                                                                          |
|                              | red, green, blue, black, white, yellow, magenta, cyan, gray                                                                                                                                                                                                                                                                      |
|                              | light and dark can accompany the color names (except black and white).                                                                                                                                                                                                                                                           |
|                              | e.g. LIGHTRED The color name must be written in one word.                                                                                                                                                                                                                                                                        |
|                              | Except for gray, full colors use the RGB values 255 and 0, light colors us                                                                                                                                                                                                                                                       |
|                              | 255 and 200, the dark colors use 200 and 0.                                                                                                                                                                                                                                                                                      |

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CC Cell color: To set the cell color, it is always necessary to add the instruction CC. CELL(CC=keyword) Example: Cell color should be lightgray and the cell text red and bold. CELL(CC=lightgray, red, bold) CELL(CC(r,g,b)) sets the colors according to the red, green and blue partitions. Example: CELL(CC(100,150,100)) Example: If X19>X17 then CELL (CC=lightred, bold) else CELL (gray); If a conflict occurs, the cell background is light red and the text is bold. Because the text color doesn't change, the definition of the text color is taken from the column layout. Without a conflict, the text color is gray. As often only the cells with conflict should be changed, the ELSE branch can be omitted. Instead of If CONFLICT (X19-X17) then CELL (ZF=lightred, bold) else CELL (); If CONFLICT (X19-X17) then CELL (ZF=lightred, bold); Example color exceedance according to the usage: if x11="GR" then Cell(CC(255,200,255)) else if x11="MI" then Cell (CC=lightgreen) else if x11="BU" then Cell(CC=lightgray) else Cell(CC=white); тс Text color: CELL(TC(r,g,b),bold) The instruction TC is needed if you use RGB values, otherwise the keyword is sufficient. Example CELL(TC(255,150,0)) Variables (Example see "Variables in formulas for Spreadsheet and file operations (page 433)") float Value as decimal value integer Value as integer value Boolean Logical value (true / false) text Text var Definition of the variables needs to start with the keyword "var" begin ... Formulas must be enclosed in a begin - end block, each command must end; be ending with a semicolon;

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**Calculating using Formulas** 

#### Variables in formulas for Spreadsheet and file operations

Now you can use your own variables in the Spreadsheet and the extended file operations of the graphics and the calculation core. This enables the user to make complex queries without the need to insert an auxiliary column.

Assign the variable a value using the operator  $_{,:="}$ . The value can be a constant or can be derived from a calculation. The definition of variables always start with the keyword  $_{,v}$  var", commands must be made visible as a block with the commands  $_{,v}$  begin" and  $_{,e}$  end". Each command needs to be ended with a semicolon ( $_{,v}$ ;").

Example: A column needs to show the higher noise exceedance (violation of the noise limit) for day or for night.

| var                                 |                |                  |         |
|-------------------------------------|----------------|------------------|---------|
| dPGwT, dPGwN, dMax :float;          |                |                  |         |
| begin                               |                |                  |         |
| dPGwT := x16-x14;                   | // noise       | limit exceedar   | nce day |
| dPGwN := x17-x15;                   | // noise       | limit exceedance | e night |
| if                                  | dPGwT          | >                | dPGwN   |
| then                                | dMax           | :=               | dPGwT   |
| else dMax := dPGwN;                 |                |                  |         |
| <pre>// the result is written</pre> | into the colum | n where the for  | mula is |
| located:                            |                |                  |         |
| if                                  | dMax           | >                | 0       |
| then                                |                |                  | dMax    |
| else                                |                |                  | 0;      |
| end;                                |                |                  |         |

In the "var" block define which data types correspond to the variables. Decide on the names of the variables; the data types are recognized by keywords.

With // you can mark the rest of the line as a comment that is not processed in the formula.

Keywords for data types:

| float   | The declared variable is a floating point value       |
|---------|-------------------------------------------------------|
| integer | The declared variable is an integer value             |
| Boolean | The declared variable is a logical value (true/false) |
| text    | The declared variable is a text                       |

Advantages:

- When columns are assigned variables, the formulas are much easier transferred to other columns / operations as only the initial assignment of the column numbers must be adjusted.
- By using variables, even complex formulas are becoming readable. Complicated nested "if then else"-queries are more readable with auxiliary variables.

**Calculating using Formulas** 

#### Export formulas

In order to get an overview on the used formulas, especially for big tables, use FILE - > EXPORT FORMULAS. All Spreadsheet columns with content, legend text and formula are written into an ASCII file.

#### Correction of errors in a formula

If there should be a mistake in the formula, SoundPLAN will open a window showing which information is needed and at which position in the formula.

| Edit formula of column 24                       | ×    |
|-------------------------------------------------|------|
| IF x19x/14>0<br>THEN text(x91-x14,1<br>ELSE ""; |      |
| Error: Operation not valid for texts !          |      |
| OK Cancel                                       | Help |

You can correct the formula in the dialog. OK executes the formula and corrects it in the formula entry, too.

When an error is detected in a formula, the cursor will jump to the cell causing the error. The error description contains the line number where the error was detected.

### **Designing Spreadsheet tables**

There are a lot of possibilities to design the Spreadsheet tables.

- Formatting of the columns using the column layout
- Format single cells, for example to highlight level exceeding
- Combine cells in the table header
- Make tables easier to read using the table structure
- Use the 3 section layouts for the formatting of text

#### **Column layout**

The column layout can be accessed either via the right mouse button menu from the column header or via **TABLE** -> **LAYOUT** -> **TITLE COLUMN** or **DATA COLUMN**. The column layout is always valid for all column marked or the current column in which the cursor is positioned. If the cursor is positioned in the table header, the column layout enters the header layout; if it is positioned in the table contents, the layout for the table contents is opened.

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| Column layout, Data, Column 1                                  | 3, Data type Value as fl | oat            |          | ×      |  |  |
|----------------------------------------------------------------|--------------------------|----------------|----------|--------|--|--|
| Column                                                         |                          |                |          |        |  |  |
| Color:                                                         | Width:                   | 15,0           | **<br>** |        |  |  |
| Value                                                          |                          |                |          |        |  |  |
| Decimal places 0                                               | Round mode:              | normal         | ~        |        |  |  |
| ☐ "-" for values <= 0                                          | Factor                   | x 10e          | 0        |        |  |  |
| use thousands separator                                        |                          |                |          |        |  |  |
| Text                                                           |                          |                |          |        |  |  |
| Font                                                           | Alignment                | right          | ~        |        |  |  |
| do not show text if same as previous text use reference column |                          |                |          |        |  |  |
| Line                                                           |                          |                |          |        |  |  |
| show line between different                                    | texts                    | Width:<br>0,20 | Color:   |        |  |  |
| Text distance                                                  | Edge lines               |                |          |        |  |  |
|                                                                |                          | Width:         | Color:   |        |  |  |
|                                                                | all                      | 0,20 🛓         |          |        |  |  |
| left 0,5 🚔                                                     | 🗌 left                   | 0,20 🚔         |          |        |  |  |
|                                                                | 🗌 top                    | 0,20 🚖         |          | ОК     |  |  |
| right 0,5 🚔                                                    | 🗹 right                  | 0,30 🚔         |          | Cancel |  |  |
|                                                                | bottom                   | 0,20 🚔         |          |        |  |  |
|                                                                |                          |                |          | Help   |  |  |

Column layout of a float column in the Spreadsheet

Depending on the column type (float column, text column, Boolean column, integer column) the column layout slightly differs.

The background color of the columns can be set to highlight a column. The background color is set to transparent by default for the table contents.



The column width can be set numerically. Via the button right to the numerical entry, the column width is assigned to the longest entry in each column.

Enter the number of decimal places and the round mode. The section VALUE is only visible if you edit the layout of a value column.

The rounding only is only used for the display of the values in the columns; they are internally always stored with all decimal places. Therefore, you have the possibility to use the parameter CALCULATE WITH DISPLAYED FLOAT VALUES under OPTIONS -> SETTINGS / FILTER. If you deactivate this parameter, the program calculates with the original values and you might get differences.

**Designing Spreadsheet tables** 

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The round mode has several rounding options

| Round mode: | normal 🗸 🗸                                             |
|-------------|--------------------------------------------------------|
| Factor      | normal<br>down (truncate)<br>up (truncate+1)<br>RLS 90 |

The round mode **NORMAL** rounds according to the mathematics standards on the specified decimal places:

| 1 decimal place:  | 0,3499 -> 0,3  | 0,3500 -> 0,4  |
|-------------------|----------------|----------------|
| 2 decimal places: | 0,3499 -> 0,35 | 0,3500 -> 0,35 |

The round result depends on the numbers of decimal places defined in the field **DECIMAL PLACES.** 

The round mode **DOWN (TRUNCATE)** cuts down the value to the specified decimal places:

1 decimal place: 0,3499 -> 0,3 0,3500 -> 0,3

The round mode **UP (TRUNCATE+1)** cuts down the value to the specified decimal places and adds 1 on the last decimal place:

```
1 decimal place: 0,3499 \rightarrow (0,3+0,1) = 0,4 0,3500 \rightarrow (0,3+0,1) = 0,4
```

Values <= 0 can be displayed with a minus (-) instead of the value. Activate the check box "-" FOR VALUES <= 0.

If the column setup has been set to "- for values  $\leq 0$ ", then values  $\leq 0$  are ignored for table statistics (i.e. for the average).

**USE THOUSANDS SEPARATOR** groups values > 1,000 to groups of three figures and inserts a comma (or a point, if the decimal separator is a comma).

The **FACTOR** can be used to rescale the unit for the display, e.g. -3 to display [km] instead of [m].

There is no round mode for **Integer columns**. If a value in an integer column comes from a float column, it is rounded arithmetically. You can change the display of the numbers from Arabic to Roman numbers.

| Value           |              |          |   |
|-----------------|--------------|----------|---|
| for values <= 0 | Numeral type | 1,2,3,4, | • |

The **floor column** 6 (integer column) can be formatted in the column layout as "ground floor, 2. floor, 3. floor". The floor description from **OPTIONS** -> **SETTINGS** in the SoundPLAN Manager is used.

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| Value                   |              |                       |   |
|-------------------------|--------------|-----------------------|---|
| for values <= 0         | Numeral type | GF,1.Fl,2.Fl,         | - |
| use thousands separator |              | 1,2,3,4,<br>LILIILIV, |   |
| Text                    |              | GF,1.Fl,2.Fl,         |   |

**Boolean columns** distinguish between true and false. Enter the text that shall be displayed in the table for true statements and for false statements.

| Boolean value |     |       |    |
|---------------|-----|-------|----|
| true          | yes | wrong | no |
|               |     |       |    |

To improve the readability of the table, you can define if a text should only be displayed if it differs from the previous text. Additionally, it is possible to automatically generate lines between the differing texts.

| Serial. | Receiver name | Station | Direction | Floor | Usage | SA     | H I-A | Li   | nit   | Statu | s Quo |
|---------|---------------|---------|-----------|-------|-------|--------|-------|------|-------|-------|-------|
| No.     |               |         |           |       |       |        |       | Day  | Night | Day   | Night |
|         |               | km      |           |       |       | m      | m     | in d | B(A)  | in d  | B(A)  |
| 1       | 2             | 3       | 4         | 5     | 6     | 7      | 8     | 9    | 10    | 11    | 12    |
| 1       | Beech Lane 1  | 0+326   | S         | GF    | GR    | 122,16 | 1,13  | 59   | 49    | 53    | 42    |
| 2       |               | 0+323   | W         |       |       | 112,70 | 1,09  | 59   | 49    | 53    | 43    |
| 6       |               | 0+334   | N         |       |       | 108.35 | 1.27  | 59   | 49    | 52    | 41    |
| 11      |               | 0+335   | 0         |       |       | 120,25 | 1,29  | 59   | 49    | 51    | 41    |
| 12      | Beech Lane 3  | 0+343   | S         | GF    | GR    | 129,01 | 1,21  | 59   | 49    | 55    | 44    |
| 13      |               | 0+341   | W         |       |       | 118.82 | 1.26  | 59   | 49    | 48    | 37    |
| 14      |               | 0+349   | N         |       |       | 113.07 | 1.07  | 59   | 49    | 55    | 45    |
| 18      |               | 0+358   | 0         |       |       | 126,49 | 0,96  | 59   | 49    | 57    | 46    |
| 19      | Beech Lane 5  | 0+426   | S         | GF    | GR    | 129,93 | -0,14 | 59   | 49    | 59    | 49    |
| 21      |               | 0+427   | N         |       |       | 119.19 | -0.18 | 59   | 49    | 58    | 48    |
| 22      |               | 0+445   | 0         |       |       | 125.02 | -0.70 | 59   | 49    | 60    | 50    |
| 23      | Beech Lane 7  | 0+460   | W         | GF    | GR    | 125,97 | -1,05 | 59   | 49    | 55    | 44    |
| 24      |               | 0+463   | S         |       |       | 131,18 | -1,12 | 59   | 49    | 64    | 53    |
| 25      |               | 0+469   | 0         |       |       | 127.82 | -1.27 | 59   | 49    | 68    | 58    |
| 26      |               | 0+465   | N         |       |       | 122.61 | -1.16 | 59   | 49    | 64    | 54    |

Only texts different to the previous text are displayed.

Enable this function with a click in the field **DO NOT SHOW TEXT IF SAME AS PREVIOUS TEXT**. If more than the text in one column should not be shown, it is necessary to define a reference column to which the column text refers. Click on the field **USE REFERENCE COLUMN** and enter the column number from the column header.

E.g. the area usage is always the same but it should be displayed with every receiver location. Click in the column area usage on the field **DO NOT SHOW TEXT IF SAME AS PREVIOUS TEXT,** activate **USE REFERENCE COLUMN** and enter the column number of the receiver name (in the example column No. 7).

Click on the field **SHOW LINE BETWEEN DIFFERENT TEXTS** and define the line width and the color.

Another possibility to make big tables easy to read is to use "<u>Structured Tables</u>" (see page 443).

Define the font, the text style and the text color via the button **FONT** and the **ALIGNMENT** of the text. All settings hold for the complete column. Enter a **TEXT DISTANCE** left or right if you want to have a distance from the cell edge. (Use conditional formatting to highlight single cells).

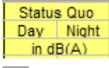
**Designing Spreadsheet tables** 

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The **EDGE LINES** define for each edge line separately whether the edge lines should be displayed, and if yes in which line width and color.

#### Changes in the table header

You can connect cells in the column title.



Highlight the cells you want to connect and select TITLE -> CONNECT HIGHLIGHTED CELLS .

#

Click on the connected cell and select **TITLE** -> **DISCONNECT CELLS** to get separate cells again. Or use the symbol button.

It is possible to insert the logical number or the physical column number in the column title. Select **TITLE -> INSERT LOGICAL NUMBER** or **INSERT COLUMN NUMBER**.

In order to insert the numbering in the last row of the column header, activate **OPTIONS** -> **INSERT ROWS AFTER**. Position the cursor in the last title column and insert the numbering.

The formulas refer to the physical column numbers. If someone else should work with the formulas without having the table itself, it is necessary to insert the physical column numbers so that the other person can recognize the references.

With the logical column numbers, all visible columns are consecutively numbered and if you defined it that way printed with the legend. See "Print legend" on page 451.



You can delete the column numbering with *Ctrl+ Del* or with the symbol **DELETE LINES** from the column header.

#### **Column width optimization tools**

SoundPLAN offers tools to optimize the column width:



To adjust the column width to the longest entry in the column, select the button in the **COLUMN LAYOUT**.

A double click on the "splitter"-cursor between two columns will optimize the column width of the left of both columns.

| ID  | Selected | Building type | Name Aum    | I ID | Selected | Building type | Name                 | Num |
|-----|----------|---------------|-------------|------|----------|---------------|----------------------|-----|
| 0   | 1        | 2             | 3 (+  +)    | 0    | 1        | 2             | 3                    | 4   |
| 686 |          | Main building | Thomas N 27 | 686  | Γ        | Main building | Thomas More Street 7 | 27  |
| 690 |          | Main building | Thomas N 22 | 690  |          | Main building | Thomas More Street 6 | 22  |
| 687 |          | Main building | Thomas N 26 | 687  |          | Main building | Thomas More Street 5 | 26  |

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To optimize the column widths for the whole table, i.e. to enlarge or shrink all columns so that they fit in the page width, choose **TOOLS** -> **OPTIMIZE COLUMN WIDTHS.** 

Or you can adjust the column widths of all columns so that all columns fit in the selected page format (portrait or landscape). Select **TOOLS** -> **FIT IN COLUMN WIDTH IN PAGE WIDTH.** 

To adjust the last column of the table to fit in the page width, choose **TOOLS** ->**FIT** LAST COLUMN IN PAGE WIDTH.

**Hint:** Be careful with combined cells in the header. The optimization tool cannot optimize combined cells. In this case SoundPLAN will optimize the cells in the table content.

#### Layout settings for the whole table (Table settings)

The three record cards on the right-hand side of the dialog box **TABLE SETTINGS** handle table header, table contents and table width definitions.

| Table header Table contents                  |        | Table header Table contents  |        |
|----------------------------------------------|--------|------------------------------|--------|
| Font                                         | >>>    | Font                         | >>>    |
| Row distance:                                | 3,81 🚖 | Row distance:                | 3,81 🕃 |
| Text distance from cell top:                 | 0,32 🕃 | Text distance from cell top: | 0,32 🕃 |
| End line       Width:       0.3       Color: |        | Background color:            |        |

The **FONT** definition is the same for table header and table contents. Once the fonts and text sizes have been modified, the texts can be proportionally enlarged or shrunk via the text size field on the right hand of the tool bar  $\boxed{8}$ . The text size displayed is the table contents text size.

The **ROW DISTANCE** is the height of each row in table contents or table header. **TEXT DISTANCE FROM CELL TOP** defines the position of the text in the row and is automatically adjusted to the row distance.

A BACKGROUND COLOR can be defined for the table header.

#### Sort

The Spreadsheet can use structured sorting. Open the **TABLE** -> **SORT** and select the column that is used for sorting. A second list allows a second sort criterion for cases where multiple entries are the same.

Designing Spreadsheet tables

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| @ Sort            |                                                   |
|-------------------|---------------------------------------------------|
| CSort by          |                                                   |
| 10: Receiver name | <ul> <li>escending</li> <li>descending</li> </ul> |
| Afterwards by     |                                                   |
| 1: Serial. No.    | <ul> <li>escending</li> <li>descending</li> </ul> |
| Finally by        |                                                   |
| 6: Floor          | <ul> <li>escending</li> <li>descending</li> </ul> |
| ОК                | Cancel Help                                       |

If columns are highlighted, the sorting is only valid within the range of the highlighted columns.

#### Page break

Use **TABLE** -> **INSERT PAGE BREAK** or *Alt+ Ins* if you need to insert a manual page break. The page break is displayed with a dotted green line.

Delete a manual page break: Place the cursor near the page break and select the page break with the arrow keys. As soon as a row is not highlighted, the page break is active. Press **Del** to delete it.

#### Conditional formatting with formulas

The analysis of results and statements must often answer to the following questions:

- Where do we have limit violations?
- What are the highest levels?
- Where are most of the inhabitants affected?

Use conditional formatting to easily highlight interesting cells or unusual values and make them visible with different colors.

| 1, K | eyland | d Road |   |        |      | U  | lsage: Re | sidentia | al |    |    |     |
|------|--------|--------|---|--------|------|----|-----------|----------|----|----|----|-----|
| 1    | 0+287  | N      | 1 | 228,05 | 0,71 | 59 | 49        | 52       | 44 | 65 | 55 | D/N |
| 1    | 0+287  | N      | 2 | 228.05 | 3.51 | 59 | 49        | 53       | 45 | 66 | 55 | D/N |
| 2    | 0+287  | E      | 1 | 237.61 | 0.71 | 59 | 49        | 47       | 39 | 59 | 48 | no  |
| 2    | 0+287  | E      | 2 | 237,61 | 3,51 | 59 | 49        | 49       | 41 | 58 | 50 | N   |
| 3    | 0+278  | S      | 1 | 240,39 | 0,72 | 59 | 49        | 41       | 33 | 48 | 38 | no  |
| 3    | 0+278  | S      | 2 | 240,39 | 3,52 | 59 | 49        | 44       | 35 | 49 | 39 | no  |
| 4    | 0+278  | W      | 1 | 230,83 | 0,72 | 59 | 49        | 52       | 44 | 59 | 49 | no  |
| 4    | 0+278  | W      | 2 | 230,83 | 3,52 | 59 | 49        | 52       | 44 | 60 | 48 | D   |

In TABLE -> TABLE SETTINGS you can define a second formula for the cell layout, so the cell layout can be stored in the templates and is still correct after a recalculation.

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| Calculation formula | Formula for cell layout                                       |   |
|---------------------|---------------------------------------------------------------|---|
|                     | if x22 > x15<br>then CELL (red,bold)<br>else CELL (CF =gray); | Ā |

The display of a cell is changed on the basis of conditions. If the condition in the IF - THEN branch is fulfilled the cell is formatted according to this condition otherwise according to the condition in the ELSE branch.

The key is:

CELL (Parameter, [Parameter, [Parameter ...]])

You can determine the text color as well as the background color of the cell. For the instructions and key words see "<u>Instructions for conditional formatting (cell layout formulas</u>" on page 431.

#### Calculate and highlight

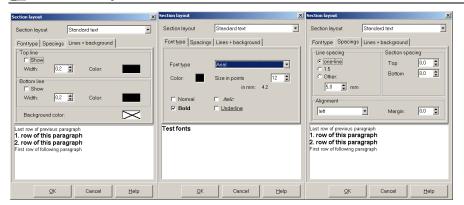
Single cells can be marked by either clicking Ctrl+ left mouse button or by using the function **CALCULATE AND HIGHLIGHT** in the right mouse button menu from the column header.

| Calculate and highlight |                |
|-------------------------|----------------|
| x19>x17;                |                |
|                         |                |
|                         |                |
|                         | OK Cancel Help |
|                         | OK Cancel Help |

With this function for example all cells in which the acceptable noise limit has been exceeded can be marked automatically to be displayed in bold.

The item **MARK** marks the current column to modify the layout.

#### Section Layout





The section layout is used to define the title, body text and block layout of text rows or structured tables in the table. Changes in the font, letter type and size, line spacing and section spacing can also be reviewed. The text rows or structured tables can be assigned a top and bottom line and a background color. The items in the section layout are self-explaining. The layout of the table columns and table header is modified in the column layout or in the table setup.

#### Subscript Texts

In text boxes, legends, scales and with general texts in the graphics as well as for headers in the Spreadsheet it is possible to have texts with the attribute subscript. Write the text like normal, mark the spot that needs to be turned into subscript and click on the symbol **SUBSCRIPT**. As you still process the text, control characters are marking the subscript part.

```
New: Subscript, for example K_{_{PA}} and Ki or R'_{_{_{W,res}}}
```

 $R'_{w,res}$  for example will be displayed as "R'@\I+w, res@\I-". As soon as you finish editing the text, the subscript will be effective.

In case you need other text attributes, you can manually insert them:

| @\l+text@\l- | = subscript   |
|--------------|---------------|
| @\h+text@\h- | = superscript |
| @\i+text@\i- | = italic      |
| @\b+text@\b- | = bold        |

#### Additional tools and hotkeys

Use **EDIT** -> **OPERATION** to do manual changes to a nearly completed table. If the column comes from a calculation result, the changes will be gone as soon as you rebuild the table.

Select the cells you want to change (or the whole column with right mouse button on the column header -> MARK) and enter the value or text that should be entered to all marked cells. With the function "replace text" (->) you can, for example correct a spelling error in the receiver name without the need to recalculate the result.

old->new: The text "old" is replaced by the text "new".

TABLE -> HIDE ROWS hides marked or not marked rows, for example to check receivers at the end of a table when the table is very long. TABLE -> SHOW HIDDEN ROWS displays them again.

Display a cell statistics of a single column or marked cells with TOOLS -> STATISTICS.

| Cell statistics      |         |
|----------------------|---------|
|                      |         |
| Number of used cells | 52      |
| Minimum value        | 35,80   |
| Maximum value        | 59,53   |
| Sum                  | 2775,02 |
| Average              | 53,37   |
| Count differences    |         |
| ОК                   |         |

TOOLS -> LEVEL SUM calculates the level sum of a column or the marked cells.

*Ctrl + Pos1* or *Ctrl + End* moves to the beginning / end of the table, *Ctrl + Shift + Pos1* or *Ctrl + Shift + End* marks all lines from the current line to the first/ last line of the table.

### **Structured Tables and Table Statistics**

|           |           | Status Q  | uo    | Prognos       | is     | Differe  | ence  | Limit ex | ceeded |
|-----------|-----------|-----------|-------|---------------|--------|----------|-------|----------|--------|
| Floor     | Direction | LrD I     | _rN   | LrD           | LrN    | Day      | Night | Day      | Night  |
|           |           | [dB(A)]   |       | [dB(A)        |        | [dB(     | A)]   | [dB(     | (A)]   |
| Jamaica F | Road 26   | Usage: MI | Limit | t day / night | t 64 / | 54 dB(A) |       |          |        |
| 1         | W         | 56,4      | 46,2  | 56,4          | 46,2   | -        | -     | -        |        |
| 2         | W         | 58,3      | 48,0  | 58,2          | 48,0   | -        | -     | -        |        |
| Jamaica F | Road 27   | Usage: GR | Limit | t day / night | t 59/  | 49 dB(A) |       |          |        |
| 1         | W         | 67,6      | 57,4  | 67,7          | 57,5   | 0,1      | 0,1   | 8,7      | 8      |
| Jamaica F | Road 30   | Usage: MI | Limit | t day / night | t 64 / | 54 dB(A) |       |          |        |
| 1         | W         | 52,2      | 41,9  | 52,1          | 41,9   | -        | -     | -        |        |
| 2         | W         | 53,3      | 42,9  | 53,2          | 42,9   | -        | -     | -        |        |
| 3         | W         | 60,6      | 50,3  | 58,4          | 48,1   | -        | -     | -        |        |
| Jamaica F | Road 31   | Usage: GR | Limit | t day / night | t 59/  | 49 dB(A) |       |          |        |
| 1         | W         | 67,6      | 57,4  | 67,6          | 57,4   | 0,1      | 0,1   | 8,6      | 8,     |
| 2         | W         | 67,6      | 57,3  | 67,6          | 57,4   | 0,1      | 0,1   | 8,6      | 8      |
| Jamaica F | Road 33   | Usage: GR | Limit | t day / night | t 59/  | 49 dB(A) |       |          |        |
| 1         | E         | 55,4      | 45,1  | 56,4          | 46,1   | 1,0      | 1,0   | -        |        |
| 2         | E         | 56,8      | 46,5  | 57,4          | 47,2   | 0,6      | 0,7   | -        |        |
| 1         | N         | 63,5      | 53,3  | 63,7          | 53,5   | 0,2      | 0,2   | 4,7      | 4      |
| 2         | N         | 63,9      | 53,7  | 64,1          | 53,8   | 0,1      | 0,1   | 5,1      | 4      |
| 1         | N         | 55,3      | 45,0  | 56,8          | 46,6   | 1,5      | 1,5   | -        |        |
| 2         | N         | 57,3      | 47,0  | 58,3          | 48,1   | 1,0      | 1,1   | -        |        |
| 1         | S         | 61,4      | 51,1  | 61,8          | 51,5   | 0,4      | 0,4   | 2,8      | 2      |
| 2         | S         | 62,2      | 52,0  | 62,6          | 52,4   | 0,4      | 0,4   | 3,6      | 3      |

Example of block definitions in the Spreadsheet

**Structured Tables and Table Statistics** 

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The **structured table** shows selected columns as a header row and exclude them from the table. Thereby the table becomes easy to read and smaller.

This way you can combine information that is the same for the whole building, for example, the receiver name, the area usage and the limits in the header line. Moreover, you can use statistical functions to further evaluate information from individual columns, for example the highest limit violation per building.

Statistical evaluations for all receivers of a table are stored in the **table statistics**, e.g. to compare the costs of different noise protection measures.

#### Create and format table structure and table statistics

We here describe the procedure of creating structured tables using the block header. Block footer and table statistics are created the same way.

Mark the columns in the table that should be displayed in the header row by selecting them with the mouse (Ctrl+ left mouse button). You don't have to mark the whole column but only a single cell.

| 1       | 10            | 13      | 12        | 21    | 11    | 14     | 15    | 16    | 17    | 18    | 19    |
|---------|---------------|---------|-----------|-------|-------|--------|-------|-------|-------|-------|-------|
| Serial. | Receiver name | Station | Direction | Floor | Usage | SA     | H I-A | Lir   | nit   | Statu | s Quo |
| No.     |               |         |           |       |       |        |       | Day   | Night | Day   | Night |
|         |               | km      |           |       |       | m      | m     | in di | B(A)  | in d  | B(A)  |
| 1       | 2             | 3       | 4         | 5     | 6     | 7      | 8     | 9     | 10    | 11    | 12    |
| 1       | Beech Lane 1  | 0+326   | S         | GF    | GR    | 122,16 | 1,13  | 59    | 49    | 53    | 42    |
| 2       |               | 0+323   | W         | GF    | GR    | 112,70 | 1,09  | 59    | 49    | 53    | 43    |
| 6       |               | 0+334   | N         | GF    | GR    | 108.35 | 1.27  | 59    | 49    | 52    | 41    |
| 11      |               | 0+335   | 0         | GF    | GR    | 120,25 | 1,29  | 59    | 49    | 51    | 41    |

Select TABLE -> STRUCTURED TABLE -> DEFINE BLOCK HEADER, the dialog box might look like that:

| ତ St | Structured block header                                         |          |      |      |     |              |            |                |
|------|-----------------------------------------------------------------|----------|------|------|-----|--------------|------------|----------------|
|      | 🖹 📄 🌆 10,0 😸 Distance between fields [mm] 📃 Keep distance       |          |      |      |     |              |            |                |
| Re   | Reference column: 8 😴 📝 Allow page break in block               |          |      |      |     |              |            |                |
| Pos  | Column                                                          | Function | Xrel | Х    | Y   | Text before  | Text after | Font           |
| 1    | 8                                                               | -        |      | 0,0  | 0,0 | Name:        |            | Begin of block |
| 2    | 9                                                               | -        |      | 40,0 | 0,0 | Usage:       |            | Begin of block |
| 3    | 11                                                              | -        |      | 60,0 | 0,0 | Limit Lim,D: | [dB(A)]    | Begin of block |
| 4    | 12                                                              | -        |      | 75,0 | 0,0 | Lim,N:       |            | Begin of block |
| Name | Jame: Comprehensive School Usage: SCH Limit Lim, DLim, N: 49.)] |          |      |      |     |              |            |                |

Block definition – not modified

The first column is the column number in the table. In the column "function" <u>statistical functions</u> (page 447) can be stored (not for text columns). X and y position show the position of the text in the header row in mm. It is automatically

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taken from the column width. **TEXT BEFORE** and **TEXT AFTER** are taken from the column header in the table. **FONT** describes the selected section layout.

The preview shows that the field definitions need to be modified. The preview does not show the first but the longest entry, so that your modifications surely fit for all entries.

Unnecessary texts can be deleted, moreover the information often overlap because the distances are taken from the column widths. Open the table structure again to rework the texts and positions (TABLE -> TABLE STRUCTURE -> DEFINE BLOCK HEADER).

Without modifications the column receiver name looks like

Name: Beech Lane 1

because the column header is displayed as "text before".

But in the header row it is not necessary to display the text "Receiver name". You can therefore delete the *text before*.

The noise limits are unmodified displayed as

Limit day 64 dB(A) Limit night 54 dB(A)

perhaps shall be displayed as

Limit day / night 64 / 54 dB(A)

Enter "Limit day / night" in the field *text before* of the column "limit day", delete the text of the *following text* of the same column and enter "/" instead. Delete the *text before* in the column "limit night" and enter " dB(A)" in the field *following text*. You should add a blank to the text before and in front of the following text, as the column contents is added directly to the text.

Activate the check box **XREL** for the column "limit night" and set the value for the x position to 0; this way the limit night is added directly after the limit day.

Place the cursor to the first row and click on the pocket calculator to calculate the distances (x position). Between each field the user defined **DISTANCE BETWEEN FIELDS** is kept.

You can also define the x position manually. With the check box **KEEP DISTANCES** activated, distances that have been defined before are proportionally adjusted.

**Hint**: The pocket calculator calculates the x position always from the row, where the cursor is placed. This way it is possible to recalculate parts of the table structure.

The y position has only to be modified if different text sizes are used in the header row to vertically center the texts or if the header is displayed in more than one row.

|             |               | Status   | Quo  | Progno | sis  | Differe | ence  | Limit ex | ceeded |
|-------------|---------------|----------|------|--------|------|---------|-------|----------|--------|
| Floor       | Direction     | LrD      | LrN  | LrD    | LrN  | Day     | Night | Day      | Night  |
|             |               | [dB(A    | 01   | [dB(A  | 01   | [dB(    | A)]   | [dB      | (A)]   |
| Jamaica F   | Road 31       | Usage: ( | GR   |        |      |         |       |          |        |
| Limit day / | night 59 / 49 | dB(A)    |      |        |      |         |       |          |        |
| 1           | W             | 67,6     | 57,4 | 67,6   | 57,4 | 0,1     | 0,1   | 8,6      | 8,4    |
| 2           | W             | 67,6     | 57,3 | 67,6   | 57,4 | 0,1     | 0,1   | 8,6      | 8,4    |
| Jamaica F   | Road 33       | Usage: ( | GR   |        |      |         |       |          |        |
| Limit day / | night 59 / 49 | dB(A)    |      |        |      |         |       |          |        |
| 1           | E             | 55,4     | 45,1 | 56,4   | 46,1 | 1,0     | 1,0   | -        | -      |
| 2           | E             | 56,8     | 46,5 | 57,4   | 47,2 | 0,6     | 0,7   | -        | -      |
| 1           | N             | 63,5     | 53,3 | 63,7   | 53,5 | 0,2     | 0,2   | 4,7      | 4,5    |
| 2           | N             | 63,9     | 53,7 | 64,1   | 53,8 | 0,1     | 0,1   | 5,1      | 4,8    |
| 1           | N             | 55,3     | 45,0 | 56,8   | 46,6 | 1,5     | 1,5   | -        | -      |
| 2           | N             | 57,3     | 47,0 | 58,3   | 48,1 | 1,0     | 1,1   | -        | -      |

The modified dialog box might look as follows:

| <mark>@</mark> \$ | Structured block header                                    |          |      |      |     |                 |            |                |
|-------------------|------------------------------------------------------------|----------|------|------|-----|-----------------|------------|----------------|
|                   | E E Mil 10,0 C Distance between fields [mm] Keep distance  |          |      |      |     |                 |            |                |
| R                 | Reference column: 8 😴 🖉 Allow page break in block          |          |      |      |     |                 |            |                |
| Pos               | Column                                                     | Function | Xrel | X    | Y   | Text before     | Text after | Font           |
| 1                 | 8                                                          |          |      | 1,0  | 0,0 |                 |            | Begin of block |
| 2                 | 9                                                          | -        |      | 57,3 | 0,0 |                 |            | Statistik      |
| 3                 | 11                                                         | -        |      | 1,0  | 5,0 | Limit day/night | 1          | Statistik      |
| 4                 | 12                                                         | -        | V    | 0,0  | 5,0 |                 | dB(A)      | End of block   |
|                   | Comprehensive School 10 SCH<br>Limit day/night 59/49 dB(A) |          |      |      |     |                 |            |                |
|                   | OK Cancel Help                                             |          |      |      |     |                 |            |                |

Block definition - modified

The different section layouts are modified with the symbol button section layout.

If more than one column is displayed in the block header, it is necessary to define a reference column to which the column text refers to. Select the column number from the column header in the field **REFERENCE COLUMN**.

The block footer has a dedicated reference column so that multiple block end definitions are possible within one block.

If the check box **ALLOW PAGE BREAK IN BLOCK** is disabled, only whole blocks are printed on one page. With long blocks it might be suitable to allow the page break in the block.

As soon as you press OK the selected columns are automatically hidden from the table and inserted in the header.

To change the table structure or statistics or to add or remove columns as fields invoke the table structure again with TABLE -> TABLE STRUCTURE -> DEFINE BLOCK HEADER. Use the symbol INSERT ROW to add additional fields in the table structure

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itself. Enter the column number from the column in the table. If the column number is 0 you can use it as a header row. The symbol **DELETE ROW** deletes a column definition.

To delete a defined structured table definition, select **TABLE -> STRUCTURED TABLE -> DELETE BLOCK HEADER**. The columns that had been displayed in the header row have to be made visible manually in the **TABLE SETTINGS**.

**Hint:** Once a structured table has been defined, this definition can be stored as a template so that the definition is available for other projects and tables. In the new project, open the table structure once to adjust it with the pocket calculator to the longest entry in the field definition.

#### **Statistical Functions**

The definition of block header, block footer and table statistics contains statistical information per block (e.g. per building) or for the whole table.

Add new value columns and enter a formula in the table settings. If these columns are only used to calculate the statistics, you can hide the columns in the table settings.

These functions are available:

| Function |   |
|----------|---|
| sum      | • |
| -        |   |
| sum      |   |
| Average  |   |
| count    |   |
| min      |   |
| max      |   |

If the column setup has been set to "- FOR VALUES <= 0", then values < 0 are ignored for statistics. For the calculation of the averaged level reduction due to a noise protection measure you can this way omit levels that have already been within the limits without the measure.

The table statistics can be placed at the beginning (default) or at the end of the table. Check **INSERT STATISTICS ON TOP** at the bottom of the definition mask table statistics.

Definition of a statistics in TABLE -> TABLE STATISTICS -> DEFINE:

Structured Tables and Table Statistics

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|                                          | 🗌 🗌 Keep distan                                                                          | ce   |      |                           |                 | Font<br>Title |  |
|------------------------------------------|------------------------------------------------------------------------------------------|------|------|---------------------------|-----------------|---------------|--|
| use X value as distance to previous text |                                                                                          |      |      |                           |                 |               |  |
| Column                                   | Function                                                                                 | X    | Y    | Text before               | Text after      | Font          |  |
| 0                                        | -                                                                                        | 0,0  | 0,0  | Facade length and inhabit | a               | Title         |  |
| 28                                       | sum                                                                                      | 1,0  | 5,0  | Prognosis w/o NP:         | m               | Statistik     |  |
| 29                                       | sum                                                                                      | 1,0  | 10,0 | Wall height 3,5 m:        | m               | Statistik     |  |
| 30                                       | sum                                                                                      | 1,0  | 15,0 | Wall height 5 m:          | m               | Statistik     |  |
| 31                                       | sum                                                                                      | 50,0 | 5,0  |                           | affected people | Statistik     |  |
| 32                                       | sum                                                                                      | 52,0 | 10,0 |                           | affected people | Statistik     |  |
| 33                                       | sum                                                                                      | 52,0 | 15,0 |                           | affected people | Statistik     |  |
|                                          | SS sum S2,0 15,0 anected people statistic ✓ insert statistics on top       OK     Cancel |      |      |                           |                 |               |  |

Effect in the Spreadsheet:

| Prognosis w/o NP: 1.140,0 m | 18.491 affected people |
|-----------------------------|------------------------|
| Wall height 3,5 m: 471,3 m  | 2.506 affected people  |
| Wall height 5 m: 308,7 m    | 1.504 affected people  |

#### Usage of structure fields in formulas

You can assign fields in structure lines to formulas, too. This way the contents of a column for which an operation has been carried out per unit (e.g. per building) can be written back to a table cell in a new column.

BHposition Block header

BFposition Block footer

**STAT***position* Table statistics

*"position"* refers to the row number of the field the table of the block header footer or statistics:

| <mark>0</mark> s                                  | tructured | block header |      |      |     |              |            |                |
|---------------------------------------------------|-----------|--------------|------|------|-----|--------------|------------|----------------|
| E E Main 10.0 C Distance between fields [mm]      |           |              |      |      |     |              |            |                |
| Reference column: 8 🐼 🗹 Allow page break in block |           |              |      |      |     |              |            |                |
| Pos                                               | Column    | Function     | Xrel | X    | Y   | Text before  | Text after | Font           |
| 1                                                 | 8         |              |      | 1,0  | 0,0 | Name:        |            | Begin of block |
| 2                                                 | 9         |              |      | 40,0 | 0,0 | Usage:       |            | Begin of block |
| 2                                                 | 11        |              |      | 60,0 | 0,0 | Limit Lim,D: | [dB(A)]    | Begin of block |
| 3                                                 |           |              | _    |      | 0.0 | Line Mile    |            | Deale of block |
| 4                                                 | 12        |              |      | 0,0  | 0,0 | Lim,N:       |            | Begin of block |

The field "No. of conflicts" in the block header for example is evaluated in a formula with "BH5".

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#### Example 1:

As soon as one single receiver at a building is exceeding the noise limit, all receivers shall indicate that they are eligible for noise control subsidies.

Add a Boolean column and enter the following column to mark the receivers with conflicts:

"xLevelD > xLimitD OR xLevelN > xLimitN;"

Click at least on one cell of this new column, open the block header definition and enter the **FUNCTION** "count" for this column. Click OK and add another Boolean column (noise control subsidies) and enter the formula

"BHposition > 0; position is the row number in the block header definition.

#### Example 2:

Only the receiver with the highest exceedance per building shall be printed as a receiver flag in the Graphics.

Add a value column and calculate the exceedance using the formula xLevelD - xLimitD;.

Click at least one cell of this column, open the block footer definition and enter the **FUNCTION** "max" for this column. Close the block definition, add a Boolean column and assign the formula

xExceedance =BF*position* position = row number in the block footer definition.

#### Example 3:

The total number of exposed people should be used within a formula. x32/STAT2\*100;

# Print Spreadsheet

#### Page Layout

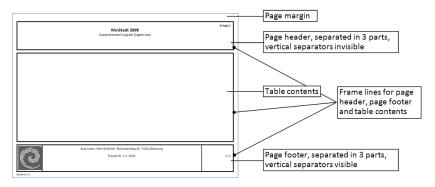
The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

Open the page layout with TABLE -> PAGE LAYOUT.

Define the format of the page in the tab index card "page format".

**Print Spreadsheet** 

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#### The different parts of the printout

| Page format      | Header ar  | nd footer text | Print options |               |           |          |         |              | 7       |
|------------------|------------|----------------|---------------|---------------|-----------|----------|---------|--------------|---------|
| Paper size       | •          | Width          | 210,0         | Length        | 297,0     | Portrait |         | •            |         |
| largins (mm)     |            |                |               |               |           |          |         |              |         |
| Тор              | 10,0 🛢     | Left           | 20,0 🛢        |               |           |          |         |              |         |
| Bottom           | 10,0 🕃     | Right          | 10,0 🕃        |               |           |          |         |              |         |
| rame widths [mm] | and colors |                |               |               |           |          |         |              |         |
| Header frame     |            |                | 0,7           | Header sepa   | ator line |          | 0,3     | 5 🕷          |         |
| Body frame       |            |                | 0,7           | Footer separa | ator line |          | 0,3     | 5 🛢          |         |
| Footer frame     |            |                | 0,7 🚡         |               |           |          |         |              |         |
| leader logo      |            |                |               | Footer logo   |           |          |         |              | Save    |
|                  | [          | Visible        |               |               | 3         | Visible  |         | V            | Load    |
|                  |            | Stretch        |               | 1 ac          | A L       | Stretch  |         | $\checkmark$ | Preview |
|                  |            | Left           | •             |               |           | Left     |         | •            |         |
|                  | X          | Width [mm      | ] 20          |               |           | Width    | [mm] 20 |              | OK      |
|                  |            | Height [mm     | ] 20 🕃        | Logo SP.bm    |           | Height   | [mm] 20 |              | Cancel  |

Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

The header and footer sections have three partitions: Left, middle, right. Texts or logos in the left partition are left aligned, in the middle partition centered and in the right partition right aligned.

A graphics can be inserted in the header as well as the footer, for example your company logo or the logo of the customer. Click on the gray field to select the graphics file. Define the position (left, middle, right partition) the height and the width of the graphics. When you check the logo justification button ("**STRETCH**"), the logo is fitted into the allocated space. The print preview however will decrease its speed because of it and therefore it is advisable to select a logo of proper size.

Format the content and the size of the page frame in the tab index card "*header and footer texts*". The texts can be text variables, automatically updated with information stored in the project or own texts.

Print Spreadsheet

| Fable settings: Single Receiver |                                                                                                                 |                                             |              |  |  |  |
|---------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------|--------------|--|--|--|
| Column setup Table layout Page  | e format Header and footer text                                                                                 |                                             |              |  |  |  |
| Text variables >>               | Arial 8                                                                                                         | 🗹 Use Rich Text format                      | Save         |  |  |  |
| Text page header                |                                                                                                                 |                                             | Load         |  |  |  |
| Left aligned                    | Centered                                                                                                        | Right aligned                               |              |  |  |  |
|                                 | <pre><pre>cpn:Project title&gt; <rn:table title=""> - <rt:run pre="" title<=""></rt:run></rn:table></pre></pre> | Annex 2<br><pi:project no.=""></pi:project> | Transfer     |  |  |  |
|                                 | sin. Table duez - src. Kun due                                                                                  |                                             | Reset titles |  |  |  |
|                                 |                                                                                                                 |                                             | Preview      |  |  |  |
| Show separator                  | Box height [mm] 20 😭                                                                                            | Show separator                              |              |  |  |  |
| Distance [mm] 10 😭              |                                                                                                                 | Distance [mm] 28 😭                          |              |  |  |  |
| Text page footer                |                                                                                                                 |                                             |              |  |  |  |
| Left aligned                    | Centered                                                                                                        | Right aligned                               |              |  |  |  |
|                                 | <cn:company name=""></cn:company>                                                                               | ###/ <total></total>                        |              |  |  |  |
|                                 |                                                                                                                 |                                             | ОК           |  |  |  |
| Show separator 🛛 🔽              | Box height [mm] 20 凄                                                                                            | Show separator 🛛 🔽                          | Cancel       |  |  |  |
| Distance [mm] 20 😭              |                                                                                                                 | Distance [mm] 25 😭                          | Help         |  |  |  |

Page header and page footer are printed on all pages of the table as well as for the legend. To format the texts, highlight the text or text variable and click on the button **FONT**. Define the width of the left and right partition and the height of the frame. The three sections can be partitioned with vertical **SEPARATOR LINES**.

For the entry the following **TEXT VARIABLES** are prepared for you and will automatically be updated in case the information changes. Click the cursor to the partition where the text should be displayed and select the variable to be displayed:

|    | Text variables >> | A Ca         | mbria      | 8           |
|----|-------------------|--------------|------------|-------------|
| Τe | Company name      | Project path | Result No. | Page        |
|    | Project engineer  | Run title    | Text 1     | Total pages |
|    | Project title     | Table title  | Text 2     | Date        |
|    | Project No.       | File name    |            | Time        |

In the tab index card "*print options*" you can select the first page number for the printout.

Click on the button **PREVIEW** to check the page layout.

Open the printer via **FILE** -> **PRINT**. If the printout of the legend is active, it is automatically printed before or after the table.

#### **Print legend**

The legend of the column headers is automatically created using the legend texts you entered in the **TABLE SETTINGS**. The legend contains only visible columns with assigned legend texts. All other columns are ignored. If you combined columns in

**Print Spreadsheet** 

the column title, the legend text is only inserted from the first of the combined columns. The legend is drawn in the section layout standard text.

Select FILE -> LEGEND.

| Legend          |                | ×                               |
|-----------------|----------------|---------------------------------|
| Columns         |                |                                 |
|                 | 1. / 2. Column | ו                               |
| Column numbers: |                |                                 |
| Column header:  |                | Preview                         |
|                 |                |                                 |
| Print           |                |                                 |
| O no print      | C before table | <ul> <li>After table</li> </ul> |
|                 |                |                                 |
| <u>0</u> K      | Cancel         | <u>H</u> elp                    |
|                 |                |                                 |

Select the order of column number and column header (text). If you don't want to show one of them deselect the check box.

Click preview to look at the printout:

| 🛐 Previev        | Preview          |                                                                                |  |  |  |  |  |
|------------------|------------------|--------------------------------------------------------------------------------|--|--|--|--|--|
| Column<br>Number | Column           | Description                                                                    |  |  |  |  |  |
| 1                | Serial           | Serial receiver number                                                         |  |  |  |  |  |
| 2                | Receiver name    | Descriptor of the receiver                                                     |  |  |  |  |  |
| 3                | Station          | Kilometer                                                                      |  |  |  |  |  |
| 4                | SA               | Orthogonal distance Receiver / road or railway axis                            |  |  |  |  |  |
| 5                | H I-A            | Height of the receiver above road or railway axis                              |  |  |  |  |  |
| 6-7              | Limit            | Limit level day / night                                                        |  |  |  |  |  |
| 8-9              | Status Quo       | Assessment level status quo day/night                                          |  |  |  |  |  |
| 10-11            | Prognosis w/o NP | Assessment level prognosis without noise protection day/night                  |  |  |  |  |  |
| 12               | Claim            | Claim on Noise protection measures at the facades (passive measures) day/night |  |  |  |  |  |
|                  |                  |                                                                                |  |  |  |  |  |

Select the print options for the legend in the lower part of the legend definition (before table, after table or no printout). The page number of the legend is automatically adapted.

# **Export Spreadsheets and formulas**

#### **Export spreadsheets**

You can export the spreadsheet table in ASCII format or to ESRI Shape files using **FILE** -> **EXPORT**. If you want to export only a part of the Spreadsheet you can also use **Copy & paste** to insert the table in another program (e.g. Excel).

For the export to **ESRI Shape files** the coordinates of the receivers are automatically exported to the shp file and the visible columns are exported to the dbf file. The software proposes unique column headers that you can change:

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**Export Spreadsheets and formulas** 

8

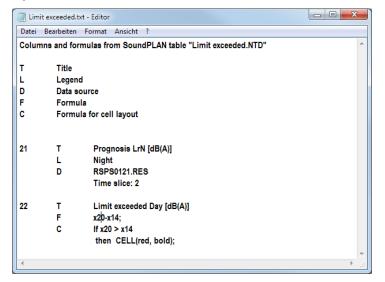
| Column                                                                                                | Field name |
|-------------------------------------------------------------------------------------------------------|------------|
| 1: No.                                                                                                | No_        |
| 6: Floor                                                                                              | Floor      |
| 8: Name                                                                                               | Name       |
| 9: Usage                                                                                              | Usage      |
| 10: Direction                                                                                         | Direction  |
| 13: Limit LrDN,lim [dB(A)]                                                                            | LimiLrD_dB |
| 14: Road noise - Present situation (FNM) LrD [dB(A)]                                                  | RoadLrD_d1 |
| 15: Road noise - Present situation (FNM) LrN [dB(A)]                                                  | RoadLrN_dB |
| 16: Road noise - Present situation (FNM) LrDN [dB(A)]                                                 | RoadLrD_d2 |
| The field names must be unique with up to 10 cha<br>(alpha-numerical and "_") and without special cha |            |

When you export building tables to ESRI Shape files, you can select whether you want to export the outline of the buildings or one reference point per building in the center of gravity.

The **ASCII export** only exports the visible columns. If you need the coordinates to be exported, please activate the columns in the **TABLE SETTINGS**.

#### **Export formulas**

You can document the contents of all table columns using **FILE** -> **EXPORT FORMULAS**. Title, Legend text, data source and the formulas for the calculation and for the cell layout are written to an ASCII file.



**Export Spreadsheets and formulas** 

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# Calculation of the economic damage (Swiss cost benefit index)

The Swiss cost benefit index for the calculation of the economic damage caused by noise distinguishes between planning and redevelopment. Redevelopment additionally distinguishes between complete redevelopment and not complete redevelopment. In SoundPLAN only the complete redevelopment is implemented.

There are two approaches for planning situations.

1. Calculation of grid noise maps and estimation of the costs with the area table.

2. If you know the maximum area for the buildings and the size of the buildings, digitize them and calculate the costs on the basis of a facade noise map.

Use always the second way for redevelopment.

During the installation of the country specific files tick Germany (Switzerland) for the templates in order to install the prepared templates for the area table (calculation on the basis of a grid noise map) and receiver table (calculation on the basis of a facade noise map). You can also copy the three templates manually to the SoundPLAN x Globdata folder (1 - costs of noise.bft, 2 - costs of noise variants.bft, 3 - noise costs FNM.ntt).

#### Estimate the cost using grid noise map and area table

Digitize the areas in the Geo-Database using the object type area usage. Separate the areas according to sensibility class, number of floors and floor space index. Define the properties **AREA USAGE** (sensibility class), **NUMBER OF FLOORS** and **FLOOR SPACE INDEX**.

| 👹 Area Usage Properties 📃 🔳 🗵 |                      |            |   |  |  |
|-------------------------------|----------------------|------------|---|--|--|
| Name: B2                      |                      |            |   |  |  |
| <u>A</u> rea usage:           | Sensibility class II |            | • |  |  |
| Population:                   | 0                    | Dwellings: | 0 |  |  |
| Number of floors:             | 4                    |            |   |  |  |
| Floor-space index             | 0,80                 |            |   |  |  |
| (                             | )k Ca                | ancel He   | p |  |  |

You can calculate the grid noise map in the free field or with existing buildings. It is necessary that you calculate one grid noise map per floor. These grid maps must be

```
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```

consecutively numbered from the ground to the highest floor. Define and calculate the calculation runs in the run table.

| Ē | Run file Log-Book   Graphics   Run info |                |                |        |                      |  |  |  |  |
|---|-----------------------------------------|----------------|----------------|--------|----------------------|--|--|--|--|
| Γ | Calc                                    | Name           | Calc Type      | Result | Data                 |  |  |  |  |
|   | Yes                                     | GNM - 1. floor | Grid Noise Map | 11     | "Grid Noise Map.sit" |  |  |  |  |
|   | Yes                                     | GNM - 2. floor | Grid Noise Map | 12     | "Grid Noise Map.sit" |  |  |  |  |
| Е | Yes                                     | GNM - 3. floor | Grid Noise Map | 13     | "Grid Noise Map.sit" |  |  |  |  |
|   | Yes                                     | GNM - 4. floor | Grid Noise Map | 14     | "Grid Noise Map.sit" |  |  |  |  |

Open the spreadsheet and select the file type **area table (conflict map)**. Select one of the delivered templates or "new template" if you want to create your own table.

We deliver two templates for the area table.

- 1 costs of noise template for one variant
- 2 costs of noise template for two variants

Select the template and fill in the dialogue **TABLE CONTENTS** with the situation, which includes the area usages and the grid map(s) calculated for the ground floor.

Select in the next dialogue whether you work on a planning situation or on redevelopment (according to your selection SoundPLAN uses the planning value or the alarm value and handles the division in the different noise classes), the region for the mean annual rent costs per m<sup>2</sup> and if needed a correction factor on the gross floor area.

| Swiss costs of noise    |           |                   | ×        |
|-------------------------|-----------|-------------------|----------|
| Settings                |           |                   |          |
| Planning                | Region    | Periphery         |          |
| C Redevelopment         |           | ,<br>Costs per m² | 104,50   |
| Fixed reference columns |           |                   |          |
| Number of floors        | NF        |                   |          |
| Floor space index       | FSI       |                   |          |
| Correction factor       | 6: CF     |                   | <b>T</b> |
|                         | 🔽 set fac | tor               | 0,70 🚖   |
| Sensibility level       | 7: SC     |                   |          |
| Presettings             | OK        | Cancel            | Help     |

Click OK, the table filled in and the total costs of noise are displayed in a statistic row.

#### Presettings

Call **TOOLS** -> **SWISS COSTS OF NOISE** and open the presettings via the button on the lower left hand side. The presettings define the annual rent costs for the different regions, alarm value (AW), planning value (PW) and limit value (IGW) for each of the sensibility classes as well as the rent cost factor for the four noise classes. The calculation of the economic damage is done on the basis of these specifications.

| Sw | iss settings                          |       | × |  |  |  |  |  |  |
|----|---------------------------------------|-------|---|--|--|--|--|--|--|
| R  | Regions Sensibility level Rent factor |       |   |  |  |  |  |  |  |
|    | -                                     |       |   |  |  |  |  |  |  |
|    | Region                                | Costs |   |  |  |  |  |  |  |
|    | Average                               | 127,4 |   |  |  |  |  |  |  |
|    | Neighbourhood of large cities         | 155,4 |   |  |  |  |  |  |  |
|    | Large cities                          | 146,1 |   |  |  |  |  |  |  |
|    | Cities                                | 122,3 |   |  |  |  |  |  |  |
|    | Small cities                          | 112,1 |   |  |  |  |  |  |  |
|    | Periphery                             | 104,5 |   |  |  |  |  |  |  |
|    | Others                                | 140,0 |   |  |  |  |  |  |  |
|    |                                       |       |   |  |  |  |  |  |  |
|    | OK Cancel                             | Help  |   |  |  |  |  |  |  |

Description of the columns for the cost benefit index (area table)

| 1         | 2         | 3         | 4  | 5    | 6    | 7  | 8   | 9        | 10         | 11       | 12      | 13      | 14     | 15           | 16  | 17     |
|-----------|-----------|-----------|----|------|------|----|-----|----------|------------|----------|---------|---------|--------|--------------|-----|--------|
|           |           |           |    |      |      |    |     |          |            |          | Costs o | f Noise |        |              |     |        |
| Name      | Type      | Size      | NF | FSI  | CF   | SC |     | Affected | Noise Zone | es in mª |         |         | (      | Costs in SFr |     |        |
|           |           | [m²]      |    |      |      |    | NC1 | NC2      | NC3        | NC4      | Total   | NC1     | NC2    | NC3          | NC4 | Total  |
| Summed up | costs (SF | r): 111.7 | 94 |      |      |    |     |          |            |          |         |         |        |              |     |        |
| A1        |           | 3200      | 2  | 0.50 | 0.70 | -  | 140 | 980      | 0          | 0        | 1120    | 3.233   | 12.482 | 0            | 0   | 15,716 |
| A2        |           | 2200      | 2  | 0,50 | 0,70 | -  | 0   | 350      | 420        | 0        | 770     | 0       | 2.607  | 1.847        | 0   | 4.454  |
| B1        |           | 3600      | 2  | 0.80 | 0.70 |    | 336 | 1680     | 0          | 0        | 2016    | 7.760   | 23.666 | 0            | 0   | 31.426 |
| B2        |           | 4500      | 4  | 0,80 | 0,70 |    | 0   | 1943     | 578        | 0        | 2520    | 0       | 16.726 | 2.616        | 0   | 19.342 |
| C1        |           | 4200      | 2  | 0,70 | 0,70 |    | 343 | 1115     | 600        | 0        | 2058    | 5.521   | 10.253 | 2.755        | 0   | 18.529 |
| C2        |           | 3150      | 3  | 0,70 | 0,70 |    | 0   | 0        | 1429       | 0        | 1429    | 0       | 0      | 3.285        | 0   | 3.285  |
| C3        |           | 2100      | 2  | 0,70 | 0,70 |    | 0   | 0        | 172        | 0        | 172     | 0       | 0      | 53           | 0   | 53     |
| D         | 1         | 5400      | 1  | 0,50 | 0,70 | 1  | 140 | 1190     | 560        | 0        | 1890    | 3.214   | 13.480 | 2.296        | 0   | 18.990 |

Column 2: Type = Area usage

The area usage is defined in the Geo-Database; it is used for the determination of the sensibility class (see description for column 7).

Column 4: NF = Number of floors Column 5: FSI = Floor space index

The number of floors and the floor space index are defined in the properties of the area usage in the Geo-Database.

Column 6: CF = Correction factor

You can preset a value for all areas in the CBI dialogue. If needed, the correction factor can be changed in the table for each area separately.

Column 7: SC = Sensibility class

For this column the following formula is stored (change it if necessary):

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case X2 of "I": 1; "II": 2; "III": 3; "IV": 4; else: 2; end;

According to this formula the first area usage in the library represents the sensibility 1, the second one the sensibility 2 and so on. The fifth or all following area usages are handled as sensibility class 2.

The sensibility class is determined from the area usage (column 2).

For the calculation example project we redefined the first four area usages in the SoundPLAN presettings to I to IV so that the types I - IV are automatically available.

You can define your own usage types according to other criteria, for example

R2 (residential area with two floor buildings)

R3 (residential area with three floor buildings)

Adjust the formula in column 7 and recalculate the table.

The column SC is an integer column, the display in roman numbers is handled via the setting in the column layout

Columns 8-12: Affected noise zones in m<sup>2</sup>

Columns 13-17: Economic damage due to noise (costs of noise)

The assigned grid noise maps are stored in the background for these columns. The calculation of the affected area and the costs is automatically done by the software; there are no parameters to change the calculation.

The calculation is executed as follows:

First the gross floor space (GFS) representing one grid cell is calculated:

GFS = area of one grid cell \* floor space index \* correction factor / number of floors (GFS = grid area \* FSI \* CF / NF)

Next the program determines for each floor and grid cell of which the center point is within the area, which time slice causes the decisive level exceedance (level difference to the limit value or planning value of the sensibility class). The level exceedance determines the noise class to which the gross floor space and the costs of this grid cell are added.

The costs of a grid cell are calculated as follows:

Costs = gross floor space of a grid cell \* decisive limit level exceedance \* rent factor of the noise class \* costs per m<sup>2</sup>.

Calculation of the economic damage (Swiss cost benefit index)

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#### Noise costs using facade noise map and receiver table

Digitize the buildings and create the calculation run for the facade noise map.

The procedure in the Spreadsheet is nearly the same as for the area table. Select the template 3 - noise costs FNM (file type receiver table).

Select the facade noise map in the dialogue TABLE CONTENTS.

Select in the next dialogue whether you work on a planning situation or on redevelopment (according to your selection SoundPLAN uses the planning value or the alarm value and handles the division in the different noise classes), the region for the mean annual rent costs per m<sup>2</sup> and if different the column for the gross floor space.

| Swiss costs of noise    |           |              |          |
|-------------------------|-----------|--------------|----------|
| Settings                |           |              |          |
| C Planning              | Region    | Others       | -        |
| Redevelopment           |           | Costs per m² | 140,00   |
| Fixed reference columns |           |              |          |
| Gross floor space       | 13: GFS   | [m²]         | •        |
| Correction factor       | 16: CF    |              | <b>_</b> |
|                         | 🔽 set fac | tor          | 0,70 🚖   |
| Sensibility level       | 17: SC    |              | <b>T</b> |
| Presettings             |           | < Cancel     | Help     |

Click OK, the table filled in and the total costs of noise are displayed in a statistic row.

In addition to the fixed columns described in the section using the area table you will get the following columns:

- Level above limit value or planning value
- assigned noise zone
- resulting costs

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# Description of the columns for the cost /benefit index (receiver table)

| 6           | 1                 | 11          | 12        | 13    | 14    | 15    | 16   | 17 | 18       | 19      | 20     |
|-------------|-------------------|-------------|-----------|-------|-------|-------|------|----|----------|---------|--------|
|             |                   |             |           |       | Level |       | 1    | i  | <u> </u> | Noise c | osts   |
| Floor       | No.               | Usage       | Direction | GFS   | LrT   | LrN   | CF   | SC | >ILV     | NC      | Costs  |
|             |                   | _           |           | [m²]  | [dB   | (A)]  | ĺ    |    | dB[A]    |         | SFr    |
| Total costs | : 4               | 7.474,12 \$ | SFr       |       |       |       |      | -  |          |         |        |
| A1-1        | A1-1 2.606,83 SFr |             |           |       |       |       |      |    |          |         |        |
| 1           | 1                 |             | W         | 15.00 | 65.2  | -19.8 | 0.70 |    | 10.2     | 2       | 135.01 |
|             | 2                 |             | W         | 15,00 | 66,7  | -18,3 | 0,70 |    | 11,7     | 2       | 154,69 |
|             | 3                 |             | S         | 22,50 | 69,8  | -15,2 | 0,70 |    | 14,8     | 2       | 294,15 |
|             | 4                 |             | S         | 22,50 | 69,8  | -15,2 | 0,70 |    | 14,8     | 2       | 294,21 |
|             | 5                 |             | E         | 15,00 | 66,8  | -18,2 | 0,70 |    | 11,8     | 2       | 156,14 |
|             | 6                 | - 11        | E         | 15,00 | 65,4  | -19,6 | 0,70 |    | 10,4     | 2       | 137,38 |
|             | 7                 |             | N         | 22,50 | 56,5  | -28,5 | 0,70 |    | 1,5      | 3       | 27,17  |
|             | 8                 | -           | N         | 22,50 | 56,4  | -28,6 | 0,70 |    | 1,4      | 3       | 24,92  |
| 2           | 1                 |             | W         | 15.00 | 65.8  | -19.2 | 0.70 |    | 10.8     | 2       | 142.42 |
|             | 2                 | - 11        | W         | 15,00 | 67,1  | -17,9 | 0,70 |    | 12,1     | 2       | 160,73 |
|             | 3                 |             | S         | 22,50 | 70,2  | -14,8 | 0,70 |    | 15,2     | 1       | 335,86 |
|             | 4                 |             | S         | 22,50 | 70,2  | -14,8 | 0,70 |    | 15,2     | 1       | 335,90 |
|             | 5                 |             | E         | 15,00 | 67,3  | -17,7 | 0,70 |    | 12,3     | 2       | 162,28 |
|             | 6                 |             | E         | 15,00 | 66,0  | -19,0 | 0,70 |    | 11,0     | 2       | 144,89 |
|             | 7                 |             | N         | 22,50 | 57,9  | -27,1 | 0,70 |    | 2,9      | 3       | 51,33  |
|             | 8                 |             | N         | 22.50 | 57.8  | -27.2 | 0.70 |    | 2.8      | 3       | 49.75  |

Column 11: area usage  $\rightarrow$  see column 2 (area table) Column 13: Gross floor space (GFS):

The corresponding facade length is calculated according to the building geometry for each receiver. This information is used to calculate the part of the building floor space which is used as gross floor space.

Column 14+15: Assessment level day + night

Column 16: CF  $\rightarrow$  see column 6 (area table)

Column 17: SC  $\rightarrow$  see column 7 (area table)

Column 18: Decisive level exceedance day or night referring to the limit value or planning value depending on the sensibility class (SC)

Column 19: Noise class - results from the decisive level exceedance

Column 20: economic damage due to noise (noise costs)

The noise costs for one receiver are calculated as follows:

Costs = Gross floor space \* CF \* decisive limit exceedance \* rent factor of the noise class \* costs per  $m^2$ .

The columns 18-20 are calculated in one step, therefore you cannot change the values manually.

# Usage of the cost benefit index in other countries (e.g. action planning)

The Swiss method to determine the noise related costs can be applied by analogy in other countries, e.g. in the scope of noise action planning.

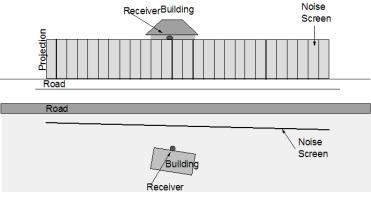
The calculation would be done on the basis of a façade noise map. It should be considered that the Swiss regulations do not know the  $L_{DEN}$ . Therefore, the assessment should use the time slices day and night. It is also necessary to adapt the annual rent per m<sup>2</sup> living space. The default sensibility class is II which represents more or less a residential area.

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# 9 Wall Design

## **Overview Wall Design**

Calculating and optimizing the dimensions of noise protection walls is a timeconsuming task. Designing the wall for one receiver is manageable if the source is just one line. Usually the permitted height is selected and the barrier length needed to shield the receiver to the proper noise level must be determined. Otherwise, you can specify the length of a noise screen and calculate the screen height needed to reach the proper noise level.



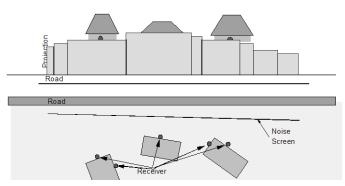
Dimensioning a noise screen for a single receiver

The task of optimizing becomes complicated when more than one receiver must be protected.

In most cases you would begin dimensioning the noise screen for each one of the receivers, superimpose the screens, and check how much the noise control target was exceeded. You would then modify the screen by hand to optimize it at certain locations. Real optimization by hand (even with the help of a computer) is impossible!

**Overview Wall Design** 

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Optimizing a noise screen by hand for multiple receivers

Optimizing a noise screen means finding the screen with the smallest surface area shielding the receivers to the desired level. A second optimization is a minimization of costs. SoundPLAN provides these options plus even more.

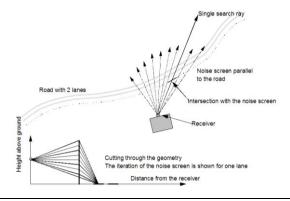
The optimal noise screen might be the least expensive solution, but it may also be the least aesthetic. The structure of noise protection walls should fit into the landscape. Beginning with the minimal solution, you can modify the noise screen design while keeping the noise control objective.

SoundPLAN can optimize complicated areas with multiple sources (road, rail, industry) and receivers in areas having different requirements (residential or industrial).

#### Wall Design's Internal Organization

In order to better understand Wall Design's capabilities, examine the completed calculations. The following picture shows an example of a road with a parallel noise barrier which is to be dimensioned for one receiver.

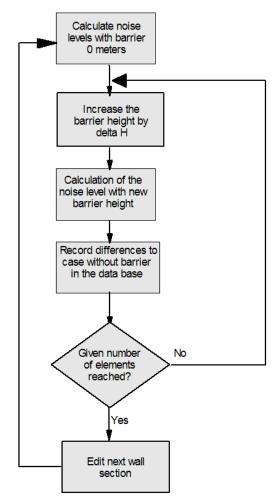
SoundPLAN's search rays intersect the barrier and the roads when scanning. The geometry for every cut is organized according to the distance from the receiver as seen in the flow chart following. Wall Design's goal is to calculate the screening influence for every intersection with the noise barrier and record the differences.



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**Overview Wall Design** 

After the search ray intersects the screen element, the influence of a 0.0 screen is calculated. A defined increment is used to increase the height of the noise barrier a specified number of iterative steps. The element height and the number of elements are defined in the calculation properties.



Flow chart of optimizing calculations

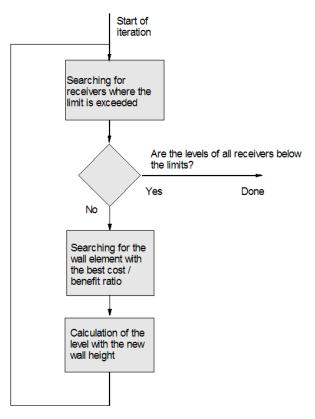
Completely calculating the noise in one ray allows the influence of ground attenuation and screening to be evaluated and used later to optimize the noise barrier.

As more than one search ray may pass over an element of the noise barrier, the values stored in the matrix must have different energies than the zero height barrier. When all contributions that passed over a single barrier section have been evaluated, the "noise footprint" of this barrier element for the receiver being

**Overview Wall Design** 

calculated has been recorded. SoundPLAN stores all energetic reductions in a matrix for every receiver and as wide as the total wall elements.

Wall design loads this matrix and searches for the barrier elements yielding the highest reduction of sound energy per surface (or per cost). The barrier selection uses an iterative process.



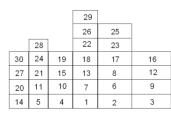
Selecting the barrier elements in an iterative process

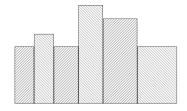
As documented in the flow chart, receivers are included in the barrier selection process only if their noise level exceeds the set limit. For all improperly shielded receivers, SoundPLAN searches for the element resulting in the highest reduction of noise energy (stored in the matrix) for all receivers. During this search SoundPLAN examines the next element to be added and evaluates the usage of the next elements.

If the base of the noise screen was not intersected with the search ray, the first element has no protecting value. Only elements high enough to intercept the line of sight provide a positive reduction of noise per area. In this case the highest attenuation per square meter requires many more elements than just those breaking the line of sight.

**Overview Wall Design** 

#### Selection sequence

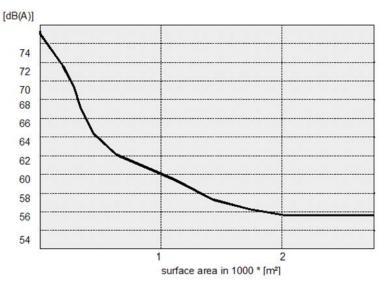




Shape of the noise screen

Selection of barrier elements

The noise reduction per square meter of wall surface (or wall surface \* specific cost) is the main goal for selecting barrier elements. The element's efficiency can be seen in the diagram.



Noise level reduction and increase of wall size

As seen in the diagram, increasing the wall size beyond 2000 m<sup>2</sup> does not decrease the noise levels at a justifiable rate. Even if SoundPLAN manages to reach the set noise levels, the cost to performance ratio becomes increasingly worse. The decision maker must decide how much sound the noise screen shall shield, and at which point passive measures (improved windows) are the more cost effective solution.

For clarity, the cost-performance diagram was shown only for one receiver. In a real situation, the diagram would contain many more lines, and for each receiver a characteristic cost to performance line.

**Overview Wall Design** 

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### **Wall Design Performance**

Wall Design can perform accurately only if all the parts are present. Before the optimization can be run, several steps need to be completed.

- 1. Define the wall's position as a regular screen in the Geo-Database. Copying and moving the coordinates sideways defines the position of the major road or rail, or the screen can be digitized. The wall height can be ignored because Wall Design will determine this. It is advisable to extend the potential wall beyond both sides of the perpendicular position of the receivers. If the wall segments are not needed, Wall Design will ignore them, and if they are necessary, the will be included in the pre-calculation. The wall elements should not be longer than 10% of the distance between the source line and the receiver. The wall has to be entered in separate Geo-File, otherwise the wall cannot be pre-calculated.
- 2. Wall Design can optimize a noise control wall for minimum surface area or for minimum cost. Minimizing the cost requires price information for the noise control wall. SoundPLAN offers a cost matrix which you must configure to local conditions. Costs can be defined for walls and berms and can consist of land acquisition, foundation and building costs for different wall heights. Planting costs for berms are a separate factor. When digitizing the wall base line, different wall elements may have different cost. One part could be concrete, another part could have translucent material and yet another part could be constructed of lumber.
- 3. A calculation run is necessary for Wall Design to obtain all information about the efficiency of wall sections. SoundPLAN dimensions all wall base lines check marked in the field **OPTIMIZATION** in the properties of the walls and berms in the Geo-Database. They have to be stored in a separate Geo-File. Other berms and walls may be present in the calculation. Sources can be from road, railway and industry.
- 4. Use Wall Design for on line dimensioning and optimization of the noise screen. The noise screen element heights are dimensioned using the calculated data. The following tools are available:
  - Automatic calculation of the lowest wall height or the least cost. The selection can be all at once or step by step.
  - Definition of the minimum and maximum wall height so that the wall can aesthetically fit into the landscape.
  - View the optimized noise screen as a graphic in the top view and as a 2D projection or 3D view.
  - Generation of a cost performance diagram. This is part of the procedure for deciding when to stop dimensioning the wall if it does not meet the

Wall Design Performance

objective. The selected wall can be transferred to the selection matrix for further studies.

• Transfer of the wall to the Geo-Database as a normal screen for later use (calculation of noise maps, etc.). Please recalculate the result in any case.

# **Using Wall Design**

Wall Design requires work in different SoundPLAN modules:

#### Additional Properties in the Geo-Database objects

Define the position of the base line(s) of walls and/or berms in a **separate Geo-File** in the Geo-Database. Activate the field **OPTIMIZATION** in the properties dialog.

| noise prot      | -                               | -            |  | × |  |  |  |  |
|-----------------|---------------------------------|--------------|--|---|--|--|--|--|
| Name:           | Name: Wall base line Oak Street |              |  |   |  |  |  |  |
| Geo-File:       | 007_Wall base line Oak Street   |              |  |   |  |  |  |  |
| ➢ Properties    |                                 |              |  |   |  |  |  |  |
| Base element    | Additional elements             |              |  |   |  |  |  |  |
| Jse for Wa      | Se for Wall Design              |              |  |   |  |  |  |  |
| Height          |                                 |              |  |   |  |  |  |  |
| Wall floats abo | ve ground                       |              |  |   |  |  |  |  |
| Wall height (m  | Constant element height         | $\checkmark$ |  |   |  |  |  |  |

Additional properties and different elements are ignored for the Wall Design precalculation. The property reflection loss is also not taken into account, but the selection is kept after you stored the optimized wall back to the Geo-Database.

In case of a berm please define the slope and the top width for noise protection, in order to correctly calculate the screening edge in the precalculation.

| 🔺 Noise protect         |                                        |   | × |  |  |  |  |  |
|-------------------------|----------------------------------------|---|---|--|--|--|--|--|
| Name:                   | Name: Noise protection wall at highway |   |   |  |  |  |  |  |
| Geo-File:               | 003_Roads Prognosis ~                  | _ |   |  |  |  |  |  |
| Properties              |                                        |   |   |  |  |  |  |  |
| Jse for Wall De         | Use for Wall Design                    |   |   |  |  |  |  |  |
| Height [m]:<br>Slope 1: | 0,00<br>1,5 Slope rear side 1: 1,5     |   |   |  |  |  |  |  |
| Top width [m]:          | 2                                      |   |   |  |  |  |  |  |

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**Using Wall Design** 

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You don't have to enter a wall height because it is optimized in Wall Design. But existing heights e.g. from a retaining wall can be taken into account in the wall optimization.

The sections of the wall base line should not be too wide. Depending on the geometry situation and the distance of the receivers from the source, the size of the sections can be different. The following table shows empirical values:

| Inner cities   | 5 to 10 meters   |
|----------------|------------------|
| Outside cities | 20 to 40 meters  |
| Highways       | up to 100 meters |

Use the Geo-Tool **DIVIDE SECTIONS** to divide the wall base line into several sections. The elevation information will be interpolated.

#### Precalculation in the Calculation Kernel

In the next step execute a pre-calculation in the Calculation Kernel to obtain all information about the efficiency of the wall sections.

Add a calculation run to the already existing or create a new run file. For details see also Chapter "Calculations".

You can use Wall Design for single receivers as well as for Facade Noise Maps.

Enter a run name, select the run type Wall Design from the selection list and select the data needed.

Check the settings in the dialogues **SETTINGS** and **STANDARDS** and look at the Wall Design properties:

| General  | Settings                                                                                | Standards  | Assessment | Wall Design | Description |     |  |  |  |
|----------|-----------------------------------------------------------------------------------------|------------|------------|-------------|-------------|-----|--|--|--|
|          |                                                                                         |            |            |             |             |     |  |  |  |
| Wall ele | ment heigh                                                                              | nt [m]     |            |             |             | 0,5 |  |  |  |
| Max. W   | all Height (                                                                            | Element #) |            |             |             | 20  |  |  |  |
| 🔲 Igna   | Ignore wall or berm heights in Design Geo-File                                          |            |            |             |             |     |  |  |  |
|          | Calculate reflection of assigned facade and ignore standard dependent facade correction |            |            |             |             |     |  |  |  |

The default setting for the height of each element is 0.5 meters and for the maximum number of elements used for the iteration it is 20 elements.

These default settings can be modified according to your needs.

Activate the field **IGNORE WALL/BERM HEIGHTS IN DESIGN GEO-FILE** if the wall that should be optimized has been assigned a wall / berm height in the Geo-File.

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**Using Wall Design** 

The checkbox **CALCULATE REFECTIONS OF THE ASSIGNED FACADE AND IGNORE STANDARD DEPENDENT FAÇADE CORRECTIONS** means that regardless of the terms in the standard the reflection at the façade is calculated (default: unchecked).

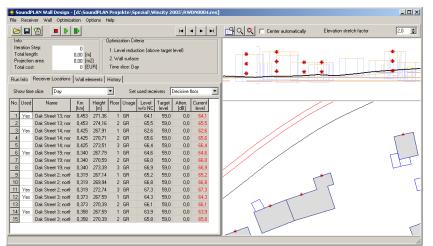
Some standards suppress the reflection for the façade levels other use specially described corrections and yet others calculate the assigned façade.

Start the calculation with **b**.

# **Optimization in Wall Design**

After the calculation run has been finished successfully, open Wall Design from the SoundPLAN Manager. Load the result of a designed (pre-calculated) screen file in the **OPEN** window.

The Wall Design window will be displayed on the screen:



Wall Design window

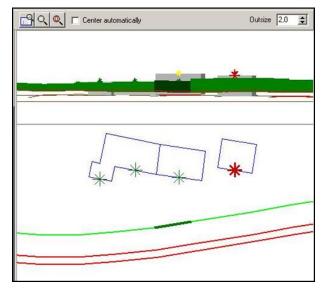
The four tab index cards on the left hand side provide information on the calculation run, the receivers, the wall segments and the iteration history. On top of the window, information on the surface, length and costs are shown. Additionally, the used optimization criteria are displayed.

The lower part of the graphic displays the site map, and the upper part the front elevation. Right click to change the **DISPLAY TYPE** (site map, front elevation, 3D) as well as the **DRAW TYPE** (wire frame, hidden lines or areas).

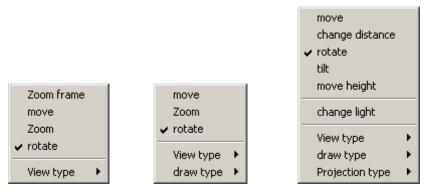
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**Using Wall Design** 

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Depending on the display type, further functions are available via the right mouse button.



Right mouse button menu for site map (left), front view (middle) and 3D map (right)

Additional options:

- OPTIONS -> SHOW ONLY BUILDINGS WITH RECEIVERS removes buildings without assigned receivers from the graphics.
- It is possible to enter a stretch factor for the front elevation.
- To speed up the optimization, the building process of the wall is no longer displayed (OPTIONS -> DISPLAY WALL BUILDING PROCESS).

In the Wall Design graphics the screen can be zoomed to the current receiver location or the current wall element, depending on the current table on the left hand side. Set **CENTER AUTOMATICALLY** to refresh the screen section while going through the receiver or wall element list.

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Using Wall Design

Wall design uses the SoundPLAN Graphics. The object types **OPTIONS** -> **OBJECT TYPES** control the objects representation and particularly the representation whether or not receivers exceed the limits.

You can select the representation (color, size) for all receivers, for the highlighted receiver and for the wall base line, all wall elements and the highlighted wall segment.

| ─Points to optimize<br>←normal |       |               |        |
|--------------------------------|-------|---------------|--------|
| Color < limit                  |       | Color > limit |        |
| highlighted                    |       |               |        |
| Size as factor                 | 1,5 🚖 | Line width    | 0,60 🔮 |
| Color < limit                  |       | Color > limit |        |
|                                |       |               |        |

The graphics window in Wall Design contains all object types stored in the Situation. You can also select the objects you want to see. Open the object types and deselect show for the object types you don't need to see.

## Starting the optimization

All floors are shown, however only the decisive floor is by default activated for dimensioning. Via the selection list **SET USED RECEIVERS** under the tab *receiver locations* select other floors, the floor with maximum level found at a receiver or all floors of a receiver.

| Set used receivers | Top floor 🔹                    |                         |  |  |
|--------------------|--------------------------------|-------------------------|--|--|
|                    | All receivers<br>Maximum level | *                       |  |  |
|                    | Top floor                      |                         |  |  |
|                    | EG                             |                         |  |  |
|                    | 1.0G                           | =                       |  |  |
|                    | 2.0G                           |                         |  |  |
|                    | 3.0G                           |                         |  |  |
|                    | 4.0G                           | $\overline{\mathbf{v}}$ |  |  |

As all floors are contained in the receiver table, the current level and how much the receiver exceeds the limit is always visible for all receivers, even for the receivers that are not activated for the optimization.

In case the big number of receivers becomes too crowded, you can hide receivers not activated for the optimization with **RECEIVERS** -> **SHOW ONLY SELECTED RECEIVERS**.

The optimization is started by clicking on **b** or via the **OPTIMIZATION** -> **RUN** <**F9**>. The criteria for the optimization, the time slice and possible corrections to the noise target level are requested before the start of the optimization.

**Using Wall Design** 

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| Optimization Criteria                   | ×         |
|-----------------------------------------|-----------|
| Select                                  |           |
| 1. Level reduction {above target level} | •         |
| 2. Wall surface                         |           |
| Time slice Day                          | •         |
| Target level                            |           |
| <ul> <li>use defined limit</li> </ul>   |           |
| C correction for defined limit          | 0,0 🚖     |
| C correction for calculated level       | 0,0 🚖     |
| 🔘 set target level                      | 0         |
|                                         |           |
| C                                       | IK Cancel |

The first criterion is

- Level reduction
- Level reduction per meter façade length
- Level reduction per inhabitant

As a second criterion select between "minimum wall surface" and "minimum cost" and select the time slice for the optimization.

The target level is the level that should be reached after the optimization. You have the possibility to use the limit defined in the assessment during the precalculation, add /subtract a correction to the defined limit, add/subtract a correction to the calculated level, set a target level for all receivers or edit the target level.

The wall is gradually built until all used receivers keep the limits or the number of wall elements is not sufficient to keep the target levels. In this case the following message is displayed:

| Wall Design              |                                            |
|--------------------------|--------------------------------------------|
| The calculated wall is n | ot sufficient to reach the target values ! |
|                          |                                            |
|                          | OK                                         |

And still some of the used receivers are displayed in red. The level reduction is also calculated for the receivers not used for the optimization; these receivers are often still displayed in red. This message will normally show up for wall optimizations with Façade Noise Maps.

**Using Wall Design** 

A step by step iteration with constant observation of the selection of the wall elements can be done by clicking **D** or via item **SINGLE STEP** <F7> from the **OPTIMIZATION** menu. If you choose the step by step approach, you can interrupt the building of the wall at any time with **D**.

#### **Receiver locations**

The tab index card "receiver locations" gives detailed information on the receivers.

| No. | Used | Name         | Km<br>[km] | Height<br>[m] | Floor | Usage | Level<br>w/o NC |      | Atten.<br>[dB] | Current<br>level |
|-----|------|--------------|------------|---------------|-------|-------|-----------------|------|----------------|------------------|
| 1   | Yes  | Oak Street 2 | 0,335      | 268,27        | GF    | GR    | 65,2            | 59,0 | 6,2            | 59,0             |
| 2   |      | Oak Street 3 | 0,390      | 268,21        | GF    | GR    | 64,1            | 59,0 | 4,9            | 59,2             |

If a reference axis of a road or railway has been defined in the road or railway properties of the Geo-Database, the kilometer post is shown for the exact location of a receiver. The next columns display the receiver height above ground, the number of floors and the area usage.

The **TARGET LEVEL** is the level that should be kept after the optimization. If the area usage has been defined for the receivers in the Geo-Database and an assessment library element has been selected in the calculation run the target level is taken from the limits in the assessment library. If not, a target level can be set in Wall Design for all receivers by either using <F4> or selecting the item **RECEIVERS -> SET TARGET VALUES**.

When starting Wall Design, a **YES** is placed in the first column for the decisive floor of all the receivers, which means that all the receivers are included in the optimization. Sometimes it is suitable to exclude a receiver from the optimization after the first calculation, e.g. if the limit cannot be kept and therefore passive measures (improved windows) have to be designed. Use the space bar in the first column to change the selection of the receivers used for the optimization.

| ſ | Run Info Receiver locations Wall elements History |       |                    |     |     |       |                           |               |            |            |
|---|---------------------------------------------------|-------|--------------------|-----|-----|-------|---------------------------|---------------|------------|------------|
|   | No.                                               | Km    | Base height<br>[m] | min | max | Elem. | Wall<br>height [m]<br>[m] | Length<br>[m] | Cost group | Cost<br>[] |
|   | 1                                                 | 0,262 | 265,90             | 0   | 20  | 0     | 0,00                      | 19,75         | 1          | 0          |
|   | 2                                                 | 0,281 | 266,12             | 0   | 20  | 8     | 4,00                      | 18,31         | 1          | 47595      |
|   | 3                                                 | 0,300 | 266,01             | 0   | 20  | 9     | 4,50                      | 15,43         | 1          | 43196      |
|   | 4                                                 | 0,315 | 266,39             | 0   | 20  | 9     | 4,50                      | 23,09         | 1          | 64648      |
|   | 5                                                 | 0,338 | 266,01             | 0   | 20  | 8     | 4,00                      | 14,19         | 1          | 36898      |
|   | 6                                                 | 0,353 | 266,34             | 0   | 20  | 2     | 1,00                      | 15,90         | 1          | 22258      |
|   | 7                                                 | 0,369 | 266,39             | 0   | 20  | 3     | 1,50                      | 14,49         | 1          | 23185      |

Wall segments

Section Wall segments

For your information this section shows the assigned km post and the base elevation of the wall.

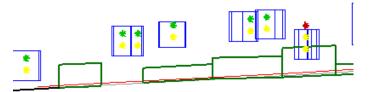
Using Wall Design

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Wall height, length and costs can only be added after the first optimization. When optimizing a wall, often a minimum or maximum height is pre-defined by the planning authorities. Those default heights can be entered via the items **SET MINIMUM HEIGHTS** or **SET MAXIMUM HEIGHTS** from the **WALL** menu.

**Hint:** The maximum number of wall elements cannot be higher than defined in the Wall Design properties in the calculation run.

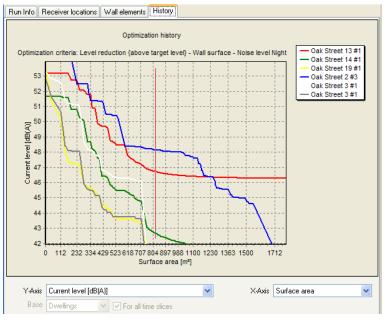
After the first calculation the wall might look like that:



Wall with gaps after the first optimization

Some segments of the wall do not need to be built to keep the limits. Therefore, minimum and maximum heights (number of elements) can be set in the table itself. Modify the number of elements in the columns **MIN** and **MAX** but not in the column **ELEMENTS**, this column should be calculated. Please do not forget to optimize again after modifying minimum or maximum heights!

#### **Optimization History**



Optimization history

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**Using Wall Design** 

If the objective of dimensioning the noise screen to the set noise limits cannot be met, or if Wall Design requires an excessive amount of wall surface, the situation can be analyzed using the cost to performance diagram.

The diagram shape is a representation of the Fresnel diagrams with attenuation and extra path length. If the noise screen is lengthened, the benefits per surface area decrease. This is also visible in the wall size to noise level diagrams. Wall Design, however, uses elements in the perpendicular position and elements along a stretch of receivers, the height is increased and the elements chosen shield the noise from the sides.

The diagram can be plotted in different modes:

The x-axis can map the surface area or the total cost, while the y-axis can map the absolute noise levels over the area of the noise screen (actual level), the noise reduction (level difference to the start level) or the levels exceeding the limits (level difference to the target level). For the optimization according to characteristics (façade length above target level, inhabitants above target level ...) further diagrams help with the analysis of the best cost / benefit ratio.

| Info             |         |       |
|------------------|---------|-------|
| Iteration Step:  | 69      |       |
| Total length:    | 209,70  | [m]   |
| Projection area: | 821,22  | [m2]  |
| Total cost:      | 538.191 | [EUR] |
|                  |         |       |

The navigation buttons are used to move in the diagram to view every state of the wall – the wall elements built are displayed in the graphics, costs, length, surface area and so on are displayed in the table.

The x-axis either shows the wall surface or the total costs. The y-axis either shows the absolute levels over the surface of the wall (current level), the level reduction (difference to the start level), or the level difference to the target level. When optimizing according to other characteristics, additional charts help to give answers on which iteration step still keeps the cost / efficiency relationship.

# Cost table

If the objective in Wall Design is to minimize the cost, SoundPLAN needs the cost definitions. Call **WALL -> COST TABLE** (*F8*).

9

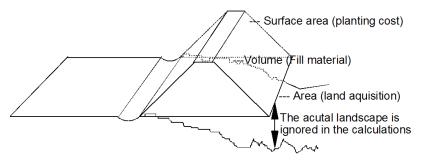
Using Wall Design

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| Cost           | table for wall opt                                                                           | timization |        |         |      |        |        |        | x      |
|----------------|----------------------------------------------------------------------------------------------|------------|--------|---------|------|--------|--------|--------|--------|
| No.            | Cost group                                                                                   | Land       | Volume | Surface | Base | Height | Height | Height | Height |
|                |                                                                                              | acquision  |        |         |      | <1m    | 1-3m   | 3-5m   | >5m    |
|                |                                                                                              | /m²        | /m3    | /m²     | /m   | /m²    | /m²    | /m²    | /m²    |
| 1              | Group 1                                                                                      | 250        | 100    | 100     | 1000 | 400    | 250    | 400    | 520    |
|                | Berm: Cost of land acquisition Units: Costs per meter facade length above target level : 400 |            |        |         |      |        |        |        |        |
| EL             | EUR Ratio from active to passive noise protection : 10 : 1 🕃                                 |            |        |         |      |        |        |        |        |
| OK Cancel Help |                                                                                              |            |        |         |      |        |        |        |        |

Cost table in Wall Design

The cost table is divided into costs applying to berms and costs applying to walls. The costs for berms are rough estimates because the volume and area are calculated with a simple model rather than with a digital ground model.



Calculations of berm parameters

| Land acquisition | Defines the cost per area that the wall or berm developer needs to acquire                                                                                                                                                                   |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Volume           | Defines the cost per volume for berms. The<br>material must be transported, compacted,<br>etc. Sometimes there is a demand to<br>deposit excavation material and the<br>charges to dump that location allow the<br>entry of a negative cost. |
| Surface area     | Defines planting costs for the berm                                                                                                                                                                                                          |
| Base             | Startup costs and foundation costs                                                                                                                                                                                                           |
| Height < 1 m     | Cost of the wall if the wall height is less than 1 meter                                                                                                                                                                                     |

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Using Wall Design

| Height 1- 3 m | Cost of the wall if the wall height is between 1 and 3 meters |
|---------------|---------------------------------------------------------------|
| Height 3- 5 m | Cost of the wall if the wall height is between 3 and 5 meters |
| Height > 5 m  | Cost of the wall if the wall is higher than 5 meters          |

#### Print wall table

After the optimization has been finished, you can print the wall table with headers and footers from the SoundPLAN page layout. Select **WALL -> PRINT TABLE**.

Go to the **PREVIEW** to show the wall table on screen. Click on **PAGE LAYOUT** to change the headers and footers, see Page layout.

# 📕 Storing the Wall back in the Geo-Database

After the optimization of the wall or berm has been finished, it can be stored in the Geo-Database for further calculations and for the display in the Graphics. Select **FILE -> SAVE WALL** or click the symbol button **SAVE WALL**.

| Save Wall as 🗙              |
|-----------------------------|
| New Situation               |
| File name                   |
| Variant 1 with noise screen |
| Description                 |
|                             |
|                             |
|                             |
|                             |
| Geofile of designed wall    |
| File name                   |
| Noise screen variant 1      |
| Description                 |
| Wall up to 3.5 m            |
|                             |
| Ok Cancel Help              |



Dialog box for storing the designed wall in the Geo-Database

The optimized wall and the original geometry situation will be stored in a new planning variant. The new Situation includes all Geo-Files from the original Situation used for the pre-calculation for Wall Design. The Geo-File with the wall base line is exchanged with a Geo-File with the optimized wall. Enter a name for

**Using Wall Design** 

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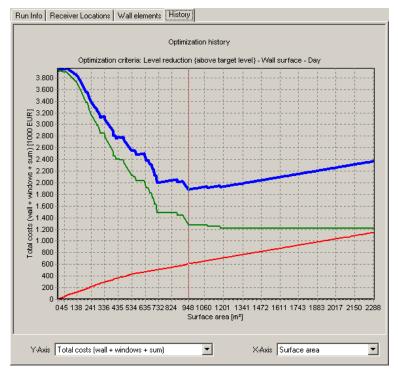
the new Situation and for the Geo-File with the optimized wall. You can also select an existing Situation or an existing Geo-File but make sure not to overwrite the original data.

When saving back a berm with different wall heights to the Geo-Database the berm heights will be smoothened.

# **Using Wall Design for areas**

For a wall optimization of Facade Noise Maps the program optimizes not just single receivers but entire sections of towns. Very likely you will receive a message that not all receivers with all the floors as calculated in the Facade Noise Map can be shielded and thus pressed below the target level. After processing of the cost parameters, it is possible to select the position in the noise protection histogram where the total cost, the sum of active and passive measures has a minimum.

The curves in the diagram below show which iteration step has the best cost benefit ratio. The passive noise control was made more expensive with a weighting factor of 10:1 in the cost table.



The weighting of receivers can be set either to be for the number of inhabitants above the limit (level reduction per inhabitants) or to the total length of the facade that is not properly shielded (level reduction per facade length). Receivers at

Using Wall Design for areas

facades that are already in the iteration below the limit are disregarded in the iteration. All inhabitants of a building are assigned to the loudest facade.

Another criterion assessing the performance of a noise control wall is the diagram "specific attenuation".

Additional diagram types according to the Swiss cost index:

- 1. The benefit of the noise protection wall
- 2. The efficiency of the wall, i.e. the benefit/cost ratio
- 3. The effectivity, indicating the percentage of how much the target value is reached in %
- 4. The WTI (Wirtschaftlicher Tragbarkeits-Index= Economic feasibility index according to the Swiss (BAFU) EPD)
- 5. The cost per solved case of conflict

The topics 1-4 are based on the Swiss Cost Index (-> Swiss Environmental Protection Department = Schweizer Bundesamt für Umwelt BAFU), the WTI (Wirtschaftliche Tragbarkeit und Verhältnismäßigkeit von Lärmschutzmaßnahmen = Economic feasibility of noise protection construction), which you probably already know from the SoundPLAN Spreadsheet the fifth topic is based on a regulation of the German Federal Rail Authority.

This study assumes that noise is responsible costs to the economy. By controlling the noise, the economic costs are reduced, thus noise control not only has costs associated but there also is an economic benefit to the society.

In the diagram-selection you will find "base value above the target value" instead of "inhabitants above target value" in the diagram type "base value above the threshold value". For this diagram type as well as for effectivity, the WTI and the costs per solved conflict, a selection list is available where you can set the base to be:

- o inhabitants
- o dwellings
- o receivers

In addition, you can select for these diagram types if the evaluation is for the active time slice of for all time slice.

## Calculation of the economic (cost) damages due to noise

The damage per receiver is calculated as follows:

damage = (A \* B) \* Conf \* RentF[nc] \* cost\_per\_m<sup>2</sup>

- A = square meters of entire floor divided by number of receivers calculated on that floor
- $\circ~$  B = Correction factor for A to adjust for non-inhabited areas such as staircases etc.

Using Wall Design for areas

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- Conf = conflict the damages are based upon
- RentF= rent factor per noise class
- $\circ$  Cost\_per\_m<sup>2</sup> = rent price per m<sup>2</sup> per year
- The area A is automatically calculated from the geometry of the building. The correction factors and all other parameters are defined under options -> settings.

The damages defining conflict is given by the excess of noise above a given threshold value for day or night and also depends on a sensitivity setting for the building. This sensitivity depends on the usage of the building. In order to keep the work defining parameters at bay, the program used the usage assigned to the building in the Geo-Database. A common sensitivity is assumed but threshold- and alarm-values can be defined. The pre-setting is for a value -5 for sensitivity step II for residential areas.

The noise class is selected in accordance to the noise level (day/night) as follows:

| Noise class | Evaluation noise level |
|-------------|------------------------|
| I           | > Alarm level          |
| П           | > Threshold value+5    |
| Ш           | > Threshold value      |

The rental cost per m<sup>2</sup> per year are set to represent the average rental cost in Switzerland and must be adjusted to represent the true cost in your area.

**Benefit of noise control measures**: The benefit of the noise control measures is defined as the reduction of the economic damages.

The efficiency: Is defined as the ratio of cost to benefit.

**The effectiveness:** In reference to the base "inhabitants", "dwellings" or "receivers", the percentage of inhabitants properly shielded from noise is calculated. When all receivers are shielded to be below the noise threshold, the effectiveness will be 100%.

**The WTI (Wirtschaftlicher Tragbarkeits-Index = Economic Feasibility Index):** The WTI is calculated as follows:

WTI = Effectivity \* Efficiency / 25

WTI according to BAFU is evaluated in classes

| WTI    | Evaluation   |
|--------|--------------|
| > 4.0  | Very good    |
| > 2.0  | Good         |
| >= 1.0 | Sufficient   |
| < 1.0  | Insufficient |
| < 0.5  | Bad          |

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Using Wall Design for areas

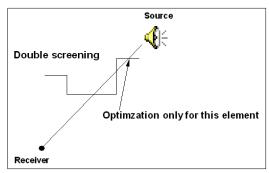
#### Cost per solved conflict case:

In reference to the base "inhabitants", "dwellings" or "receivers" the cost for each shielded receiver is presented. The default setting is for dwellings and for all time slots in accordance to the benefit/cost analysis from the "Hinweisen zur Erstellung Schalltechnischer Untersuchungen = Hints for conducting noise technical investigations" of the German EBA (Eisenbahn-Bundesamt = Federal Railway Authority).

# Model restrictions of Wall Design

Wall Design is set up to iterate the height of a noise protection wall. Every model has certain restrictions, and Wall Design is no exception.

 If a search ray finds more than one wall section to be optimized, only the wall element closest to the source is iterated, and the second intersection of the wall will be set to a height of zero.

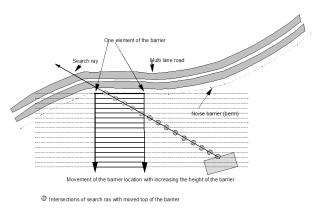


- Wall Design calculates only the screening effect and the influence on the ground effect. It does not calculate the influence of the reflection on the other side of the road. If this is important, calculate and optimize the wall for the side where the screening is important and then transfer the coordinates to another wall object type on the other side.
- The optimization is exact for vertical walls. A post calculation will deviate from the Wall Design results only if there were multiple intersections between the search ray and the screen. (This may happen when reflections are on the other side of the road.)
- The optimization is not exact for berms. During the calculation, SoundPLAN intersects a wall element. Inside the calculation, the wall element increases in height. For a vertical wall, the coordinates of the top remain the same. For berms, the top moves away from the road. Eventually the cut of slanting intersections will get out of scope from the element originally intersected. If all wall elements have the same height, the reduction will be accounted for the wrong element, which leads to a systematic error.

After optimizing a berm, it is mandatory to check the results with an extra calculation run!

Using Wall Design for areas

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Optimizing problem with berms

After optimizing a berm, it is mandatory to check the results with an extra calculation run!

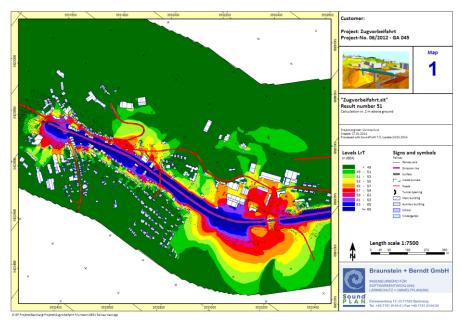
In the picture, the first 5 iterations of the berms generate an intersection within the element credited for the final reductions. The next 8 iterative steps extrapolate where the wrong element is credited. The last iterations move the screen beyond the position of the building and no extra screening is found. In normal cases, the barrier is not as flat as in the example, but optimizing the barrier over the building does not make sense either. The problem of crediting the wrong element with a reduction is still serious and needs to be observed.

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Using Wall Design for areas

# **10** Graphics

# **Overview Graphics**



Graphics sheet automatically created on the basis of one of the provided standard templates.

SoundPLAN Graphics combines the geometry data and calculation results with supplemental elements such as north arrows, scale bars, legends, color scales and textboxes to form dynamic maps and drawings to be printed on printers and plotters or saved on disk for use in other forms of documentation. The individual elements are stored as SoundPLAN sheets so you can activate and edit them on screen anytime. A sheet represents a complete drawing with all data and settings shown as they will appear when printed.

10

**Overview Graphics** 

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Use templates with text variables to develop highly refined graphics and store them for future use in the same or other projects. If you develop your own templates for each of your standard paper/drawing formats and store them as templates, everything is stored except the files. In the future, you only need to select the template and activate the data files to efficiently create drawings of your company standard. The variables for example for project name, calculation name or date of creation provide additional convenience. The templates delivered with SoundPLAN can be used as a basis for creating your own styles and templates.

# **Getting started**

The following section is a short overview of the procedures used to create new graphics. The functions themselves will be described later in more detail.

• Open the graphics from the SoundPLAN Manager. Choose the format most suitable for your drawing from the list of templates.

| 👹 Graphics File Manager                                                                                                                                                                                                 |                                                                                            |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|----------|
| Create a new sheet                                                                                                                                                                                                      | Template<br>de\System\A3 Querformat.SGT<br>Description                                     |          |
|                                                                                                                                                                                                                         | Standardformular A3 Quer Sheet settings                                                    | New Help |
| Select from current project                                                                                                                                                                                             |                                                                                            | Open     |
| Open recently used sheets<br>d:SoundPLAN Projekte\Spezial\Winci<br>d:SoundPLAN Projekte\Spezial\Winci<br>d:SoundPLAN Projekte\Spezial\Winci<br>d:SoundPLAN Projekte\Spezial\Winci<br>d:SoundPLAN Projekte\Spezial\Winci | y 2004\08-2 Cartography.SGS<br>ty 2004\08-1 Cartography.SGS<br>ty 2004\07 3D-Animation.SGS |          |

• The File Selection Manager will appear. Select the files to be included in the map, choosing from the pick lists of available geometry and result files.

Click on a situation (or geo-files) and move the file(s) using drag and drop, by double clicking, or clicking the arrow symbol from the left box to the right box representing the map. Select the proper legend and decide if descriptive text attributes shall be generated automatically from the geo-data (kilometer, wall height...). The legend selection only becomes important when additional data are added or when using templates.

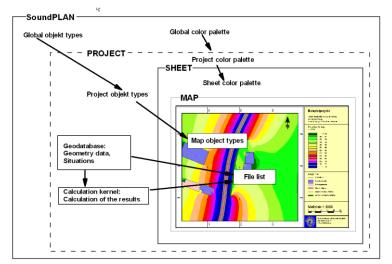
From the list of result types, select the type of results you want to display and move the result file to the right side the same way as you did the situations. Many result files have data for many different time slots. You must select the time slot and confirm it with OK. After selecting all result files desired in the map, click the OK button to leave the file selection.

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**Overview Graphics** 

- Open the menu **ELEMENT** -> **SHEET COMPONENTS** (*F6*) to view the relationships of the sheet elements.
- In "edit map" (double-click on the marked map or press the right mouse button and select EDIT CONTENT), adjust the scale and the rotation with the menu GEOMETRY VIEWPORT and the menu selections GEOMETRY PARAMETER (numerical entry of scale and rotation) and CHANGE GEOMETRY VIEWPORT (right mouse button ZOOM, ROTATE or MOVE). Click CHANGE GEOMETRY VIEWPORT to finalize the modifications. Click the OK button on the bottom right side of the screen to close the edit map mode.
- Edit the content of the space holders in the form by double clicking on it or by right clicking on the space holder and selecting the **EDIT CONTENT** option. In order to activate an element, the element must be active.
- The Map Object Types library controls the appearance of individual objects in the map. It also includes the settings of the calculation results. Activate the map and select the right mouse option MAP OBJECT TYPES. Move to the appropriate branch of the Object Setup. Here is where you determine if the object is to be drawn, set the drawing sequence, and control the pen colors, pen width, hatch patterns, etc. Additional controls linked to the Cartography module are available under the Cartography tab. There are also additional settings under 3D-Graphics for users licensed with this module.
- Store the graphics and print it via the File menu.

# Interdependencies of the graphics elements



The sketch shows the interdependencies of the elements of a SoundPLAN graphic:

- 10
- SoundPLAN is delivered with a global color palette which is copied into every project and every sheet. Changes made to the global color palette do

**Overview Graphics** 

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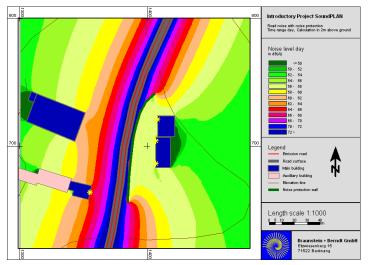
not modify the appearance in current projects or existing sheets. This palette is only the template for future projects.

- Every object has an entry in the global object type library that contains predefined drawing settings. When a new project is started, the global object type library is copied into the project. A local copy of the object type library is included with every map. Customizing the global object type library will only affect future projects. Customizing the projects object library will only affect new plans. Changes in the global or project object type libraries do not affect existing saved plans.
- The objects in the geometry data and the result types in the map define the object types of a map. They influence both the legend and scale of the map.
- The geometry view (position, zoom factor and rotation) controls the generation of the north arrow and scale bar. You can position these anywhere on the map.
- Select situations and calculation results via the file selection manager. They
  appear in the map as file lists.

# **Sheet Elements in the Graphics**

SoundPLAN is designed so you work on a sheet which is independent of printer capabilities and settings. You arrange and insert all the required elements on this sheet. The elements are layered hierarchically, meaning that every element has a parent element associated with it. The sheet is the highest layer; all other elements are associated with the sheet.

The following example is a drawing you can view on screen and print on a printer. Below the drawing is the arrangement of the individual elements as seen on screen.





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**Sheet Elements in the Graphics** 

| Sheet components |
|------------------|
| Properties       |
| Contents         |
| Exit             |
| Help             |

On the same layer in the sheet, you see a group box containing a map and a group box for the map's descriptive field. The north arrow is inserted directly on the map. Within the descriptive box, you find a text box with the map header, color scale, legend and scale, and another group box for the company name. Within this group box, you see a bitmap and a text box for the company address.

The elements of the sheet can be arranged in any order; whatever element is activated when a new element is requested will automatically become the parent element for the new element. The sheet is always the top of the hierarchy and can be present only once on the drawing. Parallel sheets or a sheet within a sheet are not possible.

The following elements can be part of a sheet:

- Map
- Text box
- Color scale
- Legend
- Scale bar
- Graphics box (for jpegs...)
- Text
- Symbol
- Spreadsheet box

Each element has properties (background color, borderline color, etc.) and content (the text in a text box or the scale bar, etc.).

If a new element is requested, this new element becomes the child element and inherits certain settings from the parent. When the parent element is moved, all its

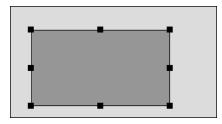
Sheet Elements in the Graphics

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children move with it. Child elements can only be moved within the space of the parent element.

Experience the procedures yourself. On the menu bar, click the text box symbol and use the left mouse button to pull open a text box. Request another text box and pull it open inside the first text box. Now click on the frame of the first box to activate it and drag it to a new location. As you can see, the text box contained in the parent moves with it.

Click the arrow on the top right side of the menu bar to deactivate the parent box. Now activate the child box and move it. As you can see, the child box only moves within the parent box.



Now activate the outside box and zoom it by dragging the corner marks. The child box enlarges proportionally when the parent box is zoomed.

You can undo the relationship of parent and child element by copying the element from the parent to the next ancestor. Here is the process. Cut the element from the parent box by activating the child box and then typing Ctrl+ X. Now click on the background and insert the element with Ctrl+ V. The parent/child relationship has ended. The elements are now siblings and can be moved independently. You can even move the former child box over the former parent.

Additional elements can be oriented and anchored as parent elements. The child element is now fixed in its position in relationship with the parent. Further details are part of "<u>Alignment</u>", page 506.

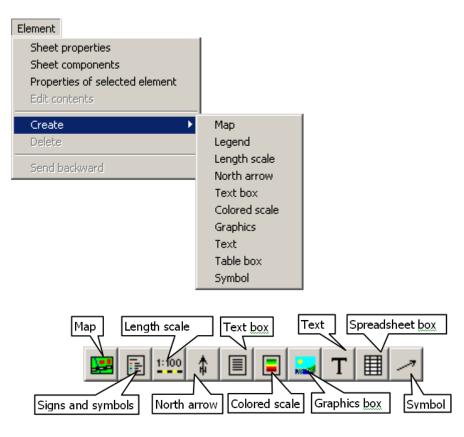
# **Create New Elements**

Some elements are automatically generated when the data for the map are loaded. For example, when geometry data are loaded, a legend is automatically generated from the object types contained in the situations and geo-files. Likewise, a color scale is generated for file types that require color scales. The value range of the result files is queried to find a sensible color progression for the scale.

All other elements (and, if needed, a new legend or color scale) are user generated via the symbol buttons or via the menu **ELEMENT -> CREATE**.

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**Sheet Elements in the Graphics** 



Hint: Except with the Cartography module, only one map and one graphics box can be on a sheet. Cartography has no limitation. The elements for symbol and spreadsheet are only available with the Cartography module.

The cursor changes to a rectangle with a crosshair for "pulling open" a new element (text box, graphics box, color scale or legend). Position the cursor in the upper left corner. Press the left mouse button and pull the element to the approximate desired size. You can resize the box any time. Use adapt box to content to adjust the box size to the content size.

For all other elements (scale bar, north arrow and symbol), click the appropriate symbol button and then click on the sheet where you want the element to appear. The cursor adapts to the element type.

For more information about editing the properties and contents of the elements, go to the section, "<u>Element Properties</u>", and read the sections pertaining to the specific elements.

Sheet Elements in the Graphics

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# **Activate Elements**

Only one element can be the active element at any given time. This active element can be edited. It is highlighted by "grab" points outlining it. Aligned elements (page 506) cannot be moved to all directions, therefore the stop symbol is displayed.

When an element is active, only a parent or sibling element on the same hierarchy can be activated directly or via the "<u>Sheet components</u> (page 495)".

In order to activate inserted elements, the cursor must have the arrow format. To get the arrow format, click the arrow on the right frame of the screen, press <*ESC*>, or click on the gray frame around the drawing.

For sheets with complex nested elements, it is best to activate an element directly. Do this via the "<u>Sheet components</u>", page 495, or via the keyboard by pressing the *space bar* until the desired element is activated. You will see the name of the element in the status line. *Shift+ space bar* activates the parent of the active element.

To delete an element, activate it and press < delete >.

# **Move and Zoom Elements**

When an element is activated, the corners and middle of each frame show "grab" points. Resize the element box by clicking the "grab" points while pressing the left mouse button. If the cursor is inside the element, this procedure will move the element. You can also move the element using the arrow keys. Press <**Return**> to confirm the new position. Under **PARAMETERS** -> **OPTIONS** in the **EDIT** tab, you can set the movement to millimeters or pixel.

When the cursor is close to one of the "grab" points, it changes to a small double arrow. The element box can now be enlarged or reduced (zoomed). Press the left mouse button if you want to zoom the box and its content proportionally. If you want to keep the ratio of the sides of the box but do not want to zoom the content, press the *<Ctrl>-key* while pressing the left mouse button. If you want to change the widths and heights non-proportionally, press the *<Shift> -key* with the left mouse button. The following table is valid for all rectangular elements.

| Left mouse button                  | Content is zoomed proportionally with box                            |
|------------------------------------|----------------------------------------------------------------------|
| <ctrl>+ left mouse button</ctrl>   | Only the box (not the content) is zoomed                             |
| <shift>+ left mouse button</shift> | Height and width are zoomed independently; the content is not zoomed |

Use **PARAMETER** -> **OPTIONS** tab **EDIT VISUALLY**, to define if the frame and the distance between the inner frame and the outer line shall be zoomed proportionally with the box.

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Sheet Elements in the Graphics

#### Move elements with the Ctrl-key pressed

With **Ctrl + left mouse button** you can change the reference between boxes and their parent element. In the sheet components (**F6**) you can instantly see the new hierarchy. The sheet itself is exempted from this logic; you cannot move entire boxes from other places to this element.

If a non-aligned color scale is moved out of the plan to a group box with the *Ctrl-key* the reference between the scale and the data is maintained.

## Special Considerations for Text, North Arrow and Symbol

Press Ctrl+ left mouse button to rotate texts continuously.

The north arrow zooms with any of the "grab" points. If you want to rotate the north arrow, do this in the symbol properties, but be aware that the direction of the north arrow will coincide with the Y-axis of the loaded data.

A symbol is zoomed using the "grab" points on the lines and is rotated with the "grab" points in the corners. Shift and Ctrl have no meaning for symbols.

# Cut, Paste and Copy Elements

When an element is active, you can cut and copy it via the keyboard, menu or symbol buttons. When cutting an element and inserting it into an element of a different hierarchy, you are moving the element to a different place in the hierarchy tree.

The displacement of the inserted element is defined under **PARAMETER** -> **OPTIONS**, tab **EDIT VISUALLY**.

Do not panic when you cut a color scale included in a map to paste it into a map descriptive box and the map is redrawn without the noise map. The noise map requires the intervals and colors definitions and will reappear when the scale is reinserted into the map in a different hierarchy.

# **Store and Insert Elements**

Single elements of a graphics sheet (for example, a formatted color scale) can be stored globally to be available for any project. To store the element, select the menu FILE -> STORE ELEMENT (or right mouse button) and navigate to the global folder. Elements stored this way can be inserted into any sheet via the menu FILE -> INSERT ELEMENT. If an element is active at the time of insertion, the new element will be inserted into the active element. If nothing is activated, the new element will be inserted into the sheet.

10

Sheet Elements in the Graphics

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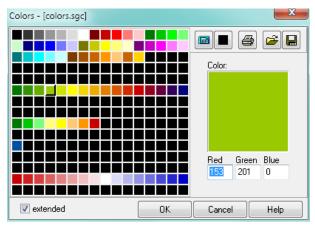
# **Central Editing Tools**

# **Color favorites**

The color favorites are used to store often used colors and color sequences / color scales. SoundPLAN is delivered with a default color matrix the user can amend or customize and save it as a file in the Globdata folder. You can save several color favorite files. One favorite matrix can contain up to 240 colors organized in 15 lines of 16 colors. The colors are defined as RGB values.

RGB = Red-Green-Blue components of a color, each ranging 0 - 255.

A click on a color field opens the color dialog. Activate the checkbox extended to define additional colors. In the Graphics the color dialog can also be opened via **PARAMETER** -> **COLORS**.



The extended color dialog is automatically opened, if you click on a color field using a color not stored in the color favorites.

The displayed colors are approximate values as the real representation of the colors depends on the screen resolution and the used printer.

## Define colors /compile scale colors

Click on **EXTENDED**. Enter the numerical value for the RGB components click on an existing color to modify it.

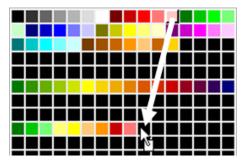
Rotating the color wheel in a color field will proportionally vary all RGB components while rotating the mouse wheel in one of the components will only vary the individual component.

With OK the color from the color field is assigned the object type or element. To save a color in the favorites, move it with Drag&Drop to the desired position.

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You can compose color sequences for a colored scale the same way. Move the colors in the desired sequence to free (black) fields in the matrix.



#### Interpolate colors



To generate color gradients for scales or to detail color settings for objects, SoundPLAN interpolates colors between 2 given color values. Click on **EXTENDED**. Select the first color and place it into an empty black field. Select the second color and place it to the right of the first color, leaving as many black spaces as you want to have interpolated in between.



Click on the pocket calculator symbol to fill the gap with interpolated colors. Color sequences can also be defined stretching across lines.

For a gray scale, the first value cannot be black (0,0,0). The program would ignore this. Set a very dark gray for the first color, for example, 5,5,5.

Hint: Color gradients can also be interpolated directly in the color scale, see "<u>Color</u> <u>scale</u>" on page 520.

#### Set colors to black

Click on the symbol "set black". It remains active as long as you keep the left mouse button pressed. This allows you to quickly erase no longer desired color favorites with the left mouse button.

## Print and calibrate color values

Use the **PRINT** button to send the color favorites to the printer. Colors are printed with the RGB values. Depending on screen and printer resolutions and the printer drivers, the colors can appear very different on paper than on screen. As the printed version is usually more important, it is wise to calibrate the colors for the printer.

For single sheets you can make the entire palette brighter or darker in the sheet properties.

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Some printers allow the calibration of colors to the screen; please refer to the printer handbook.

## Colors according to DIN 45682

In your color favorites (graphics -> Parameter -> colors) you can have the program generate the standard palette for noise maps in accordance to the DIN. Click on the color field from where on you want to have the colors inserted.

Ctrl+S inserts the 11 scale colors

Ctrl+O amends the object colors with the colors not present yet. As the entire layout section was updated the global settings will already contain the needed color presets. If you want to insert all of the new DIN object colors, use the shortcut Ctrl+Shift+O.

You can still manually generate the color scales. Some standard color scales are delivered with the global settings, they are selected when you choose the scales with the "System\" in front of the scale name.

# Zoom

Use the zoom function (zoom mode or mouse wheel) to enlarge the map on screen. The geometry view port is not modified. It is set independently in Edit Map.

Click on the magnifying glass to activate the zoom mode. You can pull open an area (press the left mouse button while pulling open the frame) or click on the left mouse button until the step by step zoom reaches the desired magnification. The area to be zoomed is always the area around the cursor. To zoom out, click the right mouse button. Use Parameter -> Options to set the size of the zoom step in [%].

Click on the magnifying glass again or click on the arrow in the top right corner to leave the zoom mode.



It is also possible to zoom an element to maximum size on screen. Click on zoom element and then click with the left mouse button on the element.

Use the overview symbol to set the zoom factor to view the entire sheet on screen.



# **Graphics Sheet Manager + Sheet Components**

The sheet manager in the Graphics is a new addition to perform tasks on multiple sheets at the same time. For example, to change the scale colors for all sheets with grid noise maps it is not necessary to open each sheet that has a grid noise map in it, set the scale to the new colors by hand and then save it again. This operation and others can be performed with the sheet manager effectively.

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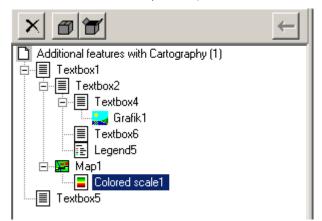
The sheet manager and the sheet components are displayed on the left-hand side as a tree diagram. To open it select **FILE** -> **SHEET MANAGER** (*F5*) or **FILE** -> **SHEET COMPONENTS** (*F6*). The area where the sheet manager or the sheet components are visible can be varied with the window splitter. Sheet manager and sheet components are mutually exclusive, only one of them can be presented at a time.

Via the sheet manager you can transfer elements, content and settings from one sheet to other sheets, it is also possible to print and export multiple sheets at the same time. With Drag&Drop sheets that are not loaded at the time can be opened very quickly. With the sheet components you can modify the content, properties and settings of an element and assign these to other elements of the same sheet.

For example, if you decided that the background color of all your text boxes is no longer what you want, adjust it in one element and then transfer the new settings to all others without opening each individual box.

## Sheet components

Under the menu **FILE** -> **SHEET COMPONENTS** or via <**F6**> the sheet component box is made visible/disappears. For the sheet components all structured components are placed into a tree structure indicating the hierarchy between the components (who inherits what from which parent...).



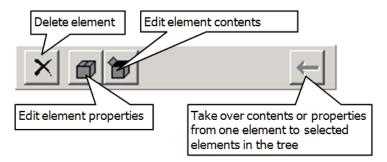
The tree structure and the sheet itself are coupled, which means that by clicking on an element in the tree, it is active in the sheet and vice versa.

On top of the tree there are 4 buttons:

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The buttons **DELETE ELEMENT, EDIT ELEMENT CONTENTS** and **EDIT ELEMENT PROPERTIES** are only active as long as an element in the tree or on the sheet is active. To take over content or properties from an element to another is only active if multiple elements in the tree are activated.

#### **Take-over element components**

With the pressed Ctrl key mark one or multiple elements in the tree which you want to assign the properties of other elements. Now click on the element of the tree from which you want to assign content or properties. Click on the arrow symbol and select what you want to take over. The selection of content, properties and actions depend on the selected element.

| Select action  take over from: Map6  properties  position and size (if possible)  file list  geometry viewport  object types | Select action       Image: Select action     Image: Select action |
|------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OK Cancel Help                                                                                                               | OK Cancel Help                                                                                                                                                                                                                                                                                                                        |

On the left the take-over from a map, to the right for a text.

#### Sheet manager

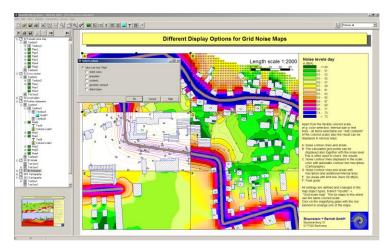
Via the menu **FILE** -> **SHEET MANAGER** or with **<F5>** the sheet manager is activated/deactivated. For the sheet manager a tree structure is generated that lists all sheets. As sub nodes of the tree all elements contained in the sheets are visible. The currently opened sheet is displayed in red and without the sub nodes.

By dragging a sheet from the tree to the graphics pane, you open the sheet.

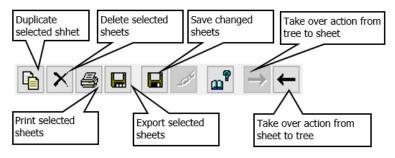


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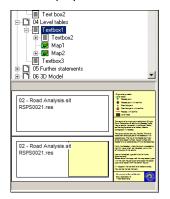
**Central Editing Tools** 



On top of the tree several buttons are placed.



In the preview window below the tree you see the active element. For sheets the preview bitmap is displayed and for elements the content and the child elements. As it is not possible to load all data for all sheets at the same time, for maps the file list is displayed.



With this tool you can very quickly get an overview over all sheets, maps and the data contained in them. The tree area and the pre-view panel can be resized by dragging the divider to the desired position.

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Except in the sheet itself you can use the **right mouse button** in the preview window to get to the properties and the content and for the plan into the file selection and the plan-object types. In the file selection you can only alter the settings of the data already loaded or swap data for a data type already present. This restriction is needed because for new data types new elements might become necessary that are not included in this frame work. It is for example not possible to generate a new scale here and place it somewhere on the sheet.

|                                         | _   |                       |                  |
|-----------------------------------------|-----|-----------------------|------------------|
| 12 - Petrol station.sit<br>RSPS4001.res |     |                       | New York (C)     |
| RSPS4001.res<br>RRLK4002.GM             |     |                       |                  |
| RREIGHOUZ.Com                           |     |                       | Nation Intel Day |
|                                         | 2   | File selection manage | er               |
|                                         | . 0 | Map object types      |                  |
|                                         |     | Properties            |                  |
|                                         | -   | Edit contents         |                  |

In the symbol bar of the sheet tree you can duplicate multiple sheets by clicking on the symbol **1**. This way you can save a sheet under a new name and then load it using the right mouse button into a map of the sheet -> **FILE SELECTION** to modify the time slot without loading the sheet.

The preview bitmap in the sheet tree now is saved in a bigger size than before (400 pixel for the longest side). For already existing sheets this bitmap is only updated to the new size after loading the sheet and saving it. You can modify the settings in **PARAMETER** -> **BASE SETTINGS** in the tab *Sheet*.

#### Take-over element properties and contents to other sheets

Depending on which element you have selected, you can take-over different attributes:

- Sheet colors
- Properties
- Position and size (if possible)
- File list
- Content
- Section layout (text attribute settings)
- Geometry viewport
- Object types



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| Select action                           |      |
|-----------------------------------------|------|
| Take over from: Plan4                   |      |
| properties                              |      |
| 📰 position and size (if possible)       |      |
| 📰 file list                             |      |
| geometry viewport                       |      |
| Diject types                            |      |
| Option                                  |      |
| only for the element with the same name |      |
|                                         |      |
| OK Cancel                               | Help |

With the properties the receiver element will take on the layout of the donor element, for text boxes that would be the box color, line settings, for a plan it would be the frame parameters, however size, docking parameters and position of the boxes would remain unaltered.

For text boxes, texts, scales, legends and graphics boxes "content" is clear, everything but the section layout is transferred as this item can be selected separately.

For the **map TAKE-OVER CONTENT** means that the file selections are taken over, geometry viewport parameters and object types are activated separately.

When taking a legend from one sheet into other sheets you can optionally update altered legend texts of the plan object types for derived object types. Manual changes to legend texts contained in the legend will not automatically overwritten.

#### Procedure:

With the pressed **Ctrl key** highlight one or multiple elements in the tree which you want to assign the properties of other elements. **Finally** click on the element in the loaded sheet. Click on the arrow symbol "arrow left" to transfer information to the elements highlighted in the tree. And vice versa click on the arrow symbol "arrow right" to transfer information to the loaded sheet. The selection of content, properties and actions depend on the selected element.

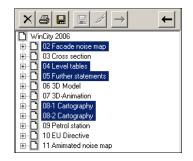
When dragging an element onto the sheet, you can select if the element shall be taken-over into the drawing.

If you only want to transfer (take-over) one or a few object types from map to map, open the map object types and mark the desired object types and press on TAKE-OVER ELEMENT COMPONENTS or simply drag them in the tree to the destination.

#### Print or export multiple or all sheets

You can mark multiple sheets and jointly perform the actions print, export (as a bitmap, WMF or with the contained contour lines) or delete.

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In the main branch, where the project name is the active element, all actions will apply to all sheets of the project.

When printing multiple sheets please be aware that only sheets with the same sheet sizes can be printed jointly because the sheet settings for example the sheet sizes are the same for all sheets. If you print into a file or save the sheet as a PDF, SoundPLAN will request the file name for each document

#### Export

| Select export action               | - D ×  |
|------------------------------------|--------|
| Export sheet                       |        |
| C Export sheets as bitmaps         |        |
| C Export sheets as meta files      |        |
| F enhanced                         |        |
| Export contour lines               |        |
| C Export contour lines             |        |
| C Export limit lines               |        |
| from result type                   |        |
| 🔲 Grid Noise Map                   |        |
| 🔲 Digital ground model             |        |
| 🕅 City noise map                   |        |
| Export format                      |        |
| ASCI                               | -      |
|                                    |        |
| Enter or select sub directory name |        |
|                                    | T      |
|                                    |        |
| OK                                 | Cancel |

When exporting you first get to a selection where you select what you want to export. For the export of contour lines, you also must define for which file format you want to generate the export. The export files are written into a sub folder in the active project, the program will suggest a name which you can alter to suit your needs or select an existing folder.

#### Hints:

- Sheets where anything was altered are marked with bold type in the tree.
- All actions in the tree are final; there is no "undo"! The actions before they are saved however are only existing within the tree and thus leaving the tree

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**Central Editing Tools** 

and not saving it will act as an "undo" for all actions since it was saved last, not only the last change will be lost.

• If you want to load a different sheet from the same project, simply click on it in the tree and drag it to the right side (Drag&Drop).

By making modifications it can be that the preview-bitmap does not reflect the content of the sheet any more. Please regenerate the preview-bitmap by clicking on the paint-brush-symbol.

# Acceleration of the Screen Output

When editing elements, dialog boxes and entry screens appear that you must close after setting the parameters. The area under these dialog boxes must be redrawn every time a box is closed. When you have a large amount of data in a grid noise map or many objects that contain hatch patterns, the redraw can take a lot of time.

In order to save time, you can choose what needs to be redrawn every time a box is closed. **REFRESH ALL** redraws the entire map. **ONLY GEOMETRY** will omit the noise maps. **ONLY SIMPLE GEOMETRY** draws only the simple geometry but omits the hatch patterns, etc. **SIMPLE GEOMETRY WITH RESULTS** will also omit hatch patterns but will show the noise maps. **NO REFRESH** takes the least time redrawing because the area where boxes are closed remains white. After you have finished editing, it is wise to redraw the entire screen using **REFRESH ALL**.

To save time redrawing, the symbol hints appear on the status line rather than next to the symbols.

If you have extensive noise maps and are not interested in viewing the colored areas between the contour lines, you can prevent drawing the contour fills by pressing <ESC>.

# Sheet Templates

To save time when you begin a new sheet, SoundPLAN generates templates to store all the sheet settings without the files. These templates can be stored in the global folder so every project can access them.

Several templates in different formats (A4, A3, portrait, landscape) are present in SoundPLAN. These templates are examples how the various elements of the map can be placed on the sheet and how to use <u>text variables</u> (page 512).

We assume you have a standard layout for your office's plans, with the unique logo, colors, etc. of your company. Use our templates to help create your own company templates for the three standard formats, with predefined map description boxes, company logo, etc. Map folding schemes are regarded the same as color sequencing for noise maps. If you use different printers, it is wise to customize the templates for each printer, so the printable size is observed and the color sequence looks good on each particular printer.

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Generate templates from existing graphics sheets for various sheet sizes and purposes and store them via **FILE** -> **SAVE AS TEMPLATE** in the GLOBDATA folder. When making the next map, select the appropriate template in the graphics file manager and select the desired graphics and result files to fill the template. The box **RECALCULATE FORMAT** in the file selection must be checked.

| O Graphics File Manager |                                                                                                                                                                                                                     |          |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Create a new sheet      | Template<br>Template GNM landscape.SGT                                                                                                                                                                              | •        |
|                         | New template<br>Template GNM Jandscape.SGT<br>en\System\A4 Jandscape.SGT<br>en\System\A4 Jandscape 1.SGT<br>en\System\A4 Jandscape 2.SGT<br>en\System\A4 portrait.SGT<br>© Open file selection<br>© Save as default | New Help |

**Hint**: If you want to compile the legend, scale, north arrow and a text box to form one block, leave some space in the box in case the object type description of the legend has more entries than the template and requires more room. Likewise, the north arrow might consume more room if the view port is rotated differently than in the template.

# **Options for editing**

| Options                 |               |            |               | $\overline{\mathbf{X}}$ |
|-------------------------|---------------|------------|---------------|-------------------------|
| Edit visually           | Additional    | Data types |               |                         |
| ─Move eleme             | nts by arrow  | keys       |               |                         |
| 📀 Step in               | n mm          |            | Step size     | 1,0 🕃                   |
| 🔿 Step in               | n pixels      |            | Step factor   | 5 🚖                     |
| Zoom with o<br>Zoom ste | p             | [%] 10     | ۲             |                         |
| Shade                   |               |            | Minimum width |                         |
| 🗹 Edge I                | line          |            | Lines         | 0,10 🚖                  |
| 🗹 Distan                | ice to conter | nts        | Edge lines:   | 0,10 🕃                  |
| 🗌 Map fr                | ame           |            |               |                         |
| 🗹 Map s                 | cale          |            |               |                         |
|                         |               |            | ОК            | Cancel Help             |

Under **PARAMETER** -> **OPTIONS**, select the **STEP SIZE** the elements are moved in the map. The **STEP FACTOR** determines how far elements are displaced from the original element when they are copied and pasted.

Determine the **ZOOM STEP SIZE** per mouse click for zooming with the mouse.

For Editing plans and boxes, select whether shadows, box frame lines, box frame width and map frames shall be zoomed with the parent element or not.

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**Central Editing Tools** 

For lines and box frame lines, select a minimum line width below which the lines are no longer visible on a plotter and will therefore be omitted.

Further setting is available under additional:

| Edit visually Additional Data types       |    |   |
|-------------------------------------------|----|---|
| - Undo                                    |    |   |
| Maximum number of undo:                   | 10 | • |
| Ridge height                              | -  |   |
|                                           |    |   |
| normal (above sea level)                  |    | * |
|                                           |    |   |
| Additional                                |    |   |
| do not load geometry bitmaps              |    |   |
| show hint at cursor                       |    |   |
| ✓ show hint in status bar                 |    |   |
| show file manager also with sheet manager |    |   |

- Number of "undo" steps .
- Geometry bitmaps may be excluded from loading if there is not enough memory.
- Definition of ridges of roofs in the Geo-Database (absolute elevation above sea-level or height above building reference plane or height above the upper edge of the building walls).
- The hints for the symbol buttons can either be displayed at the cursor or in the status bar. If you use "at cursor" the data of the map need to be redrawn. This might lead to annoying waiting times when large grid noise maps are loaded.
- When the sheet tree is open, the file selection manager is not displayed by default opening the Graphics. You then open it clicking the new symbol.

The tab index card *data types* contains a list of all data types that are covered by your license. If there are data types, you rarely use you can exclude them from the selection list in the file selection manager. Moreover, you sort the data types with drag & drop according to your preferences.

## Log book

The Graphics records the actions while loading and working with the data.

The log book is opened with the button in the symbol bar and displayed at the bottom of the screen. In order to provide you with information of possible warnings and errors even if the log book is closed, the text color changes to red when problems occur.



**Central Editing Tools** 

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# **Element Properties**

Layout

The element properties (background color, borderline color, frame width, etc.) define the appearance of the element boxes.

There are multiple ways to open the element properties:

Click on the element and select **PROPERTIES** from the right mouse popup menu.

Use the menu **ELEMENTS -> SHEET COMPONENTS**.

Activate the element with the space bar on the keyboard and use *Shift+ Ctrl+ Return*.

The sheet and map contain specific properties discussed below. The other element type properties vary only slightly, so they can be described together.

There is a box labeled **SHOW** to the lower left that must be marked in order to show (print) this element. Normally the box is checked. However, there are some situations where you don't want to show an element but still want it included in the map. For example, a scale in a 3D Grid noise map or a legend that does not fit into the 3D-map.

When you want the element to reappear, open **ELEMENTS** -> **SHEET COMPONENTS**, click on the properties and check the box to show the item.

| Box-Properties       X         Layout       Name, Position and Size       Edge       Line         Background       inherit       Itransparent       Fill color         Edge lines       Width:       Color:         Image: all       0,3 Image: all       Image: all         Image: left       Image: all       Image: all                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -                    | -                     |            |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------|------------|-----|
| Background<br>inherit I transparent Fill color<br>Edge lines<br>Width: Color:<br>I all 0,3<br>I left 0,3<br>top 0,3<br>T ight 0,3<br>J bottom 0,3<br>U left 0,3<br>I left 0,3 | Box-Properties       |                       |            | ×   |
| inherit transparent Fill color   Edge lines Width: Color:   ✓ all 0,3 ♀ ■   ✓ left 0,3 ♀ ■   ✓ top 0.3 ♀ ■   ✓ right 0,3 ♀ ■   ✓ bottom 0,3 ♀ ■                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Layout Name, Positio | on and Size Edge Line |            |     |
| Edge lines<br>Width: Color:<br>all 0,3<br>top 0,3<br>right 0,3<br>bottom 0,3<br>Landow Landow                                                                                                                                                       | Background           |                       |            |     |
| Width: Color:   Image: Strain and Strai                                                                                                                                                                                                    | 🔄 inherit            | transparent           | Fill color |     |
| ✓ all       0,3 ♀         ✓ left       0,3 ♀         ✓ top       0,3 ♀         ✓ right       0,3 ♀         ✓ bottom       0,3 ♀                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Edge lines           |                       |            |     |
| Image: second secon                                                                                                                                                                         |                      |                       | Color:     |     |
| Image: Constraint of the second se                                                                                                                                                                               | 🗹 all                | 0,3 🚔                 |            |     |
| ✓ right     0,3 ♀       ✓ bottom     0,3 ♀                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 🗹 left               | 0,3 🚔                 |            |     |
| ✓ bottom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 🗹 top                | 0,3 🚔                 |            |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 🗹 right              | 0,3 🚔                 |            |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ✓ bottom             | 0,3 🚔                 |            |     |
| Shauow                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Shadaw               |                       |            |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | _                    |                       | Di Li      |     |
| show Color: Right 4,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | show                 |                       |            |     |
| Bottom 2,0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                       | Bottom     | 2,0 |

The **BACKGROUND COLOR** can be inherited from the parent element. This is especially useful if you want to place multiple elements in the parent element and want the background to be the same color. If you decide to change the background

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**Element Properties** 

color, you only need to set the background on the parent element and the children will automatically change. You also have the option to set the background as transparent or assign a color from the color palette.

The frame can be adjusted jointly or line by line. There are controls to activate/disable a line, and to define line width and color.

O The Cartography module allows shadows behind the boxes. The shadow is halftransparent.

## **Base Settings for Elements**

Use **PARAMETER** -> **BASE SETTINGS FOR ELEMENTS** to define the general layout for all new elements in all projects. Each new box, legend and scale will use these default settings until the definitions are changed.

| Base settings |              |       |        | ×    |
|---------------|--------------|-------|--------|------|
| Boxes Text Co | olored scale |       |        |      |
| Background    |              |       |        |      |
| Fill color    |              |       |        |      |
| Edge lines    |              |       |        |      |
| 🔽 Show        | Width:       | 0,2 🜲 | Color: |      |
| Shadow        |              |       |        |      |
| C Show        | Color:       |       | Right  | 4,0  |
|               |              |       | Bottom | 2,0  |
| p             |              | OK    | Cancel | Help |

Select base settings that will require the least amount of editing. You can always adjust the properties for each of the elements locally to suit your map.

In the tab index card *color scale*, you define with which color from the color favorites the automatically created color scale is to begin and whether the intervals should be arranged in ascending or descending order by default. You can change the settings in the autoscaling of the color scale at any time.

The preview window in the sheet tree is preset to 400 px for the longer side. For existing sheets, the size is not updated until the sheet has been loaded and saved. You can change the setting in the tab index card *sheet*.

**Element Properties** 

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## Name, Size and Position

| Layout Name, Position | and Size Edge Line | e          |      |
|-----------------------|--------------------|------------|------|
| Name                  | Group header       |            |      |
| Alignment             | Тор                | ✓ Rotation | 0° ~ |
| Position              |                    |            |      |
| Left                  | 0,0                | Тор        | 0,0  |
| Size                  | 74.1               |            | 22.7 |
| Width:                | 74,1               | Height     | 22,7 |
| Reep proportions      |                    |            |      |

Box-properties - name, position and size

Each element can be assigned a **NAME**. The name created automatically for new elements is the element type and a number. The number is automatically incremented for new elements, so the name is unique.

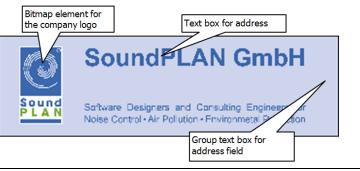
The element name is presented in the sheet components and when moving between element with the space bar. The name appears in the status line at the bottom of the screen.

The **POSITION** of an element describes the relative position in [mm] of an element in relation to the parent. You can also see the **size** of the element. Use these fields to place the elements accurately. **KEEP PROPORTIONS** forces the box to zoom up and down proportionately, keeping the ratio of the sides constant.

The text box and bitmap box can be rotated in increments of 90°. Select **ROTATION** from the selection list. Texts can be rotated any degree by pressing the <Ctrl> and the left mouse button. Moving the mouse will rotate the text. If you want to rotate multiple texts the same number of degrees, it is useful to enter the **ANGLE** in the element properties.

#### Alignment

In the following example, the address field is grouped within the combined text boxes.



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**Element Properties** 

A specific box to combine multiple texts and other boxes is not necessary because a regular text box with no text does this. In the example above, the group combine box contains a graphics box that is anchored on the left side. The additional text box is fitted into the group box and adjusts to the size of the text box. When the bitmap is enlarged, the texts will zoom with it.

When a text box is anchored to the top as a legend box, its height can only be modified by moving the bottom of the text box. All other measurements are determined by the size of the parent box. The text box size is fixed and cannot be moved. If the width of the legend box is changed, the width of the text box will automatically change. Therefore, the cursor within anchored boxes is no longer a cross but a symbol for "movement denied".

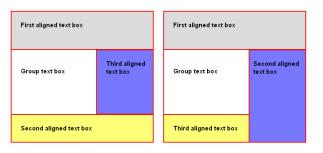
The following possibilities exist to anchor a child element within the parent box:

- Top
- Bottom
- Right side
- Left side
- Fitted
- fixed
- Free (only text boxes)

Fitted elements use the entire remaining space of a parent box. They are completely dependent in their location and size. As nothing remains of the parent box, it only functions as a container used to move the entire group of boxes. To activate the group box, navigate to the correct box using the space bar or select **ELEMENTS -> SHEET COMPONENTS**.

Please remember when the parent box is activated, the other elements can no longer be activated automatically. Only the parent box can be moved or edited. Click the arrow symbol on the right side of the screen or press Esc to activate the correct element or use the space bar to move through the list of elements.

The sequence of anchoring and fitting boxes inside the parent box is crucial. The first box will use the remaining width of the parent box. The sizes of the next boxes will use the remaining space. Please observe the following samples.



**Element Properties** 

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Caution: If you mix boxes that are anchored top/bottom and left/right in the parent box and then delete a box, the entire arrangement may no longer work. For complex boxes, it might be sensible to sub-group items and place another group box rather than place each individual element separately.

Use **CUT** and **PASTE** to move existing boxes (legends and color scales that were created automatically on the sheet) into a group box. To do this, activate the box to be moved, click the symbol **CUT** (scissors), activate the parent box where you want to insert the element and click the symbol to **INSERT**.

## Edge

Use the **Edge** tab index card to state the distance between the frame and the content of the box. The edge can be set for all sides or for individual sides. You can also set the increments of the edge distance to 0.1, 0.5 or 1 [mm].

If increasing the edge of the box causes the text to no longer fit the box, the text is truncated. It is the user's job to resize the text to fit the box.



## **Specialties for Sheet Properties**

When a sheet is stored, the file name is stored as the description and as the name of the element (sheet).

The *folding marks* are calculated according to a German DIN norm. Select the size the sheet should be folded to and the width of the stapling margin. You can also change the layout of the folding marks.

Click the paintbrush symbol to make the folding marks visible in the sheet.



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**Element Properties** 

| Layout Name and Size Edge | Folding marks Brighten colors |
|---------------------------|-------------------------------|
| show                      |                               |
|                           |                               |
| Settings                  |                               |
| Folding size              | 210,0 297,0                   |
| Stapeling margin          | 20,0                          |
| 🗌 draw stapeling margin   |                               |
| Layout                    |                               |
| Length                    | 3.0 🛢                         |
| Width                     | 0,2 🕃 Color                   |
|                           |                               |

## **Specialties of the Map Properties**

Use **NAME**, **POSITION AND SIZE** to designate if child boxes inside the map shall be attached to the inner frame of the map. This is especially useful if your map has a double frame with the coordinate crosses in it.

## Frame Properties

The map can have specialized frame properties instead of edge properties.

| Layout Name, Position    | and Size Frame  |           |                  |     |
|--------------------------|-----------------|-----------|------------------|-----|
| Width: 3,0               | <b>•</b> tr     | ansparent | Color:           |     |
| Inner edge lines         |                 |           |                  |     |
| 🗹 show                   | Width:          | 0,6       | Color:           |     |
| Coordinate axis          |                 |           |                  | 400 |
| Beference marks          |                 |           | Grid size in [m] | 100 |
| _                        |                 |           | Size             | 5   |
| show                     | Combine referen |           | Size             | 9   |
|                          | Width:          | 0,2       | Color:           |     |
| Axis lines in frame      |                 |           |                  |     |
| show                     | Width:          | 0,2       | Color:           |     |
| Coordinate text in frame |                 |           |                  |     |
| show                     | Size in points  | 8         | Color:           |     |
|                          | it to frame     |           |                  |     |

A map can be enclosed with a double frame which may contain coordinate cross marks. The map content moves inwards due to the size of the frame. The default

**Element Properties** 

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frame setting is 3 mm wide with a gray background. If you only want to see the outer frame, set the frame width to 0 mm and deactivate the inner frame lines. Color and width of the outer frame lines are changed under the tab **LAYOUT**.

Choose if you want the inner frame lines and pick the color and thickness.

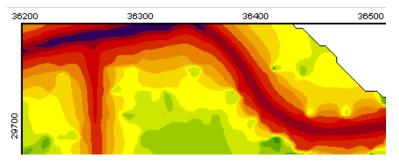
SoundPLAN pre-selects the spacing of the coordinate grid inside the frame according to the scale selected for the map. Use the field **COORDINATE AXIS - GRID SIZE IN [M]** to change the settings. Aside from the grid in the frame, this value also controls the coordinate raster reference.

The **RASTER REFERENCE MARKS** on the map can be activated or suppressed. **COMBINE REFERENCE MARKS** connects the marks creating a regular grid pattern over the entire map. When this is active, the size settings for the marks are ignored. Other controls are for line thickness and color.

If you have activated the raster reference marks but do not see them on screen, the spacing of the marks is probably too big.

The **coordinate text in the frame** in the double frame can be enabled or suppressed. Other controls are for text size and color.

The coordinate text in the frame of the sheet now can be customized to place the text parallel to the edges of the sheet.



Select the map property and under the tab frame select the box FIT TO FRAME.

## **Professional plan presentation**

Expressive and professional plan presentation is included in the SoundPLAN Graphics if you use the individual design features of the elements. Color scales and legends are automatically generated with the data with default settings. Text boxes host descriptions or are used to group several elements. Length scale, graphics boxes and the north arrow complete the element boxes. The content of the element boxes is opened with a *double click* on the box or via the **RIGHT MOUSE BUTTON -> EDIT CONTENTS**.

There is no need to export the results to special graphics software.

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## Common features for text boxes, legends and color scales

Within "Edit content" of a text box, color scale or legend it is possible to activate the properties for the element (edge lines, background color, alignment, frame width ...).



After closing the properties again, you will get back to "edit content".

## Section layout

In the layout you can define two formats for two layouts; one for the layout of the **STANDARDTEXT** and for the **TITEL**. You can see how changes of font, size, spacing and justification influence the result.

When entering a title, <*return*> starts a new line and <*Ctrl* + *return*> starts a new paragraph.

Automatic word wrapping is not possible; please enter the line breaks manually to fit the text to the box.

Use the red + button to add own section layouts.



With "-" the own additions can be deleted. In case the format to be deleted is still in use in a text, it will be purged from the text, i.e. the text will be presented with the previous section layout.

## Subscript and superscript texts

In text boxes, legends, scales and with general texts in the graphics as well as for headers in the Spreadsheet it is possible to have texts with the attribute subscript. Write the text like normal, mark the spot that needs to be turned into subscript and click on the symbol **SUBSCRIPT**. As you still process the text, control characters are marking the subscript part.

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## New: Subscript, for example $K_{_{PA}}$ and Ki or $R'_{_{_{W,res}}}$

 $R'_{w,res}$  for example will be displayed as "R'@\l+w, res@\l-". As soon as you finish editing the text, the subscript will be effective.

In case you need other text attributes, e.g. to write a word in a paragraph in bold, you can manually insert them:

| @\l+text@\l- | = subscript   |
|--------------|---------------|
| @\h+text@\h- | = superscript |
| @\i+text@\i- | = italic      |
| @\b+text@\b- | = bold        |

Text variables >>

## Text variables

For text boxes, the color scale and text, you can insert variables that automatically adapt text to

the sheet content. Variables advantages include quick and error free generation of maps and the constant update of the version number and sheet date to the status when the map was last edited.

If you want to generate a sheet with a grid noise map for time slot day and another sheet with a grid noise map for time slot night, you can insert the variable <ID time slot> in the scale. If you save the sheet under a different name, open the file selection again and select the time slot for night and the header for the scale is automatically set to night.

If you use the text variables in your templates, it is even faster to get the information current.

| Text variables >> Project title<br>Project No.<br>Project engineer<br>Customer<br>Project path<br>Company name | Version No.<br>Version date<br>Sheet name<br>Sheet file date<br>Date<br>Map name<br>Map section texts<br>Length scale | Situation description<br>Run title<br>Run No.<br>Calculation date<br>Scale unit<br>ID Time slice<br>Time slice name<br>Frequency [Hz] / Group<br>Displayed floor<br>Height above ground |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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I

n the box content click on TEXT VARIABLES and select the variable from the list:

| Variable name         | Origin                                                                                      |
|-----------------------|---------------------------------------------------------------------------------------------|
| Project title         | Project-info                                                                                |
| Project No.           | Project-info                                                                                |
| Project engineer      | Project-info                                                                                |
| Customer              | Project-info                                                                                |
| Project path          | Location of the project or project path name                                                |
| Company name          | License file                                                                                |
| Version-No.           | SoundPLAN Info                                                                              |
| Version date          | SoundPLAN Info                                                                              |
| Sheet name            | Graphics                                                                                    |
| Sheet file date       | Graphics                                                                                    |
| Date                  | Current computer date                                                                       |
| Map name              | Graphics                                                                                    |
| Map section texts     | Texts from the free attributes of the object type "map section" (GeoDB – Property Explorer) |
| Length scale          | Map length scale. If the length scale is 1:500, the result of the variable is 500           |
| Situation description | First row of the description of the Situation (Geo-<br>Database)                            |
| Run title             | Result file of the run or description of the formula of a file operation                    |
| Run No.               | Result number of the calculation run                                                        |
| Scale unit            | Loaded data                                                                                 |
| ID time slice         | Abbreviation of the time slice in the result file                                           |
| Time slice name       | Name of the time slice in the result file                                                   |
| Frequency [Hz]/Group  | Frequency or group (Grid Noise Map, group also<br>Façade Noise Map)                         |
|                       | Frequency or frequency band (Meshed Map)                                                    |
| Displayed floor       | File selection manager (Façade Noise Map)                                                   |
| Height / Floor        | Calculation parameter (Grid Noise Map/Meshed Map)                                           |

Noise level <ts: ID Time slice> in dB(A)

As soon as you leave a line, the variable is processed so you see the variable content rather than the variable name.

Professional plan presentation

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You also can concatenate multiple variables, for example <**Project** path>\<sheet name>.

#### **Free Text boxes**

For text boxes, additional properties can be defined under the tab "name, position and size ". The **ALIGNMENT** can be "free". This allows you to place information on the frame (for example, the version number of the sheet).

**Hint**: SoundPLAN does not check for "free" text boxes if they are within the printable area of the sheet; this is the user's responsibility.

Switch the alignment of the text box to "fixed" when you are satisfied with the position of the variable on the sheet border.

#### Multiple files or maps on a single sheet and the file operations

If multiple results or situations are loaded into a plan, the variables for **RUN TITLE**, **SITUATION DESCRIPTION, ID TIME SLICE** and **NAME TIME SLICE** are always taken from the result file or situation found **first** in the file selection list.

When multiple map are on the sheet, the variables are from the first map that was placed on the sheet (top position in the sheet components list).

For file operations, the variable for run title will display the formulas found in the field description of the file operations.

| Select file type                                                                                                                                                            | c extended                                                                                                                  |   |           | Base files          |             |                     |          |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---|-----------|---------------------|-------------|---------------------|----------|---|
| Grid noise map 🔹                                                                                                                                                            |                                                                                                                             | > | Name      | Description         | Last change | Size (B)            | Gr       |   |
| lame                                                                                                                                                                        | Description                                                                                                                 | - | <         | RRLK0101.res        |             | 29.10.2012 12:07:20 | 5965     |   |
| RRLK0001.res Straßenverkehrslärm heutige Situation (RLK)     RRLK0002.res Schienenverkehrslärm heutige Situation (RLK)     RRLK0003.res Gewerbelärm heutige Situation (RLK) |                                                                                                                             |   | Operation |                     | Subtract    |                     |          | • |
| RRLK0007.res                                                                                                                                                                | Beide Max auf einem Gleis<br>Max auf zwei Gleisen                                                                           | E |           | Files for operation |             |                     |          |   |
| RRLK0008.res                                                                                                                                                                |                                                                                                                             |   | >         | Name                | Description | Last change         | Size (B) | G |
| RRLK0010.res                                                                                                                                                                | Schienenverkehrslärm - heutige Situation (RLK)                                                                              |   | <         | RRLK0001.res        |             | 02.07.2013 10:44:16 | 5915     |   |
|                                                                                                                                                                             | Schienenverkehrslärm - heutige Situation (RLK)                                                                              |   |           | •                   |             | m                   |          |   |
| RRLK0101.res<br>RRLK0102.res                                                                                                                                                | Schiene mit LS (Vorbeifahrpegel)<br>Straßenverkehrslärm - Prognose (RLK)<br>Schienenverkehrslärm - mit Lärmschutzwand (RLK) |   |           | Add constant        |             | [dB]:               | 0,00     | ) |
|                                                                                                                                                                             | Gebiet Eichenweg - ohne Lärmschutz                                                                                          | Ť |           |                     |             |                     |          |   |
| Operation for ove                                                                                                                                                           | rlapping areas                                                                                                              |   |           |                     | I           | ast value           |          | - |
| 🔽 Describe auto                                                                                                                                                             |                                                                                                                             |   |           |                     |             |                     |          |   |
| Description                                                                                                                                                                 | RKL101:1 - RKL1:1;                                                                                                          |   |           |                     |             |                     |          |   |
| ☑ Describe auto                                                                                                                                                             |                                                                                                                             |   |           |                     | l           | ast value           |          |   |



Deactivate **DESCRIBE AUTOMATICALLY** if you want to write your own description for the run title instead of the formula.

| Describe autom        | atically                          |
|-----------------------|-----------------------------------|
| Description           | Difference road noise 2015 - 2006 |
| (used for text variab | le "run title")                   |

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## **Connection lines**

For text boxes, texts and graphic boxes in the box settings you can request a line tying the box to the location it describes. Optionally you can make the end of the line appear as an arrow.



When the box is selected, you can grab the connection line and move it, grab either the beginning or the end of the line. The default position of the start point of the line is the middle of the box. When the entire box is moved, the line is adapting. You can change the position of the start point, for example to one of the corners.

| Layout     | Name, Position and Size | Edge   | Line |   |       |     |
|------------|-------------------------|--------|------|---|-------|-----|
| 29         | Show line               |        |      |   |       |     |
| -Line se   | ettings                 |        |      |   |       |     |
| Widt       | h                       |        | 0,3  | • | Color |     |
| Arrow o    | definitions             |        |      |   |       |     |
| <b>√</b> S | how                     | Length | 3,0  | • | Width | 2,0 |
| 0          | ←───                    | •      |      |   | ○ ←   | -   |
|            |                         |        |      |   |       |     |

## **Text boxes**

Text boxes are available for entering descriptions on the map. They function as containers for nested boxes with legends, etc..

| 🚺 Edit text box                                                          |                                |         |        |                        | × |
|--------------------------------------------------------------------------|--------------------------------|---------|--------|------------------------|---|
|                                                                          | Text variables >> Zf 1,00 ▲ ×₂ | Standar | d text |                        | ~ |
| Sample project                                                           |                                |         |        | dapt box to<br>ontents | , |
| Grid Noise Map with noise protection<br>Calculation in 2 m above terrain |                                |         |        | OK                     |   |
|                                                                          |                                |         |        | Cancel                 | _ |
| Project-No. 16-GS-080                                                    |                                |         |        | Help                   |   |

Edit text box

After requesting and sizing a text box, double click on it or choose EDIT CONTENT from the right mouse menu. An entry screen with a text editor opens. You can write and format your text in this editor.

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Use the symbol buttons to insert lines a or delete lines. The text editor does not offer the comfort of flow text, so you must request new lines with <return> and start new paragraphs with <Ctrl+Enter>. Within a paragraph (or section) the layout must be the same.

Use **ADAPT BOX TO CONTENT** to adjust the size of the text box to the size of its content. With nested elements, any adjustment may mean you need to refit boxes within the parent box. If the option to adjust the box to the content is not used and the content has increased, the excess content will be truncated.

Use the **ZOOM FACTOR** (Zf) to increase the size of the legend for editing.

Section layout, subscripted texts and text variables are described in "Professional plan presentation" on page 510.

The **entire text in text boxes** can be centered horizontally and vertically even if the text contains complex paragraph layout.

In the parameters to set the properties of boxes the tab edge contains the parameter to center the content, in this case the frame width will be ignored.

Center complete text

vertical

When enlarging shrinking the text box, the text font is adjusted accordingly.

| Road noise - present situation (GNM)                |
|-----------------------------------------------------|
| Result Number: 1<br>Calculation in 2 m above ground |
| Road noise analysis                                 |

Road noise - present situation (GNM) Result Number: 1 Calculation in 2 m above ground

Road noise analysis

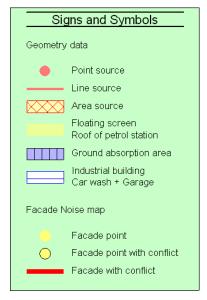
When you use nested text boxes, please observe that the text boxes are not checking the visibility, if there is a free space it may be sensible to fill these areas with empty text boxes that are "fitted" to the gap.



SoundPLAN creates the legend from the object types present in the data and the drawing settings from the object type setup.



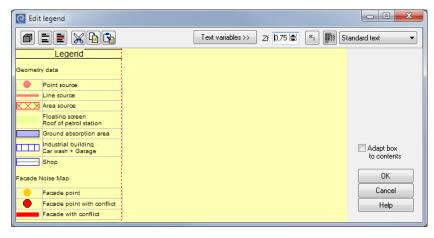
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Only object types and section headers in the object type setup that have the explicit OK to be included in the legend as shown in **USE IN LEGEND**. The automatically generated legend consists of all activated section headers and all loaded and activated object types. The sequence in the legend is the same as in the object type setup.

The legend contains the object type and the legend text. How an object type is presented in the legend depends on the current layout setting of the object type setup. If you change the color of an object type, the color in the legend is automatically adjusted.

Activating / deactivating the legend text in the plan object types will insert/delete them in the legend immediately.

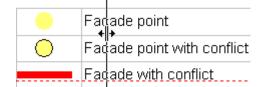




Use the symbol button 🖹 to insert text lines for additional segmentation and 🖹 to delete text or data lines.

Data lines are organized as a table. The width of the columns can be adjusted by left clicking the column separator and moving the slider to the desired position.

Facade Noise map



For line and area type objects, the width of the legend can be adjusted by modifying the first column.

The legend definition of area-type objects distinguishes between areas, buildings and bands. Buildings are shown as a rectangle with the ratio of the sides of 1.8 : 1. For elongated areas (bands), for example the road surface or the tilt of a wall, the symbol uses the entire width but with diminished height. All other areas use the total space.

Sub objects (for example in tunnels or the meddle divider), for which no extra data are available, are not written into the legend.

When using templates, the legend often contains elements that are not present in the sheet. You now find a button to mark all object types in the legend that do not visible objects in the sheet.

With *Ctrl* + left click on a legend entry the entry is marked / respective unmarked. This is useful for example if the templates contain a noise protection wall but the current sheet does not have a noise protection wall in the visible area.

All marked legend entries can then be deleted commonly with the **DELETE BUTTON**.

**ADAPT BOX TO CONTENT** resized the box around the legend to accommodate the legend. With nested box constructions, this means that other elements may have to be moved. If you do not activate this switch, the legend box will remain the same size, which may cause the content of the legend to be truncated.

Use the **ZOOM FACTOR** (Zf) to increase the size of the legend for editing.

Section layout, subscripted texts and text variables are described in "<u>Professional</u> plan presentation (page 510)".

#### Change the positioning of the layout entries

The legend entries sequence is determined by the sequence of loading of the geofiles. Result types are sequenced according to the sequence of the files loaded. Use

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the symbol buttons for cut, copy and insert or use the shortcuts (*Ctrl+ X, Ctrl+ C, Ctrl+ V*) to change the sequencing. The legend entries are always inserted above the cursor position.

## Insert additional legend entries

If data are loaded with no entry in the legend, for example because the box "use in legend" was not clicked, you can still insert this in the legend.

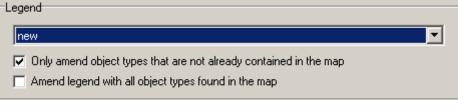
Make sure the desired object type in the object type settings is checked for insertion in the legend. Open a new legend box. The content is initially empty and is filled when you double click the legend box or select **EDIT CONTENT** from the right click mouse menu.

Mark the object type you want to insert, press Ctrl+ C or the symbol button COPY.

Double click the existing legend and position the cursor below where you want to insert the entry and paste in the line with Ctrl + V or use the symbol button **INSERT**. This possibility is especially useful to insert a single object type into a legend.

Open the file selection and click on the situation with the right mouse button to show the parameter selection of the geometry data.

Activate the menu entry **COMPLETE LEGEND WITH ALL DATA FOUND IN MAP** and click OK. If needed, you can always delete undesired entries from the legend.



The second way of amending the legend is more useful if many object types were missing in the legend.

## Ø Presentation of total objects in the legend

[Module Cartography] For object types that consist of multiple sub-objects, for example road or noise protection wall, the entire object type is presented in the legend when the main object type is activated for presentation and all the sub-object types are not activated for the presentation in the legend.

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Professional plan presentation

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| Signs and symbols |                       |
|-------------------|-----------------------|
| Emission line     |                       |
| Surface           |                       |
| Base line         |                       |
| Wall              | Signs and symbols     |
| Base line         | Road with bridge      |
| Berm slope area   |                       |
| Berm top          | Noise protection berm |

## **Color scale**

Color scales are used for all area type displays and the Facade Noise Map. If you work without a template, the color scale is usually generated when loading the data. It is created by searching for the lowest and highest values and suggesting a scale with steps between the values.

You can save color scales separately in the Globdata folder (right mouse button -> SAVE ELEMENT) and open them from other projects via the file selection or via INSERT ELEMENT.

| С | olored scale    |    |
|---|-----------------|----|
|   | Colored scale 1 | >> |
|   | new             |    |
|   | Colored scale 1 |    |
|   | DIN 18005.ssc   |    |

The basis for the color scale is the color favorite matrix in which the colors are defined and grouped together to color scales.



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| C Edit   | col      | ore      | d sca    | le                            |                       |
|----------|----------|----------|----------|-------------------------------|-----------------------|
|          |          |          |          | Text variables >> Zf 1,00 🖨 🙁 | Title 💌               |
| <u> </u> |          | _        | V2       | ID Time slice>                | Min: 0 dB(A)          |
| in dB(A  |          |          |          |                               | Max: 82 dB(A)         |
|          |          | <=       | 45       |                               | Scale type            |
|          | 45       | -        | 50       |                               | Color V1 <= V2 -      |
|          | 50       | -        | 55       |                               |                       |
|          | 55       | -        | 60       |                               | 📝 use lowest interval |
|          | 60       | -        | 65       |                               | closed                |
|          | 65       | -        | 70       |                               |                       |
|          | 70       | -        | 75       |                               | As description        |
|          | 75       | -        | 80       |                               |                       |
|          | 80       | ->       | 85<br>85 |                               | Adapt box             |
|          | <u> </u> | <u>_</u> | 85       |                               | to contents           |
|          |          |          |          |                               | ОК                    |
|          |          |          |          |                               | Cancel                |
|          |          |          |          |                               |                       |
|          |          |          |          |                               | Help                  |
|          |          |          |          |                               |                       |

The start color defined under **PARAMETER** -> **BASE SETTINGS** is used as the beginning of the color sequence.

The scale intervals are generated as a table. You can enlarge columns by left clicking the column header after the cursor is displayed as the splitter cursor. Use the splitter cursor with the left mouse button pressed to change the column width to the desired size.

| Color | V1 | <b>+</b> + | V2 |
|-------|----|------------|----|
|       |    | <=         | 49 |
|       | 49 | -          | 51 |

You can also insert data is and text is lines in the scale to mark additional intervals and include comments in the scale. This could be done to indicate from which level the noise limit has been exceeded. Use the symbol 'delete line' to delete both text and data lines.

You can interpolate colors between two color fields for example to quickly generate a difference scale.

Select the colors between which you want to interpolate, select the color lines in between and set them with the symbol button  $\blacksquare$  to black.



Now click on the symbol for the calculator.

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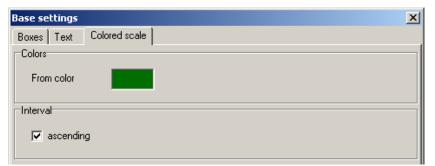
| C Edit colored scale                                                                                                                          |                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Text variables >>> Zf 1.00 🗟 🚬                                                                                                                | Standard text                                                 |
| Color         V         V2           Difference $-5$ $-5$ $-5$ $-4$ $-3$ $-3$ $-3$ $-2$ $2$ $-1$ $-1$ $1$ $-0$ $0$ $0$ $-1$ $1$ $2$ $-3$ $-3$ | Min: 0 dB(A)<br>Max: 84 dB(A)<br>Scale type<br>Color V1 <= V2 |
|                                                                                                                                               | Adapt box<br>to contents<br>OK<br>Cancel<br>Help              |

When the number of columns in a scale or the width of the scale is increased, use **ADAPT BOX TO CONTENT** to resize the box around the scale. With nested elements, however, this may force you to rearrange some of the elements or to resize the scale again. If you do not click "adapt," the box will remain its original size. If the content is bigger than the box, the remaining part is truncated.

Use **ZOOMFAKTOR** (Zf) to enlarge the scale for editing.

Section layout, subscripted texts and text variables are described in "<u>Professional</u> <u>plan presentation</u>" on page 510.

## Base settings for the color scale



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Scale colors are defined in **PARAMETER** -> **BASE SETTINGS** as well as the selection if the values shall be ascending or descending. Both settings can be edited any time.

## Automatic scaling

Automatic scaling creates a new scale of up to 16 intervals. Click on **E AUTOMATIC SCALING**.

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| Scaling             |       |              | <b>— X —</b>        |
|---------------------|-------|--------------|---------------------|
| Interval            | ٨     | Minimum valu | e Maximum value     |
| Values in the data  |       | 18,783       | 83,686              |
| Values in the scale |       | 45,000       | 65,000              |
| Increment:          |       | 2,000        | 🔽 ascending         |
| No. of intervals    |       | 12 🕻         |                     |
| Unit of measurement |       |              |                     |
| Measure:            | Noise |              | Decimal places 0 😂  |
| Unit:               | dB(A) | •            |                     |
| Colors              |       |              |                     |
| 🔽 set               |       |              | From color          |
| 🔽 ascending         |       |              | keep color sequence |
|                     |       |              | OK Cancel Help      |

For automatic scaling, select the **MINIMUM VALUE IN THE SCALE**, the **INCREMENT** and the **NUMBER OF INTERVALS**. **ASCENDING** sets the first value of the scale as the highest or lowest value.

The automatic scaling procedure calculates the highest value of the scale according to the size and the number of intervals.

In addition, define the **MEASUREMENT** and **UNIT** (the scale is used for all grid based maps) and the **NUMBER OF DECIMALS**. If you select a decimal number as the increment size, the number of decimals is automatically adjusted.

The color favorites are used for the **COLOR SELECTION**. A line in the palette has 16 color fields so you can administer color scales with ease. SoundPLAN is delivered with a line of palette entries. At any given time you can define your own scales with **PARAMETER** -> **COLORS**, see "Color favorites (page 492)".

If SoundPLAN defines the colors, the scale is generated using consecutive colors beginning with a user entered start color. If you deactivate **SET**, your modified colors are not overwritten, and additional intervals remain blank. **ASCENDING** means colors are inserted to the right or to the left of the clicked color field.

For the smallest value and the increment size, 3 digits after the decimal are presented. When leaving the screen, this is automatically adjusted to the requirements. If it is smaller than the number entered, the defined number of digits is used.

The color scale for auto scaling is only rescaled when the parameters fed into the scaling make this a requirement. For example, if you change the number of digits displayed in the scale box, this would not make a complete reset necessary which

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in turn would reset any of your custom color definitions. With the checkbox **RESCALE** you can force a full re-scaling.

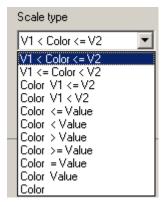
#### Designing the scale

It is possible to have a scale generated automatically and customize it later

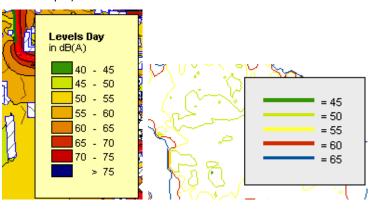
You are not bound to restrictive interval sizes. You can assign the left value field any value and the right-side value will adjust to it. This allows you to create "speaking" scales. For example, use green colors up to the target value, yellow colors to the noise limit, and red and purple colors to highlight the problems.

Single scale colors can be changed by clicking the color field and selecting a new color from the palette.

For different display possibilities, the graphics offer the following scale types for your selection.



The Grid Noise Map is a nice example. If you designate the space between contour lines be filled with color, the color will indicate, for example, that the noise level is between 55 und 60 dB(A). Or you can omit the color fill and color the noise contours themselves. The color is the indication of the value (55 or of 60 dB(A) in our example).



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**SCALE TYPE** defines if the color shall represent an interval (the first 8 scale types) or if the color shall represent a discrete value.

Other parameters define if the interval boundaries shall be part of the interval itself and which column shall be presented in what sequence. If you are still not satisfied with the scale labeling, you can use the suggested scale description and customize it. The description can be any length and can cover multiple lines. In this mode, however, you can no longer use the auto scaling nor can you insert or delete lines in the scale, so this option should be set only when scale type and intervals are already satisfactory. If you have to modify these parameters later, simply deactivate the click box **COMMENT COLUMN**.

(The lowest interval can be truncated if, for example, you do not want to show areas smaller than 50 dB(A). For area type maps, the contour areas of the lowest value will be left blank. For Facade Noise Maps, you can select if the building point shall be drawn in the color selected in the object setup or if it shall be omitted.

| Options                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------|
| Use scale colors Ishow receiver only for displayed intervals                                                                    |
| <ul> <li>fill buildings with scale color</li> <li>fill only buildings with conflict</li> </ul>                                  |
| show facades in scale color           show only facades with conflict           The layout is defined in "facade with conflict" |

If you use the lowest interval, you can convert the interval from an open interval of the type >= into a closed one of the type =. This may be useful for conflict maps that always would show, for example, <= 3. A closed interval would show 0 < color <= 3.

Please be advised that the scale type is only the display setting for the scale and has no influence on the presentation of the results. The switch "use lowest interval" modifies the drawing of the map itself.



To add to the flexibility of the display of the scale, you can further customize the scale in the **SCALE LAYOUT**:

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| Scale layout         |    |          |               |           | x    |
|----------------------|----|----------|---------------|-----------|------|
| Color fields         |    |          |               |           |      |
| Row height (>= 3,53) |    |          |               | 4,2       |      |
| Color field height   |    |          |               | 3,5       |      |
| Left distance        |    |          |               | 0,9       |      |
| Right distance       |    |          |               | 0,9       |      |
| Color field edge     |    |          |               |           |      |
| 🗖 show               |    |          |               |           |      |
| Color                |    | Wie      | lth           | 0,20      |      |
| Interval number      |    |          |               |           |      |
| show                 |    | Text typ | e [,   ,      | , IV,     | -    |
| Interval layout      |    |          |               |           |      |
| only colors          |    | 🔘 with   | hatches / bri | ghtening  |      |
|                      |    |          | Define all    | intervals |      |
|                      | OK |          | Cancel        | н         | lelp |

- line height (not smaller than the indicated letter size)
- height (or thickness, for contour lines) of the color field
- left and right margin
- a line shall be drawn around the color rectangle and line width and color
- the scale interval numbers in Arabic or Roman numerals
- the color of the scale interval number

You can set the text color separately for bright and dark color intervals. Define the gray value (0-255) that separates bright from dark colors.

This setting is also used for grid point values and texts of the facade noise map receivers.

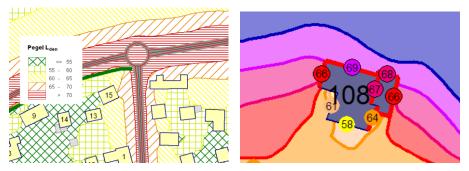


• the interval-layout (see below)

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## Scale with color brightness and hatch patterns

In addition to having solid colored surfaces, it is possible to display the areas with hatch patterns and color brightness.



Double click on the scale to edit the content, then click on the symbol button scale layout, activate **WITH HATCHES / BRIGHTENING** and click **DEFINE ALL**. The screen display with brightened or hatched colors will take considerably longer to update.

| Interval layout |                                                |
|-----------------|------------------------------------------------|
| 🔘 only colors   | <ul> <li>with hatches / brightening</li> </ul> |
|                 | Define all                                     |
|                 |                                                |

As the contour lines and the scale colors in the facade receiver points are not brightened, you have another possibility to customize your graphics.

## Interval - Layout

Click on the hatch field to customize the interval-layout.

| Titerval layout |                             | <u>_                                    </u> |
|-----------------|-----------------------------|----------------------------------------------|
| Show            | Color                       |                                              |
| Brighten color  | 80                          |                                              |
| Hatch           |                             |                                              |
| 🔽 Show          |                             |                                              |
| Hatch type      | >>>                         |                                              |
| Distance        | 3,00 🚖                      |                                              |
| Hatch line      |                             |                                              |
| Width           | 0,30 🚖 Color                |                                              |
| Edge line       |                             |                                              |
| 🔽 Show          | 🔽 use hatch line definition |                                              |
| Width           | 0,30 👤 Color                |                                              |
|                 | OK Cancel                   | Help                                         |

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You can also combine the fill color with the hatch and brighten the colors by a certain margin.

For the hatch the standard hatch types are available. Define spacing, and color and width of the hatch lines.

To speed up the definition you can select the border line to coincide with the hatch line style or define a different border line.

## North arrow

When a north arrow is inserted, it is positioned with a predefined size. Grab the north arrow by the positioning marks to resize it.

Normally the north arrow is automatically rotated to point north. You only have to manually rotate the north arrow to point it north if the bitmap used for digitizing was not oriented towards true north. If the need arises, open the **PROPERTIES** via the right mouse menu.

| Symbol properties |              |                           |        | ×      |
|-------------------|--------------|---------------------------|--------|--------|
| Name              | North arrow1 |                           |        |        |
| Position          |              |                           |        |        |
| Left              | 58,1         | Тор                       | 18,9   |        |
| Layout            |              |                           |        |        |
| Size              | 23,6 婁       | Proportion width : height | 1,00 🚖 |        |
| Line width:       | 1,2 🜲        | Color:                    |        |        |
| Rotation          | 0,0 🜻        |                           | Symbol |        |
| Shadow            |              |                           |        | ок (   |
| 🗖 show            |              | Right                     | 4,00 🚖 | Cancel |
| Color:            |              | Bottom                    | 2,00 🚖 | Help   |
|                   |              |                           |        |        |

Define color and line parameters in the layout settings. Use **SYMBOL** to select a symbol for the north arrow and to select colors for borders and fills.

| Symbol definit | ion |          |          |    |               |       |        | ×   |
|----------------|-----|----------|----------|----|---------------|-------|--------|-----|
| Layout         |     |          |          |    |               |       | Symbol |     |
| Fill color     |     |          |          |    |               |       |        | 1   |
| Area edges     |     |          |          |    |               |       |        |     |
| Width:         | 0,2 | \$       | Color:   |    | $\rightarrow$ |       | N      | -   |
| Lines          |     |          |          |    |               |       |        |     |
|                | 1,2 | <b>A</b> | <u> </u> |    | >>            |       | Change | 1 H |
| Width:         | 1,2 | \$       | Color:   |    |               |       | Change | J   |
| <u>.</u>       |     |          |          | OK |               | Cance | I Help |     |
|                |     |          |          |    |               | cance |        |     |

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## **Graphics box**

Use the graphics boxes to include company logos or additional information (map description, photos of a machinery, receiver locations etc.) from a graphic file or a pdf file in the Graphics. The SoundPLAN Graphics offers at least one graphics box for your company logo. Several graphics boxes can only be included if Cartography is licensed.

The pdf file is first converted to a bitmap, see "PDF as background graphics" in the chapter Geo-Database.

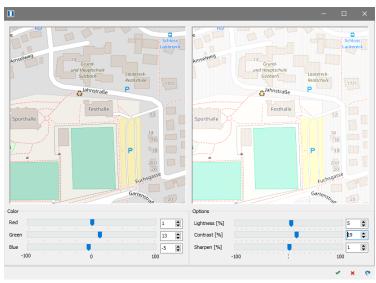
Click on the symbol **GRAPHICS BOX** and pull a frame on the map. Select whether the graphics you want to include is a Windows Metafile or a pixel graphics (bmp, gif, jpg, png, tif).

| Select graphics type                                                   |     | ×      |
|------------------------------------------------------------------------|-----|--------|
| <ul> <li>Bitmaps (Pixel graphic</li> <li>Windows meta files</li> </ul> | :s) |        |
|                                                                        | OK  | Cancel |

You can edit the graphics with a double click or right mouse button -> EDIT CONTENTS. Via the menu BITMAP it is possible to adjust the graphics (for example rotate, brighten or convert to gray scale).

Pulling open a frame within the graphics allows cutting the graphics with the scissor symbol. You can store the changed graphics under a new file name.

Brightness, contrast, clarity and color components of bitmap files can now be post processed in a graphics box.



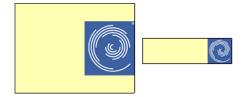
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Adjust bitmaps in graphics boxes with alignment (left, right, top and bottom):

As soon as the settings for alignment are selected, the mark **FIT GRAPHICS IN THE BOX** becomes active.

For the alignment to/bottom the picture is located centrally in the parent element. For the alignment left/right the picture is centered vertically.



When a parent box is enlarged, the picture will remain centered with the existing scale, if the box is shrunk in size, the picture will be scaled down to fit the new space if it would exceed the size of the parent box.

With shrinking/enlarging the graphics box the ratio of X/Y will not change, if needed the picture is scaled down to make it fit the box.

## Scale bar

The scale is generated automatically from the min/max coordinates and the sizes of the sheet. Changes in the viewport or manually resetting the view, changes the scale factor.

| Le | ngth | scale | 1:7500 |     |     |
|----|------|-------|--------|-----|-----|
| 0  | 50   | 100   | 200    | 300 | 400 |
|    |      |       |        |     | n   |

You can choose if you want to present the scale as the scale factor or as the scale bar or both.

| ength scale text                    |           |                |            |        | Base unit |
|-------------------------------------|-----------|----------------|------------|--------|-----------|
| Text Scale 1:                       |           |                |            |        | ) cm      |
| ✓ show scale value Space text - bar | use 1,5 G | housands separ |            | Font   | Center    |
| ength scale bar definition          |           |                |            |        | _         |
| 🔽 show                              |           | Width:         |            | 1,3 🛢  |           |
| Color:                              |           | Unit           | Image: 0 m | n 🔘 km |           |
| Number of sections:                 | 4         | Section lengt  | h          | 50,0   |           |
| Divide first section in two         | parts     |                |            |        | Adapt box |
| Distance<br>Labeling text - bar     | 0,5 厳     |                |            | Font   |           |
| Edge                                |           |                |            |        | Cancel    |
| 🔽 show                              | Width:    | 0,1 🛢          | Color:     |        | Help      |



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Use **FONT** to select the text attribute for the distance scale text and for labeling the scale bar. Delete the text **SCALE 1**: if you do not want the text. Use **SHOW SCALE VALUE** to insert the numeric scale value defined in the geometry parameters. The check box **USE THOUSANDS SEPARATOR** groups scale values >= 1,000 to groups of three figures and inserts a comma (or a point if the decimal separator is a comma). The **SPACE** between the scale text and the scale bar is used to separate the components from each other.

For the **SCALE BAR**, select for metric scales the unit [m] or [km], the **NUMBER OF SECTIONS** and the **SECTION LENGTH** in the set unit size. The first section is presented in two colors if the switch **DIVIDE FIRST SECTION IN TWO PARTS** is clicked. To further customize the scale bar, select the **WIDTH OF THE BAR** and the color of the segments.

Additionally, request an **EDGE** around the bar to frame the white. Check **SHOW** to draw the edge; as usual, color and line width is your choice.

Use **ADAPT BOX TO CONTENT** to adjust the size of the text box to the size of its content. With nested elements, any adjustment may mean you need to refit boxes within the parent box. If the option to adjust the box to the content is not used and the content has increased, the excess content will be truncated.

## The Map

There are several steps in creating a map. The first step is selecting the data in the file manager. Use **EDIT MAP** to select the geometry view port. Customize the appearance of the objects in the Map-Object-types (right mouse button) and customize how each object type is drawn. Set the properties for the map and other elements and customize the graphics objects in the object type setup. You can edit this information anytime during a project.

## **Graphics-File-Selection-Manager**

When you open the graphics, the Graphics-File-Selection-Manager opens so you can select a template for a new sheet, select files from the current project or open any of the recently processed sheets.

The Map

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| 👹 Graphics File Manager                                                                                                                                                                                                                                                                                                               |                                                                              | <u>- 🗆 ×</u> |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|--------------|--|--|--|
| Create a new sheet                                                                                                                                                                                                                                                                                                                    |                                                                              |              |  |  |  |
|                                                                                                                                                                                                                                                                                                                                       | Template                                                                     |              |  |  |  |
|                                                                                                                                                                                                                                                                                                                                       | de\System\A3 Querformat.SGT                                                  | •            |  |  |  |
|                                                                                                                                                                                                                                                                                                                                       | Description                                                                  |              |  |  |  |
|                                                                                                                                                                                                                                                                                                                                       | Standardformular A3 Quer                                                     |              |  |  |  |
|                                                                                                                                                                                                                                                                                                                                       | Sheet settings Insert map<br>Open file selection<br>Save as default<br>New H | lelp         |  |  |  |
| Select from current project                                                                                                                                                                                                                                                                                                           | 0                                                                            | en           |  |  |  |
| Open recently used sheets                                                                                                                                                                                                                                                                                                             |                                                                              |              |  |  |  |
| d:\SoundPLAN Projekte\Spezial\Wincity 2004\09 Petrol station.SGS<br>d:\SoundPLAN Projekte\Spezial\Wincity 2004\08-2 Cartography.SGS<br>d:\SoundPLAN Projekte\Spezial\Wincity 2004\08-1 Cartography.SGS<br>d:\SoundPLAN Projekte\Spezial\Wincity 2004\07-3D-Animation.SGS<br>d:\SoundPLAN Projekte\Spezial\Wincity 2004\06-3D ModeLSGS |                                                                              |              |  |  |  |

The **TEMPLATE-SELECTION** contains the model plots delivered with SoundPLAN. The SoundPLAN system folders contain multi-lingual templates. The GLOBDATA folder (which is located under ..\My Documents\SoundPLAN\) hosts user generated templates. The **OPEN FILE SELECTION** is the default setting for templates with a single map on the sheet and opens the File Selection Manager for situations and result files when you click the **NEW** button. If multiple maps are on the sheet, SoundPLAN cannot determine which map is to be used, so the **OPEN FILE SELECTION** is deactivated. You must open the sheet, mark the map and then activate the **File Selection Manager** via the right mouse button menu.

If you click the button **SAVE AS DEFAULT**, the next time you open the graphics this template will be suggested as the standard.

The **SHEET PROPERTIES** and the box **INSERT MAP** are only active when you open an empty sheet. Open the new sheet, open the **SHEET PROPERTIES** and define the sheet size and orientation. If the box **INSERT MAP** is active, the new map will be maximized to use the entire space on the sheet.

To leave the graphics file selection manager, click **NEW**, which opens the file selection or moves to the main graphics level, or **OPEN**, which loads an existing sheet of the current project, or select one of the graphics sheets processed recently.

## **File Selection**

The File Selection determines which data will be used in the map.

When generating a new map, you will usually use the File Selection after choosing the templates or forms.

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The Map

From the graphics main level, activate the map, right click and select **FILE SELECTION**. If the sheet does not contain a map, the box in the Graphics-File-Selection-Manager for generating a map was deactivated. Request a new map with the symbol **INSERT MAP**.

The **FILE TYPE** "situation" is the default setting. Other types must be requested. All existing situations are listed on the left side. The top box contains the file name and description. The bottom has a bitmap depicting the data in the situation and the geo-files that make up the situation. Activate situations with the mouse (use the shift and Ctrl keys to mark multiple situations) and move the files to the right side, creating a list of files that will be included in the map. To move the files, double click the file, mark a file and use the arrow symbol between the file boxes or "Drag & Drop."

| 🐺 File selection manager                     |                                                                                                           |   |                                       |    |        |      |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------|---|---------------------------------------|----|--------|------|
| Select files                                 |                                                                                                           |   | Files in the map                      |    |        | (    |
| Select file type                             |                                                                                                           |   | Edit map area                         |    |        | >> [ |
| Situation                                    | •                                                                                                         |   | Ioad only data inside the map area    |    |        |      |
|                                              |                                                                                                           |   |                                       |    |        |      |
| Name                                         | Description L                                                                                             |   | Name Description Last change Size (B) |    |        |      |
| 💐 01 - All Data.sit                          | All data in the project; 1                                                                                |   |                                       |    |        |      |
| 🕺 02 - Road Analysis.sit                     | Road noise analysis; 1                                                                                    |   |                                       |    |        |      |
| 🔣 03 - Road Prognosis.sit                    | Road noise; Prognosis with new traffic data and noise protec                                              |   |                                       |    |        |      |
| 🍂 04 - Rail 1.sit                            | Rail noise; 2                                                                                             |   |                                       |    |        |      |
| 📲 05 - Rail 2.sit                            | Rail noise; with noise protection wall; 2                                                                 | > | 🝂 03 - Road 🔤 gnosis.sit              |    |        |      |
| 💐 06 - Industry.sit                          | Industry noise; 1                                                                                         | < |                                       |    |        |      |
|                                              | Wall base line at the Oak Street ; Precalculation Wall desig 1                                            |   |                                       |    |        |      |
| 🟘 08 - Oak Street 1.sit                      | Dak Street without noise protection; 2                                                                    |   |                                       |    |        |      |
| 💐 09 - Oak Street 2.sit                      | 2                                                                                                         |   |                                       |    |        |      |
| 📲 10 - 3D Data.sit                           | Input data especially for 3D, with trees, roofs and ; smooth 2                                            |   |                                       |    |        |      |
| 11 - Cartography.sit 12 - Petrol station.sit | Data for Cartography; 2                                                                                   |   |                                       |    |        |      |
| 12 · Metrol station.sit                      |                                                                                                           |   |                                       |    |        |      |
| •                                            | •                                                                                                         |   |                                       |    |        |      |
| "03 - Road Prognosis.sit" cor                |                                                                                                           |   |                                       |    |        |      |
|                                              | BUILDINGS 3 gao<br>RIALIS PHOLINGS geo<br>WALL Dat STREET geo<br>WALL Dat STREET geo<br>Beraton Line: geo |   |                                       |    |        |      |
| Recalculate format                           |                                                                                                           |   |                                       | OK | Cancel | Help |

File Selection

For the geometry data, SoundPLAN creates a legend of all object types contained in the situations and geo-files. Confirm the request to generate the legend. If you used a template for the sheet, the legend was taken from the template and may need editing.

Use **RECALCULATE FORMAT** to define if the geometry view port that was the basis of the template shall be used or if the scale and view shall be recalculated from the geometry in the situation. The field **RECALCULATE FORMAT** is shown at the bottom of the main screen when you open a template. This enables you to view the geometry even if the template was based on a different part of the coordinate system.

After selecting all situations, proceed with other file types. Use the arrow symbol to move a file into the map. The program only copies the file name and removes it from the list of available files on the left.

The Map

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| -Select | files                                                                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Selec   | at file type                                                                                                                                                                  |
| - 18    | Grid noise cross section map 🛛 💌                                                                                                                                              |
|         | Situation<br>Geo-File<br>Digital ground model<br>Geometry bitmap<br>Facade Noise Map<br>Level tables / RLS 90 symbols<br>Receiver flags<br>Meshed Noise Map<br>Grid noise map |
|         | Grid noise cross section map<br>Facade map operations<br>Triangle operations<br>Grid operations<br>Area map (Conflict map)<br>Limit map                                       |

File types are only displayed, if compatible data are available. Nevertheless, there might be a lot of file types, because one result type can be used in several Graphics file types. E.g. a simple single point result can be loaded as facade noise map, level tables, level chart or used in the FNM operations.

Click on the wheel symbol in front of the file selection to find a list with all file types corresponding to the modules in your license (or **PARAMETERS** -> **OPTIONS).** File types not calculated in this project are displayed in *italic*. Here you can **switch on and off file types** and change the **display order**. Drag the file type with the mouse to the desired position.

These settings are project specific, but you can store them globally. After you pressed the button save globally the settings are used in all other projects, too. It is therefore sensible to consider a general setting with the file types you normally use and save it globally before you make special changes for the current project.

Some of the file types require additional parameters. These are requested when the data are loaded. The parameter description is included in the description of the file types.

For grid noise maps, for example, you are asked which time slot shall be presented and which scale shall be used. Scales already contained in the sheet can be activated here.

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The Map

| Grid Noise Map    | ×                     |
|-------------------|-----------------------|
| Select value      |                       |
| Select time slice | show ground elevation |
| Value             |                       |
| Sum level         | ~                     |
| LrD               | ~                     |
| Color scale       |                       |
| new               | ~ >>                  |
|                   |                       |
|                   | OK Cancel Help        |

Use the double arrow to edit the scale or accept the automatic settings. To edit the scale later, right click on it and select the option **EDIT CONTENT**. More information about scales is described in the section "Color palette".

Leave the parameter entry with OK and click OK again to return to the main graphics screen.

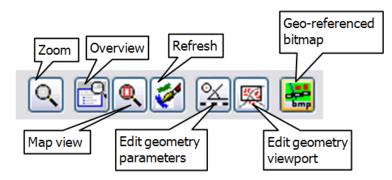
## Edit the Content of a Map



Double-clicking the map (or using the right mouse button -> EDIT CONTENTS) opens the Edit Map facility. The black line framing the loaded data indicates the section of data to be printed. The view port depends on the measurements of the map (width and height) and thus cannot be modified here. You can modify the part of the geometry that shall be visible in the printed map. The currently selected scale factor is seen in the status line at the bottom of the screen.

The Map

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Functions in Edit Map:

- Define the view port (world coordinates of the geometry at the center of the map, rotation around the center and scale factor) via numerical definition (geometry parameter) or with the mouse (change geometry view port).
- Show cross-section display and 3D-view. Even without a license for the Cross-Sectional Map and 3D modules, the cross-section through the terrain and the 3D-wire frame models can be started.
- Store the map view as a geo-file.
- Generate your own geo-referenced bitmap from the loaded data (i.e. as a reference map for the tiling or to check the contour lines of a DGM). Load the desired data into the Graphics, open edit map and store the map data with EDIT -> CREATE GEO-REFERENCED BITMAP (or the symbol button) in one of the available graphics formats.
- Customize the map-object types via **PARAMETER -> MAP-OBJECT TYPES**

Functions dependent on the data and the license for certain operations:

- Edit grid values.
- Export of contour lines and grid values.
- Position level tables and receiver flags.
- Move contour line texts.
- Store the map view of one or multiple (loaded) bitmaps in a new file. For example, to crop a large geometry bitmap or to compile one bitmap from multiple, single bitmaps.

When the Situations and results are loaded, SoundPLAN automatically calculates the world coordinates of the center of the view port and defines the scale factor. The scale is calculated to maximize the view of the geometry with north being the y-axis of the coordinate system.

Elements positioned in the map are not displayed in "Edit map content". For your information activate the elements with **PARAMETERS** -> **SHOW CHILD BOXES**.

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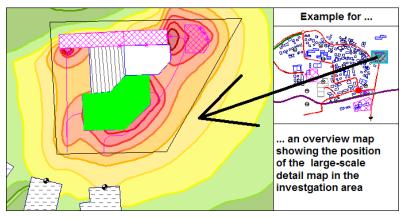
The Map

## 🖳 Geometry parameter

The most common practice is to print the map with a fixed rounded scale factor rather than maximizing the scale. Open the geometry parameter with the symbol **GEOMETRY PARAMETER** or via **GEOMETRY VIEWPORT** -> Use **GEOMETRY PARAMETER** to enter the numerical values for the scale factor. If desired, also enter the rotation around the middle. If you know the world coordinates of the center of the view port (this is the best way to make sure the view is the same as in another map), you can enter them here.

| Geometry parameters        |          |                       |             | ×     |
|----------------------------|----------|-----------------------|-------------|-------|
| Map viewport               |          |                       |             |       |
| Length scale               | 1:       | 7399                  | Rotation    | 0,000 |
| Middle coordinate X:       |          | 3532375,633           | Y: 5423305, | ,691  |
| 🔲 Overview map             |          |                       |             |       |
| Fixed map viewport (e.g. d | io not u | ise for map sections) |             |       |
|                            |          | ОК                    | Cancel      | Help  |

A map can be defined as OVERVIEW MAP. Then the frame of the large-scale detail map is displayed along with the geometry in the overview map.



Additionally, for very large sale investigation areas it is possible to scale the overview map and center the displayed map section in the overview (deactivate **FIXED MAP VIEWPORT**).

In the map object types select how to format the frame. The object type **CURRENT MAP SECTION IN OVERVIEW MAP** determines how the frame section shall be highlighted in the overview map.

The Map

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## 🕺 Change viewport graphically

The viewport can be changed graphically. First, use the symbol button **OVERVIEW** to zoom to maximum size. This presents the entire data on screen with a black line framing the printed part of the view port.

To graphically edit the viewport, click the symbol button or select **CHANGE GEOMETRY VIEPORT** from the **GEOMETRY VIEWPORT** menu.

Now you can move, zoom and rotate the black frame representing the view port. Use the right mouse button to request a menu to change the functionality of the mouse. Aside from these options, secondary options use the shift and Ctrl keys. The following options are available:



move – keep left mouse button pressed and move.

€‡ ≁

move down=zoom in.

zoom - <Shift>- keep left mouse button pressed. Move up=zoom out,

Ċ;

rotate - <Ctrl>- keep left mouse button pressed and move.

Selection via the right mouse button:

| <ul> <li>Change geometry viewport</li> </ul> |
|----------------------------------------------|
| ✓ move                                       |
| Zoom                                         |
| rotate                                       |

The symbol button remains pressed until the changes to the view port are made permanent by clicking it a second time.

## Site View, Cross Section or 3D-View

Use Edit Map to edit the top view, geometry cross section and wire frame 3D model regardless of the license situation with 3D and Cross-Sectional Map.

## **Site View Content**

When data is loaded into a map, the default view is the top view (except for Crosssectional Noise Map).

10

For the site view, you can also generate the following standard settings. To edit the settings, open **PARAMETER** -> **SITE MAP SETTINGS**, or open it via the symbol "settings" (wheel symbol) in the object types.

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The Map

| Settings for site map                                                           |                |
|---------------------------------------------------------------------------------|----------------|
| Minimum proportions                                                             |                |
| Minimum line width                                                              | 0,10 🖨         |
| Minimum text size                                                               | 0,5 🕃          |
| Text mode                                                                       |                |
| Only show complete texts                                                        |                |
| ✓ Use reference scale as factor for line ☐ draw lines and area hatches after ge |                |
|                                                                                 | OK Cancel Help |
|                                                                                 |                |

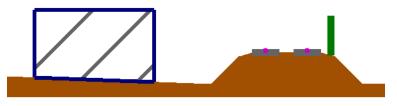
The **MINIMUM LINE WIDTH** defines the pen thicknesses. Line widths, which for a selected scale factor would be smaller than the set minimum size, will be drawn with the minimum line width. The **MINIMUM TEXT SIZE** ensures texts will be suppressed when their size falls below the minimum text size when the scale factor is increased causing the geo-texts to scale down.

For displaying texts, choose if texts that are clipped at the border of the map shall be totally suppressed, or if clipped texts shall be printed. If you only want complete texts to be printed, click the box.

**USE REFERENCE SCALE AS FACTOR FOR LINE WIDTH, HATCH DISTANCES...** adjusts the spacing of the line width and distance of the hatch lines when the scale of the map is increased or decreased (see "<u>Reference Scale</u>" on page 545). If you deactivate this setting, the objects are always drawn with the same hatch regardless of the ratio of the map scale and hatch reference scale.

**DRAW LINES AND AREA HATCHES AFTER GEO-BITMAP / CONTOUR MAPS** shows the hatches and lines but not a selected background color without changing the layout setting in the object types.

## **Geometry Cross Section**



A predefined cross section can be presented on screen and can be printed. Choose **VIEW -> CROSS SECTION -> NEW** and mark the cut line with the cursor.

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The Map

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| View            | _    |
|-----------------|------|
| 🗸 Site map      |      |
| Cross section 🔸 | Show |
| 3D model        | new  |

For the cross section, you can adjust the following settings under **PARAMETER** -> **CROSS SECTION SETTINGS**:

| Settings for vertical cross section       |     |  |  |  |  |
|-------------------------------------------|-----|--|--|--|--|
| Relief height [m]                         |     |  |  |  |  |
| Maximum point distance from cross section | 0,5 |  |  |  |  |
| Vertical exaggeration factor              | 1,0 |  |  |  |  |
|                                           |     |  |  |  |  |

The **RELIEF HEIGHT** [M] is the vertical height of the ground. It is derived from the geometry data. Sometimes flat situations look better if the relief height is artificially increased. For grid noise maps, it is possible that the ground doesn't cover the lowest row of grid points. Increasing the relief height helps in this situation.

If point objects are contained in the cross section cutting line, the parameter **MAXIMUM POINT DISTANCE FROM CROSS SECTION** defines the distance in [m] from the cutting line where the point object is displayed (as a projection).

The **VERTICAL EXAGGERATION FACTOR** controls the ratio of the vertical to the horizontal scales (stretch of the height).

When processing a vertical grid noise map, you cannot generate a new cross section. You can, however, toggle between the cross-section display and the site view and you can modify the cross-section parameters.

## **3D-Wire Frame Model**

Even without a license for 3D Graphics, you can create a rudimentary view of your data as a 3D wire frame model.

Double click on the map or press the right mouse button -> EDIT CONTENT, and VIEW -> WIRE FRAME MODEL. You can move freely in the entire study area. Use the right mouse button to open a menu with the following movement options:

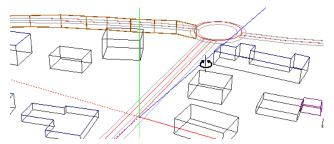


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The Map

| ✓ move                       |
|------------------------------|
| change distance              |
| rotate                       |
| tilt                         |
| move height                  |
| zoom (change focal distance) |
| change distance + move x     |
| rotate + tilt                |

"Move" is active by default. The modes used the most, such as "change distance" and "rotate + tilt," are also available using the left mouse button + the Shift key and Ctrl key. The mouse cursor shows the active mode. See also "<u>3D Graphics</u>" on page 619.



The red, blue and green lines indicate the x, y, and z axis and their intersection with the scene. The scene rotates around the green line (z-axis). The intersection of the coordinate lines is the center for changes in the distance.

Choose the borderline color and whether to draw an object as a 3D-wire frame model under the tab **3D** in the map object types.

# **Show Child Boxes**

You can show the child boxes related to the map (text boxes, scales...) within **EDIT MAP**. Activate **PARAMETERS** -> **SHOW CHILD BOXES** to accurately move and zoom the view port to fit on the map with the child boxes. The child boxes cannot be modified here. To modify them, you must return to the graphics main menu.

# **Update Results and Geometry**

After you have recalculated results or have changed the geometry files you can update the map data without opening the file selection manager: **FILE -> UPDATE MAP DATA** or **Ctrl+ R**.

For huge amounts of data, it can take a while to reload all data for the entire sheet, therefore with *Alt+ R* you can force the program to only reload the data that have changed.

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The Map

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Changes in the loading settings are done in the file selection manager. Right click on one of the files in the map and change the desired setting, e.g. time slice or text attributes.

# **Object Type File**

The object type file contains the entire layout information for all objects to be drawn (geometry-object types such as buildings and roads, result types such as grid noise map and façade noise map, and external data such as geometry bitmaps). Layouts for all object types are included in SoundPLAN, but you can customize and store them as your own company layouts. The object types defined in the projects object type file are not only used in the graphics but also control the on-screen appearance of the data in the modules Wall Design and Expert System for Industrial Noise.

| 💥 Object types in project - d:\Soundf                                                                                                                                                                                                                | PLAN Projekte\Projekte Version                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6\Another new english project\Objec       | ts.GOT             | _ 🗆 🗵        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------|--------------|
| Object types Edit Settings Help                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                           |                    |              |
|                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                           | Reference length s | cale 1: 1000 |
| Signs and symbols<br>⊕ General objects<br>⊕ Traffic sources<br>⊕ Industrial sources<br>⊕ Air craft noise objects<br>⊕ Air pollution sources<br>⊕ Environment<br>⊕ Wall                                                                               | Base settings Cartography 3D g<br>Main building<br>I⊄ Show<br>Name<br>Legend text                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | rsphies<br>Draw sequence<br>Main building | 15 💽               |              |
| Bern     Bern     Broting screen     Milgation areas     Ground absorption     Elevation point     Elevation line     Farain edge     Building     Main building     Industrial building     Industrial building     Objects in industrial buildings | Image: Image of the second | Color Color                               |                    |              |
| <ul> <li>Beceivers</li> <li>Area usages</li> <li>Flesuits</li> <li>Wald design</li> <li>Expert industry</li> <li>External data</li> </ul>                                                                                                            | Hatch line<br>Width<br>Edge line<br>IF Show<br>Width                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.30 🔮 Color                              |                    | OK<br>Cancel |

The layout possibilities for the various object types are described in the following sections.

#### Administration and Access of the Object Types

When you install SoundPLAN, a global object type file is automatically installed with the file name: objects.got. This file is duplicated as the project-object types for each new project and is stored in the project.

For each map you create, the project object types of all objects in the map are included as the map-object types. If you include additional data later on, the object map-types are supplemented to contain layout information for all object types. All object type files can be edited individually.

The Map

The advantages of this structure are as follows:

- Modifications delivered with new versions of SoundPLAN do not influence the layout of existing projects and maps.
- If a client wishes to have a special layout for their particular project, the settings made for this client do not automatically become the default setting for all projects.
- Layout changes and options, you want to make permanent can be moved to the global object types using Drag & Drop.
- As the map-object types only contain the objects found in the map, the map object types are probably smaller than the global or project variant.

**Hint:** Changes in an existing map must be made in the map-object types. Changing the project-object type setup or the global-object type setup here has no influence.

Some object types belong to certain SoundPLAN modules, so they are only included in the object type file if you have a license for the particular module. For example, the object types for point, line and area sources are not available if you do not have a license for Industrial Noise Propagation.

Open the map-object types in the current map via the right mouse button menu or via "Map Object Types" in the **PARAMETER** -> **MAP OBJECT TYPES** menu. The project-object types you can process in the main graphics level under **PARAMETER** -> **OBJECT TYPES IN PROJECT.** 

In the Geo-Database open the project object types with a click on the symbol EDIT OBJECT TYPE when you select an graphics object type via EDIT -> GRAPHICS OBJECT TYPE.

#### Transfer the layout to other object type files, maps and sheets

If you have customized the layout of a map's object types and want to use it for the entire project or for all projects, you can move the customized object types from the map-object types to the project-object types or to the global object types. To do this, open the map-object types with the right mouse button.

If you want to transfer from or to another object type file open the project object types, the global object types or the project object types from another project with the open button.

When you have opened two object type files open, you can use Drag&Drop or the button **TAKE OVER LAYOUT** to copy the layout of a selected (one or multiple) object type to a secondary object type file. The layout is only copied if the type is already present in the secondary layout type file. If you want to copy the layout even for layout types that do not have an equivalent in the secondary layout type file, you need to hold the shift key while dragging the layout types to the second file. In this case the new types will be generated in the secondary layout type file.

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If only a single object type file is opened, the layout of marked object types will be transferred to the object type file of the next higher hierarchy (from plan to project or from project to the global settings).

**Transferring the layout of object types to other sheets in the project:** Open the sheet tree (*F6*). Open the plan object type file that you want to use as the master, click on individual object types or entire branches (using the shift and Ctrl keys) to mark them. Now click on all sheets in the sheet tree that you want to transfer the layout to.

| ×ð∎ ∎≠ ∎°                                                                                                                                                                                                                                                                                                                                            | $\rightarrow$                                                                                                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul> <li>Wincity 73</li> <li>01 Grid Noise Map</li> <li>02 Facade Noise Map</li> <li>03 Cross Section Map</li> <li>04 Level tables</li> <li>05 Further Statements</li> <li>06 3D Model data</li> <li>07-1 3D-Animation</li> <li>07-2 Animated train pass-by</li> <li>08-1 Cartography</li> <li>09 Petrol station</li> <li>10 EU Directive</li> </ul> | Map object types          Image: Signs and symbols         > General objects         - Traffic sources         > Road         - Signal         Image: Environment         - Auxiliary building         - School         - Ridge         - Receivers |

The layout of the object type road and all object types in the branch "Environment" are to be transferred to the marked sheets on the left

With the button **TAKE OVER IN SHEET TREE**, the layout is transferred to the object types of the sheets if the object type is included in the particular sheet.

In the map object types all objects not used or not included in the legend will be displayed *gray and cursive*.



With this red **DELETE CROSS** these obsolete object types can be deleted from the plan object types (except for sub-objects such as middle dividers and bridges).

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The Map

#### **Reference Scale**

Use the reference scale to assign sizes in [mm] to items referenced in the map layout. This reference scale ensures hatch patterns have the correct size and lines have the correct thickness. When the map is enlarged to the world-scale factor, lines, texts and patterns are scaled down. When the world-scale is reduced, lines, texts and patterns are enlarged.

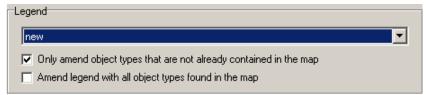
The reference scale can also be used to increase or decrease all line thicknesses, patterns and hatches.

If you want the entries in [mm] maintained even when they are scaled up or down, deactivate the reference scale in the object types clicking on the settings wheel and removing the check from the box **USE REFERENCE SCALE AS FACTOR FOR LINE WIDTH, HATCH DISTANCE...** 

# Site map / geometry data

After moving a situation or a geo-file to the right side of the file selection box, you must decide if the new geometry object types should be hosted in a new legend or if the existing map legend should be used and amended.

An existing legend will only be present if you are developing the current map from a template or if you are reloading data. The options are only relevant for these two situations. If this is not the case, do not change the default settings.



The option **ONLY AMEND OBJECT TYPES THAT ARE NOT ALREADY CONTAINED IN THE MAP** causes only object types to be included that are now in the map but were not in the map prior to reloading (in other words, the newly created ones). A new plan will not insert a legend if the check box "amend" is deactivated or if no object type has the box "Show in legend" clicked.

AMEND LEGEND WITH ALL OBJECT TYPES FOUND IN THE MAP causes the graphics to poll the entire geometry for object types not already contained in the legend. Old and new object types will be included.

Users with a license for the Cartography module can load properties as text into the map.

Site map / geometry data

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| <b>II</b> Situation                                                                                                                                                        |                                    | _          |    | ×    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------|----|------|
| Load properties as text                                                                                                                                                    |                                    |            |    |      |
| <ul> <li>Tools</li> <li>Verkehrstärmquellen</li> <li>Gewerbeschallquellen</li> <li>Industriehalle</li> <li>Fluglärmobjekte</li> <li>Umgebung</li> <li>Empfänger</li> </ul> | <ul> <li>&gt;</li> <li></li> </ul> |            |    |      |
| Legend                                                                                                                                                                     |                                    |            |    | ~    |
| Only complement object types that     Complement legend with all object                                                                                                    |                                    | in the map |    | _    |
|                                                                                                                                                                            |                                    | ОК         | Ca | ncel |

If you want to display properties of objects as text for example, stationing a reference kilometer of a noise protection wall load these by double clicking, using Drag & Drop or by clicking the arrow between the file windows. The properties as text are formatted via the object types. See "<sup>O</sup> Display properties as text " (page 617)".

The attributes are displayed separately for all object types in the project, therefore you can load other attributes for own generated object types.

The loaded geometry data are customized with the map-object types. SoundPLAN delivers a basic layout for all standard objects. You can use these or adapt them to your company drawing style. All object types you enter in the Geo-Database have a corresponding entry in the object type file. The map object types are only a subset of the project-object types. As the settings in this class of object types are very similar, we will describe only the difference between a point, line and area type object type, the geometry-text and a composite object. Settings made with the Cartography module have their own tabs. The tab 3D graphics is always present as it is possible to control the object layout for the wire frame model.

The base settings of each object type determine if the object shall be drawn in the site map and the cross-sectional map, and what name the object type will have in the legend. Defining the drawing sequence determines the "stacking order" of objects in the map. The larger the number in the **DRAWING SEQUENCE** field, the later the object will be drawn. The larger number will never be overwritten.

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Site map / geometry data

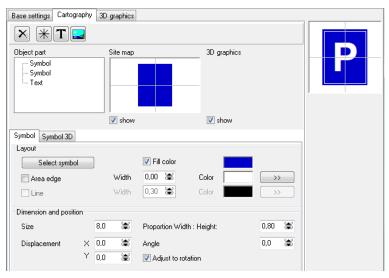
# **Point Type Object Types**

| Map object types                                                                                                                                                                         |                                                                                                                                        |                                                         |                           |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------|------|
| 🗃 🖬 🗙 📢 🥵                                                                                                                                                                                |                                                                                                                                        |                                                         | Reference length scale 1: | 1000 |
| Signe and symbols<br>General lobjects<br>→ General text<br>@: Traffic sources<br>@: Industrial sources<br>@: Environment<br>@: Planitreceivent<br>→ Noice calculation area<br>@: Results | Base settings Catography 2<br>Point receiver<br>Show<br>Name<br>Legend text<br>Luse in legend<br>Layout<br>Size<br>Line width<br>Color | Draw sequence       Point receiver       8.0       1.30 | 20                        | *    |

You control the layout of point type objects via the base settings. If you have the Cartography module, the screen looks a little bit different; the selection of the point symbol is under the Tab *Cartography*. Enter the object size in [mm] or [m]. If the size is [mm], the symbol is drawn in [mm] regardless of the scale of the drawing. If [m] is chosen, the symbol will always have the same ratio with other objects, but it will zoom up and down. To determine the size, an imaginary rectangle is drawn around the symbol. The longest side of this rectangle defines the symbol size.

Click **SYMBOL** to select a different symbol. Customize it further by selecting the color for the entire symbol.

In the tab Cartography you can customize point type objects even more by combining multiple point type objects and including texts and bitmaps. Depending on the drawing element (symbol, text, bitmap), additional layout controls are available.



Site map / geometry data

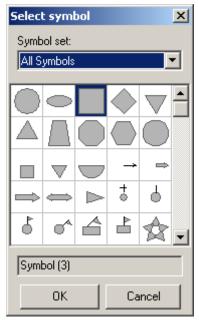
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In this example, two signs and a text were combined to form the parking lot symbol. In the preview under "site map" you will see the part of the symbol highlighted in the tree, and to the right you see the entire symbol.

#### 🥝 Symbol definition

 $\ast$ 

Click the asterisk to insert a symbol and select a symbol from the symbol selection matrix.



In the selection list, choose if you want to see all the symbols or only the symbols of a selection list. SoundPLAN provides a symbol library which you can amend with your own symbols created in the symbol editor. See "SoundPLAN Symbols," for details.

Symbols can be comprised of lines and/or areas. FILL COLOR, BORDER COLOR, LINE COLOR and LINE WIDTH are the tools used to create symbols. A check box defines what is to be drawn and what is not to be drawn. Use the double arrow behind the line color fields to correct line connections and line ends.

For each symbol, enter the **SIZE**, the **DISPLACEMENT** in x- and y- direction and the **RATIO** between width and height. Symbols can have different appearances without creating separate symbols.

Unsymmetrical symbols can be rotated by defining the **ANGLE**. If the symbol should have a fixed orientation in the world-coordinate system (i.e., a north arrow), the symbol must be rotated when the entire map is rotated. To ensure this happens, click the box **ADJUST TO ROTATION**.

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Site map / geometry data

T Texts can also be used to create composite symbols such as the parking lot symbol or a symbol depicting the area usage.

Assign the size in [mm] or in [m] to the text and select a font. The box **ADJUST TO ROTATION** forces a symbol to be drawn with a fixed direction referenced to the axis's of the world coordinate system. When the map is rotated, the symbol moves with it. This is useful for the north arrow.

Symbols available as graphics (as files of the type \*.bmp, \*.jpg, \*.gif, \*.tif, \*.png, \*.wmf, \*.emf...) can be integrated into symbols for point type objects. Select if the graphics is available in bitmap format or as a Windows metafile, and then choose the file.

If the file you selected is not present in the current project, SoundPLAN asks if it should copy the file, move it to the project or only generate a link to the file.

Enter the **SIZE** and click the **TRANSPARENT** box if you do not want to have the background shown.



To delete individual symbol components of composite symbols, highlight them and click the X-button.

### Line Type Object Types

| Map object types                                          |                                |               |                           |      |
|-----------------------------------------------------------|--------------------------------|---------------|---------------------------|------|
|                                                           |                                |               | Reference length scale 1: | 1000 |
| Signs and symbols                                         | Base settings Cartography 3D g | raphics       |                           |      |
| <ul> <li>General objects</li> <li>General text</li> </ul> | ~Line source                   |               |                           |      |
| ⊕ Traffic sources                                         | Show                           | Draw sequence | 15 🕃                      |      |
| - Industrial sources  - Point source                      | Name                           | Line source   |                           |      |
| Area source     House source                              | Legend text                    |               |                           |      |
| ⊕ Environment                                             | 🔽 use in legend                | Line source   | ×                         |      |
| Receivers                                                 |                                |               | ×                         |      |
| Point receiver Noise calculation area                     | Layout                         |               |                           |      |
|                                                           | Width                          | þ.00 🕃        |                           |      |
|                                                           | Color                          |               |                           |      |

Enter the line thickness and color.

#### 🥝 Line definition

In the Cartography module under the tab base settings, you can request the appearance of line type objects. They can be drawn by simply connecting the coordinates or smoothed using an exact or smooth Bezier line. The exact Bezier line will pass through the entered coordinates whereas the coordinates in the smooth Bezier line are subject to an interpolation.

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Site map / geometry data

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Left shows "no Bezier," the middle, "exact Bezier," and the right, "smooth Bezier."

Under the Cartography tab, you can further customize lines by sandwiching multiple lines or generating chains of lines and symbols. When Cartography settings are present, line thickness and color are not part of the base settings.

| Base settings Cartography             | 3D graphics |               |             |       |              |
|---------------------------------------|-------------|---------------|-------------|-------|--------------|
| ×                                     |             |               |             |       |              |
| Object part                           | Site map    | ~             | 3D graphics |       |              |
|                                       | 🔽 show      |               | 🔽 show      |       |              |
| Line                                  |             |               |             |       |              |
| Line type                             |             |               | _           |       |              |
| Line type                             |             |               |             |       |              |
| Line position                         |             |               |             |       |              |
| Draw line left aligned                |             | •             |             | 0     |              |
| Layout                                |             |               |             |       |              |
| Width                                 | 2,00 法      | Color         |             |       |              |
| Pattern size                          | 6,0 🗮       | Pattern ratio |             | 0,5 厳 |              |
| Line connection                       |             | Line end      |             |       |              |
|                                       |             | ۲             |             |       |              |
|                                       |             | 0             |             |       | OK<br>Cancel |
|                                       |             |               |             |       | Help         |
| · · · · · · · · · · · · · · · · · · · |             |               |             |       |              |

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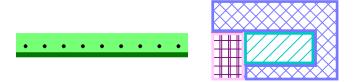
Customize the layout of lines, selecting from different **LINE TYPES** (solid, dashed, pointed or dash point...).

**LINE POSITION:** The line can be drawn directly on the digitized line and also bordering to the left/right or in a defined spacing. The border of areas can be set to be outside the area or included in the area. Special effects are possible when you define a second (border) line with different colors, line width, type and position (example on the left below). For area borders of adjacent areas, the quality

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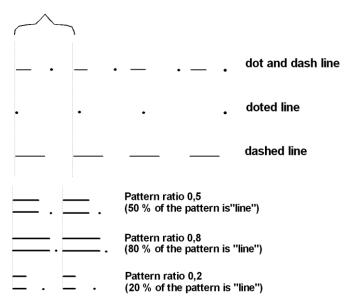
Site map / geometry data

improves when the lines are remaining completely inside the area (example on the right below).



Enter the line thickness and color, and for non-solid lines, the **PATTERN SIZE** (pattern length includes the space between the line elements) and the **PATTERN RATIO**.

#### Pattern size



For dash point lines, the points are always placed in the middle of the space between the patterns.

For LINE CONNECTIONS and the END OF THE LINE, select from the options shown.

A line object can be comprised of multiple lines. To show a railway, for example, use a thick black line and place a thinner, dashed white line on top.



Hint: Lines are drawn in the sequence listed in the "components of the objects" box. If you need to change the sequence, simply Drag & Drop the components where you need them.

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Use the symbol chains to display an unlimited number and type of symbols along the line. The line itself does not have to be displayed.

| Base settings Cartograp                                   | bhy 3D graphics |             |  |
|-----------------------------------------------------------|-----------------|-------------|--|
| × ~ *                                                     |                 |             |  |
| Object part Chain Symbol Chain Symbol Chain Symbol Symbol | Site map        | 3D graphics |  |
|                                                           | Show            | Show        |  |

The symbol chains must contain at least one symbol. In the symbol chain shown above, for example, two symbols represent the line; one is the arrow depicting the migration and the other is a toad depicting the subject of the migration. See "Symbol definition," and "Line definition".

Select the symbol spacing in the symbol chain of the object component chain.

| Settings                                 |       |
|------------------------------------------|-------|
| Point size                               | 5,0 🚔 |
| Align symbols equidistant                | ~     |
| ☐ fit symbol to line                     |       |
| Distance as factor of the point size     | 2,0 🚔 |
| Displacement as factor of the point size | 0,0 🚔 |

You have 3 possibilities to position the symbols along the line:

- in a defined distance
- at the coordinates of the line
- with 2 symbols per line section

With all 3 possibilities it is possible to customize the symbols along the line.

For the option ALIGN SYMBOLS EQUIDISTANT define the spacing DISTANCE BETWEEN SYMBOLS and a DISPLACEMENT. Both values are entered as a factor referring to the symbol size.

For the option **SYMBOLS AT THE COORDINATES** you can define the position of the symbol using the distance of the symbols from the line point or the line segmenting. If you divide the line segments in two parts, the symbol is displayed in the middle of the line segment; with four parts after a quarter of the line segment. If the distance to the line point is 0, you can determine, whether you want to display a symbol at the last a line coordinate.

With the option of having **TWO SYMBOLS AT THE LINE ENDS**, at the beginning of the line and at the end of the line each a symbol is displayed. With a line segmentation

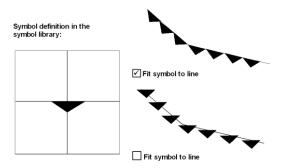
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of 4 the symbols are displaced ¼ of the line ends. The sine segmentation 0 positions the symbols directly at the line ends.

Use **ADJUST SYMBOL TO LINE** to select if the symbols are rotated to conform to the direction of the line or if the symbols are always oriented in a fixed direction.



**SYMBOL AT LAST POINT** displays a symbol at the last line point, even if the entered distance cannot be kept.

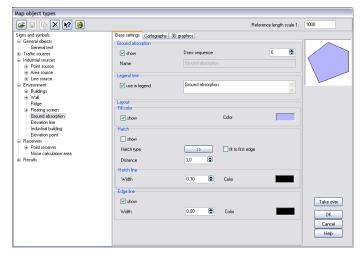
For all line types, you can insert a 3D wall that is only visible in the 3Dgraphics (including the wire frame variant), so that a line can be placed at a user selected height. Ensure that this object type is also marked for printing under the tab 3D-graphics.



To delete individual symbol components of composite symbols, highlight them and click the X-button.

# Area Object Types

For area type objects, define fill color, borderline and hatch separately from each other.

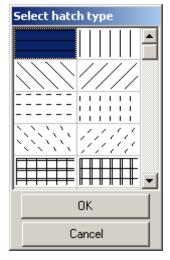


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#### **Hatch Patterns**

To select a hatch pattern, click on the double arrow and select one from the pattern list. Click OK to confirm the selection.

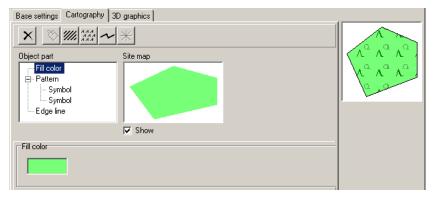


When the box **FIT TO FIRST EDGE** is marked, the pattern will be oriented on a line going through these first two coordinates.

#### 🥝 Area Definition

Cartography allows you to define your own hatch patterns and fill areas using customized symbol fills.

Standard hatches with fill color and border color are best defined in the base settings. When you define more complex definitions under the tab Cartography, the controls in the base settings are deactivated for this object.



In addition to the standard hatches, you can also generate composite hatches. This can be a useful tool if you want to display hatches with different colors. Define the line type (see "<u>Line definition</u>," page 549), the

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parameters for angle, spacing, displacement (sideways offset) and the displacement (offset of the beginning of the line).

| Line Hatch        |       |
|-------------------|-------|
| Settings          |       |
| Angle             | 0 🚖   |
| Distance          | 3,0 🚖 |
| Displacement      | 0,0 🚖 |
| Displace          | 0,5 🚖 |
| Fit to first edge |       |

Use **DISPLACE** to generate a pattern of dashed and other non-solid lines:

Displace = 0,0

| Displace = 0,5 |  |
|----------------|--|
|                |  |

| L _ |  |
|-----|--|
| ⊢ − |  |
|     |  |

Use the pattern definition to assign any shape and any number of symbols to fill the shape. The shape can also have a background fill color.

The pattern must contain at least one symbol. In the example above, the fill of the area used symbols for conifer and deciduous trees. You define the fill pattern. See "O Symbol definition," page 548.

To define the symbol spacing, click on the pattern in the component list.

| Settings     |                 |
|--------------|-----------------|
| Point size   | 5,0 🚖           |
| Distance     | X 3,0 🜩 Y 3,0 🜩 |
| Displacement | X 1,7 뢎 Y 1,3 뢎 |
| Displace     | 0,00 🚖          |

For the **POINT SIZE**, first enter the size from the symbol definition. This field may have to be customized if you have chains comprised of multiple symbols. For multiple symbols, the point size is the pattern size (i.e. the size of all symbols together).

**DISTANCE** and **DISPLACEMENT** of the symbols are defined in [mm].

Use **DISPLACE** to offset individual symbol chains.



Use the X in the symbol bar to delete individual object components of object definitions.

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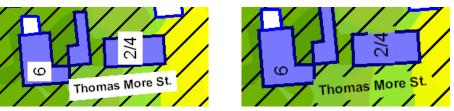
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# **Object Type Geometry Text**

| 🏶 Map object types                                                                                                                                        |                                                                                                              |                                               |                       | I XI |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------|------|
| Object types Edit Settings Help                                                                                                                           |                                                                                                              |                                               | Reference length scal |      |
| Signe and symbols<br>General objects<br>→ General text<br>⊕ Traffic sources<br>⊕ Environment<br>⊕ Receivers<br>→ Area usages<br>→ MI<br>→ GR<br>⊕ Results | Base settings 3D graphics<br>General text<br>✓ Show<br>Name<br>Legend text<br>✓ Layout<br>Size as factor 1.0 | Draw sequence<br>General text<br>General text | 50 🗲                  |      |

The layout of geometry texts was defined in the Geo-Database. All settings from the Geo-Database (color, text type and font) are used in the texts of the graphics. Only the size can change. Enter the size as a **FACTOR OF GEODB SIZE**.

Text backgrounds can be completely clipped as in the left picture, so the background is white, or the clipping can be confined to lines and symbols as in the right picture.



Select the options in the settings with the wheel symbol in the object types.

**Hint**: If texts included in the geometry data are not displayed, check the site map settings in the object types with the wheel symbol. Texts smaller than the minimum text size are suppressed, so check the minimum text size and make changes as needed.

If you do not have Cartography, the general layout for the object type text is derived from the Geo-Database.

Cartography has the option to control the size of the text in [m] (of the drawing) or in [mm] (of world coordinates). You can also generate your own text object types and format them in the graphics. After defining your own text object type, assign it to the object in the Geo-Database.

For the display of geometry texts, you can select if you want to enter the font and position of the text reference marker like in the Geo-Database.

You can also highlight texts and assign a background color.



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| Base settings Cartography 3     | D graphics           |
|---------------------------------|----------------------|
| ×                               |                      |
| Object part                     | Site map             |
| Text<br>Text background         | Text                 |
|                                 | Show                 |
| Options                         |                      |
| 🔲 Text clipping                 | Background color     |
| ☐ Show edge                     | Width 0,20           |
| Frame width of the clipping boy | (                    |
| ☑ Width as factor of text siz   | re                   |
| Left                            | 0,25 文 Right 0,25 文  |
| Тор                             | 0,10 🚖 Bottom 0,10 🚖 |

Use **TEXT CLIPPING** to clip the text background from the geometry. One of the text clipping options in **SETTINGS -> SITE MAP** must be activated.

The box **DISPLAY FRAME** creates a frame around the text with the frame color and width of your choice. The frame width can be defined for all four individual sides as a factor of the text size or in [mm].

# **Composite Object Types**

Some object types consist of multiple sub-object types (i.e. roads, railways or noise protection walls). The layouts of all sub-object types are defined independently of each other. The user also determines which sub-object type will be displayed in the map and included in the legend.

🚊 - Railway

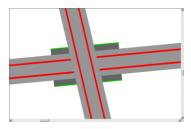
- Railway axis
- Emission line
- --- Surface
- --- Bridge
- --- Wall
- ..... Stationing

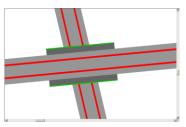
Each object type (with all sub-object types) is printed in the same output sequence; the only distinction is the order the object is read from the file. Files read first will be printed first, which allows you to control the drawing sequence of objects within the same object type. For example, you can use the sequence of loading and drawing to influence how the intersection is drawn and which road is drawn last. If 10

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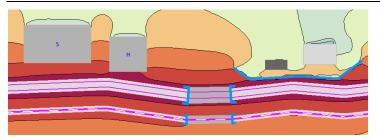
you want to print a bridge with the noise protection walls attached to the sides as in the picture below to the right, store both objects in separate Geo-Files and load them in the correct sequence.





In the picture to the left, road 1 was loaded first, with the result that the road intersects the bridge, but the road is actually underneath the bridge. In the picture to the right, road 2 was loaded first and the output is correct.

# DIN 45682 – Thematic maps for noise protection assessment (Germany)



The presentation of the bridge abutment was added for the presentation according to DIN 45682. Depending on the width of the bridge the bridge abutments are entered as a new sub-object for bridges in roads and railway tracks. In the legend the bridge is presented in combination with the bridge abutment and the noise protection wall on the bridge. For tunnel openings and the location of traffic signals new objects are inserted. The traffic light still must be positioned by hand on the map.

**DIN** To help with the layout definitions, the object type setup has a "DIN" button to set the object types to be conform with the DIN 45682. In the sheet object types only the object types present in the sheet will be converted.

# Presentation of Area-type Results

Area-type data types are:

- Grid Noise Map
- Meshed Noise Map
- Cross-sectional Grid Noise Map

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- DGM (Digital Ground (or terrain) Model)
- Measurement Map
- Grid Operations (for example: Difference map)
- Triangle Operations (for example: Difference map)
- Area Maps (Conflict Map)
- Contour Map Aircraft Noise

Select the needed **FILE TYPE** in the file selection. Depending on the type of results selected, additional information may be requested at loading time.

## **Result requests for area-type calculations**

The calculation results are calculated simultaneously for all time slices and all air pollution components and are hosted in the same file. Therefore, the program requires information concerning which time slice or pollution component you want to depict in the map and which color scale to use.

For a new sheet, you can select between a new color scale, which is generated from the value range in the result, scales delivered with the software (e.g. colored scales according to EU, French or US requirements) or your own scales, stored in the Globdata folder. When you are working with a template the scale scales stored in the template is select as a default.

As an alternative, you can present the terrain elevations of the model that was the basis of the noise simulation via a color scale. In this case, select a new color scale in order to represent the value range correctly. The general data entry for scale related parameters is similar, but details vary.

| Grid Noise Map    |                                  | ×      |
|-------------------|----------------------------------|--------|
| Select value      |                                  |        |
| Select time slice | $\bigcirc$ show ground elevation |        |
| Value             |                                  |        |
| Sum level         |                                  | $\sim$ |
| LrD               |                                  | ~      |
| Color scale       |                                  |        |
| new               | ~                                | >>     |
|                   |                                  |        |
|                   |                                  |        |
|                   | OK Cancel                        | Help   |

Parameters for loading area type results – Grid Noise Map shown

Click the double arrow to process the scale at this location or accept the values of the automatically generated scale and customize it later using "Edit content" via

**Presentation of Area-type Results** 

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the right mouse button. Editing scales is described in section "<u>Color scale</u> (page 520)".

Press OK to confirm the selection. Click OK again to leave the file selection. If you want to modify loaded data (time slot, pollutant or scale), open the file selection again and right click the result file selection. The time slice, pollutant and scale selection will open.

The EU area evaluation is described on page 604 [NMP Toolbox].

#### **Change loaded data**

If you want to change the loaded data (time slice, result, or color scale) call the file selection manager again and click on the result file with the **right mouse button**. The result request will be opened.

#### Show results for individual groups or frequencies

For Grid Noise Maps, select from the selection list, whether you want to display the sum level or an individual frequency or group.

For Meshed Noise Maps calculated frequency by frequency, you can select an individual frequency or a frequency band in addition to the sum level. The detailed result tables must have been stored in the calculation run settings.

| O Meshed Noise Map    |   |      |   | _  |          |
|-----------------------|---|------|---|----|----------|
| Time slice            |   |      |   |    |          |
| LrD (Noise level Day) |   |      |   |    | <b>v</b> |
|                       |   |      |   |    |          |
| ⊙ Sum level           |   |      |   |    |          |
| O Octave              | 3 | 1    |   |    | ~        |
| ○ 1/3 Octave          |   |      |   |    |          |
| ◯ Band                | 2 | 5    | ~ | 25 | ×        |
| Filter                | d | B(A) |   |    | ~        |
| Colored scale         |   |      |   |    |          |
| new                   |   |      |   |    | »        |
|                       |   |      |   |    |          |
|                       |   | OK   |   | Ca | ncel     |

# 10

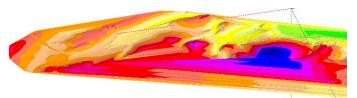
#### Load DGM

For DGMs, you can optionally clip triangles out of a selected area or calculation area, e.g. to filter border triangles that are very narrow and do not represent the geometry. Select a Geo-File containing the area.

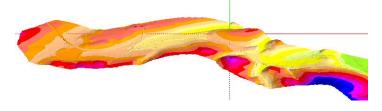
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| 🚺 Data par        | ameters                              | -  |        | ×    |
|-------------------|--------------------------------------|----|--------|------|
| -Clip triangles a | at selected area or calculation area |    |        |      |
| 🗹 yes             | 005_Calculation Area.geo             |    |        | 2    |
| Color scale       |                                      |    |        |      |
| 🗌 with col        | lor scale                            |    |        |      |
| new               |                                      |    | $\sim$ | >>   |
| Legend            |                                      |    |        |      |
| new               |                                      |    | $\sim$ | >>   |
| 🗹 compler         | ment                                 |    |        |      |
|                   |                                      | OK | Car    | ncel |

#### Unfiltered:



Edge triangles filtered using a selected area:



#### Difference Grid Maps

Difference maps and other mathematical calculations are created using the file type Grid Operations. (see "<u>File Operations</u> (page 605)").

# **Object types for area-type results**

The layout of area type results can be customized using the settings found in the object type file. Each file type has a primary object type.

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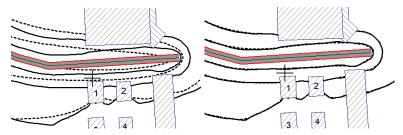
Presentation of Area-type Results

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| 🛎 🗉 🗅 🗙 🗙 🗳 🔈                                                                                                                                                                                                                                         | ? 🥵 DIN                                                                         |                                            | Reference length                                | scale 1: 1000        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------|----------------------|
| igns and symbols                                                                                                                                                                                                                                      | Base settings Cartogr                                                           | aphy 3D graphics                           |                                                 |                      |
| <ul> <li>General objects</li> <li>Fraffic sources</li> <li>Traffic sources</li> <li>Fraviorment</li> <li>Fraviorment</li> <li>Gind noise map</li> <li>Mid interval</li> <li>Mid interval</li> <li>Additional intervals</li> <li>Limit line</li> </ul> | Grid noise map<br>✓ show<br>Name<br>Contour lines<br>✓ show<br>Filter width [m] | Draw seque<br>Grid noise n<br>draw line or | nap                                             |                      |
|                                                                                                                                                                                                                                                       | Delete contour area<br>Bezier type                                              | s smaller than [m²]<br>O exact<br>0 💭      | 0 smooth Step size (m) 1,00 contour line text 0 |                      |
|                                                                                                                                                                                                                                                       | Edge line<br>Show<br>Value as text<br>show                                      | Color:<br>Decimal places                   | Width: 0.3                                      | •                    |
|                                                                                                                                                                                                                                                       | Grid                                                                            |                                            | fluid colors                                    | Apply                |
|                                                                                                                                                                                                                                                       | Drawing into geometry<br>transparent                                            | bitmap 50 😭                                | bitmap area to gray                             | OK<br>Cancel<br>Help |

**SHOW CONTOUR LINES** is always active unless you want to display the grid or the triangles. If it is deactivated, neither the main interval nor the mid interval nor additional intervals will produce contour lines or fills. The contour lines can be drawn at different positions, see "<u>line definition</u>" (page 549).

The **FILTER VALUE** defines the bandwidth where the contour points are interpolated, resulting in a smoothing of the contour lines.

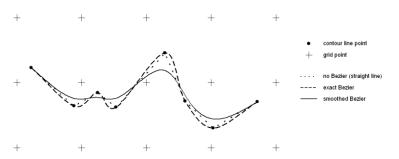


The comparison above shows that a filter bandwidth of 1 meter is not correct, while the result with a filter bandwidth of 0.1 meters is almost the same as the unfiltered contours. In order to not falsify the results, the filter width is limited to 1/10 of the grid size.

For the display of the noise contour lines it is possible to **DELETE CONTOUR AREAS SMALLER THAN X** [M<sup>2</sup>] in order to omit not relevant small color changes.

**BEZIER TYPE** determines the display quality of the contour lines. The difference between the exact and the smooth Bezier curve is that the contour lines move through the base points for the exact Bezier and the base points for the smooth Bezier curves are interpolated.

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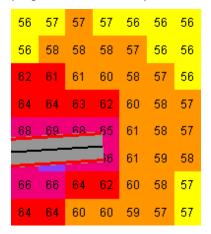
Although the exact Bezier curve moves through the base points, the curve may be subject to big fluctuations causing the smoothed Bezier curve to describe the nature of the contour line more correctly. If the quality is insufficient, reduce the grid spacing!

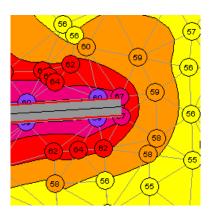
The **OUTPUT SEQUENCE** for contour lines can be set independently from the main object type. Additionally, the optional contour line texts can be set so they are always printed on top of all other objects. Forcing the contour line labels to be printed over the other objects means you do not have to reset the output sequence.

The **EDGE LINE** (border of the calculation area) is not a contour line, so you can choose if you want to display it and choose which line color and width it should have.

If you want to display the grid (only grid noise), activate **SHOW GRIDS** and deactivate the **SHOW CONTOUR LINES**. You can have the color of the grid cells interpolated between the scale colors by checking the box with the label **FLUID SCALE**.

The values of the base grid/triangulation can be presented by marking **VALUES AS TEXT**. This is not a sensible presentation option, but it can be very helpful to check the model results. With the checkbox in front of the font, you can force the program to automatically fit the font size to the size of the grid cell.





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Edit Map includes an option to edit the grid values. Select **EDIT GRID VALUES** from the selection list.

| Edit grid map        |                    |       | × |
|----------------------|--------------------|-------|---|
|                      |                    |       |   |
| Kind:                | 87, 106            |       |   |
| Grid position (X,Y): |                    |       |   |
| Coordinate:          | 36222,5<br>29757,5 |       |   |
| Value:               |                    | 73,39 |   |
| Recalculate          |                    |       |   |
|                      | ОК                 | Cano  |   |
|                      |                    |       |   |

The entered corrections will be lost with a new calculation or if the grid file is not stored.

#### Definition of Intervals

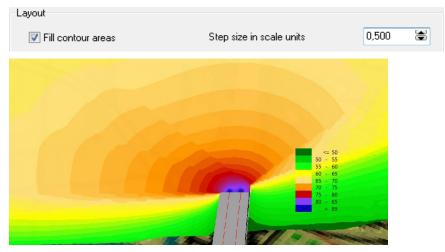
| Base settings 3D graphics |               |       |
|---------------------------|---------------|-------|
| Main interval             |               |       |
| Show                      |               |       |
| Name                      | Main interval |       |
| Layout                    |               |       |
| 🔽 Fill contour areas      |               |       |
| Contour line              |               |       |
| Show                      | Width         | 0,3 🚖 |
| 🗖 use scale color         | Color         |       |
|                           |               |       |

**FILL CONTOUR AREAS** fills the areas between the contour lines with the scale color. You determine if the contour lines themselves are printed and in which color and with which line width. Users with Cartography can also select the line type (solid, dashed, dotted ...).

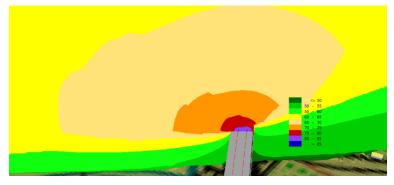
The sub-objects for the main, mid and additional intervals determine if only the intervals present in the scale will be shown or these plus other intervals. The mid interval splits the base intervals in half. The additional interval generates an interval for each dB value, but different spacing is possible. **FILL CONTOUR AREAS** for mid and additional intervals (enter **STEP SIZE IN SCALE UNIT** for the additional

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intervals) interpolates the color between the colors of the scale. This allows you to generate a color sequence showing each dB step in a consistent fashion.



With extra intervals (example in 3D)



Without extra intervals (example in 3D)

If the contour lines are output in scale color, you can request that the colors are not the fill scale colors, but rather the colors of discrete values. See "<u>Designing the</u> <u>scale</u> (page 524)".

The settings for mean and additional intervals are used for the contour line export as the distance between the contour lines.

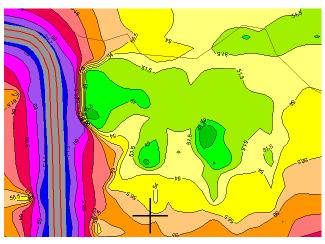
If a **DGM** in the graphic is supposed to be shown with elevation contours, you now can use Main, Middle and intermediate intervals that are also depicted in the legend.

| <br>100 m elevation line |
|--------------------------|
| <br>50 m elevation line  |
| <br>5 m elevation line   |

**Presentation of Area-type Results** 

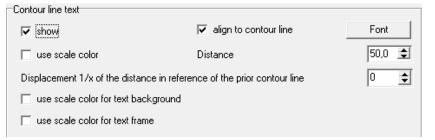
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#### **Label Contour Lines**



Activate the labels for the contour values for area type results in the sub-object types.

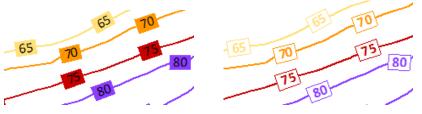
Activate the SHOW button and select the DISTANCE between the text labels.



With the switch **ALIGN TO CONTOUR LINE** the text labels can be either aligned with the contour line or aligned with the sheet.

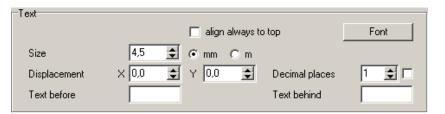
Via the **DISPLACEMENT** of the text by 1/2, 1/3 or 1/4 of the text label spacing, it is possible to avoid congestion of labels.

Optionally set the text background or text frame in scale color:

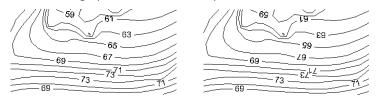


<sup>6</sup> Under the *Cartography* tab, further customize the objects of the contour line text labels (contour line, text, text background).

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Generate a main and secondary text to the contour line labels. Use **ALWAYS ALLIGN TO TOP** to select how the text should be position on the contour lines. When it is marked, the graphic will look like the picture to the left.



If the check box on the right side of the decimal-values is active, decimals are only printed if needed. For example, using a color scale with intervals of 2.5 dB, the 47.5 dB contour will have the digit after the decimal, the 50 dB contour will not.

The contour label texts themselves can be processed further in "Edit map content." Select **MOVE CONTOUR LINE TEXTS** from the selection list.

When the cursor nears a contour line text, its shape changes from + to an arrow. Use the arrow to move the text with the left mouse button or delete it. Use the right mouse button to generate additional contour line labels at different locations.

The texts are inserted horizontally and maintain the existing angle when moved. Use Ctrl + left mouse button to rotate the texts to a different angle.

Hint: SoundPLAN remembers the position of contour line texts edited manually. Therefore, the program asks if you want to retain the text position when you modify the contour line spacing.

#### Limit Contour Lines

For the area type presentation, it is possible to draw the noise limit contour line independent of the scale. Simply activate the result-object-type in the sub-object **LIMIT LINE** and define the color, width and value of the limit line.

**Presentation of Area-type Results** 

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| Layout                |          |          |
|-----------------------|----------|----------|
| Value to be displayed |          | 50,000 👤 |
| Contour line text     |          |          |
| F Show                |          | Font     |
| 🔲 use text clipping   | Distance | 50,0 🚖   |
| Contour line          |          |          |
|                       |          |          |
|                       | Width    | 1,0 🚖    |
|                       | Color    |          |
|                       |          |          |

Just as with the scale dependent contour lines, the noise limits can be assigned text labels indicating the dB value.

<sup>(e)</sup> The Cartography module allows you to duplicate object types and sub-object-types creating multiple noise limit lines in the same map. <sup>(e)</sup>

# Drawing Grid Maps and Meshed Maps in geometry bitmap

You have the option to calculate the color value of Grid maps and Meshed Maps pixel by pixel in an already loaded bitmap. The prerequisite for this is that the geometry bitmap is exceeding the size of the calculation area, as this procedure would clip the grid or meshed map with the bitmap.

In the object type of grid and meshed maps you can find 2 options to calculate the color values of pixels:

- transparent
- shaded

| Drawing into geometry bitmap |   |    |   |                       |
|------------------------------|---|----|---|-----------------------|
| transparent                  | • | 50 | ۲ | 📃 bitmap area to gray |

For **TRANSPARENT** all pixels are calculated in a way that take the color of the SoundPLAN result map and add a bit of white color before adding the color value of the bitmap. This way the noise map is a bit pastel and the bitmap is bolder. The resulting map seems transparent. The best results seem to be attained if the contour lines are output with a higher sequence number than the noise map.

| Uutput sequence |   |   |                   |   |   |
|-----------------|---|---|-------------------|---|---|
| Contour line    | 8 | ۲ | Contour line text | 0 | ۲ |

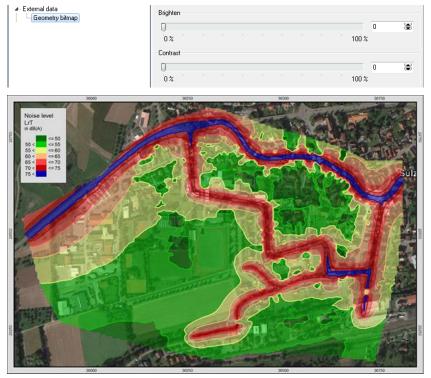
For **SHADED** the colors of the resulting noise map are presented darker than the original.

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For both settings you can also select if the color component of the bitmap is to be used directly or first converted into a gray scale value.

Resulting map and geometry bitmap are only processed when necessary for example for the first drawing or when the settings or scale of the noise map are altered. This accelerates the output, especially for big grid maps. If for whatever reason the maps were altered but the changes are not shown, use the refresh button to force a re-processing of the map.

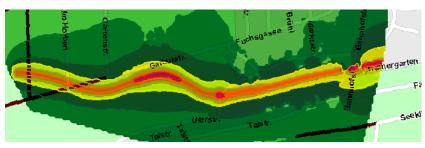
**TRANSPARENT** is a good option for full covering darker bitmaps such as aerial photography. **SHADED** is well suited for more symbolic maps that contain in addition to lines only pastel tones (e.g. light gray for constructed areas or light green for forest and meadow). As another option it is also possible to **BRIGHTEN** the bitmap or increase the **CONTRAST**, this is done with two sliders in the geometry bitmap object settings.



*Transparent presentation of the contour areas –contour lines are drawn with a higher order on top of the areas* 

Presentation of Area-type Results

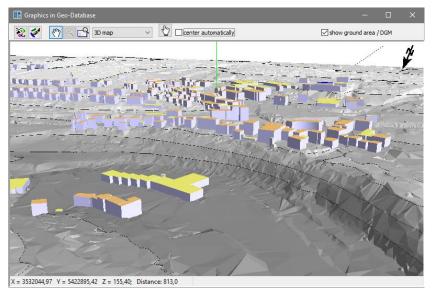
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Shaded presentation of the contour areas

# Presentation of DGM with continuous color flow / elevation lines

[Module Cartography] For the DGM display, a color gradient can be defined in 2D and in 3D. This applies to both the Geo-Database and the Graphics.



Call the map object types via right mouse button -> **MAP OBJECT TYPES**. Click on the object type "Digital Ground Model" -> sub object type "Triangles". In the tab *base settings*, you can define a second color for the lowest interval.

| Fill color             |    |                      |  |
|------------------------|----|----------------------|--|
| 🗹 show                 |    | Color                |  |
| ⊡use interval size [m] | 10 | Lower interval color |  |
|                        |    |                      |  |

Check mark **USE INTERVAL SIZE** and define the interval size in meter. SoundPLAN calculates the number of intervals on the basis of the lowest and highest elevation and interpolates the colors.

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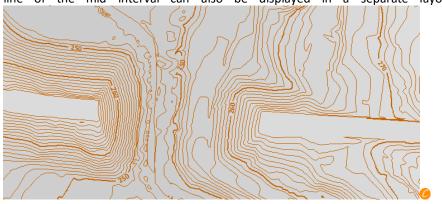


You can choose the same setting for 3D in the tab index card *3D-Graphics*. Interval size and the lower interval color are coupled between 2D and 3D view.

Additionally, you can display the DGM **AS ELEVATION LINES.** You will find this setting in the main object type "Digital ground model", tab index card *Base settings*.

| Contour lines                          |                        |   |
|----------------------------------------|------------------------|---|
| 🗹 show                                 | draw line on area edge | ~ |
| Filter width [m]                       | 0,00 🚔                 |   |
| Delete contour areas smaller than [m²] |                        | 0 |
| show as elevation line                 | s                      |   |

Define the step size in the sub object type "Additional intervals". The step size 10 displays an elevation line every 10 m in the layout of the contour line in the additional intervals. An elevation line in the layout of the contour line in the main interval is displayed all 10 times of the step size (here every 100 m). The contour line of the mid interval can also be displayed in a separate layout.



#### 🥝 Measurement map

Measurement values present as an ASCII text file (file extension \*.txt) can be displayed as measurement map. Cartesian coordinates as well as polar data can be processed.

Select the file type **MEASUREMENT MAP** and activate the ASCII file. SoundPLAN reads part of the file and shows the structure of the file in a screen so you can define the import filter and declare which column shall have which meaning:

10

**Presentation of Area-type Results** 

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| Import format for poi                                                                                                                                                | int data |     |              | _O×  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----|--------------|------|
| Number of title rows                                                                                                                                                 |          | 1 👤 |              |      |
| Columns                                                                                                                                                              |          |     |              |      |
| 36152.91<br>29781.54                                                                                                                                                 | >>       | 0 🌲 | point number |      |
| 65.30<br>56.70                                                                                                                                                       | >>       | 0 🚖 | point name   |      |
| 56.70                                                                                                                                                                | >>       | 1 🚖 | x position   |      |
|                                                                                                                                                                      | >>       | 3 🌩 | first value  |      |
|                                                                                                                                                                      | >>       | 0 🚖 | last value   |      |
| Preview                                                                                                                                                              |          |     |              |      |
| 36152.91;29781.54;65.30;56.70<br>36315.55;29516.68;72.10;62.40;<br>36495.22;29755.21 ;73.50;62.10<br>36321.74;29809.42;70.80;60.30<br>36419.32 ;29555.40;68.80;58.30 |          |     |              |      |
|                                                                                                                                                                      |          | ОК  | Cancel       | Help |

Enter the number of header lines. If there aren't any, set the value to 0.

The individual columns are listed one below the other. Activate the column and use the double arrow to connect it to one of the data slots in the SoundPLAN measurement array. You could also enter the column number in the measurement array as an alternative. Column number 0 means that this value is not present.

For point data, assign at least the fields **X POSITION, FIRST VALUE** and **LAST VALUE**.

SoundPLAN needs different values for data present in the polar system. For this, assign at least the fields **ANGLE POSITION**, **DISTANCE POSITION** and **FIRST VALUE** and **LAST VALUE**. Additionally, you can enter the coordinates of the center. In order to decipher the coordinate transformation, SoundPLAN needs to know the direction of the zero angle and if the angles are rotating around the center in a mathematically correct (counter clockwise) direction. For SoundPLAN, the direction of 0° is equivalent with the positive X-axis, or east. In case the definition of 0° in your data differs from this definition, enter the angular difference. For example, enter 90° if the coordinate system is mathematically positive and 0° points north. For the negative Y-axis, enter the offset as –90°.



#### **Target File**

SoundPLAN automatically creates a \*.PLI and a \*.TRX file with the file name taken from the import file. The \*.PLI file contains the point list and the assigned values. The \*.TRX file contains the triangulation of the measurement data. Open the PLI file, if you want to re-open the measurement file or need to do mathematical operations with the measurement data.

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# **Contour Line and Grid Value Export**

Grid values and/or contour lines in the area type presentation can be exported to various file formats:

- ASCII (grid values and contours)
- DXF (grid values and contours)
- ESRI ArcView Shapefile (grid values and contours)
- CARD/1 (contours)
- Contour lines as kml
- SoundPLAN Geo-File elevation lines / poly-lines (contours)

Some of the export options are only present if that particular export type is licensed.

To subdivide the contour lines in smaller sections than defined in the color scale settings, enter the desired distance in the map object types for the **ADDITIONAL INTERVALS**.

Open *Edit Map* (double click on the map or right click -> EDIT CONTENTS) and then open the export menu via EDIT -> EXPORT OF GRID VALUES or EDIT -> EXPORT OF CONTOUR LINES.

Enter the path, the export type and the file name. Depending on the export type and file type, different export settings are displayed and requested.

| Export settings                                                                         |        | _ 🗆 × |
|-----------------------------------------------------------------------------------------|--------|-------|
| ASCII<br>Field seperator                                                                | Tab    | •     |
| Grid map<br>© export only the loaded value                                              |        |       |
| <ul> <li>export all values of the grid file</li> <li>export ground elevation</li> </ul> |        |       |
| ОК                                                                                      | Cancel | Help  |



Example: Export settings in ASCII-export

When exporting grids to DXF-files, the exported values always represent the time slice selected for the map display. For ASCII and SHP export, you can choose to either export the displayed values or the values of all time slices. When you select **EXPORT ALL VALUES OF THE GRID FILE**, you can also export the elevation of the receivers **(EXPORT GROUND ELEVATION)**. For the ASCII export, also enter the column separator character.

10

Presentation of Area-type Results

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For contour line export, the filter value and Bezier type is requested. This setting will greatly influence the size of the export file. The smooth Bezier type will greatly inflate the number of exported points. Additionally, the parameter **STEP SIZE** in [m] will further influence the number of exported points.

Contour lines can be exported as areas or individual lines. Exporting to SoundPLAN elevation lines or poly lines using the setting "area" is not sensible.

For the export of grids and contour lines you can transform the data into another coordinate / reference system, see "<u>Transformation between coordinate systems</u> (page 175)".

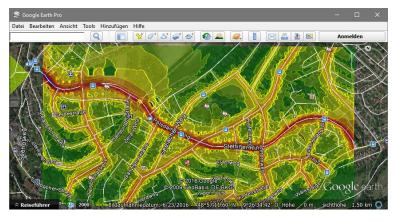
Coordinate transformation to target coordinate system

|                     | 🗹 activate                                | EPSG code     |
|---------------------|-------------------------------------------|---------------|
| Coordinate system   | ETRS-TMzn Pan-European Transverse Mercato | r (UTM) 👘 🗸 🗸 |
| Reference system    | ETRS89 (EU), geocentric, GRS80            | ~             |
| Offset X / Offset Y | 32000000 0 Stripe / a                     | zone 32       |

Export of contour lines as kml: [Cartography module]. In Edit Map open EDIT -> CONTOUR LINE EXPORT. The transparency [%] can be added as an additional parameter when exporting contour bands to your kml Viewer. Additionally, select if you also want to export the border lines and the border line width.

| 🚺 Exporteinstellungen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ×   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Farbtransparenz                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 40 🖨                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |     |
| Randlinien zeichnen                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Linienbreite [Pixel]:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 🌲 |
| and a second sec | a and the state of the stat |     |

For the presentation of contour lines in a kml viewer only the contour type **BAND** is sensible.





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Presentation of Area-type Results

In the kml viewer the appropriate interval is presented in a brighter color when you move the mouse over the contour line. With a mouse click in a contour line band, the interval of dB is shown.



# **Export triangles**

For DGMs and Meshed Noise Maps the points of the triangulation (**TRIANGLE POINTS**) can be exported. Moreover, you can export the results **AS GRID**. Enter the grid size for this option. The values of the grid points are interpolated from the triangle points of the triangulation.

DGMs can additionally be exported in the ITF-format. ITF (Intermediate TIN Format) is an exchange format for DGMs, described in the internet.

# **Presentation of the Facade Noise Map**

The following results can be presented as a Facade Noise Map with the Facade Noise Map license:

- Calculation type Facade Noise Map
- Calculation type Single Receivers
- Spreadsheet (receiver tables)

## **Result Requests in the Facade Noise Map**

After selecting one of the results, additional parameters are requested for display and layout:

10

Presentation of the Facade Noise Map

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| Facade Noise Map                                                                                                         |                    |             | ×      |
|--------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|--------|
| Select value                                                                                                             |                    |             |        |
| Time slice                                                                                                               | LrD (Day)          | •           |        |
| Floor                                                                                                                    | 1. Floor           | •           |        |
| Select conflict value                                                                                                    |                    |             |        |
| Assessment                                                                                                               | 16.BlmSchV         | •           |        |
| show conflicts                                                                                                           | Show conflict from | 0,0 🛫       |        |
| Load options                                                                                                             |                    |             |        |
| 🔽 Do not load points on facades sma                                                                                      |                    |             |        |
| ✓ Do not load points on facades smaller than       4,0 €         ✓ Load only the point with the loudest level per facade |                    |             |        |
| Colored scale                                                                                                            |                    |             |        |
| Colored scale1                                                                                                           |                    | ▼ >>        |        |
| Legend                                                                                                                   |                    |             | OK     |
| Legend1                                                                                                                  |                    | <b>▼</b> >> | Cancel |
| Complete                                                                                                                 |                    |             | Help   |

Select the time slice to be displayed (day, night ...) and choose for which floors the Façade Noise Map shall be drawn. You can select a particular floor, the maximum / minimum level per receiver or the top floor of each building. These settings are valid in the site map; in the 3D-view all floors are presented.

The noise assessment used in the calculation is needed in order to display receivers with conflicts (depending on the setting in the object-type Facade Noise Map) and for the conflict map of receivers with limits violations. In the field **CONFLICT FROM**, select the threshold noise level from which all receivers are to be counted as conflict receivers. For example, a value of -5 dB will count receivers as having a conflict even if the noise level is 5 dB below the noise limit.

In "load options," select if receivers representing a section of the facade smaller than xx meters shall be loaded. Suppressing very small facade sections will increase the readability of the map. If the calculation settings enabled multiple receivers per façade, it is possible to suppress all but the receiver with the highest noise level per facade (LOAD ONLY THE POINT WITH THE HIGHEST LEVEL PER FAÇADE).

Use the double arrow to process the scale at this time or accept the default settings and customize the scale later by requesting "edit content" via the right mouse menu. Customizing scales is described on page 492.

Click OK to return to the graphics display.



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Presentation of the Facade Noise Map

### Load Spreadsheet as Facade Noise Map

| Boolean column for identification as conflict poin    | ıt                                 |        |  |  |  |  |
|-------------------------------------------------------|------------------------------------|--------|--|--|--|--|
| 🗹 use                                                 |                                    |        |  |  |  |  |
| Select column                                         | 24: Claim for noise protection day | ~      |  |  |  |  |
| Text column for own texts in the facade points        |                                    |        |  |  |  |  |
| Select column                                         | 21: SW                             | ~      |  |  |  |  |
| Text column for text in the building reference points |                                    |        |  |  |  |  |
| Select column                                         | 30: Identifier                     | $\sim$ |  |  |  |  |

When a Spreadsheet is loaded as a Facade Noise Map, three additional parameters can be entered. A column with Boolean values can be loaded as **BOOLEAN COLUMN FOR IDENTIFICATION AS CONFLICT POINT**. This column will be used instead of the noise level to determine if a receiver has a conflict. The conflict can also be made dependent on a column of the spreadsheet containing the information of "significant increase" of noise levels. Use the **TEXT COLUMN FOR OWN TEXTS IN THE FAÇADE POINTS** to insert your own text for the facade points. All text columns present in the Spreadsheet are offered as an option. In the object type Facade Noise Map, select the text "selected column from spreadsheet". You can also assign own texts to the building reference points (**TEXT COLUMN FOR TEXT IN THE BUILDING REFERENCE POINTS**).

The load options are omitted because potential filters (receivers on facades smaller than x meters) are already executed in the Spreadsheet.

#### Show results for individual groups

For Façade Noise Maps select from the selection list, whether you want to display the sum level or an individual group. For a Spreadsheet receiver table, select the appropriate column from the level column selection list.

### Difference Facade Noise Maps

Difference maps and other mathematical calculations are created using the file type Façade Noise Map Operations. (see "<u>File Operations</u> (page 605)").

Presentation of the Facade Noise Map

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| <b>Object Type Facad</b> | le Noise Map |
|--------------------------|--------------|
|--------------------------|--------------|

| 🛎 🗉 🖻 🗙 🗙 🎺 🤧                                                                                      | 🎯 DIN                                                                                                                      |                  | Reference length scale 1: | 1000        |
|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------|---------------------------|-------------|
| igns and symbols                                                                                   | Base settings Cartography                                                                                                  | 3D graphics      |                           |             |
| <ul> <li>Results</li> </ul>                                                                        | Facade Noise Map                                                                                                           |                  |                           |             |
| <ul> <li>Facade Noise Map</li> <li>Facade point</li> </ul>                                         | show                                                                                                                       | Draw sequence    | 25                        |             |
| <ul> <li>Facade point with conflict</li> <li>Free field point</li> </ul>                           | Name                                                                                                                       | Facade Noise Map |                           |             |
| <ul> <li>Free field point with conflict</li> <li>Facade with conflict</li> </ul>                   | Legend text                                                                                                                |                  |                           |             |
| <ul> <li>Facade with contrict</li> <li>Start marking</li> <li>Building reference points</li> </ul> | 🗹 use in legend                                                                                                            | Facade Noise Map | < >                       |             |
| > · Building reference points                                                                      | Layout Round mode mathematical Text show Level Options Use scale colors fill buildings with scale fill only buildings with | th conflict      | 1 🐡                       |             |
|                                                                                                    | show only facades                                                                                                          |                  |                           | Apply<br>OK |
|                                                                                                    |                                                                                                                            |                  |                           | Cancel      |
|                                                                                                    |                                                                                                                            |                  |                           | Help        |

Various options are available for the Facade Noise Map layout. The default setting displays all receivers as hexagons filled with a color from the color scale. Receivers exceeding the noise limit have a black border. You can customize these setting to suit your needs.

In order to use the same values in the table type printout as in the graphics, the noise values can be rounded the same way:

normal round up truncate RLS-90

The rounding is always done for the decimal position requested.

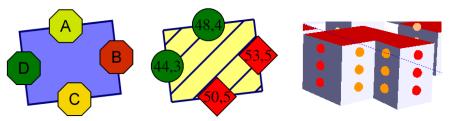
In addition to, or instead of the color coding, the values can be presented as a text for example to get a reference between spreadsheet and graphics:

- Level value
- Conflict value
- Scale interval number (for example, for noise level zones)
- Serial number (automatically generated at run time)
- Object number (defined in the Geo-Database)
- Facade identifier (only for calculation type Facade Noise Map)
- Selected column from the Spreadsheet

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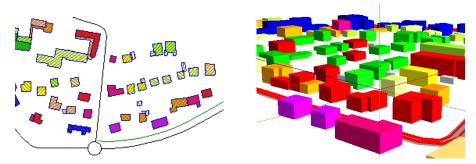
The following options are also available:

**USE SCALE COLORS** defines if symbols on the facade are to be drawn in scale color as shown in the left example, or in a color of a Facade Sub Object (Facade Receiver, Conflict-Facade Receiver, Free Field Receiver and Conflict-Free Field Receiver) as shown in the middle example. The last example shows Façade Receivers in the 3D-Graphics.

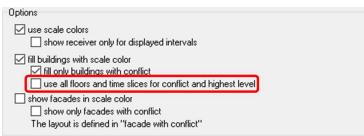


If you selected a "closed" scale type (the lowest interval is not used), you can prevent the receiver symbols below the lower end of the scale from being drawn.

**FILL BUILDINGS IN SCALE COLOR** fills buildings with the color representing the highest noise level found on the facade of this building. This display variant is especially helpful for zoom factors where the individual façade points are no longer visible. In 3D-Graphics the buildings are also filled in the scale color instead of the color assigned to the object type buildings.



If you want to show the buildings in scale color, you can additionally search for conflicts amongst all floors of the building and for all time slots.

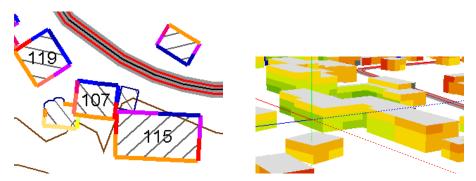




It can also be useful to have **FACADES FILLED IN SCALE COLOR** if you want to show individual facades of floors exceeding the noise limits.

Presentation of the Facade Noise Map

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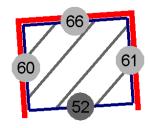
The layout of the color bars (width and distance from the facade) is determined by the sub-type "Facade with noise level exceeded." As there is a display conflict between the modes "Show facades with scale color" and "Show only facades with conflict," only one of the settings can be active at a time. Deactivate one before selecting the other.

Hint: if facades or buildings are not filled with the scale color even if selected in the object types use <u>Reset building IDs</u> (page 355) in the Calculation Kernel.

The receivers are separated into **FACADE POINTS, CONFLICT-FACADE POINTS, FREE FIELD POINTS** and **CONFLICT-FREE FIELD POINTS** so you can give the different receivers a different layout. In the sub object types for the facade and free field points you define:

- Show yes/no
- Symbol and symbol size
- Fill color, if not determined by the scale color
- Show border line and border color

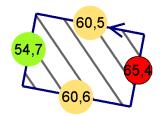
If you select **FACADE WITH CONFLICT**, all facades and floors with a conflict in the assigned time slot will be highlighted by a bar using your choice of color, line thickness and spacing. Under the Cartography tab, customize line joints and line endings. You can also extend the conflict facade to cover all floors and all time slots.



The sub-object type **START MARKER** (via a small arrow) shows the entry direction of the corners of the building and marks the first corner. This reference makes it easier to understand the tabular form of the grid noise map. The receiver names

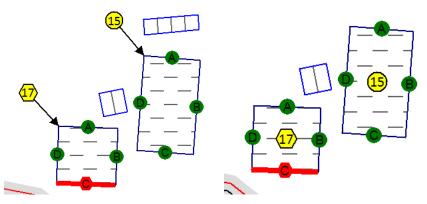
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are generated sequentially in the data entry direction starting with the first receiver, "A."



Create difference maps and other arithmetic operations using the file type "Façade Noise Map Operations", see "<u>File Operations</u>" on page 605.

For the presentation you can present the object number of the processed building as a **building reference** in addition to the receiver points.



In the map object types of the Facade Noise Map activate the sub-object-type **BUILDING REFERENCE POINT**.

| Results     Facade Noise Map     Facade point     Facade point with conflict     Free field point with conflict     Facade with conflict     Facade with conflict     Start marking     Building reference point     Building reference point | Name<br>Legendentext<br>I in Legende verwenden       | Building reference points                                                  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------|
|                                                                                                                                                                                                                                               | Options<br>Position<br>I show arrow to building edge | Font size assigned to reference point<br>inside building<br>Distance  10.0 |
|                                                                                                                                                                                                                                               | Line from building to point<br>Width                 | 0.2 Color                                                                  |

Select the position of the reference point:



| P | osition of anchor point                                                                                   |   |
|---|-----------------------------------------------------------------------------------------------------------|---|
|   | Wall corner of the loudest facade of the selected time slice $\sim$                                       |   |
|   | inside building<br>Wall corner of first facade                                                            | Ľ |
|   | Wall corner of the loudest facade of the selected time slice                                              |   |
| Ρ | loudest point of the selected time slice                                                                  |   |
|   | loudest point of the selected time slice<br>Wall corner of the quietest facade of the selected time slice |   |
|   | quietest point of the selected time slice                                                                 |   |

For the selections, where the anchor point is positioned at the **WALL CORNER**, you can enter a **DISPLACEMENT ALONG THE FAÇADE** in [mm]. If the movement of an anchor point is longer than half the length of the facade, the anchor point will be placed in the middle of the façade.

With the selection **WITHIN BUILDING** the connection line will only be drawn if the reference point lays outside the building. The angle in this mode is to be entered counter clockwise with the x-axis being the zero angle. For the other options the angle is measured between the connection line and the facade.

Moving the anchor point along the facade or the distance between anchor point and reference point or a change in the angle are all not directly effecting the manual selections. To reset all the Facade Noise Map needs to be removed from the file selection of the map.

Manuel moves:

The selected mode has only limited influence upon the manual customization of anchor and reference points.

For the selection **WITHIN BUILDINGS** an anchor point can be moved freely within the building. The reference point remains in place.

All other modes are only default settings. If all facades are calculated, the anchor point can be only moved along the perimeter of the building (this is so the anchor point for the selection **LOUDEST/QUIETEST FACADE/FACADE RECEIVER** can be moved to a different part of the facade!).

The reference point always is moved too. When you move to the starting point of the next facade element, the location of the reference point is calculated depending on the selected angle. The preset distance is used.

Always position the anchor point correctly before moving the reference point to its final location.

The building corner can be marked with an **ARROW**. The building reference point can be drawn in different ways depending on the sub object type for buildings with / without noise limit violation.

**Hint:** A building is marked with the conflict building reference point as soon as the limit is exceeded in one time slice or one floor. Activate **ALL TIME SLICES** and **ALL FLOORS** in the sub object type "façade with conflict" so that the building reference point and the labeling as conflict facade correspond.

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Via the delivered template "Spreadsheet with building reference.ntt" for the spreadsheet you can connect the graphical presentation to the receivers in the table.

| Facade         | Station         | Dir | Floor    | Usage | Lii      | Limit             |          | Prognosis     |            | dance      |
|----------------|-----------------|-----|----------|-------|----------|-------------------|----------|---------------|------------|------------|
|                |                 |     |          |       | Day      | Night             | Day      | Night         | Day        | Night      |
|                | km              |     |          |       | in d     | in dB(A) in dB(A) |          | dB(A) in dB(A |            | B(A)       |
| 3              | 4               | 5   | 6        | 7     | 8        | 9                 | 10       | 11            | 12         | 13         |
| ObjNo.: 42     |                 |     |          |       |          |                   |          |               |            |            |
| 0.0]. 140      | 74              |     |          |       |          |                   |          |               |            |            |
| Jamaica R      |                 |     |          |       |          |                   |          |               |            |            |
|                |                 | N   | EG       | GR    | 59       | 49                | 65       | 55            | 6,0        | 5,6        |
| Jamaica R      | oad 27          | N   | EG<br>EG |       | 59<br>59 | 49<br>49          | 65<br>67 | 55<br>57      | 6,0<br>7,7 | 5,6<br>7,1 |
| Jamaica R<br>A | oad 27<br>0+769 |     |          | GR    |          |                   |          |               |            | -          |

# Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

The following calculation results can be displayed as level tables, RLS-90 symbols or Austrian planning guideline:

- Single point receivers
- Façade Noise Map
- Spreadsheet tables (receiver tables)

### File selection of level tables / RLS-90 symbols

After selecting the calculation results, additional parameters are requested for layout and display details.

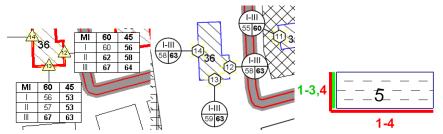
| vel tables / RLS 90 symbo  | l map                         |          | 2      |
|----------------------------|-------------------------------|----------|--------|
| Layout                     | Level tables                  | <b>_</b> |        |
| )ptions                    |                               |          |        |
| 🔲 Set in box               |                               |          |        |
| Distance between reference | point and results point:      | 10,0 🚖   |        |
| Distance between facade ar | d reference point:            | 0,0 🚖    |        |
| 🔲 use positions of file    |                               |          |        |
| oad options                |                               |          |        |
| Do not load points on fac  |                               | 1,0 👤    |        |
|                            | he loudest level per facade   |          |        |
| Load only the point with t | he loudest level per building |          |        |
| egend                      |                               |          | ОК     |
| new                        |                               | ▼ >>     | Cancel |
| 🔽 complete                 |                               |          | Help   |

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Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

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Select the layout from the layout list. The layout can be customized later in the object type level tables/RLS-90 symbols.

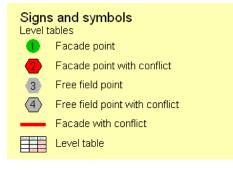


From left to right: Level tables, RLS-90 symbols, noise control measures Austria

In the map, you can attach the level tables and the RLS-90 symbols directly to the facades, or they can be located in a **RESULT BOX** where a reference point is placed at the facade or in a defined space in front of it. The result box is then detached from the facade.

To make the map more readable, use **LOAD OPTIONS** to reduce the number of result points presented so the information won't overlap. This is especially useful for Façade Noise Maps in order to have readable texts without manually adjusting them in "Edit Map Contents".

The symbols of the result presentation are included in the symbol explanation. A new legend can be used to house the explanations, but it is also possible to include them in the existing legend.



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Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

### Load spreadsheet as a level table/RLS-90 symbols

| Select columns                           |                                |        |
|------------------------------------------|--------------------------------|--------|
| 1. level column                          | 13: Sum level LrD [dB(A)]      | $\sim$ |
| 1. limit column                          | 11: Limit Lim,D [dB(A)]        | $\sim$ |
| Number of time slices                    | 2                              |        |
| Boolean columns for the identification a | as conflict                    |        |
| 🗹 use                                    |                                |        |
| 1. Boolean column                        | 19: Claim for noise protection | $\sim$ |
| Text column for own texts in the facad   | e points                       |        |
| Select column                            | 20: Contribution road noise    | $\sim$ |

When you load a SoundPLAN spreadsheet as a level table/RLS-90 symbol, additional parameters are required. Enter the first level column and the first noise limit column. The spreadsheet can contain multiple sets of answers, so carefully choose the variant you want displayed.

For example, if a façade shall be colored to show the noise limit exceeded or possible subsidies for noise control windows, you can substitute the columns of the noise limit with Boolean columns from the spreadsheet (true = color marking). Check mark use and select the first Boolean column. There must be as many successive level columns as time slices used in the calculation. If there are not as many, only the time slices with a corresponding reference column can be presented.

Use the **TEXT COLUMN FOR OWN TEXTS IN THE FAÇADE POINTS** to amend the reference points with a user defined text. All text columns are presented. In the object type level tables/RLS-90 symbols, select the key for the reference point with "Identification with the selected column of the spreadsheet".

The load operations are obsolete here because the filter (receivers on facades smaller than x...) has already been defined in the spreadsheet.

Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

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| Map object types Diject types Edit Settings Extra Help                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                             |               | <u> </u>                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                             | Reference ler | gth scal 750                                                                                                                               |
| Signs and symbols     General objects     Fraffic sources     Environment     Freceivers     Frecults     Frecede point     Frecede point     Frecede point     Freceld     Freceld point     Freceld     Freceld     Freceld p | Base settings Cartography  <br>Level tables / RLS 30 symbol<br>Show<br>Name<br>Legend text<br>Layout<br>Level tables<br>Reference Result<br>show all references<br>Key<br>identification by serial 1<br>identification by a sele<br>-Line from facade to point<br>Vicith | s Draw sequence Level tables / RLS 90 symbols Level tables / RLS 90 symbols | 23 👮          | WA         59         49           1         57,3         49,8           2         58,3         50,8           3         59,3         51,8 |

### **Object Type Level Table/RLS-90 Symbols**

Because there are so many options available, the layout can have so many different variations that it is not practical to discuss all the options and combinations. Modifications in the definition of the object type can always be seen in the preview picture. Use trial and error to determine what best fits your needs.

The **REFERENCE POINTS** are the link between the graphics and the table, respectively the result box of the graphics. The layout of the reference points is divided into the sub-types facade point, free field point, conflict faced point, and conflict free field point.

You can display all reference points or only those showing the noise level violations.

The reference is identified via a **KEY** entered as a text for each reference point.

- continuous number (generated automatically during calculations)
- object number (defined in the Geo-Database)
- house number and facade marking
- selected text columns of the spreadsheet

If the results shall be presented directly in the map or the line between results and result box is desired, the line between **FACADE AND RECEIVER** determines the line between the reference point and the results.

Under the tab "results," select if you want to display all results or only those with conflicts (noise limit violations). In order to maintain compatibility between the documentation and the graphics, it is possible to round the results the same way:

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Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

- normal
- rounded up
- truncated
- RLS-90

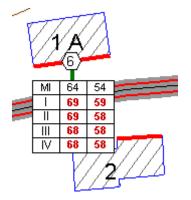
Rounding is always done to the number of decimal slots selected.

The reference points are divided into **FACADE NOISE LEVELS, CONFLICT-FACADE POINTS, FREE FIELD POINTS** and **CONFLICT-FREE FIELD POINTS** so you can customize the layout for different points and treat them individually. In the sub object types for the facade and the free field points, you select:

- draw yes/no
- drawing symbol and symbol size
- fill color
- border lines draw/suppress and if selected the border color

Use the sub-type **FACADES WITH CONFLICT** to highlight the facades with a special color when the noise level of the receiver exceeds the noise limit defined for that type receiver. Use the file type "façade noise map" to limit the façade marker to display only a single time slot and a single selected floor.

Define the bar color and width, and if needed, the displacement between the bar and the façade. Under the *Cartography* tab, line connections and endings can be further configured.

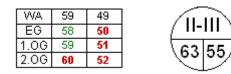


The sub-object types level tables and RLS-90 symbols are split into the tabs for layout and content + fonts. These sub-object types are easily distinguished due to their different components.

The **MINIMUM NUMBER OF FLOORS** in the level table displays the number of floors selected in "set floors" even if the building has fewer floors. This setting is only sensible for keeping an entire row of result tables the same shape.

Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

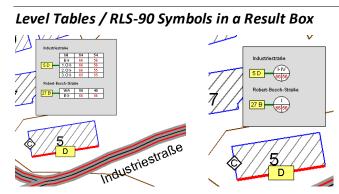
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For RLS-90 symbols, the top unit shows which floor exceeds the limit, and the bottom units show the highest level at the receiver during the day and night. If the top unit is empty, no level violations were found at the receiver.

Activate the boxes under the tab *Content and fonts* to select the content. The level with noise level violation cannot be deactivated. Use the double arrow to open the text layout and configure the fonts.

Modifications in the settings are immediately visible in the preview picture.



When loading, determine if the results shall be presented in a result box. If so, only the facade will show the reference point. To show only selected receiver positions in the box, delete the appropriate lines in the table (double click or use the right mouse button ->EDIT content) using delete line.

Reference point and results are referenced with the key you selected in the main object type. Choosing "Identification via house number and facade marker" amends the reference point with the facade identifier and the result box with the house number and facade identifier. The switch **side by side** determines if house number and facade identification shall be drawn side by side or below each other in the reference point. Depending on the selection, you may have to customize the symbol for the reference point (change height ratio to width or select a different symbol) under the cartography tab.

### Layout Result Box

Use the cog wheel to define the spacing and relative positioning, and to determine if the header shall be generated from the street name or the receiver name. If the reference point or the results in the box are too large or too small, correct the box with a factor the size selected in the object types.

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Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

| Level tables / RLS 90 symbols        |                  |          | ×               |
|--------------------------------------|------------------|----------|-----------------|
| Distance between reference point and | f results point: | 5,0      | \$              |
| Size factor for the reference points |                  | 1,00     | \$              |
| Size factor for the result           |                  | 1,00     | \$              |
| Minimum floor number                 |                  | 0        | \$              |
| Distance between                     |                  |          |                 |
| Rows 3,0 🚖                           | Columns          | 2,0      | \$              |
| Order                                |                  |          |                 |
| horizontal                           | O vertical       |          |                 |
| Alignment of result points           |                  |          |                 |
| ◯ Left                               | ○ Тор            | C Bottom |                 |
| Additional identification features   |                  |          | Save as default |
| 🔽 create headlines                   |                  |          | ОК              |
| <ul> <li>from road names</li> </ul>  |                  |          | Cancel          |
| from receiver name                   |                  |          | Help            |

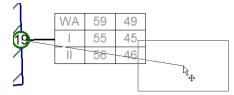
Headers generated from street or receiver names are always inserted in front of the first receiver for which the reference fits. The header lines structure the result box.

Select **STORE AS STANDARD** if you always want this layout.

### **Move Results**

Use "Edit map content," to move the results to a new location. Activate **MOVE TABLES** "*RESULT FILE*".*RES*.

When the cursor nears one of the results, it changes from a + to an arrow. Use the arrow cursor with the left mouse button pressed to move the table or symbol.



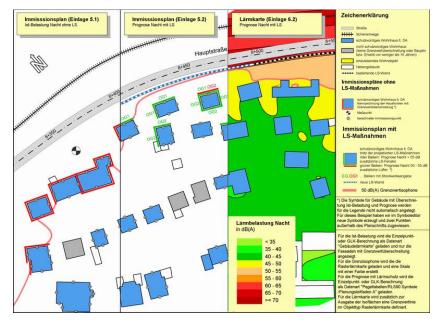
SoundPLAN remembers the new position. If you load another result file in the same map, you can decide if you want to keep the result positioning from file xxx.

### Planning Guideline Austria

According to the "Planungsleitfaden" (planning guideline) for noise control, the excessive noise limit must be mapped for the time slot night. For the display, the assessment standard expects two time slices (Lden and Lnight) of which SoundPLAN automatically selects the second one.

Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

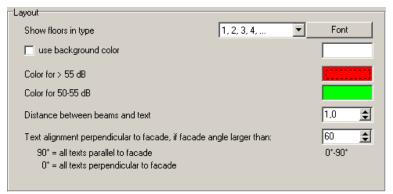
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Load the status quo of the current situation (either as single receivers or as a Facade Noise Map) for the time slot LrN and have the program display only the facades currently exceeding the noise limit (map-object types -> Façade Noise Map -> activate facades with noise limit violation and select the appropriate time slice.)

For the border contour line to show, the appropriate grid noise map must be loaded. In the map-object types /object type Grid Noise Map, deactivate the main interval and activate the border contour line.

To present the noise immission map for the prognosis, load the single receivers or the Facade Noise Map via the file type **LEVEL TABLES / RLS 90 SYMBOLS**. Select **NOISE CONTROL MEASURES (AUSTRIA)** from the options. Customize the presentation layout as usual in the object types.



For the two bars, the color, width and spacing to the facade is defined in sub-object types "Beam 50-55 dB" and "Beam >55 dB".

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Presentation as Level Tables, RLS-90 Symbols, Planning Guideline Austria

For the prognosis noise map, the object type Grid Noise Map must have the border contour line activated and the value and color must be set.

# o Presentation as Receiver flags

Use small flags at the receiver points to present any content of a receiver table (Spreadsheet) in a map. In contrary to the level tables, that only present the level values per receiver, you can flexibly display all desired information.

The below extract from the spreadsheet and the resulting receiver flag explain the relationship:

| 31                                 | 24             | 12   | 28    | 29         | 16       | 17       | 22                            | 23        | 25                     | 26       |
|------------------------------------|----------------|------|-------|------------|----------|----------|-------------------------------|-----------|------------------------|----------|
| Object                             |                |      |       |            | Le       | vel      | Excee                         | dance     | Display in             |          |
| number                             | Floor          | Dir. | SA    | H I-A      | LrD      | LrN      | day                           | night     | Graphics               | Conflict |
|                                    |                |      | [m]   | [m]        | [dE      | B(A)]    | [dE                           | B(A)]     |                        |          |
| Oak Street 15 GR                   |                |      |       |            |          |          |                               |           |                        |          |
| Limit, D/N: 59 /                   | / 49 dB(A)     |      |       |            |          |          |                               |           |                        |          |
| 1                                  | 1              | NW   | 23,30 | 2,57       | 64,4     | 56,7     | 5,4                           | 7,8       |                        | Х        |
| 1                                  | 2              | NW   | 23,30 | 5,37       | 65,4     | 57,7     | 6,4                           | 8,8       | X                      | Х        |
| 2                                  | 1              | NO   | 27,66 | 2,17       | 60,0     | 52,3     | 1,1                           | 3,4       |                        | Х        |
| 2                                  | 2              | NO   | 27.66 | 4.97       | 61.6     | 53.9     | 2.6                           | 4.9       |                        | Х        |
| 3                                  | 1              | SO   | 34.37 | 2.49       | 49.2     | 41.2     | -                             | -         |                        |          |
| 3                                  | 2              | SO   | 34,37 | 5,29       | 50,6     | 42,5     | -                             | -         |                        |          |
| 4                                  | 1              | SW   | 29,98 | 2,85       | 60,5     | 52,9     | 1,6                           |           |                        | X        |
| 4                                  | 2              | SW   | 29,98 | 5,65       | 61,2     | 53,5     | 2,2                           | 4,5       |                        | Х        |
|                                    | Oak 3<br>Limit |      |       | V 49 dB(A) | FIN:     | in the S | opreadshe                     |           | iined≁<br>e-column-set | 1        |
| 1 64,4 56,7 5,4<br>2 65,4 57,7 6,4 |                |      |       |            | ,8<br>.2 | Data-ro  | ow-from-ti                    | he-Spread | sheet¶                 |          |
|                                    |                |      |       |            |          |          |                               |           |                        |          |
|                                    |                |      |       |            |          |          | ict facade po<br>point with B |           |                        |          |

The receiver flags are connected with a reference line to the receiver point in the map. With Boolean (logical) columns generated in the spreadsheet you define which receiver points shall be represented with receiver flags and which points and facades shall be marked as conflicts (columns 25 and 26 in the table above). Apart from the any column you can also display structured rows you have defined in the spreadsheet.

columns in the Spreadsheet¶ Layout definition in the map object types¶

The columns and headers are stored separately in so called column combinations in the table so that the tabular format and the graphical display as receiver flag can come from the same spreadsheet with completely different layout and contents.

**Presentation as Receiver flags** 

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### Olumn combinations and file type selection

Select the file type **RECEIVER FLAGS** in the Graphics file selection manager, you will see a dialog for the selection of the columns to be displayed.

| Colur      | nn combinations for graphics              |             |           |              |          |
|------------|-------------------------------------------|-------------|-----------|--------------|----------|
| Name       |                                           |             |           |              |          |
|            | and exceedance                            |             |           | >> +         |          |
| Callings   |                                           |             |           |              | _        |
| Settings   | for text in reference points              | 21, 01,     |           | -            |          |
|            |                                           | 31: Object  |           | ſ            | <u> </u> |
|            | , in which conflict points are defined    | 26: Conflic | :t        |              | ~        |
| Column     | , in which the points to show are defined | 25: Display | y in Grap | phics        | ~        |
| Header     | type                                      | short head  | ler       |              | ~        |
| 🗹 sho      | w structured header lines                 |             |           |              | _        |
| sho        | w structured footer lines                 |             |           |              |          |
| -Select co | shumas                                    |             |           |              |          |
|            | w all columns                             |             |           |              |          |
| -          | w only visible columns                    |             |           |              |          |
|            | w only selected columns                   |             |           |              |          |
| Col.       | Name                                      |             | Show      | Short header |          |
| 6          | Floor                                     |             | •         | SW           | 1        |
| 16         | Level LrD [dB(A)]                         |             | •         | LrT          |          |
| 17         | Level LrN [dB(A)]                         |             | ~         | LrN          |          |
| 22         | Exceedance day [dB(A)]                    |             | ~         | Diff T       |          |
| 23         | Exceedance night [dB(A)]                  |             | ~         | Diff N       |          |
|            |                                           |             |           |              |          |
|            |                                           | ОК          |           | Cancel Hel   | p        |

Select the column that contains the **TEXT IN REFERENCE POINTS**. This can be a text or integer column from the spreadsheet. Whether the text is shown in the Graphics however depends on your definitions for the receiver flags in the object types. Select the Boolean columns for marking it as a **CONFLICT POINT** and for marking **POINTS TO B DISPLAYED IN THE GRAPHICS** (both columns can be the same).

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| 31                               | 24             | 12   | 28    | 29    | 16   | 17   | 22         | 23    | 25         | 26       |
|----------------------------------|----------------|------|-------|-------|------|------|------------|-------|------------|----------|
| Object                           |                |      |       |       | Le   | vel  | Exceedance |       | Display in |          |
| number                           | Floor          | Dir. | SA    | H I-A | LrD  | LrN  | day        | night | Graphics   | Conflict |
|                                  |                |      | [m]   | [m]   | [dB  | (A)] | [dB        | (A)]  |            |          |
| Oak Street 13                    | GR             |      |       |       |      |      |            |       |            |          |
| Limit,D/N: 59 /                  | 49 dB(A)       |      |       |       |      |      |            |       |            |          |
| 26                               | 1              | N    | 37,38 | 1,98  | 55,8 | 46,2 | -          | -     | Х          |          |
| 26                               | 2              | N    | 37,38 | 4,78  | 58,7 | 49,0 | -          | -     | X          |          |
| 26                               | 1              | 0    | 42,34 | 1,66  | 57,8 | 47,6 | -          | -     |            |          |
| 26                               | 2              | 0    | 42.34 | 4.46  | 58.9 | 48.8 | -          | -     |            |          |
| 26                               | 1              | S    | 46.43 | 2.01  | 56.0 | 46.0 | -          | -     |            |          |
| 26                               | 2              | S    | 46,43 | 4,81  | 48,8 | 48,9 | -          | -     |            |          |
| 26                               | 1              | W    | 41,38 | 2,29  | 54,9 | 45,3 | -          | -     |            |          |
| 26                               | 2              | w    | 41,38 | 5,09  | 58,2 | 48,5 | -          | -     |            |          |
| Oak Street 14<br>Limit,D/N: 59 / | GR<br>49 dB(A) |      |       |       |      |      |            |       |            |          |
| 2                                | 1              | N    | 31,40 | 2,14  | 58,9 | 49,3 | -          | 0,4   | X          | X        |
| 2                                | 2              | N    | 31,40 | 4,94  | 60,5 | 50,9 | 1,5        | 2,0   | X          | X        |
| 2                                | 3              | N    | 31,40 | 7,74  | 61,3 | 51,7 | 2,4        | 2,8   | Х          | X        |
| 2                                | 1              | 0    | 38.13 | 2.00  | 54.4 | 44.6 | -          | -     |            |          |
| 2                                | 2              | 0    | 38,13 | 4,80  | 55,4 | 45,6 | -          | -     |            |          |
| 2                                | 3              | 0    | 38,13 | 7,60  | 57,9 | 48,2 | -          | -     |            |          |
| 2                                | 1              | S    | 43,16 | 2,27  | 53,3 | 43,4 | -          | -     |            |          |
| 2                                | 2              | S    | 43,16 | 5,07  | 54,7 | 44,9 | -          | -     |            |          |
| 2                                | 3              | S    | 43,16 | 7,87  | 57,5 | 47,7 | -          | -     |            |          |
| 2                                | 1              | W    | 36,27 | 2,39  | 57,1 | 47,6 | -          | -     |            |          |
| 2                                | 2              | W    | 36,27 | 5,19  | 58,7 | 49.3 | -          | 0,3   |            | Х        |
| 2                                | 3              | W    | 36.27 | 7.99  | 59.9 | 50.4 | 0.9        | 1.4   |            | Х        |

In the table above, Boolean columns have been generated for the selection of the conflict and for the display in the graphics. This way you can for example present a level table for the loudest receiver on a building and mark additional ones that generate conflict receivers and conflict facades.

Choose the **HEADER TYPE** for the column combination. You can select to use the column headers from the SoundPLAN Spreadsheet or define your own short title.

If **STRUCTURE LINES** (block beginning and/or block end) are contained in the spreadsheet, you can select if you want to display them in the small tables.

**SELECT COLUMNS:** Now select the columns that shall be visible. By default, all columns visible in the spreadsheet are marked visible here. If desired enter a short header if you want to have a different text (one line) than the header from the spreadsheet, which can have multiple lines.

Is there a column missing, you want to display? Then switch to **SHOW ALL COLUMNS**. **SHOW ONLY SELECTED COLUMNS** gives you a better overview if there are columns already selected.

Further compilations of this table you can generate by clicking on the + sign next to the column combination name. The name must be unique. Column combinations no longer in use are deleted with the - sign. With >> change the name of the column combination. If you change a name to a column combination that is already in use in a sheet, the connection to this column combination will be lost however!

| Name                  |      |
|-----------------------|------|
| Levels and exceedance | >> + |
|                       |      |



### Ø Result request for receiver flags in the file selection

After selecting the spreadsheet and defining the column combination, additional parameters for the presentation are requested:

| C Receiver flags                                      |                  |
|-------------------------------------------------------|------------------|
| Select column set                                     |                  |
| Levels and differences                                | ✓ >>             |
| Distance between receiver point and reference point   | 0,0 🖨            |
| Distance between reference point and center of tables | 10,0 🚖           |
| Header type                                           | short header 🛛 🔽 |
| ✓ optimize column with                                |                  |
| show structured header rows                           |                  |
| show structured footer rows                           |                  |
| use positions of file                                 |                  |
| ОК                                                    | Cancel Help      |

Define the **DISTANCE BETWEEN THE RECEIVER AND THE REFERENCE POINT** and the **DISTANCE BETWEEN THE REFERENCE POINT AND THE MIDDLE OF THE TABLE**. The reference points can later be moved in "Edit map".



Both distances "facade - reference point" and "reference point - receiver flag" are connected with a line, the layout of the line can be further defined in the map object types.

The type of header and whether structure lines are used or not, is taken from the column combinations but can be modified in the current sheet.

**OPTIMIZE COLUMN ZIZES** fits the width of the columns to the longest text present. Structure lines are not used in the calculation of the table width, if they are longer than the table allows, they are truncated.

### Object type receiver flags

The layout of the receiver flags is set in the object setup under the tabs "general" and "table layout".

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| leceiver Ilags<br>- Facade point<br>- Facade point with conflict<br>- Free field point<br>- Free field point with conflict<br>- Facade with conflict |  | General Table layout Table background colors Use for header rows: Use for structured header Use for structured header Use for structured footer |       |       |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|--|--|--|
|                                                                                                                                                      |  | Table edge line<br>Width<br>Table lines<br>Lines between columns<br>only Spreadsheet definition                                                 | 0.3 🕃 | Color |  |  |  |
|                                                                                                                                                      |  | Width                                                                                                                                           | 0,2 🕃 | Color |  |  |  |

As the test size from the spreadsheet may be too big for the display in the graphics, you have a **SIZE FACTOR** to your disposal to scale the texts up and down without having to redo the table itself.

If you only want to use the receiver flags to mark individual receivers specially, you can deactivate the receiver flags with the switch **SHOW TABLES**.

Use the switch ONLY SHOW TABLES THAT ARE MARKED IN THE BOOLAN "PRESENT" COLUMN, in order to show the receiver flags for all receivers contained in the spreadsheet.

With **SHOW ONLY FLOORS WITH CONFLICT** you can set to print only table lines with a conflict or for all floors as soon as that location on the building shows a conflict in any of the floors.

| Name          | FI. | L w/o NP, | D/N | L w NP, | D/N |   |               |     |             |    |         |     |
|---------------|-----|-----------|-----|---------|-----|---|---------------|-----|-------------|----|---------|-----|
| Oak Street 34 | 1   | 59        | 56  | 49      | 45  |   |               |     |             |    |         |     |
|               | 2   | 59        | 55  | 52      | 49  |   | Name          | Fľ. | L w/o NP, D | /N | L w NP, | D/N |
|               | 3   | 60        | 56  | 55      | 53  |   | Oak Street 34 | 3   | 60          | 56 | 55      | 53  |
|               |     |           |     |         | 1   | 7 |               |     |             |    |         |     |

A checkmark in front of **SHOW TEXTS IN REFERENCE POINT** prints the text from the column you have defined in the column combinations. Font and color and size are also defined here.

Define the **WIDTH** and **COLOR** of the connection line between the facade and the table. In case the reference point was moved from the façade, both parts are displayed the same way.

Under the tab *Table layout* select background colors for the headers, the structure and data lines. They are administered independently from the spreadsheet.

**Presentation as Receiver flags** 

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| General Table layout        |                          |                           |  |  |  |
|-----------------------------|--------------------------|---------------------------|--|--|--|
| Table background colors     |                          |                           |  |  |  |
| Use for header rows:        |                          | Use for data rows:        |  |  |  |
| 🔽 Use for structured header | Structured header on top |                           |  |  |  |
| Use for structured footer   |                          |                           |  |  |  |
| Table edge line             |                          |                           |  |  |  |
| Width                       | 0,3 🕃                    | Color                     |  |  |  |
| Table lines                 |                          |                           |  |  |  |
| Lines between columns       |                          |                           |  |  |  |
| only Spreadsheet definition | ~                        | 🗹 show lines between rows |  |  |  |
| Width                       | 0,2 🖨                    | Color                     |  |  |  |
|                             |                          |                           |  |  |  |

Click on the checkbox in front of the line types in order to make a selection of colors valid. The color then can be different in the graphics from the colors in the spreadsheet. If the checkbox is unchecked, the colors from the spreadsheet are used. Structure lines can either be placed under the header from the spreadsheet or the column combination or on top.

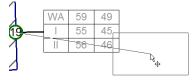
Often the lines between the time slice columns are switched off in the Spreadsheet. Therefore, you can define the **TABLE LINES** in the object types. You can select, whether you want to keep the settings from the Spreadsheet (then only lines between rows can be additionally displayed), display lines from the object type definition additionally to the settings from the Spreadsheet or completely ignore the settings from the Spreadsheet and only use the line color and line width defined in the object types.

The TABLE EDGE LINES are always taken from the definition in the object types.

### Move the receiver flags

Individual tables can be moved under "Edit Plan". Activate **MOVE TABLE "RESULT FILE".\***.

When the cursor moves on to a table, the cross of the cursor changes into the movement arrow. With the left mouse button pressed, move the table or the symbol.



SoundPLAN remembers the position you have moved results to. When you load another result file into your plan, you can force the program to use the same

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position as was used in the result file xxx. First select the spreadsheet to be loaded (the original table must be still part of the plan), then mark the **USE THE POSITION FROM FILE xxx** and then take the original table out of the plan.

The anchor position of the line connecting the facade receivers to the receiver flags will not be moved if you press the *Ctrl* key when moving the table.

## **Presentation as Level Chart**

Level charts can be presented in the graphics when the calculation run is set for the generation of level charts. Otherwise the data for the level charts are not stored. It is possible to store level charts for:

- Single receivers
- Façade Noise Maps

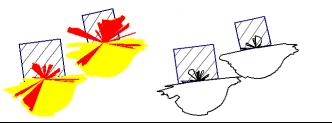
Because SoundPLAN stores all the level charts of an entire calculation run, the files can become very large, especially for Façade Noise Maps. It is therefore wise to only activate the storage when you intend to use the data later in the graphics.

### Parameters for the Level Chart

| Level chart  |            |      | X      |
|--------------|------------|------|--------|
| Select value |            |      |        |
| Level column | LrD (Day)  | •    |        |
| Floor        | T op floor | •    |        |
| Drawing type |            |      |        |
| Rays         | O Outline  |      |        |
|              |            |      |        |
|              |            |      |        |
| Legend       |            |      | ОК     |
| Legend1      |            | ▼ >> | Cancel |
| Complete     |            |      | Help   |

Select the time slot and the floor for which you want to present the level chart. **HIGHEST LEVEL** queries all receivers and shows the floor with the highest noise level for each receiver location.

Level charts can be presented as a ray diagram or as a circumference line.



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**Presentation as Level Chart** 

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You can even load the same level chart diagram file twice, perhaps to present the nighttime levels as a ray diagram and the daytime levels as an outline.

| Object type Le                                                                                                                                                                                                                                                                                                                | vel Charts                                                                                                                                                                                             |                                                                      |                           |                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------|----------------|
| Object types in project                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                        |                                                                      |                           |                |
| 🖻 🖬 🗅 X 🏈 🕭 🕅 😫                                                                                                                                                                                                                                                                                                               | DIN                                                                                                                                                                                                    |                                                                      | Reference length scale 1: | 1000           |
| Signs and symbols Signs and symbols General objects Traffic sources Stage Arrollhois objects Stage Arrollhois objects Stage Arrollhois objects Services Results Results Results Level tables / RLS 30 symbols Results Results Results Services flags Facade Noise Map Defined Noise Map Defined Noise Map Services sector map | Base settings Catography<br>Level chart<br>Show<br>Name<br>Legend text<br>Use in legend<br>Legout<br>Round mode<br>mathematical<br>Text<br>Size in (mm) for 10 dB<br>Options<br>I buildings with scale | Draw sequence Level chart Level chart  Decimal places  Background co | 21 •                      |                |
| Grid pollution map     Universal grid map     Facade map operations     Triangle operations     Grid operations                                                                                                                                                                                                               |                                                                                                                                                                                                        |                                                                      |                           | ОК             |
| Area map (Conflict map)     Contour map     Limit map                                                                                                                                                                                                                                                                         | ,                                                                                                                                                                                                      |                                                                      |                           | Cancel<br>Help |

The level values can be drawn in the middle of the diagram. To do this, activate the text and format it. The level can be displayed for the current time slice or for all time slices found in the result file.

The size of the level charts is defined by the parameter SIZE IN [MM] FOR 10 DB.

In the sub-object types total noise level, reflected noise and outline are customized with line colors and pen width.

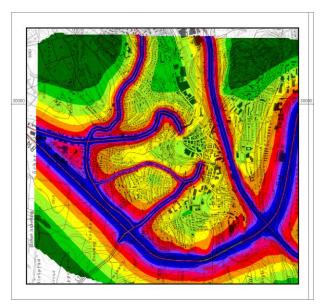
Additionally, in the sub-object type "Dimensioning" you can activate the scale rings and the dB scale.

# **Presentation of Geometry bitmaps**

Background graphics that were calibrated in the Geo-Database to be used as digitizing background can be sandwiched with other data in the SoundPLAN graphics. In the file selection, only files geo-referenced by the Geo-Database are shown (\*.grf). For this purpose, you can find geo-reference files in the project folder that contain the transformation information. The filename is the same as the graphics itself.

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**Presentation of Geometry bitmaps** 



Geometry bitmaps in the Graphics

### **Object type Geometry-bitmap**

The format options for geometry bitmaps are located in the object type setup in the branch external data -> geometry-bitmap.

| Map object types                  |               |                          |                 |         |            |            |      |
|-----------------------------------|---------------|--------------------------|-----------------|---------|------------|------------|------|
| 🖻 🛛 🖻 🗙 🎽 🤌 😫                     | •             |                          |                 | Referen | ice lengtł | n scale 1: | 5000 |
| Signs and symbols                 | Base settings | Cartography 3D gra       | aphics          |         |            |            |      |
| ⊿ - General objects               | Geometry bitr |                          |                 |         |            |            |      |
| ◊ · Fhoto point                   |               |                          |                 |         |            | D#1        |      |
| - General text                    | 📝 show        |                          |                 |         | 6          | ۲          |      |
| ▲ Traffic sources                 | Name          |                          | Geometry bitmap |         |            |            |      |
| ⊿ Railway                         | INGINE        |                          | acomony binnap  |         |            |            |      |
| Railway axis                      | Draw mode     |                          |                 |         |            |            |      |
| Emission line                     | Diaw mode     |                          |                 |         |            |            |      |
| Surface                           | normal        |                          |                 | •       |            |            | 1    |
| Bridge                            |               |                          |                 |         |            |            |      |
| Wall                              | Transparen    | nt brighter than RGB val | ue              | 255     |            |            |      |
| inside tunnels                    |               |                          |                 |         |            |            |      |
| Stationing                        | 1.1.1.1.1.1   |                          |                 |         |            |            |      |
| - Eigenschaften als Text          | Brighten      |                          |                 |         |            |            |      |
| ⊳-Road                            |               |                          |                 |         |            |            |      |
| Tunnel opening                    | Ū.            |                          |                 |         | 0          | ۲          |      |
| Environment                       | 0%            |                          |                 | 100 %   |            |            |      |
| ▷ - Buildings                     |               |                          |                 |         |            |            |      |
| ⊳·Wall                            | Contrast      |                          |                 |         |            |            |      |
| ⊳ · Wall on berm                  | D.            |                          |                 |         | 0          | ۲          |      |
| ⊳·Berm                            | 0%            |                          |                 |         | ·          | œ          |      |
| Ridge                             | 0%            |                          |                 | 100 %   |            |            |      |
| - Objects in industrial buildings |               |                          |                 |         |            |            |      |
| - Receivers                       | 📝 quick dra   | awing                    |                 |         |            |            |      |
|                                   |               |                          |                 |         |            |            |      |

In the object type definitions, you can select if the bitmap shall be drawn solid or transparent (normal or additive). Use the additive setting to combine bitmaps with other area bound output. In this case the color values from the bitmap and the existing background colors are added. The "normal" output only shows the bitmap as a solid area. In the solid display, colors brighter than a user defined threshold value will default to white and be output 100% transparent. In these places the background is visible.

**Presentation of Geometry bitmaps** 



A mode for a fast re-draw was implemented that allows much higher rates of redrawing, especially for black and white bitmaps, however with this fast-redraw mode the quality on screen in some resolutions is a bit reduced. This only affects the screen, not printed output.

Drawing any bitmap on screen the bitmap first needs to be converted into the pixel-matrix of the screen and then it is drawn. As most bitmaps have a higher resolution than the screen, often multiple pixels from the bitmap are presented with only a single pixel on screen. The fast re-draw does not calculate an average of all the pixels from the bitmap that should be presented as a single pixel on screen but rather has each one of them draw the pixel, which means that the last bitmap pixel to be drawn is what you see in the end. This may result in the picture looking like having less detail. The slower mode averages the bitmap pixels resulting in a better picture quality. In the addition mode multiple draws will result in black, in the normal draw mode will yield gray.



### Transparent Geometry Bitmaps

What does transparent mean? A single color from the palette (in general, white, RGB = 255 / 255 / 255) is drawn with the transparent attribute. None of the pixels with this color attribute are drawn.

### When is transparency necessary?

 When you are using two overlapping bitmaps (aerial photography) and want to rotate them, OpenGL has some problems with displaying them. Why? – Bitmaps cannot be rotated. The only way is to rotate a bitmap externally and to generate a joint bitmap which contains the original bitmap pixels rotated into their new position. As the joint bitmap is bigger than the original, some part of the bitmap remains white and parts of the bitmap positioned second hide parts of the first bitmap. Only after the white parts of the bitmap are made transparent, everything shows.

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Presentation of Geometry bitmaps

• If you have diagrams (for example, a wind diagram to be placed on a grid noise map without the white background of the diagram).

There is a small glitch in the way the data are printed by OpenGL. The printer cannot cope with transparency and will most likely produce a black area instead of the transparent area. Therefore, the entire map must **PRINT AS BITMAP.** The setting for this is in the print preview.

# When is it correct to treat transparent bitmaps as "normal", and when is "additive" preferred?

"Normal" should always be used when the bitmap is a background graphic and other line and area elements are placed on top but show completely. In this case the output sequence for the bitmap must print it first.

As soon as you want to combine Grid Noise Maps and a grayscale bitmap, the bitmap should be drawn as "additive" on top of the Grid Noise Map. Here the question is if your printer can print this directly or not. White pixels allow the color of the Grid Noise Map to show unaltered, black ones hide them completely, and gray pixels make a darker shade of the color.

### Store viewports of geometry bitmaps

The view of a single or multiple bitmaps can be stored in a geo-referenced fashion under a new name. This is especially advisable for very large bitmaps where only a small section is required in the map, for rotated bitmaps, or if multiple bitmaps are contained in the map. Because the new bitmap is already present in the correct size and rotation, the loading time is greatly reduced. It is advisable to store the bitmap only when the final map section has been selected. In "Edit map", open the menu item **FILE** -> **STORE GEOMETRY BITMAP** and enter the picture file format, resolution and color depth. In the map itself, the old bitmap will be replaced with the one just stored.

### Inhabitant and Area Statistics in the Graphics

[Noise Mapping Toolbox] Inhabitant and/or area statistics can be presented in graphical form for the following calculation types:

- Facade Noise Map (Building assessment)
- Meshed Noise Map (Area assessment)
- Grid Noise Map (Area assessment)

The definition for both assessment types originally comes from annex VI of the European Environmental Noise Directive (END), however, it can be used as well for other purposes than stated in the END.

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Inhabitant and Area Statistics in the Graphics

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### **Inhabitants Statistics**

For the facade assessment, the results must be loaded in the file manager for the data type EU Buildings (Annex VI). If you select a new color scale, the new scale will automatically be created in the colors and according to the scale of the annex VI with the preset intervals and with the extra columns for the display of inhabitants affected in the various intervals. But you can change the colored scale to any number of intervals and scale type.

Noise level Lnight in dB(A) + Statistics of the inhabitants in the displayed noise zones

|         |     |    |    | Total | With N | IF with | QF  |
|---------|-----|----|----|-------|--------|---------|-----|
| 50      | ) . | -  | 55 | 111,0 | 0,0    | ) (     | 0,0 |
| <br>- 5 | 5.  | -  | 60 | 247,0 | 0,0    | ) (     | ),0 |
| 6       | ) ( | -  | 65 | 391,0 | 0,0    | ) (     | ),0 |
| 6:      | 5   | -  | 70 | 422,0 | 15,0   | ) (     | 0,0 |
|         | >   | >= | 70 | 692,0 | 54,0   | ) 182   | 2,0 |

For the assessment of the quiet facade with the building assessment, additional receivers are inserted 2 meters in front of the facade. The results are then compared to the results of the noisiest facade and if the difference is greater than 20 dB the facade is marked as being an especially quiet facade and the number of inhabitants assigned to the facade are then added to the number of residents living with an especially quiet facade.

The attribute "with noise control" is processed if the building has been marked as having noise control windows and other noise control measures (ADDITIONAL tab in the building properties).

You can activate/deactivate the additional columns of the building assessment in the scale layout. The columns are only presented when the assessment has been completed.

| EU evaluation                                       |
|-----------------------------------------------------|
| 📝 use EU rounding                                   |
| 🔽 use thousands separator                           |
| Show EU columns                                     |
| 📝 Total inhabitants                                 |
| Inhabitants in buildings with special noise control |
| Inhabitants in buildings with quiet facade          |
| V Dwellings                                         |
| 🔽 Schools                                           |
| 🔽 Hospitals                                         |
| V Kindergartens                                     |

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Inhabitant and Area Statistics in the Graphics

| EU buildings (Appendix VI)                                                    | <b>X</b> |
|-------------------------------------------------------------------------------|----------|
| Select value                                                                  |          |
| Time slice LrD (Noise level Day)                                              |          |
| Floor Maximum level                                                           |          |
| Calculation method for EU building evaluation                                 |          |
| 🕅 use quiet facade maximum value                                              |          |
| Lden 55 Ld,Le,Ln 50                                                           |          |
| Calculation method to assign inhabitants and dwellings                        |          |
| or assign all inhabitants and dwellings to the loudest value                  |          |
| essign inhabitants and dwellings according to the level of the facade section |          |
| Assign special buildings (schools,) on the basis of:                          |          |
| <ul> <li>the loudest level</li> </ul>                                         |          |
| 🔘 the energetical mean level                                                  |          |
| Color scale                                                                   |          |
| new V>                                                                        |          |
| Legend                                                                        | ОК       |
| Legend1                                                                       | Cancel   |
| ✓ complete                                                                    | Help     |

Select the time slot and the floor for which you want to present the level chart. **MAXIMUM LEVEL** queries all receivers and shows the floor with the highest noise level for each receiver location.

Select whether the all inhabitants shall be assigned to the loudest value at the building or the inhabitants shall be split up to the levels at each façade.

**Hint**: Reload the results (open the file selection manager and right click on the result file) after you changed the intervals in the colored scale, in order to update the additional columns.

| Object type EU buildings (Anne | x VI) |
|--------------------------------|-------|
|--------------------------------|-------|

| 🐺 Map object types                                             |                                            |                            |                           |   |
|----------------------------------------------------------------|--------------------------------------------|----------------------------|---------------------------|---|
| Object types Edit Settings Extra Help                          |                                            |                            |                           |   |
|                                                                |                                            |                            | Reference length scal 300 | 0 |
| Signs and symbols                                              | Base settings Cartography 3D gr            | aphics                     |                           |   |
| ⊟- General objects<br>General text                             | EU directive (Appendix VI)                 |                            |                           |   |
| Traffic sources                                                | Show                                       | Draw sequence              | 25 🛫                      |   |
| i≘- Environment<br>⊡- Results                                  | Name                                       | EU directive (Appendix VI) |                           |   |
| EU directive (Appendix VI)     Coudest facade     Quiet facade | Legend text                                | EU directive (Appendix VI) |                           |   |
| ···· Noise control measure<br>⊞- City noise map                |                                            |                            | ×                         |   |
|                                                                | Round mode                                 | Decimal places             |                           |   |
|                                                                | Options<br>fill buildings with scale color |                            |                           |   |

Inhabitant and Area Statistics in the Graphics

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In the sub-object types for the *loudest facade* and *quietest* facade define the width and color of the bar and the distance to the facade.

If buildings with special noise control measures are present, the outline of the building will be colored according to your color and line width selection.

### **Area Type Statistics**

For the area type assessment of grid noise maps and meshed noise maps the area sizes per scale interval is plotted out by the program to find how many square meters are in each scale interval. It is also possible to find the number of square meters above a threshold noise level and to document the number of residential buildings and inhabitants in a scale interval or above the threshold value.

Activate the area assessment in the file selection by checking the box **CREATE EU AREA EVALUATION** for grid noise maps and meshed noise maps.

| 🍀 City noise map                           |    |        |
|--------------------------------------------|----|--------|
| Time slice                                 |    |        |
| Lden (Lden)                                |    | •      |
|                                            |    |        |
| Colored scale                              |    |        |
| new                                        |    | ▼ >>   |
| 🔽 Create EU area evaluation                |    |        |
| calculate the iso areas with step size [m] |    | 1 👤    |
|                                            |    |        |
|                                            | 0K | Cancel |

By default, the area assessment will deliver statistical answers for the threshold values over 55 dB(A), over 65 dB(A) and over 75 dB(A). In additional columns the total area, the total number of buildings and the total number of residents above the thresholds are listed. This means too that the interval above 65 dB(A) contains the values for the interval 75 dB(A) etc..

| Area size, number of residential buildings<br>and number of inhabitants<br>over 55, 65 and 75 dB(A) |            |      |               |             |  |  |
|-----------------------------------------------------------------------------------------------------|------------|------|---------------|-------------|--|--|
| Time slice: Lden                                                                                    |            |      |               |             |  |  |
|                                                                                                     |            | km²  | Res.buildings | Inhabitents |  |  |
|                                                                                                     | > 55 dB(A) | 0,30 | 138           | 1655        |  |  |
|                                                                                                     | > 65 dB(A) | 0,13 | 73            | 1080        |  |  |
|                                                                                                     | > 75 dB(A) | 0,02 | 9             | 88          |  |  |

Only activate the check box **CALCULATE THE ISO AREAS WITH STEP SIZE [M]** if results or the scale intervals have changed. Via the step size you control the size of the grid

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Inhabitant and Area Statistics in the Graphics



that is the basis of the plotting of the areas. The default setting is 1 m. The smaller the number, the more accurate the results but the higher the calculation time for the plotting.

Out of the contour lines of the scale intervals SoundPLAN creates a grid structure in the defined step size. Next each grid point is checked for its value and the grid area is added to the appropriate interval, except the grid point is within a building.

Afterwards the building area is added to the interval of the highest level at the building and the building as well as the residents is entered into the appropriate scale interval.

Caution: The levels include all reflections.

The area evaluation is only created if you select a **NEW COLOR SCALE.** The new scale will be generated for the intervals over 55, 65 and 75 dB(A) by default. Edit the scale with the double arrow button if you want to generate the evaluation for more or other intervals or another scale type. If you change the intervals in colored scale editing in the Graphics, it is necessary to update the evaluation in the file selection manager. Activate the click box **CALCULATE THE ISO AREAS**.

The area evaluation is coupled to the scale type. With the first four scale types (which represent intervals) area size, residential buildings and inhabitants are calculated for the set intervals. With the next four scale types (which represent thresholds) area size, residential buildings and inhabitants are calculated above these thresholds.

The additional columns of the area assessment you can activate/deactivate in the scale layout. The selection is not shown until the assessment has been carried out.

| EU area evaluation              |              |
|---------------------------------|--------------|
| 🔽 Total area size (km²)         | Decimals 🛛 🚖 |
| Number of residential buildings |              |
| Number of occupants             |              |
|                                 |              |

# **File Operations**

Some of the calculation results can be used for calculation operations on a file basis. Depending on the file type, there are 3 different file operation types that can be defined as an object type or in the file selection:

- Facade Noise Map operations
- Triangulated Map operations (Meshed Noise Map, Measurement values point lists)
- Grid Map based operations

For the building-, triangle and grid-based maps, select from the following options:

**File Operations** 

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- add
- subtract (difference map)
- add as level
- subtract as level
- select smallest value from receivers of 2 maps
- select the highest value from receivers of 2 maps

In addition, you can add a constant or a base noise level to a map.

### Procedure for the file operations

In the file selection, select the operations type with the double arrow normally used to select files.

| Select files          |      |
|-----------------------|------|
| Select file type      |      |
| Facade map operations | ▼ >> |

The basic procedure is the same for all file operations: Select the base file, then the operation to be performed and then the operand file. To add a constant to a noise level, a second operand file is not required.

| File operation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                            |   |                                                                                              | ſ                       | <u>- I ×</u>                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------|-------------------------|------------------------------------------|
| Select file type<br>Facade Noise Map                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | n extended                                                                                                                                                                                                                                                                                 | - | Base files                                                                                   | Description Last change | Size (B)                                 |
| Name         Description           RGLK0011-res         Road noise - Present situation (FNM)           RGLK0012-res         Rain noise - present situation (FNM)           RGLK0112-res         Rain noise - vite noise protection (FNM)           RGLK0112-res         Rain noise - with noise protection (FNM)           RGLK0112-res         Rain noise - with noise protection (FNM)           RGLK0320-res         Gebiet Eichenweg - ohne Lämschutz           RGLK0320-res         Oak Street - with noise protection (FNM)           RGLK0320-res         Oak Street - with noise protection (FNM)           RGLK0320-res         Oak Street - with noise protection (FNM)           RGLK1111-res         Road noise - calculation for 3D           RGLK11114-res         Road noise - Present situation (FNM) | Last change         Size           16.03.2004 14:06:34         1287           17.03.2004 17:27:50         1224           18.04.2002 17:56:32         1411           12.04.2002 11:40:00         1207           16.03.2004 17:14:22         1235           18.03.2002 18:41:32         1052 | ( | GPERATION     Rel K0011.res     Operation     Files for operation     Name     Rel K0211.res | 16.03.200               | Size (B)<br>1287<br>Size (B)<br>1235<br> |
| Describe automatically     Description     GKL11:1 - GKL211:1;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                            |   |                                                                                              |                         |                                          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                            |   | OK                                                                                           | Cancel H                | elp                                      |

Internally, SoundPLAN generates a formula similar to the ones used in the SoundPLAN spreadsheet. The formula is stored with the drawing and will reexecute when you decide to load different files into the same sheet or if you store the drawing as a template.

The parameters or the operation itself can be modified later. Right click on the file "formula" in the file selection to open the entry screen for file operations. To change the time slot, for example, right click on the base file and the operations file.

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**File Operations** 

### Extended formula entry

| File operation                                                                                               |                                |                                                                                                                                                                                                                                                |                                                                          |                                                                                                                                                                                                               | - C ×                     |
|--------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| Select file type<br>Facade Noise Ma                                                                          | p                              |                                                                                                                                                                                                                                                |                                                                          | ✓ extended<br>▼                                                                                                                                                                                               | → +.*/++ 123<br>()^&. 456 |
| RGLK0012 res<br>RGLK0013 res<br>RGLK0111 res<br>RGLK0112 res<br>RGLK0321 res<br>RGLK0322 res<br>RGLK1111 res | runde(GKL11:1)++runde(GKL12:1) | Last change<br>1702 2015 101-24<br>2310 2012 132 2015<br>2310 2012 132 2015<br>2310 2012 1332 2015<br>2310 2012 133750<br>2310 2012 133750<br>2310 2012 133540<br>2310 2012 133540<br>2310 2012 133540<br>2310 2012 134154<br>2310 2012 134154 | Size (B)<br>7289<br>7299<br>7165<br>7212<br>7196<br>7275<br>7279<br>6923 | Group<br>Present abadion<br>Present abadion<br>Present abadion<br>Present abadion<br>Present abadion<br>Arture abadion<br>Oak theet<br>Oak theet<br>30, Eu Directive and Catography<br>Studies and Catography |                           |
|                                                                                                              |                                |                                                                                                                                                                                                                                                |                                                                          |                                                                                                                                                                                                               | OK Cancel Help            |

Activate **EXTENDED** to open the extended formula entry. Enter your formulas (for example, for weighing different noise source types). You don't need to open the Spreadsheet from the SoundPLAN Manager to change the formulas there. This formula interpreter is the same as in the Spreadsheet. Please read the section "<u>Calculating using Formulas</u> (page 425)" in the Spreadsheet chapter.

Mark a file on the left side. Use the arrow symbol or double click on the file to open a specific parameter window. Click OK to insert the file with the selected parameters (e.g. time slice, group or frequency) and correct syntax at the cursor position into the formula.

The **OPERATORS** are in the upper block. Aside from the basic arithmetic symbols, use (^) to raise a value to the power of or use (++) to add energetically and (--) to subtract energetically. The comma as separator is used for additional parameters.

The **NUMBER BLOCK** contains the decimal separator and the semicolon to mark the end of the formula. Click on the button in order to move the content into the formula.

In the selection list **FUNCTIONS**, select the function of choice. With the arrow to the right-hand side of the pick list, add the function to the formula. Brackets are added and the cursor is positioned between them to enter required parameters or taking over the results with a double click.

### Specialty of grid-operations

You can unite several adjoining grid maps. Check mark EXTENDED and link them with the operator  ${\bf \&}.$ 

For grid points in the overlapping areas, select how the grid values shall be processed:

- use the last value loaded
- generate an average value of all values

**File Operations** 

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- use the lease favorite value (highest level)
- use the most favorite value (lowest level)
- add the values as levels

If you process grid operations for grid maps with different grid sizes, the finest grid must be polled as **BASE FILE** (for the enhanced formula entry as first file in the formula). The less detailed grid map is polled as **FILE FOR OPERATION**. The coarser grid is interpolated at loading time to yield the finer grid. The result map will also only contain receiver points contained in the base file. Receivers that would enlarge the base area are discarded.

### Arithmetic with Meshed Maps and measurement data

It is also possible to use the triangulated data from meshed noise maps and measurements as an operand file. Here again the base files determine the grid of the result files. The value at the grid point is interpolated within the triangles of the operand file.

In order to best represent a meshed noise map, the grid spacing for the base file should be much finer than the triangulation distance. To facilitate this, a grid spacing of the base file is displayed to allow the user to manually select a finer spacing for the conversion of the triangulated file.

### Specialty of the Facade Noise Map operations

In order to avoid time intensive searches for receivers, the receivers in both files should be the same. To achieve this, both calculations should contain the same buildings and the resolution of the Facade Noise Map defined in the calculation settings should be the same.

Select the time slot so the results for different propagation conditions or different assessments can be compared with each other.

After leaving the file selection, select the floor to be presented. SoundPLAN carries out the operations for all floors and presents the selected floor. If you selected the operation "subtract" and the view option "highest value," the results are obtained by subtracting the values floor by floor and then finding the highest value.

### Specialty of operations on triangulated results

Triangulated operations can be carried out with the Meshed Noise Map or with measurement point lists. If the Meshed Noise Map constitutes the base map, the operand map can be a Meshed Noise Map or a measurement point list (in order to calibrate a noise map for a background noise level). In case the base map is a measurement point list, the operand can only be a measurement point list.

If a Meshed Noise Map is the base map, the calculation area of the base map is also the calculation area for the result file. This means that the calculation areas do not

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**File Operations** 

need to be identical, but also means the calculation area is not expanded beyond the area of the base file. As the calculation area is not truncated, this means difference maps for Meshed Noise Maps only make sense for identical calculation areas.

As measurement point lists are not associated with calculation areas, you must define if the operation shall be carried out for the entire area or for the area defined by the points contained in both files.

The structure of base and operation files should be identical. Both maps should contain the same time slots. Measurement point lists need to have the same information in the same columns of the file. SoundPLAN does not check if the content of the columns fit together; this is the responsibility of the user. SoundPLAN only checks that the columns are compatible with each other.

### Operations with files containing different points in them

If base and operation files are the same file type, either Meshed Noise Maps or measurement point lists, SoundPLAN proceeds as follows:

- First the points are synchronized. This means points contained on the base file that are not in the operations file are inserted in the operations file. In the process, the triangle where the point is located is searched and values of all columns are derived by linear interpolation.
- Next, a copy of the base file is generated. The operation is carried out for all points and all value or level columns. If a column in one file is a value column but the other file contains a different type in this place, no operation is invoked for this column.
- After carrying out the operation, a new triangulation is made. For Meshed Noise Maps, the calculation area is regarded. For measurement point lists, a new hull around all points is generated.

If the base file is a Meshed Noise Map and the operations file is a measurement point list, steps 1 and 3 are omitted. The program will locate the receiver positions of the Meshed Noise Map in the measurement point list, interpolate the value with a linear interpolation and then process the result.

# • Highlight the calculation area

The calculation area has been amended with a new Cartography attribute to highlight the calculation area.

10

Highlight the calculation area

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In the map object types for the calculation area open the tab Cartography and select the tab background.

| Background Line |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------|
| Shadow          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| show            | Color                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Right         | 8,0 🚔 |
|                 | around                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bottom        | 4,0   |
| Effects         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| draw no objects | 🗌 draw no                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | results       |       |
|                 | use back                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | kground color |       |
| Brighten colors |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | •             | 100%  |
| Gray colors     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | 100%  |
|                 | <ul> <li>The second s</li></ul> |               |       |
| 3D effect       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
| show 🗌          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Right         | 8,0 🚔 |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Bottom        | 4,0 🚔 |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |       |

You have multiple options of highlighting the calculation area (see also "<u>Effects for</u> <u>the calculation area</u> (page 663)"):

- Put a **SHADOW** to the right and bottom or all around it.
- Do not draw objects and/or results outside the calculation area
- Select a background color that will be drawn outside the calculation area Make the colors or the gray scale a bit brighter
- Use a 3D-effect that raises the data within the calculation area.

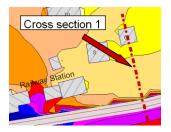
Just experiment what option you like best!

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Highlight the calculation area

# emphasize Graphically Using Symbols

Use the element "Symbol" do draw arrows or other symbols on a map. You can define a line or arrow for text boxes and graphics boxes in the box properties in the tab index card *Line*, see "<u>Connection lines</u> (page 515)".



Click the symbol button and then click on the map about where you want to insert the symbol. A symbol will be displayed. Double click on the symbol to edit attributes and select a different symbol. Aside from the default symbols, you can also create your own library of user defined symbols.

| symbol properties | 5       |                           |        | ×      |
|-------------------|---------|---------------------------|--------|--------|
| Name              | Symbol1 |                           |        |        |
| Position          |         |                           |        |        |
| Left              | 90,0    | Тор                       | 134,5  |        |
| Layout            |         |                           |        |        |
| Size              | 11,6 婁  | Proportion width : height | 1,00 🚖 |        |
| Line width:       | 0,4 🚖   | Color:                    |        |        |
| Rotation          | -25,0 🚖 |                           | Symbol |        |
| Shadow            |         |                           |        | OK     |
| 🗖 show            |         | Right                     | 4,00   | Cancel |
| Color:            |         | Bottom                    | 2,00 🚖 | Help   |

### Move symbol, rotate and zoom

In the symbol settings, define the size, position, angle, line width and the ratio of height to width. Grab the middle of the symbol box to move it to a new location. Click of the grab points of the symbol frame with the mouse to stretch the symbol. To rotate the symbol, click on one of the corners, and to zoom, click on one of the middle markers. Move the symbol with the left mouse button pressed while moving the mouse on the canvas.

The old position of the symbol remains valid until you release the mouse button.

Symbols are rotated and zoomed around the middle marker of the symbol:





**Emphasize Graphically Using Symbols** 

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# SoundPLAN Symbols

### Ø Administration of symbols

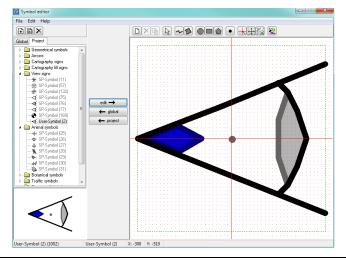
SoundPLAN is delivered with a small symbol library named "Symbols.sym". The file is installed in the system folder and will remain there for future extension of the symbol library.

You can create your own symbols in the symbol editor. All symbols are accessible, both the SoundPLAN default symbols and the user created ones, so you can use both sets jointly.

User generated symbols are stored in the project under the name "User.sym". To store the symbols so that they become accessible in other projects, store the file "User.sym" via the menu **FILE -> SAVE** in the Globdata-folder. If you change to another project that does not already contain a User.sym file, the file from the Globdata folder will be copied into the project. If the file already exists, it will not be overwritten but amended with the new symbols. Otherwise projects received from outside bureaus would have the symbol file overwritten or if your global symbol file was shorter, the graphics would attempt to load a symbol from an empty place.

### Output to the symbol editor

Open the symbol editor from the **OBJECT TYPES** via **EXTRA -> SYMBOL EDITOR**.





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SoundPLAN Symbols

The symbol editor is a tree structure containing all symbols (the SoundPLAN symbols and the user created ones) in the GlobData folder. By default, the SoundPLAN symbols are named "SP-Symbol" with the symbol-ID trailing.

SP-symbols cannot be altered, but they can be used as the basis of your own creations.

The symbols you generate are called "user symbol". These symbols depict the symbol ID as well. You can alter the symbol name; however, the name has little meaning for the drawing. The drawing references the symbol by the symbol ID.

The symbols are organized according to function groups. In each group you can amend the symbols and generate new ones and even generate new function groups. You can delete you own symbols and user created branches of the symbol tree.

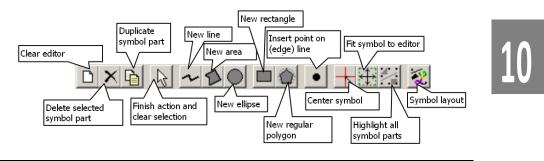
To the right of the symbol tree is the symbol editor. Between the symbol tree and the symbol editor you see three buttons. The upmost button moves the symbol from the symbol tree to the symbol editor. The two lower buttons move the symbol in the symbol editor to the currently active location of the symbol tree, either to the global or to the project symbols. If the symbol is a SoundPLAN symbol, a copy of the symbol is created as a user generated symbol. If the symbol was user created and is already present, the program asks permission to overwrite the symbol. If permission is denied, the symbol is inserted as a new user created symbol. To include it, first generate a new symbol in the branch of the symbol library you want to place the symbol, and then move the symbol from the drawing canvas to the symbol tree.

## Ø Requesting new symbols

A symbol can be generated from multiple symbol elements:

- Lines
- Areas
- Rectangles
- Ellipses

Click on the particular symbol to open it for drawing.



SoundPLAN Symbols

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For lines and areas, mark the first point with the mouse, then move to the next point with the mouse and enter it. Do this until you close the symbol with a double click. Areas are automatically closed.

Ellipses, rectangles and regular polygons are entered by pulling the box around it open. For regular polygons, also enter the number of points in the polygon.

| Number polygon edges |   | ×      |
|----------------------|---|--------|
| Number               | 3 | *      |
| OK                   |   | Cancel |

You can generate squares, circles and regular polygons if you select the object and pull open it with the *Ctrl*-key pressed. If you keep the *Shift*-key pressed, the start position is used as the center of the new object.

A marked symbol part is proportionally enlarged / downsized if you select the black squares in the corners (except if you press the *Shift*-key). The black squares in the middle change the symbol part only in one direction.

With the move mode active, symbol parts can be rotated around the center if you keep the *Ctrl*-key pressed or enlarged / downsized if you keep the *Shift*-key pressed.

Replace symbols: A global symbol can be taken over in the project symbol collection as well as a project symbol into the global collection. Load the symbol to the editor. If this symbol is not yet part of the global or project symbols the button **PROJECT** or **GLOBAL** becomes active.

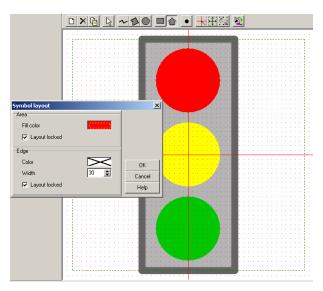
For newly generated or changed symbols both buttons are active.

#### 🥝 Symbol layout

The symbol components can be assigned attributes such as line colors, line width and for area type symbols the border and fill colors. This flexibility allows the generation of very complex multicolored symbols. As a color of its own, you can assign "no color" to area type objects for the border or fill.

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SoundPLAN Symbols



You can assign symbols to be drawn in the colors defined in the symbol generator or you can assign the color via the object setup for the object type. In order to distinguish both color definitions, the switch **LAYOUT FIX** in the symbol definition must be set appropriately for each element. If the box is checked, the symbol is drawn with the settings of the symbol lib. If not, the color setting of the object setup is used.

Please look at the symbol for the traffic light:

The symbol consists of a rectangle with 3 circles of different colors. The circles are assigned the colors red, yellow and green. The frame is disabled. Both are marked with the setting "Layout fix". For the rectangle, the default settings were left intact, i. e. the border is dark gray and the fill is light gray. You can modify the fill and border colors and leave the lights untouched. If the lights were not set "Layout fix", they too would be drawn in the new fill color.

#### 🥝 Entry grid

In the editor you see a green frame which indicates the normal size of the symbol. The lower left coordinate is (-500/-500), the upper right one is (500/500). The middle coordinate (0/0) is the pivot point around which all rotating and stretching actions revolve.

For a point type object type consisting only of a symbol, the (0/0) coordinate is located at the exact location of the world coordinate assigned to the object in the Geo-Database.

The editor contains a visible and an invisible coordinate grid. The grid size functions as an orientation and the pixel size constitutes an entry aid as points can only be placed in the fixed grid of the pixel grid. Both grid spacing can be adjusted in the options menu.

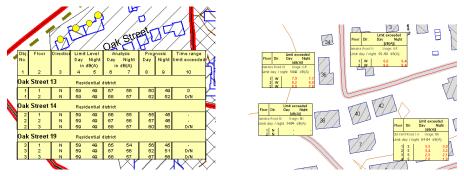
SoundPLAN Symbols

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# o Spreadsheets in the graphics

Spreadsheets and parts of spreadsheets can be presented in a table box.



Pull open a table box and double click to edit content (or use the menu item edit content). Select the desired table in the "file open" dialog and set the file filter to show the desired type of table (level-, measurement value or area table).

| 🐺 Spreadsheet box    |                 |                 |       |
|----------------------|-----------------|-----------------|-------|
| Spreadsheet          |                 |                 |       |
| Oak Street.NTD       |                 | Select          | (Edit |
| <b>F</b> 1           |                 |                 |       |
| Filter               |                 |                 |       |
| 🔽 use filter         | V               | hide filter col |       |
| Column               |                 |                 |       |
| 24: show in Graphics | :               |                 | •     |
| Value                |                 | 0               | •     |
|                      | 🔽 adapt box siz | e to table      |       |
|                      | OK              | Cancel          | Help  |

The next part of the file open dialog shows the selected file along with two buttons. Use **SELECT** to choose a different table. Use **EDIT** to open the spreadsheet from the graphics so you can customize the table, select different columns, and so on.

Near the bottom you can choose if the entire table shall be shown in the box or only the part of the table that fits the definition of the filter. Any integer number

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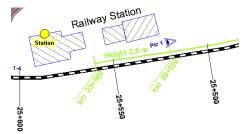
Spreadsheets in the graphics

column can function as the filter. In a level table, the definition, for example, fits for the object number (i.e. to present the spreadsheet only for a single building) and the building number. It is also possible to generate an integer column of your own (TABLE -> ADD COLUMN -> VALUE AS INTEGER VALUE).

The filter column can be deactivated from showing in the box, for example, if the content is also part of a structured table. Likewise, a filter column of the spreadsheet can be temporarily activated.

The lines selected by the filter to be presented in the box do not have to be located in adjacent positions. If a start of structure line is in front of the filtered line or an end of structure line is found after the filtered line, they are included in the box.

# Oisplay properties as text



The types of available property labels to be included as text labels are shown when the files are loaded. Double clicking the attribute or using the arrows causes the labels to be included in the map. The following attributes can be printed on the map:

- Receiver names and numbers
- Number and name of point, line and area sources as well as parking lots and wind turbines
- Number and name of sources of an industrial building
- Number and name of receivers in an industrial building
- Road and railway kilometer marks if the road or railway line is defined as the reference axis
- Section name of a road
- Wall height for noise control walls and berms where the height of the wall changes
- Reference kilometer of the reference axis of noise control walls and berms for the beginning and end of the wall or berm and where the wall height changes.
- Name of measurement points
- Name of usage areas

**Display properties as text** 



- Photo location
- Name of map sections

The display definition is set in the object type setup under the cartography tab. Select the map-object type for the sub-object.

| 🖻 Traffic sources   |
|---------------------|
| 🖻 Road              |
| Road axis           |
| Emission line       |
| Surface             |
| Central reservation |
| Bridge              |
| Wall                |
| Stationing          |
| 🚊 Environment       |
| ⊡ ·· Buildings      |
| ⊨- Wall             |
| Base line           |
| Wall                |
| Reference station   |
| Height              |

Sub object types are always inserted; the attribute labels, however, are only displayed when you have selected them in the file selection.

The preview picture shows how modifications on the definition will change the appearance of the attribute labels.

| Base settings Cartography 3 | 3D graphics         |             |      |
|-----------------------------|---------------------|-------------|------|
| ×                           |                     |             |      |
| Object part                 | Site map            |             |      |
| Text background             | He wash             |             |      |
|                             | Show                |             |      |
| Text                        |                     |             |      |
|                             | 🔽 align always to I | top         | Font |
| Size 3,0                    | ) 🛨 Omm 👁 m         |             |      |
| Displacement X 1.0          | ) 🌲 Y 0,0 🜲         |             |      |
| Text before                 | 1                   | Text behind |      |
| Alignment with object line  |                     |             |      |
| Left 🔽                      | 🐔 fit to line       | Angle       | 45 🚖 |
| Reference line for the text |                     |             |      |
| Show                        | Color               | Width       | 0,4  |
| Lext position               | _ength 20,0 🜩       | Jut         | 2,0  |
|                             | 20,0 💌              | out         | 12,0 |

10

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Display properties as text

For duplicate object types, for example to distinguish between existing and planned noise control walls, the text attributes are defined and administered separately. If you want to draw text labels describing the height of the wall, etc., you must load the text attribute labels for both attribute types in the load procedure of the graphics file manager.

The text properties receiver name, source name and photo position can now be moved and rotated (this is not yet possible for the attributes along other objects such as the stationing and the height of walls).

Open "Edit Map" and select the **MOVE PROPERTY TEXTS** from the selection list. As soon as you move the cursor over a text, the cursor changes into a movement cursor with which you can grab the text and move it to a new position. Rotate the text with the Control key and mouse movement.

Texts moved manually can no longer be placed with the object type placement settings. If you modify the object type, the position calculation no longer functions correctly and some of the texts will be miss-placed. As a consequence, it is recommended to manually move the texts only after the layout placement is finished.

**Hint**: Movements of texts cannot be transferred to other situations even if they contain the same geo-files (and thus the same texts).

# Printing

For printing and plotting your sheets, SoundPLAN uses the infra-structure Windows supplies.

When editing the sheet, the preparations are totally independent of the printer. After you invoke **FILE -> PRINT** or press the print symbol button, select which printer shall be used. The printer selected in the settings of the SoundPLAN Manager under Program/Printer for graphics is the default.

Enter the page margins of the printer in the sheet properties, tab index card "*edge*". It is also possible to generate a new sheet, select the sheet size and the desired printer and then view the sheet **FILE -> PRINT PREVIEW**. The active drawing area is requested from the printer driver and displayed. If it does not fit, you see the message:

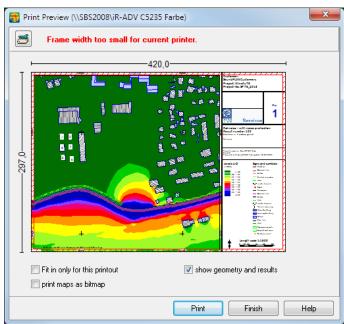
| Graphics 🔀                                 |
|--------------------------------------------|
| Frame width too small for current printer. |
| ОК                                         |
|                                            |

In case the paper format for the sheet and the printer do not match and the sheet is too big, the message "sheet too big for selected paper size is displayed".

Printing

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At the same time the print preview shows the preview of the sheet and the non-printable border frame.



If the borders around it are exceeding the printable area, the printed part will be centered on the sheet. The non-printable area is hatched with red lines in the print preview.

You also have the option to change the printer here or to change the printer settings. Click on the symbol in the upper left-hand corner to CHANGE PRINTER SETTINGS.

Enter the desired sheet border in **ELEMENT -> SHEET PROPERTIES**, tab *edge*.

You can view the sheet with or without the frame to maximize the active viewing area on screen. With **VIEW** -> **WITHOUT SHEET FRAME (CTRL+ E)** the frame is activated/deactivated.

After defining the sheet frame, it is no longer possible to move the child elements beyond the sheet frame.

You can activate the checkbox **FIT ONLY FOR HTIS PRINTOUT** to leave the sheet frame untouched but to have the content fitted correctly to the sheet. Additionally, you can disable the presentation of more complex content in the preview (speeding up the generation of the preview) if you uncheck the checkbox **SHOW GEOMETRIE AND RESULTS**.



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Printing

# Print plan as a bitmap

**PRINT PLANS AS BITMAP** is automatically activated when there is a transparent geometry bitmap. In this case, the setting cannot be deactivated. As the bitmap size depends on the printer's resolution, the bitmap can get very big quickly and exceed the available memory. To avoid an overrun, the program segments big plans and the bitmaps are sent to the printer separately.

If parts of the bitmap are missing, the size of the original bitmap probably exceeded the max size. In the SoundPLAN Manager you can define the max size in the settings -> system -> MAX BITMAP SIZE IN PIXELN. If decreasing the bitmap size doesn't solve the problem, generate a PDF file first and print this file externally.

# **Export of sheets or elements**

The sheet or individual elements of the sheet can be copied to a file or the clipboard and can be entered in other applications such as a word document.

Call **FILE** -> **COPY TO CLIPBOARD** or **Shift+Ctrl+C** and select the type of bitmap or metafile. For bitmaps, select the color depth and resolution. With Ctrl+ V, the graphics is inserted in the target application. (Ctrl+ C in the Graphics is used to copy the elements within the SoundPLAN graphics.)

Invoke **FILE** -> **SAVE AS GRAPHICS FILE**. If an element (not the entire sheet) is active, select if you want to export only the active element or the entire sheet.

Enter a file name and select the graphics format; Metafile (\*.wmf, \*.emf) or bitmap (\*.bmp, \*.tif, \*.jpg, \*.png) via the filter selection list. By default, the graphics is stored in the project, but you can customize the path.

Metafiles are scalable vector graphics, so the quality of the graphics is better if you use a different resolution in the target application.

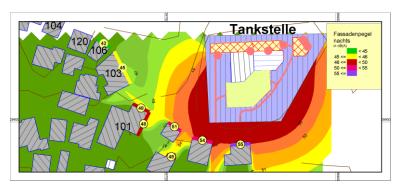
# **Graphics formats**

The graphics format PNG is a sensible choice for the export of SoundPLAN sheets. Depending on the number of colors, PNG can have a significant compression with almost no loss in quality.

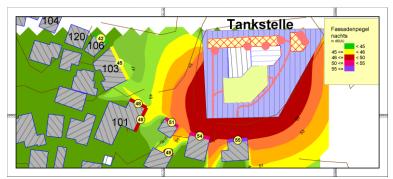
As SoundPLAN graphics and the 3D-graphics use relatively few colors, the PNG format is very well suited for exporting these graphics to:

Export of sheets or elements

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Size as a 24 bit - bitmap: 8,1 MB (uncompressed TIF is similar in size)



Size as a 24 bit - PNG: 98 kB

## Settings for the Export of Graphics

For the export of graphics and diagrams from the Result Table, the Expert System for Industrial Noise and the Graphics you can define additional options for the graphics formats.

For BMP, PNG and TIF you can define the resolution in [dpi] and the color resolution when selecting the topic **OPTIONS**.

| True color (24 bit)     | • |
|-------------------------|---|
| Black and white (1 bit) |   |
| 16 colors (4 bit)       |   |
| 256 colors (8 bit)      |   |
| High color (16 bit)     |   |
| True color (24 bit)     |   |

If graphics are to be exported in the JPG-format, you can choose between 3 JPEG-**COMPRRESSION TYPES**: YUV 4:1:1 (low resolution), YUV 4:2:2 (mean resolution) and YUV 4:4:4 (high resolution). For the compression type 4:1:1 the program stores the data as 4x1x1 bytes instead the shown 4x4x4 bytes.

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Export of sheets or elements

| JPG settings                      |                                        |
|-----------------------------------|----------------------------------------|
| Compression type                  | 4-1-1 💌                                |
| Compression quality               | 15                                     |
|                                   |                                        |
| No compression<br>Maximum quality | Maximum compression<br>Minimum quality |

With the switch compression quality, you can select the magnitude of the file compression. The higher the compression, the smaller the file and the bigger the quality loss of the picture.



Export of sheets or elements

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# **3D Graphics**

3D-Graphics is organized in two modules. With the 3D-Graphics module you can view your project in 3D and move inside the data set using the mouse and cursor movements. The 3D Animations module allows you to use drive along roads, railways or a user defined track. The scenes can be stored as an AVI file so can play it back on any PC. 3D-Animation also includes a 3D train pass-by and the visualization of the level-time histogram.

It is possible to enhance the scene with trees, roofs and (<sup>6</sup> with Cartography) additional 3D properties for points, lines and walls.

Load the data as usual and call Edit Map by double clicking on the map or using the menu. Select **VIEW -> 3D-MODEL**. Depending on the graphics card and the amount of data, the 3D picture can appear almost instantly, or it can take a short time to process the data and display the picture.

# **Basic principles**

**Basic principles** 

The 3D-graphics uses the graphics 3D-standard OpenGL. As soon as the 3D-graphics is triggered, the objects are converted into OpenGL objects.

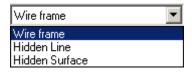
Unfortunately, OpenGL only draws on screen and does not have its own printer driver. Because of this, when you click the OK button to leave 3D graphics, a bitmap is generated for the selected viewport. The bitmap generated here can have a different resolution than the screen resolution. Higher resolutions are desired if the bitmap is to be printed in bigger format. Bitmap here stands for a map delivered in individual pixels. The scene can be stored as \*.bmp, \*.jpg, \*.png and \*.tif. The bitmap is stored in the sheet rather than as a separate file. Depending on the graphics format, this storage principle can make the files for the 3D-graphics very big. Modifications invoked by changes in the object type settings are not instantly effective in the bitmap bound into the drawing. They only become effective when the user regenerates the bitmap by opening it with a double click on the map.

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The speed of redrawing and manipulating 3D-Graphics depends very much on the speed of the graphics card. So it is wise to pay attention to the graphics processor. Please contact SoundPLAN if you would like a recommendation.

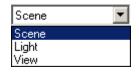
#### Display options, views and movements

The 3D-view can show the model as a solid model or as a wire frame with or without hidden line removal. Select the display type from the list.



Normally the solid model is sufficient. However, for very big models, the faster display may prove helpful to format the drawing in the 3D wire frame model and activate the solid model after the formatting is finished. View parameters are the same in all display types.

In the list next to the display, select what you want to manipulate with cursor movements.



**SCENE** lets you move within the 3D-model. **LIGHT** lets you tilt and rotate the light source. **VIEW** is only active in conjunction with the module 3D-Graphics Animation (see below).

In menu accessible by right clicking, there is the menu topic **OVERVIEW**, with which you can recall the view of the last saved scene (in case you got lost in 3D space).

#### **Movements in 3D-Graphics**

The various movement modes are selected via the right mouse button, the cursor keys and the mouse. All movements are relative to the 0/0/0 location of the coordinate system. The coordinate axis is displayed by default, but it can be deactivated in the menu **PARAMETER -> 3D SETTINGS**. The coordinate axis and the frame around the drawing are not displayed in the final bitmap.

The step size of the movement is controlled using the slider to the right of the frame.

The various movement modes are selected via the right mouse button, the cursor keys and the mouse. All movements are relative to the 0/0/0 location of the coordinate system. The coordinate axis is displayed by default, but it can be deactivated in the menu **PARAMETER -> 3D SETTINGS**. The coordinate axis and the



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**Basic principles** 

frame around the drawing are not displayed in the final bitmap. The step size of the movement is controlled using the slider to the right of the frame.

| Motion<br>slow |          |  |
|----------------|----------|--|
|                | -        |  |
|                | -        |  |
|                | -        |  |
|                | <u> </u> |  |
|                | _        |  |
| quick          |          |  |

Step sizes are dependent on the size of the data model, the types of objects present in the map (facade points of the Facade Noise Map, for example, will slow the graphics considerably) and the type of graphics card installed in the PC.

The cursor changes appearance depending on the movement type. The most common movements are available via mouse and arrow keys. A right click on the canvas opens a menu with all available movements.

|   | Map object types<br>Overview                                                                                                          |
|---|---------------------------------------------------------------------------------------------------------------------------------------|
| • | move<br>change distance<br>rotate<br>tilt<br>move height<br>zoom (change focal distance)<br>change distance + move x<br>rotate + tilt |



Left mouse button + movement (or via the arrow keys): Move the world (move in all directions in the model)

Left mouse button + shift or page up/down pull mouse wheel: Change distance to the middle of the world (change distance)



Left mouse button + Ctrl or Ctrl + arrow keys: Rotate and tilt the world or light Left mouse button + Alt or shift + arrow keys: Move height

For the movement in the 3D-graphics you can select how the mouse and its functions shall be interpreted. For example what is the reaction to rotating the

mouse wheel forward: zoom in or zoom out? With Ctrl+ M you can customize the movements how you see best fit. The same settings are used also in the other

**Basic principles** 

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places where the 3D-graphics is active – Wall Design, the Expert System and the Geo-Database.

You can also use the right mouse button to rotate and tilt the model and change the distance. Left and right movements combine the movements. Use the zoom command to change the focus length of the view. Caution! This will change the perspective of the model.

Some modifications are not instantly visible; they require a redraw triggered by the **REDRAW** button to the right of the screen. The redraw not only refreshes the screen but forces Open-GL to re-render the model. As the rendering requires considerable calculation time, this command is not directly triggered but must be started by the user. If the changes you made to the model are not visible immediately, it is advisable to click **REDRAW**.

#### Geometry parameters of the scene

Use **GEOMETRY VIEWPORT -> GEOMETRY PARAMETER** to open a dialog that depicts all view parameters of the scene.

| Scene viewport     |                                 | ×      |
|--------------------|---------------------------------|--------|
| Scene              |                                 |        |
| Center (x/y/z):    | <b>36750,00</b> 29500,00 279,21 |        |
| Rotation           | 0.0 🚖                           |        |
| Tilt:              | 30,0 🚖                          |        |
| Viewer             |                                 |        |
| Distance           | 1500,0                          |        |
| Visual angle       | 54,0 👤                          |        |
| Nearest clip plane | 0,1 📑 🔽 use system settings     |        |
| Light              |                                 |        |
| Rotation           | -45,0 🚖                         | OK     |
| Tilt               | 30,0                            | Cancel |
| T IIC.             |                                 | Help   |

The **NEAREST CLIPPING PLANE** is defined in the system settings of the SoundPLAN Manager (options -> settings, under program -> system). As different viewports might correct display problems, it is also possible to override the system settings locally by hand.

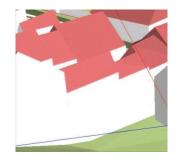
Even good graphics cards sometimes have difficulties displaying the nearest clipping plane if this clipping plane is only 0.1 meters away from the object. This inaccuracy leads to display problems at the edges of objects.

Try setting the minimum distance for the nearest clipping plane to 5 meters and to 0.1 meters and check the results in the 3D-Graphics.

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**Basic principles** 





Example: Clipping plane 0.1 m

Example: Clipping plane 5 m

# **3D-settings**

| General Effects User anin       | nation Track animation Train animatio | on    |
|---------------------------------|---------------------------------------|-------|
| -Projection type                |                                       |       |
| <ul> <li>perspective</li> </ul> | 🔘 orthogonal                          |       |
| -Light-                         |                                       |       |
| Rotation                        | 345,0 🕃 🗹 adapt to scene              |       |
| Inclination                     | 5,0 🕃 📃 adapt to scene                |       |
| Hidden line settings            |                                       |       |
| use black color for lines       | 3                                     |       |
| Line width                      |                                       | 0,5 🕃 |
| Fill color                      |                                       |       |
| Others                          |                                       |       |
| Background color                |                                       |       |
| 🗹 Show coordinate system        | m                                     |       |
| Show map frame                  |                                       |       |

Additional settings are found under **PARAMETER -> 3D-SETTINGS**:

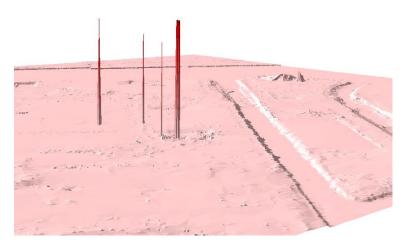
- Perspective or orthogonal projection
- Rotate and tilt the light along with the world
- For display type "hidden lines": Draw lines in black or in object color, line width and fill color
- Background color for scene
- Produce a map frame: The view selected in 3D-model is shown on screen allowing a more exact positioning of the view
- Display coordinate axis: Helps with navigation in 3D-graphics as the 0/0/0 position is the pivot point for rotation
- You can set the effects fog and ambient light in the tab index card effects, see "<u>Effects</u>" on page 631.

**Basic principles** 

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# **3D-Graphics model data check**

The 3D-data model check allows you to see errors in the model.



The elevation errors in the example above were extreme. However, for the noise propagation, the 3rd dimension is crucial and the model data should always be reviewed with a critical eye in the 3D model check. A verification of the 3D model quality is a corner stone of quality assessment.

The following data types are displayed:

- Road and railway bands with emission lines and signal addition
- Point, line and area sources
- Buildings without roofs
- Walls and berms
- Mitigation areas
- Elevation lines, elevation points
- Receivers with all floors
- General points, lines and areas
- Digital Ground Model
- Grid Noise and Grid Air Pollution maps
- Facade Noise Maps
- Meshed Noise Maps
- Cross-sectional Noise Maps
- File operations



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**3D-Graphics model data check** 

# Effects

With the **fog effect** you can now simulate distances from the viewer.



Open **PARAMETER** -> **3D-SETTINGS**, (the 3D model must already be loaded via **VIEW** -> **3D MODEL**).

| Settings for 3D |            |                |                 |      |
|-----------------|------------|----------------|-----------------|------|
| General         | Effects    | User animation | Track animation |      |
| Fog             |            |                |                 |      |
| linear          |            |                | *               |      |
| -Fog ran        | ge         |                |                 |      |
| 🛃 fit t         | o distance | •              |                 |      |
| Start           |            | 1087           | End             | 1687 |
|                 |            |                |                 |      |

Select from the pick list the fog type of choice "linear", "exponential" or "steepexponential" and the "color", that causes the fog effect. The fog effect can be fitted dynamically to the middle of the scene, but you also can define the distances.

With the switch **APPLY** you immediately can see how the settings influence the scene. Try for yourself what you like best.

#### Light effect

| ient |    |   |   | U  |   |   |   |   |     |   |    |  |
|------|----|---|---|----|---|---|---|---|-----|---|----|--|
| ioni | Ĩ. | 1 | 1 | Ť. | 1 | 1 | 1 | 1 | 1   | 1 | T. |  |
| se   |    |   |   |    |   |   |   |   | U   |   |    |  |
|      | 1  |   |   |    |   | 1 |   | 1 | 1.1 |   | 1  |  |

**3D-Graphics model data check** 

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**AMBIENT-LIGHT** is light where the source is not recognizable. It stems from multiple reflections on walls and other surfaces.

"DIFFUSE"-LIGHT allows the detection of the light source. The angle to the light source determines how bright an object is.

Changes in the ambient and diffuse light are immediately effective in the scene. Press **ABORT** to keep the original settings.

## 3D tab in the object type setup

For the geometry and result object types, you may configure the appearance of the 3D-objects independent of the top view graphics settings.

#### Point object types

| Base settings Cartography     | 3D graphics     |
|-------------------------------|-----------------|
| Options                       |                 |
| 📝 show                        | 🔽 shade         |
|                               |                 |
| Point<br>Size                 |                 |
| ⊚ 3,0 🛣 m                     |                 |
| Reference for object position |                 |
| symbol center                 | 🔘 symbol bottom |

Point objects in 3D-graphics are presented in the x, y and z plane. For object positions on the terrain, you can choose between the bottom and the middle of the symbol.

Cartography includes additional options and possibilities. Under the Cartography tab, switch to the 3D-symbols.

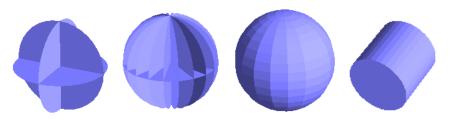
| Symbol Symbol 3D    |                 |        |
|---------------------|-----------------|--------|
| Layout              |                 |        |
| View type           | Cylinder / cone | •      |
| Height [m]          |                 | 10,0 🕃 |
| Top diameter [m]    |                 | 0,4 🗋  |
| Bottom diameter [m] |                 | 1,3 🖀  |
| 🥅 horizontal        |                 |        |



You can display the points as planes, rotation symmetric solids or as cylinders/cones. For trees there is an additional parameter. Select the **VIEW TYPE** from the selection list.

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**3D-Graphics model data check** 



From left to right: 2 xz planes, 10 xz planes, rotation symmetric body with 18 steps of rotation, cylinder.

For 3D-graphics, rotation symmetrical objects are best suited.

#### Line object types

For line type object types in 3D-graphics, the line width is interpreted as the height of the object. For noise control walls, the height defined in the Geo-Database is used to set the height of the wall. For changes in the wall height, the property "constant wall element" is evaluated.



With Cartography, a 3D-wall is inserted to simulate the appearance of the noise control wall. (The 3D wall can be inserted in all line type objects, not only in the noise protection wall.)

| ~Wall            |                            |
|------------------|----------------------------|
| Color            | Transparency [%] 0 😭       |
|                  | show edges in color        |
| Thickness        | 0,25 🕃                     |
| Height           | 0,00 🕃 🗹 from Geo-Database |
| Post             |                            |
| 🗹 show           |                            |
| Color            |                            |
| Thickness        | 0,35 🕃                     |
| Higher than wall | 0,30 🕃                     |
|                  |                            |

Use the **TRANSPARENCY** setting, in order to present buildings behind a noise protection wall made of transparent material.

When the posts are activated, a round post is generated at the location of every coordinate. If the posts are generated a little bit wider and higher than the wall, the construction is more vivid.



**3D-Graphics model data check** 

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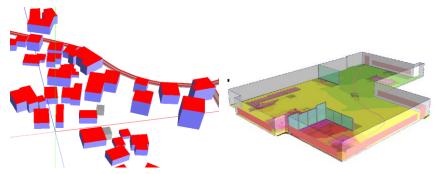
## Area object types

| Base settings Cartography | 3D graphics   |                            |       |      |
|---------------------------|---------------|----------------------------|-------|------|
| Show                      |               | ✓ shade<br>Transparency [۶ | 8]    | 30 😭 |
| Area                      |               |                            |       |      |
| 🗹 fill with area color    | Surface color |                            |       |      |
|                           | Side color    |                            |       |      |
| ✓Edge lines ✓ show        | Width         | 0,3 🕃                      | Color |      |

In order to present sources within an industrial building or a bitmap underneath an area source, you can assign the **TRANSPARENCY** in [%] in the section for *3D Graphics*.

For areas in the 3D-graphics, it is possible to assign different color schemes than in the top view. The border line of the area can be drawn with the set line width and color, which is especially interesting if you assign a transparency.

All objects with vertical components (buildings, industrial buildings, bridges, mitigation areas) can have different colors for the top surface and the sides.

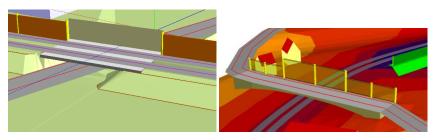


Bridge thickness is taken over from the settings in the Geo-Database. The bridge edges are defined via the noise control wall built into the bridge object.



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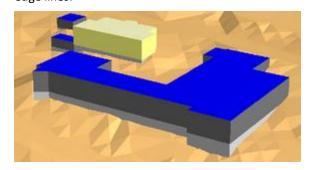
**3D-Graphics model data check** 



Buildings have an additional option to assign a color for slanted roofs (page 639).

| Building           |  |
|--------------------|--|
| Slanted roof color |  |
| in show pedestal   |  |
| show floor lines   |  |

In addition, the check box **SHOW PEDESTRAL** extends facades that are floating above the DGM to the terrain. The DGM must be loaded in the Graphics. With the check box **SHOW FLOOR LINES** the lines between the floors are drawn in the color of the edge lines.



## Digital Ground Model (3D)

The Digital Ground Model can be loaded without or with (<sup>O</sup> Cartography) a color elevation scale. Without a color scale the triangles are drawn in a single color. When **SHADED** is activated, the 3D character is much more vivid.

Also see "Presentation of the DGM with continuous color flow and elevation lines"

#### Grid Noise Map (3D)

When Grid Noise Maps are drawn in 3D, the settings in the main object type of the Grid Noise and Grid Air Pollution Map are relevant. The map is drawn in the elevation where the receivers of the grid maps are calculated. In the 3D-tab, the button **USE GROUND ELEVATIONS** can be activated to project the noise map onto the ground. If the ground is displayed with the noise map, the program has difficulties in the drawing sequence with 2 objects of the same location. Therefore, it is advisable to add a negative value to the ground elevation.

11

**3D-Graphics model data check** 

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| Base settings Cartography | 3D graphics                 |  |
|---------------------------|-----------------------------|--|
| Options                   |                             |  |
| 🔽 Show                    | 🔽 shade                     |  |
| 🔲 put on ground           |                             |  |
| Grid Noise Map            |                             |  |
| 🔽 use ground height       | add to ground height -0,4 🚖 |  |
|                           |                             |  |
|                           |                             |  |

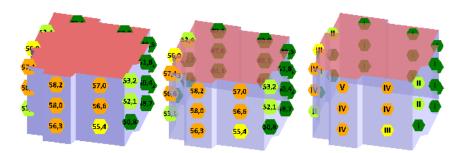
Changes become active only when the paintbrush button is clicked, which renders the scene again.

#### Façade Noise Map (3D)

Facade Noise Maps are especially suited for displaying in 3D because the noise levels of all floors are shown. Variations of the layout and general configuration are described in the section "<u>Object Type Facade Noise Map</u>" (page 578).

Drawing the Facade Noise Map on screen is very demanding of the processor, so please be patient with the speed of movements in the 3D-Graphics. A faster option is to color the entire façade according to the level rather than drawing single receiver locations. The 3D-settings for facade points are the same as for the <u>3D-Point object types</u> (page 632).

Noise levels, conflict values or scale interval numbers of a Facade Noise Map can now be presented in the 3D-Graphics as a facade mark.



The output as text means that the facade noise symbol no longer can be presented as a 3D symbol but that it always will be presented as a 2D symbol. For the 3D environment the program needs to know how far this flat symbol shall be placed in front of the face of the building. The default value for **MOVE FORWARD** is set to 1 m. Additionally the text **SIZE** in [m] can be set. The text color will be inverted if the contrast to the scale colors make this necessary.



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**3D-Graphics model data check** 

| Map object types         |                                       |                           |
|--------------------------|---------------------------------------|---------------------------|
| 🖻 🛛 🖻 🗙 🎺 🏞 🕺 🧕          |                                       | Reference length scale 1: |
| Signs and symbols        | Base settings Cartography 3D graphics |                           |
| Traffic sources          | Settings for levels as text           |                           |
| Environment              | ▼ show                                |                           |
| E Receivers              | I∕ snow                               |                           |
| - Noise calculation area | Size [m]                              | 1.0                       |
| Results                  |                                       |                           |
| Facade Noise Map         | Move forward [m]                      | 1,0                       |
| - Facade point           |                                       | ,                         |

In connection with the settings for "half-transparent" for the building the labels deliver a very informative presentation.

## Cross Sectional Noise Map (3D)

Cross sectional noise maps are very well suited to present the functionality of a noise map.

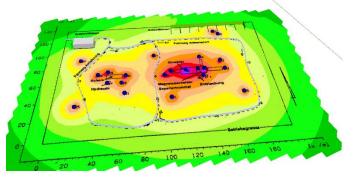


Cross sectional noise maps can also be presented in 3D together with a digital ground model or a grid noise map.

#### Geo-referenced bitmaps in 3D-Graphics

Geo-referenced bitmaps can now be used in 3D Graphics with some restrictions:

- $\circ~$  Only a single bitmap can be present at any time for the 3D display.
- The bitmap is only projected to a DGM, Grid Noise Map or Meshed Noise Map, but not to objects such as roofs and roads.
- The border of the bitmap shows some distortion, so make the area bigger than the area upon which the bitmap is projected.



The 3D-Graphics (OpenGL) can only use bitmaps with sizes that are a multitude of 2 (1024, 2048, 4096, ...). SoundPLAN automatically enlarges the bitmap to the next



**3D-Graphics model data check** 

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size so that, for example, a bitmap of the size  $1025 \times 1025$  pixels will become a bitmap of the size 2048 x 2048, in this case almost 4 times the size! The enlarged area is preset in white so that it will not be visible on screen.

In the map object types, the bitmap must be enabled in the 3D-graphics section. If you activate the bitmap after you open the 3D-graphics in **EDIT MAP**, the bitmap must be rendered before it is visible. To do this, click on the button for new rendering (paintbrush symbol).

**Hint:** If you have a very large grid map and want to project a bitmap onto it, it is advisable to first select the proper view port of the 3D-graphics and then load the bitmap. The usual method with the bitmap preloaded will slow down the screen movement considerably.

# **3D-Graphics Animation**

The 3D-Graphics Animation contains the following extra features (see graphics sheets 07-1 and 07-2 in the example project "Wincity"):

- Trees: 3 types of trees are delivered with the standard object setup deciduous trees, conifer trees and shrubs.
   Cartography allows you to generate any shape of tree.
- Presentation of slanted roof forms in 3D.
- Movement mode "View" with the view from any one of the receivers contained in the situation.
- Animation along an animation track (each road, railway or a user defined animation track, e.g. the flight to a scene) and generation of an AVI movie file of a simulated pass along the animation track.
- Calculation of a train pass-by, display of the level-time histogram at any point of the calculation area and animation of the 2D and 3D train pass-by from different viewports.

# **View display**

When you activate the view-mode, the center of the loaded scene becomes the camera position. The movement STROLING **AROUND** is active in this display mode.

Mouse movements back and forward with the left mouse button pressed move you backward and forward. With mouse movements left and right you rotate left and right.

An additional movement mode is **GLANCE AROUND**.

By moving the mouse left/right your view rotates left/right. (Ctrl+ arrow keys right/left) or mouse movement back and forward will move your view up and down relative to the horizon (Ctrl+ arrow keys up/down).

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**3D-Graphics Animation** 

#### View settings

For the view settings, you can find an extra configuration sheet under **PARAMETER** - > **3D-SETTINGS**:

| General   | User animation                        | Track animation  |    |  |  |  |  |
|-----------|---------------------------------------|------------------|----|--|--|--|--|
| _View set | View settings                         |                  |    |  |  |  |  |
| 🔽 ca      | calculate ground height automatically |                  |    |  |  |  |  |
| Heigh     | t above ground                        | 2,0              | \$ |  |  |  |  |
| 🗖 us      | 🔲 use ground slope                    |                  |    |  |  |  |  |
| Point     | distance for slope                    | calculation 10.0 | \$ |  |  |  |  |
| Extras    |                                       |                  |    |  |  |  |  |
|           |                                       |                  |    |  |  |  |  |
|           | o not pass through                    | ) objects        |    |  |  |  |  |

Define if the Grid Noise Map and the triangulation of measurement locations shall be used for the automatic elevation modeling and if SoundPLAN should assess the camera position relative to the terrain.

Activate the ground slope if you do not always want to look strictly horizontal in the movement mode **STROLE AROUND** and **GLANCE AROUND**. If the box is checked, the view will follow the terrain. Define the distance between the camera position and the second point used in the slope calculation.

As it is very confusing for the viewer to move through solid walls and find himself inside a building, you can set a switch to disable the movement through solid walls. If the switch is set, it is impossible to move into buildings. If it is not set, there are no restrictions.

Both the automatic tilting of the view while on the move and making sure you are not vanishing inside buildings take a lot of computation power and will limit the speed of movement in the model.

#### 3D View direction

In this mode, all receivers contained in the situations and geo-files are polled and the views from each "window" are recreated. By jumping from receiver to receiver, the 3D view direction is set to be perpendicular to the façade direction away from the building. With selecting a particular building, the view mode is set to **LOOK AROUND.** 

#### Roofs

Define the ridges on the roofs as a noise control wall and assign the graphics object type "ridge" to the object. This way the roof can function in the calculation as a barrier and the program can generate 3D roof structures from it. The third

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**3D-Graphics Animation** 

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dimension of the top of the roof ridge needs to be set to absolute elevation above sea level. If you can import the geometry of the ridges with a different definition, the graphics has an adjustment of the definition available for this case under **PARAMETER** -> **OPTIONS**. This definition is valid not only locally but as a general setup for all projects. The roof ridge lines must be stored in the same situation as the buildings themselves.

How does the 3D graphics work? First, all ridges belonging to a building are polled (all ridges whose mid-point is inside a building). These lines are shortened and lengthened to end directly at the side of the building (if they are more than 0.1 meters from the edge they are not extended). Afterwards the ridges are triangulated and presented in 3D. If the roof does not look as planned, additional ridge lines may be needed to define the surfaces. The new lines must also be given the graphics object type of the ridge lines.

# Drive or fly along an animation track

The animation can be carried out online in **EDIT MAP** or can generate an AVI file to be displayed by any multimedia player.

In Edit Map, select the animation track under **PARAMETER** -> **3D-SETTINGS** in the tab index card *track animation*. Tracks can be a user defined camera track or any road or railway alignment.

| General User animation Track animation |        |  |  |  |  |
|----------------------------------------|--------|--|--|--|--|
| Track                                  |        |  |  |  |  |
| Old Kent Road                          |        |  |  |  |  |
| Distance from track axis               |        |  |  |  |  |
| Height above track                     | 1,0 👤  |  |  |  |  |
| Distance to view point on the track    | 0,0    |  |  |  |  |
| Animation                              |        |  |  |  |  |
| Number of frames per sec.              | 10 👤   |  |  |  |  |
| Speed [km/h]                           | 54,0 🜩 |  |  |  |  |
| Frame distance [m]                     | 1,5 🔹  |  |  |  |  |
| 🥅 max. speed                           |        |  |  |  |  |
| repeat                                 |        |  |  |  |  |

The parameters at the top of the form define the position of the "driver." The **DISTANCE FROM TRACK AXIS** is the vertical offset (if set to 0 the driver drives in the middle of the road) and uses positive values to move to the right and negative values to move to the left.

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The lower half of the entry window defines the parameters of the film generation, such as the number of frames per second. The speed is regulated by entering the driving speed on the road or by defining the spacing between the pictures.

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**3D-Graphics Animation** 

If the spacing between pictures is small, the film gets smoother but the size of the AVI file increases.

In order to have the film as smooth as possible, it is necessary to smooth the animation track in the Geo-Database. For this purpose the geo-tools "<u>Smooth elevations</u> (page 171)" and "<u>Create segments of constant length</u> (page 161)" are available.

The animation is controlled using the recorder keys.



The green arrow is used to start the on-line animation. When the animation is running, use the red block as the pause key and the red dot as the stop key. When the pause key has been pressed, it is possible to look around or move around at the location where the animation stopped. When the stop key is pressed, the viewpoint returns to the overview. Use the blue arrows to move along the animation path between start and stop.

#### Create AVI file

Press the record key to generate an AVI file from the animation. By default, the animation starts with the frame you selected with the green arrow.

| Create AVI    |           |    |          | ×      |
|---------------|-----------|----|----------|--------|
| File name     |           |    |          |        |
| Train pass-l  | byl       |    |          |        |
| Expected file | e size    |    | 643,6 MB |        |
| Bitmap format |           |    |          |        |
| 🔽 Keep pro    | oportions |    |          |        |
| Width [pixel] | l         |    | 1812     |        |
| Height [pixe  | ]         |    | 759      |        |
| Size          |           |    | 4,1 MB   |        |
| Frames        |           |    |          | ОК     |
| From          | 233 🕃     | То | 389 😹    | Cancel |
| FIUII         | 200       | 10 | 303      | Help   |

The AVI file is stored in the project folder. For your information the expected size of the AVI file is shown. If the file exceeds your space, reduce the number of frames or the size of the movie. When the AVI file is generated, the file is uncompressed, so the files can easily become multiple gigabytes. The internet is a good source for you to choose compression programs. Please also be aware to use a common CODEC because this driver must not only be present on the PC generating the compressed AVI but also on the PC playing it back.

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**3D-Graphics Animation** 

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# 2D and 3D animated noise map

For the time being, the animated noise map is only available for railway noise. The railway must be entered using a standard that utilizes the maximum noise level.

The following conditions must be fulfilled for an animated noise map:

- In the railway properties (emission calculation railway) provisions for the maximum noise level must be made; trains must be selected that constitute the maximum noise level.
- In the calculations, the calculation run for the maximum noise level must have an assessment that enables the maximum noise level. Storage for the maximum noise level must be enabled under the tab "assessment."
- Under the section **RESULTS** in the tab index card *grid noise map*, the **ANIMATED NOISE MAP** (TRAIN PASS-BY) box must be checked.

The calculation of the level-time-histogram needs to calculate all grid points; therefore, the interpolation is deactivated. The position of the train is stored every 0.125 seconds.

During the calculation, the animated noise map generates very big files. Moreover, the calculation time increases, because the interpolation of the results is disabled.

Load the calculated grid noise map along with the geometry data in the file selection manager of the graphics. Double clicking on the map opens the "edit map" section. Here you must load the level-time file containing the charts of the noise level over time. Select **LOAD LEVEL TIME HISTORY** from the selection list and click on the check box **ACTIVATED**. The animation control bar is displayed.



With the check box **CENTERED** the geometry moves with the train pass-by. Start the on-line animation with the green arrow. While the animation is in progress, the stop and pause buttons are active. After the animation is run, you can move the slider to visualize a particular time of the animated noise map.

If you left click on the noise map, the program opens a box with the level-time histogram.

Clicking the red recorder button on the animation controls saves the animation as an AVI file, see "<u>Create AVI file</u> (page 641)".

Caution: Depending on the operating system, the size of the AVI files are restricted to 2 respective 4 GB. This size can be reached easily with high resolution animated maps of some kilometers of train tracks in urban area.

When the level time charts are loaded, a left click on the map will open the chart for the area where you are clicking.



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**3D-Graphics Animation** 



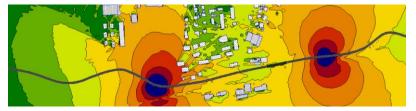
## Grid operations with animations

The animations are also calculated for grid operations. This way you can for example display two train pass-bys with a displace in time or two train pass-bys in different directions.

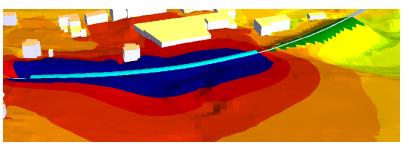
If one of the animations should begin later, enter this in the extended formula entry with the parameter:

GMN53:1:100 ++ GMN54:1;

The animation 53 starts 100 time steps (~125 seconds) later than animation 54.



#### **3D Train Animation**



A Grid Noise Map with the activated option "Animated Grid Map (moving train)" must be calculated.

Load the grid map and the geometry into the Graphics.



**3D-Graphics Animation** 

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To present the train in 3D the train axis must be marked as reference line in the Geo-Database.

For the presentation of the train, the sub-object-type "Emission line" of the train object is used. In the top view the train is presented as a line, in 3D as a solid figure.

For the color and thickness of the train, the normal line display is used. In order for the train not to be covered by the emission line, the emission line itself must be deactivated.

The length of the train and the length of the rail cars are defined in the tab index card *Cartography*:

- **PATTERN SIZE** = length of the train

- PATTERN RATIO = approximate length of a rail car

In 3D the width and height of the train cannot be altered, the train body starts 30 cm above the railhead and is 2.5 meters wide and 2.8 meters tall.

#### **Presentation in 3D**

In order to present the train-animation in 3D, the data must be loaded while the Edit-Map facility is operating in 2-D. After loading the data, switch to the 3-D mode. Please make sure that the object types for the grid noise map has the switch **USE GROUND ELEVATIONS** set in the tab 3D of the object settings.

In the settings for 3D there is a new tab for the train animation, select one of the 4 different way of presentation:

- Keep the current view
- Move with the train and look at the noise map from a position on the train in a defined angle.
- Move with the train and look towards the center of the of the animation world
- Look from the center of the animation towards the train.

Depending on the animation setting, select the position relative to the animation track (distance to the front of the train, height above the train) and the view angle.

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**3D-Graphics Animation** 



# 12 Noise mapping projects and strategic noise maps

This chapter deals with the handling of large projects in the field of noise impact analyzes, conflict maps and summed-up conflict maps and the creation of strategic noise maps according to the EU Environmental Noise Directive.

In order to cope with such projects, additional tools have been integrated into SoundPLAN in different modules, which are described here together. Individual components of the processing of large amounts of data, such as the evaluation of elevation grids, are already described in the corresponding chapters, here it is only referred to. Therefore, in this chapter we must assume that you are familiar with how SoundPLAN works.

The following topics are covered in detail:

- Tile system Divide the study area into tiles of the same size
- Implementation of the EU Environmental Noise Directive
- Conflict maps and summed-up conflict plans
- Process elevation points for a tile DGM

# **Tiling projects**

In order to process big noise studies without losing the overview and keeping the loading times, calculation and graphics preparations times as short as possible, the entire project can be sectioned into equally sized tiles. The basis of the tiles is a geo-referenced background graphics. The x- and y-size of the tiles can be different from each other.

**Tiling projects** 

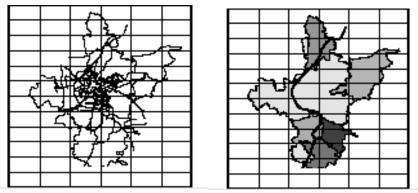
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# The tiling manager

## Preparing the tile project: generating the background graphics

First you need a geo-referenced background bitmap. The best way to get this graphics is to generate it directly in SoundPLAN with large-scale data that cover the geographical scope of the project (e.g. the main roads and districts). Small-scale information or an aerial photo is unsuitable.

Examples:



Left image: small-scale information, right image: only a few large-scale information in different gray shades

Hint: Please keep in mind that the graphics for the background of the tiling needs to be opened each time the tiling manager or the navigator is opened. Depending on the size of the used geo-referenced bitmap and the throughput of the PC this can amount to considerable time. For this reason, the background image is converted to gray-scales for the tile manager.

Store the situation and load it in the graphics. Invoke "edit map" and store the data via EDIT -> CREATE GEOREFERENCED BITMAP in one of the available data formats. The background graphics generated this way is used in Geo-Database, Calculation core and the graphics to graphically select the area for which data need to be loaded. The background graphics is always presented by the tiling manager in gray tones to allow other content which is in color to be superimposed on it.

#### Setting up the tiling system

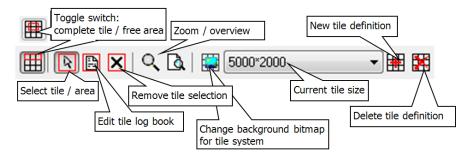


Open the Geo-Database and open the situation manager with **VIEW TOOLS** -> **TILES**, or with the symbol button **TILING MANAGER**.

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**Tiling projects** 

Overview of the symbols in the tiling manager:



Define a new tile system with and select the size for the tiles in [meters]. Depending on the project size enter the size for the tiles in x-direction and y-direction individually in a value scope of 500 meters to 10 km. Because of the nowadays screen dimensions rectangular tiles advisable. It might be sensible to use different tile sizes for dealing with roads or buildings.

As soon as the tile size is determined, select the background graphics. Only georeference files with the extension \*.grf are presented. The tiles are superimposed on the bitmap and the tiling system is completely defined.

Open FILE -> OPEN BITMAP, if you want to select a new background graphics for tiling.

You have the possibility to zoom within the tile manager. Click on the symbol button **ZOOM** or use the mouse wheel.

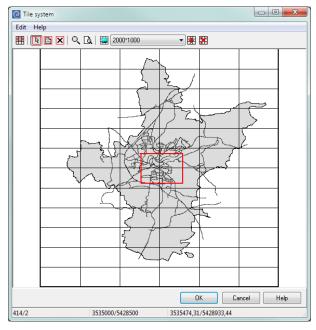
#### Working with tiled projects

When loading data, the tile manager opens up to let you select for which geographical region you need the data. The default only entire tiles are loaded. If you want to activate an area free of the constraints of the tile borders, deactivate the button ,tile". In the calculation core it is only possible to select complete tiles.

E Select complete tile

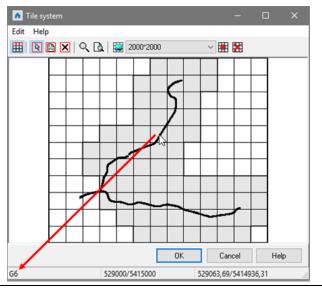
Select free range

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Click on the button **CANCEL SELECTION**  $\boxtimes$  to cancel the selection of the area marked in red.

Each tile has a unique tile-ID (A0, A1, ... depending on the location in the tile system), this should help with checking individual tiles in different parts of the program. The logbook will always write entries with the reference to the tile, if you are opening the tile manager and move the cursor over a tile, the status line will show the tile-ID. A0 is the lower left tile (horizontal axis (A, B, C, D, ...), vertical axis (1, 2, 3, 4, ...)).

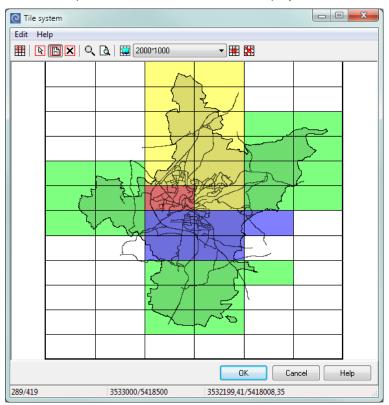


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**Tiling projects** 

#### Document the project status tile by tile

For each tile you can document the status of the project:



Open the tiling manager (either in the situation manager or via the tiling navigator) and press the symbol button **EDIT**. In this mode you can enter the status for the activated tiles. Aside from the status you can also enter the name of the operator and write comments pertaining the status of the project or what needs to be done or where problems were found with the data.

The project statuses to be assigned tile by tile are:

- undefined (no color)
- currently edited (yellow)
- calculating (blue)
- contains errors (red)
- done (green)

By right clicking (on a tile or activating an area), the tiling log book is opened. It contains all entries for each of the tiles.

Tiling projects

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#### Tiles Log File: Status Quo

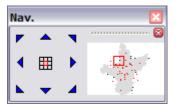
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Date                   | User | Status        |               | Info                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------|---------------|---------------|--------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 14.03.2005<br>15:41:29 | CK   | in<br>process | check         | building heights         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 11.03.2005<br>15:26:55 | PS   | ready         | emiss         | ion calculation<br>roads |
| tringer and the second se | 24.02.2005<br>17:34:51 | DS   | in<br>process | te            | rrain ready              |
| 28500_40500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |      |               |               |                          |
| - AZ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Datum                  | Bear | beiter        | Status        | Info                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 14.03.2005<br>15:41:29 | Ι    | DS            | in<br>process | Corrections<br>terrain   |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 08.03.2005<br>15:41:14 | C    | K             | corrupt       | Terrain!                 |
| A State of the second sec |                        |      |               | in            | check building           |

This information is stored in the situation file. If the calculations or graphics are using only a single situation, the log book is presented here as well. You can then define the project status for example to mark the area as having errors. This way you can find it in the tiling manager right away.

#### **Tiling navigator**

In the Geo-Database and in the Graphics under **VIEW** -> **NAVIGATOR** the tiling navigator is opened where you can easily change the geographical area for which the data are loaded.

Aside from the navigator buttons with which you can quickly change the area, a little overview window is presented. You can move the navigator any place on the screen even move it outside of the drawing area.



When you move with the navigator arrow into an area from which no data have been loaded, the Geo-Files for the area are loaded instantly which may result in a little delay.

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**Tiling projects** 

Via the symbol tiling navigator in the middle of the arrows you open the full tile manager to choose a different area or to enter the project status for the tiles.

You can move the overview window out of the navigator and zoom it at will. Left click on the double line on top of the overview picture and move the graphics window. If you want to recombine the windows, move it with the left mouse button to the navigation window until you see a gray double line on the right side of the arrow keys.

## Tiling projects in the Geo-Database

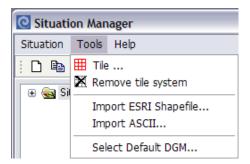
When a situation is loaded in the situation manager where a Geo-File contained in the situation is completely outside of the area selected in the tiling manager, the Geo-File is not loaded.

As the program need to load entire Geo-Files when the file is opened for editing, it is advisable to structure the Geo-Files in such a manner that the data are stored borough by borough with each section of town represented by a different Geo-File. It is also advisable to contain the data of variants and noise types in separate situations, this way the tiling manager can keep track of the project status. For the calculation and the graphics, it is also possible to load individual Geo-Files in addition to situations.

The tile manager opens up to let you select the region of your project you want to process as soon as a project has been organized with tiles. The region is selected before the situation manager starts. Keep the left mouse button pressed to select the region or directly select the tiles you want to load for processing. By clicking the OK button, the data are loaded.

#### Import data in tiles

The Shape-file and ASCII import is accessible in the Geo-Database Situation Manager under the menu topic **TOOLS**, so you can distribute the data to different files in a tiled environment.



Select the geo-referenced bitmap in the tiling manager and select the area for which you want to import the data.

Tiling projects

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Enter a text which will be used as the prefix in front of the coordinate area. The text and the coordinate range will be used for naming the Geo-Files.

The text "building\_" will generate Geo-Files with the names

building\_X30Y25 building\_X30Y26 building\_X31Y26

For the sake of the file names, the kilometers are truncated. In case you plan to read and distribute data from multiple imported files for the same tiles using the same prefix, the new files will be amended with a successive number (1)..(n).

The standard settings of the objects cannot be set at this location. The screen for defining the settings cannot be started from outside the edit facilities of the Geo-Database. Please define these standard settings with property functions at a later stage.

#### **Calculate tiled projects**

Tiles help in the structured processing of a project, but they are not meant to be a replacement for calculation area. Results for grid noise maps, meshed noise maps and facade noise maps are only generated within the calculation area.

For the calculations a tile size of 2 x 2 km has proved itself as it delivers an optimal relationship between loading and calculation time and yields data size that are still manageable.

The calculation core needs information beyond the tiles where it is requested to produce results. For this reason, data within the maximal search radius around the selected tiles will be loaded.

If the project is set up for tiles, the tab *General* in the calculation properties box allows the project to be calculated tile by tile- even tiled and distributed to multiple PCs in a network. Distributed Computing processes each tile the same as a nontiled environment, thus the speed advantage remains even if there is only a single tile.

| Calc Tiles | Tiles |
|------------|-------|

Activate **CALCULATE TILES** and click the button **TILES** to select the tiles to be processed. The status of the tiles as defined in the Geo-Database, are presented in color, so you can see which tile needs to be calculated and which is not done with data entry. Unfortunately, this service is only available is you use a single situation to manage your data.

Select all tiles with *Ctrl+A* or pull open a frame around the desired tiles (selection of not continuous tiles with additionally pressed *Ctrl-key*).

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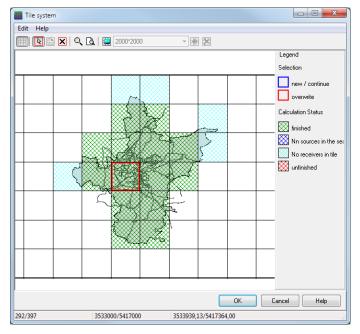
**Tiling projects** 

A dialog opens that shows the status of the selected tiles.

| IIIe selection info       |              |           |
|---------------------------|--------------|-----------|
| Not yet calculated tiles  | (1 selected) |           |
| Ocalculate                | 🔘 Skip       |           |
| Not yet finished tiles (0 | selected)    |           |
| Ontinue                   | Overwrite    | 🔘 Skip    |
| Finished tiles (3 selecte | d)           |           |
| Overwrite                 | Skip         |           |
|                           |              | OK Cancel |

For a partly calculated calculation run you can this way mark all tiles with *Ctrl+A* and then use the dialog to pass over all tiles already done with the calculation.

Under **VIEW** -> **TILES** you can see the status of the tiles. Depending on their status they are differently colored:



Completely calculated tiles are displayed in green, currently calculated in red. Additionally you can see if a tile was not calculated because there were no receivers in the tile or because no sources were found in the defined search radius. If there is more than one "red" tile visible it is quickly identified that there are tiles with errors as they were started but did not finish their calculation.

**Tiling projects** 

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There is an additional overview window under **VIEW** -> **OVERVIEW OF THE TILE CALCULATION RESULTS** to step through all already calculated results with the arrow keys or a click on an individual tab. This is possible even if multiple run files from different projects are open.

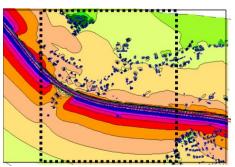
**Hint**: Because the calculation stops at the end of a tile the overview window closes automatically after a certain time.

## Tiling projects in the graphics

In the graphics use the tiling manager to select the region for which you want to load the data. After the selection of the region proceed to the selection of the files.

If you click OK without selecting a region, all data will be loaded.

The selected region is automatically fitted into the scope of the visible frame with the maximum zoom factor.



Use the navigator arrows (VIEW -> NAVIGATOR) to go to the next scope and the tile manager (symbol in the middle of the navigator area or EDIT MAP AREA in the file selection) to select another scope.

## **Preprocess elevation data for the Calculation Kernel**

If you need to filter elevation points for very big areas, the amount of data is too big to open these elevation points as a Geo-File in the Geo-Database. Therefore, there is a separate import interface in the Geo-Database for preprocessing these data under FILE -> IMPORT -> PREPROCESSING ELEVATION DATA.

The data are filtered the same way as described in the chapter Geo-Database, section <u>filter and import elevation data</u> (page 114).

#### Move files outside of areas / corridors to a sub-folder

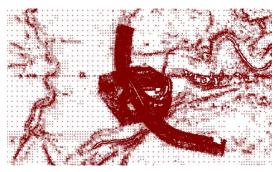
With this task you can move all elevation files located outside of selected areas or line corridors to a sub-folder. Entire files will be moved, not only the part that is located within the selected area. The sub-folder is generated in the normal project folder.

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Preprocess elevation data for the Calculation Kernel

#### Filter points in outlying areas with increased tolerance

Often the area of a community consists of areas with buildings and outlying areas with fields, forests and meadows. As in the non-built up areas the accuracy is not quite as important as between buildings, a bigger tolerance can be chosen here.

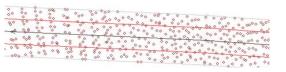


As soon as you select this task, a dialog opens to select the Geo-File. Select the Geo-File with the area(s) and/or lines (e.g. roads / railways) outside of which the coarser filter value shall be used. The line corridor width is only valid for line type objects. Determine the **FACTOR FOR COARSER FILTER VALUE** in the elevation filter.

#### Clip elevations at areas (e.g. buildings/roads)

This task provides elevations within areas or line corridors without filtering them. It can be helpful for example to use elevations of the roofs of buildings for the building height or elevations in road bands to determine the road elevation with a separate DGM.





The amount of data of these elevations is often not too big, so that you could store them with the task **SAVE ELEVATIONS TO** directly to a Geo-File.

#### Save elevations to

The filtered elevations are in most cases saved to the sub-folder ElevData. The files in this sub-folder are directly assigned for the tile DGM calculation in the calculation kernel, if needed together with additional elevation points or elevation lines in the project. The elevation data are always stored in tiles of 10 x 10 km.

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| Tasks                            |           |
|----------------------------------|-----------|
| Save elevations to               |           |
| Use areas and/or line corridors: |           |
| Line corridor width              | [m] 12    |
|                                  | Ē         |
| Save options                     |           |
| ◉ save in subfolder "ElevData"   |           |
| 🔘 save as Geo-files              | File name |
| 🔘 save as ASCII files            |           |
| Subfolder name                   | TxtElevs  |
|                                  |           |
|                                  |           |
|                                  |           |
| Execute                          | Cancel    |

In addition, you can save the data as Geo-Files which are not automatically loaded to the Geo-Database.

The filtered data can also be stored as ASCII files, for example to use them in another system.

#### Combine elevation data from different sources

It might happen, that you get elevation data from different sources in different accuracy for one project. In this case you determine when storing the data what should happen in overlapping areas.

Files already exist in ElevData - what shall happen?

| Delete existing files                              | - |
|----------------------------------------------------|---|
| Delete existing files                              |   |
| Replace existing elevations in overlapping areas   |   |
| Import elevation only outside of overlapping areas |   |

You can either update the data completely (DELETE EXISTING FILES), delete existing data in overlapping areas (REPLACE EXISTING ELEVATIONS IN OVERLAPPING AREAS) before new (more accurate) data are imported or ignore the new data in overlapping areas if the existing elevation data are better (IMPORT ELEVATIONS ONLY OUTSIDE OF OVERLAPPING AREAS).

#### Save file frames to a Geo-File

With this task the frames of all elevation files are stored as general areas in a Geo-File. In addition, the file name is written in the center of the area as a Geotext. This is very helpful, if you want to get an overview of the scope of the delivered elevation data.

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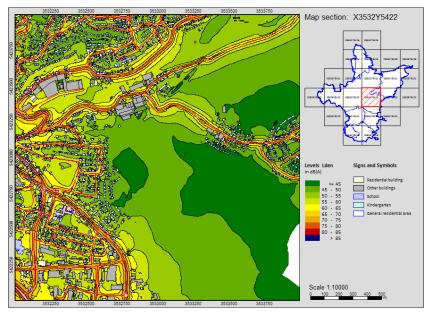
Preprocess elevation data for the Calculation Kernel



## Map section, overview map and sheet tools

#### **Generate Map Sections**

Map sections are very helpful if you want to present multiple sheets with the same content but varying sections (viewports), i.e. if you have a single Grid Noise Map and want to divide the presentation into many sections like a world atlas. You can automate the generation of multiple sheets with ease and thus can present your findings with a high resolution on multiple pages.



Map section, overview map and sheet tools

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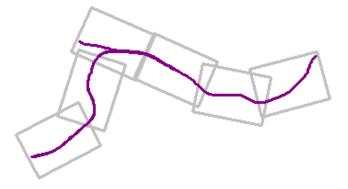
You can generate the map sections manually from the Geo-Database or automated directly from the Graphics. Map sections are always rectangles. In the Graphics you can -like in previous versions- process the map viewport in Edit Map. For licenses without the Cartography module the map section is saved as a general area and the sheet name as a Geotext. When the Cartography module is present the section is saved as a new object type, the map section and is to be saved under user defined names.

| Map section   |                |        | ×    |
|---------------|----------------|--------|------|
| <u>N</u> ame: | Petrol station |        |      |
|               | ОК             | Cancel | Help |

To generate the map sections in the Graphics, you need a "template sheet" with a plan which has the desired size and scale.

The current map viewport can be saved as a Geo file via EDIT MAP/GEOMETRY VIEWPORT -> SAVE CURRENT MAP SECTION AS GEO FILE.

A typical application for this procedure is to create multiple map section frames along the route of a planned road or railway. Load the Geo file with the map section into the situation along with the base data you want to present and duplicate the map section and rotate and move it in plane. To duplicate the map section mark it and move the cursor to the purple route in the middle of the object and with the ALT + left mouse button move a copy of the object to a new location. You can rotate the new map section with Ctrl +left mouse button movement. All new map sections need to be hosted in the same Geo.



As an alternative to the manual generation of map sections in the Geo-Database you sometimes want to generate a grid of plans covering the entity of the entire map. Create your "template sheet", load it in the Graphics (inclusive of the calculation area) and via Edit map **GEOMETRY VIEWPORT -> CREATE MAP SECTIONS FOR ENTIRE CALCULATION AREA** create a grid of map sections to display the entire calculation area in the desired resolution.

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Map section, overview map and sheet tools

| Create map sections                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                       |  |    | x  |  |
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| Map sections                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |  |    |    |  |
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| Create map sections for complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | rectangle around the calculation area |  |    |    |  |
| Ocreate map sections only if they of the section | overlap with the calculation area     |  |    |    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -                                     |  |    |    |  |
| Section names                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |  |    |    |  |
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| Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Select name variable                  |  |    |    |  |
| %va%hn                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Rows as charachter                    |  |    | -  |  |
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| for complete rectangle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                       |  |    |    |  |
| from top to bottom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                       |  |    |    |  |
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| Geofile name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |  |    |    |  |
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| Map viewports                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |  |    |    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                       |  |    |    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                       |  |    |    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | OK Cancel                             |  | He | lp |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                       |  |    |    |  |

You can decide to generate map sections covering a rectangle around the calculation are or only the sections that contain part of the calculation area.

The map sections are automatically named according to your settings:

- Continuously numbered
- Rows as letters, columns as numbers
- Columns as letters, rows as numbers
- Middle coordinates X/Y in [km]
- X/Y of the top left corner in [km]

The two last options are only available when the middle coordinates are set to kilometers and the map has the size of multiple kilometers so that the maps are not overlapping.

Example: The scale factor is set to 1:10.000 and the map shall have the dimension of 200 x 200 mm. If the map shall feature a frame of 5 mm, the map size must be set to  $210 \times 210$  mm.

You can format the section name for example to insert an additional identifier or a separator between the variables for example to display the default section name X3530Y5422 as X3530/Y5422.

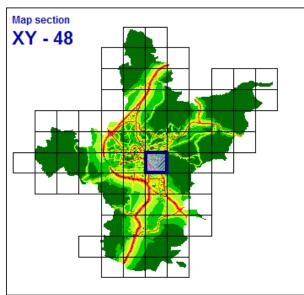
The section names can be included as a text into the plan with the function "Show attributes as text" of the file selection manager. Include the parameter Tools/Map section/Name as the text. The file containing the map section however must have been loaded once in the Geo-Database.

Map section, overview map and sheet tools

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#### Overview map

In the overview map all map sections found in the Geo-File are displayed along with the geometry.



A plan is marked as overview map in "Edit Map", **GEOMETRY VIEWPORT -> GEOMETRY PARAMETER**.

| Geometry parameters                                                   |            |                      |             | ×     |
|-----------------------------------------------------------------------|------------|----------------------|-------------|-------|
| Map viewport                                                          |            |                      |             |       |
| Length scale                                                          | 1:         | 1000                 | Rotation    | 0,000 |
| Middle coordinate X:                                                  |            | 3532000,000          | Y: 5423300, | 000   |
| <ul> <li>✓ Overview map</li> <li>✓ Fixed map viewport (e.g</li> </ul> | . do not u | se for map sections) |             |       |
|                                                                       |            | ОК                   | Cancel      | Help  |

Additionally, for very large sale investigation areas it is possible to scale the overview map and center the displayed map section in the overview.

In the map object types select how to format the map sections and -if loaded- the map section names. The object type **CURRENT MAP SECTION IN OVERVIEW MAP** determines how the currently displayed map section shall be highlighted in the overview map.

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Map section, overview map and sheet tools

In accordance to the map section of the overview the data are loaded in the main plan. The coordinates in the middle of the section rectangle are calculated and set as the middle coordinates for the viewport. Select the desired map section from the pop-up-menu (right mouse button) or with *Alt + Left click*. With FILE -> MAP **SECTION** or *F7* the map sections are listed on the left hand side of the screen and can be loaded from there with Drag&Drop.

The **TEXT VARIABLE** "Map name" is filled with the map section name as soon as a map section is selected or defined from the sheet tools.

The **TEXT VARIABLE** "Map section-text" can contain additional free text attributes that you can assign with the Property Explorer of the Geo-Database.

#### Sheet-Tools

With a sheet that contains map sections or areas (usage areas) it is possible to automate the generation of sheets, print the sheets or create bitmaps for the sheets. If a Grid Noise Map is loaded the grid noise map sections can be exported to the ESRI-ASCII-Grids or as a contour map.

The map section or the area names are used as the text variable "Plan name", and for the sheet and the export file name.

Load or activate the map section / areas via FILE -> MAP SECTION or <F7>.

Select the Geo file with the map section / areas. If an overview map with the selected map section visible is contained in the sheet, it is automatically set to show the loaded section. With the cog wheel select a different Geo-File and go to the settings.

Modifying the map section / areas only changes the middle coordinates of the plan.

Settings for the processing of the map section / areas

| Sheet tools                          |                              |
|--------------------------------------|------------------------------|
| Settings                             |                              |
| Geofile with map sections            |                              |
| Map viewports.geo                    | >>                           |
| Calculate rotation                   |                              |
| 🔲 calculate map scale                | Distance to frame [mm] 0,0 🖨 |
| Ioad result only in map section area |                              |
| 🔲 use object type calc area          |                              |
|                                      |                              |
|                                      | Exit Help                    |

**CALCULATE ROTATION**: is only sensible for maps that are not set up to be parallel to the coordinate axis, i.e. sections along a road or railway line. The rotation is measured from the first line of the section rectangle.

Map section, overview map and sheet tools

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**CALCULATE MAP SCALE**: the map section or respectively the Min/Max-rectangle of the area is fitted to the map with regarding the parameter **DISTANCE TO THE FRAME**. Printing the scale bar gives a better understanding then using the scale factor numbers.

**LOAD RESULTS ONLY IN THE MAP SECTION AREA**: is only sensible for areas as otherwise the data are loaded for the section anyway.

**USE OBJECT TYPE "CALCULATION AREA"**: it only sensible for areas. Via the area the "background" definition in the tab *Cartography* the plan outside the calculation can be masked.

With OK list all map sections / areas on the left the same way as the sheet tree is listed. Select a desired map section and load it using the arrow to the right or with Drag & Drop.

To trigger the sheet tools, mark the map sections or select all with <*Ctrl+A*> and click on the symbol button **SAVE UNDER**.



Select the desired action; it is also possible to run them parallel to save time.

| Sheet tools                                                |                              |
|------------------------------------------------------------|------------------------------|
| Settings                                                   |                              |
| Geofile with map sections                                  |                              |
| 002_Gebiete Kernstadt u .Stadtteile.geo                    | >>                           |
| calculate rotation                                         |                              |
| calculate map scale                                        | Distance to frame [mm] 0,0 🗟 |
| load result only in map section area                       |                              |
| use object type calc area                                  |                              |
| Actions                                                    |                              |
| Create sheets                                              | Subfolders                   |
| Print sheets                                               | >> Plots\                    |
| Export grid values                                         | >> Grids\                    |
| Export contour lines in shape files                        | >> Contours\                 |
| Export sheets as bitmap                                    | >> Sheet bitmaps\            |
| Export maps as bitmap                                      | >> Map bitmaps\              |
| Files                                                      |                              |
| Prefix for file names + % for map section na<br>Grid LrN % | me (e.g. GNM Lden_%)         |
| GIU_LIN_ 70                                                |                              |

The **SETTINGS** have been already explained in the chapter for the definition of the map sections.

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Map section, overview map and sheet tools

**CREATE SHEETS** generates an SGS file for the map sections / areas with the name of the section / area so that you can post process the sheets individually.

**PRINT SHEETS** prints all marked sheets. The sub folder indicated here is only relevant if you want to create plot files, i.e. reroute the plotting stream into a file. If you want to create a PDF file, you need to also observe the settings of the printer driver. Often you can define a sub folder and use the file name created automatically by SoundPLAN (from the sheet name).

**EXPORT GRID VALUES** exports the grid values in ASCII or GeoTiff format. You can define if levels on buildings are regarded as sufficient levels and how many digits after the decimal shall be used.

**EXPORT CONTOUR LINES TO SHAPE FILES** exports the results of a Grid Noise Map for the selected map section / area as an ESRI Shape files (details can be found in the chapter Graphics, Export of contour lines).

**EXPORT SHEETS AS A BITMAP** exports the entire sheet as a bmp, jpg, tif or png. Resolution and compression parameters are definable.

**EXPORT PLAN AS BITMAPS** only exports the main plan including its frame. If you only are interested in the plans, set the frame size to 0 in the plan settings.

The file name is important for the execution of the sheet tools: The file name must contain a "%" as the place holder, the "%" in the file name will be replaced with the map section name.

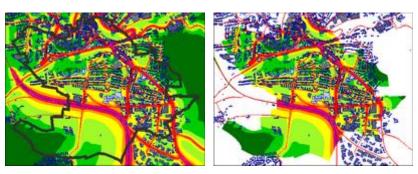
#### Effects for the calculation area

When working with areas set in the sheet tools the option **USE OBJECT TYPE CALCULATION AREA**, to allow the following options.

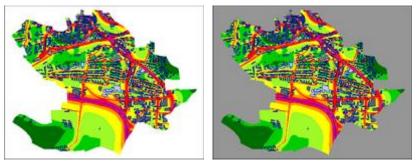
| draw no results use background color |    |  |  |
|--------------------------------------|----|--|--|
| •                                    | 0% |  |  |
|                                      | 0% |  |  |
|                                      | _  |  |  |

In the object type calculation area, tab *Cartography* define the method to clip the background outside the area or have only the basic geometry printed.

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Left picture: no effect (with area border), right picture: do not display results



Left picture: Do not display objects, right picture: additionally, with background color

When the area outside the calculation area / area is not to be displayed, the area within the section rectangle between the calculation area and the frame is filled with white or another background color.

When masking with color intensity settings or converting into gray scales, first the entire plan is plotted. After this a windows function defines the entire "clipping area". For screen and bitmap output this procedure is working well but most printer drivers cannot cope with this procedure. Additionally, print files and PDF files are becoming so big that it is advisable to first generate a bitmap when working with masking.

# Processing Noise Mapping Results according to the EU Directive

The transfer of the EU Environmental Noise Guideline into national law gave a lot of the reporting requirements a local component where details of the statistics of exposed inhabitants, exposed areas and special buildings (schools, hospitals ...) are defined. Please acquire the information about the procedures locally in your country SoundPLAN may not know all details to be a reliable source here.

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Processing Noise Mapping Results according to the EU Directive

## Schools, hospitals, kindergartens

Schools and hospitals (in some countries kindergartens too) must be accounted for and their numbers have to be assigned the individual noise zones.

In the Geo-Database always enter the usage type (school, hospital, kindergarten) for each building in the Property Explorer.

Special buildings are treated as normal buildings, which means that if inhabitants are assigned (for example for the care taker family) the inhabitants are accounted for the normal way.

Marking buildings as special buildings does not have to be done before the noise map is calculated as the information is directly taken from the geometry data.

#### **Building clusters**

A special building can be comprised of multiple single buildings. As soon as the field **PROPERTY NUMBER** contains the same text for multiple buildings, the cluster of buildings in the final processing for the statistics will be treated as one building cluster.

When defined as a building cluster, the statistics for the "loudest level" and the "energy mean value" are derived and accounted for the entire building cluster (see Settings for the EU-Statistics, page 669.).

## Subdividing multiple areas

You can divide your investigation area into multiple areas (community, borrow) and generate a joint statistics with entries area by area. The borders of the areas must be contained in the data as "area usages". In the tabular results the object name is presented, the number of inhabitants and the area usage are irrelevant here

Area and inhabitant statistics in the SoundPLAN Spreadsheet (area table) are based on the area usage and assign area size, number of inhabitants, number of dwellings and special buildings.

The areas are even accounted in the statistics if they have been generated after the calculation of the noise map.

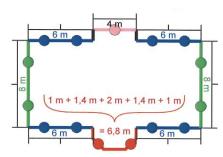
#### Calculation

#### Calculation of the façade noise level

If you set the calculation of the facade noise levels (**Facade Noise Map**) to VBEB (Germany) in the calculation settings for **RECEIVERS ACCORDING TO VBEB** receivers, then are generated in accordance to the rules of VBEB:

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- Facades longer that 5 meters are divided into smaller segments for which a single receiver is calculated.
- Facades with a length between 2.5 meters and 5 m are represented by a single receiver
- Smaller facades are ignored except if multiple subsequent facade segments reach the combined length of more than 5 meters. In this case the combined façade is then treated as a façade longer than 5 meters and if needed subdivided into 5 meter sections.

This procedure is advisable for non-German areas as it generates a sensible distribution of inhabitants and dwelling units as long as the accounting does not required setting the loudest level as default for the entire building.

The EU Noise Mapping leaves the member states some freedom, for example has Austria chosen to set receivers along a facade at a spacing of 3 meters, select the setting **RECEIVERS SPACED** with a distance of 3 meters.

**Hint:** As soon as at least one facade has been activated in the Geo-Database for the calculation with the Facade Noise Map, all receivers for that building are switched to be calculated in accordance to VBEB. For the calculation of the façade noise levels in Austria, all facades must be activated.

#### Calculation of noise contours

For the calculation of noise contours (**Grid Noise Map**) in Austria for example a grid spacing of 5x5 meters is required, in Germany the standard is a 10x10 grid. Additional settings are not required.

#### Hints for the calculation of very large areas

For the calculation of facade noise levels and grid noise maps for very large calculation areas it is paramount to analyze the ratio of invested calculation time and accuracy up front. This for example can be accomplished with a statistics calculation run, see "Statistical accuracy" on page 378.

The following recommendations for the calculation parameters in the calculation core should be checked in any case and possibly should be coordinated with your client.

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Filter the elevation data for the DGM sensible during the import in the Geo-Database. If the DGM is too dense, the calculation and loading time increases significantly.

The reflection order has a considerable influence on the calculation time. If possible, reduce the refection order to 1 and use in city environment the Geo-Tool <u>"Estimate multiple reflections</u> (page 177)" to account multiple reflections in street canyons at the side of the emissions.

Restrict the search radius to between 2000 meters and 4000 m depending on the question of how far prominent noise sources can be heard.

The allowed tolerance can be set to 0.5 - 0.8 (total result) for large projects.

If necessary, reduce the refection distance around source and receiver.

For grid noise map calculations, the interpolation can interpolate much more if you change the difference (Interpolation during the Grid Noise Map Calculation (page 347)) to 0.5.

## Post processing in the SoundPLAN Spreadsheet (area table)

The post processing of the EU statistics has been implemented in SoundPLAN flexible enough that the same procedures in SoundPLAN can be used throughout the entire EU with their diverging national implementation of the EU Directive. As there are big differences in the national ways, you first of all need to settle what data is required for your country and how the data shall be processed (for example the accounting of the quiet façade or the distribution of the number of inhabitants amongst the façade receivers). As soon as the table with all settings, title texts and other settings is fulfilling your needs, you are best advised to save the table as your template for the noise mapping project.

The accounting can be accomplished for the entire calculation area or it can be based on individual usage areas. For that reason, the EU statistics are integrated into the area table.

Normally the area table only processes "area usages ". In case the selected Geo-File or Situation does not contain any area usages, the EU-statistics is then applied for the entire calculation area.

#### Which EU-Statistics are available?

- Inhabitant statistics: Accounting on the basis of façade noise levels (from Façade Noise Maps)
- Area statistics: Accounting of the noise in outside areas (Grid Noise Map, Meshed Noise Map)

Open the Spreadsheet and in the file manager select the **FILE TYPE** "Area table (conflict map)".

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| -Create a new table- |                                                                                                                      |   |
|----------------------|----------------------------------------------------------------------------------------------------------------------|---|
| File type            | Receiver table (Single points, Facade Noise Map)                                                                     | ~ |
|                      | Receiver table (Single points, Facade Noise Map)<br>Measurement table<br>Area table (conflict map)<br>Building table |   |

In the initial selection select the Geo-File or Situation in which area usages and calculation area are contained.

The data for the statistics (buildings, dwellings, residents) are taken from the Situation that was used during the calculation of the Facade Noise Map or Grid Noise Map. The request to enter a situation for the area table only will affect the area definition by loading the areas from either the same situation or from a secondary situation where mistakes in the areas have been corrected.

With the switch **COLUMNS** you can deactivate the columns for "inhabitants" and "size", that are irrelevant for the statistics, before the file is loaded.

Via FILE -> ADD ADDITIONAL COLUMNS select the desired EU statistics.

| Add result column(s)     |   |                                                      |
|--------------------------|---|------------------------------------------------------|
| Add additional column(s) | • | Add additional information columns                   |
| Add result               |   | Add point list column                                |
| Page layout<br>Legend    |   | Add EU building statistics<br>Add EU area statistics |
| Drint                    |   |                                                      |

After selecting the proper result file (depending on the selected statistics a Facade Noise Map for the building statistics or the Grid Noise Map or Meshed Noise Map for the area statistics), you get to the dialog where you define how and with which time slices the EU-statistics shall be evaluated (see "<u>Settings for the EU-statistics</u>" on page 669).

Afterwards select which data and which time slices you want to use.

| Select result columns                                                                                                  |             |
|------------------------------------------------------------------------------------------------------------------------|-------------|
| Column types<br>Size [km²]<br>Inhabitants<br>dwelling count<br>schools count<br>hospitals count<br>kindergartens count | Time slices |
| Select which column types shall be created.                                                                            | OK Cancel   |

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The EU-statistics will be calculated separately for each area. When more than one area is present, the program automatically will generate a sum line that sums up the data of the areas.

Hint:

- The calculation depending on the size of the areas and the requested task can take several minutes or even longer!
- The buildings needed for the statistics are automatically loaded from the data of the run file that is kept with the results.
- One area table can only contain a single EU-statistics. The area table thus cannot contain both the building- **and** the area- statistics, neither is it possible to have a comparison of variants in the area table.

#### Settings for the EU-statistics

Because of the diverging requirements for the EU-statistics, some clarifications need to be made:

| Settings for the current document                                     |                                |              |
|-----------------------------------------------------------------------|--------------------------------|--------------|
| Options                                                               |                                |              |
| Calculate with displayed float values                                 |                                |              |
| EU statistics                                                         |                                |              |
| intervals                                                             | C threshold values             |              |
| Minimum interval value 50.0 🚖                                         | Interval size                  | 5.0 🚖        |
| Maximum interval value 75.0                                           | Intervals count                | 6 🛫          |
| Assign special buildings (schools,) on the basis of:-                 |                                |              |
| <ul> <li>the loudest level</li> </ul>                                 |                                |              |
| C the energetical mean level                                          |                                |              |
| Calculation method to assign inhabitants and dwelling                 | 15                             |              |
| C assign all inhabitants and dwellings to the loude                   | ist value                      |              |
| <ul> <li>assign inhabitants and dwellings according to the</li> </ul> | ne level of the facade section |              |
| Quiet facade                                                          |                                |              |
| use quiet facade maximum value                                        |                                |              |
| Lden 55 Ld,Le,Ln 50                                                   |                                |              |
|                                                                       | <u>O</u> K Cancel              | <u>H</u> elp |

#### Level ranges

First you need to decide if the results are accrued for an interval (for example levels between 50 and 60) or if the level is understood as a threshold value (i.e. >50 includes values above 50 and values above 60).

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This selection can be changed at a later time via **OPTIONS** -> **DOCUMENT SETTINGS** -> **CURRENT DOCUMENT**, for other changes the statistics must be regenerated with **FILE** -> **REBUILD TABLE**!

## **Statistics of exposed residents**

Assignment of residents to dwellings:

ASSIGN ALL INHABITANTS AND DWELLINGS TO LOUDEST VALUE accounts all residents and dwelling by using the loudest on the building occurring noise level interval for all residents and dwelling.

When you choose the setting **ASSIGN INHABITANTS AND DWELLINGS ACCORDING TO THE LEVEL ON THE FACADE SECTION**, there are 2 different ways to proceed:

- When the facade receivers were generated according to VBEB (Germany), all inhabitants are distributed equally amongst the facade receivers, likewise the dwellings.
- For all other settings in the calculation of the Facade Noise Map, the inhabitants and dwellings are distributed according to the facade length representing each individual receiver.

If the Façade Noise Map was calculated **floor by floor** also in the statistics the inhabitants and dwellings are floor by floor assigned to the corresponding level interval.

#### Assessment of the quiet facade

Like in many places in the execution of the END, here too there are many national ways of determining what the quiet facade shall be, here some possibilities:

The relevant receivers for the assessment of the quiet facade can be located on the facade or 2 meters in front of it. The additional receivers 2 meters in front of the façade are calculated when you request **ADDITIONAL RECEIVERS 2 METERS IN FRONT OF THE FACADE** in the **RUN SETTINGS** under the tab *Façade Noise Map* (Caution the calculation time will double!). In case the 2 m receivers were calculated, they will be used to assess the quiet facade, otherwise this is done directly with the receivers on the façade itself.

To assess the quiet facade, the loudest noise level found on the building or per floor is determined and compared with other receivers on the facades (or 2 meters in front). If the difference between the maximum and the assessed receiver exceeds 20 dB, the inhabitants and dwellings associated with the receiver are accounted for as being on a quiet facade.

As long as a maximum acceptable noise level has been set for the quiet facade, this is also checked. Only receivers below the threshold level that make the 20 dB difference criterion make the grade to be accounted for in the table of the quiet façade.

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To set the threshold, check the box **USE MAXIMAL VALUE FOR QUIET FACADE**.

#### Caution:

- The assessment assumes that the first time slice in the assessment library is the Lden. The first threshold value always assumes that is meant for the Lden for all other time slots the second threshold value is used.
- In Austria the level must be 5dB below the threshold value, i.e. if the threshold value is 50 dB the value set in SoundPLAN must be 45 dB.

Assessment of hospitals, schools and kindergartens:

If inhabitants and dwellings have been assigned to these buildings, those figures will be used in the accounting.

For the assessment of special buildings, the property number is used to determine which structures belong to the same building complex and then the accounting is dome treating the building complex as a single entity.

Example inhabitant statistics:

| Statistics                             | on Affected                                                                                                                | l Inhabitants                                                                    |                                                            |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------|
| Name                                   | Intervals                                                                                                                  | Number of af<br>Inhabitan                                                        |                                                            |
|                                        |                                                                                                                            | Lden                                                                             | Ln                                                         |
| All communities<br>Community Arbenrath | 50 - 55<br>55 - 60<br>60 - 65<br>65 - 70<br>70 - 75<br>> 75<br>50 - 55<br>55 - 60<br>60 - 65<br>65 - 70<br>70 - 75<br>> 75 | 4700<br>2800<br>1300<br>300<br>100<br>0<br>600<br>300<br>200<br>0<br>0<br>0<br>0 | 2400<br>1000<br>200<br>-<br>-<br>200<br>100<br>0<br>0<br>- |
| Community Wiesenach                    | 50 - 55<br>55 - 60<br>60 - 65<br>65 - 70<br>70 - 75<br>> 75                                                                | 2000<br>1100<br>600<br>100<br>0                                                  | 1100<br>400<br>100<br>0<br>-                               |
| Braunstein + Ber                       | rndt GmbH · Etzwiesenb                                                                                                     | erg 15 - 71522 Backnang                                                          | page 1                                                     |

EU Directive on Environmental Noise

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## Area statistics

The area size for the individual noise level intervals by internally rastering the contour map and accounting the level found in the middle of each grid cell to the interval it falls in. The areas within buildings are ignored, that means that in a situation where all levels are above 50 dB and also the buildings are exposed to high noise levels, the area accounted for as being above 50 dB is smaller than the entire area itself, in fact it will be the area minus the cumulative size of all buildings.

The settings and the processing of all other values is the same as in the inhabitant statistics, the only difference is that checkpoints along the facades must be generated first. These checkpoints are generated in accordance to the procedures from VBEB (see "Calculation of Façade Noise Levels").

Example area statistics:

| EU Directive on Environmental Noise<br>Statistics based on the Result of the Grid Map Calculation |                      |                      |                        |                      |                        |                             |  |  |
|---------------------------------------------------------------------------------------------------|----------------------|----------------------|------------------------|----------------------|------------------------|-----------------------------|--|--|
| EU Flächenstatistik für Lden                                                                      |                      |                      |                        |                      |                        |                             |  |  |
| Name                                                                                              | Threshold            | Size [km²]           | Number of<br>Dwellings | Nunber of<br>Schools | Number of<br>Hospitals | Number of<br>Kinder gartens |  |  |
| Sum over all communities                                                                          | > 55<br>> 65<br>> 75 | 5,60<br>2,53<br>0,66 | 5400<br>1300<br>100    | 6<br>2               | 3                      | 6                           |  |  |
| Community Wiesenach                                                                               | > 55<br>> 65<br>> 75 | 2,51<br>1,28<br>0,32 | 2300<br>600            | 2                    | 1                      | 2                           |  |  |
| Community Geisdorf                                                                                | > 55<br>> 65<br>> 75 | 2,02<br>0,69<br>0,19 | 2000<br>400            | 2                    | 2                      | 1                           |  |  |
| Community Arbenrath                                                                               | > 55<br>> 65<br>> 75 | 0,60<br>0,25<br>0,07 | 700<br>100             | 1                    | -                      | 1                           |  |  |
| Community Reichendorf                                                                             | > 55<br>> 65<br>> 75 | 0,47<br>0,31<br>0,08 | 400<br>100<br>-        | 1                    | -                      | 2                           |  |  |
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## Variant comparisons using the statistics

You can import multiple variants of an inhabitant or area statistics into a single area table to create variant comparisons according to the affected inhabitants or area.

|         |           | Statis | tics | Stais | tics | Diffe | rence | Sum a | affecte | d occup | pants | Improv | /ement |  |  |     |  |  |  |
|---------|-----------|--------|------|-------|------|-------|-------|-------|---------|---------|-------|--------|--------|--|--|-----|--|--|--|
| Name    | Intervals | Var.   | .1   | Var   | . 2  | Var1  | -Var2 | Var   | r. 1    | Va      | r. 2  |        |        |  |  |     |  |  |  |
|         |           | LrDT   | LrN  | LrD   | LrN  | LrD   | LrN   | LrD   | LrN     | LrD     | LrN   | LrD    | LrN    |  |  |     |  |  |  |
| Wincity | 50 - 55   | 1601   | 825  | 1596  | 697  | -5    | -128  | 3665  | 1836    | 3389    | 1558  | 276    | 278    |  |  |     |  |  |  |
|         | 55 - 60   | 698    | 632  | 642   | 490  | -56   | -142  | 1     |         |         |       |        |        |  |  |     |  |  |  |
|         | 60 - 65   | 696    | 303  | 467   | 245  | -229  | -59   | 1     |         |         |       |        |        |  |  |     |  |  |  |
|         | 65 - 70   | 476    | 76   | 430   | 126  | -46   | 50    | 1     |         |         |       |        |        |  |  | 1 1 |  |  |  |
|         | 70 - 75   | 193    | -    | 233   | -    | 39    | -     | 1     |         |         |       |        |        |  |  |     |  |  |  |
|         | > 75      | -      | -    | 21    | -    | 21    | -     | 1     |         |         |       |        |        |  |  |     |  |  |  |

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To interconnect multiple statistics, select the column type **TABELLE -> ADD COLUMN** - > **INTERVALS**. To compare the effectiveness of different noise control measures, the difference between the intervals is not a good decision criterion by itself. In addition, it is recommended to calculate the sum of the noise effected persons for each variant. Enter the formula SUMXstatisticsscolumn (no blanks permitted) in a value column.

## **EU-Statistics in the Graphics**

The graphical representation of area and inhabitant statistics is not part of the EU Directive but an additional feature in SoundPLAN. The building statistics is selected in the graphics via the data type **EU BUILDINGS (ANNEX VI)**.

Settings and calculations are the same as in the area table except that in the area statistics you must define the intervals separately, in the graphics this is done via the scale.

The difference may be in what data are used: in the area table the accounting is done on the basis of areas or the entire calculation area and in the Graphics it is always representing all data loaded.

The area statistics may show a little variance between the area table and the graphics as the area table accounts only grid cells where the center is in the calculation area, the graphics accounts for all loaded grid points.

With a 10 x10 m grid for the calculation, some of the scan points will be outside the calculation area but will also be added to the area size.

#### Peculiarity in the presentation of the areas

- For the calculation of the area sizes for each noise level interval (respectively above a threshold value) the contour map is always rasterized in a 1x1 m raster.
- The receivers for the assignment of inhabitants, dwellings and special usage buildings to the noise level intervals is always done in accordance to VBEB (see "Calculation of Facade Noise Levels"), except when all values are set only to the highest level found on the entire building.

#### Peculiarity of the Facade Noise Map

If the Facade Noise Map was computed only on a single elevation (most often in a height of 4 meters above ground), there is no difference in the statistics of the area table and the graphics.

If multiple floors were calculated, for example in the framework of an action plan, the floors are treated as separate entities as if each were a separate building. This means that inhabitants and dwellings are equally distributed amongst all floors and per floor the questions of the quiet façade is evaluated separately.

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In the area table the statistics is always calculated for all floors. In the graphics select the floor for which you want to display the statistics. The statistics is then computed only for the selected floor, including the selection of the loudest façade and the quiet façade.

In addition, you have the option via the floor selection to set it to all floors. Here the loudest façade and quiet façade are evaluated jointly for all floors of the building and thus the results should be the same as in the area table (provided you have calculated the same content and loaded it).

According to the selected scale, the building itself is filled with the color of the loudest noise level found on the building; the façade where this level occurred is marked. For the quiet façade the values with the loudest floor are used, therefore it can occur that a building in the statistics is set to have a quiet faced but in the Graphics it is not indicated as the loudest floor in the position where the quiet façade exists, may be above the noise threshold.

CAUTION: For the calculation of the statistics (regardless if area table or in the graphics) the data are used that were used in the calculation run, the situation requested in the area table is not used here; neither is the geometry loaded in the graphics relevant here. If you rename or delete Geo-Files or Situations after the calculation run was done, this will result in a change in the statistics as the result files keep a copy of the file names rather than a copy of all data.

This procedure still allows you to start calculating the noise maps before you have entered all data for the inhabitants or have sorted out the special usage buildings. Or it might be that you get more accurate information on the number of residents; you can add the information and just recalculate the statistics.

## Conflict map / Summed-up conflict map

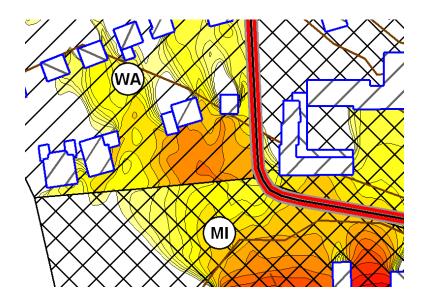
#### **Conflict map**

Conflict maps show limit violations for each of the area usages of one noise type. The limit violations sharply change at the area usage boundaries.

The basis of the graphical representation is an automatically created Spreadsheet of the file type area table.

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Conflict map / Summed-up conflict map



## How to generate conflict maps

Go to the file selection manager in the Graphics. Load the geometry and select the file type "Area table (Conflict map)". Click on the double arrow to define the content of the conflict map

| 🐺 Select value                                                          |                  |            |             |
|-------------------------------------------------------------------------|------------------|------------|-------------|
| Column                                                                  |                  |            |             |
| 6: Level LrD                                                            |                  |            | •           |
| Kind                                                                    | Calculated value | (Conflict) | •           |
| <ul> <li>C show all values</li> <li>O show only values above</li> </ul> |                  |            | 0,0 🚖       |
| Colored scale                                                           |                  |            | <b>•</b> >> |
| TICAA                                                                   |                  |            |             |
|                                                                         | OK               | Cancel     | Help        |

Select first a Situation or a Geo-File which includes the noise zones / area usages and assign it with a double click or the arrow. The file is automatically assigned to the upper part of the dialog. Then select the file type Grid Noise Map or Meshed Noise Map from the file type selection list. Choose the result file and the time slice you want to display. The default assessment is the assessment used in the

```
Conflict map / Summed-up conflict map
```

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calculation run. If necessary, you can select another assessment from the selection list. Click OK.

Now you are asked for the column of the automatically created area table you want to display in the Graphics.

| 🍯 Area map (Co   | nflict map)                                                                          |                                |   |                                       |
|------------------|--------------------------------------------------------------------------------------|--------------------------------|---|---------------------------------------|
| Select file type |                                                                                      |                                |   | Selected files incl. area usage:      |
| Grid Noise Map   |                                                                                      | •                              |   | Name Description Last change Size (B) |
| Name             | Description                                                                          | Last change 🔺                  |   | DISCONES.geo ZONES; 08.08.200 44443   |
|                  | Road noise - present situation (GNM)                                                 | 26.07.2005 16                  |   |                                       |
|                  | Rail noise - present situation (GNM)                                                 | 26.07.2005 17                  | > | ľ                                     |
|                  | Industry noise - present situation (GNM)<br>Rail noise - with noise protection (GNM) | 17.03.2004 17<br>26.07.2005 17 | < | Selected grid maps:                   |
|                  | Road noise · Prognosis (GNM)                                                         | 15.09.2005 17                  |   | Name Description Last change Size (B) |
|                  | Oak Street - without noise protection (GNM)                                          | 16.03.2004 13                  |   | BRLK0111.res 15.09.200 1724           |
|                  | Oak Street - with noise protection (GNM)                                             | 16.03.2004 13                  |   |                                       |
|                  | Road noise for sheet "cartography"                                                   | 17.04.2002 17                  |   |                                       |
| RRLK2003.res     | Test 2                                                                               | 29.06.2005 12 💌                |   |                                       |
| Assessment       | Road                                                                                 |                                |   | V                                     |
| Description      | Area map (Conflict map)                                                              |                                |   |                                       |
| Use template     | New area map                                                                         |                                |   |                                       |
|                  |                                                                                      |                                |   | OK Cancel Help                        |

The pre-settings are suitable for the graphical representation of the conflict map: The value you loaded in the conflict map definition (column of the area table), the display kind (calculated value (conflict)) and "show values above 0" or with a correction.

Click OK to view the conflict map on the screen.

You can view the area table that is the basis of the conflict map with a right click -> **CONFLICT /AREA MAP** and process it to prepare summed-up conflict maps.

#### Procedure for summed-up conflict maps

Generate a "normal" conflict map in the Graphics. Click right to open the area table (right mouse menu -> CONFLICT /AREA MAP).

| 1                                                               | 2        | 3                    | 4              | 5               | 6                    |
|-----------------------------------------------------------------|----------|----------------------|----------------|-----------------|----------------------|
| Name                                                            | Түре     | Size                 | number of occu | Limit<br>(dB[A] | Level<br>LrD         |
| Beer garden and Jamaica Road                                    | M        | [m²]<br>70708,48     | 1220           | 65              | 4.0                  |
| Inner City (Mixed)                                              | M        | 54795,86             |                |                 | -4,0<br>-5,8         |
| Buisness district at railwav<br>Residential Oak Street          | BU       | 40886.90<br>19556.81 | 700<br>870     | 65<br>65        | -1.5                 |
| Residential Oak Street<br>Residential Th. More St. / Plough Way | GR<br>GR | 19556,81             |                | 65              | -1.5<br>-8,2<br>-8,2 |

Automatically created area table

The area table is another type of the Spreadsheet. Instead of the receiver points, the area table is built up according to the usage areas defined in the Geo-Database. You see the names of the noise zones in the first column, the area usage type in the second, the zone size, the number of inhabitants if defined in the fourth column,

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Conflict map / Summed-up conflict map

the limit level per zone in the fifth column and the average noise level day minus the limit level in the last column (formula GV0-x5;).

How to interpret this formula?

SoundPLAN creates a copy of the grid map for each area covering just the boundaries of the grid map. This copy is filled with the values according to the formula: Use Grid Value from the grid map which is assigned to this column (0) and subtract the value in column 5 (limit value).

Please see chapter <u>Spreadsheet</u> (page 407) for details.

To add grid values of another Grid Noise Map for a summed-up conflict map, go to **FILE -> ADD RESULTS**. Load another calculation result file, select in the next dialog the time slice and if necessary, another assessment (e.g. if you used another assessment for industry noise) and import the data into new columns. Click OK.

Now you can sum up and weigh the results in a new grid column.

Enter a new grid column (TABLE -> INSERT GRID COLUMN) for the summed-up conflicts.

Go to **TABLE -> TABLE SETTINGS** and enter the formula for the summed-up conflict. The following example adds the single conflicts of both grid maps:

GV6 ++GV8; Please read section "formula editor (page 426)" for details.

Leave the table settings and click yes to recalculate all columns.

The area table shows the average value of all grid columns. Therefore, a conflict may occur in a part of the grid cells even if the average is < 0.

**Hint:** This formula for summed-up conflict adds all grid points. I.e. there might be grid points that do not have a single conflict but a summed-up conflict.

If only grid points with a single conflict should be taken into account, us CV ( $\underline{c}$  onflict  $\underline{v}$  alue) instead if GV:

CV6 ++CV8;

Example:

Conflict value of the grid point in column 6: -0,1

Conflict value of the grid point in column 6: +0,5

The formula "GV6 ++ GV;" adds both levels.

The formula "CV6 ++ CV8;" ignores the "-0,1" and returns the result of column 8.

Go back to the Graphics with **FILE -> RETURN TO GRAPHICS** and save the table under a new name.

To change the displayed values (time slice, noise type, summed up conflicts) in the conflict map, go to the file selection manager, right click on the file \*.bfl and select column 7 from the selection list.

Conflict map / Summed-up conflict map

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## **Annoyance Analysis**

A Facade Noise Map is necessary for creating annoyance analyses and other implementation of the EU Directive on Environmental Noise.

#### **Supplementary Necessary Information**

For an annoyance analysis, add additional information to the building properties (e.g. number of occupants, employees or pupils per building, or the zone type) and import them to the SoundPLAN spreadsheet for analysis.

In most cases, you won't know the occupants per building, but you can also use the number of occupants per area or calculate them in the SoundPLAN spreadsheet using the floor area.

Define the usage areas in building blocks, in order to prepare the graphical display of affected people per hectare.

It would be useful to select the buildings where no one lives or works, store them in separate Geo-Files and assign 'auxiliary buildings' in the building properties. In this way, these buildings won't be taken into account in a Facade Noise Map calculation.

#### Working on an Annoyance Analysis in SoundPLAN

Load the results file and exclude unnecessary columns in the TABLE SETTINGS.

Call FILE -> ADD ADDITIONAL COLUMNS -> COLUMNS WITH ADDITIONAL INFORMATION, select a situation that includes the buildings and choose the information that shall be added.

Then create a new value column and interpret the information using formulas.

Example:

"Building area x number of floors" has been loaded in column 25. Assuming that all buildings are residential buildings and there is one inhabitant per 40 m<sup>2</sup> floor area, create a value column and enter the formula "x25/40;" to obtain the number of occupants per building.

If you want to determine the number of affected people over an *Lden* of 65 dB(A), add another value column and calculate the affected inhabitants per building with the formula

IF "Column Lden" > 65

THEN "column number of occupants per building" ELSE 0;

to calculate the number of occupants per building.

Use TABLE -> TABLE STATISTICS to show the affected people for the whole area.

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Annoyance Analysis

For the graphical result check and presentation, the magnitude of the conflict should be mapped in the Graphics using a colored scale. Within the SoundPLAN spreadsheet create a new area table (FILE -> FILE TYPE -> AREA TABLE) with the building blocks that were previously prepared in the Geo-Database. Select FILE -> NEW and load the Situation or Geo-File containing the building blocks as area usages. Then load the column with the affected occupants per building from the original SoundPLAN spreadsheet (which is a table referenced to a point list):

**FILE -> ADD ADDITIONAL COLUMNS ->COLUMN FROM RECEIVER TABLE** and select the Spreadsheet and appropriate column.

Use the column operation to select how to insert the contents of the column in the area table:

| Select column            | ×    |
|--------------------------|------|
| 26: Affected people      |      |
| ⊂Do with column contents |      |
| C Average                |      |
| C count                  |      |
| C Minimum<br>C Maximum   |      |
|                          |      |
| ☐ only values > 0        |      |
| <u>D</u> K Cancel        | Help |

Select if only values > 0 should be loaded.

In order to obtain a convincing statement of the annoyance, the affected people per building block must be standardized to a specific reference size (e.g., to affected people per km<sup>2</sup>).

Create another value column and enter the appropriate formula:

"Column affected people" / "Column size of the building block in m<sup>2</sup>" \* 1000000;

Call the Graphics, load the situation and select the file type **AREA MAP (CONFLICT MAP)** in the file selection manager.

**Annoyance Analysis** 

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| 👹 Select value                                                      |            |          |                 |
|---------------------------------------------------------------------|------------|----------|-----------------|
| Column                                                              |            |          |                 |
| 5: Affected people per kr                                           | n²         |          | •               |
| Kind                                                                | Area value |          | -               |
| <ul> <li>show all values</li> <li>show only values above</li> </ul> |            | 0.0      | ) 🔹             |
| Colored scale                                                       |            | <b>_</b> | <u>&gt;&gt;</u> |
|                                                                     | <u>0</u> K | Cancel   | <u>H</u> elp    |

Select the column you want displayed. Additional selections are possible.

The result "affected people per km<sup>2</sup>" might appear as:

## **Total noise assessment according to VDI 3722-2**

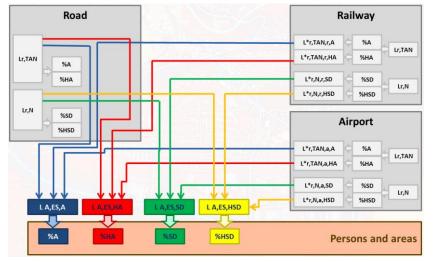
The German VDI 3722-2 is mainly a systematic compilation of already accepted concepts, papers and reports. This new standard is offering a procedure to calculate annoyance and sleep disturbance when more than a single noise type is the culprit. This paper is still somewhat limited as it only regards the transportation noise sources (road, railway and aircraft) and disregards the industrial noise. The basis of the new standard are the dose response curves for annoyance and for sleep disturbance from the "Position Paper on dose response relationships between transportation noise and annoyance (page 369)".

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Total noise assessment according to VDI 3722-2

General procedures:

- Calculation of Grid Noise Maps and Facade Noise Maps for each of the noise types (road, railway, aircraft).
- Calculation of the percentage of the annoyed or sleep disturbed persons as annoyed, highly annoyed, sleep disturbed and highly sleep disturbed (% A,% HA, % SD, % HSD) and the number of affected persons, each for the transportation noise sources of road noise, railway noise and aircraft noise.
- Backwards calculation of the re-normed substitute noise levels (L\*r, TAN, L\*r, N) on the basis of the numbers of affected persons for railway and for aircraft noise.
- Estimation of the "sum level" (effect based substitution level, L A, ES) for all traffic noise sources.
- Definition of a noise indicator for the geographic presentation (hotspots) and to facilitate a ranking.



Flow chart

## Formulas for the implementation of the VDI 3722-2

For the implementation of the VDI 3722-2 file operations and the SoundPLAN Spreadsheet are fitted with a new set of formulas.

The formulas are using the following keywords:

A=Annoyed, HA=Highly annoyed, SD=Sleep disturbed, HSD=Highly sleep disturbed,

STR=Street, RAI=Railway, AIR= Aircraft, TOT=total, MOD=modified (modified formulas), TOTMOD=total modified.

Total noise assessment according to VDI 3722-2

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(x) either refers to the column of the Spreadsheet or the Grid Noise Map / Grid Noise Map Operation and the time slice.

VDI3722\_HAstreet(x7) - Spreadsheet

VDI3722\_HAstreet (RKL600:1) – Grid operation in the Calculation Kernel or the Graphics (the number after the colon refers to the time slice). The re-normed substitution level results from a grid operation. The result is therefore indicated in the formula with RKO.

#### % Annoyed / % Highly annoyed / % Sleep disturbed / % Highly sleep disturbed

| VDI3722_Astreet(x)             | VDI3722_HAstreet(x)             | VDI3722_SDstreet(x)             | VDI3722_HSDstreet(x)             |
|--------------------------------|---------------------------------|---------------------------------|----------------------------------|
| VDI3722_Arail(x)               | VDI3722_HArail(x)               | VDI3722_SDrail(x)               | VDI3722_HSDrail(x)               |
| VDI3722_Aair(x)                | VDI3722_HAair(x)                | VDI3722_SDair(x)                | VDI3722_HSDair(x)                |
| VDI3722_Atot(x1,x2,x3)         | VDI3722_HAtot(x1,x2,x3)         | VDI3722_SDtot(x1,x2,x3)         | VDI3722_HSDtot(x1,x2,x3)         |
| VDI3722_A_totmod(x1,x2,<br>x3) | VDI3722_HA_totmod(x1,x2,<br>x3) | VDI3722_SD_totmod(x1,x2,<br>x3) | VDI3722_HSD_totmod(x1,x2,<br>x3) |

#### Backwards calculation of the Re-normed Substitute Level

| VDI3722_RE_A(x)    | VDI3722_RE_HA(x)    | VDI3722_RE_SD(x)    | VDI3722_RE_HSD(x)    |  |  |  |
|--------------------|---------------------|---------------------|----------------------|--|--|--|
| VDI3722_RE_Amod(x) | VDI3722_RE_HAmod(x) | VDI3722_RE_SDmod(x) | VDI3722_RE_HSDmod(x) |  |  |  |

#### **Effect Related Substitution Level**

| VDI3722_ES_A(x1,x2,x3) | VDI3722_ES_HA(x1,x2,x3) | VDI3722_ES_SD(x1,x2,x3)  | VDI3722_ES_HSD(x1,x2,x3) |
|------------------------|-------------------------|--------------------------|--------------------------|
| VDI3722_ES_Amod(x1,x2, | VDI3722_ES_HAmod(x1,x2, | VDI3722_ES_SDmod(x1,x2,x | VDI3722_ES_HSDmod(x1,x   |
| x3)                    | x3)                     | 3)                       | 2,x3)                    |

For formulas adding up the total noise and for the calculation of the effect related substitution level, three levels (x1, x2, x3) must be entered in the formula.

- x1 Road noise
- x2 Railway noise
- x3 Aircraft noise

If a noise type is missing, enter 0 for the missing noise type.

Example: VDI3722\_A\_totmod(RRKL101:1,RRKL102:1,0)

Depending on which noise type you have to evaluate and how the tasks are defined, you only need to define a subset of the grid noise map operations or define only a portion of time slices for the grid operations. If the re-normed substitution level is not required, it is not needed to have this result calculated as a separate step.

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Total noise assessment according to VDI 3722-2

### **Modified formulas**

We suggest using the modified formulas in SoundPLAN because the formulas of VDI3722-2 are only valid for the value range defined in the standard. As part of the generation of a test case the formulas were modified for the edge zones.

According to VDI 3722-2 the formulas are valid for the determination of %A for road and railways in the zone of 37 dB  $\leq$  L,r,TN  $\leq$  75 dB and for aircraft noise in the zone 37 dB  $\leq$  L,r,TN  $\leq$  65 dB. For the percentage of highly annoyed persons the lower border is 42 dB. The value range in the nighttime to determine %SD and %HSD is 40 dB  $\leq$  L,r,N  $\leq$  65 dB for all three noise types.

The modified formulas linear interpolate in the lower value ranges between 0 and the lowest defined value, in the value ranges above the definition the values are extrapolated.

## Calculation with the file operations in the calculation kernel

Go to the Calculation Kernel and select as CALCULATION TYPE Tools - grid operations or FNM operations. Enter the desired time slices.



To enter and later edit the formulas click on the edit symbol and activate the check box EXTENDED.

| Time slice ID | Unit | Time slice name        |
|---------------|------|------------------------|
| %HA,s         | %    | Highly Annoyed Street  |
| %HA,r         | %    | Highly Annoyed Railway |
| %HA,a         | %    | Highly Annoyed Airport |
| %HA,t         | %    | Highly Annoyed Total   |

Suchen + Ersetzen.

% Highly annoyed road (formula for row 1)

```
Formel editieren
VDI3722 HAstreet(RKL101:1);
```

% Highly annoyed total with modified formulas (formula for row 4)

```
Suchen + Ersetzen...
Formel editieren
VDI3722_HAtotmod(RKL101:1, RKL201:1, RKL301:3);
```

#### Hotspots with Total Annoyance or Total Sleep Disturbance

For the presentation of the Total Annoyance/Sleep Disturbance you need a Spreadsheet in the form of the receiver table with which to calculate the total

Total noise assessment according to VDI 3722-2

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annoyance/ sleep disturbance from the number of affected persons, the population number per receiver and the annoyance factors Nj.

Calculate a separate Facade Noise Map for road, railway and aircraft noise.

Generate a **Spreadsheet** (receiver table) and load the results of the Facade Noise Map. Calculate the annoyance and load additional columns with the number of inhabitants per facade and floor or the number of inhabitants per receiver. With the formula "Annoyance x number of inhabitants " you can calculate the annoyance factor Nj.

|                        | Straße         | Schiene       | Flug        |       | Annoy     | ance |          | Renormierte | r Ersatzpegel | Efektb. Sub.Pegel | Beei | inträchti | aunasa | öße  |
|------------------------|----------------|---------------|-------------|-------|-----------|------|----------|-------------|---------------|-------------------|------|-----------|--------|------|
| Nr.                    | LTAN,s         | LTAN,r        | LTAN,a      | %HA,s |           |      |          | L*r,TAN,r   | L*r,TAN,a     | LA.ES             |      | Ni.r      |        | Nj.t |
|                        | [dB(A)]        | [dB(A)]       | [dB(A)]     |       | [9        | 6]   |          | [dB(A)]     | [dB(A)]       | [dB(A)]           |      |           |        |      |
| Anzahl E               | inwohner: 35.1 | 79,31         |             |       |           |      |          |             |               |                   |      |           |        |      |
| Beeinträ               | chtigungsgröße | Nj,s: 2.263,2 | 2 Nj,r: 250 | ,1    | Nj,a: 50  | 7,7  | Nj,t: 2. | 655,0       |               |                   |      |           |        |      |
| Anzahl Einwohner: 5,45 |                |               |             |       |           |      |          |             |               |                   |      |           |        |      |
| Beeinträ               | chtigungsgröße | Nj,s: 0,3     | Nj,r: -     |       | Nj,a: 0,2 | 2    | Nj,t: 0, | 4           |               |                   |      |           |        |      |
| 4                      | 53,7           | 34,7          | 47,5        | 5,6   | 0,0       | 2,8  |          | -           | 48,0          | 54,7              | -    | -         | -      | -    |
| 5                      | 54,0           | 35,7          | 47,5        | 5,8   | 0,0       | 2,8  | 6,4      | -           | 48,0          | 55,0              | -    | -         | -      | -    |
| 6                      | 52,7           | 36,7          | 47,5        | 5,1   | 0,0       | 2,8  | 5,8      | -           | 48,0          | 54,0              | -    | -         | -      | -    |
| 7                      | 53,0           | 37,5          | 47,5        | 5,2   | 0,0       | 2,8  | 5,9      | -           | 48,1          | 54,2              | -    | -         | -      | -    |
| 8                      | 53.2           | 38.7          | 47.6        | 5.3   | 0.0       | 2.8  |          | -           | 48.1          | 54.3              | -    | -         | -      | -    |
| 9                      | 53,9           | 38,7          | 47,6        | 5,7   | 0,0       | 2,9  | 6,4      | -           | 48,2          | 55,0              | -    | -         | -      |      |
| 10                     |                | 37,6          | 47,6        | 6,2   | 0,0       | 2,9  | 6,8      | -           | 48,2          |                   | -    | -         | -      | -    |
| 11                     | 55,6           | 36,8          | 47,6        | 6,8   | 0,0       | 2,9  | 7,3      | -           | 48,3          | 56,3              | -    | -         | -      |      |
| 12                     | 57,7           | 39,2          | 47,7        | 8,3   | 0,0       | 2,9  | 8,7      | -           | 48,3          | 58,2              | -    | -         | -      | -    |
| 14                     | 56,7           | 41,4          | 47,7        | 7,5   | 0,0       | 2,9  | 8,0      | -           | 48,3          | 57,3              | -    | -         | -      |      |
| 15                     | 55,7           | 40,8          | 47,6        | 6,8   | 0,0       | 2,9  | 7,3      | -           | 48,3          | 56,4              | -    | -         | -      | -    |
| 16                     | 52,6           | 39,5          | 47,6        | 5,0   | 0,0       | 2,9  | 5,8      | -           | 48,2          | 53,9              | -    | -         | -      |      |

Example table

Go to the **Calculation Kernel** and select the **CALCULATION TYPE** "Tools - Hotspots". In the tab "*General*" click on the double arrow next to **DATA** and enter the Situation with the buildings and inhabitants, a calculation area and the Spreadsheet. For the presentation in 3D you also need a DGM.

Select the columns of the Spreadsheet that shall be used to calculate the Hotspots.

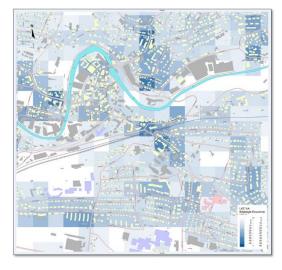
| General Hotspots Description       |            |  |  |  |  |  |  |
|------------------------------------|------------|--|--|--|--|--|--|
|                                    |            |  |  |  |  |  |  |
| Grid space [m] 100                 |            |  |  |  |  |  |  |
| Hotspots definition                |            |  |  |  |  |  |  |
| Calculation method                 |            |  |  |  |  |  |  |
| 🔘 Within radius                    |            |  |  |  |  |  |  |
| Search radius [m] 100              |            |  |  |  |  |  |  |
| Within grid cell                   |            |  |  |  |  |  |  |
|                                    |            |  |  |  |  |  |  |
| Column                             | Name       |  |  |  |  |  |  |
|                                    | LKZ, s, %A |  |  |  |  |  |  |
| 22: Beeinträchtigungsgröße Nj,r 🗸  | LKZ, r, %A |  |  |  |  |  |  |
| 23: Beeinträchtigungsgröße Nj,a 💌  | LKZ, a, %A |  |  |  |  |  |  |
| 24: Beeinträchtigungsgröße Nj, t 📼 | LKZ, t, %A |  |  |  |  |  |  |

For this type of hotspot calculation, it is important to use the calculation method **WITHIN THE GRID**, which corresponds to a summation per grid cell.

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Total noise assessment according to VDI 3722-2

Load the results of the hotspot calculation as a file type **GENERAL GRID MAP** for the presentation in the Graphics. Deactivate the contour lines in the plan object types and activate the grid presentation.



## Level statistics in the Spreadsheet

In an Area Table you can read in the content of the receiver table as level statistics or a limit value via fixed intervals. Open a Receiver Table with FILE -> ADDITIONAL COLUMNS -> ADD LEVEL STATISTICS and select which column shall be processed. Additionally, you also need to have a LEVEL COLUMN, that will be the source of information for the column operations.

| Select column                                          |
|--------------------------------------------------------|
| 10: Annoyed %A %A,r [%]                                |
| Column operation                                       |
| Sum                                                    |
| O Average                                              |
| 🗇 count                                                |
| 🔘 minimum                                              |
| 🔘 maximum                                              |
| Select level column for the column operation           |
| 24: 1915_Effektbezogener Substitutionspegel - %A / I ▼ |
| OK Cancel Help                                         |

You can insert multiple level statistics in sequence into the area table.

Total noise assessment according to VDI 3722-2

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|          | Annoyed Persons (%HA) |         |     |       |  |  |  |  |  |  |
|----------|-----------------------|---------|-----|-------|--|--|--|--|--|--|
| Interval | Street                | Railway | Air | Total |  |  |  |  |  |  |
|          |                       |         |     |       |  |  |  |  |  |  |
| < 40     | -                     | -       | -   | -     |  |  |  |  |  |  |
| 40 - 45  | 3                     | 0       | 1   | 5     |  |  |  |  |  |  |
| 45 - 50  | 137                   | 24      | 25  | 208   |  |  |  |  |  |  |
| 50 - 55  | 463                   | 77      | 105 | 558   |  |  |  |  |  |  |
| 55 - 60  | 582                   | 61      | 193 | 683   |  |  |  |  |  |  |
| 60 - 65  | 476                   | 36      | 147 | 576   |  |  |  |  |  |  |
| 65 - 70  | 344                   | 24      | 24  | 355   |  |  |  |  |  |  |
| 70 - 75  | 202                   | 24      | 11  | 213   |  |  |  |  |  |  |
| 75 - 80  | 56                    | 4       | 3   | 56    |  |  |  |  |  |  |
| > 80     | 0                     | 0       | -   | 0     |  |  |  |  |  |  |

## Process receivers with non-identical positions

For the assessment of the total noise, the individual assessments for each noise type often are done in accordance to different standards and guidelines that place the receivers in slightly different positions. In the end the noise levels for each source type must be accrued to the total noise. So far, the SoundPLAN Spreadsheet could not add these contributions as the rece3ivers did not have identical positions.

Now you can clarify how receivers are treated. The document settings allow for the possibility of using the location with (x / y/ z) coordinates and additionally can choose the following options:

- x / y / floor
- Object number / floor

Before generating new result columns, select the option #3 "object number/floor" as the receivers differ in their coordinates. It is self-evident that receivers belonging to one another must share the same object number and thy must be unique.

#### Preparation in the Geo-Database:

Single receivers: The best option is to host the different receivers in different Geo-Files. To do this, generate the original receiver, save it in a Geo-File, with the Situation Manager copy the Geo-File and open it in another situation (make sure that the original receivers Geo-File is not part of this situation). In "GEO-TOOLS -> REASSIGN RECEIVERS TO BUILDINGS" there is a new option to "change distance". This option is only active when the option "use existing building reference" is active.

If you also want to change the height of the first floor, you can do so in the Property Explorer.

Facade Noise Map calculation: The buildings must have unique object numbers. If only the distance to the facade is changing, no additional action is required. If the height of the first floor changes, you need to duplicate these buildings and correct the first floor height in the property explorer. Again, make sure that both buildings have the same object numbers.

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# 13

## **13** Aircraft Noise

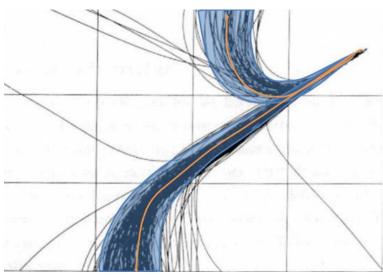
The emission for aircraft noise can be found in two different types, analytical flight path can be defined with headings, turn to instructions like the air traffic controller would give to the pilots or these paths can be generated in the form of backbones from recorded flights. The second type is the simulation of single or multiple recorded tracks. The "radar tracks" can be from the primary radar for the x/y part of the track and from the secondary radar response of an aircraft's transponder or the data can be recorded directly from the ADSB broadcast that ADSB equipped aircraft are sending. As the origin of the recorded data is different, so is the format used to record the data. Flight tracks are usually generated in close cooperation with the airport and air traffic control, in a generalized form, they need to represent the existing traffic or the proposed or studied traffic conditions. The flight tracks can be used to analyze the existing traffic/ noise situation or can be used for a prognosis. Comparison between the scenarios can indicate advantages and disadvantages of planning scenarios. Radar tracks as they are based on actual flights can only be used for existing situations, a prognosis is not possible unless the flights are generalized into backbones and the aircraft numbers are the variable to change. The simulation with radar tracks in general has the advantage that it represents the existing situation very well with minimal amount of data entry and definition.

For most aircraft noise simulations, a DGM is required to define the location of the receivers on the ground, for the project a suitable project coordinate system should be defined.

Total noise assessment according to VDI 3722-2

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Radar tracks and backbones

5. Data cheets for Airport

The calculation of aircraft noise based on flight tracks is available for all calculation standards that SoundPLAN has implemented. The direct simulation with recorded radar tracks is only offered for the standards: AzB 2008, ECAC Doc 29, 3rd edition,  $4^{\rm th}$  edition and CNOSSOS.

## 🔠 Airport

Select the symbol for the airport to define the airport reference point. All other data are relative to this coordinate. The aircraft noise definition box appears and automatically will open the tab for *airport data*. Enter the airports ICAO-code and if needed correct the project coordinates for the airport reference point.

The airport elevation for calculations in accordance to the AzB 2008 and the DIN 45684-2012 only have informative character and will not be used in the calculation as runways fro take off and landings are automatically placed on top of the DGM.

| I General properties 5.2 Airport Data Runwa                                      | ays / Traffic history | Tracks / Traffic | Radar tracks             | Logbook      |
|----------------------------------------------------------------------------------|-----------------------|------------------|--------------------------|--------------|
| 5.2.1 Name                                                                       | EDDV                  |                  |                          |              |
| ICAO airport code                                                                | EDDV                  |                  |                          |              |
| 5.2.2 Airport reference point (ARP)                                              |                       |                  |                          |              |
| Geogr. latitude and longitude $[\overset{*}{\leftarrow}\overset{*}{\leftarrow}]$ | E 9 41                | 0,70             | N 52 27                  | 36,78        |
| Project-Coordinates                                                              | (x) 32546441,5        | 85 [m]           | (y) 5812446,6            | 624 [m]      |
| 5.2.3 Airport Elevation (informative)                                            | (z) 54,15             | [m]              | Influence ra<br>20000,00 | adius<br>[m] |
| additional information                                                           |                       |                  |                          |              |
| <ul> <li>civil use</li> </ul>                                                    | © n                   | nilitary use     |                          |              |



Airport

The airport usage for civil / military is only available for the AzB 2008, for other standards this is irrelevant.

For the definition in accordance to ECAC the environmental parameters of relative moisture of the air, temperature and air pressure need to be defined. These parameters are used to calculate the flight profiles and are needed for the calculation of the backbones and for the import of recorded radar tracks. Changing these parameters will not influence radar tracks already imported.

| Environment         |         |  |
|---------------------|---------|--|
| Humidity [%]        | 70,00   |  |
| Air Pressure [mbar] | 1013,25 |  |
| Temperature [°C]    | 15,00   |  |

Under the tab *general* define the general airport information and the emission time slices that can differ for aircraft noise from the settings made in the SoundPLAN Manager.

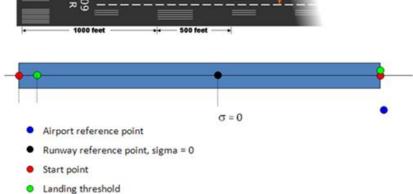
| ata shee  | ts for  | Airp   | ort   |       |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
|-----------|---------|--------|-------|-------|---------|-------|-------|-------|------|------|-------|-------|----|------|----|----|----|----|----|----|----|----|----|------|---|
| ieneral p | roper   | ties   | Air   |       | Data    | - 11  |       |       |      |      | (7-   | affic |    | gboo |    |    |    |    |    |    |    |    |    |      |   |
| eneror p  | lope    | uca    | AI    | port  | Data    |       | Runv  | ays   | 1 11 | dCKS | 7 114 | ame   |    | gooo | к  |    |    |    |    |    |    |    |    |      | _ |
|           |         |        |       |       |         |       | _     |       |      |      |       |       | _  |      |    |    |    |    |    |    |    |    |    |      |   |
| Creat     | tion d  | ate o  | DE    | S     |         |       | 1.1   | 1.200 | 1    |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| Year      | of pre  | edicti | on    |       |         |       | 20    | 01    |      |      |       |       | 1  |      |    |    |    |    |    |    |    |    |    |      |   |
|           |         |        |       |       |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| Comr      | ment    |        |       |       |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| Tim       | e slice |        |       |       |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
|           |         |        |       |       |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| Sta       | art tim | es of  | · the | time  | 2 slice | es:   |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| 0         | 1       | 2      | 3     | 4     | 5       | 6     | 7     | 8     | 9    | 10   | 11    | 12    | 13 | 14   | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |      |   |
|           |         |        |       |       |         | x     |       |       |      |      |       | x     |    |      |    |    |    |    |    |    |    | х  |    |      |   |
| Def       | fined   | time   | slice | s wit | th tim  | ne si | ice n | ame:  |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
|           |         |        |       |       |         |       | _     |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    | <br> |   |
|           | ours    | [h]    |       |       | script  | or    |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| 6-        | 12      |        | Day   | ( AM  |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| 12        | 2-22    |        |       | PM    |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |
| 22        | 2-6     |        | Nigh  | nt    |         |       |       |       |      |      |       |       |    |      |    |    |    |    |    |    |    |    |    |      |   |

You can define up to 24 time slices, i.e. one time slice for every hour of the day. An **X** for the respective hour for **START TIME OF THE TIME SLICE** marks the beginning of the time slice. The time slices are listed in the table below. Enter the respective **DESCRIPTOR**.

Be sure to only have one airport reference point in a situation as all other objects are defined relative to this airport reference point and are automatically geometrically defined to the airport reference point. If multiple airport reference points were found in a situation there is an ambiguous relationship which will lead to errors.

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Runways for take-off and landings can be either digitized graphically with the runway reference point or via the aircraft noise definition screen with the tab *runways/traffic history*.

| 🔯 SoundPLAN Aircraft Noise - AzB: 2008  |                                                    |                          | <b>X</b> |
|-----------------------------------------|----------------------------------------------------|--------------------------|----------|
| 5. Data sheets for Airport              |                                                    |                          |          |
| 5.1 General properties 5.2 Airport Data | tunways / Traffic history Tracks / Traffic Logbook |                          |          |
| Runway                                  | 5.2.4 Runways 6. Traffic History                   |                          |          |
| 09C / 27C                               | Name                                               | 09L / 27R                |          |
| 09R / 27L                               | Planning status                                    | Vorhanden                |          |
|                                         | Compass Angle [deg]<br>geographic north (WGS84)    | 90,0000 / 270,0000 (info | )        |
|                                         | Project-Coordinates                                | 92,0504 / 272,0504 (cal  | c)       |
|                                         | Total length [m] 3198,70                           | Width [m] 30,00          |          |
|                                         | Coordinates of runway reference point (RRP)        |                          |          |
|                                         | Geographic coordinates (WGS84) E 9 40              | 34,38 N 52 28 3,37 (ir   | ifo)     |
|                                         | Project coordinates [m] (x) 32545937               | (c) 5813263,27 (c        | alc)     |
|                                         | Distance of RRP to (dx) -504,54<br>ARP [m]         | (dy) 816,64              |          |
|                                         | Distance of start of roll to RRP<br>[m]            | -1513,38 / -1538,22      |          |
| New                                     | Distance of approach threshold to RRP [m]          | 1599,35 / 1599,35        |          |
| Copy<br>Delete                          | Meridian convergence [*,,'']                       | 0 0 0,0000 (info)        |          |
| Check Data Refresh                      |                                                    | OK Cancel                | Help     |

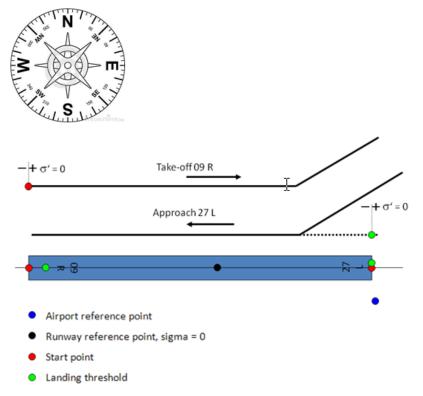
Additional runways can be generated via the list on the left, can be copied or deleted. In SoundPLAN each runway is associated with two directions of departure and approach, therefore with 4 different operational configurations In the presented example there is start and approach for the directions 09 (to the east =

```
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```

**Runway for starts and landings** 

90 degrees) or respective for the direction 27 towards the west with 270 degrees. Runways are always referenced by the rounded compass heading divided by 10, so landing on runway 27 means that the aircraft is heading west for landing.

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For the definition and also the calculation, the runway direction and the relative position of the runway reference point to the airport reference point is important as is the relative position of the runway reference point to the start point and the threshold position.

The definition of the start point and the landing threshold (and later on also the flight tracks) is always in the reference system  $\sigma$ . If a starting point for a start direction is in front of the runway reference point (this is normally the case), the starting point usually is a negative distance. For the modeling of landing aircraft it is very difficult to describe the track in a way that the landing aircraft would actually land on the runway and at the correct spot. For this reason, the data entry of landing aircraft is the opposite direction than the aircraft movement. So the modeling starts with the touch down point and then describes the path the aircraft has taken to get to this position. For the landing, the touch down point usually is in front of the runway reference point and therefore the distance is positive.

For an airport in accordance to AzB 2008 it is necessary to define the traffic statistics of the last years for each direction and each emission time slice in the tab *traffic history*.

Runway for starts and landings

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| 5.1 General properties 5.2 Airport Da | ata Runways / Traffic hist      | ory Tracks / Traffic                                 | Radar tracks Logi                                    | book                                                 |                                                      |                                                      |  |  |  |  |
|---------------------------------------|---------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|--|--|--|--|
| Runway                                | 5.2.4 Runways 6.                | Traffic History                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
| 🔲 09C / 27C                           |                                 |                                                      |                                                      | Runway:                                              |                                                      |                                                      |  |  |  |  |
| 09L / 27R                             |                                 |                                                      |                                                      | 000 (070                                             |                                                      |                                                      |  |  |  |  |
| 09R / 27L                             |                                 | 09C / 27C -                                          |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
| 09X / 27X                             | Selected runway a               | Selected runway associated with                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       | Traffic ab Molice for the last  |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       | Traffic statistics for the last |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       |                                 |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       |                                 |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       |                                 |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       | Day Meta                        |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       | Day Night                       |                                                      |                                                      |                                                      |                                                      |                                                      |  |  |  |  |
|                                       | Day Night<br>year/RWY           | Departure                                            | Approach                                             | Departure                                            | Approach                                             | Sum                                                  |  |  |  |  |
|                                       | · · · · ·                       | Departure                                            |                                                      | Departure<br>0.00500000                              | Approach<br>0.00310000                               |                                                      |  |  |  |  |
|                                       | year/RWY                        |                                                      | Approach<br>0,00220000<br>0,00220000                 |                                                      |                                                      | 0,01440000                                           |  |  |  |  |
|                                       | year/RWY                        | 0,00410000                                           | 0,00220000                                           | 0,00500000                                           | 0,00310000                                           | Sum<br>0,01440000<br>0,01230000<br>0,01040000        |  |  |  |  |
| New                                   | year/RWY                        | 0,00410000                                           | 0,00220000                                           | 0,00500000<br>0,00350000                             | 0,00310000                                           | 0,01440000                                           |  |  |  |  |
| New<br>Ccoy                           | year/RWY<br>1<br>2<br>3         | 0,00410000<br>0,00380000<br>0,00530000               | 0,00220000<br>0,00220000<br>0,00240000               | 0,00500000<br>0,00350000<br>0,00140000               | 0,00310000<br>0,00280000<br>0,00130000               | 0,01440000<br>0,01230000<br>0,01040000               |  |  |  |  |
|                                       | year/RWY 1 2 3 4                | 0,00410000<br>0,00380000<br>0,00530000<br>0,00160000 | 0,00220000<br>0,00220000<br>0,00240000<br>0,00160000 | 0,00500000<br>0,00350000<br>0,00140000<br>0,00460000 | 0,00310000<br>0,00280000<br>0,00130000<br>0,00460000 | 0,01440000<br>0,01230000<br>0,01040000<br>0,01240000 |  |  |  |  |

## 🛎 Tracks and 📓 APU

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The flight tracks are defined in tabular form. Depending on the standard various track types are available.

| Track type                                                       | DIN   | AzB  | ECAC    | ECAC    | CNOSSOS |
|------------------------------------------------------------------|-------|------|---------|---------|---------|
| mack type                                                        | 45684 | 2008 | 3rd Ed. | 4th Ed. | 000000  |
| Taxiing from a parking position to the<br>starting point         | ٧     | ٧    |         |         |         |
| Taxiing from the runway after landing to<br>the parking position | ٧     | V    |         |         |         |
| APU-usage before starting                                        |       | ٧    |         |         |         |
| APU-usage after landing                                          |       | ٧    |         |         |         |
| Departure of fixed wing aircraft                                 | ٧     | ٧    |         |         |         |
| Approach of fixed wing aircraft                                  | ٧     | ٧    | ٧       | ٧       | ٧       |
| Pattern flight for fixed wing aircraft                           | ٧     | ٧    | ٧       | V       | V       |
| Departure of helicopters                                         | ٧     | ٧    |         | ٧       | V       |
| Approach of helicopters                                          | ٧     | ٧    |         |         |         |
| Pattern flight for helicopters                                   | ٧     | ٧    |         |         |         |
| Departure with elevation profile                                 | ٧     | ٧    |         |         |         |
| Approach with elevation profile                                  | ٧     | ٧    |         |         |         |
| Pattern flight with elevation profile                            | ٧     | ٧    |         |         |         |
| Helicopter departure with elevation<br>profile                   | ٧     | ٧    |         |         |         |
| Helicopter approach with elevation<br>profile                    | ٧     | ٧    |         |         |         |
| Helicopter pattern flight with elevation<br>profile              | v     | V    |         |         |         |

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Tracks and APU

For the calculation of aircraft noise from recorded radar tracks only approach and departure can be regarded. Pattern flight and APU usage cannot be derived from the radar data and thus cannot be simulated with imported data.

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| Track/APU name                                                 | ~ | 5.4 Taxiway          | s, APU / 5.5                            | 5 Flight tracks   | 5.4 / 5.5 Tra       | ffic Data          |                                       |                                     |     |  |
|----------------------------------------------------------------|---|----------------------|-----------------------------------------|-------------------|---------------------|--------------------|---------------------------------------|-------------------------------------|-----|--|
| H3_von_EAST<br>H3_von_ECHO_1<br>H3_von_NOVEMBER_1              |   | Type of fl           | ight track:                             |                   | 5.                  | 5.2 Approach       | for fixed-wing a                      | rcraft                              | •   |  |
| H3_von_SOUTH                                                   |   | 5.5.2.1.1            | Track name                              |                   | If                  | R_09L_von_H        | HLZ_1_P1                              |                                     |     |  |
| IFR_09L_nach_CEL<br>IFR_09L_nach_CEL_1                         |   | 5.5.2.1.3            | Runway (dir                             | rection of appro  | oach)               |                    |                                       | 09L                                 | •   |  |
| IFR_09L_nach_DLE                                               |   | 5.5.2.1.4            | Angle of ap                             | proach            |                     |                    |                                       | 3,00                                | [°] |  |
| IFR_09L_nach_DLE_2                                             |   | 5.5.2.1.5<br>flight) | Description                             | of approach fli   | ght track (vs.      | direction of       | •                                     | + 14 4                              | -   |  |
| IFR_09L_nach_MULDO<br>IFR_09L_nach_MULDO_1<br>IFR_09L_nach_NIE |   | Section<br>No.       | Distance<br>[m]                         | Segment type      | Turn angle<br>[deg] | Turn radius<br>[m] | Corridor width<br>at the begin<br>[m] | Corridor width<br>at the end<br>[m] |     |  |
| FR 09L nach OSN                                                |   | 1                    | 23305,07                                | straight 🔻        |                     |                    | 0,00                                  | 450,00                              |     |  |
| FR_09L_nach_OSN 1                                              |   | 2                    | \$1111111111111111111111111111111111111 | right turn 🔻      | 89,4151             | 2866,13            | 450,00                                | 4000,00                             |     |  |
| FR 09L nach WRB                                                |   | 3                    | 1688,74                                 | straight 🔻        |                     |                    | 4000,00                               | 4000,00                             |     |  |
| FR_09L_von_DIRBO                                               |   | 4                    |                                         | right turn 🔻      | 91,2554             | 3571,15            | 4000,00                               | 4500,00                             |     |  |
| FR_09L_von_DIRBO_P1                                            | 1 | 5                    | 36047,45                                | straight 🔻        |                     |                    | 4500,00                               | 7000,00                             |     |  |
| FR_09L_von_GITEX                                               |   | 6                    |                                         | right turn 👻      | 11,4231             | 5000,00            | 7000,00                               | 7000,00                             |     |  |
| FR_09L_von_GITEX_P1                                            |   | 7                    | 17716,43                                | straight 🔻        |                     |                    | 7000,00                               | 7000,00                             |     |  |
| IFR_09L_von_HLZ_1<br>IFR_09L_von_HLZ_1_P1<br>IFR_09L_von_HLZ_2 |   |                      |                                         |                   |                     |                    |                                       |                                     |     |  |
| IFR_09L_von_HLZ_2_P1<br>IFR_09L_von_HLZ_3                      | - | 5.5.2.1.6            | Intermediat                             | e altitude (only  | IFR flights)        |                    |                                       |                                     |     |  |
| New                                                            |   |                      | 1. Interme                              | ediate altitude a | above ARP           |                    |                                       | 1800,00                             | [m] |  |
| Сору                                                           |   |                      | 2. Length                               | of intermediate   | segment             |                    |                                       | 0,00                                | [m] |  |
| Delete<br>Sort                                                 |   | 5.5.2.1.7            | Elevation ab                            | oove airport (or  | ly VFR flights      | )                  |                                       | -,                                  | [m] |  |

With the list on the left in the under the tab *Track, APU name* additional flight tracks can be generated or copied and deleted. After selecting the appropriate track type, the data entry adapts to the required format for the type of operation. The track type presented above is an example for the takeoff of a fixed wing aircraft in accordance to AzB 2008.

The definition of the flight track is done with a series of straight segments and standard turns to left and right that start where the last segment ended and end with the new heading of the aircraft. Please remember that for the approaches the definition is done in the reverse order of the actual flight. Changes in the corridor width are updated with **VIEW** -> **REFRESH** or **Ctrl+ R**.

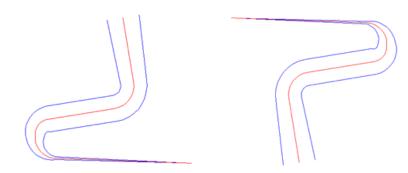
By changing the operations direction (LANDING DIRECTION) the track reverses:

If you change the display of the flight track to print the tracks ", with properties", the corridor edges are presented in the Geo-Database.



Tracks and APU

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*Left landing direction 09, right landing direction 27* 

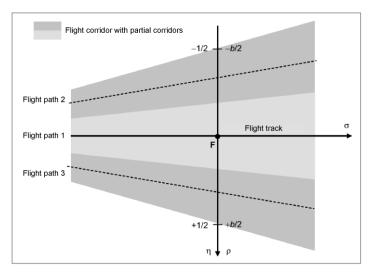
### Corridor width and source lines

The noise emission of a single flight track is distributed within the selected corridor width. The number of source lines used in this distribution depends on the standard used.

| AzB 2008                 | 15 parallel emission lines   |
|--------------------------|------------------------------|
| DIN 45684                | 5-15 parallel emission lines |
| ECAC Doc 29, 2nd Edition | 7 parallel emission lines    |

ECAC Doc 29, 3rd Edition

7 up to 13 parallel emission lines



Exemplary presentation of a flight track with 3 partial corridors

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Tracks and APU

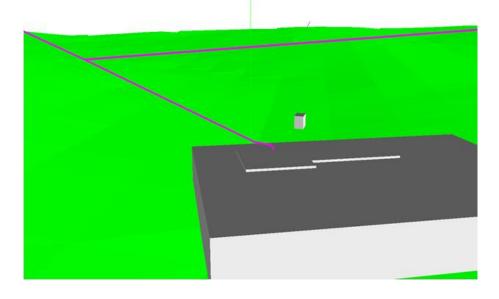
### Special case: helicopter landing pad

For a helicopter landing pad (the typical application of the DIN 45684) for systematic reasons a runway is needed. Typically only a single auxiliary runway is used (direction of the runway is unimportant). Takeoff and landing are performed on the runway reference point.

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Like always the start point and the threshold/touch down point and also the emission lines are automatically set on top of the DGM.

As a specialty for helicopter noise, the buildings are regarded. This way for a helipad on top of a building, the start and landing point are set to the top of the building and the flight track can start/end on the roof of the building underneath.



## Track and traffic data

For each of the flight tracks there needs to be a tab for the entry of the *traffic data* to define how many aircraft are flying on this particular takeoff or landing track.

Track and traffic data

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| i. 1 General properties 5.2 Airport D   | 1           | raffic history Tracks / |                   | _     |                     |       |                       |
|-----------------------------------------|-------------|-------------------------|-------------------|-------|---------------------|-------|-----------------------|
| Track/APU name                          | 6           | PU / 5.5 Flight tracks  | 5.4 / 5.5 Traffic | Data  |                     |       |                       |
| IFR_27L_von_OSN_4  IFR_27L_von_OSN_4_P1 | View        | -                       |                   | Acces | sment period [days] | 180 😂 | <b></b>               |
| IFR_27L_VON_OSN_4_P1                    |             |                         |                   | Asses | sment period (days) |       | Classes >>            |
| IFR 27L von OSN 5 P1                    | only select | ed classes              |                   | Decim | als                 | 0 📽   | Clear Track           |
| IFR 27L von OSN 6                       | Group       | Operation               | Class             | Day   | Night               |       | Traffic Calculato     |
| IFR_27L_von_OSN_6_P1                    |             |                         |                   | ,     |                     |       | Thattic Coliculate    |
| IFR_27L_von_OSN_S                       | P 1.3       | Departure               | P 1.3 - S         | 288   | 0                   |       | xls,txt-Import        |
| IFR 27L von OSN S P1                    | S 5.1       | Departure               | S 5.1 - S         | 698   | 31                  |       | xls.txt-Import Settin |
| IFR 27L von WRB                         | P 1.4       | Departure               | P 1.4 - S         | 121   | 24                  |       |                       |
| IFR_27L_von_WRB_P1                      | P 2.1       | Departure               | P 2.1 - S         | 88    | 23                  |       | QSI-Import            |
| IFR 27R nach CEL                        | S 5.2       | Departure               | S 5.2 - S         | 1345  | 585                 |       |                       |
| IFR_27R_nach_CEL_1                      | S 6.1       | Departure               | S 6.1 - S         | 73    | 144                 |       |                       |
| IFR 27R nach DLE                        | S 6.2       | Take-Off, Mass a        | S 6.2 a) - S      | 0     | 0                   |       |                       |
| IFR_27R_nach_LAU                        | P-MIL 2     | Departure               | P-MIL 2 - S       | 14    | 0                   |       |                       |
| IFR_27R_nach_MULDO_1                    | S 6.2       | Take-Off, Mass b        | S 6.2 b) - S      | 0     | 0                   |       |                       |
| IFR_27R_nach_NIE                        | S 3.1       | Take-Off, Mass a        | S 3.1 a) - S      | 7     | 0                   |       |                       |
| IFR_27R_nach_OSN                        | S 7         | Take-Off, Mass a        | S 7 a) - S        | 4     | 0                   |       |                       |
| IFR_27R_nach_OSN_1                      | S 3.2       | Take-Off, Mass a        | S 3.2 a) - S      | 0     | 0                   |       |                       |
| IFR_27R_nach_OSN_2                      | S 6.3       | Departure               | S 6.3 - S         | 0     | 0                   |       |                       |
| IFR_27R_nach_WRB                        | S 7         | Take-Off, Mass b        | S 7 b) - S        | 0     | 0                   |       |                       |
| FR_27R_von_DIRBO_1                      | P 1.0       | Departure               | P 1.0 - S         | 0     | 0                   |       |                       |
| FR_27R_von_DIRBO_1_P1                   | P 1.1       | Departure               | P 1.1 - S         | 0     | 0                   | -     |                       |
| IFR 27R von DIRBO 2                     |             | Total traffic of        | current track     | 2638  | 807                 |       | 1                     |
| New                                     |             | Total Traffic o         | f Helicopter      | 5263  | 843                 |       |                       |
| Copy                                    | То          | tal traffic of fixed wi | ing aircrafts     | 55767 | 10817               |       |                       |
|                                         |             | Total traffic           | of all tracks     | 61030 | 11660               |       |                       |
| Delete                                  |             | Total Traffi            | ic of Taxiing     | 54963 | 10807               |       |                       |
| Sort                                    |             | Total tr                | raffic of APU     | 45969 | 10431               |       |                       |

The classification of the different aircraft depends on the standard selected for the aircraft noise simulation. In the columns for the individual time slices (for the definition) the number of flight operations needs to be defined for each aircraft class for each assessment time slice. The time frame for the noise assessment by default is set to 180 days (according to AzB the 6 months of the year with the most traffic) but this definition can be changed to any other time frame. Other common settings will evaluate the aircraft noise for the entire year (365 days), or for 180 days or 1 day or 52 days (all Sundays of the year). These settings need to be made in agreement with the national or other responsible authorities or need to be set to reflect the need of the study to be undertaken

Via the button **QSI-IMPORT** in the tab *traffic data* all traffic data for all present tracks need to be imported. For the import of ta complete model, please refer to "<u>QSI Import / Export</u>" page 701.

In case aircraft classes you need are missing or need to be amended, use the direct access via the button **CLASSES** in the library.

### **Aircraft class library**

In the system library all aircraft classes are present that are needed (and documented) in the standards implemented in SoundPLAN. The project and the global library can be amended at will.

In general, all aircraft classes of an airport are imported via the QSI interface or are via the radar tracks. In this case the library is used mostly to check the data

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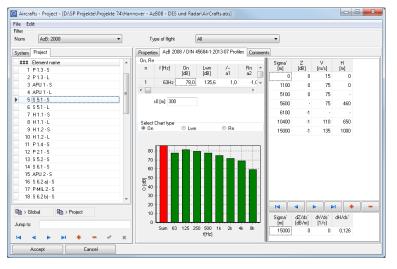
Track and traffic data

imported from outside sources or to assign individual aircraft classes. Only for very small airports or helicopter landing pads with very few relevant aircraft you will want to assemble the data in the library.

In the aircraft noise entry screen, click on the button **CLASSES**. If no aircraft have been defined in the project yet, first the project library is generated. In the next step the system library is filtered for the aircraft classes required in the selected calculation standard. An empty project library is opened, now select the aircraft classes in the system library and copy them with the button **>> PROJECT** into the project library.

| File Edit                         |                       |                                         |       |       |
|-----------------------------------|-----------------------|-----------------------------------------|-------|-------|
| Filter                            |                       |                                         |       |       |
| Norm AzB: 2008 •                  | Type of flight        | All                                     |       |       |
| System Project                    | Properties AzB 2008   | / DIN 45684-1:2013-07 Profiles Comments |       |       |
| #### Element name A               | Aircraft library type | AzB 2008 / DIN 45684-1:2013-07 🔹        | Norm  | All   |
| 1 P1.3-S                          | Ancraic librally type |                                         | NUIII | All V |
| 2 P1.3-L                          | Aircraft category     | Jet 👻                                   |       |       |
| 3 APU 1 - S                       |                       |                                         |       |       |
| 4 APU 1 · L                       | Aircraft group        | \$ 5.1 ·                                |       |       |
| > 5 S 5.1 ⋅ S                     |                       |                                         |       |       |
| 6 S 5.1 · L                       | Type of flight        | Departure -                             |       |       |
| 7 H 1.1 - S                       | Aircraft class        | S 5.1 - S                               |       |       |
| 8 H1.1 - L                        |                       |                                         |       |       |
| 9 H1.2 · S                        | Assigned APU          | APU 1 - S 💌                             |       |       |
| 10 H 1.2-L<br>11 P 1.4-S          |                       |                                         |       |       |
| 12 P 21 · S                       |                       |                                         |       |       |
| 13 \$ 52-\$                       |                       |                                         |       |       |
| 13 5 5.2 · 5<br>14 S 6.1 · S      | Qsigma (dB)           | 3,00                                    |       |       |
| 15 APU 2 - S                      | 101-1                 | 2,50                                    |       |       |
| 16 S 6 2 a) - S                   | hQ (m)                | 2,30                                    |       |       |
| 17 P-MIL 2 - S                    |                       |                                         |       |       |
| 17 P-MIL 2 - 5<br>18 S 6.2 b] - S |                       |                                         |       |       |
| 10 5 6.2 0 - 5                    |                       |                                         |       |       |
| -                                 | PA: St                | art of roll + 0,00                      |       |       |
| Ba > Global Ba > Project          | h0                    |                                         |       |       |
| Jump to:                          | X                     | 0,00                                    |       |       |
| oramp to:                         | 0,000                 |                                         |       |       |
| I                                 |                       |                                         |       |       |
|                                   |                       |                                         |       |       |

Under the tab *profile* you find the entry for the emission level including the directivity and additionally the speed profile, elevation profile and the additional level depending on the distance  $\sigma'$  ( $\sigma'=0$  at the starting point and the threshold).



Track and traffic data

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For a better control of the entered data, diagrams are visualizing the data. You can switch the diagrams between **ON** (Octave levels), **LWN** (sound power) and **RN** (directivity factor).

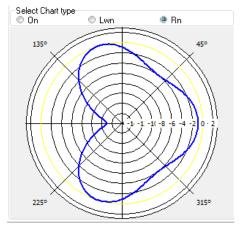


Diagram directivity of an aircraft class in accordance to AzB 2008

### Aircraft classes ECAC

For ECAC Doc 29, 3rd edition the aircraft classes as supplied by Eurocontrol are available in the library under **AIRCRAFT CLASSES** -> **AIRPLANE DATA (ECAC)**. Via the import interface it is also possible to import the data from INM (US Department of Transport software) directly into this library.

### Open the aircraft data via AIRCRAFT CLASSES -> AIRPLANE DATA (ECAC).

The entry for an aircraft consists of the following entries:

| General | Flaps | Jet thrust coefficients | NPD | Profiles | Spectra | Default weights |
|---------|-------|-------------------------|-----|----------|---------|-----------------|
|---------|-------|-------------------------|-----|----------|---------|-----------------|

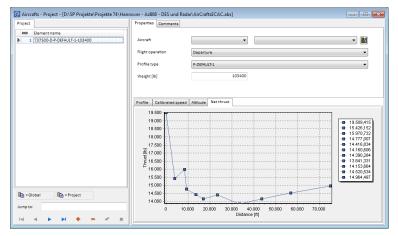
The individual definitions are interlinked and contain all information for various flight profiles. As an example, the Boeing 737-300 contains 1 approach profile and 12 different departure profiles. Each one of these profiles a has a different description of the flight segments (see the lower table).

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Track and traffic data

| 5ys | tem    | Project          | General | Flaps      | Jett   | thrust coeff | icients N   | PD | Profiles | Spectr | B Default we  | eights              |          |     |
|-----|--------|------------------|---------|------------|--------|--------------|-------------|----|----------|--------|---------------|---------------------|----------|-----|
| 1   |        | Elementname      | ОрТуре  | ProfileTy  | ype    | ProfileID    | Stage Len   | th | Weight [ | ю]     |               |                     |          |     |
|     | 19     | 737              | Α.      | P          | -      | DEFAULT      |             | 1  |          | 0,0    |               |                     |          | - ( |
| >   | 20     | 737300           | D .     | P          | -      | DEFAULT      |             | 1  | 10       | 8800,0 |               |                     |          |     |
|     | 21     | 737382           | D .     | P          | -      | DEFAULT      |             | 2  | 11       | 4100.0 |               |                     |          |     |
|     | 22     | 737400           | р.,     | P          | •      | DEFAULT      |             | 3  | 11       | 9900.0 |               |                     |          |     |
|     | 23     | 737500           | D .     |            | Ţ      | DEFAULT      |             | 4  |          | 1800.0 |               |                     |          |     |
|     | 24     | 737700           | D .     | L          | -      | ICAD A       |             | 1  |          | 8800,0 |               |                     |          |     |
|     | 25     | 737800           | D .     |            | ÷      | ICAD A       |             | 2  |          | 4100.0 |               |                     |          |     |
|     | 26     | 737D17           | D .     |            | ÷      | ICAO_A       |             | 3  |          | 9900.0 |               |                     |          |     |
|     | 27     | 737N17           |         |            | -      | -            |             | 2  |          | 5500,0 |               |                     |          | _   |
|     | 28     | 737N9            |         |            |        | 4            |             |    |          |        |               | +                   |          | •   |
|     | 29     | 737QN            | Depart  | ure Proced | ural P | rofile       |             |    |          |        |               |                     |          |     |
|     | 30     | 747100           |         |            |        |              |             |    |          |        |               |                     |          |     |
|     |        | 74710Q           |         | Step       |        |              | rust Rating |    | Flap II  |        | Altitude [ft] | Climb rate [ft/min] | CAS [kt] |     |
|     | 32     | 747200           | 1       |            | akeof  |              | MaxTakeof   |    |          | 5 🕶    |               |                     |          |     |
|     |        | 74720A           | 2       |            | Climb  |              | MaxTakeof   |    |          | 5 🔻    | 1000          |                     |          |     |
|     |        | 74720B           | 3       | Accel      | lerate | •            | MaxClimb    | •  |          | 5 🔻    |               | 1154,7              | 194,6    |     |
|     |        | 747400           | 4       | Accel      | lerate |              | MaxClimb    | •  |          | 1 👻    |               | 1295,8              | 211,5    |     |
|     |        | 747SP            | 5       | Accel      | lerate | •            | MaxClimb    | -  | z        | ERO 🔻  |               | 1391,6              | 220,5    |     |
|     |        | 757300           | 6       |            | Climb  | •            | MaxClimb    | •  | z        | ERO 🔻  | 3000          |                     |          |     |
|     | 38     | 757PW +          | 7       | Accel      | lerate |              | MaxClimb    | •  | z        | ERO 👻  |               | 1444,8              | 250,0    |     |
|     |        | Pro esta         | 8       |            | Climb  | -            | MaxClimb    | -  | Z        | ERO 👻  | 5500          |                     |          |     |
|     | ) > GI | obal 🛱 > Project | 9       |            | Climb  | •            | MaxClimb    | -  | z        | ERO 👻  | 7500          |                     |          |     |
| -   |        |                  |         |            |        |              |             |    |          |        |               |                     |          |     |

For the calculation model in accordance to ECAC 29/3rd edition you need to assemble the required aircraft classes and flight profiles in the library **AIRCRAFT CASSES** -> **AIRCRAFTS (ECAC)**. The element name is automatically generated from the aircraft name, the flight profile and the aircraft weight.



Only the aircraft classes (with profile) assembled here are available to the calculation model.

## Import of the aircraft class databases (ECAC and INM)

Open the aircraft class library with AIRCRAFT CLASSES -> AIRPLANE DATA (ECAC).

Via **FILE -> IMPORT** you can select on the right side if you want to import ECAC data (\*.csv) or INM data (\*.dbf).

Track and traffic data

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## Flight track computer

With the flight track computer, it is very easy to control (and extrapolate the numbers for the future) the number of flight operations. Various possibilities exist, for example to multiply all flight operations for all tracks and classes with a constant factor. After triggering the calculation you must confirm to keep the manipulations with an "OK".

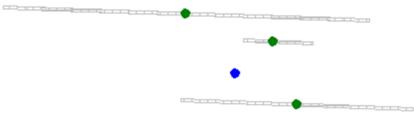
| Q Air Traffic Calculator                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                          |                | x      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--------|
| All Tracks                                                                                                                                                                                                                                                 | • 15                                                                                                                                                                                                                                     | All Tracks 👻   |        |
| All Groups 🗸                                                                                                                                                                                                                                               | • 1,5 —                                                                                                                                                                                                                                  | All Groups 👻   |        |
| All Times 🔹                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                          | All Times 👻    |        |
| Execute Undo                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          | OK Cancel Help |        |
| 1. {"All Tracks";"All Groups";"All Times"} * 1,50                                                                                                                                                                                                          |                                                                                                                                                                                                                                          |                | *<br>* |
| LANDUNG#POS_01.P.21 := LANDU<br>LANDUNG#POS_01.S.52 := LANDU<br>LANDUNG#POS_01.S.61 := LANDU<br>LANDUNG#POS_01.S.7 := LANDU<br>LANDUNG#POS_01.S.7 := LANDU<br>LANDUNG#POS_01.S.63 := LANDU<br>LANDUNG#POS_01.S.63 := LANDU<br>LANDUNG#POS_01.S.63 := LANDU | NIG #POS_015_5111_50<br>NIG #POS_017_5221_150<br>NIG #POS_017_5221_50<br>NIG #POS_015_511_50<br>NIG #POS_015_511_50<br>NIG #POS_015_511_50<br>NIG #POS_015_521_50<br>NIG #POS_015_621_50<br>NIG #POS_015_6321_50<br>NIG #POS_017_5221_50 |                | •      |

## Work in the Geo-Database

It is sensible to use the capabilities of the Geo-Database with its Geo-Files for structuring the model. The following minimum structure is a typical example for structuring a calculation in accordance to the AzB 2008 for a big airport (also see the example project on the program DVD):

| 🚽 🛛 💡 | calculation area             |
|-------|------------------------------|
|       | DES - APUs                   |
| 📲 🛱 💡 | DES - Prop and jet airplanes |
| 🚽 🛛 💡 | DES - Runways                |
| 📲 🏾 🖓 | measurement points           |

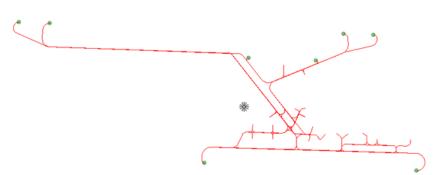
The Geo-file "DES – Runways" contains the airport reference point and the runways for start and landings.



The Geo-files DES-APUs, DES-Helicopter, DES-Prop and jet aircraft and DES-Taxiing contain the individual flight tracks.

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Work in the Geo-Database



#### Example: DES-Taxiing

With the organization of the individual route types in individual Geo-files it is much easier later on to select, display and process particular operations.

### **QSI Import / Export**

For the AzB 2008 and the VBUF, it is possible to import and export entire airports in the QSI format. The entire calculation model of an airport including additional data such as buildings, receivers are written to the export files. When importing the data, make sure that you have set the standard for the aircraft noise model (in the settings of the SoundPLAN Manager) to the same standard that was used exporting the data to QSI.

It is sensible to generate a DGM and assign it to a situation before you import as all data are referenced to this DGM.

Start the import with **FILE -> IMPORT -> QSI** and select the qsi-file. A complete model can be exported with **FILE -> EXPORT -> QSI**.

## Calculating aircraft noise

First define/select the noise descriptors you need in the **assessment library**. For aircraft noise it is common to use:

| Leq                                | averaged for the defined time slices                                                                                                                                   |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lmax aircraft noise                | Absolute max level for a selected time slice                                                                                                                           |
| NAT aircraft noise                 | Number of noise events exceeding a user defined threshold value in a selected time slice                                                                               |
| Threshold by NAT<br>aircraft noise | (or inverse NAT-criterion). The threshold value is documented that led to a selected number of events exceeding the threshold value for a selected time slice.         |
| Awakening due to<br>aircraft noise | The awakening reaction in accordance to a German DLR study<br>for a selected time slice (ZfL (2005) Nr. 4 - Juli, Markus Basner,<br>Ullrich Isermann, Alexander Samel) |

Calculating aircraft noise

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| Туре                        | NAT-Aircraft-Noise              |  |
|-----------------------------|---------------------------------|--|
| Names, Shorts               |                                 |  |
| ID                          | NAT 68                          |  |
| Name, Legend                | NAT 68 (Number above threshold) |  |
| Limit Short                 | NAT 68,lim                      |  |
| Limit Name, Legend          | Limit for NAT 68                |  |
| Definition                  |                                 |  |
|                             |                                 |  |
| Hours                       | 22-6                            |  |
|                             |                                 |  |
|                             |                                 |  |
|                             |                                 |  |
| take additions into account |                                 |  |
| Threshold [dB]              | 68,0                            |  |
|                             |                                 |  |

For the noise assessment type "NAT aircraft noise" in addition to the time slice the threshold value and a Rw value for the building shell needs to be defined. For the awakening reaction, the Rw value of the building is required.

In the **calculation core** under the tab *general* in the left pick list select the category **AIRCRAFT NOISE** and in the right pick list select the **CALCULATION TYPE**.

| 🛐 Run C | ommand Edi | itor           |                                          |   |                                                 |             | ×                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------|------------|----------------|------------------------------------------|---|-------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General | Assessment | Aircraft noise | Description                              |   |                                                 |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Calcula | tion type: |                | an a | ~ | <br>1990 A. | her a start | the state of the s |
| Aircraf | ft noise   | ∽ Si           | ngle points                              |   |                                                 |             | $\sim$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Data:   |            |                | -                                        |   | <br>                                            | <br>        | han a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

For aircraft noise you can calculate single receivers, Façade Noise Maps, Grid Noise Maps and Cross-sectional Noise Maps.

Enter the situation(s) and the Geo-Files for the calculation and assign a DGM.

In the tab for *assessment* select the desired noise assessment from the assessment library and tell the program which of the noise descriptors you want to use.

| Store assessment time slices |
|------------------------------|
| 🗸 Leg                        |
| Lmax-Aircraft-Noise          |
| NAT-Aircraft-Noise           |

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Calculating aircraft noise

In the tab Aircraft Noise select the standard for which the aircraft noise is to be calculated. (the default is set in the SoundPLAN Manager under the standards section).

For single receivers and Facade Noise Maps it is also possible to save a Lmax statistics. Check the box for **MAX LEVEL STATISTIC (SUM)**, if you are only interested in the resulting distribution off the maximum noise level.

| General Assessment Aircraft Noise | Radar tracks Description                   |
|-----------------------------------|--------------------------------------------|
| Standard                          |                                            |
| AzB: 2008                         | ▼                                          |
| Save calculation results          |                                            |
| V Plain Result Tables             | ☑ Including Maximal Level Statistics (Sum) |
| 📝 Detail Result Tables            |                                            |
| Protocol tables                   |                                            |

If you request the detail result tables, additionally for each aircraft class the detailed max level statistics will be stored. Please observe that the statistics is using the emission time slices from the airport definition and that the file size of the stored data can be very large. Such a statistics practically therefore is only usable for selected single receivers.

Under the tab for the respective calculation types you set the parameters used in the calculation. These parameters are the grid spacing and interpolation controls for the Grid Noise Map and Cross-Sectional Noise Map and the settings for the Façade Noise Map. To save calculation time you can opt to calculate only a single receiver per façade, a setting that is sufficient for most aircraft noise studies.

| General    | Assessment                                                                                                              | Aircraft Noise   | Facade Noise Map     | Radar tracks | Description |  |  |  |  |
|------------|-------------------------------------------------------------------------------------------------------------------------|------------------|----------------------|--------------|-------------|--|--|--|--|
| 0          | One receiver in center of facade     Only first facade per building     Two receivers at edges of facade; Indention [m] |                  |                      |              |             |  |  |  |  |
| -          | ention in                                                                                                               |                  |                      |              | 1           |  |  |  |  |
| C Rece     | ivers with spa                                                                                                          | cing [m]         |                      |              | 0           |  |  |  |  |
| Receiption | ivers with spa                                                                                                          | cing acc. to VBE | В                    |              |             |  |  |  |  |
| _          |                                                                                                                         |                  | facade (EU-Directive |              | 0.01        |  |  |  |  |
| Distance   | e to facade [m]                                                                                                         | ]                |                      |              | 0,01        |  |  |  |  |
| Rece       | ivers in height                                                                                                         | above ground     | [m]                  |              | 4           |  |  |  |  |

For the calculation with radar tracks additional parameters need to be defined under the tab *radar tracks*, see page 717.

Calculating aircraft noise

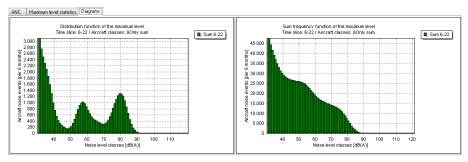
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## Document aircraft noise with the Result Tables

In the ANC-table (detail table) the level contributions of a flight track or a radar track are documented for the time slices calculated. For a calculation in accordance to AzB 2008 additionally the "alpha"- and "gamma"-values are saved for each flight track. These values document the utilization of the flight track in years past.

The detail tables for "maximum noise level statistics" and "diagrams" are closely connected. In the tab "diagrams" the distribution or the sum frequency function of the maximum noise level is presented for the selected receiver.



The content of the diagrams is governed by the settings in the table "max level statistics". With a right click on the table the following options can be selected:

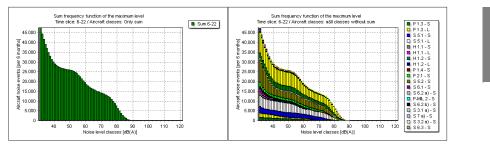
| Table settings                                   |   | 1 | ,    | -, |
|--------------------------------------------------|---|---|------|----|
| Maximum level statistics Report<br>Legend report | × |   |      |    |
| Display time slices                              | • | < | All  |    |
| Aircraft classes                                 | • |   | 6-22 |    |
| Scaling                                          |   | _ | 22-6 |    |
| Sort                                             |   |   |      |    |

The choice to present the max level statistics for all aircraft classes or only to display the sum of the classes:

| Aircraft classes | × |   | all classes + sum       |
|------------------|---|---|-------------------------|
| Scaling          |   |   | all classes without sum |
| Sort             |   | < | Only sum                |

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Document aircraft noise with the Result Tables



*Left max level statistics –only the sum, right side statistics but differentiated for each aircraft class* 

The definition of the scaling:

| Scaling                      |         |   | ×      |
|------------------------------|---------|---|--------|
| -Noise level classes [dB(A)] |         |   |        |
| 1st interval                 | >=29    | • |        |
| Last interval                | >=95    | - |        |
| Interval size                | 1       | • |        |
| No. of intervals             | 67      | ۲ |        |
|                              |         |   | ок     |
| Aircraft noise events        |         |   | Cancel |
| Reference period             | per day | • | Help   |
|                              |         |   |        |

With this scaling the interval borders and interval sizes can be set. The smallest interval step is 1 dB. Most commonly 1 dB and 5 dB steps are used. The time reference is usually set to present the results per day.

## Presentation of the aircraft noise protection zones in the Graphics

The aircraft noise protection zones in accordance to the German law can be generated automatically. In the file selection select the data type **LIMIT MAP** and assign the calculated Grid Noise Map to the plan.

| Select files     |   |
|------------------|---|
| Select file type |   |
| 🛞 Limit map 🗸 🗸  | ] |

In the settings for the noise limit map, select the type of airport and the time slices and noise limits.

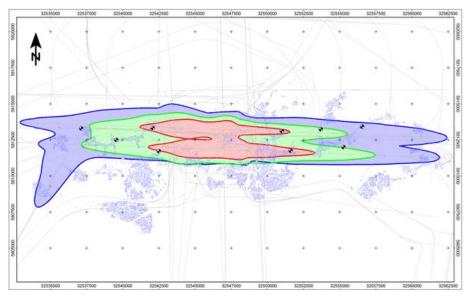
Presentation of the aircraft noise protection zones in the Graphics

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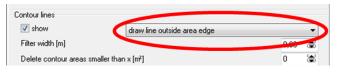


| New    | civil airport    | :            |       |            |   |        |  |
|--------|------------------|--------------|-------|------------|---|--------|--|
|        | es slices        |              |       |            |   |        |  |
|        | civil airport    |              |       |            |   |        |  |
|        | vil airport      |              |       |            |   |        |  |
|        | military airp    |              |       |            |   |        |  |
| Old mi | ilitary airpo    | rt           |       |            |   |        |  |
| ~      |                  |              |       |            | _ |        |  |
| 💽 Lim  | nit map settin   | gs           |       |            |   |        |  |
| Limits |                  |              |       |            |   |        |  |
|        |                  |              |       |            |   |        |  |
|        | ld civil airport |              |       |            |   | •      |  |
| T      | ime slices       | Load         | Limit | Join with  |   | Limit  |  |
|        | ine silces       | LUau         | LIIII | time slice |   | LIIII  |  |
| Lr     | rD               |              | 65,0  | •          | • | 0,0    |  |
| Lr     | rD               | $\checkmark$ | 60,0  | •          | • | 0,0    |  |
| Lr     | rN               | $\checkmark$ | 55,0  | NAT 72     | • | 6,0    |  |
|        |                  |              |       |            |   |        |  |
|        |                  |              |       | ОК         |   | Cancel |  |

Depending on the airport type the aircraft noise protection zones are automatically defined. For the time slice night additionally, the encasing area is generated from the Leq and NAT values of the Grid Noise Map.



For the correct display in accordance to the German aircraft noise law, it needs to observe that the line positions in the object type limit map is set to **DRAW THE LINE OUTSIDE AREA EDGE**.



```
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```

Presentation of the aircraft noise protection zones in the Graphics

## Work with radar tracks

SoundPLAN can import radar tracks recorded in one of the three data formats (Stanly, Fanomos and Topsonic). During the import each radar track is assigned an aircraft class from the database of aircraft classes. The aircraft class is dependent on the desired calculation standard as it is selected in the SoundPLAN Manager. During the import into a special database, SoundPLAN performs various checks and sometimes needs to adjust the given data to be usable for the aircraft noise calculation. Radar tracks not suitable for the calculation (for example pattern flights) are automatically discarded. After a successful import it is possible to calculate any of the descriptors (L<sub>eq</sub>, NAT, L<sub>max</sub> or max level statistics) for single receivers and horizontal and vertical noise maps for any time slice defined in the assessment library. The results are identical to the noise calculations based on conventional back bones.

### Library – airplane data (general)

The library "airplane data (general)" contains information about the correct assignment of the "aircraft type" (AC-type) from the radar tracks to the emission library (aircraft data) of AzB 2008 and ECAC Doc 29, 3rd Edition. Invoke LIBRARIES -> AIRCRAFT CLASSES -> AIRPLANE DATA (GENERAL).

| 🖸 Gei  | eneral Aircraft Data - Project - (D:\SP Projekte\Proj | ekte 74\Hannover - Doc29 3rd - DES and radar\GenAircraft.abs] |
|--------|-------------------------------------------------------|---------------------------------------------------------------|
| Filter | e                                                     |                                                               |
| Syster | m Project                                             | Properties                                                    |
|        | Element name                                          |                                                               |
| 9      | 91 8703                                               | Manufacturer                                                  |
| 9      | 92 8721                                               | BOEING                                                        |
| 9      | 93 B722                                               | Model                                                         |
| 9      | 94 8731                                               | 737-700, BBJ, C-40                                            |
| 9      | 95 8732                                               | Description                                                   |
| 9      | 96 8733                                               | · · · · · · · · · · · · · · · · · · ·                         |
| I s    | 97 8734                                               | L2J/L                                                         |
| 9      | 98 B735                                               | Maximal takeoff mass (MTOM) [kg]                              |
|        | 99 8736                                               | 77565                                                         |
| Į 10   | 00 B737                                               | Assigned AZB Class                                            |
| B. >   | >Global 📴 > Project                                   | \$5.2                                                         |
| Jump   | e to:                                                 | Assigned ECAC class                                           |
| I      | < > > * * * * ×                                       |                                                               |

Exemplary presentation of the definitions for a Boeing 737-400.

The element name "B734" is used during the import as a database key and therefore needs to be the same as is stored in the radar tracks as the "aircraft type". Some attributes from the settings such as producer, model, description and maximal takeoff weight are informative and are not evaluated during import. For the import and correct assignment, the two last pick lists are the most important. Via the selection of the AzB or the ECAC class the import automatically assigns the emission to the radar tracks. The database delivered with SoundPLAN can be amended at will.

Work with radar tracks

## Preparation of the import

Before we can import radar tracks, we must have the airport defined with its runways and need to have made a DGM and assigned it to the Situation.

## Step 1: Import of radar tracks into a database

Start the import of radar track data via FILE -> IMPORT -> RADAR TRACKS -> AIRPORT-DATABASE SYSTEM.

Define the settings for the import of radar data and what data to import.

| 🧛 Radar track import      |              |                             |            |    |            |            |  |  |
|---------------------------|--------------|-----------------------------|------------|----|------------|------------|--|--|
| Import format             | Fanomos      | Fanomos                     |            |    |            |            |  |  |
| Database name             | Radar tra    | cks - Fanomos - Januar      | .abs       |    |            | •          |  |  |
| Import file(s)            |              |                             |            |    |            | ^ <b>P</b> |  |  |
| Coordinate Adjustment     |              |                             |            |    |            |            |  |  |
| false easting (x-offset)  |              | 32000000                    |            |    |            |            |  |  |
| false northing (y-offset) |              | 5000000                     |            |    |            |            |  |  |
| Height correction         |              | 0                           |            |    |            |            |  |  |
|                           |              |                             |            |    |            |            |  |  |
| UTC to local time         |              |                             |            |    |            |            |  |  |
| (UTC+01:00) Amsterdar     | m, Berlin, B | ern, Rom, Stockholm, V      | Vien       |    |            | <b>~</b> ] |  |  |
| 📝 Daylight saving time    |              |                             |            |    |            |            |  |  |
| Time offset [h] 1         |              | Start (UTC)                 | 25.03.2012 |    | 01:00:00 🚔 |            |  |  |
|                           |              | End (UTC)                   | 28.10.2012 |    | 01:00:00   |            |  |  |
|                           |              |                             |            |    |            |            |  |  |
| Filter                    |              |                             |            |    |            |            |  |  |
| Band Width [m]            | 1            | 100                         |            |    |            |            |  |  |
|                           |              | œ                           |            |    |            |            |  |  |
|                           |              |                             |            |    |            |            |  |  |
|                           |              |                             |            |    |            |            |  |  |
| Append                    |              |                             | Overwrit   | te |            |            |  |  |
| Meta data                 |              |                             |            |    |            |            |  |  |
| VarName                   |              | <ul> <li>Fanomos</li> </ul> |            |    |            |            |  |  |
| DataType                  | _            | E                           |            |    |            |            |  |  |
| Standard                  |              |                             |            |    |            |            |  |  |
| Files                     |              |                             |            |    |            |            |  |  |
| Filter                    |              |                             |            |    |            |            |  |  |
| UTCToLocal                |              | <b>T</b>                    |            |    |            |            |  |  |
|                           |              |                             |            |    | ОК         | Cancel     |  |  |

Via **IMPORT TYP** select the data format of the radar tracks.

| Fanomos  | - |
|----------|---|
| Stanly   |   |
| Fanomos  |   |
| Topsonic |   |

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Work with radar tracks

The radar tracks to be imported are saved in the SoundPLAN database format (\*.abs). The **NAME OF THE DATABASE** can be assigned at will or can be taken from a list of already existing databases. The database is saved to a sub folder of the project under the name "RTDatabaseFiles".

With the folder symbol select any number of files (radar tracks) for import. The organization of the data is up to the user. For small airports it may be advisable to save a complete year in a single database file. With this the project will be very compact as only a few databases need to be created. For a very big airport with many flight operations it may be sensible to split the data and create a separate database for each month. This decision will not restrict future possibilities, it only changes the database management and helps with a clearer data handling.

**COORDINATE ADJUSTMENT:** In general, the radar tracks must be available in the same coordinate system and reference system as the rest of the data from the project. During the import however, it is possible to shift the data in x or y direction.

When importing Fanomos-data, it is possible to have an **ELEVATION CORRECTION** (to adjust a difference between the ground and the position of the radar data receiver).

For the import of Fanomos- and Topsonic-data the time information needs to be transformed for (UTC) to the local time system as otherwise it would be impossible to correctly perform the noise assessment. For this correction, the correct relationship of the local airport time to UTC needs to be set and the beginning and the end of the summer time needs to be defined. Summer time differs every year and must be individually defined. The screenshot shows the correct settings for Germany for the year 2012.

If you choose an already existing database for the import you can either **AMEND** the data and thus expand the database step by step (for example by importing month by month or you can opt to **OVERWRITE** the already existing database.

#### Data check after the import

After all tracks are imported, there is very efficient way to get an overview or detailed information of all data.

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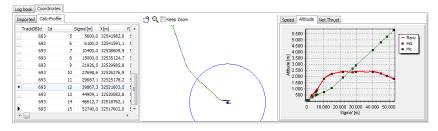


| eta                      | Tracks                                                                                     | Statistics                                 |                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |           |            |          |                                                                                |                   |            |                       |                       |
|--------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------|------------|----------|--------------------------------------------------------------------------------|-------------------|------------|-----------------------|-----------------------|
| Track                    | OBId I                                                                                     | FlightId                                   | FlightType                                                                                                                                        | ata_atd                                                                                                                                                                                                                                                                                                                                                                                                                              | ata_atd_weekday origin | destin ru | nway route | callsign | registration                                                                   | ac_type Tr        | adkId      | startDateTime         | endDateTime           |
|                          | 3656                                                                                       | 25176801                                   | Arrival                                                                                                                                           | 25.01.2012 20:57:16                                                                                                                                                                                                                                                                                                                                                                                                                  | 4 EBBR                 | EDDV 09   | R OSN5R    | BEL8AJ   |                                                                                | DH8D              | 1          | 25.01.2012 19:48:32   | 25.01.2012 19:        |
|                          | 4444                                                                                       | 25223342                                   | Arrival                                                                                                                                           | 31.01.2012 01:02:18                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 EDDS                 | EDDV 09   | ELNAT 1F   | TUI950   |                                                                                | 8738              | 1          | 30.01.2012 23:54:09   | 31.01.2012 00:        |
|                          | 3642                                                                                       | 25175823                                   | Arrival                                                                                                                                           | 25.01.2012 19:23:11                                                                                                                                                                                                                                                                                                                                                                                                                  | 4 EHAM                 | EDDV 09   | OSN5R      | MTRIX    |                                                                                | CL60              | 1          | 25.01.2012 18:14:16   | 25.01.2012 18:        |
|                          | 4183                                                                                       | 25207684                                   | Arrival                                                                                                                                           | 29.01.2012 10:49:13                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 UUW\                 | EDDV 09   | DIRBO4     | LXTQJ    |                                                                                | FA7X              | 1          | 29.01.2012 09:34:48   | 29.01.2012 09:        |
|                          | 3611                                                                                       | 25174179                                   | Arrival                                                                                                                                           | 25.01.2012 16:51:49                                                                                                                                                                                                                                                                                                                                                                                                                  | 4 GCTS                 | EDDV 09   | R OSN5R    | TUI85Y   |                                                                                | B738              | 1          | 25.01.2012 15:43:43   | 25.01.2012 15:        |
|                          | 4150                                                                                       | 25205969                                   | Arrival                                                                                                                                           | 28.01.2012 22:36:14                                                                                                                                                                                                                                                                                                                                                                                                                  | 7 HSSS                 | EDDV 09   | GITEX2R    | ACX4752  |                                                                                | B744              | 1          | 28.01.2012 21:22:21   | 28.01.2012 21:        |
|                          | 3164                                                                                       | 25147290                                   | Arrival                                                                                                                                           | 22.01.2012 22:00:59                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 EDDM                 | EDDV 27   | 7R GITEX2P | BER605   |                                                                                | DH8D              | 1          | 22.01.2012 20:50:18   | 22.01.2012 20:        |
|                          | 2650                                                                                       | 25116214                                   | Arrival                                                                                                                                           | 19.01.2012 10:15:32                                                                                                                                                                                                                                                                                                                                                                                                                  | 5 LTBA                 | EDDV 27   | 7R HLZ4P   | THY9LX   |                                                                                | A321              | 1          | 19.01.2012 09:06:10   | 19.01.2012 09:        |
|                          | 4315                                                                                       | 25215535                                   | Arrival                                                                                                                                           | 30.01.2012 09:36:21                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 EHAM                 | EDDV 09   | OSN5R      | KLM27G   |                                                                                | F70               | 1          | 30.01.2012 08:26:38   | 30.01.2012 08:        |
|                          | 2940                                                                                       | 25133059                                   | Arrival                                                                                                                                           | 20.01.2012 23:00:20                                                                                                                                                                                                                                                                                                                                                                                                                  | 6 LEPA                 | EDDV 27   | TO         | BER 31W  |                                                                                | A320              |            | 20.01.2012 21:48:53   | 20.01.2012 21:        |
|                          |                                                                                            |                                            |                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |           |            |          |                                                                                |                   |            |                       |                       |
| og bod<br>Import         | ted Ca                                                                                     | 25134462<br>rdinates<br>Ic-Profile         |                                                                                                                                                   | 21.01.2012 08:59:07                                                                                                                                                                                                                                                                                                                                                                                                                  | 7 EDDM                 | EDDV 27   |            |          | Speed                                                                          | E190              | 1          | 1 21.01.2012 07:48:59 | 21.01.2012 07         |
| og bod<br>Import         | ok Coo<br>ted Ca                                                                           | rdinates<br>Ic-Profile<br>Id               | Sigma'[m]<br>10 22937,1                                                                                                                           | X[m] Y[ ^<br>7 32527260,8 5<br>8 32527161,3 5                                                                                                                                                                                                                                                                                                                                                                                        |                        |           |            |          | 1                                                                              | E190              | 1          | 1 21.01.2012 07:48:59 | 21.01.2012 07:        |
| og bod<br>Import         | ok Coo<br>ted Ca<br>ckDBId<br>4183                                                         | rdinates<br>Ic-Profile<br>Id<br>3 1        | Sigma'[m]<br>10 22937, 1<br>11 20940, 8                                                                                                           | X[m] Y[ ^<br>7 32527260,8 5                                                                                                                                                                                                                                                                                                                                                                                                          |                        |           |            |          | 1                                                                              | E 190             | 1          | 1 21.01.2012 07:48:59 | - Raw                 |
| og bod<br>Import         | ok Coo<br>ted Ca<br>ckDBId<br>4183<br>4183                                                 | rdinates<br>Ic-Profile<br>Id<br>3 1<br>3 1 | Sigma'[m]<br>10 22937,<br>11 20940,8<br>12 18248,9                                                                                                | X[m] Y[ ^<br>7 32527260,8 5<br>8 32527161,3 5                                                                                                                                                                                                                                                                                                                                                                                        |                        |           |            |          | 1.                                                                             | E190              | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| og bod<br>Import         | ok Coo<br>ted Ca<br>ckDBId<br>4183<br>4183<br>4183                                         | rdinates                                   | Sigma'[m]<br>10 22937, j<br>11 20940, {<br>12 18248, {<br>13 16958, {                                                                             | X[m] Y[ ^<br>7 32527260,8 5<br>8 32527161,3 5<br>9 32527294,4 5                                                                                                                                                                                                                                                                                                                                                                      |                        |           |            |          | 1.                                                                             | E 190             | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| og bod<br>Import         | ok Coo<br>ted Ca<br>ckDBId<br>4183<br>4183<br>4183<br>4183                                 | rdinates                                   | Sigma'[m]<br>10 22937,<br>11 20940,<br>12 18248,<br>13 16958,<br>14 16077,                                                                        | X[m] Y[ ^<br>7 32527260,8 5<br>8 32527161,3 5<br>9 32527261,4 5<br>4 32527695,9 5                                                                                                                                                                                                                                                                                                                                                    |                        |           |            |          | 1.                                                                             | E 190             | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| og bod<br>Import         | ok Coo<br>ted Ca<br>dkDBId<br>4183<br>4183<br>4183<br>4183<br>4183                         | rdinates                                   | Sigma'[m]<br>10 22937,<br>11 20940,<br>12 18248,<br>13 16958,<br>14 16077,<br>15 15079,                                                           | X[m] Y[ ^<br>7 32527260,8<br>8 32527161,3<br>9 32527294,4<br>5 3252795,9<br>2 3252855,9<br>2 32528338,6<br>5                                                                                                                                                                                                                                                                                                                         |                        |           |            |          | 1.<br>1:<br>[s/ш] paads                                                        | E 190             | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| og bod<br>Import         | ok Coo<br>ted Ca<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183                   | rdinates                                   | Sigma'[m]<br>10 22937;<br>11 20940;<br>12 18248;<br>13 16958;<br>14 16077;<br>15 15079;<br>16 13189;                                              | X[m]         Y[           7         32527260,8         5           8         32527161,3         5           9         32527294,4         5           23527383,6         5         4           3252760,8         5         32527317,00           32553117,00         5         32535117,00           325361,00         5         325361,00                                                                                            |                        |           |            |          | 1:<br>1:<br>[s]<br>[s]<br>[s]<br>[s]<br>[s]<br>[s]<br>[s]<br>[s]<br>[s]<br>[s] | E 190<br>Altitude | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| og boo<br>Import<br>Trac | ok Coo<br>ted Ca<br>dkDBId<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183         | rdinates                                   | Sigma'[m]<br>10 22937,<br>11 20940,8<br>12 18248,9<br>13 16958,7<br>14 16077,1<br>15 15079,<br>16 13189,9<br>17 7400,0                            | X[m] Y[ ^<br>7 32527260,8 5<br>3 32527161,3 5<br>9 32527294,4 5<br>4 32527695,9 5<br>2 3252338,6 5<br>4 32527260,8 5<br>9 32531176,0 5                                                                                                                                                                                                                                                                                               |                        |           |            |          | 1.<br>1:<br>[sr II]<br>see(S                                                   | E 190             | 1          | 1 21.01.2012 07:48:59 | - Rew<br>• Vd         |
| .og bod<br>Import        | ok Coo<br>ted Ca<br>dkDBId<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183 | rdinates                                   | Sigma'[m]<br>10 22937,<br>11 20940,8<br>12 18248,9<br>13 16958,<br>14 16077,<br>15 15079,<br>15 15079,<br>16 13189,5<br>17 7400,0<br>18 -300,0    | X[m] Y[ ^<br>7 32527260,8 5<br>8 32527161,3 5<br>9 32527294,4 5<br>4 32527695,9 5<br>2 3252738,6 5<br>4 325290,8 5<br>9 3253176,0 5<br>9 3253176,0 5                                                                                                                                                                                                                                                                                 |                        |           |            |          | 1.<br>1:<br>[sr II]<br>see(S                                                   | E 190             | Net Thrust | 21.01.2012 07-48:59   | - Raw<br>• Vd<br>• Vc |
| .og bod<br>Import        | ok Coo<br>ted Ca<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183<br>4183           | rdinates                                   | Sigma'[m]<br>10 22937,<br>11 20940,8<br>12 18248,9<br>13 16958,4<br>14 16077,1<br>15 15079,-<br>16 13189,9<br>17 7400,0<br>18 -300,0<br>19 -400,0 | X[m]         Y[           7         32527260,8         5           3         32527161,3         5           9         32527294,4         5           4         32527294,4         5           9         32532630,6         5           9         3253290,8         5           9         3253690,6         5           9         3253690,6         5           9         3253695,7         5           9         3253695,8         5 |                        |           |            |          | 1.<br>1:<br>[sr II]<br>see(S                                                   | E 190             | Net Thrust | 21.01.2012 07-48:59   | - Rew<br>• Vd         |

Under the tab *Meta* you find the general information for the import settings.

| leta  | TSTracks | Statistik |   | ~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~                                                   |  |
|-------|----------|-----------|---|----------------------------------------------------------------------------------|--|
| VarN  | ame      |           | - |                                                                                  |  |
| Data  | Туре     |           |   | DST: Offset: 1 h; Start(UTC)-End(UTC): 25.03.2012 01:00:00 - 28.10.2012 01:00:00 |  |
| Stan  | dard     |           |   |                                                                                  |  |
| Files |          |           |   |                                                                                  |  |
| Filte | r        |           |   |                                                                                  |  |
| UTC   | ToLocal  |           |   |                                                                                  |  |

Via the tab *tracks* you can obtain an overview of all imported tracks.



In the top section of the window all imported flight tracks are shown. Amongst others you can find the information of the "aircraft call sign", time, assigned runway for take-off and landing, track type, "aircraft type" and the aircraft class representing this particular aircraft for the standard selected (according to AzB or ECAC). Each individual track can be selected with a mouse click that will present detailed information in the lower part of the window for the selected flight track.

In the tab *Logbook* all problems and errors found in the imported track data are documented.

In the tab *coordinates* all imported coordinates used in the calculation are presented. Additionally a small graphical display will provide an overview of the

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Work with radar tracks

track and the track parameters such as speed, elevation, additional level (AzB) respective the thrust of the engines via sigma' for ECAC).

In the tab statistics you can get a quick overview of the quality of the imported data.

8,286

1,631

4,328

0,000

0,000

0,000

0,652

0,043

0,348



| Meta Tracks | Statistics |       |           |                  |                  |                  |
|-------------|------------|-------|-----------|------------------|------------------|------------------|
| AC type AzB | -Class     |       |           |                  |                  |                  |
| Туре        | AzB-Class  | Count | Total [%] | Error-Code=0 [%] | Error-Code=1 [%] | Error-Code=2 [%] |
| All         |            | 4598  | 100,000   | 91,844           | 0,000            | 8,156            |
| Arr         |            | 2284  | 49,674    | 43,258           | 0,000            | 6,416            |
| Dep         |            | 2265  | 49,261    | 48,586           | 0,000            | 0,674            |
| Pat         |            | 49    | 1,066     | 0,000            | 0,000            | 1,066            |

411

77

215

|  | Obs. Kalkar | 1 |
|--|-------------|---|
|  |             |   |
|  |             |   |

S 5.2

S 5.2

S 5.1

| Meta | Tracks | Stausucs |
|------|--------|----------|
|      | A-P.   |          |

B738

B733

E170

| AzB-Class | Count | Total [%] | Error-Code=0 [%] | Error-Code=1 [%] | Error-Code=2 [%] |
|-----------|-------|-----------|------------------|------------------|------------------|
| All       | 4598  | 100,000   | 91,844           | 0,000            | 8,156            |
| Arr       | 2284  | 49,674    | 43,258           | 0,000            | 6,416            |
| Dep       | 2265  | 49,261    | 48,586           | 0,000            | 0,674            |
| Pat       | 49    | 1,066     | 0,000            | 0,000            | 1,066            |
| S 5.2     | 2431  | 52,871    | 49,717           | 0,000            | 3,154            |
| S 5.1     | 1300  | 28,273    | 26,077           | 0,000            | 2,197            |
| P 2.1     | 520   | 11,309    | 10,679           | 0,000            | 0,63             |

8,939

1,675

4,676

For this statistics there are 2 different views, either sort the data in accordance to the "aircraft type" or sort it according to AzB respective ECAC classes. In the first line of the table there always is the synopsis of the data and its statistics. All tracks containing errors (column error-code =2 [%]) are not used for the noise simulation. If you have entries marked as such, the reason can be one of the following:

- Geometry was found to contain severe errors, for example if the track contains only a single coordinate or the flight time represented by the track exceeds one hour.
- The track is a pattern flight or is another track type not processed by ECAC (for example Taxiing for ECAC)
- The speed as calculated from the time stamps of the recorded coordinates would yield a speed that is out of the possible range
- ٠ The radar data are incomplete (for example no runway assigned to an aircraft or no "aircraft type")
- No reference exists between the "aircraft type" to any aircraft class in the SoundPLAN library. Without this reference no calculation is possible
- Takeoff and landing time is undefined or cannot be identified.

Work with radar tracks

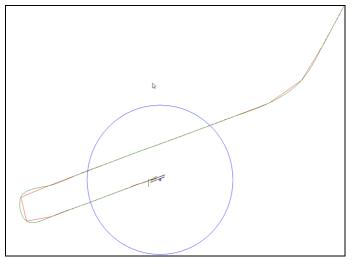
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<u>Info:</u> To check the data of already imported databases, you can open this database later on or re-import the data. For this procedure follow the import described above.

### Automatic correction of imported data / preparing the import data

Radar track data can vary in their quality and accuracy, depending largely on the type of radar track storage format. It is therefore important that the program is adjusting some of the data with several geometrical tools:

Radar tracks in the formats Topsonic- and Fanomos are recoding the flight tracks in very short time intervals, therefore the tracks are represented with a very large number of coordinates. For Stanly-data the tracks are recorded only with one sample every 60 seconds. Especially for curves of the track this lack of resolution leads to flight tracks that do not look realistic. SoundPLAN approximates the flight track with spline, which generates a more realistic flight track. The graphics below shows the approximation, the green line identifies the flight track in the corrected version, the red line shows the track as it was recorded by Stanley.



Original Stanly-data (red line) and the line approximated by SoundPLAN (green line).

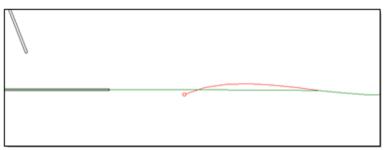
With radar tracks it can happen that the first coordinate or the last coordinate of a radar track is a big distance away from the runway. For an assumed speed of 80 m/s the maximal distance can be up to 4.700 m for Stanley data with their recording every 60 seconds. Other common problems arise from parallel runways or a radar echo. To solve these problems, the program will automatically delete all imported coordinates that are closer than 3 km to the runway reference point and replace the rest of the track with coordinates are inserted for the last part of takeoff or landing. The new track coordinates are inserted in the area between  $\sigma$ '=3000 m and the starting point or respective the landing threshold. With this correction, the flight track is automatically starting or ending on the correct

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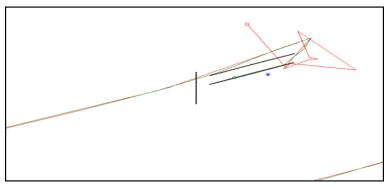
Work with radar tracks

runway. The following graphics are illustrating this correction. The red lines show the radar tracks and the green lines represent the flight track generated by SoundPLAN.

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The radar track (red) ends before reaching the airports runway. After deleting the last coordinates of the radar track and inserting the coordinates for short final, the flight track (green) ends directly on the runway.



Sometimes a radar echo is creating unrealistic tracks when the aircraft is close to the grounds or on the ground. These unrealistic tracks are corrected by SoundPLAN (green).

When the appropriate elevation flight profile is assigned to the flight track via the SoundPLAN database, the coordinates of the radar tracks are augmented by the data from the elevation profile. The coordinates can be thinned out using a user defined corridor width. The band width is preset to 100 meters but can be adjusted in the import dialog to other values. Interval by interval coordinates are eliminated within the bandwidth set up between the first and last coordinate of the flight tracks coordinate list. The program only eliminates coordinates that originated from the radar track, coordinates from the flight profile are marking changes in the throttle setting and therefore must remain.

### ECAC-radar import – selection of the procedural profile

In the ANP-database from Eurocontrol which is the basis in SoundPLAN, the procedural elevation points are defined for each aircraft type, additionally the database also contains fixed elevations that the aircraft will pass through without changing the power or flap settings. Procedural profiles use atmospheric conditions and the takeoff weight of the aircraft to set the sequence of flight procedures. With

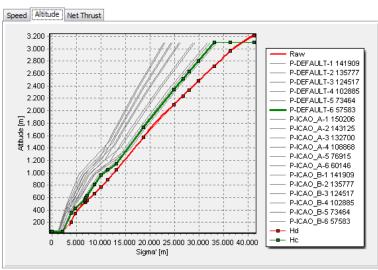
Work with radar tracks

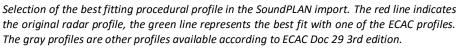
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this systematic the procedures in SoundPLAN remain flexible. Fixed elevation profiles, similar to the elevation profiles of the AzB, are not flexible, they only depend on the distance of the aircraft to the runway reference point.

For the calculation with radar tracks the position of the radar tracks are coordinates without information of the throttle and flap settings. As this information is needed for the calculation of the aircrafts noise emissions the missing data need to be inserted from the procedural profiles. To facilitate this, the program will select procedural profiles that fit the aircrafts current climb/ descend rate. The procedural profile is checked in intervals of  $\sigma'=100$  m, the absolute deviations between the radar profile and the procedural profile are tallied. The procedural profile with the smallest deviation is selected for the calculation. The following graphics shows the selection of the procedural profile.





## Step 2: Generation of Geo-Files with radar tracks

The import of radar data from the already generated database into Geo-Files is done in the Geo-Database via FILE -> IMPORT -> RADAR TRACKS -> GENERATE GEO-FILES FROM DATABASE.

In the tab *general* select the database that contain the radar data to be imported into the Geo-File.

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Work with radar tracks

| Radar tracks query definition        |                                                      | ×          |
|--------------------------------------|------------------------------------------------------|------------|
| General Filter (standard) Filter (   | extended) SQL                                        |            |
| Database file name<br>Geofile name   | Radar tracks - Fanomos - Januar.abs<br>Week 4 - 2013 | • <u>1</u> |
| Settings<br>Original or profile data | use always radar track data (z,v)                    |            |

Additionally, you can specify the elevation or speed (radar data or classes). By default (be careful if you alter this) z and v are taken from the radar tracks and are not taken from the aircraft class definition.

Additional selection possibilities:

| Settings                 |                                                                                                                                                                                             |  |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Original or profile data | use always radar track data (z,v) 🔹                                                                                                                                                         |  |
|                          | use always Profil data (z,v)<br>use radar track heights (z) and profile speed (v)<br>use profile data (z,v), radar track heights (z) only for landings<br>use always radar track data (z,v) |  |

In the tab *Filter (standard)* you can set the standard filter of time frame, the selection of special days and hours. For information purposes the number of days used is also displayed.

| General Filter (standard) Filter (extended) | QL                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                    |
|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Time slice                                  | 01.01.2012                                                                                                                                                                                                                       | to 01.02.2012                                                                                                                                                                                                                                      |
| Day specification                           |                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                    |
| Weekend days Working days                   | I Sun<br>I Mon<br>I Tue                                                                                                                                                                                                          | ☑ Thu<br>☑ Fri<br>☑ Sat                                                                                                                                                                                                                            |
| Individual days                             | Wed                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                    |
| Number of considered days                   | 32                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                    |
| Time specification                          |                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                    |
| Hours                                       | ☑       0-1       ☑       6-7         ☑       1-2       ☑       7-8         ☑       2-3       ☑       8-9         ☑       3-4       ☑       9-10         ☑       4-5       ☑       10-11         ☑       5-6       ☑       11-12 | ✓       12-13       ✓       18-19         ✓       13-14       ✓       19-20         ✓       14-15       ✓       20-21         ✓       15-16       ✓       21-22         ✓       16-17       ✓       22-23         ✓       17-18       ✓       23-0 |

In the tab *Filter (extended)* additional filters can be applied to select the flight operations.

Work with radar tracks

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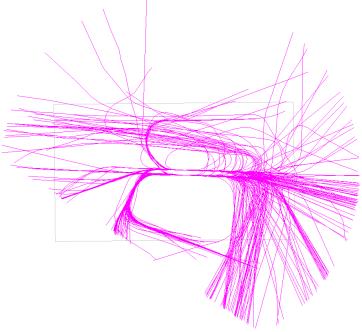
| 13 |  |
|----|--|
|    |  |

| -Flight Type                          |  |
|---------------------------------------|--|
|                                       |  |
| Selection ✓ Start ✓ Landing ✓ Pattern |  |

In the tab *SQL* you find the filter definition that was automatically generated for the SQL database query. The user can change and re-define this query.

| General    | Filter (standard)              | Filter (extended)  | SQL       |        |           |            |              |            |  |
|------------|--------------------------------|--------------------|-----------|--------|-----------|------------|--------------|------------|--|
| -SQL o     | queries                        |                    |           |        |           |            |              |            |  |
| creat      | ed by filter settings          | £                  |           |        |           |            |              |            |  |
|            | ct * from tracks wł<br>9:59'); | nere (Error-Code<> | 2) and (a | ta_atd | l>='01.01 | .2013')and | i(ata_atd<'i | 01.02.2013 |  |
| <b>u</b> : | ser defined                    |                    |           |        |           |            |              |            |  |
|            |                                |                    |           |        |           |            |              | Test query |  |

With the button **TEST QUERRY** the SQL-query is carried out and returns the number of tracks that fit the SQL filter. This test only has informative character.



Display of a radar track Geo-File in the Geo-Database

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Work with radar tracks

Geo-File: 🖆 😟 💡 Radar tracks - Fanomos - 1 Woche



A Geo-File generated with an SQL-query can be re-generated later on with different filter settings. Use the symbol button "Filter" to re-define the SQL filter settings. This symbol is only visible if a Geo-File with radar tracks is the current Geo-File.

### Additional settings in the calculation core

In general, the calculation settings for the manual track definition and the definitions with imported radar tracks are the same. The calculation with radar tracks has a single tab with some more definitions.

| General Assessment Aircraft Noise Grid Noise Map Radar tracks                      | s Description |
|------------------------------------------------------------------------------------|---------------|
|                                                                                    |               |
| Survey period [days]                                                               | 180           |
| Max Search Radius [m]                                                              | 30000         |
| Threshold level [dB]<br>(only segments with higher segment Lmax contribute to Leq) | -1000         |

As the selection of the **SURVEY PERIOD** is very flexible and as data can be contained in more than one Geo-File, this setting must be made manually.

To accelerate the calculation, it is possible to define a maximum **SEARCH RADIUS** in meter. Depending of the number and geographical distribution of the radar tracks sometimes it is possible to reduce the influence radius of the aircraft in the calculation.

To improve the fitting between measured values and the simulation, it is possible to define a **"THRESHOLD LEVEL"** that suppresses all track sections with a level lower than the threshold level. For noise monitoring stations this technique is used to mask out background noise.

## 14 Tools Industry Noise

Tools Industry Noise is a module to consider special tasks in the field of industry noise. Apart from the analysis tool Expert System for Industrial Noise it contains additional features, on the one hand the calculation of the sound power from measured data on the other hand the definition of the emission of point-, line- and area sources via formulas.

## **Expert System for Industrial Noise**

### Overview

The Expert System for Industrial Noise is an analysis tool to develop noise control concepts for industrial complexes that often have very many individual sources and for each source may have different spectra, time histograms and solutions. As this program module has multiple windows it is possible to view different aspects of the same facility at the same time from different angles. With sort functions it is possible to very quickly figure out which are the problem receivers and to locate the main sources causing the problems and to simulate noise control options to see which combination of noise control measures has the best ratio of cost to performance.

In the following chapter read a short synopsis about the generation of noise control with the module Expert System for Industrial Noise. The functions used are described in detail in the next section:

- In the Calculation Core a noise calculation must be already carried out with the "tables for Expert Industry" stored before the Expert System for Industrial Noise is of any use.
- Open the module for the Expert System from the SoundPLAN Manager
- With FILE -> NEW read all result files from the single receiver calculation (with tables for Expert Industry enabled at the calculation) into the Expert

**Expert System for Industrial Noise** 

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System. (FILE -> OPEN opens an already prepared and stored noise control concept.)

- Initially the screen contains 3 windows: The top two windows, the receiver list and the source contribution list are always visible. In the third window you can select different views to your data by clicking on different tabs. For the receiver list you can select different time slots (EDIT -> TIME SLICES, in brackets the assessment standard used in the calculation is visible) and change the sort criteria. (EDIT -> SORT RECEIVERS ACCORDING TO). For the source contribution select if individual sources, groups or both shall be displayed (right click -> VIEW SOURCES).
- With the right mouse button additional detail windows can be generated or closed.
- In the additional detail windows select the content via the tabs on top of each window:
  - Top view or 3D- view show all sources and receivers highlighting the receiver marked in the receiver list (active receiver) in the top left window and highlighting the source marked in the source list (active source) in the top right-hand window.
  - Day histogram of the noise level at the receiver
     Day histogram of the sources
     Day histogram of source contributions to the receiver
  - Sound pressure spectrum at the receiver
     Spectrum of the source
     Spectrum of the source contribution
  - Sorted source contribution diagram (lowest contributions on the right edge of the diagram with each contribution sorted so the magnitude is rising to the left)
  - List of noise control measures
  - Ranking of the noise control measures Noise control cost/performance diagram
- The layout of the diagrams (diagram type, colors, title of the axis) can be customized via OPTIONS -> DIAGRAM SETTINGS or via a right click on the diagram.
- To generate a noise control concept, noise control options are assigned to the sources in the noise control measures list: left click on a source in the source list (top right hand window) to put the focus on a particular source and right click in the noise control measure list (or enter it via MEASURES -> ADD MEASURES FOR "NAME OF SOURCE") to add a new noise control measure for the highlighted source. It is possible to define multiple measures for each source. The noise control measure is either inserted from the noise control measures library when the measure is defined as a level difference over frequency or directly if the measure is a single figure reduction of noise levels. By right clicking on the noise control measure list and selecting the

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**Expert System for Industrial Noise** 

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option **GENERATE NEW LIBRARY ELEMENTMENT** you open the library to generate a new frequency dependant noise control measure (difference and cost).

- Generate noise control measures in the noise control measure library: Enter the element name and under the tab **VALUES** difference spectrum and under the tab **CHARACTERISTICS** assign the costs to the measure.
- Single figure broad band reductions in noise levels can be directly assigned to the measure list in the Expert System without using the library. From the entry selection use the **OWN VALUES (SINGLE VALUE)** and enter the values in the fields **MITIGATION** and **COST**. Overwrite the text in the selection list.
- Each source can be assigned multiple noise control measures. The measures are either alternative or additive (see index).
- Multiple sources in the source list can be jointly activated and assigned a joint noise control measure from the library or single value mitigation.
- By right clicking on the source list and selecting the option VIEW -> SOURCES AND GROUPS you can assign a group of sources the same noise control measure.
- Optimizing: In the noise control measure list each measure needs to be set to one of the following options in the column "Active": Yes, No or Opti. YES means that the mitigation will be used in any case and the influence of noise control measure will be accounted for the particular source and all receivers. NO likewise means that the measure will not be used for noise control of the source and **OPTI** allows the program to evaluate if it has a beneficial ratio of price to performance and will use it if this is the case and not if there are no sufficient benefits or the measure is not needed to attain the goal. With the setting for **OPTI** the influence of the noise control measure is not accounted right away, this is done by triggering the menu option MEASURES -> OPTIMIZATION. The program then polls all combinations and ranks the source modification measures according to the ration of price to performance and uses all measures until the noise control goal is met. If you want all new measures to have the default setting to optimize it, click on the menu option OPTIONS -> ADD MESURES AS "OPTI". By activating multiple measures at the same time (shift click) the status for multiple measures can be changes simultaneously.
- With the column **INDEX** you can define how multiple measures for the same source are handled. For example, there are the options of silencer A or silencer B for the same source. Both options are used as alternatives to each other, therefore the index for one measure needs to be different from the index of the other option. If the index number would be the same both measures could be used at the same time.
- After running the optimization, you can manually fine tune the noise control concept. The measures recommended by the program are printed in the noise control measure list on a white background; measures not needed are

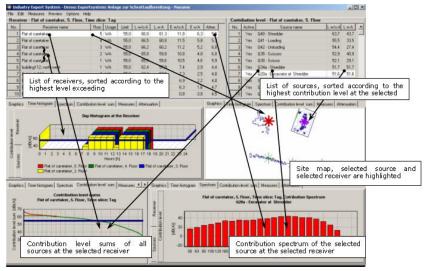
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printed on a gray background. Under the tab labeled "Attenuation" select the left side tab "Attenuation/cost plot" to see from which source modification on the relationship of cost/benefit becomes unproductive. On the diagram click on the source modification position from where on all further modifications should not be used any more. In the table under the tab "Measure range" you can check the results of this limitation but can also change the status of individual entries into "Yes" or "No". After this setting you can redo the optimization under the constraints given.

- The noise attenuation concept now needs to be stored and is available to be included in any calculation run involving industrial noise sources. To include the attenuation concept in a calculation, open the calculation run and select the mitigation file in the section with the label DATA as the file type EXPERT INDUSTRY ATTENUATION FILES (\*.ATN). If the purpose of the calculation is to generate feed data for the documentation, the results can be directly stored back into the result database by using the Expert's menu with the option FILE -> SAVE TO RESULT NO. XXX.
- With FILE -> PRINTDRUCKEN you can print a table of the MEASURES USED, the RECEIVER LIST or the details of the CURRENT RECEIVER. The header and footers of the pages are customized in the section PAGE LAYOUT of the print menu.

## **Concept of the Expert System for Industry Noise**

Before the Expert System can be opened, the data first must be generated in the Calculation Core. Start a **SINGLE POINT SOUND** calculation with the **TABLES FOR EXPERT INDUSTRY** in the tab **SPS** enabled. This setting will store the intermediate and final results needed by the Expert System.



Relationship of the individual graphics and tables amongst each other.

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**Expert System for Industrial Noise** 

The graphics show that the result data can be assembled in various forms and formats. Depending of project size, scope and advancement of the study it may be advisable to rearrange the detail windows depicting different content. The typical steps in the Expert System are:

- Check input data (sources, receivers, geometry)
- Gain an overview over which sources have a prominent influence upon the receivers.
- Generate the concept of noise control measures
- Post process the optimized noise control measures

The tables of the receiver list and the source list are always visible. Under **PREVIEW** - > **SWITCH ALIGNMENT** the alignment of source and receiver list can be toggled from side by side to sequential. Detail windows, which you can request by right clicking on a table or diagram (but not on graphics), you can place in the same row or in separate rows below each other.

Receivers by default are sorted by the magnitude of the excess of noise (E w/a A). With **EDIT -> SORT RECEIVERS BY** the sort criteria can be changed.

#### Sort criteria

Point number (number of the receiver) Name Lr w/o A (Assessed noise level without noise control measures) E w/o A (Excess of the noise limit without noise control) Lr w A (Assessed noise level with noise control measures) E w A (Excess with noise control measures) Attenuation (Magnitude of the noise control measure)

Source contributions are always ranked in accordance to their contribution at the receiver highlighted in the receiver list. You can search for a source in this list with *Ctrl+F*.

If groups have been assigned to the sources, it is possible not only to assign attenuations to individual sources but also to the group itself. Switch the display in the source contribution list in **PREVIEW** (or via right clicking):

Sources Groups and sources Groups

In additional detail windows select different views to the data for a selected receiver or source.

#### Detail window

You can add multiple detail windows side by side or below each other. On any window (except the 3D or top view graphics, where you need to click on the tabs)

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right click on the window and then -> **ADD DETAIL WINDOW.** In the following dialog select where the new window shall be inserted.

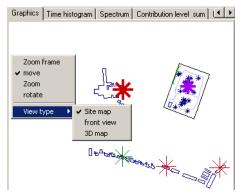


When no longer needed close the additional windows again by right clicking and selecting -> **REMOVE DETAIL WINDOW**.

• You can modify the width of the detail windows and the height of the rows by positioning the cursor on the border between the windows and as soon as the cursor changes the shape to a splitter move the border to its new position.

## **Graphics window**

You can display the geometry data in a top view as a frontal projection or as a 3D projection. To switch between the display modes right click on the graphics picture and in the select the **VIEW TYPE**. If the view type is "front view" or "3D map" there is an additional choice to define the **DRAW TYPE** with the choices "Wire frame", "Hidden line" and "Hidden surface". The graphics settings and selection of the movements (move, zoom, rotate, move height) are also controlled via right clicking on the picture and selecting the menu choices, the movements are invoked by moving the mouse while holding down the left mouse button.



In the graphics the selected receiver and the selected source are highlighted. Colors, sizes and line thicknesses are controlled from the menu point **OPTIONS-> OBJECT TYPES**.

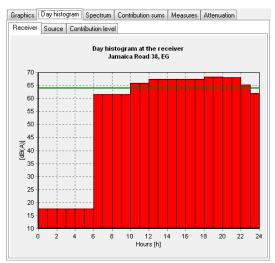
#### Day histogram

In the diagram type for the day histogram there are 3 tabs on the left side of the diagram allowing the display to switch between the day histogram at the receiver

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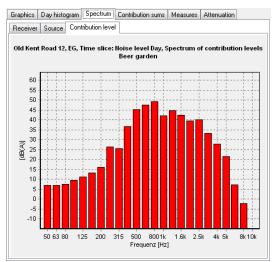
(receiver) or to view the day histogram of the sound power (source) or the contributions at the receiver.





## Spectrum

With the 3 tabs on the left side of the spectrum diagram you can select the view to represent the spectral information at the receiver caused by all sources (receiver) or the sound power spectrum of the highlighted source (source) or the contribution of the highlighted sources at the receiver.

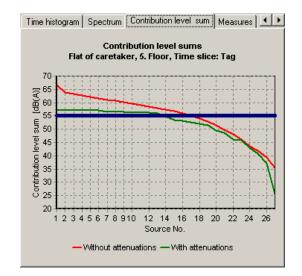


## **Contribution Level Sum**

For a quick overview of potential noise control measures the diagram with the progressive addition of the sources is very helpful.

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The vertical blue line depicts the noise limit for the selected time slot. The diagram is generated by ranking the source contributions and from the right-hand side of the diagram starting with the lowest contribution to the source. As the source contributions are ranked each additional source is added to the left of all smaller contributions the new data point in the diagram is always representing all contributions from the new source contribution on. The diagram shows how much the level is rising if the new source is being considered. In this display it is quickly visible that noise control must start with controlling the sources above the noise limit and sources that are very close to it. If the diagram is very flat the noise at the receiver is caused by many independent sources, if the rise is steep, only a few sources are responsible. The red line represents the situation without and the green with noise control measures in place.

For measures and attenuations see the chapter <u>"Preparation of a noise control</u> <u>concept</u>" (page 729).

On any of the charts you can right click and select the option **COPY CHART TO CLIPBOARD** to copy the diagram into other software packages such as WORD.

## **Diagram properties**

The properties of the diagrams can be set individually for each of the diagram types, the program can display different content in different formats and configurations. It makes sense to display multiple sources in the source contributions but in the attenuation diagram it is wise to only view it for a receiver at the time for the selected receiver only.

The diagram properties are opened by right clicking on the diagram to be edited and selecting the option **CHART PROPERTIES**. Another access is via the options menu and the selection of chart properties there.

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| Chart properties                | ×                                       |
|---------------------------------|-----------------------------------------|
| General Contribution level sum  |                                         |
| Font                            |                                         |
| Chart title                     | Legend                                  |
| Axis title                      | Axis labels                             |
| Colors                          |                                         |
| Background                      | $\mathbf{X}$                            |
| Back wall (only for 3D charts)  | $\mathbf{>}$                            |
| Left wall (only for 3D chart)   |                                         |
| Bottom wall (only for 3D chart) |                                         |
| Element colors                  |                                         |
|                                 |                                         |
|                                 | , , , , , , , , , , , , , , , , , , , , |
| Limit line                      |                                         |
| Width 2                         | Color                                   |
|                                 | 1 1 1                                   |
|                                 | Cancel Help                             |

Diagram properties with general settings

All settings under the tab **GENERAL** are valid for all diagram types. Here the text fonts for the diagram header, legends, axis title and axis labels are set. To set the parameters click on the button boxes and configure them. In addition, you can set the colors for the background of the normal diagrams and the background, bottom and sides for the 3D diagrams.

Up to 10 elements can be displayed in the diagrams (10 sound power spectra, day histograms at 10 receiver locations ...) therefore there are 10 boxes where you can individually select the colors from the SoundPLAN palette. The color and thickness of the border line for the selected time slot is set on this control box. The content and appearance of the diagrams is set individually for each diagram type.

In the second tab the diagram properties for each individual diagram is set. To navigate from diagram type to diagram type use the navigation buttons in the lower left hand of the diagram properties box.

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| Titles and Scale | Elements 9       | ityle |       |     |
|------------------|------------------|-------|-------|-----|
| Elements         |                  |       |       |     |
| Number of series |                  |       |       | 2 🚖 |
| 🔽 Show limit     |                  |       |       | ,   |
| Element names    |                  |       |       |     |
| Element names    | in title as list |       |       | •   |
| Legend           |                  |       |       |     |
| Alignment        |                  | Bo    | ottom | •   |
| Background       |                  |       |       |     |
| 🗖 Show           | Color            |       |       |     |
| Frame            |                  |       |       |     |
| 🗖 Show           | Color            |       | Width | 1 🌻 |
| Shadow           |                  |       |       |     |
| Show             | Color            |       | Width | 3 🜩 |

Diagram properties for individual diagrams

The diagram-properties for each diagram is split into 3 sections: Title and scale, Elements and Style.

Under the tab **TITELE AND SCALE** find the diagram headers and the titles of the axis. The **Y-AXIS** can either be scaled automatically according to the data or if the box "automatic" is not clicked be scaled according to the **MINIMUM** and **MAXIMUM** values to be user defined.

Specialties for some diagrams: For the **CONTRIUTION PLOT** you can define for the **X-AXIS** if you want to display all sources or only the N loudest sources. As the sources are sorted according to their contribution at the receiver the degree of detail will increase when the number of sources is limited.

Under the tab **ELEMENTS:** The **NUMBER OF SERIES** indicates how many sources or receivers are displayed in the chart as a line, bar or 3D graph. Up to 10 series can be displayed at the same time. For noise level contribution charts the level sum without and with noise control are always displayed on the same chart therefore the selection of the number of series is not available for this diagram type.

The lower part of the tab **ELEMENTS** configures the appearance of the element names and the general layout of the legend.

Select the element name from the following possibilities:

**NO ELEMENT NAMES** – The element names are not displayed in the diagram

**ELEMENT NAME IN TITLE AS LIST** – The element names are printed on the diagram as a table

ELEMENT NAME IN ONE TITLE ROW - All element names are all placed in the title row

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**Expert System for Industrial Noise** 



**ELEMENT NAMES IN LEGEND** – Places the element names into the legend. To recognize the elements color coding is used. For this option additional settings are for the placement of the legend, background color, frames and shadows.

For the STYLE of the diagrams the following chart styles are to your disposal:

Bar diagram

Line diagram Line diagram with steps

Area diagram Area diagram with steps

All diagram types can be drawn as regular 2D diagrams or as 3D-diagrams.

The **LINE THICKNESS** is only valid for line diagrams relevant: For 2D-diagrams the parameter **LINEN THICKNESS** sets the thickness of the element line, for 3D-diagrams this parameter controls the thickness of the border line.

In addition you can specially highlight the data points with the **SHOW POINTS** option (not available for bar graphs).

## Preparation of a noise control concept

First all data is analyzed using the tables and diagrams and the noise control potential of prominent sources at critical receivers is evaluated.

Before you start with the noise control concept in the Expert System, define the noise mitigation potential inside the factory buildings by evaluating absorptive material at the ceilings, design needed noise control walls and evaluate the timing of the sources and check if sources can be shifted from the costly night time into daytime. After all these factors are exploited rerun the calculation.

In the Expert System the first step is to assign noise control measures and costs to the sources with sufficient control potential. The optimization itself can only rank the noise control measures to find which combination will control the noise for the lowest price possible.

Optionally you can set the program in **OPTIONS** -> **DO OPTIMIZATION WITHOUT COSTS** to only evaluate the noise control potential without taking the cost into account.

Noise control measures can be set to a status as **YES**-> use this measure or **NO** -> do not use this measure or **OPTI** -> to leave it up to the optimization to choose if the noise control benefits are greater than the costs.

Often the exact costs connected to a noise control measure are not known at this stage. If this is the case it is possible to substitute the cost with a point system where low costs are set to 1, middle costs are associated with 5 and high costs are represented by the figure 20. A noise control calculation with these figures will not yield the total costs but nonetheless will show the tendency in the optimization.

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## Assign noise mitigations

In the detail window select the tab measures. In the level contribution table select a group or source that shall be assigned a noise control measure (the source will be highlighted with a white background) and add a noise control measure in the table of measures by right clicking or by invoking the process through the menu **MEASURES.** The sub menu allows to **ADD A MEASURE TO SOURCE "XXX"**.

| Graph | nics   Time | histogram | Spectrum Contribution level sur | Measures Attenuation     |     |        |       |
|-------|-------------|-----------|---------------------------------|--------------------------|-----|--------|-------|
| No.   | Active      | Index     | Group-/Source name              | Name                     | Lib | Atten. | Costs |
| 1     | Opti        | 1         | Loud Speaker 1 (Beer Garden)    | Own entry (single value) |     | 0,0    | 0     |

Add a measure for a single source or group

The field with the header "name" shows "Own entry (single value)". If you want to work with broad band values without using the noise attenuation library, you can type the name of the measure here and enter the magnitude of the attenuation in the next field and the cost of the measure in the last one.

Own entry (single value)

## Attenuations from the library

Open the library from the menu with **EDIT** -> **LIBRARY** or in the detail window "measures" by right clicking and selecting -> **NEW LIBRARY ELEMENT**. You can find the details of how to work with the library in the chapter Library. Check the system library if there are elements that fit your needs; if there are elements already in the system library, copy them to the project lib. The attenuations are given in octaves, the costs are added under the tab characteristics in the top most left position:

| Spectrum Comment | Values | Groups | Characteristics |
|------------------|--------|--------|-----------------|
|                  |        |        |                 |
| Costs            |        |        | 5               |
|                  |        |        |                 |
| J                |        |        |                 |
|                  | Γ      |        |                 |

Entry of the cost in the attenuation library

Pick the measure in the Expert system in the window measure from the lib list.

## Assign multiple sources to the same noise control measure

Mark multiple sources or groups with the mouse or by using the shift + arrow keys. The selected sources or groups are showing on a white background when marked. By right clicking in the detail window "Measures" select the option ADD MEASURE TO SOURCES: NO. – NO.. In the following window the measures are predefined.

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Expert System for Industrial Noise



| Define measure |                          | ×      |
|----------------|--------------------------|--------|
| Used<br>Index  |                          | Opti 💌 |
| Measure name   | Own entry (single value) | •      |
| Attenuation    |                          | 0      |
| Cost           |                          | 0      |
|                |                          |        |
|                | OK                       | Cancel |

| 1 | Λ |
|---|---|
| L |   |

Predefine measures assigned to multiple sources

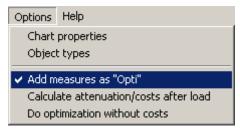
Enter the dialog if you want to have the same measures for multiple sources or skip this phase by clicking on the **OK** button. If you skip the definitions here, you still can assign the measure manually or select the library elements.

## The Optimization

With the optimization routines the noise control concept can be optimized even if the measures are not beneficial for all the receivers. The program will select the most suitable combination of noise control measures.

**The Optimization Algorithm:** In the first step the program looks for the receiver with the highest violation of the noise limit. In the next step the program evaluates the ratio of cost to benefit for all source modifications (if the option -> opti is active for the measure) to find the best ratio of cost to performance (or just the attenuation if the optimization was run disregarding the cost). After the noise control measure was selected the noise level of the source is subtracted from the noise level of all receivers. If the noise levels at one or multiple receivers are still above the limit, the optimization procedure is carried out again. The optimization only stops if all receivers are below the limit or no further unused noise control measure is available.

When you want to carry out the optimization the measures need to have the status "OPTI". Select OPTIONS -> ADD MEASURES AS "OPTI" so that you do not need to modify the status manually.



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In this case the measures and costs are not accounted for immediately but only in the process of the optimization. The difference due to noise control measures is accounted for in the noise level at the receiver and at the contribution table. If there are measures that have been determined to be undertaken in any case, it may be beneficial to switch the status from **"OPTI"** to **"YES"**.

## Meaning of the status of "Active"

In the noise control Measure list the source modifications assigned to sources can have any of 3 states in the column "Active": Yes, Opti and No. **YES** means that the measure will be used in any case, the measure is instantly accounted for in the contribution list etc.. If **OPTI** is selected, the differences are not accounted for until the **OPTIMIZATION** has determined that the measure has a beneficial ratio of cost to performance. With **NO** the measure will not be used at all (this only becomes relevant when the optimization has been run and certain measures that the program might select shall be blocked from being used).

If measures have been entered with the status "Yes" and shall be modified later on into "Opti", mark the column with the shift and arrow keys and change the status of the last entry by clicking on the field and selecting the option for "opti".

| Graph | iics   Time       | histogram | Spectrum     |
|-------|-------------------|-----------|--------------|
| No.   | Active            | Index     | Grou         |
| 1     | Yes               | 1         | Loud Spea    |
| 2     | Opti              | 2         | Loud Spe.    |
| 3     | Yes               | 0         | Parking Lo   |
| 4     | Yes 💌             | 0         | Industrial d |
|       | Yes<br>No<br>Opti |           |              |

Change the status of multiple measures simultaneously

**Limitation of the optimization algorithm:** The algorithm used in the optimization is non-recursive. When the most suitable measure was found (example: Measure A, 5 dB attenuation, \$1000 cost), it is added to the measure list. If the noise limit is violated at one or multiple receivers, the next measure (example: Measure B, 15 dB attenuation, \$4000 cost) is requested and entered in the measure list. The ratio of cost to benefit for the measure 2 is worse than for measure 1. If measure 2 alone would have been sufficient, the program would not realize, the optimization is not recursive and does not reevaluate that measure 1 is obsolete. If multiple receivers and multiple sources with multiple modifications are in the optimization, it is not very likely that the outcome would be different from a recursive procedure.

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#### Mutually exclusive measures

Each noise source can be assigned multiple noise control measures that can be either in addition to each other of exclude each other. The "Index" column is defining the status of noise control measures for the same source.

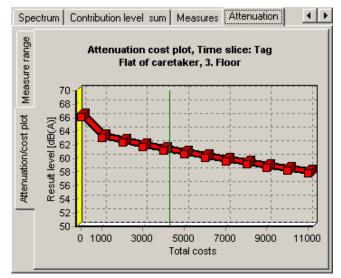
Meaning of "Index": For a source only measures having the same index can be used simultaneously, measures with different index numbers are mutually exclusive. Exception: Index 0 can be combined with another index.

**Alternative measures:** If you have multiple different fan types to choose from you ultimately want to have only one selected, so the measures are mutually exclusive. Fan a can have the index 1, fan B the index 2... If the optimization finds fan B to have the best ratio of cost to performance all other fans are discarded. If a silencer is considered for any of the fans the index should be set to 0 to be compatible with any of the measures.

Additive Measures: Noise control measures that can be used in addition to each other share the same index number. Example: The noise control for a piece of equipment can comprise of multiple independent measures (swap bearings, reduce RPM, building an enclosure around the machine).

**Measures that are connected** must be defined as one measure. A silencer that only fit one of the new fans must be defined as a combination package, if it fits multiple source modifications it could be split and the index should be 0 then.

In order to have the measure used in the optimization the status must be set to Opti. Select **MEASURES** -> **OPTIMIZATION** to start the optimization run. After the Opti calculation click on the tab *Attenuation* (if needed add a new detail window).



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| Graphics | Time histogram | Spectrum | Contribution level sum | Measures | Attenuation |
|----------|----------------|----------|------------------------|----------|-------------|
|          |                |          |                        |          |             |

|               | No. | Active | Group-/Source name | Name                     | Costs | Lr   | dLr | Sum dLr |
|---------------|-----|--------|--------------------|--------------------------|-------|------|-----|---------|
| ge            | 1   | Yes    | Q40 · Shredder     | Own entry (single value) | 1000  | 63,1 | 3,1 | 3,1     |
| Measure range | 2   | Yes    | Q41 - Loading      | Own entry (single value) | 2000  | 62,4 | 0,7 | 3,8     |
| sure          | 3   | Yes    | Q42 - Unloading    | Own entry (single value) | 3000  | 61,7 | 0,7 | 4,5     |
| Mea           | 4   | Yes    | Q35 - Scissors     | Own entry (single value) | 4000  | 61,2 | 0,5 | 5,0     |
|               | 5   | No     | Q30 - Scissor      | Own entry (single value) | 5000  | 60,7 | 0,5 | 5,5     |

Attenuation-/cost diagram and ranking of the measures

Under the tab Attenuation click on the left side tab "Attenuation plot" to view the attenuation / cost diagram. The vertical line shows to which noise control measure the noise control options need to be considered. Under the tab "*Measure range*" the list of measures is ranked according to the effectiveness of the source modification and the cost of it. Measures with a gray background are not needed.

After the optimization measures not used because of index number conflicts are displayed with cursive text.

| 0 | Graphics Time histogram Spectrum Contribution level sum Measures |      |   |                                       |           |  |
|---|------------------------------------------------------------------|------|---|---------------------------------------|-----------|--|
|   | No. Active Index Group-/Source name                              |      |   |                                       |           |  |
|   | 1                                                                | Opti | 1 | Loud Speaker 1 (Beer Garden) Own entr |           |  |
| Γ | 2                                                                | Opti | 2 | Loud Speaker 1 (Beer Garden)          | Own entry |  |

The optimization is a tool, the decision which measure to use however is yours. Therefore, the optimization status is not switched after the optimization. You can change the status of individual source modifications by hand from opti to "Yes" or "No". Sometimes you run the optimization for one time slice, determine what source modifications are required there, set these to "Yes" and then run the optimization for another time slice with some measures already predetermined and others open for further optimization.

## Print and reuse the noise control concept

For the documentation of the noise control concept you can print the following tables:

- Receiver list
- List of used noise control measures
- Contribution of the sources at selected receivers

Select the table of your choice after invoking the menu **FILE** -> **PRINT**. In the preview review the layout of the table. The normal SoundPLAN page format is used, with **PAGE LAYOUT** in the print menu customize the layout of your printout. Details about the page layout can be found in the chapter about the result tables.

By right clicking on one of the detail windows you also can select the option **COPY USED MEASURES TO CLIPBOARD** to move your data into other programs and format the printout there

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**Hint:** Only measures containing the "yes" status are printed and moved to the clipboard, measures containing "opti" or "no" are ignored.

## Using the noise control concept in additional calculations

Save the noise control concept via **FILE** -> **SAVE** or **SAVE** AS as an attenuation file (xxx.atn). By including this file in the list of files of a calculation run, the attenuations of the noise control concept are included in the calculation.

Enter the attenuation file in the calculation run properties in addition to the situations and geo files. To include the attenuation file click on the >> in the "data" entry field and select the attenuation file from the list of attenuation files. With the > key you include the attenuation file (\*.atn) in the list of files assigned to the current calculation run.

| -Available F | iles                                                                                                                                             |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| File type:   | Situations (*.sit; *.sfl)                                                                                                                        |
| 🍂 01 - All   | Situations (*.sit; *.sfl)<br>GeoFiles (*.geo)<br>DGM Files (*.dgm)<br>Expert Industry attenuation files (*.atn)<br>GausBeam Script files (*.gbs) |

The results can be processed as usual, the Documentation, Spreadsheet and Graphics always will show the noise levels as defined in the Geo-Database reduced by the attenuations defined in the noise control concept of the Expert System for Industrial Noise.

## Store the noise control concept into existing result tables

With the menu **FILE** -> **SAVE TO RESULTX NO. XXX** the noise control concept is directly stored back into the result files. When the result files are opened in the documentation the selected source modifications are accounted for.

**Caution:** A new calculation run will overwrite the results in the result files, so if the noise control concept shall be accounted for it must be added to the calculation as a \*.atn file!

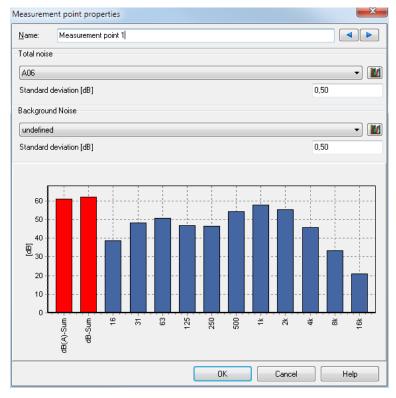
# Calculate sound power from measured data

First import the spectrum measured at a measurement point into the emission library with **file -> Import**.

Digitize or import the location (x,y) and height (z) of the measurement points. There is no upper restriction of the measurement points, but as a minimum, you need at least as many measurement points as you have "unknown" sources that you want to evaluate. Select the object type **measurement point** from the Geo-Databases tool tab.

Calculate sound power from measured data

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In **Total noise** assign the library element from the emission library that contains the measured spectrum of the respective measurement point. For the assessment of the cumulative error, the uncertainty is entered into the field **Standard deviation**. Additionally you can enter a background noise level with corresponding standard deviation.

Digitalize the sources for which the sound power shall be assessed from the measurement locations. Open the emission library and enter a new emission element. Under the tab *values* select the option **Calculate emission from Measurement points**. Like normal you can enter **Height above ground** and **directivity**.

| General Values   | Groups Characteristics OLE1 OLE2 Formula            |
|------------------|-----------------------------------------------------|
|                  |                                                     |
|                  |                                                     |
| Calculate emissi | on from measurement points  Height above ground [m] |
|                  |                                                     |
|                  |                                                     |
|                  |                                                     |
| Directivity      |                                                     |
| Genelec - 1029   | A Vertical (rotational symmetrical)                 |
|                  | · · · · · · · · · · · · · · · · · · ·               |

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Calculate sound power from measured data



The fact that the sound power is calculated from measurement points is made visual with the symbol measurement point in the Graphics. The day history does not apply to these sources.

If multiple sources entered in the Geo-Database refer to the same library element that has the property "Calculate emission from measurement points", the sources are considered the same and will have the same sound power over frequency.

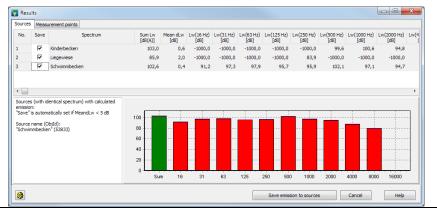
Additionally you can enter other sources with known sound power, day histories entered for these sources are ignored. The influence of the "known" sources is applied to the measured noise levels at the measurement location.

Start the calculation of the sound power spectra with **Tools -> Calculate source emissions from measurement points**. After the calculation a dialog opens with a full documentation of the results.

In the tab *measurement points* all measurement points with their measured spectra (Lp,meas), the extrapolated emission spectra (Lp,prog) and the difference between the measurements and the prognosis are listed.

| MP                | Туре    | Sum<br>[dB(A)] | 16 Hz<br>[dB] | 31 Hz<br>[dB] | 63 Hz<br>[dB] | 125 Hz<br>[dB] | 250 Hz<br>[dB] | 500 Hz<br>[dB] | 1000 Hz<br>[dB] | 2000 Hz<br>[dB] | 4000 Hz<br>[dB] | 8000 Hz<br>[dB] | 16000 Hz<br>[dB] |  |
|-------------------|---------|----------------|---------------|---------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|------------------|--|
| Measurement point | Lp,meas | 61,0           | 38,5          | 48,3          | 50,7          | 46,9           | 46,3           | 54,3           | 57,8            | 55,5            | 45,7            | 33,2            | 21,1             |  |
|                   | Lp,prog | 59,9           | 46,6          | 53,1          | 54,6          | 50,1           | 48,4           | 53,9           | 56,7            | 54,1            | 45,4            | 33,8            | 22,3             |  |
|                   | dif     | 1,1            | -8,1          | -4,7          | -3,9          | -3,2           | -2,0           | 0,5            | 1,1             | 1,4             | 0,4             | -0,6            | -1,2             |  |
| Messpunkt 1       | Lp,meas | 56,5           | 46,1          | 52,0          | 54,7          | 47,8           | 45,7           | 51,7           | 52,4            | 50,8            | 44,2            | 33,7            | 22,6             |  |
|                   | Lp,prog | 58,0           | 48,3          | 56,0          | 57,1          | 51,0           | 49,1           | 53,4           | 53,5            | 52,7            | 45,0            | 33,6            | 17,2             |  |
|                   | dif     | -1,5           | -2,2          | -3,9          | -2,4          | -3,2           | -3,3           | -1,6           | -1,1            | -1,9            | -0,8            | 0,1             | 5,4              |  |
| Messpunkt 2       | Lp,meas | 57,9           | 45,5          | 50,8          | 51,9          | 46,7           | 45,9           | 50,8           | 55,4            | 51,1            | 43,8            | 32,8            | 22,5             |  |
|                   | Lp,prog | 59,1           | 43,9          | 49,9          | 50,6          | 45,3           | 42,9           | 51,6           | 56,6            | 52,9            | 44,2            | 32,4            | 23,9             |  |
|                   | dif     | -1,3           | 1,6           | 0,9           | 1,3           | 1,4            | 3,0            | -0,8           | -1,2            | -1,8            | -0,4            | 0,4             | -1,4             |  |
| Messpunkt 4       | Lp,meas | 57.2           | 50,2          | 58,6          | 59,1          | 53,7           | 51,7           | 53,8           | 52,0            | 51,4            | 44,8            | 33,5            | 25,7             |  |
|                   | Lp,prog | 56,9           | 47,2          | 53,4          | 54,4          | 49,9           | 46,8           | 52,5           | 52,8            | 51,2            | 44,2            | 33,3            | 17,5             |  |
|                   | dif     | 0,3            | 3,0           | 5,2           | 4,7           | 3,8            | 4,9            | 1,3            | -0,8            | 0,2             | 0,7             | 0,2             | 8,2              |  |
| Messpunkt 5       | Lp,meas | 51,4           | 47,5          | 52,4          | 52,5          | 44,9           | 42,0           | 46,1           | 49,2            | 43,4            | 31,0            | 20,8            | 17,8             |  |
|                   | Lp,prog | 50,8           | 41,0          | 47,0          | 47,7          | 41,1           | 35,1           | 40,7           | 47,8            | 45,8            | 33,2            | 14,6            | -10,8            |  |
|                   | dif     | 0,6            | 6,5           | 5,4           | 4,8           | 3,8            | 6,9            | 5,4            | 1,4             | -2,4            | -2,2            | 6,2             | 28,6             |  |

Under the tab *sources* the emission spectrum is listed along with the uncertainty to all emission spectra. Sources with a known sound power are presented on a yellow background.



Calculate sound power from measured data

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If a frequency cannot be evaluated, the table will contain the value -1000 dB and no bar will be presented in the graphics.

If entered, the graphics will present the uncertainty in addition to the evaluated spectrum as a purple bar.

Click on **save emissions to sources**, to save all sources that have the column **save** enabled. When doing so, the emission spectra in the library will be updated. If you have assigned day histories to the sources that were ignored in the phase determining the sound power, they will be activated for the normal propagation calculations that you can now undertake with both the pre-set sources and the sources calculated from measurement points. The column **save** is automatically activated if the mean dLw is smaller than 5 dB. If this value is exceeded, you as the user can still activate the sources at will.



With the button **settings** you can check the calculation parameters and if needed adjust for the next calculation.

# Define emissions via formulas

It is possible to calculate the sound power of a point, line or area source with formulas from technical parameters. With these tools it is for example possible to calculate the internal noise level of a pipe consisting of compressors, silencers and regular pipe elements. The internal sound power and also the emitting noise can be calculated with formulas. This way it is possible to simulate the decay of the noise levels in a pipe with a disturbance onwards. The emission of a single line source changes as a function of the distance from the beginning of the line.

The formulas are entered in the emission library, the technical parameters are defined and set to default values. These values can be overwritten in the entry of the sources in the Geo-Database so that a general formula becomes specific to this case only with the entry of the source properties.

## Definition of Formulas in the Emission library

Under the tab *value* as usual select the type of spectrum (octave or third octave), the frequency range, the filter (dB, dB(A)..dB(D)) and the reference (Lw/unit, Lw/m,m<sup>2</sup>).

As a next step, select from the lower selection list **SUM BY FORMULA** or **SPECTRUM BY FORMULA**.

|   | General            | Values    | Groups    | Characteristics  | OLE1 | OLE2     | For    | mula      |        |        |                         |
|---|--------------------|-----------|-----------|------------------|------|----------|--------|-----------|--------|--------|-------------------------|
|   | 1/1 Oct            | ave spec  | trum      |                  | •    | 63H      | łz     | -         | 8kHz   | •      | dB(A) 🔹 🖊 Lw/unit 💌     |
|   | Sum by             | formula   |           |                  | -    | Height a | above  | ground (r | n]     |        | Standard deviation [dB] |
| [ | Table er<br>Sum by |           |           |                  | 500  | Hz 1k    | Hz     | 2kHz      | 4kHz   | 8kHz   |                         |
|   | Spectru            | m by form |           |                  | 103, | ,23 10   | 0,00   | 98,80     | 99,03  | 101,11 |                         |
|   | Calculat           | e emissio | n from me | asurement points |      | 00 10    | n nn l | 100.00    | 100.00 | 100.00 |                         |

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Define emissions via formulas

For the data entry type **"SUM BY FORMULA"** under the tab *value* a spectral distribution of the reference spectrum is needed that is then scaled up or down to fit the total sound power Lw that is calculated with parameters and formulas.

For the data entry type **"SPECTRUM BY FORMULA**" each value of the sound power spectrum (lwf) of the octave/third octave band is set with formulas and parameters.

After the selection of "spectrum by formula" or "sum by formula" the library has a new tab *Formula* where the parameters and formulas are entered.

## Variables in the Formulas

A formula needs at least one variable but can contain multiple variables. There are three types of variables: Input variables, Output variables and Local variables.

The value of an input variable can either be assigned directly to the input variable or can be connected to an output variable of another source. With the connected input/output variables it is possible to pass data from one source object to another source object. This is useful for example for pipes where the internal sound power is passed along the pipe from object to object.

Output variables are values calculated by a formula and are passed on to the outside either as the sound power for a calculation or as input data for another source object.

Local variables are only used internally within a formula for example to break up a single formula that otherwise would become too complicated. These variables are not made available to the outside world.

For each variable type there are several pre-defined variables that contain information that was defined in other places.

The following pre-defined variables are available:

For input variables:

- Length of the line source
- Area of an area source
- Distance from the beginning of the source object (distance from start)
- Distance to the end of the source object (distance from end)

For output variables

- for "**SUM BY FORMULA**" the total sound power Lw
- for "SPECTRUM BY FORMULA" the sound power for each third octave / octave band Lwf

For local variables:

for "SPECTRUM BY FORMULA" the frequency f

Define emissions via formulas

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Variables have

- A NAME how they appear in the formula
- A UNIT (except for local variables)
- A TYPE:
  - Float: real numbers with a decimal
  - o Integer: numbers without a decimal
  - Emisspectrum: an emission spectrum ((frequency range depends on the settings in the tab "value")
  - Transspectrum: a transmission spectrum (frequency range depends on the settings in the tab "value")
  - $\circ~$  Difspectrum: a difference spectrum (frequency range depends on the settings in the tab "value")
- A VALUE (or multiple values for local spectrum variables)
- A **DESCRIPTION** for the documentation (except for local variables)
- The formula interpreter can handle multiple lines of formulas but each formula must have a "," at the end of the formula. A value is assigned to a variable with the operator ":=".

## Data entry example 1

The sound power of a fan depends on the flow rate Q  $[m^3/s]$  and the pressure difference P [Pa]:

Lw = 10\*log(Q) + 20\*log(P) + 40

#### Entry in the emission library

Request a new library element in the emission library and give it the name "Fan". Under the tab *value* set the boundary parameters. Select the data entry type **SUM BY FORMULA**.

#### Open the tab Formula.

| Ad   | d predefined v | ariable       | Add user va | iable Delete variable |  |
|------|----------------|---------------|-------------|-----------------------|--|
| Name | Unit           | Variable type | Value       | Description           |  |
| Q    | m³/s           | Float 👻       | 10          | Flow rate             |  |
| Р    | Pa             | Float 👻       | 1000        | Fan static pressure   |  |

Add the new input variables Q and P by clicking on the field **ADD USER VARIABLES** in the tab *input variables*. Define the names, the units, types (here float) and default value and the description. As the variable is also accessible in the source definition,

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Define emissions via formulas

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the default value is not this important, the value will be set in the source definition of the Geo-Database when the source is entered.

Open the tab Output variable; the pre-define output variable Lw is automatically set.

| Ade  | d predefined varia | able          | Add user va | riable         | Delete variable |  |
|------|--------------------|---------------|-------------|----------------|-----------------|--|
| Name | Unit               | Variable type | Value       | Description    |                 |  |
| Lw   | dB(A)/Lw           | Float 👻       | 110         | Sound power le | evel (sum)      |  |

Now enter the formula in the field FORMULA:

Lw := 10\*log(Q) + 20\*log(P) + 40;

Log is a pre-defined function (logarithm to the basis of 10). For a list of all available functions look at "Table of the formula commands" in the chapter "Spreadsheet".

Click on the button **CALCULATE**, as a result you will find that the tab *Output variable* now has the value of the calculate Lw in the slot labeled Lw.

In this case the variable Q has a default value of 10 and P the default of 1000.

From the formulas and parameters we see:

Lw = 10\*log(Q) + 20\*log(P) + 40 = 10 + 60 + 40 = 110

If the formula contains an error, the cursor will jump to the place in the formula where the error was found and will issue an error message.

#### Definition of the point source

Enter a new point source in the Geo-Database and assign the source the library element "fan". As soon as you enter a spectrum with a formula, the source properties will open a new tab with the label *Formula*.

| eneral A     | ditional Geome | try/Building F | let. For | mula No | tes   |      |      |        |      |   |               |                     |  |
|--------------|----------------|----------------|----------|---------|-------|------|------|--------|------|---|---------------|---------------------|--|
| Sources in v | /icinity       |                |          |         |       |      |      |        |      |   |               |                     |  |
| Search rar   | nge [m]        | 1              | 5        |         |       |      |      |        |      |   |               |                     |  |
|              |                |                |          |         |       |      |      |        |      |   |               |                     |  |
|              |                |                |          |         |       |      |      |        |      |   |               |                     |  |
|              |                |                |          |         |       |      |      |        |      |   |               |                     |  |
| Name         | Unit           | Value          | Lin      | k type  |       |      | Link |        |      |   | Variable type | Description         |  |
| Q            | m³/s           | 1              | 00       | None 🔻  | •     |      |      |        |      | • | Float         | Flow rate           |  |
| Р            | Pa             | 10             | 00       | None 🔻  |       |      |      |        |      | • | Float         | Fan static pressure |  |
|              |                |                |          |         |       |      |      |        |      |   |               |                     |  |
|              |                |                |          |         |       |      |      |        |      |   |               |                     |  |
|              | Value/Sum      | 6347           | 12547    | 25087   | 500Hz | 1644 | 2647 | dista- | eku- |   |               |                     |  |
| Name         | Value/Sum      | 63Hz           | 125Hz    | 250Hz   | 500Hz | 1kHz | 2kHz | 4kHz   | 8kHz |   |               |                     |  |

The input variables defined in the library element are presented but the values can be customized for the very case your source definition is describing, for example to adjust the volume stream of the fan.

Define emissions via formulas

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The search distance for sources in the vicinity and the settings to concatenate input and output variables of multiple source objects are irrelevant for this example as the fan only consists of a single source object.

In the lower part all output variables with their calculated values are presented.

If you change the value of the input variable Q from the default value of 10 to 100, the output of the Lw changes from 110 dB to 120 dB.

## Source entry example 2

Now let's review a more complex example: A line source with variable sound power where the sound power along a pipe decays.

## **Entries in the Emission library**

Enter a new library element "Variable Lw" in the emission library and under the tab *value* define the boundary conditions: The emission spectrum is defined as Lw/m with the entry type **SPECTRUM BY FORMULA**. The frequency range is set to 63Hz-8kHz in dB(A).

Define the following variables:

| Ad   | d predefined v | ariable        | Add user va | riable              | Delete variable |
|------|----------------|----------------|-------------|---------------------|-----------------|
| Name | Unit           | Variable type  | Value       | Description         |                 |
| In1  | dB             | EmisSpectrum 👻 | 90          | Eingangsspektrum    |                 |
| D_s  | m              | Float 👻        | 0           | Distance from start | (Line sources)  |
| L    | m              | Float 👻        | 100         | Source length (Line | sources)        |

Own input variables:

Name = IN1; Unit = dB; Type = Emisspectrum; Default value = 90; Description = Input spectrum

Predefined variables Input variables:

Name = D\_s; default value = 0

Name = L; default value = 100

| Ad   | d predefined v | ariable        | Add u | iser va | ariable Delete variable                     |
|------|----------------|----------------|-------|---------|---------------------------------------------|
| Name | Unit           | Variable type  | Value |         | Description                                 |
| Lwf  | dB(A)/I        | w.EmisSpectrum | -     | 90      | Sound power level (frequency bands)         |
| OUT1 | dB             | EmisSpectrum   |       | 80      | Emission spectrum at the end of line source |

Predefined output variables:

Lwf: spectral emission level;

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Define emissions via formulas

Own output variables:

Name = OUT1; Unit = dB; Type = Emisspectrum; Description = Emission spectrum at the end of the line source

| AU    | d predefined variable |       | Add user | valiable |       |       | Der  | ete variabl | e    |      |
|-------|-----------------------|-------|----------|----------|-------|-------|------|-------------|------|------|
| Name  | Variable type         | Value | 63Hz     | 125Hz    | 250Hz | 500Hz | 1kHz | 2kHz        | 4kHz | 8kHz |
| alpha | DifSpectrum ·         | •     | 0,10     | 0,10     | 0,10  | 0,10  | 0,10 | 0,10        | 0,10 | 0,10 |



Own local variables:

Name = Alpha; Type = Difspectrum; Default value = 0,1 in each frequency band

Enter as a formula

Lwf:= IN1 - alpha \* D\_s; OUT1:= IN1 - alpha \* L;

The formula above will result in a continual decay of the sound power per meter from the beginning of the line source. At the beginning of the source  $D_s=0$ , therefore Lwf = IN1. At the end of the line source  $D_s=L$  therefore Lwf = OUT1.

With the default values we get for OUT1:

OUT1 = IN1 - alpha \* L = 90 - 0.1 \* 100 = 80

The formulas are evaluated for each frequency. The shown values for Lwf and OUT1 in the library are the values for the highest frequency.

#### Definition of the line sources

In the Geo-Database we now define two line sources "pipe 1" and "pipe 2". The last coordinate of pipe 1 is identical with the first coordinate of pipe 2. Both sources are assigned the emission spectrum "Variable Lw".

General Additional Geometry/Building Ref. Formula Notes

| Sources in vi<br>Search rang |           | 1     | ά     |         |       |      |      |      |      |                                 |                  |
|------------------------------|-----------|-------|-------|---------|-------|------|------|------|------|---------------------------------|------------------|
| Name                         | Unit      | Value | Lir   | nk type |       |      | Link |      |      | Variable type                   | Description      |
| In1                          | dB        |       | 90    | None 🔻  |       |      |      |      |      | <ul> <li>EmisSpectru</li> </ul> | m Input spectrum |
|                              |           |       |       |         |       |      |      |      |      |                                 |                  |
| Name                         | Value/Sum | 63Hz  | 125Hz | 250Hz   | 500Hz | 1kHz | 2kHz | 4kHz | 8kHz |                                 |                  |
| Lwf                          | 90        |       |       |         |       |      |      |      |      |                                 |                  |
| OUT1                         | 80        |       |       |         |       |      |      |      |      |                                 |                  |

In the tab *Formula* the variable IN1 is entered for both sources from the library definition.

In the footer you will see an error message as the program expects a link:

Error in calculation of formula "Spectrum affords link, variable: In1"!

Define emissions via formulas

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This link first must be defined.

For the source "pipe 1" the input variable IN1 is set as a link to the emission spectrum of the library. For this the column link type must be set to "Library". Now you can select any emission spectrum that was not defined as a spectrum by formula.

If IN1 would be a transmission spectrum (Transspectrum) rather than the emission spectrum, all elements from the transmission library would be shown instead of the emission spectra.

| Name: Pipe<br>Object No. 2<br>General Additiona<br>Sources in vicinity<br>Search range [m] |          | ilding Ref. | Formula No  | tes   |       |       |           |         |      |             |                |            |  |
|--------------------------------------------------------------------------------------------|----------|-------------|-------------|-------|-------|-------|-----------|---------|------|-------------|----------------|------------|--|
| General Additiona                                                                          |          |             | Formula No  | tes   |       |       |           |         |      |             |                |            |  |
| Sources in vicinity                                                                        |          | ilding Ref. | Formula No  | tes   |       |       |           |         |      |             |                |            |  |
|                                                                                            |          |             |             |       |       |       |           |         |      |             |                |            |  |
| Coards range [m]                                                                           | 1        |             |             |       |       |       |           |         |      |             |                |            |  |
| search range [m]                                                                           | 1 1      | Ó.          |             |       |       |       |           |         |      |             |                |            |  |
| -                                                                                          | -        |             |             |       |       |       |           |         |      |             |                |            |  |
| Pipeline 2                                                                                 |          |             |             |       |       |       |           |         |      |             |                |            |  |
|                                                                                            |          |             |             |       |       |       |           |         |      |             |                |            |  |
|                                                                                            |          |             |             |       |       |       |           |         |      |             |                |            |  |
| Name                                                                                       | Unit \   | /alue       | Link type   |       |       | Link  |           |         | Vari | able type   | De             | escription |  |
| In1 dE                                                                                     | в        | 90          | Library 🗖   |       |       |       | Motor com | pressor | - E  | misSpectrum | Input spectrum |            |  |
|                                                                                            |          |             |             | _     |       |       |           |         |      |             |                |            |  |
| Name Va                                                                                    | alue/Sum | 63Hz 12     | 25Hz 250Hz  | 500Hz | 1kHz  | 2kHz  | 4kHz      | 8kHz    |      |             |                |            |  |
| Lwf                                                                                        | 95,67    | 54,40 6     | 57,60 73,07 | 85,37 | 91,10 | 91,00 | 87,97     | 81,69   |      |             |                |            |  |
| OUT1                                                                                       |          |             | 48,26 53,73 | 66,02 | 71,76 | 71,66 | 68,63     | 62,35   |      |             |                |            |  |

As soon as the link is established the entry in the column "value" is ignored.

For "pipe 2" the variable for IN1 is set to the emission spectrum OUT1 from the last source. To do so the column link type is set to "source". Now you can choose from all output variables of the correct type for all sources that are presented in the window **SOURCES IN THE VICINITY**. If the source you want to connect to is not found in the list, you may need to increase the **SEARCH RANGE**, however in our example we set the end coordinate of pipe 1 to identical coordinates as the beginning of pipe 2 and therefore will not have problems finding the connection between the pipes.

| General   Ad | ditional Geome | try/Building Ref. | Formula Notes |      |               |             |
|--------------|----------------|-------------------|---------------|------|---------------|-------------|
| Sources in v | icinity        |                   |               |      |               |             |
| Search ran   | ige [m]        | 3                 | )             |      |               |             |
| Pipeline 1   |                |                   |               |      |               |             |
|              |                |                   |               |      |               |             |
| Name         | Unit           | Value             | Link type     | Link | Variable type | Description |

For pipe 2 the variable IN1 in the link is set to pipe 1.OUT1, therefore the pipe 2 is taking over the emission spectrum with the value of Lwf at the end of Q1.

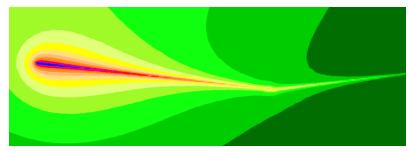
For the calculation the sources pipe 1 and pipe 2 are automatically sub divided into smaller sections that are small enough that the difference of the Lw between the beginning and the end of a sub source are less than 1 dB.

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Define emissions via formulas



Result in a grid noise calculation:

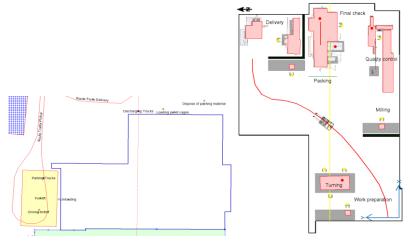


# Noise at Workplace

Noise at Workplace is a powerful tool to assess and document the noise dosage of workers exposed at different stations/locations to varying noise levels. The graphical presentation of the situation helps with the assignment of work stations to workers. Each worker can be assigned multiple work stations, they can be in the same industrial building or a different industrial building or outside of the building. The duration of the work at different stations is set individually for each worker.

Noise at Workplace at the moment is part of the industrial noise module but SoundPLAN reserves the right to at a later stage when additional tools for noise at work are developed, convert this module into a separate module with its own price. During the life time of SoundPLAN 8.1 Noise at Work will for sure remain part of industry noise.

To prepare the assessment of the noise exposure for workers, the sound pressure level for all work stations must be calculated. Each work station is represented by a receiver.



Noise at Workplace

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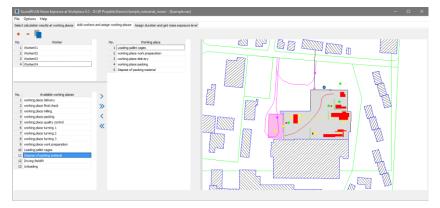
For work stations outside please calculate the single receivers for environmental noise outside, for work stations in a factory building an Indoor Single Point calculation is required.

After the pre-calculation for the work station, start Noise at Workplace from the SoundPLAN Manager **EXECUTE -> NOISE AT WORKPLACE**.

| 😰 No     | oise at Workplace      |                |                                      |      |            |                     |                           | - 🗆         |   |
|----------|------------------------|----------------|--------------------------------------|------|------------|---------------------|---------------------------|-------------|---|
| File (   | Options Help           |                |                                      |      |            |                     |                           |             |   |
| Select o | calculation results at | working places | Add workers and assign working place | s As | ssign dura | ation and get noise | exposure level            |             |   |
| Availat  | ble result files (in   | door and outd  | oor)                                 |      | Select     | ed result files     |                           |             |   |
| No.      | Result file            |                | Description                          |      | No.        | Result file         |                           | Description |   |
| 1        | RSPS0006.res           | 03_Outdoor s   | ingle point - only industrial hall   |      | 1          | RHSP0003.res        | 02_Indoor working places  |             |   |
| 2        | RSPS0009.res           | 04_Outdoor s   | ingle point - all Sources            | >    | 2          | RSPS0012.res        | 05_working places outside |             |   |
| 3        | RSPS0012.res           | 05_working pl  | aces outside                         | 1    |            |                     |                           |             |   |
| 4        | RHSP0003.res           | 02_Indoor wo   | rking places                         |      |            |                     |                           |             |   |
|          |                        |                |                                      |      |            |                     |                           |             |   |
|          |                        |                |                                      |      |            |                     |                           |             |   |
|          |                        |                |                                      |      |            |                     |                           |             |   |
| <        |                        |                | >                                    |      | <          |                     |                           |             | > |
|          |                        |                |                                      |      |            |                     |                           |             |   |

In the tab *selected calculation results at work stations* the left side hosts all single point receivers for inside and outside. Using a double click or the blue arrow, transfer the required calculation runs to the right side.

Click on the second tab to add workers and assign them to work stations.



The top left offers a red + to add additional workers. With a click "worker01" is highlighted in blue, you can now assign a new name to this worker.

In the lower list the work stations (activity, job) from the assigned calculation results are listed. Assign the activities over the course of the work day to the workers at the various work stations. Individual activities are assigned with a double click or the blue double arrow, multiple activities require marking them with the *Shift* key for individual and the *Ctrl* key for consecutive activities.

The graphics on the right show all work stations assigned to the worker in green, work stations not assigned to the highlighted worker are presented in yellow. With a double click on a work station you can also assign this work station to the active worker.

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Noise at Workplace



The Assessment of the noise dosage is done under the tab *assign duration and get noise exposure levels*.

| and                                                                |
|--------------------------------------------------------------------|
| Allho                                                              |
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| 3h23.24h                                                           |
| 23h23-24h<br>Helt for "Devation"                                   |
| Unit for "Duration"                                                |
| Unit for "Duration"<br>© %<br>O mn/h<br>Exposure time [h]<br>8.0 © |
| Unit for "Duration"                                                |
| Unit for "Duration"<br>© %<br>O mn/h<br>Exposure time [h]<br>8.0 © |
| Unit for "Duration"                                                |
|                                                                    |

The table on the bottom contains a list of all work stations assigned to individual workers along with the sound pressure levels found at these work stations. For each worker the proportional work time is listed for each work station for each hour.

Set the **DURATION** to min/h or %. Additionally, assign a noise reduction for example to accommodate work stations where hearing protection is required.

The **DURATION** describes the length of the averaging time which is part of the assessment of the noise exposure limit. The allowable **LIMIT** is the constant noise level equivalent over a period of an 8-hour shift. Most standards foresee a noise limits between 80 and 90 dB(A) for the duration of 8 hours. If the noise dosage is exceeding the limit, the duration must be reduced, or noise protection must be used to avoid violating the noise dosage limit. The **HALVING PARAMETER** is the value in dB, used for doubling the noise level / noise exposure time. In the literature the most common value for this parameter is 3 dB. If the USA OSHA deviated from this rule and set this parameter to 5 dB.

From this parameter and the work time at various work stations the table calculates the noise exposition level Lex and the noise dosage for each worker.

Both tables can be copied using the left mouse button into the clipboard to be inserted in your documents and presentations.

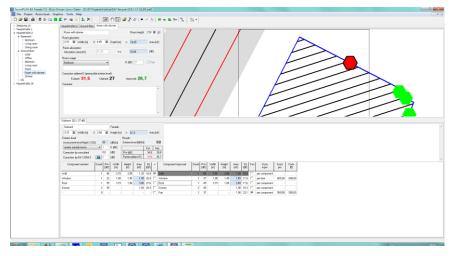
Noise at Workplace

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# 15 BA-Outside

# The scope of the module Building Acoustics-Outside

BA-Outside assesses the required valued sound reduction index  $R'_w$  of the outside shell of a building subjected to noise from outside sources in accordance to the EN 12354 and other standards.



EN 12354 calculates the required sound reduction index on the basis of different room types from the room assessment library and traffic routes from the outside level. Depending on the use of the room, the day or night assessment level is decisive.

The correction summand L2,nT is understood as the maximum permissible internal level in order to enable the guidelines to be implemented on more than one external wall. The total level L2,nT is the energetic sum of the partial levels L2,nTi of all facades. The partial level L2,nTi of a façade is obtained by the energetic summation of all partial levels L2,nTij of the components of this façade.

The scope of the module Building Acoustics-Outside

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## **General overview**

The formulas to calculate the indoor noise levels for known outside levels and  $R'_w$  are relatively simple and can easily be accomplished in an Excel spreadsheet. The problem is that you need to feed it with the noise levels outside and are left without any sensible documentation. If the number of buildings for which the assessment of the façades shall be done is large, it is much more efficient to use a program module such as BA-Outside. As this module helps document the buildings / dwellings / rooms in text and graphically, this BA-Outside module is the program of choice for small and big projects alike.

BA-Outside offers the following possibilities:

- A hierarchically structured presentation with the object types building, floor, Dwelling and Room with specific data for each layer.
- SoundPLAN-results of the outside noise calculation can in case they are present - be used for the noise assessment of the BA-Outside. In this case the buildings used in the calculation are created for BA-Outside together with the information road name, house number and limit. The noise levels from a Façade Noise Map are later on assigned to each façade of the building.
- A room can be exposed to the outside via one or multiple façades. For the room the inside noise level is calculated that is presented in red color as soon as the noise limit has been exceeded.
- The elements making up the façade are made up of the size in square meters and the valued sound reduction index R'w. Inserted façade elements are automatically accounted for in the tally remaining wall area with the exception of the openings of the forced ventilation pipes where the pipe diameter is neglected.

The sound reduction index is set manually or is taken from the SoundPLAN transmission library or via a façade element calculator. For each element it is possible to host values describing the current status as well as values after possible improvements to the situation.

- On all object layers, you can enter and save comments and graphics. Graphics are either pixel graphics (bmp, jpg, png, tif), a pdf file or simple drawings and texts created with a built-in tool (or both). If present SoundPLAN model data can also be used.
- The result printout is either for a selected element or the entire BA-Outside project. Customize the scope of the printout with options menus, select to include comments and pictures.
- When selecting the noise improvement measure list, only the elements are printed that during the BA-Outside process had been changed.

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The scope of the module Building Acoustics-Outside

# Generation of a new room book

Start a new project or select an existing project and start BA Façade with the symbol button BA-Outside in the main menu area of the SoundPLAN Manager.

With **FILE -> NEW** or via the symbol **NEW** you get to the dialog to start a new room book.

| New room book             |                      |        |
|---------------------------|----------------------|--------|
| Standard                  |                      |        |
| EN 12354                  |                      | •      |
| Room assessment           | VDI 2791 (upper limi | t) 🗾 🔟 |
| -Standard dependent def   | ault settings        |        |
| Spectrum adaptation ter   | m                    |        |
| С                         |                      | -      |
| Import SoundPLAN result   | 8                    |        |
| 🔲 do import               |                      |        |
| Settings                  |                      |        |
| Building type             |                      |        |
| only buildings            |                      | •      |
| Decimal numbers of rece   | eiver level          | 0 -    |
| Time slice displayed in S | oundPLAN data        | Day 🔻  |
| Columns for construction  | list                 |        |
| 🔲 Library elements        |                      |        |
| 🔽 Costs                   | costs calculation    |        |
|                           | New Cancel           | Help   |

15

Select the standard you want to use for the calculation. EN 12354 additionally requires a room assessment library. Click on the library symbol to select it. Select the default spectrum adaption term (or for other standards the traffic route).

With the **BUILDING TYPE** you define which hierarchical steps you want to include as a default into the tree structure of the room book and for the import of SoundPLAN data.

- Only buildings
- Building dwelling (= apartment or flat)
- Buildings dwelling room
- Buildings floor dwelling room

Generation of a new room book

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Regardless of the building type you selected at the beginning, you can always add floors, dwellings and rooms to individual buildings, just as your work requires.

Which building type to select as the pre-set for BA-Outside depends on the scope of the investigation, the national (and local) legislative framework and the structure of the borough to be investigated. If the area is predominantly built up with multi-family residential buildings then the structure "building, floor, dwelling, room" is suggested, if is structured with a mixed of single family and multi-family buildings, it may be better to activate the setting for "only buildings".

You can determine a pre-selection whether the columns "library element" (sensible for EN 12354), "cost" or "cost calculation" shall be displayed later in the list of components.

Click on **NEW** to start a new room book with one building. The building will be presented with the building tree structure in accordance to the selection of the building type. On the right side various tabs are located for the administration of the data. Starting with the active object all tabs belonging to a higher hierarchy are displayed.

| > Zeisigweg 15                                                                                                                  | Old Kent Road 12 Basement Dwelling 004                                                         |                       |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------------------|
| Hauptstraße 1     Old Kent Road 12     Basement     Deeling 004     Oling room     Diving room     Oining room     Ground floor | Dwelling 004<br>Counterparts<br>Owner<br>Mustermann; Erich V >> V<br>Tenant / main counterpart | Room height: 2,50 🕷 👽 |
| Child<br>Office<br>Bedroom<br>Living room                                                                                       |                                                                                                | A                     |

If the dwelling is the active tab, the tabs for individual rooms are not presented. For multi-family buildings showing all tabs would visibly overload the structure.

## Importing of SoundPLAN calculation results

Click on **IMPORT SOUNDPLAN RESULTS** to import data from an entire calculation area – receivers are imported along with the road name and house number. If the building type with multiple floors is selected, the number of floors present in the building properties will be used to generate the correct number of floors in BA-Outside. In the import dialog you can define the additional parameters:

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Generation of a new room book

| Import SoundPLAN results                  |                 |             |
|-------------------------------------------|-----------------|-------------|
| 📝 do import                               |                 |             |
|                                           |                 |             |
| Result                                    |                 |             |
| Result file                               | RGLK0021.res    | >>          |
| 📝 import only buildings w                 | vith conflicts  |             |
| Round type M                              | athematical 🔹 D | ecimals 1 🔻 |
| D. 1. F                                   |                 |             |
| Buildings                                 |                 |             |
| Buildings<br>Building file                | RGLK0021.res    |             |
| _                                         | RGLK0021.res    | ),30        |
| Building file                             | RGLK0021.res    |             |
| Building file<br>Ceiling width            | RGLK0021.res    |             |
| Building file<br>Ceiling width<br>Address | RGLK0021.res    |             |

Normally you should only import buildings where the noise limits at least in one of the time slices or for one of the floors are exceeded (**ONLY IMPORT WITH CONFLICT**).

With the **ROUNDING TYPE** the noise levels are rounded at import time in accordance to your settings.

The **FLOOR THICKNESS** is used in combination with the height of the floor to calculate the mean inside room height, which is important for the noise level inside.

In the field address you can pre-set the defaults for zip code and city of the buildings so that along with the road name and house number every building contains a complete postal address.

After importing the SoundPLAN results the receivers will be presented in the tree. Road name and house number are entered as the building name in the address database in the appropriate fields.

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Via **FILE** -> **UPDATE SOUNDPLAN RESULTS** you can update the outside facade noise levels if you have made a new outside noise calculation.

# Add graphics and symbols

Each element a graphic or pdf file can be assigned to document the project. You can take for example a picture of the outside or the building and assign it to the building, you may want to assign a drawing of the floor plan to a floor or a dwelling or a construction drawing to show the construction of the roof to the top floor. These graphics can be incorporated in the printout.

Load the graphics by clicking on the symbol **LOAD GRAPHICS**. If the graphics file is not located in the project, the program will copy it there.

The pdf file is first converted to a bitmap, see "PDF as background graphics" in the chapter Geo-Database.

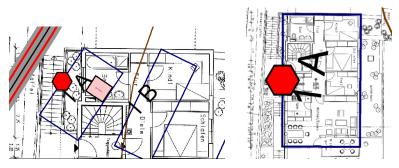
## Fit the graphics to SoundPLAN data

If you work with SoundPLAN geometry data, you can adjust size and position of the floor plan to the graphics.

Click on the symbol **GRAPHICS/BITMAP/FIT TO SOUNDPLAN DATA**, the cursor will change its appearance to a little cross. Click on a corner of the building and pull it with the with the mouse button pressed onto the appropriate corner in the bitmap (picture on the left). Now grab a second corner of the building. With the mouse button pressed fit the data to the bitmap (moving the mouse left/right will rotate the geometry, moving up/down will zoom in/out). As soon as you release the mouse button the cursor will again change into a hand.

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Add graphics and symbols



Inserted graphics can be placed easily for multiple rooms (for example for multiple floors with the same floor plan):

Via **GRAPHICS** -> ASSIGN IMAGE DETAIL TO CHILD ELEMENTS you can for example transfer the graphics viewport of a dwelling to all rooms.

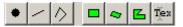
In the selection mode (arrow symbol) the graphics can be transferred with Drag&Drop to another element of the current object.

In order to prevent accidental zooming, the mouse wheel in the selection mode is deactivated.

With **GRAPHICS** -> **BITMAP** -> **DELETE** or the symbol **DELETE GRAPHICS** the bitmap can be deleted.

## Add object symbols

In BA-Outside you can add simple drawing objects for example to highlight a specific room. The following drawing objects are to your disposal:



- Point click on the position you want to set the point
- Line click on the start of the line and then on the end of the line
- Poly-line enter successive the points of the polyline, finish with a double click
- Rectangle pull open with the mouse button depressed
- Non-right angle "rectangle" (trapezoid) click on the first point, then the second point and then pull open the trapezoid with the mouse button pressed
- Polygon click on successive points of the polygon, end with a double click
- Text click on the position and enter the text in the edit field

How the individual drawing elements are entered is commented in the status line.

Enter the edit mode (arrow cursor), if you want to edit/correct an object afterwards. As soon as the cursor moves over a drawing object, the appearance of the cursor changes into a black arrow. With this cursor you can click on the object.

Add graphics and symbols

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On the 4 corner points you can rotate the object, with the middle markers you can enlarge or shrink the object (not valid for texts).

When a drawing object is activated, you can use the right mouse button to duplicate it or delete it.

## Layout types

The drawing objects are formatted with the layout types for point, lines, areas and general texts. Open **GRAPHICS** -> LAYOUT TYPES, to change the layout.

| cayour actinition                                                                |                                                                                            |                                             |      |  |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------|------|--|
| F 🖬 🗗 X 🏹 🏞 🕅 🧕                                                                  |                                                                                            |                                             |      |  |
| Layout types<br>- Font<br>- Line<br>- Area<br>- General text<br>- Point receiver | Base settings Catography 3D g<br>Point<br>I show<br>Name<br>Legend text<br>I use in legend | prophies<br>Draw sequence<br>Point<br>Point | 20 3 |  |
|                                                                                  |                                                                                            | 5.0 🐲 @mm Om<br>0.30 🎕                      |      |  |

Under the tab *Cartography* you can define additional parameters for example to select a different symbol for a point or to set a color for the border of the drawing. A pre-view of the layout is visible on the right side.

In order to display drawing objects with different attributes, duplicate the points, lines areas and texts and customize their layout.

Upon leaving the layout definition use the right mouse button to assign the layout to the activated object -> CHANGE LAYOUT TYPE.

When you work with SoundPLAN data, you can assign the layout to receivers that have been taken into BA Facade from the SoundPLAN calculation. This way you can recognize receivers that are already processed.

When working with SoundPLAN data, use the project object types to customize the layout of the data or to suppress the drawing of some objects.

## Take over the graphics

A floor plan (with or without additional drawing objects), that has been assigned to an dwelling can be transferred to a room. Open the room and click on the symbol **COPY GRAPHICS**. Afterwards you can use the right mouse button in the edit mode (hand cursor) to zoom out the room.

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Add graphics and symbols

## Edit your data

After the rough structure is defined, respectively the receivers for the calculation have been imported, additional elements are added. For the various tabs (buildings and dwellings) numerical and textual information can be augmented with graphics depicting floor plans and other information.



Building, floor, dwelling, room, facade, component

## **Duplicate and move elements**

The program allows duplicating elements, so it might be advantageous to first enter an element and completely define it and then duplicate the entire branch.

Click on the symbol **DUPLICATE ELEMENT** on the branch that you want to reuse. All elements in the hierarchy below this base element are also duplicated. When you duplicate dwelling 1 to become dwelling 1 and 2, all rooms and façades belonging to dwelling 1 are duplicated. In case dwelling 2 is located in a different building as dwelling 1 (if you have multiple, identical dwelling buildings) mark the dwelling and use the mouse to drag it to the new building you want to assign it to.

## 횐 Buildings

The room book must contain at least one building (rooms can only be generated when a building already exists, therefore buildings are required). Depending on the scope of investigation and the type of building, floors and dwellings may require further structuring.

| Old Kent Road 12                               |     |                                            |
|------------------------------------------------|-----|--------------------------------------------|
| Old Kent Road 12                               |     | Room height: 2,50 😸                        |
| Address of building<br>Street<br>Old Kent Road | No. | Counterparts<br>Owner<br>Mustermann; Erich |
| ZIP-Code Town<br>08586 Sample Town             |     | Tenant / main counterpart [ ▼ ≥≥           |
| Limit level<br>Day: 70 Night:                  | 60  | Year of construction<br>1964               |
| Space for your comments                        |     | *                                          |
|                                                |     | *                                          |

Edit your data

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The room height is a default setting for all elements below in the hierarchy. If the room height is the same as the room height in the "higher" element, take it from the "higher" element by checking the box for taking the room height form the "higher" position in the hierarchy. The administrator can also be taken over from the "higher" position. If you want to enter a new administrator in the address database, click on the double arrow.

Noise limits on the outside of building are a first hurdle a building must pass in checking the eligibility of the owner to get compensation for excessive noise levels outside.

### Address database

Via the double arrow you get to the address database to enter address and name of the person responsible for the dwelling (administrator, owner or management company...). You can later export to Excel and use it there for further full flexible documentation.

The buildings address is the default for additional counterparts entered for this building.

## 兰 Floor

A floor can only be inserted in the hierarchy below the building. This element is only used to structure the data, aside from the floor height it does not contain any data of its own required in the calculation. A floor can have additional textual and graphical information.

| Old Kent Road 12 Top floor                                             |                       |  |  |  |  |  |  |  |
|------------------------------------------------------------------------|-----------------------|--|--|--|--|--|--|--|
| Top floor                                                              | Room height: 2,50 🖨 📝 |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |
| The redevelopment limits are exceeded at the west and the north facade |                       |  |  |  |  |  |  |  |
|                                                                        |                       |  |  |  |  |  |  |  |

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## 😐 Dwelling

Dwellings can be generated directly below the building or as part of the floor. A dwelling can contain multiple rooms and floors.

| Zeisigweg 15<br>Hauptstraße 1 | Old Kent Road 12 Basement Dwelling 004 |                       |
|-------------------------------|----------------------------------------|-----------------------|
| Old Kent Road 12              | Dwelling 004                           | Room height: 2,50 🚔 📝 |
|                               | Counterparts                           |                       |
| ⊿ Dwelling 004                | Owner                                  |                       |
| Bedroom                       | Mustermann; Erich 🔹 😒 💟                |                       |
| Living room                   |                                        |                       |
| Dining room                   | Tenant / main counterpart              |                       |
| Ground floor                  | 🔻 🔊                                    |                       |
| Child                         |                                        |                       |
| Office                        |                                        | A                     |
| Bedroom                       |                                        |                       |
| - Living room                 |                                        |                       |

The first field of the dwelling definition hosts the description of the dwelling.

## 🔟 Room

The room itself is the core of interest for BA-Outside.

| Old Kent Road 12 Ground floor Children                             |  |
|--------------------------------------------------------------------|--|
| Children Room height 2,50 🐨 🗸                                      |  |
| Room geometry                                                      |  |
| 3.15 🐨 Width [m] X 4.85 🐨 Depth [m] = 15.28 Area [m <sup>2</sup> ] |  |
| Room usage                                                         |  |
| Sleeping room PR, GR, HOS   L2,nT (dB(A)) 30                       |  |
| L2,nT [dB(A)] (interior level)                                     |  |
| Existent: 39,2 Claimed: 30 Improved: 28,6                          |  |
| Comment                                                            |  |
| *                                                                  |  |
|                                                                    |  |
|                                                                    |  |

The room height from the higher element is taken as the pre-set for the height of the room. Together with the room geometry it also used for the calculation of the absorption area. To take this value, check the appropriate box. Changing the room height at a later time will not change the height of the facade element but the room absorption.

The surface area of a room - which is important for the noise calculation - can be calculated from width and depth of the room or can be directly entered after a double click on the gray field **AREA**.

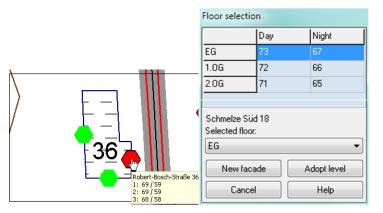
The room usage For EN 12354 comes from the room assessment library with the corresponding required indoor level L2,nT. The room assessment library is selected when defining a new room book. It is possible to change it under **ROOM BOOK** -> **SETTINGS** with a click on the library symbol. This is only sensible in very rare cases as the assignment of existing room types gets lost!

For the German standards 24. BlmSchV and VDI 2719 a parameter D (required interior level) is set according to room usage. The other standards need the room usage to determine the required resulting sound reduction index R'w.

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For the simulation of the indoor noise level you need to define one or multiple facades as the boundaries of the room. If you work directly with SoundPLAN results, click on the receivers in the list to insert a facade and take over the noise level from the outside.



Select the floor and click on **NEW FACADE** to generate a new facade. Taking levels from other facades can only be done if the receiver already contains a façade. This procedure has the advantage that outdoor calculations can update the values while maintaining the object tree of building components.

## 💻 Façade(s)

| south                    |          | Faca             | de               |              |               |              | Comme              | ent fa                  | cade 1                 |       |                  |                   |              |               |              |                    |              |                |              |              |
|--------------------------|----------|------------------|------------------|--------------|---------------|--------------|--------------------|-------------------------|------------------------|-------|------------------|-------------------|--------------|---------------|--------------|--------------------|--------------|----------------|--------------|--------------|
| Width [m]                | x        | Heig             | ht (m)           | 11,30        | ۵.            | lvea (m²)    |                    |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| Exterior level           |          |                  | Re               | oults        |               |              |                    |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| Assessment level Day     | 7        | 0.0 (dB)         | (j L1,           | 2m [dB(A)]   |               | 73           |                    |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| C.N                      | •        |                  |                  |              | Ext           | Imp.         | 1                  |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| Correction by consultant | 3        | (dB) (dB)        | D2               | in,nT+C,tr [ | dB] 33        | 6 43,8       |                    |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| Correction by EN 12354-3 | <b>1</b> | [dB]             | L2               | nTi (dB(A))  | 39            | ,4 29,2      | J                  |                         |                        |       |                  |                   |              |               |              |                    |              |                |              |              |
| Component existent       | Count    | R'w+C,tr<br>[dB] | Dn,e+C,b<br>[dB] | Width<br>[m] | Height<br>[m] | Area<br>[m²] | L2,nTij<br>[dB(A)] | -                       | Component improved     | Count | R'w+C,tr<br>[dB] | Dn,e+C,tr<br>[dB] | Width<br>[m] | Height<br>[m] | Area<br>[m²] | L2,nTij<br>(dB(A)) | Fan          | Costs<br>input | Costs<br>per | Costs<br>[6] |
| wall                     | 1        | 51               |                  |              |               | 6,30         | 13,8               | $\mathbf{V}$            | Wall                   | 1     | 51               |                   |              | -             | 6,30         | 13,8               | П            | per component  |              |              |
|                          | 1        | 29               |                  |              |               | 4,50         | 34,3               |                         | Window 1 - exchanged   | 1     | 36               |                   |              |               | 4,50         | 27,3               |              | per component  | 522,00       | 522,00       |
| Window 1                 |          | 30               |                  |              |               | 0,50         | 23,8               | $\mathbf{\overline{v}}$ | Window 2               | 1     | 30               |                   | -            |               | 0,50         | 23,8               | П            | per component  |              |              |
| Window 1<br>Window 2     |          |                  |                  |              |               | 0.10         | 37.6               |                         | controlled ventilation |       | 45               |                   |              |               | 1,90         | 14,6               | $\mathbf{V}$ | per component  | 560.00       | 560,00       |

You can assign several facades to each room. The label on the tab is taken from the field "façade". Behind the name in brackets you can see the partial noise level associated with this façade. Each façade can be assigned a comment.

Directly below the box for the facade description the dimensions of the facade are entered. With a double click on the gray field **AREA** the size of the facade can be entered directly. The labels for **WIDTH** and **HEIGHT** assume the standard case of vertical walls. By directly entering the area it is possible to accommodate the bigger sizes of slanting roofs and to add the area for a flat roof. If flat or slanted roofs need to be modeled the outside levels need to be calculated and set for this case.

The sound reduction index R'w can be adjusted with a spectrum adaption term C or C,tr. If the assessment level is printed on gray background, the value came from a

Edit your data

SoundPLAN calculation. With a right click the reference to the calculation can be deleted if needed.

In the field **CORRECTION BY CONSULTANT** you can further correct the noise level on the outside of the building. The resulting total noise level is presented in the field below the size of the façade area.

Select if necessary, the facade correction of the EN 12354.

| elect facade structure                                                                    |              | ×      |
|-------------------------------------------------------------------------------------------|--------------|--------|
| Facade type                                                                               |              |        |
| 7 Balcony                                                                                 | -            |        |
| Absorption roof                                                                           |              |        |
| >= 0.9                                                                                    | ▼ 0,90       |        |
| Height of line of sight on the                                                            | facade       | ┖━┳┵   |
| > 2.5 m                                                                                   | •            |        |
| Facade structure correction l                                                             | Lfs =        | 4,0    |
| <b>_</b> _<br>ر                                                                           | 2<br>3       |        |
| 1: Absorption area<br>2: Height of line of sight or<br>3: Facade plane<br>4: Sound source | n the facade |        |
|                                                                                           |              | Cancel |

# 15

## Components

The **COMPONENT TABLE** is set up with separate entries to cover the existing and the improved status of the facade. The first line always hosts the main element, the wall. The properties for count and area of the main element cannot be edited, the value is calculated from the total façade area minus all other inserted façade components without an area. The area of a component is always taken into account for the size tally except if the **FAN** checkmark is set in the second to last column of the table.

Additional components can be added via the symbol **COMPONENT** or CTRL+'+' obsolete components can be deleted with the symbol **DELETE** or CTRL+'-' (the component must be activated (blue background)).

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Click on the symbol **DUPLICATE ELEMENT**, if you need an additional element of the same type.

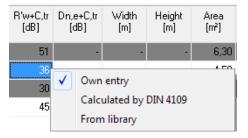
The display for the summation L2,nTij (EN 12354) or Dij (other standards) of each component cannot be modified, this value is calculated.

The properties for a planned component can only be edited after you deleted the checkmark in the column **"="**. Only then is it possible to enter values in the column "cost".

The different components are optimized in the component list. The area is calculated from width and height or can be directly entered.

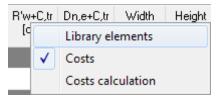
The component properties can either be defined using R'w (sound reduction index) or Dn,e (normalized level difference).

For the calculation of the weighted sound reduction index, you have 3 options to your disposal.



**OWN ENTRY**, if you know the value or if you want to find the required sound reduction value by turning the mouse wheel, the option **CALCULATED BY DIN 4109** for massive walls if the wall composition and the DIN is known or via the **TRANSMISSION LOSS LIBRARY**.

If you select from library the system library and an empty project library are opened. Select the desired element in the system library and copy it via the button **PROJECT** or the button **ACCEPT** to the project library. The selection of a group and the free text search help to find the desired element in the extensive system library. The name of the selected element is shown in the component list if you activate the column "library element" with a right mouse click on the table header (**Ctrl+L**).



The cost for the planned changes can be entered in various ways:

- The cost per component is fixed and does not depend on count or area.
- The cost per count is calculated from the individual cost

Edit your data

• The count cost related to area is calculated as a multiplication of cost per square meter times the area.

Activate the columns for cost (*Ctrl+K*) and for cost calculations (*Ctrl+Shift+K*) or with a right click on the table header.

An example for the cost calculation would be retro-fitting windows with improved rubber seals. The insertion loss improves, the cost is calculated as cost per meter of length of the rubber seal. In an additional line (inserted with CTRL+ '+') the rubber seal is entered. The meters of length of the seal are entered in the column for the area. The noise reduction index R'w is set to 130 dB to make sure this component is not influencing the noise calculation. The count in the existent side of the table is set to 0.

# 15

## Wall calculator

| Calculator DIN 4109             |                     |          |             |           | ×               |
|---------------------------------|---------------------|----------|-------------|-----------|-----------------|
| Assessed transmission loss      | for one or DIN 4109 |          |             | ible wal  | ls according to |
| Please notice the conditions r  |                     |          |             | 08 sectio | on 2, 3 and 10! |
| Exterior finery                 |                     |          |             |           |                 |
| 10 mm Kalk-, Kalkzement- o.     | Zementputz          | •        | 18,0 kg/m²  |           |                 |
| Exterior shell                  |                     |          |             | _         |                 |
| Thickness [cm]                  | 36,5                | •        |             |           |                 |
| Brick gross density [kg/m³]     | 800                 | •        |             |           |                 |
| Lightweight mortar              |                     | <b>V</b> | 281,0 kg/m² |           |                 |
| Brick work with two shells      |                     |          |             |           |                 |
| with air layer according to DIN | l 1053 part 1       |          |             | 0 dB      |                 |
| Interior shell                  |                     |          |             | _         |                 |
| Thickness [cm]                  | 0,0                 | •        |             |           |                 |
| Brick gross density [kg/m³]     | 0                   | •        |             |           |                 |
| Lightweight mortar              |                     |          | 0,0 kg/m²   |           |                 |
| Interior finery                 |                     |          |             |           |                 |
| 10 mm Gips- o. Kalkgipsputz     |                     | •        | 10,0 kg/m²  |           |                 |
| R'w,R calculated via mass       | s per area          |          |             | _         |                 |
| Bewertetes Schalldämm-Maß       | nach 28 x log       | ( 309,   | ,0 ) - 20 = | 50 dB     |                 |
| Surcharge for mass per ar       |                     |          | omponents   |           |                 |
|                                 | ▼ kg/m² 30          | 0        |             | 0 dB      |                 |
| Surcharge from user             |                     |          | _           |           |                 |
| e.g 2 dB for concrete sandv     | vich compone        | nts      |             | 0 🛢       | Cancel          |
| Assessed transmission los       | s R'wR              |          |             |           |                 |
|                                 |                     |          |             | 50 dB     | Help            |

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The wall calculator can be opened from the menu **TOOLS-> WALL CALCULATOR** or with a right click on the filed R'w in the component list. The calculation is carried out in accordance to DIN 4109, in the version from November 1989. The wall calculator is a tool to quickly assess massive components.

## Gardens, balconies and terraces (not available for EN 12354)

A compensation in accordance to the German Traffic Noise Guideline 97 can be calculated with this tool. With this it is possible to calculate the compensation amounts for garden areas and terraces depending on the magnitude of the noise level and the noise limit that applies for the area.

## Print room book

Via **FILE -> PRINT** the results of the calculations are printed. Define how much in depth you want your printed documentation.

| Print Options                        |             |
|--------------------------------------|-------------|
| Print range                          |             |
| Whole project                        |             |
| Ourrent building                     |             |
| Current selection                    |             |
| Print type                           |             |
| Interior level calculations          |             |
| 🔘 Measure list                       |             |
| 🔘 Indemnities                        |             |
| Options                              |             |
| 🔽 with comments                      |             |
| with pictures                        |             |
| print SoundPLAN data                 |             |
| only if a bitmap is assigned         |             |
| Print pages for                      |             |
| 🔽 Buildings 🛛 📝 Floors               | Dwellings   |
| only if comments or a picture exists |             |
| ОК                                   | Cancel Help |

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You can choose from various fixed formatted printouts:

- Information concerning the building and dwellings with the façade calculations. If desired graphics and comments can be printed (INTERIOR LEVEL CALCULATIONS).
- List for improved components (MEASURES LIST). Choose whether you want to include the costs for the measures in the table.
- Not available for EN 12354: Calculation of the compensation amounts for outside areas (gardens, terraces and balconies) (COMPENSATION CALCULATION OUTSIDE)

The selected printout either can print the data for all objects in the room book (ENTIRE PROJECT), the CURRENT BUILDING or the CURRENT SELECTION a selected element. Aside from this the buildings-, floor- and dwelling pages can be suppressed.

With additional options you can define if the pictures that were created within BA Facade, assigned bitmaps and comments are printed.

| B 123 Sample Town - Noise redevelo                                                                        | oment                                               | 7                  | B 123                    | Sample Tov       | vn - No      | se red                 | evelop       | ment                      |                      |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------|--------------------|--------------------------|------------------|--------------|------------------------|--------------|---------------------------|----------------------|
| Projekt-No. 08/15                                                                                         |                                                     |                    |                          | Me               | easure list  |                        |              |                           |                      |
| Room with dormer / Ground floor / Old Kent Road 12                                                        |                                                     | Room               | Facade                   | Component        | Count W      | sth Height             | Total area   | Rw.ex. Rw.ir<br>(dB) (dB) | np. Costs            |
| Room usage: Bedroom Room geometry:                                                                        | 3,15 m x 4,65 m = 14,65 m <sup>2</sup>              | Old Kent Road 12   | ,<br>,                   |                  |              |                        |              | 1001 1 100                | 1 191                |
| Divatid: 27,0 dB Diexistent / improved:                                                                   | 31,8 / 27,0 dB                                      | Balcony room       | south-west               | Fan              | 1            |                        |              | -                         | 97 550,0<br>17 600,0 |
|                                                                                                           |                                                     | Living room TP     | south-west               | Window<br>Fan    | 1            | 5,90 1,50              | 1,35         |                           |                      |
|                                                                                                           |                                                     |                    | south-east               | Roof             |              | 4.50 1.65              | 7.42         | 25                        | 40 550,0             |
|                                                                                                           |                                                     | Room with dormer   |                          | Wall             | 1            | 4,50 2,91              | 10,48        | 35 42                     | 12 0.0<br>15 0.0     |
|                                                                                                           |                                                     |                    |                          | Dormer<br>Window | 2            | 1.75 1.50              | 2.63         |                           | 15 0,0<br>99 600,0   |
|                                                                                                           |                                                     |                    |                          | Fan              |              |                        | A            |                           | F0 550,0             |
| 00                                                                                                        | 2 2                                                 | Children's room 1  | north-east               | Fan<br>Roof      | 1            | 1.50 1.65              | 7.42         | 35                        | 37 550,0             |
|                                                                                                           | 12,14                                               | Bedroom            | south-east<br>north-west | Fan              |              | 1,65<br>1,65           | 7,42         |                           | 37 550.0             |
|                                                                                                           | 12 12                                               | Childrens's room 2 | rorth-cast               | Fan              | 1            | -                      |              |                           | 37 550,0             |
|                                                                                                           | 1.75                                                | Attic room south   | south-west               | Fan<br>Roof      |              | 4,34 1,50              | 6.51         |                           | F0 550.0             |
|                                                                                                           | 2 4                                                 |                    | rorth-west               | Roof             |              | 4,34 1,50<br>4,34 1,50 | 6,51         |                           | 0.0                  |
| CIN WC @ D WC /Flur Küche go                                                                              | 1.1610 1.                                           | Attic room north   | south-west               | Fan              | 1            |                        |              |                           | 40 550.0             |
|                                                                                                           | 2 t m                                               |                    | south-east               | Wall             |              | 4,34 1,50<br>4,34 1,50 | 6,51<br>6,51 | 35                        | io 0,0               |
|                                                                                                           | 20                                                  | Tatal assts for O  | d Kent Road 12:          |                  |              | 100                    | 9,91         | 32                        | 5.600.0              |
|                                                                                                           | 2+9+                                                |                    | a real read re.          |                  |              |                        |              |                           | 0.000,0              |
| In/Essen                                                                                                  | 01 0                                                |                    |                          |                  |              |                        |              |                           |                      |
| Facade: South-west                                                                                        |                                                     |                    |                          |                  |              |                        |              |                           |                      |
| Facade geometry:                                                                                          | 3,15 m x 2,58 m = 8,13 m <sup>4</sup>               | 1 1                |                          |                  |              |                        |              |                           |                      |
| Diexistent / improved:                                                                                    | 18,5 / 10,1 dB                                      | -1 1               |                          |                  |              |                        |              |                           |                      |
| Assessment Hvell Nipht:<br>Correction Italife type Firee entry':<br>Correction by user:<br>Deterior level | 65,0 dB(<br>0,0 dB<br>0,0 dB<br>-10,0 dB<br>55,0 dB | A)                 |                          |                  |              |                        |              |                           |                      |
| ser. Component existent Count Area Rw Component improved                                                  | Count Area Rw Fan                                   |                    |                          |                  |              |                        |              |                           |                      |
| No. (m <sup>4</sup> ) (d8)                                                                                | (m <sup>9</sup> ) (dB)                              |                    |                          |                  |              |                        |              |                           |                      |
| 1 Wali 1 1,28 48 Wali<br>2 Window 1 1,45 32 Window                                                        | 1 1.28 75 -<br>1 1.45 67 -                          | 1 1                |                          |                  |              |                        |              |                           |                      |
| 3 Roof 1 3,40 35 Roof                                                                                     | 1 3,40 64 -                                         | 1 1                |                          |                  |              |                        |              |                           |                      |
| 4 Dormer 2 1,00 35 Dormor<br>5 Fan                                                                        | 2 1,00 59 -                                         | 1 1                |                          |                  |              |                        |              |                           |                      |
| 5 Fan                                                                                                     | 1 1.90 37 x                                         |                    |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     | -                  |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     | 1 1                |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     | 1 1                |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     | 1 1                |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     | 1 1                |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     |                    |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     |                    |                          |                  |              |                        |              |                           |                      |
| Breunskin + Berndt OmbH - Etzwiesenberg 15 - 71522 Beckneng                                               |                                                     |                    |                          | Breunstein       | + Bernd GmbH |                        |              |                           |                      |
| Bearbeiter: wx                                                                                            | 11                                                  | (17                |                          |                  |              |                        |              |                           | 1/                   |
|                                                                                                           |                                                     |                    |                          |                  |              |                        |              |                           |                      |
|                                                                                                           |                                                     |                    |                          |                  |              |                        |              |                           |                      |
| watchi 13                                                                                                 |                                                     | SoundPLAN 7.3      |                          |                  |              |                        |              |                           |                      |

The printout is fixed in its formatting, headers and footers can be defined in the page layout **FILE -> PAGE LAYOUT**.

Print room book

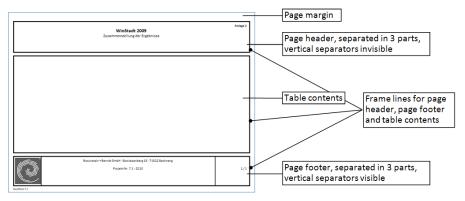
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## Page Layout

The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

#### Open the page layout with TABLE -> PAGE LAYOUT.

Define the format of the page in the tab index card "page format".



### The different parts of the printout

| Page format       | Header an  | d footer text | Print options |                 |          |          |           | _       |
|-------------------|------------|---------------|---------------|-----------------|----------|----------|-----------|---------|
| Paper size        |            |               |               |                 |          |          |           |         |
| A4                | •          | Width         | 210,0         | Length          | 297,0    | Portrait | •         |         |
| Margins [mm]      |            |               |               |                 |          |          |           |         |
| Тор               | 10,0 🛢     | Left          | 20,0 🛢        |                 |          |          |           |         |
| Bottom            | 10,0 筆     | Right         | 10,0 🚔        |                 |          |          |           |         |
| Frame widths [mm] | and colors |               |               |                 |          |          |           |         |
| Header frame      |            |               | 0,7 불         | Header separa   | tor line |          | 0,35 🚔    |         |
| Body frame        |            |               | 0,7 불         | Footer separate | or line  |          | 0,35 🛢    |         |
| Footer frame      |            |               | 0,7 🚔         |                 |          |          |           |         |
| Header logo       |            |               |               | Footer logo     |          |          |           | Save    |
|                   | [          | Visible       |               |                 | 3        | Visible  | <b>V</b>  | Load    |
|                   |            | Stretch       |               |                 |          | Stretch  | V         | Preview |
|                   | X          | Left          | -             |                 | X        | Left     | •         |         |
|                   |            | Width [n      | nm] 20 🖀      |                 |          | Width    | [mm] 20   |         |
|                   |            | Height [n     | nm] 20 凄      | Logo SP.bmp     |          | Height   | [mm] 20 凄 | Cancel  |

Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

The header and footer sections have three partitions: Left, middle, right. Texts or logos in the left partition are left aligned, in the middle partition centered and in the right partition right aligned.

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A graphics can be inserted in the header as well as the footer, for example your company logo or the logo of the customer. Click on the gray field to select the graphics file. Define the position (left, middle, right partition) the height and the width of the graphics. When you check the logo justification button ("STRETCH"), the logo is fitted into the allocated space. The print preview however will decrease its speed because of it and therefore it is advisable to select a logo of proper size.

Format the content and the size of the page frame in the tab index card "*header and footer texts*". The texts can be text variables, automatically updated with information stored in the project or own texts.

| Table settings: Single Recei  | ver                                                                                                           |        |                                             |              |
|-------------------------------|---------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------|--------------|
| Column setup Table layout Pag | e format Header and footer text                                                                               |        |                                             |              |
| Text variables >>             | Arial 8                                                                                                       | 🔽 Us   | se Rich Text format                         | Save         |
| Text page header              |                                                                                                               |        |                                             | Load         |
| Left aligned                  | Centered                                                                                                      |        | Right aligned                               |              |
|                               | <pre><pre>cpn:Project title&gt; <rr:table title=""> - <rt:run pre="" tit<=""></rt:run></rr:table></pre></pre> |        | Annex 2<br><pi:project no.=""></pi:project> | Transfer     |
|                               | <m: rable="" une=""> - <m: run="" td="" un<=""><td>.ie&gt;</td><td></td><td>Reset titles</td></m:></m:>       | .ie>   |                                             | Reset titles |
|                               |                                                                                                               |        |                                             | Preview      |
| Show separator                | Box height [mm] 20 😭                                                                                          | Show   | separator                                   |              |
| Distance [mm] 10 😭            |                                                                                                               | Distan | ce [mm] 28 🚔                                |              |
| Text page footer              |                                                                                                               | _      |                                             |              |
| Left aligned                  | Centered                                                                                                      |        | Right aligned                               |              |
|                               | <cn:company name=""></cn:company>                                                                             |        | ###/ <total></total>                        |              |
|                               |                                                                                                               |        |                                             | ОК           |
| Show separator                | Box height [mm] 20 💽                                                                                          | Show   | separator 🔽                                 | Cancel       |
| Distance [mm] 20 😭            |                                                                                                               | Distan | ce [mm] 25 🚔                                | Help         |

Page header and page footer are printed on all pages of the table as well as for the legend. To format the texts, highlight the text or text variable and click on the button **FONT**. Define the width of the left and right partition and the height of the frame. The three sections can be partitioned with vertical **SEPARATOR LINES**.

For the entry the following **TEXT VARIABLES** are prepared for you and will automatically be updated in case the information changes. Click the cursor to the partition where the text should be displayed and select the variable to be displayed:

|    | Text variables >> | A Ca         | 8          |             |
|----|-------------------|--------------|------------|-------------|
| Τe | Company name      | Project path | Result No. | Page        |
|    | Project engineer  | Run title    | Text 1     | Total pages |
|    | Project title     | Table title  | Text 2     | Date        |
|    | Project No.       | File name    |            | Time        |

In the tab index card "*print options*" you can select the first page number for the printout. Additionally, the table font and size and the colors for the column headers and heading lines are defined.

Click on the button **PREVIEW** to check the page layout.

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## **16** Noise Allotment

## Introduction

This module offers the following new options in managing the noise emissions of multiple noisy facilities within an area (such as an industrial park with multiple plants under multiple different ownership). The program helps set noise generation limits for various facilities within the area to make sure the overall noise limit is not violating the laws and the individual areas are minimized in their restrictions:

- The noise background preload from existing industrial facilities can be taken into account:
  - $\circ~$  In detail: The preload can be defined for each individual receiver or as results from a calculation run.
    - or
  - In general: Reduction of the design noise threshold by a fixed margin, for example 6 dB(A). The margin can be set individually for each receiver.
- Marking partial sources with colors in accordance to the limit violation they cause at the receiver, it is easy to see which of the sources need to be mitigated further during the interactive dimensioning process.
- Additional noise allotments:
- By increasing the emissions rate for individual directions, it is possible to further maximize the emission rates. The definition of the directions for an increase of the noise allotment is done quickly with the mouse.
- The results of the allotment simulation can be printed or via the clipboard moved to programs such as Word. Fixed user defined text formulations are available.

Introduction

## Working on a noise allotment in SoundPLAN

## Preparations

In the **Geo-Database** enter the areas representing the sections of the industrial area as area sources without defining the sound power and model the receivers in the surrounding buildings. As in this stage of the planning process the geometry such as buildings within the industrial area is unknown, therefore the allotment uses only the 2D spreading to optimize the distribution of sources in the entire area, as such the definition of areas and receivers is sufficient to generate the allotment calculation.

When the location of buildings is known, you can use this information in order to adjust the directionality of the sources for additional contingents or to improve the graphical presentation.

After the definitions open the **Calculation core** and carry out a pre-calculation.

Calculation type:

Outdoor Noise 🔻 Noise Allotment 👻

Select the category "Outdoor Noise" and the calculation type "Noise Allotment". This calculation in accordance with the DIN 45691 regards only the horizontal distance of the spreading into a full 3D sphere.

## **Start the Allotment**

Open the Allotment in the SoundPLAN Manager.

Select **FILE** -> **NEW** and load the results of the pre-calculation done in the Calculation Core (file name RNATxxxx.res) via the symbol button **OPEN**.

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| Contents / Settings            | x    |
|--------------------------------|------|
| Contents Settings Print out    |      |
| Standard                       |      |
| DIN 45691                      | -    |
| Assessment                     |      |
| DIN 18005 Gewerbe              | •    |
| Precalculation                 |      |
|                                |      |
| Preload noise                  |      |
| from single point calculation  |      |
|                                | F    |
| e manual setting               |      |
| LrT LrN                        |      |
| 0,0                            | 0,0  |
| Additional allotments          |      |
| Sectors                        |      |
|                                | F    |
| Target values                  |      |
| vound target values            |      |
| Calculate L(EK)                |      |
| equal values                   |      |
| energetically optimized values |      |
| OK Cancel                      | Help |

Depending on the selected ASSESSMENT, the assessment time slices may change.

An existing **PRELOAD NOISE** can be determined in a SoundPLAN calculation for single receivers or be entered manually for all receivers. For the allotment it is possible to alter the defined base level. The allotment can also be defined as an offset to the noise limit (example -10).

#### Selection to determine the additional noise contingents

You can select how the additional contingents shall be generated:

- With sectors (A.2 according to DIN 45691)
- By area (via the AREA USAGES)
- NO additional contingents

For the determination of additional contingents via the method by area, at first the areas need to be defined in the Geo-Database as usage areas. All usage areas to be used in the Allotment must be located in the same Geo-File, which is then assigned to the Allotment.

Working on a noise allotment in SoundPLAN

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The additional contingents are assigned to the areas instead of the sectors. If multiple receivers are located in an area, the program will use the lowest additional contingent.

According to DIN 45691 the **TARGET VALUES** shall be considered as integer rounded values. You can deactivate the check box if needed.

SoundPLAN suggests the distribution of the emission allotments L(EK) to the part areas. This can be calculated with equal values or energetically optimized

Click OK to open the table in the tab index card emission *Allotment* according to your settings.

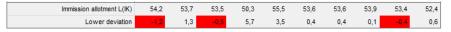
## **Carry out the Allotment**

| 0.0                  |                  |              |            |                |      |      |             |           |      |      |      |      |
|----------------------|------------------|--------------|------------|----------------|------|------|-------------|-----------|------|------|------|------|
| Options H            | lelp             |              |            |                |      |      |             |           |      |      |      |      |
| ) 🚅 🗄 (              | 5 8 🖬            | 🗹 Optin      | nize L(EK) | of this part a | area |      |             |           |      |      |      |      |
| tment Emission       | allotments Addit | ional allotm | ients Cal  | culate grid i  | map  |      |             |           |      |      |      |      |
| LrN A                | (div)            |              |            |                |      |      |             |           |      |      |      |      |
|                      |                  |              |            |                |      |      |             |           |      |      |      |      |
| Receiver             |                  |              | IO 1       | IO 10          | 10 2 | IO 3 | IO 4        | 10 5      | IO 6 | 10 7 | IO 8 | IO 9 |
| Limit L(GI)          |                  |              | 55,0       | 55,0           | 55,0 | 60,0 | 60,0        | 55,0      | 55,0 | 55,0 | 55,0 | 55,0 |
| Preload noise L(vor) |                  | 50,0         | 45,0       | 50,0           | 58,0 | 51,0 | 49,0        | 49,0      | 48,0 | 50,0 | 50,0 |      |
| Target value L(PI)   |                  |              | 53,0       | 55,0           | 53,0 | 56,0 | 59,0        | 54,0      | 54,0 | 54,0 | 53,0 | 53,0 |
|                      |                  | _            |            |                |      |      |             |           |      |      |      |      |
|                      |                  |              |            |                |      |      | Contributio | on levels |      |      |      |      |
| Subarea              | Size [m²]        | L(EK)        | IO 1       | IO 10          | 10 2 | IO 3 | IO 4        | 10 5      | IO 6 | 10 7 | IO 8 | IO 9 |
| TF 1                 | 16512,3          | 64           | 49,0       | 43,9           | 45,2 | 38,7 | 42,4        | 44,5      | 46,3 | 46,2 | 46,6 | 43,9 |
| TF 2                 | 17363,9          | 63           | 44,5       | 46,6           | 41,7 | 37,7 | 43,4        | 47,5      | 48,1 | 48,7 | 47,4 | 46,3 |
| TF 3                 | 15960,5          | 69           | 48,3       | 48,0           | 50,2 | 47,2 | 49,8        | 47,4      | 46,7 | 46,9 | 46,5 | 46,3 |
| TF 4                 | 18268,9          | 65           | 42,7       | 47,7           | 43,2 | 43,2 | 52,5        | 46,2      | 43,6 | 44,1 | 43,0 | 44,4 |
|                      | Immission allotr | ent L(IK)    | 52,8       | 52,8           | 52,4 | 49,4 | 55,0        | 52,6      | 52,5 | 52,8 | 52,2 | 51,4 |
|                      | Lower            | deviation    | 0,2        | 2.2            | 0,6  | 6.6  | 4,0         | 1.4       | 1,5  | 1,2  | 0,8  | 1,6  |

In the top section the receivers are displayed with their noise limits and if applicable the base level that needs to be taken into account. The plan value then shows the magnitude of the remaining noise levels under the constraints of the background base level.

In the lower section the industrial areas are listed that were defined in the Geo-Database together with the resulting assessed noise level and the remaining level contingent for each receiver.

Enter the emission allotments for each industrial area. Keep the shift key pressed and click on multiple adjacent areas to jointly assign their source contingents. As soon as the plant value is exceeding, the partial noise level that causes the excess and the receivers that show the problem are marked in red.



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Change the emission allotments of individual partial areas until the part value is not exceeded anywhere.

Using the **POCKET CALCULATOR**, you can reset changed emission allotments to the default setting. The emission allotment of certain subareas can be excluded from the optimization with the checkmark **OPTIMIZE L{EK} OF THIS PART AREA**, for example, if an emission allotment has already been set. The corresponding part areas are shown in bold.

Assign additional emission allotments for all time slices used in the noise assessment.

| Setting                | S              |        |         |                                              |          |            |      |
|------------------------|----------------|--------|---------|----------------------------------------------|----------|------------|------|
| Contents               | Settings       | Rece   | eivers  | Print of                                     | out      |            |      |
| Receiver<br>Display    |                |        |         | S                                            | orting   |            |      |
| $\bigcirc$ ob          | ject numbe     | r      |         |                                              | 🔿 obje   | ect numbe  | r    |
| 🖲 na                   | 🖲 name         |        |         |                                              | 🖲 nan    | ne         |      |
| 🗌 on                   | only decisives |        |         |                                              | () sec   | tor sequer | nce  |
| Column s               | size           |        |         |                                              |          |            |      |
| 🗌 cal                  | lculated       |        |         |                                              | in pixel |            | 50 🚔 |
| -Subareas<br>-Column s | •              |        |         | S                                            | orting   |            |      |
| in pixe                | in pixel       |        |         | <ul><li>object number</li><li>name</li></ul> |          |            |      |
| Column s               | izes for em    | ission | allotme | ents (in                                     | pixel)   |            |      |
| Area r                 | ames           | 100    | \$      |                                              | L(EK)    |            | 80 🚔 |
| Color for              | table head     | lers   |         |                                              |          |            |      |
| Allotment              | names          |        |         |                                              |          |            |      |
|                        |                |        | Time    | slice 1                                      |          | Time sli   | ce 2 |
| Emissio                | on allotmen    | t      | L(EK    | ),T                                          |          | L(EK),N    |      |
| Additio                | nal allotme    | nt     | EK,z    | us,T                                         |          | EK,zus,N   |      |

By default, the receivers are displayed with the name you have entered in the Geo-Database. If these texts are too long, you can also choose the object number for the display instead of the name. Go to **OPTIONS** -> **SETTINGS** to select the display style. If there are several receivers in a sector, you can hide the receivers that are not included in the noise allotment wit **ONLY DECISIVE**.

To make the tables fit the screen or printout if many receivers or many part areas are present, you can specify the **COLUMN SIZES** in pixel for receivers. part areas, and

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emission allotment. In addition, you have the option to let the software automatically determine the column width for the receiver description. The entered column width is considered as the minimum width in this setting.

For the **SORTING** you can select in which order they should be arranged in the table - alphabetically by the object name or by the object number. Receivers can also be sorted according to the order of the sectors.

The **COLOR FOR TABLE HEADERS** can be selected for display and printing. If necessary, the **ALLOTMENT NAMES** of the emission and additional allotments for each time slice can be changed.

#### Deactivate receivers

Individual receivers can be excluded, if there are too many receivers in the allotment table.

| <ul> <li>✓ 1 - 10 1 (F)</li> <li>✓ 10 - 10 10 (D)</li> <li>✓ 2 - 10 2 (A)</li> <li>✓ 3 - 10 3 (B)</li> <li>✓ 4 - 10 4 (C)</li> <li>✓ 5 - 10 5 (D)</li> <li>✓ 6 - 10 6 (E)</li> <li>✓ 7 - 10 7 (E)</li> <li>✓ 8 - 10 8 (E)</li> </ul> |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

Open OPTIONS -> SETTINGS and click on the tab index card Receivers.

## **Update results**

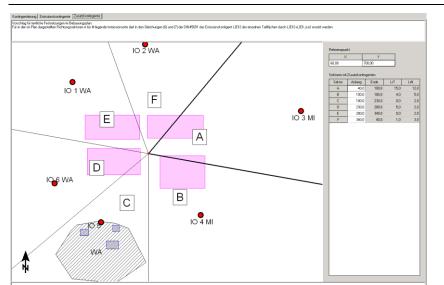
After you recalculated the pre-calculation or the preload and get back to the allotment, you are asked whether you want to update the results. Manually updating the results is possible with **FILE** -> **UPDATE RESULTS** or **Ctrl+ R**.

| ≚ Update or rebuild results |  | × |
|-----------------------------|--|---|
| Action                      |  |   |
| ◯ Rebuild                   |  |   |
| Update                      |  |   |
| Results                     |  |   |
| Precalculation              |  |   |
| Preload noise               |  |   |

If you select **REBUILD**, the results of the pre-calculation and, if present, the calculated preload are reloaded. All manual changes get lost. With **UPDATE** you can

Working on a noise allotment in SoundPLAN

reload the pre-calculation and / or the preload from the results. Manual changes to preload, emission allotments and settings are retained.



## Additional allotments

The reference point is placed in the center of the partial areas and the directional sectors for the additional contingents are split up for each receiver. For the arrangement in the land-use plan, you can set the coordinates of the reference point to even numbers. In order not to accidently move the reference point, you can fix it with the checkbox **FIX REFERENCE POINT**.

The angle segments can be changed, because they represent the different usage areas in the project. The angle segments can only be adapted until the position or the next receiver. In case this should be necessary, please delete the receiver first (at the moment this is only possible in the Geo-Database).

Additional information you could have entered in the Geo-Database (buildings, areas) is shown in the graphical representation in the tab "additional contingents".

#### Background bitmap

For a better orientation you can place a georeferenced bitmap in the background. The existing georeferenced bitmaps are present in the selection list on the top left of the screen.

#### **Object types**

You can change the representation of the single objects as usual with **OPTIONS** -> **OBJECT TYPES**. New object types have been inserted for the noise allotment.

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## **Calculation of Grid Noise Maps**

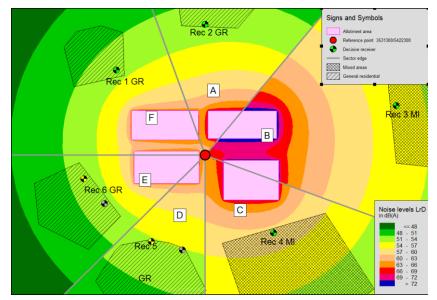
Once the Noise Allotment is finished you can calculate a Grid Noise Map using the allotment results. In order to simplify the handling, the grid noise map is saved under the same number as the pre-calculation and the allotment.

The calculation is started in the program section for "Noise Allotment" under the tab *Calculate Grid Noise Map*". Click on the green arrow to start the calculation. Like in the calculation core the logbook contains vital information about your calculations. It is not necessary to change into the Calculation core to start the calculations, however in the Noise Allotment the noise map is not graphically displayed while it is calculating.

The calculation is done in accordance to DIN 45691 with free field propagation without ground interaction. The calculation times accordingly are extremely short.

## **Display of the Noise Allotment in the Graphics**

As usual, load the noise allotment from the file selection of the graphics, the file type is "Noise Allotment". And additionally, if desired, the Grid Noise Map in the file selection manager.



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## Further processing of the results

You can print the documentation of the Noise Allotment or copy the graphics of the additional contingents and sector lines into the clipboard and paste it in your report. Likewise, you can transport the data about the receivers, industrial areas and additional allotments.

To print the data via SoundPLAN as an annex, select **FILE** -> **PRINT**. Headers and footers can be formatted under **FILE** -> **PAGE LAYOUT**.

You have additional formatting possibilities in the **OPTIONS** -> **SETTINGS**, tab index card "Printout":

| Contents                          | Settings                                                         | Receivers              | Print out           |        |      |          |
|-----------------------------------|------------------------------------------------------------------|------------------------|---------------------|--------|------|----------|
| Print in ov                       | /erall print (                                                   | out                    |                     |        |      |          |
| 🗌 Tab                             | ole A(div)                                                       |                        |                     |        |      |          |
| 🗹 Geo                             | ometry                                                           |                        |                     |        |      |          |
| Receiver                          | names                                                            |                        |                     |        |      |          |
| prin                              | t legend                                                         |                        | on separati         | e page |      |          |
| Columr                            | n count                                                          |                        |                     |        | 1    | •        |
| Font                              |                                                                  |                        |                     |        |      |          |
| Font ty                           | pe                                                               | Ari                    | ial                 |        |      | $\sim$   |
|                                   |                                                                  |                        |                     |        |      |          |
| Scale f                           | actor for fo                                                     | ont sizes              |                     |        | 1,00 | <b>•</b> |
| Scale f<br>Allotment              | actor for fo                                                     | ont sizes              |                     |        | 1,00 |          |
| Allotment                         | iactor for fo                                                    |                        | ft indent           |        | 0    |          |
| Allotment                         |                                                                  | Le                     | ft indent           |        |      |          |
| Allotment                         | itered<br>1 page widt                                            | Le                     |                     |        |      |          |
| Allotment<br>cen<br>fit ir<br>pag | itered<br>1 page widt                                            | Le                     |                     |        |      |          |
| Allotment<br>cen<br>fit ir<br>pag | tered<br>n page widt<br>ne break be<br>allotment                 | Le<br>h<br>stween time |                     |        |      |          |
| Allotment                         | itered<br>1 page widt<br>1 pe break be<br>2 allotment<br>1 tered | Le<br>h<br>stween time | slices<br>ft indent |        | 0    |          |

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## 17 Annex

## Files, created by SoundPLAN

This overview lists the file types, SoundPLAN creates during the project work. The R in the beginning of a file name stands for files generated in the **r**un kernel during the calculation. The extension RES indicates a file in which all information for a calculation run (result) are stored.

## Files in the project folder

#### Project

| i i ojett         |                                                  |
|-------------------|--------------------------------------------------|
| project.sp        | Project settins                                  |
| colors.sgc        | Color favorites                                  |
| objects.got       | Project-Object types                             |
| symbols.sym       | Symbols delivered with SoundPLAN                 |
| user.sym          | User defined symbols                             |
| *.grf             | Geo-reference of background bitmaps              |
| *.~gr             | Backup file of the geo-reference                 |
| project.vpt       |                                                  |
| project.tsd       | Definition of the tile system                    |
| calc.tsd          | Definition of the calculation tile system        |
| CurrentShpDef.sfd |                                                  |
| Geometry          |                                                  |
| *.geo             | Geo-File                                         |
| *.~ge             | Backup of Geo-File                               |
| *.sit             | Situation                                        |
| *.~si             | Backup of Situation                              |
| objdos.bin        |                                                  |
| geofiles.dat      | List of the objects in a project, with object ID |
|                   |                                                  |

Files, created by SoundPLAN

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geofiles.rpt Results RSPSxxxx.res Single point calculation RGLKxxxx.res Façade noise map calculation RRECxxxx.res Calculation results of all receiver caluclations (SPS, FNM, ...) RRLKxxxx.res Grid noise map calculation RSLKxxx.res Cross section map RRLKxxxx.gm Calculation results grid noise map / cross section map RCNMxxxx.res Meshed noise map RWNDxxxx.res Single point wall design precaluclaton Façade noise map wall design precaluclaton RWNFxxxx.res Data of the wall design precalculation RDESxxxx.dat RHOTxxxx.res Hallout calculation RHRKxxxx.res Indoor grid map Indoor single point calculation RHSPxxxx.res RSAKxxxx.res Indoor noise propagation curve Indoor cross section map RSLHxxxx.res RANSxxxx.res Aircraft noise single points RANFxxxx.res Aircraft noise facade noise map Aircraft noise grid noise map RANGxxxx.res RANIxxxx.res Aircraft noise contour lines RRHSxxxx.res Hotspots RRILxxxx.res Grid import of external grid maps RNATxxxx.res Noise allotment Result of a noise allotment RNATxxxx.nat RDGMxxxx.res Digital ground modell RDGMxxxx.dgm Contents digital ground model RPDGxxxx.abs Level charts and level time histograms RRLKxxxx.lt Result of an animated noise map REXPxxxx.abs Data for Expert Industry \*.log Log book of the calculation run Sources RROAxxxx.abs Road emission RRADxxxx.abs Train table railway RRAIxxxx.abs Track related corrections railway RSCRxxxx.abs Source table RS24xxxs.abs Source day histogram RSFQxxxx.abs Source spectrum RCFQxxxx.abs Spectra of the contribution levels

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Files, created by SoundPLAN

| RCONxxxx.abs      | Contribution levels                             |
|-------------------|-------------------------------------------------|
| RFRQxxxx.abs      | Frequencies                                     |
| RGRPxxxx.abs      | Group table                                     |
| RMNDxxxx.abs      | Attenuation table                               |
| RMPAxxxx.abs      | Mean propagation                                |
| Other files       |                                                 |
| *.runx            | Run file                                        |
| *.~run            | Backup of run file                              |
| *.sgs             | Graphics sheet                                  |
| *.~sg             | Backup of graphics sheet                        |
| *.baf             | File for BA Outside                             |
| *.lgs             | File for long straight road (RLS-90)            |
| *.atn             | Attenuations (Expert Industry)                  |
| *.ntd             | Receiver table (Spreadsheet)                    |
| *.bfl             | Area table (Spreadsheet)                        |
| *.bld             | Building table (Spreadsheet)                    |
| *.fmt             | Format file for the page layout                 |
| RWNDxxxx.set      | Settings for wall design single points          |
| RWNFxxx.set       | Settings for wall design facade noise map       |
| *.pli             | Measurement values imported to the graphics     |
| RROPxxxx.gm       | Stored result of a grid noise map operation     |
| RRECxxxx.trx      | Iteration steps of meshed noise maps            |
| DBTrackxxxx.trk   | Animation track railway                         |
| TempWork.abs      | Temporary file if the GeoDB is open             |
| *.elg             | Binary stored elevation data in grid structure  |
| *.elv             | Binary stored elevation data as point clouds    |
| FileInfo.bin      | Information about the original elevation points |
| FilterLogBook.log | Log book of the elevation filter                |
| FResInfo.bin      | Information about the filtered elevation points |
| ElevInfo.bin      |                                                 |
|                   |                                                 |

## Files in the Globdata folder

| project.sp       | Project settings for new projects                                                                     |
|------------------|-------------------------------------------------------------------------------------------------------|
| project.bak      | Backup copy project settings if the country settings have been changed                                |
| ASCII2GeoDB.abs  | Column assignment for the ASCII Import                                                                |
| Dbase22GeoDB.abs | Column assignment for the ESCRI Shape Import                                                          |
| GeoDBObjExtabs   | Settings for the display of the object properties for Property Explorer, object info and shape export |

Files, created by SoundPLAN

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| GeoDLL.abs     | Coordinate and reference systems                                                                                                                                           |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *.ntt          | Template receiver table (Spreadsheet)                                                                                                                                      |
| *.bft          | Template area table (Spreadsheet)                                                                                                                                          |
| *.fmt          | Format file for the page layout (Results table and<br>Spreadsheet as well as noise allotment, emission<br>documentation road / railway, long straight road, BA<br>Outside) |
| TAB_LAYOUT.fmt | Format file result table which is used for new tables                                                                                                                      |
| *.sgt          | Template graphics sheet                                                                                                                                                    |
| *.sge          | Single elements of a graphics sheet (old: sgb)                                                                                                                             |
| *.scc          | Color scale                                                                                                                                                                |
| *.sgc          | Color favorites                                                                                                                                                            |
| PCList.vrl     | List of the network PCs used for distributed computing                                                                                                                     |
| DUPCList.vrl   | List of the network PCs used for "distribute updates"                                                                                                                      |
| *.log          | Calculation log book                                                                                                                                                       |
| SERVER*.txt    | Protocol distributed computing (Server)                                                                                                                                    |
| CLIENT*.txt    | Protocol distributed computing (Client)                                                                                                                                    |
| Picdoc.fpd     | Photo documentation                                                                                                                                                        |
| RBLayout.lot   | Layout types BA Outside                                                                                                                                                    |
| ExpInd.set     | Window assignment (detail windows) Expert Industry                                                                                                                         |
|                |                                                                                                                                                                            |

## File Names of the Libraries

## General

| Absor.abs    | Absorption library                             |
|--------------|------------------------------------------------|
| Assess.abs   | Assessment library (Assessments)               |
| Gebiete.abs  | Assessment library (additions for area usage)  |
| Zbdef.abs    | Assessment library (definition of time slices) |
| Atten.abs    | Attenuation library                            |
| Attengrp.abs | Groups for attenuation library                 |
| Emis.abs     | Emission library                               |
| Emisgrp.abs  | Groups for emission library                    |
| Riwi3d.abs   | 3D directivity library                         |
| Riwi.abs     | 2D directivity library                         |
| Time.abs     | Day histogram library                          |
| Traffic.abs  | Road day histogram library                     |
| Trans.abs    | Transmission library                           |
| Transgrp.abs | Groups for transmission library                |

Files, created by SoundPLAN

#### Standard dependent

| Aircrafts.abs      | Aircraft classes (only system library)        |
|--------------------|-----------------------------------------------|
| MeteoStat.abs      | Meteorological station (air pollution)        |
| N2ktraf.abs        | Road day histograms for Nord2000              |
| N2kvehicles.abs    | Vehicle categories road emission Nord2000     |
| N2kWeather.abs     | Weather statistics Nord2000                   |
| N2kwind.abs        | Meteorological parameters Nord2000            |
| Nmpbmet.abs        | Meteorology NMPB96                            |
| Nor2kRoad.abs      | Vehicle categories road emission Nord2000 old |
| Roadsurf.abs       | Road surfaces Nord2000                        |
| Stoffe.abs         | Library of air pollutants                     |
| Tcrn.abs           | Train table CRN                               |
| Thurail.abs        | Train table Hungarian rail                    |
| Tjaprail.abs       | Train table Japanese rail                     |
| Tn2krail.abs       | Train table Nord2000                          |
| Tnmt.abs           | Train table NMT                               |
| Tnmveh.abs         | Vehicle categories road emission TNM          |
| Toeal30.abs        | Train table ÖNorm 305011 part 1               |
| TOeAL30TT.abs      | Train table ÖNorm 305011 part 2               |
| Trmr2002.abs       | Train table RMR 2002                          |
| Ts03.abs           | Train table Schall 03 1991                    |
| Tsemibel.abs       | Train table Semibel                           |
| TSFRA2005.abs      | Train table FRA 2005                          |
| TSS03_2006.abs     | Train table Schall 03 2006                    |
| Tssncf.abs         | Train table NFS 31-133                        |
| Tsvbusch.abs       | Train table VBUSch                            |
| Ttrapid.abs        | Train table Transrapid                        |
| VehCatFRA2005.abs  | Waggon categories FRA 2005                    |
| VehCatS03_2006.abs | Waggon categories Schall 03 2006              |
| Wind.abs           | Wind statistics for ISO 9613 (Germany)        |
|                    |                                               |

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## Implemented standards

A list of the guidelines implemented and tested in SoundPLAN is provided on the DVD and can be found in the online help.

SoundPLAN is a standard-based software. Each standard implemented in SoundPLAN undergoes an extensive testing process to ensure the correct implementation of the formulas in SoundPLAN and the consistent quality of the calculation results. If available, the test tasks of the guideline manufacturers are

Implemented standards

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used. If there are no official test items, SoundPLAN GmbH or a SoundPLAN distributor creates test cases to check the correct implementation of the guideline. With each update, all official and own test tasks are automatically checked. An update is only made available on the Internet if there are no justified changes in the calculation results compared with the previous update.

## Coordinate and reference systems worldwide

The coordinate and reference systems of the different countries are implemented in SoundPLAN using the file GeoDLL.abs developed by Killetsoft including a large number of worldwide coordinate and reference systems. In order to keep the coordinate system selection list manageable, the systems are preselected with the coordinate systems in different countries and displayed according to your country settings. Select additional systems or deselect not needed systems in the SoundPLAN Manager via OPTIONS -> SETTINGS, branch *Global*, items COORDINATE SYSTEMS and REFERENCE SYSTEMS. After activating the needed systems, they are displayed in the selection list.

| Coordinate system: | UTM coordinates (northern hemisphere)                                                                   | <b>-</b> |
|--------------------|---------------------------------------------------------------------------------------------------------|----------|
| Reference system:  | Geographic coordinates (Greenwich) [gon]<br>Geographic coordinates (Greenwich) [sec]                    | @        |
| False easting:     | GEOREF-Code (Aircraft Navigation)<br>Plate Carrée equirectangular coordinates                           |          |
| False northing:    | QTH-Code (Maidenhead)<br>UTM coordinates (northern hemisphere)<br>UTM coordinates (southern hemisphere) | E        |
| Stripe / zone:     | UTMref (MGRS) coordinates                                                                               | -        |

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