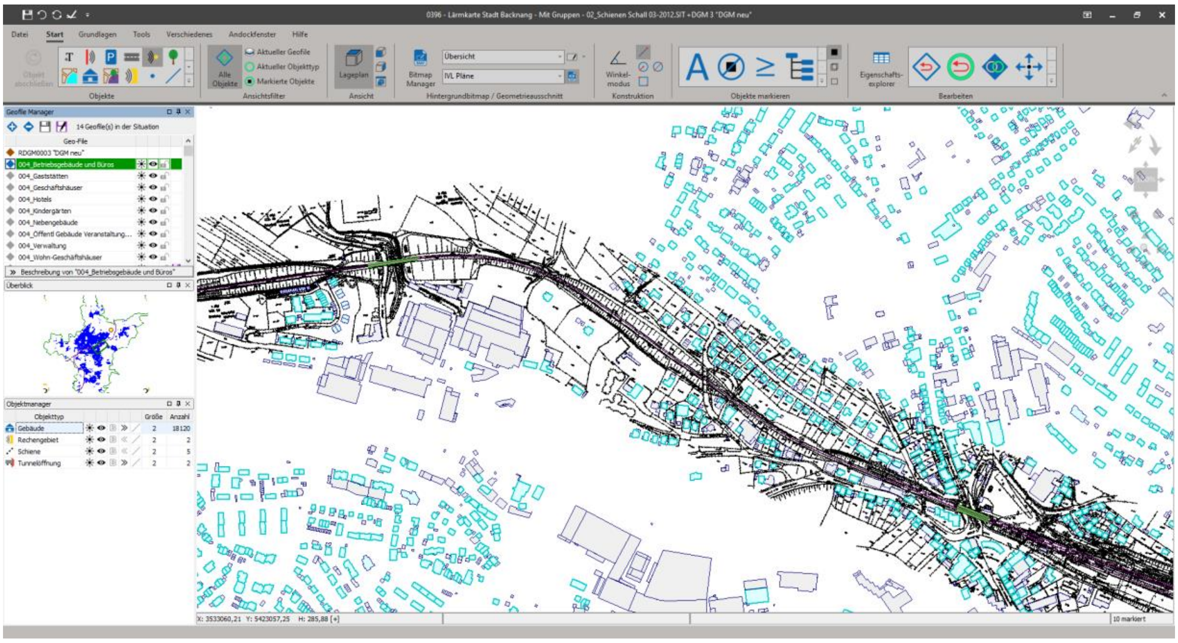
SoundPLANnoise 9.0

Manual



SoundPLAN GmbH
January 2023

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EULA
Please find the current End User License Agreement (EULA) in the download section of our website www.soundplan.eu/en/downloads.

SoundPLANnoise 9.0 - 2023

The orange dot at the beginning and end of a section indicates additional possibilities with Cartography.

Table of contents

1 Installation and Service

New installation

Multiple SoundPLAN versions can be installed on one computer so that the previous version does not need to be uninstalled. In addition, the 32-bit version and the 64-bit version can be installed in parallel.

Even if you have a 64-bit operating system, in addition to the 64-bit version, we recommend that you also install the 32-bit version for editing, as it is less sensitive to numerical problems. Both versions are mutually compatible, so that projects can be edited with SoundPLAN (32 bit) and calculated with SoundPLAN (64 bit).

The installation files for SoundPLAN are supplied on DVD or as a USB stick. Additionally, you need a Hardlock / HASP and a license file for the installation.

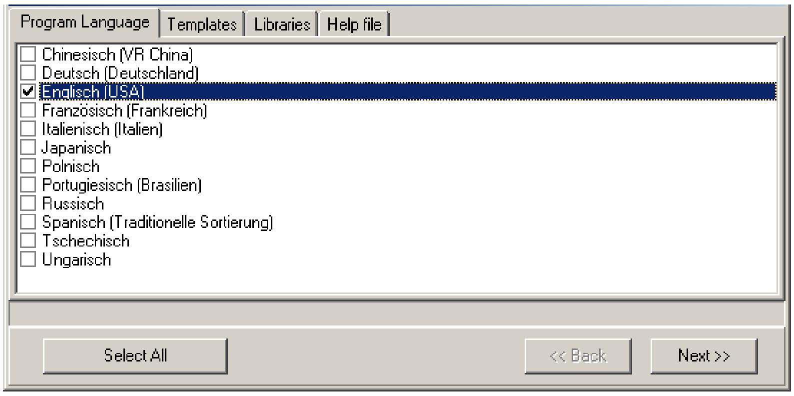
The DVD has an autostart function which automatically calls the browser. Via the browser you start the installation and you can also view more information about SoundPLAN. The manual and help are copied to your computer during the installation. Demo projects can be copied after the software installation. It is sensible to install "Wincity", as software innovations are regularly presented in this project.

Log in as administrator for the installation.

- Plug the supplied Hardlock / HASP onto a USB interface.
- Save the license file you received as an email attachment to your hard drive.
- Insert the SoundPLAN DVD and call up SoundPLAN **NOISE** - **INSTALL SOUNDPLAN** in the DVD browser.

The installation program will guide you through the installation.

Templates (default settings of standards and time slices, templates for tables and graph sheets) and libraries for the requirements of different countries are included, and program interface and online help / manual are available in several languages. Select which language and country settings you want to install. The language selection is pre-initialized with the language and country settings of the Windows version, but you can turn on additional languages.



When you first start the program, you specify which language and country settings are to be accessed in your user profile - the setting can be changed in the SoundPLAN Manager at any time.

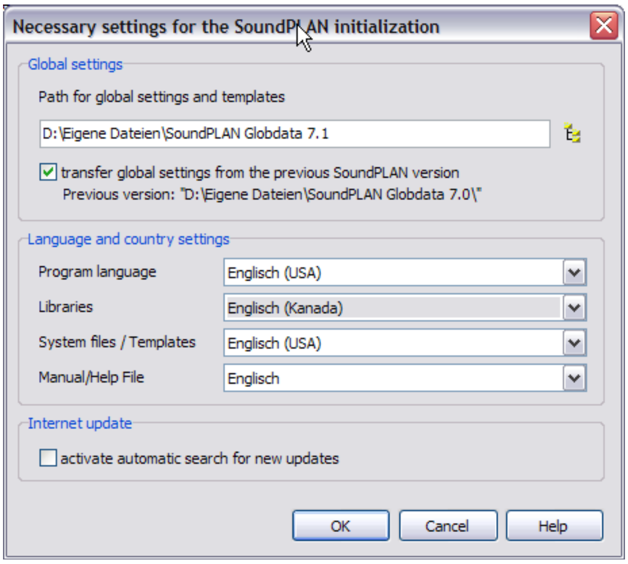
To complete the installation, the license file (BAB*xxxx.007) is required. Specify the path and click OK, SoundPLAN will now transfer your program licenses.

During installation, a check is made to see whether an older SoundPLAN version is available. If so, a valid license file is searched for on the hard disk and offered for selection.

Call up SoundPLAN via "Start | All Apps".

First program start

Fill in the settings for initializing SoundPLAN when you start the program for the first time:

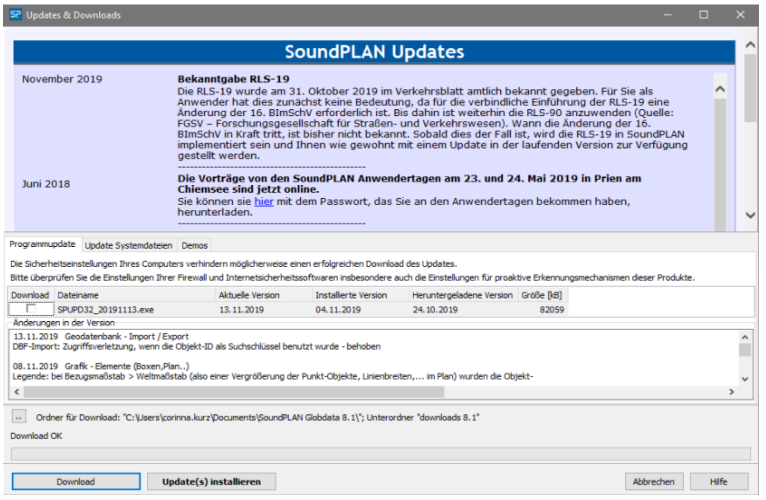


If an older SoundPLAN version is installed on the computer, you can copy your existing GlobData directory from the previous version. If you have adjusted the global settings (object types, colors, libraries, templates, etc.) it is sensible to copy the files to the new GlobData directory, if not, it is better to start with new settings taken from the system directory. It is also possible to copy individual files to the new GlobData directory using Windows Explorer.

Installing software and system updates

For the installed SoundPLAN version, updates of the software as well as the supplied system files such as libraries or templates, help and manual and the demo projects are available on the Internet. In the SoundPLAN Manager you can access this data via **HELP | UPDATES & DOWNLOADS.**

Updates & Downloads offers important information for you in the upper area, in the lower area the version history, i.e. what improvements are included in the latest update.



SoundPLAN analyzes the files installed on your computer and displays the date of the installed and available data. As soon as the files are newer on the network, they are automatically marked with a check mark for download. You can still decide for yourself whether you want to update your system or download additional files by turning the checkmarks on or off accordingly. For example, you can install templates and libraries of another country for a specific project.

Use the button with the two dots to define a path where the software updates and the system files are to be saved. By default, the data is stored in the SoundPLAN Globdata, subdirectory Download.

To install the updates, make sure you have administrator rights. Click **DOWNLOAD**. The files are copied to the download folder you selected. Then click on **INSTALL UPDATES.** Before the SoundPLAN update is installed, you can open and save the Readme file and change the installed program languages. Click OK to install the update.

You can also use the download path to store the data in the network, for example to distribute updates and system files to several computers (see "Distribute updates and system files", page 22).

In the SoundPLAN Manager you can use **HELP | UPDATE SYSTEM FILES TO** update system files that have been downloaded externally and stored in the Globdata directory in the Downloads subfolder.

License update

A license update updates the license information of your version, for example, if you purchase additional modules. You will receive this license file as an attachment by e-mail. Copy the license file (BAB? xxxx.007) to your computer and call up the license update via **START | ALL PROGRAMS | SOUNDPLAN X.X | SOUNDPLAN LICENSE UPDATE.** Specify the location of the new license file and click OK.

Notification of new updates

When you start the program for the first time, you can select whether to check for new updates on the Internet.

You can change the selection in the program settings (**OPTIONS | SETTINGS,** node *Basic settings*).

Heret you can also define the settings for a proxy server.

Install network license

In addition to the single user license, where the Hardlock / HASP (dongle) is attached to the workstation computer, there is the network license, where the HASP is attached to any computer in the network (license server PC) and the workstation computer no longer needs a dongle. The license server PC manages the license(s). When a workstation computer requests a license, it is deducted from the license pool on the license server PC.

As many workstations can work with SoundPLAN at the same time as there are licenses on the license server PC.

The network license can also be accessed via VPN (virtual private network) from outside (for example, from home).

An additional (chargeable) option of the network license is to borrow a license in order to work with SoundPLAN for a limited time independently of the network (for example, on the road). In doing so, a license is taken from the license pool. When the borrowed license is returned, it is available again in the license pool. The borrowing function can also be additionally activated at any time later, independently of the installation.

Installation of the license server PC

Any computer on the network can be used as a license server; preferably this should be a computer that is always switched on. HASP drivers are installed on the license server, through which communication with the workstation computers is handled, regardless of the SoundPLAN version. This means that the installation of the license server PC only has to be done once.

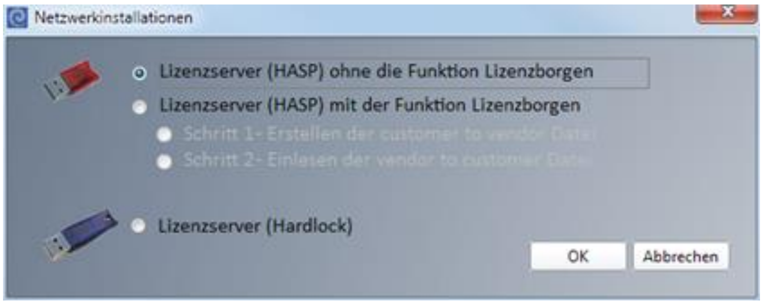
1. log in as administrator

Plug the HASP HL Net Key into the license server.

Install the HASP drivers:

To do this, insert the SoundPLAN DVD and call up the **NETWORK INSTALLATIONS IN** the DVD browser under **SOUNDPLAN NOISE / AIR.**

Select **INSTALL LICENSE SERVER** and there **LICENSE SERVER (HASP) WITHOUT THE LICENSE** Borrowing **FUNCTION.**



Click OK to start the driver installation. Follow the installation instructions of the HASP drivers.

To monitor and diagnose the installed HASP HL Net Key, the ***Admin Control Center*** can be used, which was installed together with the HASP drivers. It is a web browser based application and is accessed in SoundPLAN Manger via **HELP | LICENSE INFORMATION** or directly in the web browser with http://localhost:1947/.

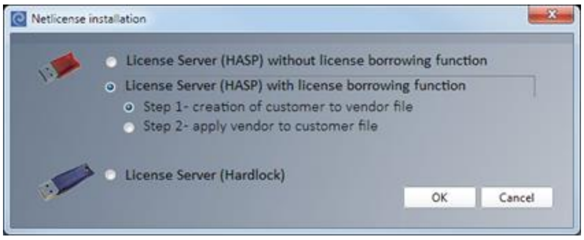
Activate additional option "Borrow license

The license protection is an additional functionality of the HASP network license. It must be activated once on the license server PC and is independent of the actual installation.

Important: The license for borrowing is bound to the computer selected as the license server PC and cannot be moved to another PC later (or only with great effort).

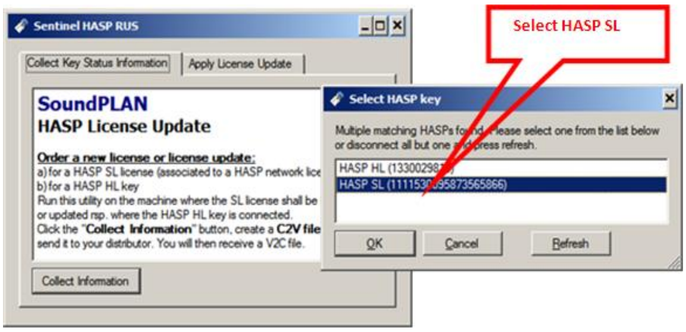
Log in as administrator.

Insert the SoundPLAN DVD and call up the **NETWORK INSTALLATIONS IN** the DVD browser under **SOUNDPLAN NOISE**. Select **INSTALL LICENSE SERVER** and there License **SERVER (HASP) WITH THE FUNCTION BORROW LICENSE, STEP 1.**



Click OK, the driver installation is performed and the HASP update program is invoked, the *Collect Key Status Information* tab is active.

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



Select the line where the **HASP SL** Key is located and click OK.

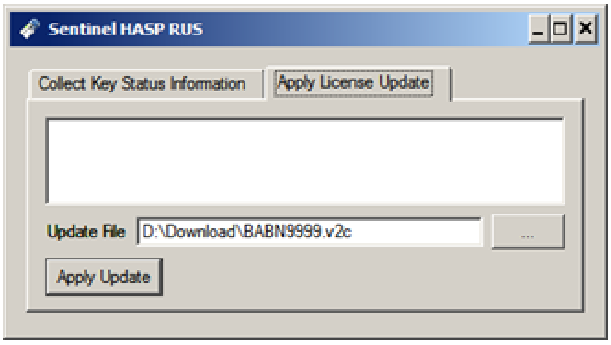
In the following **SAVE AS** dialog an information file is created from the key status. The file has the file extension c2v. Please enter BABN and the four-digit license number as file name, for example BABN1234. The file extension will be appended automatically.

! **Send this file, in our example BABN1234.c2v, by email to marketing@soundplan.de. In** the email, specify the number of boron licenses you want. This can be maximum the number of your network licenses.

We will send you back an activation file (BABN1234.v2c) and an updated license file BABN*.007.

Save both files on your computer and call up the **NETWORK INSTALLATIONS** again via the SoundPLAN DVD browser **SOUNDPLAN NOISE / AIR.**

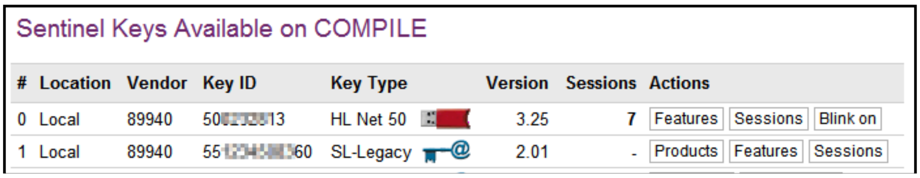
Select **INSTALL LICENSE SERVER** and there this time **LICENSE SERVER (HASP) WITH THE FUNCTION BORROW LICENSE, STEP 2.** Click OK, the HASP Update program will open. There go to the *Apply License Update* tab.



 Use the radio button to select the activation file (BABN1234.v2c); then click **APPLY** Update.

Access the **Admin Control Center** in the Internet browser using http://localhost:1947/ to enable borrowing.

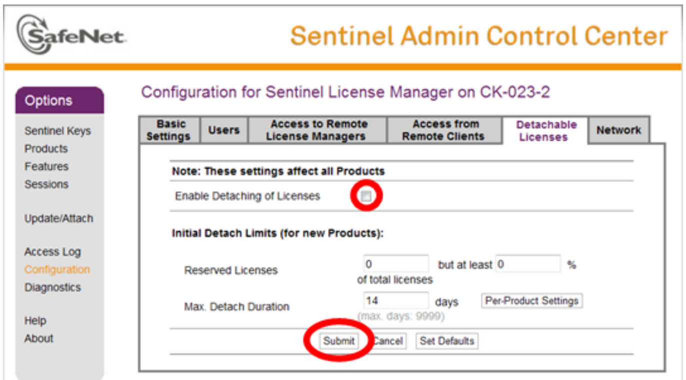
The list of **Sentinel Keys** should now show your **HL Net key** and an **SL license:**



Sentinel Keys Available on COMPILE

#	Location	Vendor	Key ID	Key Type	Version	Sessions	Actions
0	Local	89940	50[redacted]13	HL Net 50	3.25	7	Features Sessions Blink on
1	Local	89940	55[redacted]60	SL-Legacy	2.01	-	Products Features Sessions

On the left side of the Admin Control Center, click **CONFIGURATION** and then click the *Detachable Licenses* tab.



ACTIVATE ENABLE DETACHING OF LICENSES there and activate the function with **SUBMIT**.

Change license server

If the license server is to be changed, the HASP drivers and the HASP HL Net Key must first be installed on the new server PC, see "Installing the license server PC (page 18)".

As a rule, the HASP HL Net Key is then automatically recognized by the client PCs. If this fails, the configuration settings in the ACC must be checked, see section "Troubleshooting (page 21)".

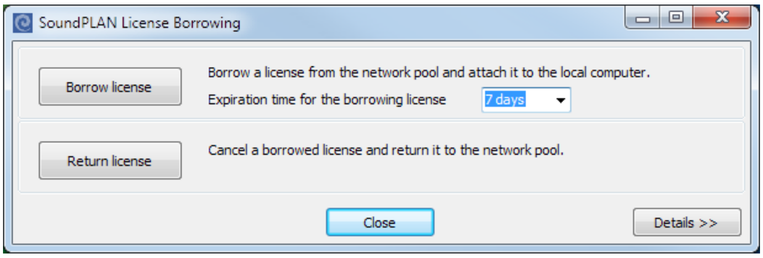
Installation on the work PC

Install SoundPLAN as described in New installation (page 15). The license file in this case is a BABNxxx.007. The workstation must be connected to the network during installation.

If SoundPLAN is already installed on the computer, it is sufficient to import the network license file via a license update (page 17). If the borrowing function has been activated, the BABNxxxx.007 sent with the activation file must be imported to the workstations via the license update (Page 17) to the workstations. A SoundPLAN workstation can also be installed on the license server PC itself.

Borrow license

To borrow a license, call **HELP | BORROW NETWORK LICENSE** in the SoundPLAN Manager.



BORROW LICENSE: Transfers a license from the network pool to the computer. This reduces the number of available network licenses. The transferred license is valid for the selected period, unless it is returned early.

RETURN LICENSE: If you decide to return a borrowed license before the regular time expires, you can transfer the license back to the network license pool.

After transferring a license:

- SoundPLAN must be restarted to log into the borrowed license.
- If you have disconnected the computer from the network, you should wait 1-2 minutes before restarting SoundPLAN. The license manager needs some time to recognize the new status. Otherwise, a connection error may be displayed.
- SoundPLAN logs into a local borrowed license with priority, even if there is a network connection. To log back into the network license, the borrowed license must be returned beforehand.

Click **DETAILS IF YOU** need more detailed information about the status of the network licenses. For example, if you get a message that there is no license available for borrowing, you can look there to see which computers have just borrowed a license.

Troubleshooting

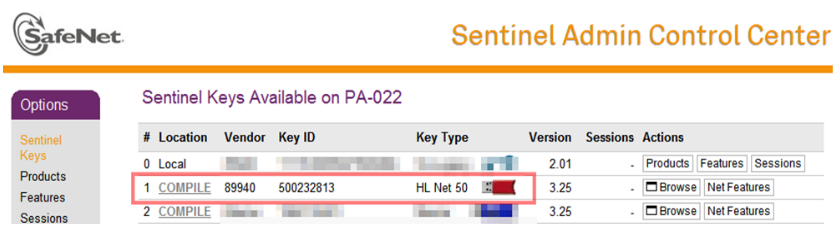
If you have installed the network license and the installation of SoundPLAN on the workstations fails (e.g. with the error "Setup Error 1130,7"), then it may be that the HASP HL Net Key plugged into the license server is not recognized on the workstation.

In this case, check the settings in the **Admin Control Center**.

Open the ***Sentinel Keys*** list in the ACC of the client PC:

http://localhost:1947/_int_/devices.html.

The SoundPLAN HL Net Keys should be displayed as follows; Vendor ID is 89940.



If the SoundPLAN HL Net Key is not displayed, then go to the configuration page:

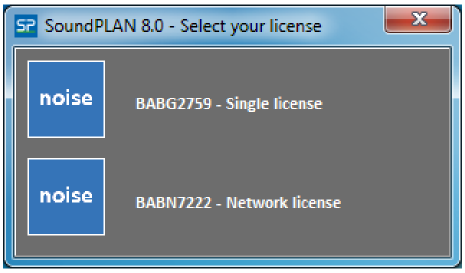
- Select the "Access to Remote License Managers" page
- Set the marks as indicated.
- Enter the computer name or IP address of the server PC in the Specify Search Parameters field.
- Confirm with "Submit" to activate the changes; wait a few seconds.

Check the "***Sentinel Keys***" list again: if the HL Net Key is displayed, it is also recognized by SoundPLAN.

If there are still problems, please send us the file ***update.log*** (to be found in the directory ***C:\Program Data\SoundPLAN***) and a report of the diagnostic page (**Fehler! Linkreferenz ungültig.**) of the PC concerned.

Additional notes

Several different licenses can be installed on a workstation PC (Hardlock, HASP, network license). A license selection is then offered at startup.



For each license file that is to be installed, the license update must be performed separately.

Install updates on multiple computers at the same time

The "Distribute SoundPLAN Updates" program allows you to install an update and updated libraries, system files/templates and manual/help (system update) on any number of computers in the network simultaneously from one workstation. Since the program is installed as a service, no administrator rights are required to install the updates afterwards.

Distribute updates and system files

Call up **DISTRIBUTE SOUNDPLAN UPDATES** via "Start | All Apps | SoundPLAN xx".

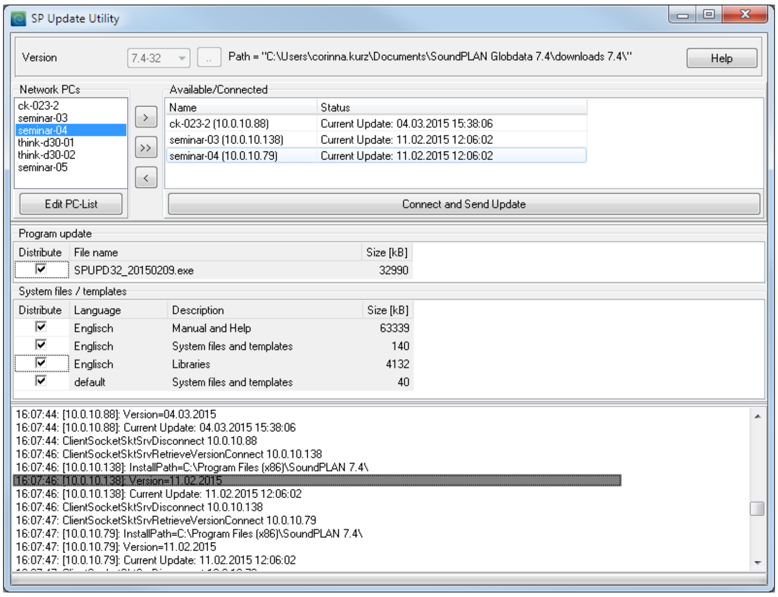
Download the latest update via **UPDATES & DOWNLOADS** in the Help menu of the SoundPLAN Manager or from the external update page in Distribute updates via the **GET UPDATE** button. User name and password for the external update page can be obtained from the SoundPLAN Hotline. When downloading from the SoundPLAN Manager, updated system files (templates, libraries, ...) are automatically downloaded as well, from the external site you have to download the system files separately and unpack the file so that the zip files for the individual system components and languages are in the folder. **It is in any case sensible to install system updates as well.**

Always save the updates downloaded from the Internet in a specified folder on a specific computer. (This folder does not have to be created on the computer from which you distribute the updates, it can be any computer on the network).

Set the path where the updates were saved via the button with the two dots. The path is displayed in the dialog and saved separately for each SoundPLAN version.

Use **NETWORK PCS | EDIT PC LIST TO ENTER** the computer names or IP addresses of the computers that are to receive an update. You can use Network PCs **| SEARCH TO** list all the computers logged on to the network (this may take a long time if the network is large). Computers for which you do not want to install an update can be removed from the list using **EDIT PC LIST.**

The arrow icon selects the selected computers for installation, the double arrow selects all listed. Select which system files should be installed in addition to the update.



Note: In case the connection to the PCs on the network is not successful (nc in the cell „status“ it might be necessary to allow the program **SPDistributeUpdates.exe** as an exception in the firewall.

From the table, select which updates and system files to install.

Click **CONNECT AND INSTALL UPDATES**. Once the installation has been successful, the new update version that was installed is displayed after the computer names. If the old update date is displayed, the connection was successful, but the update could not be installed for some reason (for example, because SoundPLAN is open on this computer). See the log for details. Errors are listed in red.

The distributed computing control is automatically closed for the update installation and reopened after the update. Automatic installation of updates also works for computers that have demo versions installed for distributed computing.

Parameters for unattended installation

x.x stands for the SoundPLAN version, e.g. 9.0

xxxx stands for the BABG/BABN number

yyyymmdd represents the date of the update you want to install.

New installation

Calling program

The calling program is the "Install32SPx.x.exe".

Note: In the installation downloaded from the website, the two required installation files ("Install32SPx.x.exe" and "Lfiles.zip") are zipped again. For unattended installation, unzip this file with a suitable program (e.g. 7zip), otherwise a message will appear that cannot be suppressed by the program.

/LANGUAGE=<LocaleID>

The program language to be installed must be entered as a local ID from Microsoft. A list of language IDs can be found on

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

1033 would be EN_US
1031 would be DE_DE

/LANGUAGE=1031

/BABG=<FileDescriptor>

The specification of the license file to be used. The specification must contain the file path and file name, as well as the file extension. If the path contains spaces, you must enclose it in quotation marks.

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

/S

The parameter indicates that you want a windowless installation.

/D=<PathDescriptor>

The specification of the installation target directory. The specification must describe a folder. If the path contains spaces, you must enclose it in quotation marks.

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

Example

"D:\Install SP\Win32\Install32SPx. x.exe" /LANGUAGE=1031 /BABG="C:\My folder\BABGxxxx.007" /S /D="C:\Program Files (x86)\SoundPLAN x. x\"

Update installation

Calling program

The calling program is SPUPDxx_yyyymmtt.exe with path.

D:\Updates\SPUPD32_20170101.exe

/LANG=<LocaleID>

The program language to be installed must correspond to a Microsoft local ID in which SoundPLAN is present.

1033 would be EN_US
1031 would be DE_DE

/LANG=1031

/SILENT

The parameter indicates that you want a windowless installation.

Example

"D:\Updates\SPUPD32_20170101.exe" /LANGUAGE=1031 /SILENT

System updates

Calling program

The calling program is the "SPUpdlic.exe" installed with SoundPLAN in the program directory.

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

/SILENT

The parameter indicates that you want a windowless installation.

/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 was installed.

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

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\"

Software and hardware recommendations

SoundPLAN supports both multi-core computers and multi-processor PCs. Each processor of a multiprocessor PC can have multiple cores.

For new PCs, we recommend purchasing the latest **processor type** but not the fastest processor in this series, as this is often still too expensive. With a slightly slower processor you get a much better price/performance ratio.

Since the pre-calculations in the calculation core (emission calculation, DGM edge search, preparing buildings ...) cannot be executed in parallel on several cores, processors with a high base clock speed or a high overclocking (Turbo Boost) are particularly powerful. Therefore, both clock speed and the number of cores/threads are important.

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

SoundPLAN is always executable with the current operating system. Should software adaptations be necessary, these will be provided at short notice.

For the **graphics card**, **hard disk**, **RAM memory** and **monitor,** we recommend making the decision in the same way as for the processor: Choose the best hardware available at a reasonable price. The screen should have FullHD resolution to display all dialogs in a sensible way.

1 GB of **RAM** per thread should be included. The **graphics card** must support OpenGL 4.1 and should have its own memory, since the 3D speed of so-called "onboard graphics cards" is rather weak.

A **second monitor,** for example, for 3D Graphics and connection to online map services (OpenStreetMap, Google Maps, WMS Server) is highly recommended.

2

2 SoundPLAN Manager

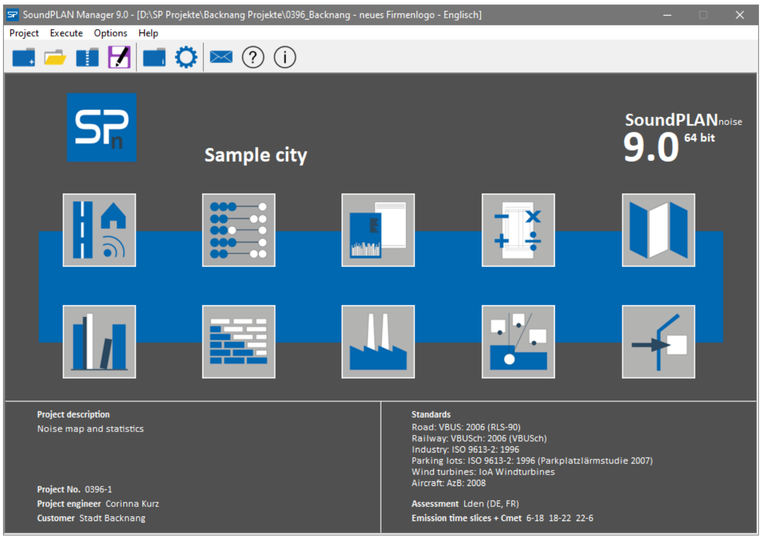
SoundPLANnoise consists of several individual program parts which together make up the power of SoundPLAN. One advantage of the division into individual programs is that you can, for example, calculate one variant and simultaneously edit a second variant in the Geo-Database or already format the map displays. Of course, this is also possible across projects.

Data organization

In SoundPLANnoise, a separate project folder is created for each project. This guarantees that all data belonging to a project is also stored together. This procedure facilitates efficient project management for you and your colleagues.

You can create new file folders as well as new project folders in the SoundPLAN Manager or convert file folders into project folders. This makes it possible to create order within SoundPLAN projects as well, for example by creating a separate folder for each employee or by initially grouping larger projects that contain different sub-areas in a common file folder.

Functions of the SoundPLAN Manager



The SoundPLAN Manager is where the project threads come together. At a glance you can see information about your project as well as the selected calculation standards. Here you create new projects, select existing projects and invoke the different program parts of the SoundPLAN program group.


As soon as you move the mouse over an area in the lower part of the SoundPLAN Manager where you can change settings, the mouse cursor changes to a hand so

that you can quickly access the relevant information, e.g. changing the selected standards or expanding the project info.

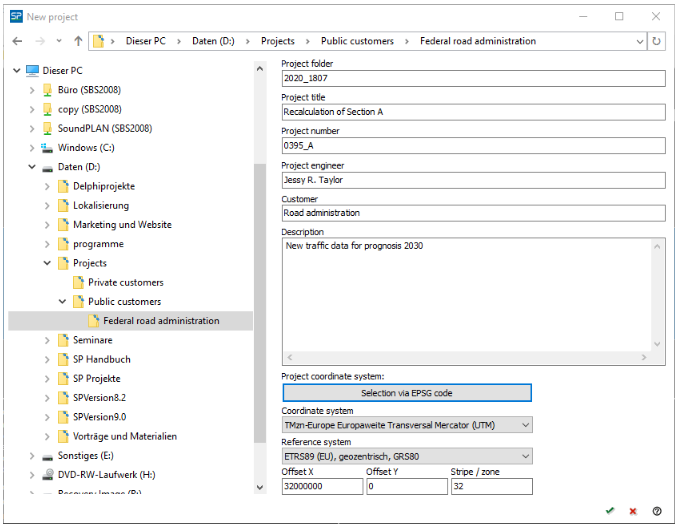
In the help menu you have access to the SoundPLAN website, you can also send a support request directly to your local distributor.

Create new project

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

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

Create a new SoundPLAN project with **PROJECT | NEW** or the corresponding symbol button.



Select the path where you want to save the project. You can create new subfolders in the tree on the left to structure your projects.

Enter the name of the project folder. If you do not enter a separate project title, the project folder name is automatically taken as the title.

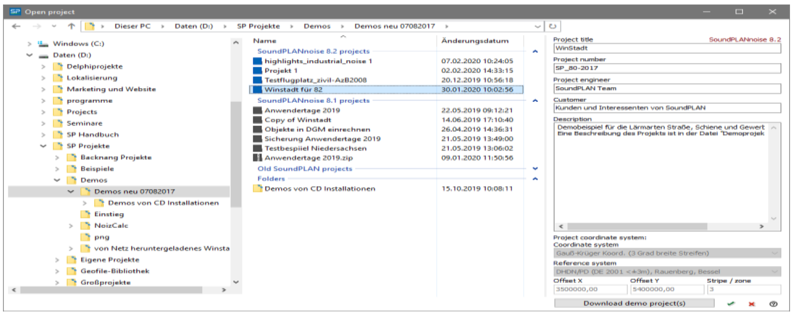
It is up to you to fill in the project number, project engineer, and client, however you can use this information as text variables later in tables and maps for automatic labeling.

You can save your own information about the project in the **DESCRIPTION**, for example telephone numbers of contact persons or notes about the project status. The project info can be extended during the project history.

You can already select a project coordinate system when creating the project, see Project coordinate system (page 31). With OK the project is created.

Open project

The last edited project is automatically loaded when the program starts. You can open another project via **PROJECT | OPEN.**



SoundPLAN projects are specially marked in the list. Depending on the version, these are different blue or gray folders. Gray folders are projects that were edited with an older SoundPLAN version and must be converted before opening with the current version. Blue folders are those of the current version. If there are projects with a "one-way symbol" in the list, these are projects that have already been converted to a newer version than the one used. In addition, the usual yellow folders may also be present in the project directory. In the info field on the right, the project description and the version number are displayed for SoundPLAN projects.

SoundPLAN projects can be accessed by double-clicking or by clicking on the green check mark.

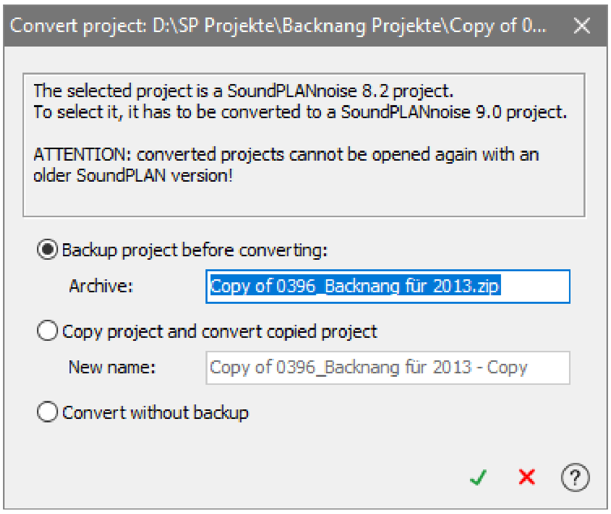
Windows folders can be converted to SoundPLAN projects via the right mouse button **| CONVERT** if, for example, you have already stored data for the import in a folder.

Note: If opening takes a long time, you can limit the working directories that are searched for projects, see *Working directories (page 36).*

Convert projects for new versions

If you want to open a SoundPLAN project with a newer version, you will be asked to convert it. This is necessary because data structures also change with new versions. Converted projects can no longer be opened with older versions.

Specify how you want to proceed with the conversion:



Depending on the settings, the project is first packed or copied. Then the files are converted. This can take a few minutes.

Copy, delete, paste and pack projects

Within the “Open dialog” right click on a project folder to copy, paste, delete and rename, pack and extract projects. Some functions are not always accessible, for example "Paste" is only active if a project has been copied before.

Project Info

The project info is displayed at the bottom left of the SoundPLAN Manager. It can always be supplemented or extended during the project history, for example to enter contact persons, the progress of the project or deadlines. Click on the description or select **PROJECT | PROJECT INFO**.

Save project as

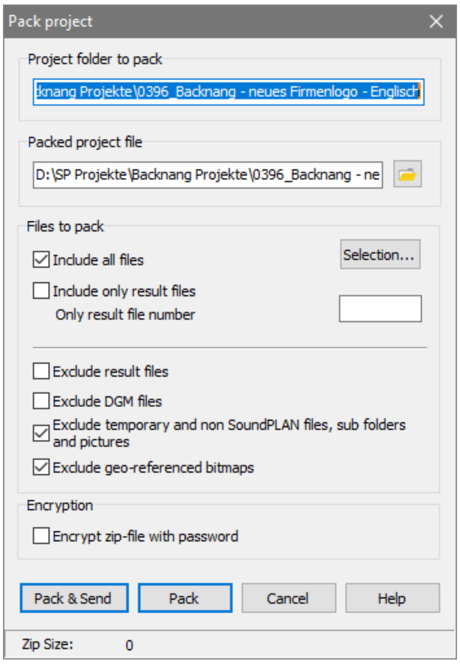
You can create copies of projects via **PROJECT | SAVE AS**.

Pack projects

For space-saving data backup or sending project data, SoundPLAN offers you the possibility to compress projects in the SoundPLAN Manager. Call **PROJECT | PACK**.

Click the **FOLDER SELECTION** icon and specify the location to save the packed project in a different path than the one suggested.

If you want to send a project to an overseeing authority or to the hotline, there are often files in the project that do not need to be sent along. To keep the packed file as small as possible, you can specify which files should be saved in the archive and which should not.



The setting **EXCLUDE TEMPORARY AND NON-SOUNDPLAN FILES, SUBFOLDERS AND PICTURES** should be checked when you send a project to the hotline. The bitmap for tiling projects is recognized and included.

The combination **ALL FILES** and **NO RESULTS FILES** packs all files except the results, for example if you want to discuss a Graphics or input problem with the support.

If a specific result of a large project is to be checked, you can send this one result as a separate email with **ONLY RESULT FILES** and the specification of a calculation run number.

After the project has been packed, the size of the zip file created is displayed at the bottom of the input mask. The **PACK + SEND** button copies the packed project directly into the attachment of an email to send it project to your SoundPLAN support address (or any other address).

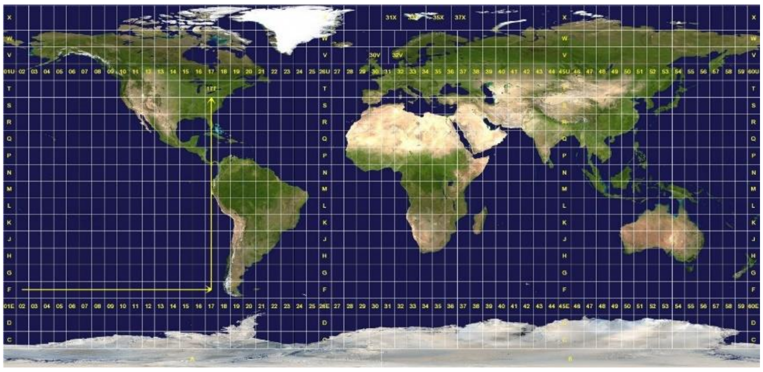
2

Coordinate and reference systems

The coordinate reference system (CRS) is described by a coordinate system (e.g. UTM, ...) and a reference system (e.g. ETRS89, WGS84, ...).

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

Geodetic coordinate systems like UTM are divided into zones or stripes. With 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.



Overview grid of UTM zones

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

A missing zone or strip specification can lead to distortions and incorrect transformations!

It is best to use EPSG code (page 32) to enter the coordinate system.

The website https://www.geoplaner.com offers a very helpful converter to different coordinate systems. For example, enter a location in your investigation area. The coordinates are displayed in different coordinate systems. This way you can quickly find out in which coordinate system the data is available.

Use the connection to online map services (***Shift+Ctrl+O***) to check if the project coordinate system is correctly selected. The map content will jump to the correct location. If this is not the case, perhaps an offset is missing, or the strip / zone is incorrectly selected.

Project coordinate system

Working with SoundPLAN does not generally require the use of a project coordinate system, regardless of whether you are working with local coordinates based on 0 or in world coordinates (UTM or country-specific coordinate systems).

The project coordinate system is necessary if you need to transform coordinates from different world coordinate systems or if you want to use the attractive connection to the online map services Google Maps and OpenStreetMap as well as WMS Server (require the Cartography module). Therefore, it is sensible to include the project coordinate system with every new project right away. You can also add it later when you call a function for which it is needed for the first time.

Enter the EPSG code, if known, or select the appropriate coordinate system from the two selection lists coordinate system and reference system and, if necessary, an offset and a zone.

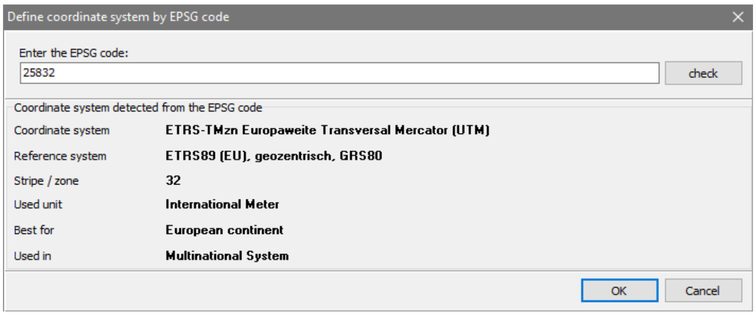
Under **OPTIONS | SETTINGS | GLOBAL** in the SoundPLAN Manager you can set a default project coordinate system that is automatically entered for new projects.

EPSG code

"*The **European Petroleum Survey Group Geodesy** (EPSG) was a working group of European oil and gas exploration companies. It was founded in 1986 and is based in London. In 2005, it was replaced by the Surveying and Positioning Committee of the International Association of Oil & Gas Producers (OGP). … The EPSG code is a system of worldwide unique, 4- to 5-digit key numbers (SRIDs) for coordinate reference systems and other geodetic data sets, such as reference ellipsoids or projections. It is continued under the same name by the successor organization OGP. The information on the EPSG codes is available in an online database.*" Translated quote from Wikipedia.de

Very often, the coordinate systems with which a WMS server is compatible or the coordinate system in which geodata are available for download are specified via the EPSG code.

Wherever you can enter coordinate systems in SoundPLAN, you can enter the EPSG code directly with the **EPSG CODE** button.



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

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

Non-metric geographical coordinate system, 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 group. Select the icon of the program module and click on it to get into:

- **Geo-Database**
  Input of data on screen from scanned bitmaps as well as import of data from DXF, shapefiles, ASCII and older SoundPLAN versions. Assignment of the properties of the individual objects, combination to Situations.
- **Calculation core**
  Calculation based on the data entered in the Geo-Database. With detailed error log, graphical control, processing of multiple calculation runs, for example, overnight.
- **Results table**
  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 propagation path.
- **Spreadsheet**
  Tabular preparation of the results of single point or Facade Noise Map calculations *of several calculation runs* for the representation of different variants with difference formation etc., the formulas increase the flexibility of the statements, far-

reaching design and evaluation possibilities, graphic representation of the evaluations.

- **Graphics**
  Powerful graphical processing of calculation results, flexible display of individual objects, creation of forms for efficient processing and compliance with office standards.
- **Library**
  Access to extensive emission, absorption, transmission and mitigation libraries, definition of 2D and 3D directivity as well as day histograms, wind statistics and assessments. Free definition of own elements in the individual libraries.
- **Wall design**
  Dimensioning of noise control structures, design of walls / berms, interactive calculation of levels and level reductions, effort / effectiveness chart.
- **Expert Industry**
  Detailed analysis of the interaction between sources and receivers for the development of mitigation concepts incl. cost optimization. By adding detail windows, the data can be viewed from different angles.
- **Noise allotment**
  Calculation of emission allotments and additional allotments 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 resulting R'w or or the permissible interior level. The calculation can be performed according to the standards 24th BImSchV, VDI 2719, DIN 4109:1989/2016/2018, the 2nd aircraft noise protection order and in single number values according to EN ISO 12354-3:2017.
  Lists of measures and cost tables allow very quickly to compile the tender documents of noise remediation programs.
- **Window dimensioning**
  Dimensioning of sound insulation window classes for simple cases is included in the Spreadsheet: Spreadsheet **| WINDOW CLASS | ADD WINDOW COLUMNS** and includes dimensioning of exterior components for given receivers based on 24th BImSchV, DIN 4109:1989 and VDI 2719. The limitation is that only one room can be assigned to each calculation point.
- **Long Straight Road**

  (**EXECUTE | LONG STRAIGHT ROAD**) Rough screening type calculations according to RLS-90.
- **Noise at workplace**

  (**EXECUTE | NOISE AT WORKPLACE**) Powerful tool to calculate and document the noise exposure that workers at different workplaces are exposed to over the work period.

Hotline support

The **SoundPLAN manual** is available as a PDF file via **HELP | MANUAL**.

The **SoundPLAN online help** is called with F1 or the help buttons for the individual functions.

The **support** is available from your local distributor. Find information on your local distributor via **HELP | ABOUT SOUNDPLAN**.

Call **HELP | SEND HOTLINE REQUEST** in the SoundPLAN Manager to send an e-mail directly to your local distributor. If you send a packed project (see page 30),

please write where exactly the problem occurs. For example, which Situation, which calculation run, which Graphics sheet is affected and what happens.

In case of questions about license, hardlock etc. you should send the files UPDATE.LOG (C:\ProgramData\SoundPLAN\Update.log) and the license file BAB? *.* (SoundPLAN installation directory). This makes the work easier for the hotline and you will get an answer faster.

Remote support via Teamviewer

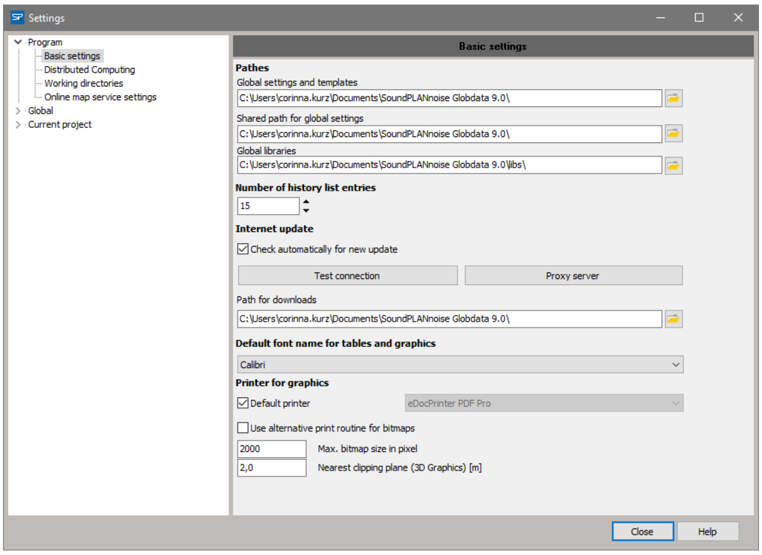
Via Teamviewer, we can remotely see your screen in case of problems, which may lead to a faster solution of your problem. If you allow it, the support staff can also take control of your mouse to show something. Call **HELP | REMOTE SUPPORT (TEAMVIEWER)** in the SoundPLAN Manager. Teamviewer will not be installed, but only downloaded.

Internet updates

Registered customers with warranty or maintenance can download updates via the Internet. **HELP | UPDATES AND DOWNLOADS** will take you directly to the download page. If you cannot access this page from the program due to security restrictions, or if your system administrator who has not installed SoundPLAN manages update installations, please contact your support.

In the info section of the Updates & Downloads page you will find important information about SoundPLAN or important changes within a version as well as links to documents with detailed technical information.

Options | Settings



The options provide various pre-settings that can be saved globally and modified for specific projects.

Program settings

Basic settings

SoundPLAN requires a defined folder for saving pre-settings and customized elements that are used across projects. This folder must always be located on the hard disk of the computer and not in the network or in a cloud. The location of this folder is set when the program is started for the first time and can be changed here via the **GLOBAL SETTINGS AND TEMPLATES** path. By default, this folder is created in the following path:

..\UserName\Documents\SoundPLANnoise Globdata x.x (x.x stands for the program version).

Often several users work with SoundPLANnoise and want to access the same color palettes, object layouts and templates for general printouts, results table, Spreadsheet and Graphics across projects and users. For this purpose, you can define a folder in the network via the **SHARED PATH FOR GLOBAL SETTINGS**.

The files are **not** automatically written to this directory but must be deliberately copied for organizational reasons. How should the software react, for example, if the network is currently not available? Or which user has priority when two people want to access files in this folder at the same time?

SoundPLAN therefore always uses the fix Globdata directory on the hard disk. To synchronize the data, right-click in the tree structure on the left on Program | **COPY CONTENTS OF GLOBAL FOLDER TO GLOBDATA**, respectively **COPY CONTENTS OF GLOBDATA TO GLOBAL FOLDER**.

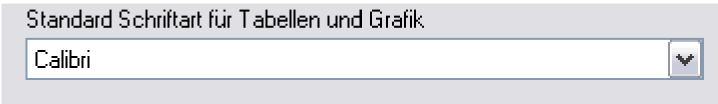
The **PATH FOR GLOBAL LIBRARIES** defines where the global project libraries are stored. If the path is not accessible, the global libraries cannot be opened.

The **NUMBER OF RECENTLY OPENED FILES** determines for all program parts how many files are displayed in the history list.

For SoundPLAN, **INTERNET UPDATES** with improvements and corrections are offered within a program version in the SoundPLAN Manager under **HELP | UPDATES & DOWNLOADS.** You can specify whether the check for new updates is automatically done on program start.

In companies that use a **PROXY SERVER** for the connection to the Internet for security reasons, the proxy settings must be known for the access to the SoundPLAN updates. Enter the address, port address and the access data here. You can verify whether the entries are correct via the **TEST CONNECTION** button.

DEFAULT FONT FOR TABLES AND GRAPHICS: You can set a font as the default for new Tables and graphics sheets. When using templates, the font is still taken from the template.



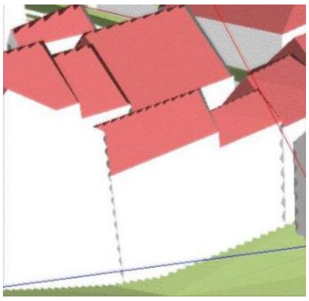
PRINTER FOR GRAPHICS: For the graphic outputs, often another printer is used than the default printer set under Windows. Therefore, you can select another printer installed on your system, which will be offered automatically when printing. The Windows default printer is still suggested for the table printouts.

If geometry bitmaps are not or not correctly output on the printer, it could be that the printer driver does not support the routine we use by default for bitmap output. In this case, switch the **ALTERNATIVE PRINT ROUTINE**.

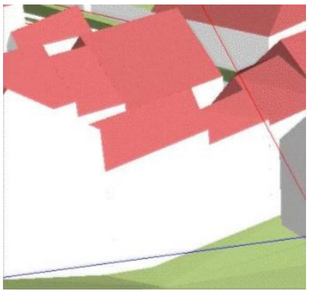
If parts (bitmaps) are missing when printing graphics sheets, the bitmap size is usually the cause. This can be changed via the **MAXIMUM BITMAP SIZE IN PIXELS.**

The **NEAREST CLIPPING PLANE** is relevant for 3D Graphics. Even good graphics cards often have difficulties displaying the nearest clipping plane, which is 0.1 m for 3D Graphics. This results in incorrect display of areas.

Set the nearest clipping plane higher, for example to 5 m and check the result in the 3D Graphics.



Example: clipping plane 0.1 m



Example: clipping plane 5 m

The nearest clipping plane can be additionally changed in the Graphics for individual scenes.

Settings for Distributed Computing

Distributed computing allows the additional use of any number of computers in the network for calculation. One computer, the master computer, controls the assignment of calculation jobs to the slaves. The settings are described in the chapter "Distributed computing" (page 284).

Working directories

When opening projects, the program scans the folders to determine whether it is a SoundPLAN project and, if so, with which version it was edited. From this it is derived, for example, whether a project must be converted for the current SoundPLAN version before it is opened.

If projects are on the network or in a cloud - which we do not recommend - this process can take a long time. Therefore, you can limit the directories to be scanned here to those actually used.

Since it has happened - also due to slow network access - that editing the project information overwrites other information, you can lock editing here.

Settings online map services

The settings for the online map services Google Maps and OpenStreetMap are described in the chapter "Connection to online map services" (page 89) in detail.

Project settings, global and current project

Define the global project settings as they are needed in most cases. When a new project is created, the global settings (for example, the selected standards, time slices, and country-dependent libraries) are automatically applied to the new project. The settings can be modified for the current project.

Time slices for emission traffic noise + meteorology

Here you specify whether you want to work with one, two or three time slices. For projects according to CNOSSOS-EU, for example, three time slices are always used. The time slices you specify here are valid for the traffic data of roads and railways as well as for the meteorological influences favorable /homogeneous and Cmet.

Depending on the country, the duration and start of each time slice differs. E.g.

Day 6-19, evening 19-22, night 22-6

The time slices must not overlap and must include the 24 hours of the day.

Object number / name industrial building sources

The object number can be defined separately for receivers / buildings, noise sources and photo points so that SoundPLAN can meet a wide range of numbering requirements in tables and Graphics, see "Object numbering" (page 39).

For industrial buildings, you can specify whether the name should be output with the source name in the results tables and which separator should be used.

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.

Calculation standards

The road, railway, industrial, aircraft noise, wind turbine, and parking lot standards, as well as the assessment standard, are selected as defaults based on your country setting. The standards for all noise types are always displayed, even if one noise type is not licensed. Click on the displayed standards to go directly to the standards branch of the settings.

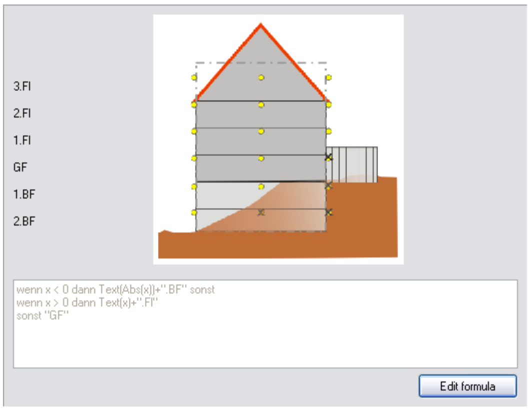
Standards
Road: Nord2000 Road (Nord2000 Road)
Railway: CNOSSOS-EU: 2021 (CNOSSOS-EU: 2021)
Industry: ISO 9613-2: 1996
Parking lots: CNOSSOS-EU: 2021/2015 (Parkplatzlärmstudie 2007)
Wind turbines: BEK nr 135 af 07/02/2019, Wind Turbines
Aircraft: ECAC Doc 29 4th Edition

Assessment Leq 06-22|22-06|00-24| Lmax
Emission time slices + Cmet 6-18 18-22 22-6

In the standards selection, you can turn on other standards or turn off standards that you don't normally need. Standards can be turned off only in the global settings.

Floor descriptor

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



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.

2

Coordinate and reference systems (global only)

For the definition of the coordinate and reference systems SoundPLAN uses the tool GeoDLL from the company Killetsoft (www.killetsoft.de).

Normally you select the project coordinate system via an EPSG code, then the settings here are irrelevant. If the EPSG code is not known, you can use the selection lists when creating a new project. So that these selection lists do not become too confusing, activate the systems that should be presented here.

We lack knowledge about the systems used in the individual countries. In the country-specific system files, a preselection has been made for Germany, Austria and Switzerland.

With ***Ctrl+F*** you can search for a specific coordinate system in the list.

Default project coordinate system: If you are mainly active locally, it is helpful to have a default project coordinate system that is automatically entered for new projects.

WMS settings (global only)

WMS servers set up here can be activated for all new projects. See "Connection to WMS server" (page 94).

Pre-settings Geo-Database

The automatically used default properties of some objects in the Geo-Database, which are partly standard-dependent or country-dependent, can be changed in the pre-settings, such as the relative height of the first receiver above ground floor, the floor height, the distance of receivers and sources in front of the facade, and the alignment of road and house number.

The **DRIVING ON THE RIGHT SIDE** checkmark takes into account the position of the two emission bands for standards that distinguish between slope and gradient in the calculation. For the animation track in the 3D Graphics, the setting determines the displacement of the viewer from the axis to the right or to the left.

When digitizing from background bitmaps, the accuracy of the input can be increased with the **BITMAP ZOOM BOX.** If this is activated, a small window is displayed in the area of the cursor position, which enlarges the section of the background bitmap.

The **SEARCH RADIUS** defines within how many pixels the properties of already entered objects will be found.

For the angle mode you define here the **ANGLE INCREMENT** in which further input points of an object can be set.

Tile system (current project only)

For tiling projects, tiling systems for editing the data are defined here, see "Tile projects" (page 497).

Graphics settings

The **GRAPHICS SETTINGS** provide the color palette (“Color scale” (page 400)) and the object types (“Object type file”(page 415)). This also allows to edit the global object types directly.

For the length scale you can also select ‘feet’.

Default settings for the calculation types

For each calculation type you can predefine default settings that are automatically applied in the Calculation core when you select the respective calculation type. For each calculation type, you can specify the definitions in the *Settings* card separately (for example the number of reflections), or also certain parameters of the calculation type itself, for example, the grid size or the calculation height above ground for grid noise maps.

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 attributes 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 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 it is not sorted alphanumerically, but via a freely definable sorting sequence. This object number is automatically incremented when entering receivers, buildings (Façade Noise Map) and noise sources in the Geo-Database.

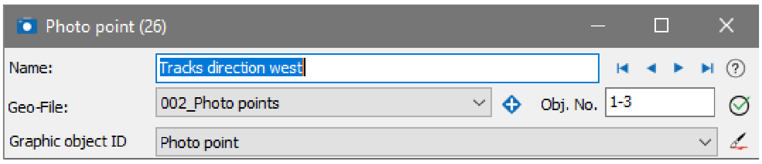
Changing the format string and sort order (almost) every specification can be fulfilled, as the following examples show:

- 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 output 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 **DEFINE BASIC NUMBER** button to define the number just entered as the new basic number, from which it is then automatically incremented again.



If the format string you defined contains letters and/or separators, the point number could also be A100 or 11.1, for example. If the entered object number does not correspond to the format string, you will get a message that outputs the defined format sequence.

In the Geo-Database you can use **TOOLS | OBJECT NUMBER** to renumber receivers, buildings and sources alphabetically according to the object name or to continue numbering based on the last number assigned.

2

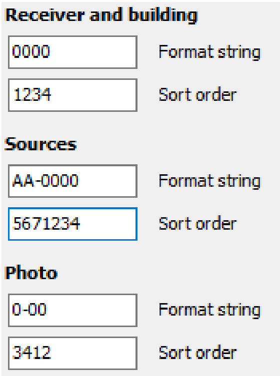
Placeholders for the format string

The format string uses placeholders for letters and numbers:

0,9,1 as placeholder 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 separators and numbers are allowed. A format string may contain several character blocks.

. , ; - as separators. Use separators to separate blocks of characters and numbers. Valid separators are: , (comma) . (period) ; (semicolon) and - (minus) are allowed as separators.



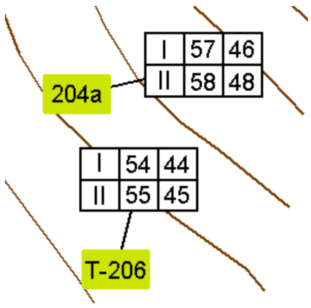
Hint: If you want to change the format order while editing the project, call the **OPTIONS** in the Geo-Database **FILE MENU** and change the format string or the sort order in the current project accordingly.


The changes will take effect as soon as you open the data input again via the "Back to Geo-Database interface" icon.

Display of the object number

The object number is written into the result file during the calculation and displayed in the table output of the result tables and spreadsheet. For the graphical output, you can use the number as a reference in different data types.

Objekt-Nr.	Formatfolge
1	001.00__
A32	032.00A_
D34	034.00D_
D34	034.00D_
A35	035.00A_
A35	035.00A_
T 200	200.00T
204	204.00__
204.1	204.10__
204.1	204.10__
T-206	206.00T-
T-206	206.00T-



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

The sort order according to the entered object number uses the column containing the format for sorting (**Format string Obj. No.**) and not the column object number.

In the Results tables, call the sort order via the right mouse button and select the sort column "Format string Obj. No.".

In the Spreadsheet, right-click 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 criterion.

Examples for format string and sort order

If a project is reworked, additional receivers / sources should be inserted at a specific location without changing the original numbering:

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

Input 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

In one project the original format string was 00 ...

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

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

The display will not change for the points entered earlier, only the stored format changes:

Input 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

In addition, you can use characters to identify receivers / sources, for example, to identify free-field receivers.

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

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

Input in the Geo-Database = Display in tables / graphics	stored format for the sort order
T 1	0001T _
2	0002___
G 3	0003G _
5	0005___
5a	0005__a
T-5	005T-_

The sort order specifies 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, and so on.

2

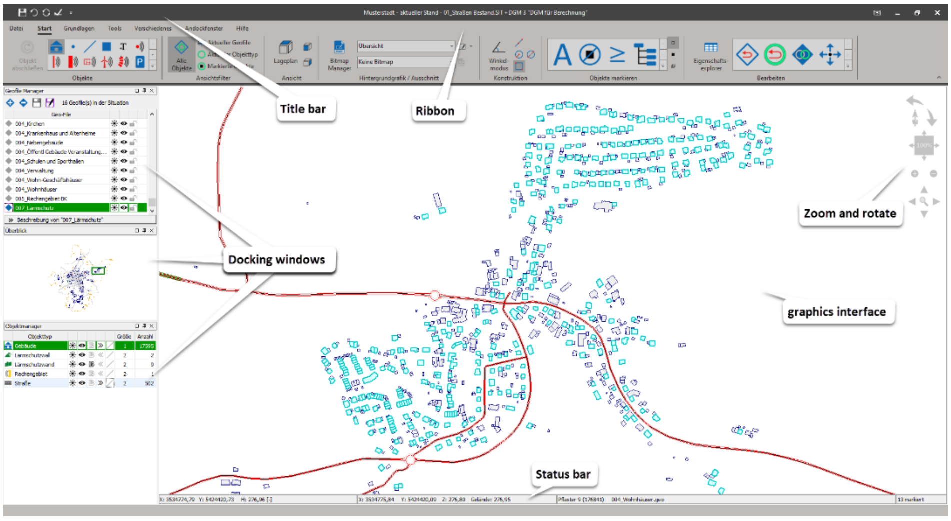
Buildings are grouped to different sections. The object number shall include the section description, which may include a letter and a number, in addition to a consecutive number.

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

Input 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-

3 Geo-Database

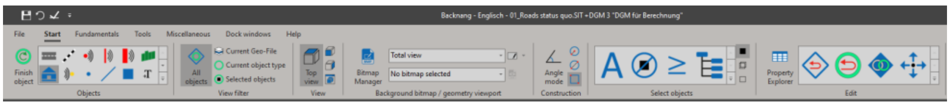
All geometry data and their properties (building height, road width, sound power level, emission level ...) are entered or imported into the Geo-Database and prepared for the calculation.



Ribbons, title bar and status bar

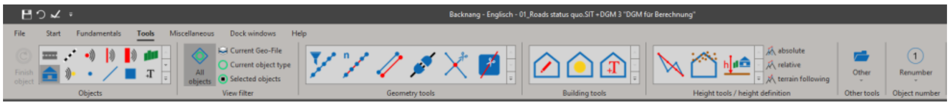
All functions for data entry, import and export, various tools for editing the data, as well as the data check are arranged in ribbons. The object selection and the view filters are repeated in all relevant ribbons.

The **START** ribbon contains all functions for data input as well as for initializing and managing georeferenced bitmaps, which are loaded as background graphics into the Geo-Database interface.

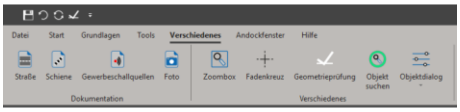


The **FUNDAMENTALS** ribbon contains the import and export of geometry data, the tools for creating and working with digital ground models, the connection to online map services and the functions for coordinate systems.

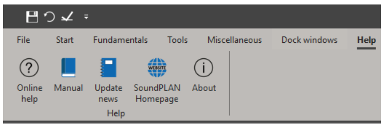
Under **TOOLS** you will find geometry tools, building tools and elevation tools that are needed to modify the data for various cases.



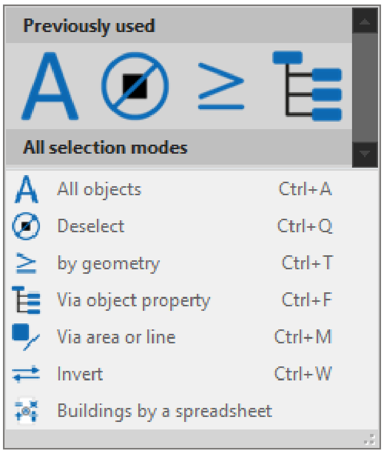
The ribbon **MISCELLANEOUS** contains the emission documentation of the sources (road and railway emission, source spectra and source day histograms) and the documentation of photo points, see corresponding sections in the chapter "Objects and their properties" (page 131). Additional settings are also provided here.



Under **HELP,** online help, manual and update letter are accessible as well as the SoundPLAN website.



Various components are used in the ribbons to clearly display the individual functions. A predefined selection of symbols is displayed in the toolbar as big symbols when the program is started. If you select a function that is not included in this toolbar, it is added to the toolbar in the first position and the last one disappears. This way you always have quick access to the functions you used last.



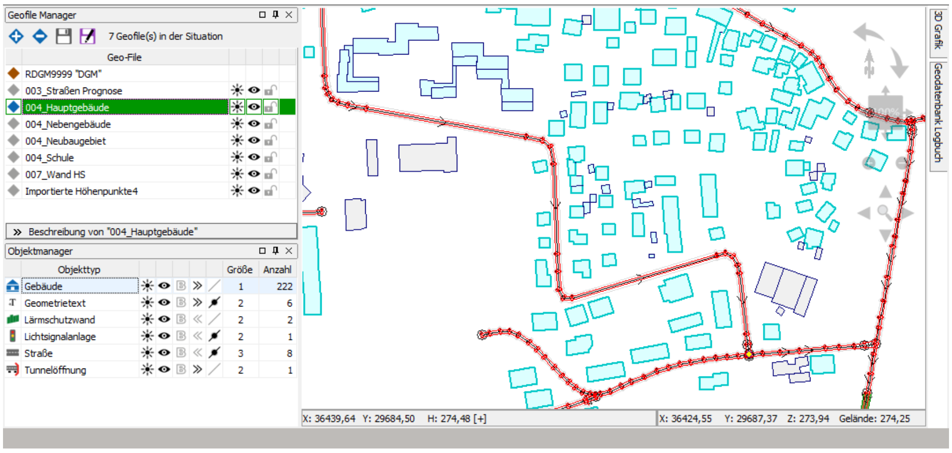
The **TITLE BAR** provides access to save, undo and preflight. It can be placed above or below the ribbon.

In the **STATUS BAR,** the coordinates of the cursor position are displayed in the left area. If a DGM is loaded, the DGM elevation is also displayed. Furthermore, the distance and the angle between the last point entered and the cursor position are displayed here during digitizing.

As soon as the cursor points to an object, the coordinates and elevations (relative elevations in red) of this object are displayed in the center area. Further to the right you see the name (in brackets the object ID) of the object and the Geo-File in which this object is stored. If objects are selected, you can see on the far right how many objects are selected.

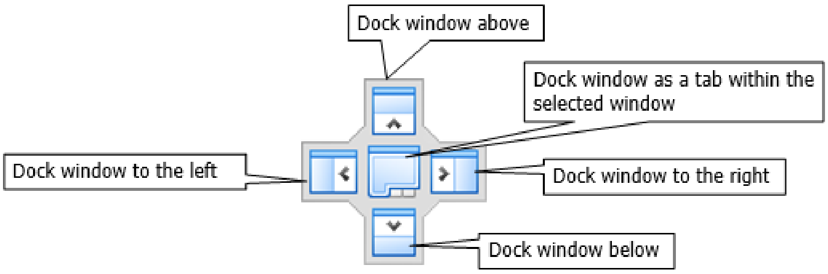
Docking windows

The Geo-Files and objects contained in a Situation as well as a graphical overview of the data in the Situation, the 3D Graphics and the Logbook are provided as so-called docking windows. These are windows that can either be docked into the interface at a user-defined position or can also float freely on another screen, for example. Docked windows can be permanently visible or only as tabs with the headline, which expand only when you move the mouse over them. In this way, you can customize the interface to suit to the way you work and to your requirements.



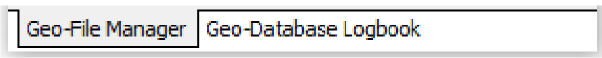
Above an example – on the left the information about Geo-Files and objects are docked and permanently visible, on the right 3D Graphics and Logbook are docked, these are only expanded and visible when you move the mouse over the tab. The graphical overview was placed free-floating on a second screen.

To change the position of a docking window, grab the corresponding window with the mouse at the title bar and move it to the desired position. Use the blue boxes to fix the position, always referring to the window that is highlighted in blue.



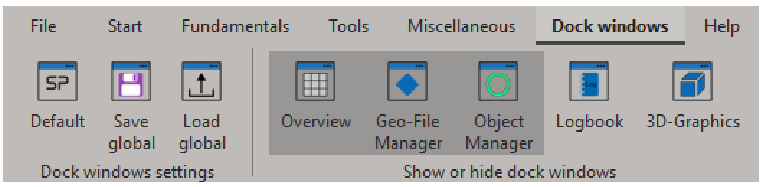
To leave a window floating rather than docked, release the window when no blue box is active.

If a window has been included as a tab in another window, the active windows is displayed. Disconnect the group by grabbing the tab instead of the title bar. If you grab the title bar of the group, the group will be docked in another place.



The needle in the title bar of the docking windows controls whether the window is expanded permanently or only when the mouse is moved to it.

In the **Docking windows** ribbon, you can manually switch on and off individual docking windows.

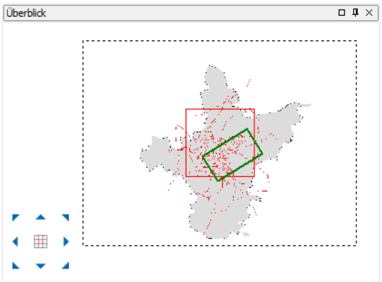


The position of the docking windows is retained when they are switched on again. You can save the positions and visibility of the docking windows **GLOBALLY**. Your selection is

3

used across all projects. Use **DEFAULT SP** and **LOAD GLOBALLY** to reset the selection of the docking windows accordingly.

Docking window overview



The overview window shows the geometry data entered and a green frame visualizing the section displayed in the main window.

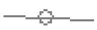
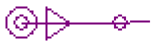
For tiling projects, the tile navigator is also displayed, and the selected tiles are also visualized as a red frame. See "Tile projects" (page 497).

The functions of the other docking windows are described in separate sections.

Enter objects and object points

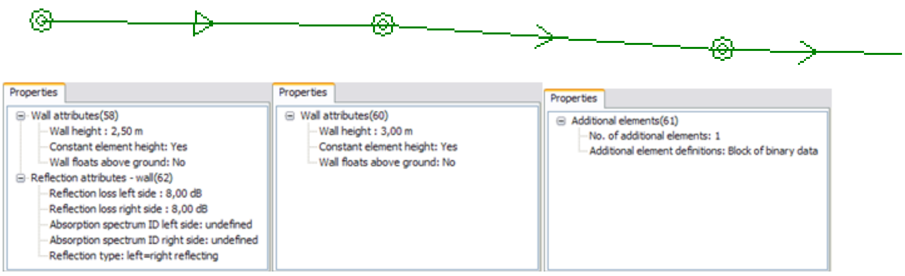
Enter the input points with the left mouse button or with the space bar. With the space bar it is sometimes easier to position the input points more precisely.

The object points, which you switch on/off in the object manager, give you important information about the properties and input direction of an object. Since it sometimes becomes confusing if the points are switched on for all objects, this setting is controlled separately for each object type.

	Coordinate - without properties
	Coordinate where properties are defined
	Start arrow between first and second input point
	Direction arrows between the object points
	The last point entered is displayed in red as long as an object is not completed or has been activated for entering further coordinates (otherwise in the color of the object).
	Object with properties changing at multiple points (variant objects)

Variant objects

For some objects, properties may change from coordinate to coordinate for example, the wall height of a noise protection wall, the traffic data of a road, or the track corrections of a railway. A property definition is valid until you specify a change.



At the first coordinate of an object all properties are stored, in the course only the properties that change. This has the advantage that properties that do not change do not have to be redefined each time.

In the example above, the wall height changes from 2.5 to 3 m at the second coordinate. At the third coordinate, a slanted wall element is added. If you change the reflective properties of the base element because a different material is to be used, you only change the property at the first point; the change is passed through to the entire wall.

To see the properties stored at a particular coordinate, click the “tree view” icon in the object dialog.

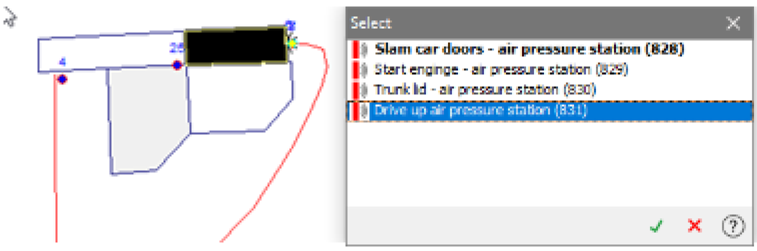
Use the double arrows to jump directly from one coordinate with properties to the next.

Objects in the search radius

When editing the dataset, the properties of existing objects are called by clicking to an object point or object line. The cursor changes to an arrow within a certain search radius around an object.

The search radius, within which the cursor becomes a selection arrow is defined in the Geo-Database **OPTIONS** in the **file menu**. By default, objects are found up to a distance of 5 pixels.

It often happens that more than one object is found within the search radius. In this case, you will see a list to select the desired object.



When you click on the objects in the list, the different objects are highlighted to make it easier to find them. Selected objects are displayed in bold in the list, coordinates where properties have been defined are displayed in italics.

The object type, object name and object ID are displayed in the list. The object ID is assigned in ascending order when entering or importing. If you copy objects, the objects are on top of each other. Then the higher object ID tells you which one is the copied object.

As soon as the selection arrow appears, the coordinates and elevations of the nearest point are displayed in the status bar.

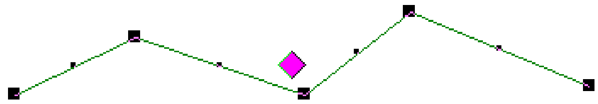
Input cursor

The mouse has to perform many functions in the Geo-Database. This is controlled by additionally pressing the Ctrl, Shift and Alt key. Since the input cursors change according to selected key combination, you can see immediately what is executed.

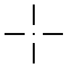
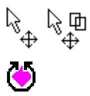
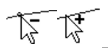
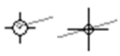
If the cursor is a cross, use the left mouse button to enter coordinates, and the right mouse button to call up a menu of frequently used editing functions.

As soon as you move to an object point or object line, the cursor changes to an arrow. The left mouse button opens the properties and the coordinates. If you click the right mouse button at an object point, you reach further functions for the selected object.

To change objects, they need to be selected. Selected objects can be recognized by the black selection squares. A pink diamond is displayed in the object's center of gravity.

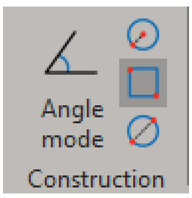


As soon as you move the mouse over selected objects, the cursor changes to the move arrow. At the selection squares, individual coordinates of the object can be moved by holding down the left mouse button. If you use the pink diamond instead, the entire object will be moved.

	Left mouse button: Enter coordinates Right mouse button: Selected actions for selected objects Rotate mouse wheel: Zoom geometry Drag a frame left mouse button: draw line, rectangle or circle Drag a frame right mouse button: select objects over area
	Left mouse button: Call up properties dialog Right mouse button at object coordinate: actions for the selected object By additionally pressing the < key, the arrow cursor is temporarily switched off.
	For selected objects: Left mouse button: Move single object points or whole objects (pink diamond) Alt+ Left mouse button: Duplicate selected objects (pink diamond) Ctrl+ Left mouse button: Rotate whole objects (pink diamond)
	Shift+ Left mouse button on object coordinate: Delete point Shift+ Left mouse button on object line: Insert point
	Ctrl+ Left mouse button on object coordinate: Snap point Ctrl+ Left mouse button on object line: Snap position to line
	Alt+ Left mouse button on object: Select object Ctrl+ Alt+ Left mouse button on object: Selects more objects Ctrl+ Alt+ Left mouse button on selected object: deselect it
	Turn the mouse wheel: Reduce / enlarge section (zoom).
	Mouse wheel pressed: move geometry
	The zoom mode on the right of the screen drags a zoom frame. Shift + pressed mouse wheel turns zoom mode on temporarily.

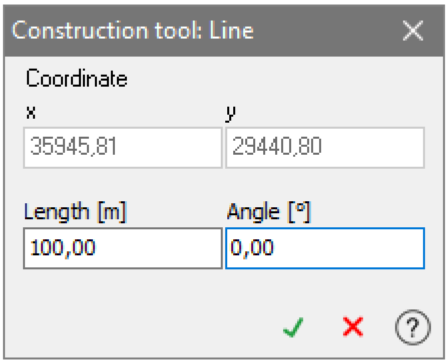
Construction

The construction tools in the **Start** ribbon can be added for all line and area object types:



With the **ANGLE MODE**, the object coordinates are entered from the 2nd coordinate in the angle step size set in the options (File menu). The default setting is an angle step size of 15 °. The angle mode can be temporarily deactivated by holding down the ***Ctrl key***, for example to model a bay window on a building or to align the first edge of an area exactly.

For line and area objects, you can enter the position of the input points numerically from the second coordinate if you want to set further input points at a defined distance or a defined angle to the previous input point. Enter the first input point with the left mouse button or the space bar. Move the mouse a bit away from the input point and press the **c** key. Enter length and angle in the construction dialog.



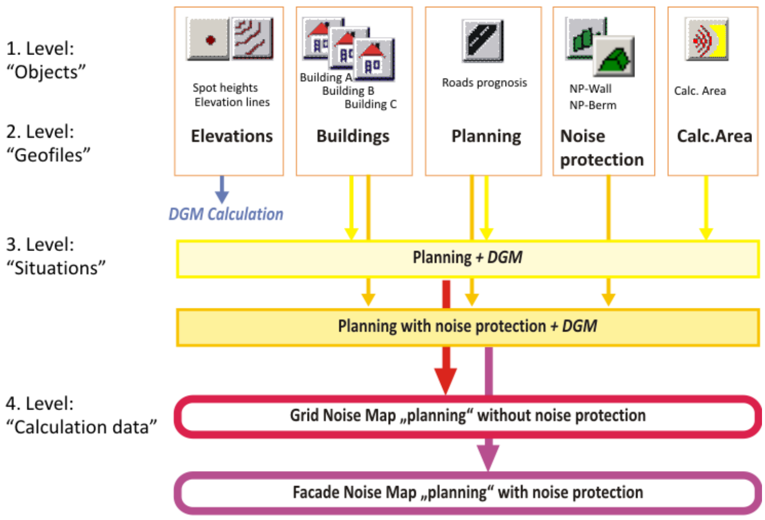
Additionally, you can add the circle and rectangle construction tools. Drag a frame with the left mouse button pressed. In the construction dialog, enter the length, width and, if necessary, a rotation angle for a rectangle and the radius for a circle. Circles can be entered from the center or from the edge of the circle.

For example, if you want to enter a roundabout, click the road object type, select the circle tool and drag the roundabout.

Structuring the data

The entered objects are stored in Geo-Files and compiled into Situations. Geo-Files are comparable to layers in CAD programs. They are used to group objects according to a user-defined logic.

The Situations are a superordinate level, which contain any combination of the Geo-Files; the same Geo-File can be part of several Situations. This has the advantage that changes in the data of a Geo-File are applied to all Situations containing the corrected Geo-File. For example, if the sound power level of a source used in several calculation variants changes, the source only needs to be adjusted once.



The example above shows a principle way of structuring a small project.

The objects "elevation points" and "elevation lines" were saved together in the Geo-File "elevations". This Geo-File is used to calculate the digital ground model (DGM). Once the DGM is calculated it is assigned to all Situations.

All buildings, the roads, the noise protection walls, and the calculation area were stored in additional Geo-Files. The road and building Geo-Files are included in both Situations, the other two Geo-Files are only referenced to one of the Situations.

The Situations are assigned to the calculations. Optionally, individual Geo-Files can also be loaded there if, for example, the calculation area for the grid noise map is not assigned to the Situation.

Background data structure

Geo-Files (*.geo) contain the coordinate and elevation information as well as the properties of the objects.

Situations (*.sit) consist of a reference list of the contained Geo-Files. The Geo-Files are therefore not physically stored in a Situation. This has the advantage that no redundant data is created, so it is not necessary to change the data in each Situation they are contained. If a Geo-File is renamed, the name is automatically changed in all Situations to which it is referenced.

The previous version of the Situations and Geo-Files is saved as *.~si or *.~ge with the same name. Besides the "undo" function, this feature increases data security.

File menu

In the file menu, you use the **SITUATION MANAGER** to manage the Situations and Geo-Files in your project, combine new Situations, and have various filtering and visualization tools for the Geo-Files.

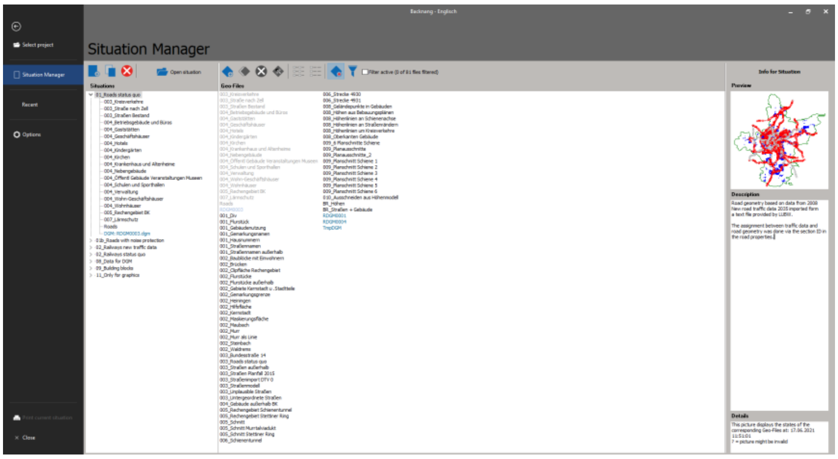
RECENTLY USED lists the last called Situations from different projects. This is helpful, for example, if during the project work the client of another project has follow-up questions. You can "pin" recently used Situations so that they are placed at the top of the list and do not disappear from the list.

The **OPTIONS** contain various default settings for SoundPLANnoise, see Options | Settings (page 34). Here you can, for example, change the standard for the emission input or change the angle step size.

The arrow at the top left takes you directly back to the Geo-Database interface, in the Situation from which you entered the file menu.

Situation Manager

The first time you call the Geo-Database in a new project, a first Situation (Situation1.sit) with a Geo-File (Geo-File1.geo) will be created automatically, you can start immediately with the data input, respectively with the data import. When you exit the Geo-Database or when you save the Situation, you will be asked to name the Situation and the Geo-File. The next time you open the Geo-Database, the Situation Manager will be displayed to select a Situation. While working in the Geo-Database, open the Situation Manager from the File menu.



On the left are the created Situations, in the middle the Geo-File list, on the right the description and a preview graphic of the clicked (blue background) Situation. It is possible that the preview image of the Situation no longer matches the Geo-Files it contains. In this case, question marks are drawn in the preview image to draw your attention to this.

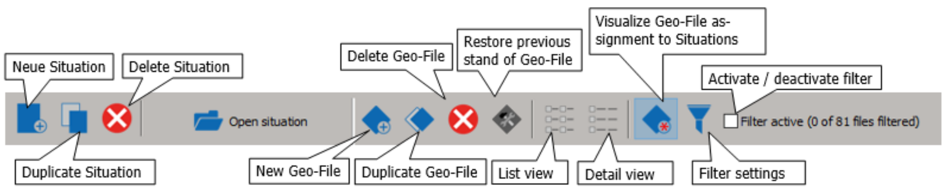
Below that, details of the Situation are displayed, for example, when created or modified.

As soon as you click on a Geo-File, no matter if in the Situation tree or in the Geo-File list, the information about this Geo-File will be displayed, i.e. the description, the preview image and the details.

In the Geo-File list, the Geo-Files contained in the Situation are displayed in gray, i.e. they cannot be assigned to this Situation again. Below that, if the Situation contains a DGM, it is listed in light blue.

All other Geo-Files and DGMs in the project are displayed below in black or dark blue. They can be added to the existing Situations with drag & drop or a double click, whereby the DGM is exchanged, since each Situation can only contain one DGM at a time.

Functions in the Situation Manager



NEW SITUATION creates a new empty Situation to which you give a name and then drag and drop Geo-Files to assign them (existing ones or a newly created one).

DUPLICATE SITUATION duplicates an existing Situation and assigns all Geo-Files contained in the original Situation.

DELETE SITUATION deletes the selected Situation and moves it to the trash.

NEW GEO-FILE creates a new empty Geo-File into which you then enter objects in the Geo-Database with their associated properties.

DUPLICATE GEO-FILE duplicates an existing Geo-File with all the data it contains to modify it later in the Geo-Database.

DELETE GEO-FILE deletes the selected Geo-File and moves it to the trash.

Example: With these functions you can create a "Calculation variant 2" from the Situation "Calculation variant 1", which is the present state of a road construction project (with the roads, buildings, texts, ground areas, etc.). The "Calculation variant 2" is additionally assigned a new (still empty) Geo-File for planned noise protection measures. Furthermore, the Geo-File containing the roads is duplicated in order to use new traffic figures for variant 2 without losing the data of the status quo. The other Geo-Files, e.g. the buildings remain the same.

RESTORE replaces the Geo-File with the previously saved file version from the backup file.

LIST VIEW lists all Geo-Files below or next to each other.

DETAIL VIEW lists all Geo-Files together with modification date and file size one below the other.

You can add several Geo-Files (***Shift*** or ***Ctrl key***) together to a Situation or remove them from a Situation using Drag & Drop.

Double-click on the Situation or click on **OPEN SITUATION** to access the Geo-Database interface.

Note: For tiling projects, the tile manager is opened before opening the Situation to load data only in a specific area, for description see "Tile projects" (page 497).

Visualize Geo-File mapping

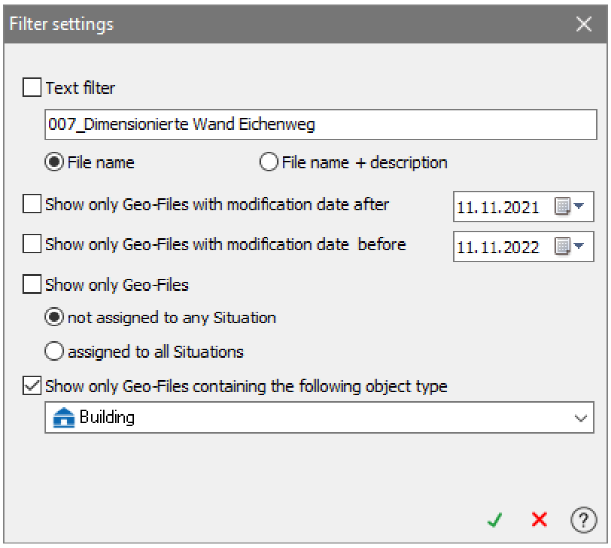
Click on the symbol with the red asterisk to turn on the Geo-File mapping visualization. Then, when you click on a Geo-File in the Geo-File list, the Situations containing this Geo-File are highlighted in red.

View filter for Geo-Files

In the filter settings you can filter out Geo-Files according to different criteria. These are a text filter, filtering by modification date and assignment to Situations. Via multiple selection of the filter criteria, you can combine them, for example show only the Geo-Files that were changed within a certain period of time.

Before you possibly delete Geo-Files without Situation assignment, remember that these Geo-Files could be used in the Calculation core or Graphics.

Additionally, you can display only the Geo-Files that contain a specific object type.



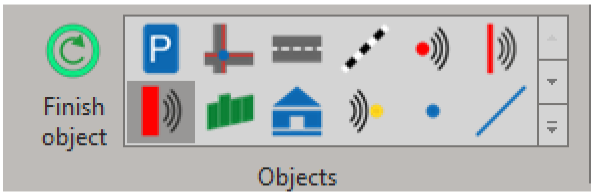
For the **TEXT FILTER**, enter a keyword that is included either in the filename or in the filename and Geo-File description.

As soon as you exit the filter settings, only the Geo-Files that match the filter criteria are displayed, and the number of Geo-Files that were filtered out is displayed. You can activate or deactivate the filter with the current settings via the **FILTER ACTIVE** check-box.

Data entry

Object toolbar and coordinates entry

There are always 12 object types displayed in the object toolbar. This is initially a default selection in a new project. Click on the arrow symbol to select other object types not listed in the toolbar. The "new" object type is then added at the first position in the toolbar of the last object types used. SoundPLAN remembers the object types you last used even after you closed and reopened the Geo-Database.



Select the object type and enter the object points with the **left mouse button** or the **space bar**. If you press the key c instead, you can enter length and angle numerically from the second object point. During the input the object points of objects can be deleted with ***Esc.***

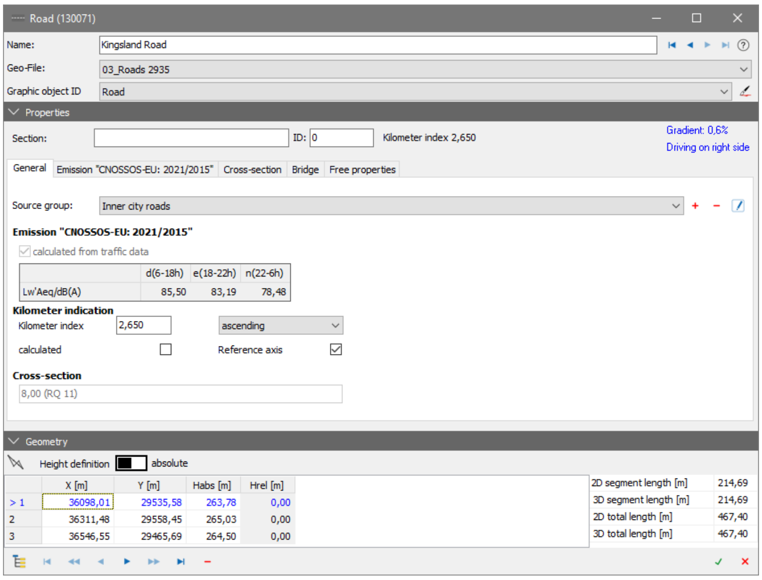

The input of line and area objects is completed with double-click, F2 or the icon **FINISH OBJECT.**

Then the object dialog opens to enter the object properties and the elevations. In the **Miscellaneous** ribbon, you can define when the object dialog should open.

Information on the properties of the individual objects can be found in the chapter "Objects and their properties"(page 131)".

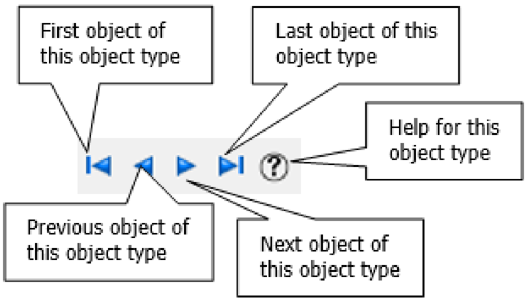
The object dialog

The object dialog contains all information about an object. The "Properties" and "Geometry" sections can be optionally expanded and collapsed.



In the upper area, the object name, for some objects an object number, the graphics object type for the display in the Graphics and the Geo-File in which the object is stored are displayed.

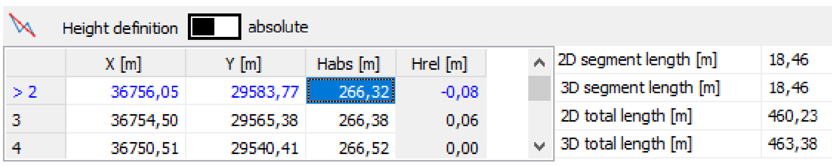
To the right of it is a navigation bar to jump between objects of an object type.



First, previous, next and last object refers to the input sequence. Point, line and area sound sources are treated as one object type. You can also use the ***Alt+Pos 1***, ***Alt+End***, ***Alt+Page Up*** and ***Alt+Page Down*** keys to jump to the first / last or next / previous object.

In the "Properties" section, the properties (for objects that have properties) are displayed. Information about the properties of the individual objects can be found in the chapter "Objects and their properties"(page 131)".

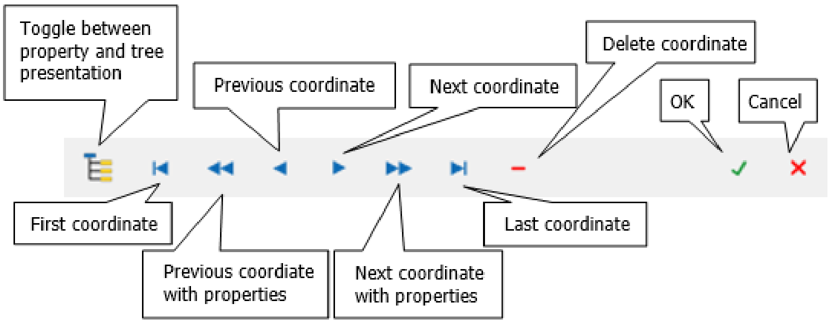
The "Geometry" section shows the coordinates and the elevation H_{abs} and H_{rel} (absolute or relative z-coordinate) together with information on 2D and 3D length or area of the object, see "(Elevation) height definition" (page 56).



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

You can copy the coordinates of an object or just a specific row or column to the clipboard with ***Ctrl+C.***

Below the geometry you see a symbol to switch the presentation to the tree view and a navigation bar to navigate within the coordinates of the object.

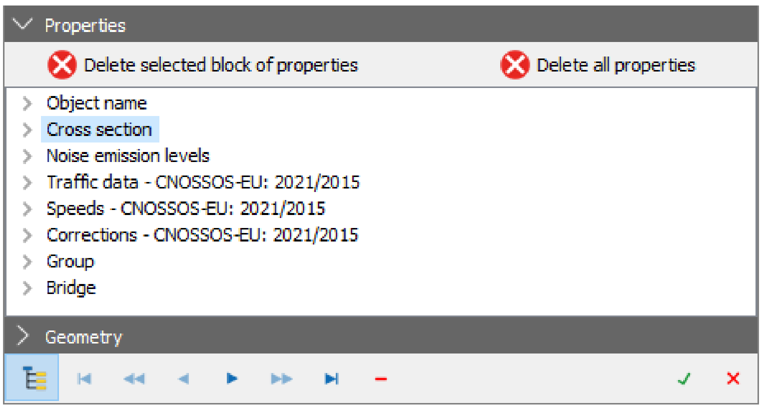


The "Next / previous coordinate with properties" icons become active only for variant objects with property changes.

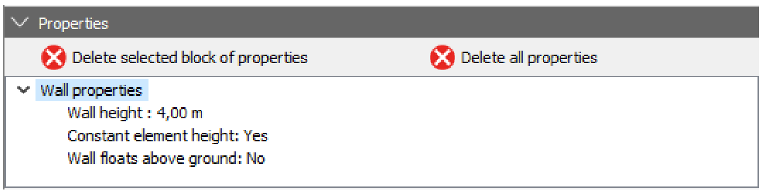
For the general objects point, line, area and measuring tape the object dialog is suppressed during input.

Tree view for variant objects

Press the "Tree View" icon in the footer of the object dialog to toggle from the property view to the tree view.



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).

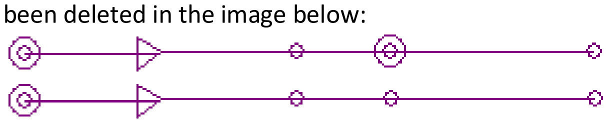


The properties are stored in property groups. If a property in a group changes, all properties in that group are saved. Here you can delete individual property groups or all properties defined at this coordinate.

In the example below, properties are defined at the first and third coordinates in the upper image (double circles). At the third coordinate, all properties defined at this coordinate have been deleted in the image below:

before

after



Note: To clear all emission changes in the course for roads or railways, use **OTHER TOOLS | RESET EMISSIONS** in the **TOOLS** ribbon.

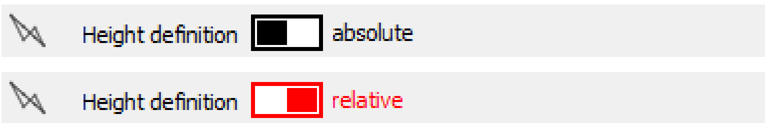
(Elevation) height definition

For noise simulations the spatial position of the objects is very important. The basis for the elevation is normally a Digital Ground Model (DGM). In the case of flat terrain, the object height can also be referenced to 0.

The height H_{abs} , which is assigned to the objects, differs depending on the object type.

Road, parking lot	Road surface. The emission height depends on the standard selected
Railway	Rail head, emission heights depend on the standard selected and the train type
Building / industrial building	Ground floor height, difference to terrain is taken into account as reflective pedestal
Floating building / floating industrial building	Ground floor height, no pedestal, noise can propagate through the space between terrain and ground height
Point, line, area sources	Emission height
Noise barrier	Base height of the wall, difference to terrain is taken into account as a pedestal
Floating noise barrier	Base height of the wall, noise can propagate through the space between terrain and base height
Noise berm	Terrain
Floating screen	Base height of the screen surface
Free-field receiver	z-coordinate is the first calculation point
Receiver assigned to building	Automatically determined from the ground floor height and the receiver-related properties of the building
Tunnel opening	A base height averaged from the two coordinates
Attenuation area	No height information needed, always referenced directly to the DGM

The height definition can be absolute above mean sea level or relative above DGM or above 0 m. You can see how the heights are defined in the object dialog and in the status bar of the Geo-Database (red coordinates).



The heights of line objects can be interpolated in the coordinates list. With the Shift key pressed and the mouse or the arrow keys in the H_{abs} or H_{rel} column, activate the first height and the last height between which you want to interpolate, and press **INTERPOLATE ELEVATIONS** or ***Ctrl+H***.

Absolute height

The absolute height H_{abs} is the height above mean sea level. With absolute height definition, the height of the objects above NHN does not change if the DGM changes. In most road and railway projects where the input data is in absolute elevations, the objects are manually reset to the DGM if the elevation changes.

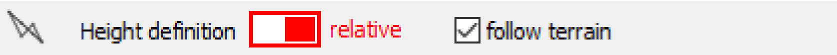
Relative height

The relative height H_{rel} is the height above a DGM or above 0 m. With relative height definition, the height of the objects automatically adjusts to the changed terrain. If the DGM changes - for example, in the case of different development stages in a quarry, then the height of the objects above sea level also changes. In this case the relative height definition is the more efficient choice. The relative height definition is also sensible for identical source geometries that can be used in several projects (for example, a discount store with buildings, parking lots and sources).

For better visualization, the coordinates of relative sources are displayed in red in the status bar.

Terrain following height

For line and area sound sources as well as parking lots, the relative height definition may additionally follow the terrain.



In the case of terrain-following objects, not only the entered coordinates are at a defined relative height above the DGM, but also each segment or partial area resulting from the decomposition in the Calculation core. The height is set equal for all coordinates. If the relative height is changed at one coordinate, it changes for all other coordinates too.

For lines with few entered coordinates and for areas, there may be inconsistencies in the 3D display, since the exact calculation of the source height is done in the Calculation core.

Change height definition

In the object dialog, you can change the height definition for individual objects by moving the slider to the right or left.

In the ribbon **TOOLS | HEIGHT TOOLS / HEIGHT DEFINITION**, you can switch the height definition for selected objects between **ABSOLUTE**, **RELATIVE** and **TERRAIN-FOLLOWING** for certain objects. If you have entered absolute heights and convert them to relative heights, the difference between DGM and z coordinate will be entered as H_{rel}. Vice verce, when converting relative to absolute heights, DGM elevation + relative height above terrain is entered as H_{abs}. If you switch the height definition to terrain-following, the **height at the first coordinate** is transferred to **all coordinates** of this object for line and area sources or parking lots.

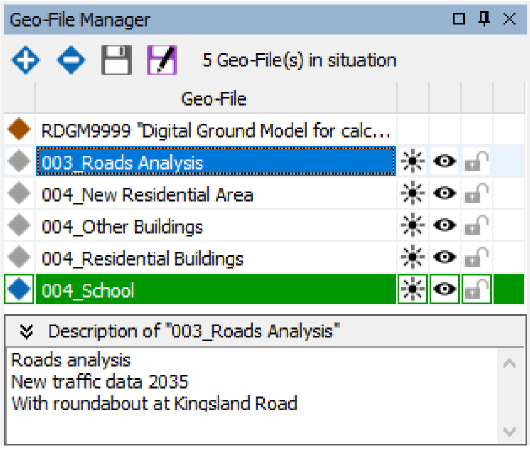
Height above ground from emission spectrum

For point, line, area sources and wind turbines, the height above terrain may already be stored in the emission spectrum, since the emission height above terrain is often dependent on the process defined in the spectrum. In this case, activate take over **TERRAIN REFERENCE FROM LIBRARY** in the properties of the respective objects.

If the height above ground in the emission spectrum is changed, the emission height is changed for all objects to which this spectrum has been assigned.

Geo-File Manager

The Geo-File Manager lists all the Geo-Files that are included in the Situation and the DGM loaded in the Situation. With a double click you can exchange the DGM. You can add more Geo-Files to a Situation or create new ones, remove Geo-Files from the Situation, save Geo-Files and save them under a new name.



The data you enter is always stored in the current Geo-File. This Geo-File is visualized with a green background. With a double-click on a Geo-File in the Geo-File Manager, it becomes the current Geo-File.

By holding down the Shift or Ctrl key, you select Geo-Files that are to be saved or that are to be removed from the Situation together. The selected Geo-Files are visualized with a blue background. Save Geo-Files, save as and remove from Situation always refers to the selected blue highlighted Geo-File(s).

Below the Geo-File list you can expand and change the **DESCRIPTION** of the selected Geo-File.

Use the three icons behind the Geo-File name to control the display:

FOREGROUND / BACKGROUND: The objects of a Geo-File that is in the background are displayed in gray and without area fill; they are ignored when editing.

DISPLAYED / HIDDEN: The objects stored in a hidden Geo-File are not displayed on the screen and are therefore ignored during editing. Small trap: if the current Geo-File with a green background is hidden, objects entered in this Geo-File will disappear as soon as the object is completed.

UNLOCKED / LOCKED: A locked Geo-File is displayed like an unlocked Geo-File and can be edited, but the Geo-File is protected from changes. If you have accidentally changed something in this Geo-File, you will be asked if you want to save it under a new name. With **CANCEL** you get back to the Situation to assign the changes to another Geo-File if necessary.

You can transfer the display mode to other Geo-Files by dragging the lower right corner of the box.

The **SAVE** icon in the last column visualizes that changes have been made in this Geo-File that have not yet been stored.

If you click the **ADD GEO-FILE** icon a separate dialog opens to create new Geo-Files or to assign one or more existing Geo-File(s) to the loaded Situation.

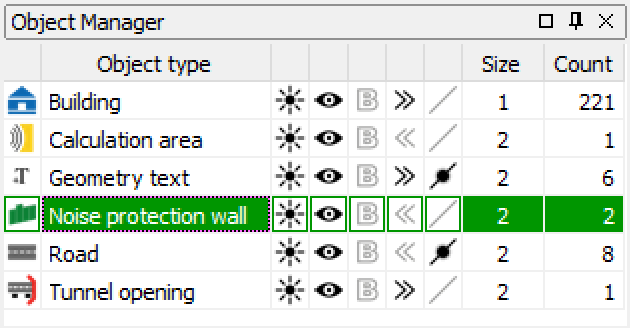
Only the Geo-Files that are not part of the opened Situation are displayed in the list. If all existing Geo-Files are assigned to the Situation, the list is empty. The functions are the same as in the Situation Manager, see "Functions in the Situation Manager" (page 51).

With the green check mark or double click on the Geo-File you return to the input interface.

3

Object Manager

The Object Manager lists all object types that are contained in the Situation, plus the number of objects for each object type. For a new project, the Object Manager is initially empty.



Object type	Size	Count
Building	1	221
Calculation area	2	1
Geometry text	2	6
Noise protection wall	2	2
Road	2	8
Tunnel opening	2	1

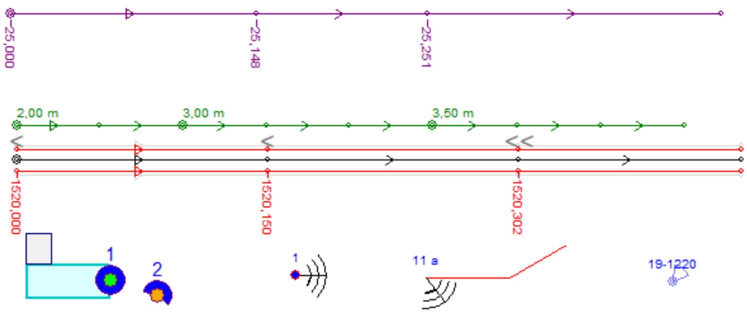
The current object type is highlighted in green. If you want to enter objects, display only a specific object type or perform actions for a specific object type, this always refers to the current object type. Select the required object type in the object type selection. Double-click in the Object Manager to activate an object type already contained in the Situation as the current object type.

Use the icons behind the object type to control the display:


FOREGROUND / BACKGROUND: Objects in the background are displayed in gray and without area fill; they are ignored when editing.


DISPLAYED / HIDDEN: Hidden objects are not displayed on the screen and are therefore ignored during editing. Small trap: if the current object type (green background) is hidden, objects disappear as soon as the object entry is completed.


WITH / WITHOUT PROPERTIES: Selected properties are additionally displayed for the object type:

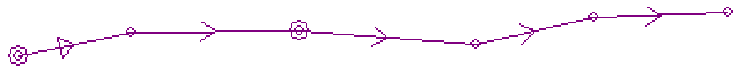


- For roads, the slope is displayed as soon as it is > 5%.
  >5 - 10% "<" or ">"
  >10-15% "<<" or ">>"
  >15% "<!!!> "
- For roads and railways, the rail or road kilometer is output if the objects are defined as reference axis.
- In the case of RLS-90 traffic signals, the signal points are displayed.
- For noise barriers, the wall height is output for each wall segment where the height changes.
- For buildings, the facades that were selected for the calculation of a façade noise map are output with a thick turquoise line, other facades with a thin blue line.
- For receivers, industrial sources and photo points, the object number is displayed.
- If a directivity has been assigned to the frequency spectrum of an industrial source, the direction is displayed.

- For photo points, the direction of view and the angle of view are output.
- For receivers, the angle range is shown in blue. A full circle means a sweeping angle of 0° - 360°, a semicircle indicates an angle range of 180°.

HIGHLIGHTED: The object type is displayed with double line width in the original color. Very useful setting when working with background graphics.

WITHOUT / WITH OBJECT POINTS: The object points localize the position of the entered coordinates, double circles visualize coordinates at which object properties were defined, this clarifies at which coordinate properties change in the course of roads, railways, noise barriers and berms (wall height, speed, traffic data, ...). For line and area objects, the input direction is displayed in addition to the input points. The direction arrow between the first and the second coordinate is specially marked.



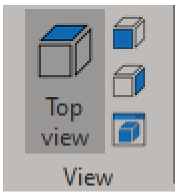
This start arrow also helps you to check whether imported data was imported as a polyline or as individual lines.

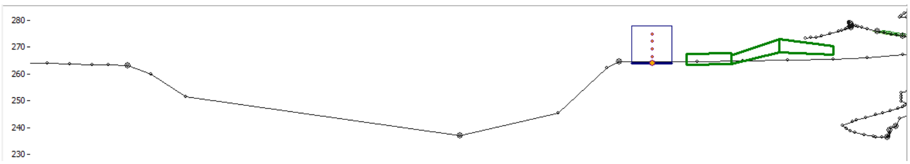
POINT SIZE: The point size determines the size of the input points, direction arrows, selection marks and the displayed selected properties.

Views

Front and side view

As an important tool for checking the height of your input data, you can switch to the elevation and side elevation display and to the 3D Graphics / 3D wireframe. In the **Start** ribbon, select **FRONT VIEW *(F8)***, **SIDE VIEW *(F9)*** or the **3D GRAPHICS *(F10)***.





Front view, here it is obvious that a bridge is missing

You see all the objects visible in the site map also in the front / side view. Depending on how far you zoom into the data, these are more or fewer objects. Hide objects in the object manager that you are not currently interested in. You can also display only selected objects.

Coordinates at which properties have been defined are displayed as a thick point. For receivers assigned to buildings, the base height is displayed as a larger, yellow-filled circle, and the receivers decisive for the calculation are displayed as smaller circles. For free-field receivers, the entered object height is the first calculation point.

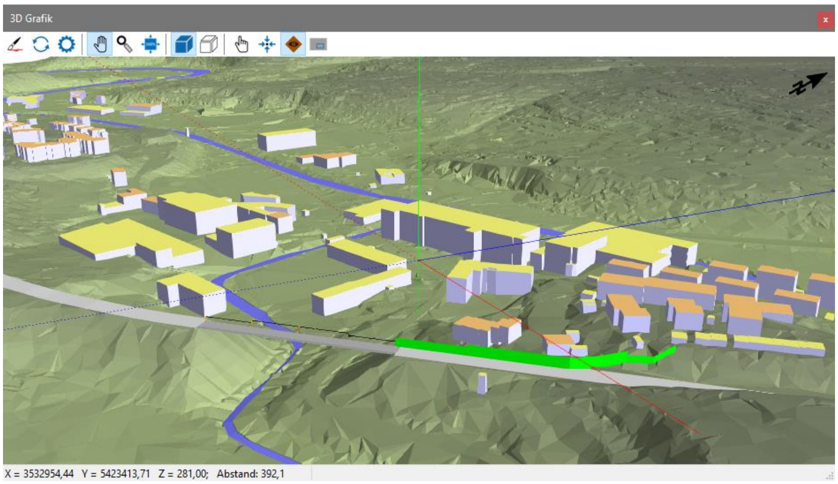
Note: If the input data is displayed very narrowly at the top of the window, this is a sign that objects with incorrect heights or "zero heights" are in your model. For example, if cadastral data are in the model as lines with zero heights, the other objects will be displayed correctly if you hide the line in the object manager.

With the mouse you can move to the objects in the front and side view. A mouse click on the left opens the object dialog, a mouse click on the right opens a popup menu to select and delete points or objects. Drag a frame with the right mouse button to select several objects in the front or side view.

Turn the mouse wheel to change the vertical exaggeration factor. **Double-clicking** in this window restores the overview. You can change the size of front and side view using the splitter at the top of the window.

3D model

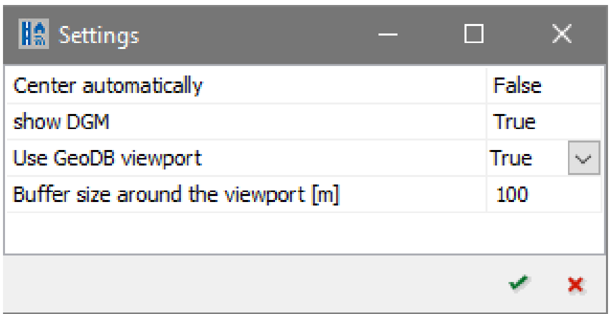
The 3D Graphics is provided as a docking window that can be added with ***F10***, permanently docked or placed floating, for example, on a second screen. You can switch between the solid 3D Graphics, a wireframe model or the site map.



The 3D Graphics window and the Geo-Database Graphics are controlled separately, so you can select different sections. You move with the mouse wheel pressed, zoom by turning the mouse wheel, and rotate and tilt the 3D Graphics with ***Ctrl*** and the mouse wheel pressed.

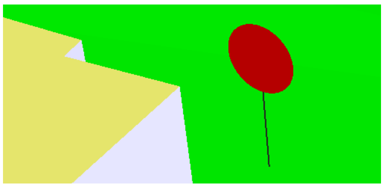

In the edit mode, you can click on an object in the 3D Graphics and open the object dialog. Optionally, the clicked object can be displayed centered in the middle of the screen.


Depending on the project size a DGM it is rendered only in the current section of the Geo-Database by default. This considerably reduces the loading time for larger projects. You can select a buffer in the settings by which the section is to be enlarged.



If no DGM is loaded in a Situation, you can display a 0 m based ground area.

For receivers and point sources, a **LINE TO THE GROUND** can be switched on in the object types, tab *3D Graphics*. This allows a better understanding of the position in space.

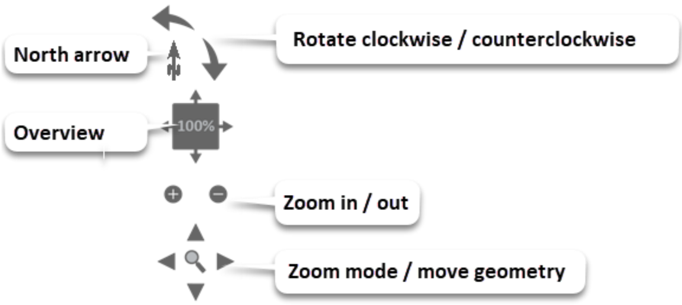


Check user-defined object types in the graphics window

Open the 3D window and switch to "site map" to check the graphics object type that you have assigned to an object for display in the Graphics, directly in the Geo-Database.

Rotation, zoom, overview

In the right area of the graphics interface, semi-transparent functions for rotation and zoom are placed. They become active when you move the mouse over the section.



With the two arrows on the top you can rotate the geometry clockwise or counter-clockwise in 5° steps. You can rotate continuously by holding down the ***Ctrl key*** and using the mouse wheel. The north arrow rotates accordingly. By clicking on the north arrow, the geometry will be displayed in the north direction again.

Via the small + and - symbol, with the mouse wheel or via the "Page up" or "Page down" buttons you zoom the geometry. Below this is the zoom mode, where the cursor changes to a magnifying glass. In the zoom mode, you can either zoom in by dragging a frame around an area or zoom out by clicking the left mouse button or zoom in by clicking the right mouse button. To use the zoom mode temporarily without the cursor changing permanently, drag an area with ***Shift + mouse wheel***. The four arrows at the bottom move the geometry section by half the width of the screen.

Object zoom

If you want to have a close look at a certain object, the object zoom will output this object full-screen. Select the magnifying glass and press the ***ALT key*** additionally. The magnifying glass is displayed together with the letters OBJ as soon as a point of an object is found within the search radius. Click the left mouse button, the object is magnified. If several objects are found within the search radius, select the corresponding object from the selection list.

Bitmap Manager

*Bitmap is used here as a superordinate term for all raster graphics that are georeferenced and placed in the background in the Geo-Database. The file formats *.bmp, *.jpg, *.png, *.tif as well as pdf files that are converted to a bitmap on opening are supported.*

In the bitmap manager bitmaps are georeferenced and edited (change color depth, flip, ...). Bitmaps can be combined into bitmap groups so that, for example, tiled aerial images are combined into one bitmap group for projects with a larger extent. Bitmaps with different levels of detail can also be displayed together within one area. For example, the detailed map of a construction project and the overview map of the surrounding area.

The bitmaps are stored in different resolutions so that the resolution is always high enough regardless of the zoom level.

Bitmaps that are to be used as background bitmaps in the Geo-Database must first be aligned with the world coordinates. If a project coordinate system is included, this is done using two reference points that span the entire investigation area if possible. For projects with local coordinates, the dimensions can also be specified from an architect's map by means of the length of a line.

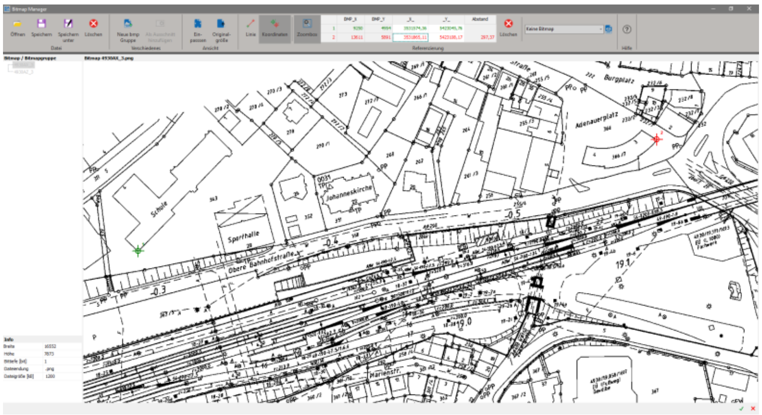
If world files (*.tfw, *.jgw, *.pgw) are available for the bitmaps or the bitmap is a georeferenced TIF, the referencing is read automatically.

In addition, sections from Google Maps, OpenStreetMap or WMS servers [Business Basic Module] can be used as background bitmap. These are georeferenced via the defined project coordinate system. The special feature when using WMS servers is that the section from WMS automatically adapts to the screen section unless a bitmap is explicitly requested.

The bitmaps are selected from the drop-down list in the Geo-Database interface. You decide whether the displayed section should be automatically adjusted to the selected bitmap. Select the setting **ZOOM TO BITMAP VIEWPORT** in the **miscellaneous** ribbon.

You can also save geometry sections in the bitmap manager and select them to jump to the area of the selected bitmap.

Open the Bitmap Manager and select the bitmap(s) or pdf file(s). They will be moved to the "BackgroundBitmaps" subfolder. If available, the world files will be read and saved in this step.

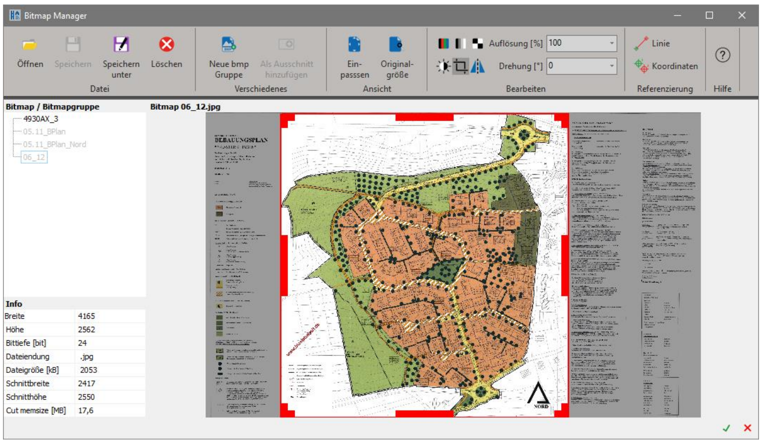


The bitmaps are listed in a tree view on the left, non-georeferenced bitmaps are displayed in gray. For each bitmap further information is displayed in the lower area.

Edit bitmaps in the bitmap manager

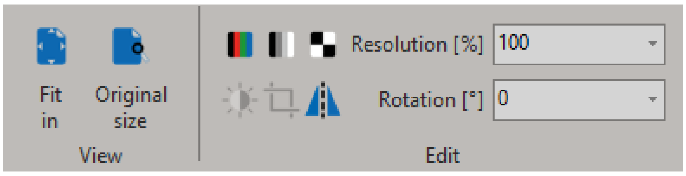
If you want to use only one or more sections of a bitmap, for example because the map description should be cut off or several views are included, drag a frame around the desired area.

3



The areas outside the frame are highlighted in gray. You can change the section using the red bars or move it within the frame using the left mouse button. Click on "**CUT**" and save the section. If you want to use several sections from a bitmap or a pdf, select **SAVE AS** to save the section so that the original bitmap is retained.

The section is reset when you press ***Esc*** or click outside the frame in the bitmap.



You can display the file either in **ORIGINAL SIZE** or **FITTED TO THE DIALOG SIZE. MIRROR IMAGE** is needed, for example, if you get a ceiling map for an industrial building, which is drawn "upwards", but for the input in the industrial building must be assigned to the ceiling the other way around.

A PDF section is first drawn into a 24-bit bitmap during conversion, since it is unknown how many colors are actually contained in the PDF. Therefore, you can convert the bitmap to **256 COLORS**, **GRAYSCALE** or **BLACK AND WHITE** accordingly to avoid using memory unnecessarily.

In addition, you can **ROTATE** the file and change the **RESOLUTION** for the graphics file. Selected values are listed in the selection list, but you can enter any angle or resolution. The dimensions and approximate size of the resulting bitmap in MB / kB are displayed in the info area.

Georeference bitmaps

Select referencing via **LINE** (only if no project coordinate system is defined) or via **COORDINATES.** Referencing via the length of a line can be the better option especially for smaller construction projects or for bitmaps of industrial buildings / rooms.

When you invoke referencing, editing is hidden, and the bitmap and world coordinates are displayed.

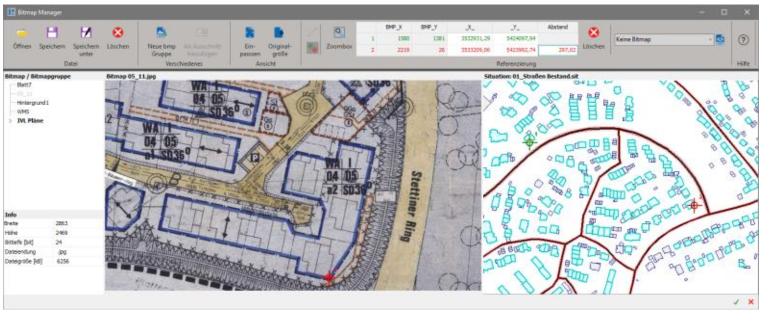
To enter the reference points more precisely, you can add a zoom box and move the cursor in the zoom box to the exact position.

When **referencing across a line**, use the mouse to specify the two reference points, for example the longest edge of a building, and enter the distance.

When **referencing via coordinates,** you also enter the two reference points with the mouse and enter the corresponding world coordinates in the X and Y fields.

If there are no objects in your project yet, select two coordinates on the bitmap that are easy to find again and note the x/y values. Coordinate crosses with even values are most suitable.

If objects are already included, the reference point dialog opens parallel to the Geo-Database interface, so that the reference points can be graphically assigned directly with a mouse click. For better orientation you can select an already georeferenced bitmap for the Situation.



Click the two reference points in the bitmap and in the Situation with the mouse.

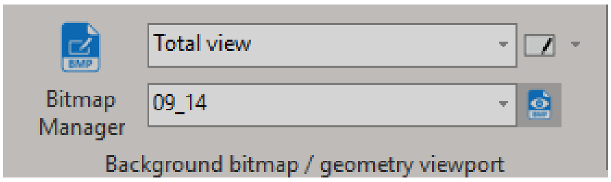
Bitmap groups

Bitmaps can be combined into groups, which are selected in the selection list in the Geo-Database interface. Create a new bitmap group, select the bitmaps you want to add to this group with ***Shift*** or ***Ctrl*** and move them into the bitmap group in the tree with the mouse. The bitmaps and bitmap groups can be added as a geometry section so that the screen section zooms to the area of the bitmap.

Transform bitmaps

If a project coordinate system was already defined when referencing or reading out the world files, the coordinate system is saved in the world file. If you change the co-ordinate system later, the bitmaps will be transformed automatically when transform-ing the project data.

Bitmap selection and geometry sections



All georeferenced bitmaps and bitmap groups are listed in the bitmap selection list. The currently selected bitmap is displayed. You can use the checkmark to the right of the list to temporarily switch off the display of the bitmap.

*Note: When entering data on background bitmaps, area objects may cover information on the bitmap, for example the exact position of a building outline. In this case, switch off the area fills with - (minus) (Ribbon **Miscellaneous | HIDE FILL COLORS**).*

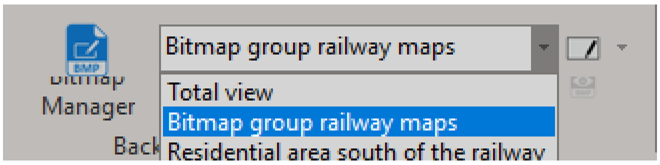
The list of saved geometry sections is arranged above this, initially only the "Total view" section is available.

For larger projects and working with background bitmaps / bitmap groups, it is sensible to save individual areas as geometry sections that you can select directly.

To save a new screen section, zoom into the desired area, select **ADD SECTION** from the drop-down list in the section administration, and enter a name. To use a bitmap or bitmap group as a geometry section, click **ADD AS GEOMETRY SECTION** in the Bitmap Manager.

The positions of the saved sections can be displayed or hidden in the Geo-Database interface. To do this, select **SHOW SECTIONS** from the selection list in the section management.

The desired section becomes active as soon as you select it from the selection list or by left-clicking on the black marker at the corners.

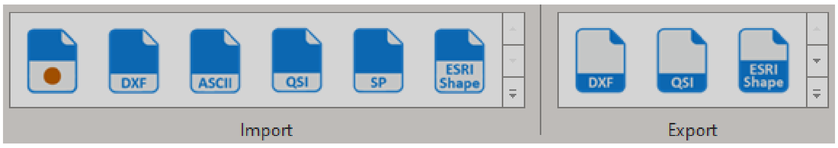


Delete or rename geometry section

Select the section you want to delete or rename. In the selection list you can select **DELETE SECTION** or **RENAME SECTION.**

Data import / export

All import and export formats are provided in the **Fundamental** ribbon.



In the gallery, the default settings are displayed first, further import and export formats are accessible via the arrow next to the gallery. If you select another import or export, it will be added to the gallery of then last used formats.

DXF Import

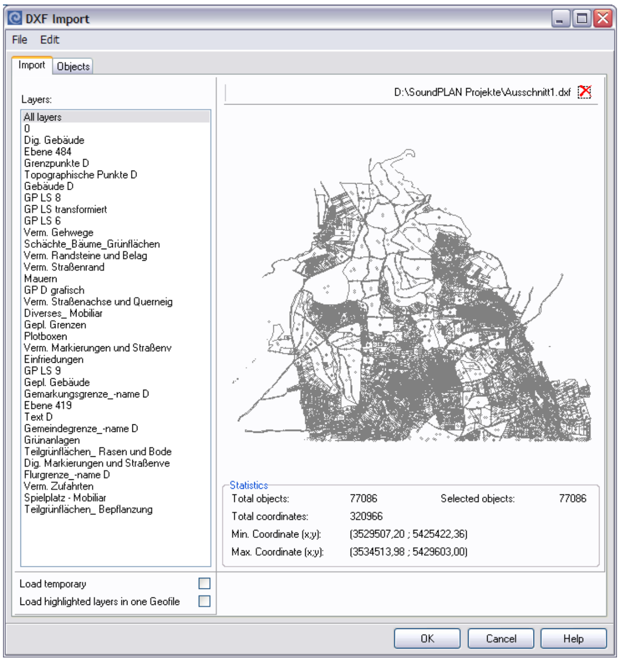
The geometry (x, y and z coordinates) is imported to SoundPLAN as general points, lines, areas and texts. The actual object type is not known at this stage.

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

To work efficiently with the DXF interface, you should know the structure 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 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 **IMPORT | DXF**, select the DXF file and click OK. The layer list is built alphabetically, and you see a preview of the DXF data.



"All layers" shows 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 view the content of each layer. Select the layers you want to import with the left mouse button and Shift (multiple layers in a row) or Ctrl key (single layers) and click OK to import the corresponding data.

EDIT | INVERT SELECTION will turn off all previously selected layers and turn on the unselected ones.

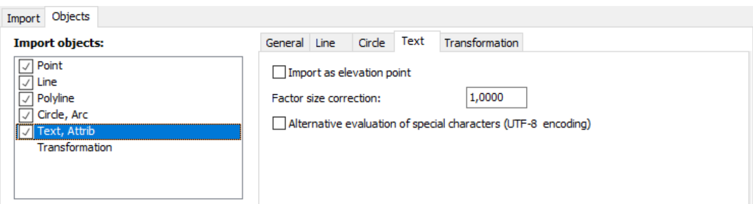
You can drag an area in the preview image with the mouse, then only the data within this area will be imported. Click the **DELETE AREA** symbol to import the entire range of coordinates.

The layers can optionally be imported temporarily if you activate the checkbox **LOAD TEMPORARY.** Temporary Geo-Files (TMP_LAYERNAME) are only stored after they have been assigned to user defined Geo-Files, permanently imported layers (DXF_LAYERNAME) will be saved in the Situation in any case.

For example, if no meaningful layer list has been supplied, it is a good idea to first import the layers temporarily, select **VIEW | CURRENT GEO-FILE (F5)** and look at the contents of the individual layers. If you then discover that the data you need is contained in only a few layers, you can create new Geo-Files and assign the required layers to user defined Geo-Files via **EDIT | CHANGE GEO-FILE ASSIGNMENT.** You don't need to worry about the other temporary Geo-Files, no data garbage will remain after saving the Situation. If you notice that you need many layers, the data is already well organized and the layer names are meaningful, it may be faster to import the data again without checking the temporary checkbox.

Additionally, you can import multiple layers into one Geo-File. Activate **LOAD HIGHLIGHTED LAYERS INTO ONE GEO-FILE** and specify a file name for the Geo-File.

The following objects are imported, partly with additional features:



- Coordinates with an elevation equal to 0 can be ignored during the import.

3

- Lines and polylines are connected to polygons if **CONNECT OBJECTS** is activated. Several lines are joined by omitting the end point of a line if the end point of this line is the same as the start point of the following line. The lines must be located one behind the other in the dataset.
- Lines with dense coordinates can be filtered during import (filter value 5 cm).
- Circles and arcs are decomposed into polygons. For the conversion you can enter the accuracy of the result (low, medium, high).
- Texts are imported as geometry texts which you can assign a size factor at import time.
- Furthermore, it is possible to convert texts into elevation points (**IMPORT AS ELEVATION POINT**), i.e. the x and y coordinates determine the position and the height information available as text is transferred to the z coordinate. Make sure that the layers to be imported only do not host any other texts (for example land parcel or house numbers). The coordinates of the elevation point are derived from the position marker of the text. This can result in a systematic position error and needs to be corrected using the coordinate functions.
- If during import special characters of texts are not interpreted correctly, check **ALTERNATIVE EVALUATION OF SPECIAL CHARACTERS (UTF-8 ENCODING)**.
- With the **TRANSFORMATION,** reference points from a local DXF scale can be converted to the world coordinates in SoundPLAN. You have to import the data twice; the first time you locate the local coordinates of the reference points and the second time you assign them to world coordinates.

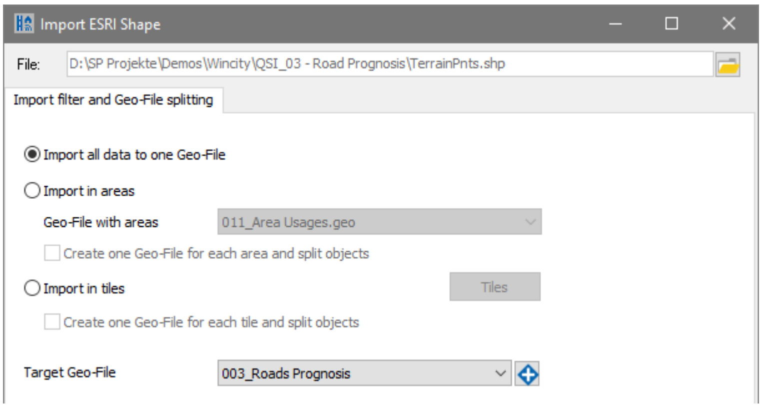
With OK the DXF data are imported into the Geo-Database as points, lines, areas and texts. The data must then be converted into the corresponding SoundPLAN objects.

DXF-Export

Situations from the Geo-Database can be exported as DXF file with **EXPORT | DXF.** SoundPLAN exports the displayed geometry data. This also allows you to export a specific Geo-File or object type via the view filters **CURRENT GEO-FILE** (***F5***) or **CURRENT OBJECT TYPE** (***F6***). Select whether you want to export a separate layer **PER OBJECT TYPE** or **PER GEO-FILE.**

Import settings for ASCII tables, ESRI Shapefiles and CityGML

For the import of ASCII tables, ESRI Shapefiles and CityGML, in addition to importing all data into one Geo-File, you can also import data within arbitrarily shaped areas or in tiles [Module Noise Mapping Toolbox].



The **IMPORT ALL DATA TO ONE GEO-FILE** option imports all data contained in the import file(s) to the Geo-File selected as the **TARGET GEO-FILE.** Use the **NEW GEO-FILE** button to create a new target Geo-File.

For the **IMPORT IN AREAS** option, you need a Geo-File that already contains the areas, for example the investigation area or districts. The areas may be available as the object type general area, area usage or map section.

Only the data located within the areas will be imported. Select the **TARGET GEO-FILE** or use the **NEW GEO-FILE** button to create a new Geo-File in which the imported data will be stored. With the checkbox **CREATE ONE GEO-FILE FOR EACH AREA AND SPLIT OBJECTS** you can split the import data to the areas contained in the **GEO-FILE WITH AREAS.** The Geo-Files are given a name that is composed of the names of the individual areas and a **TARGET GEO-FILE PREFIX** that you specify**.**

For the **IMPORT IN TILES** option, you need a tiling system. If no tiling project has been defined yet, first select the georeferenced bitmap, otherwise the Tile Manager will open so that you can enter the area for which you want to import the data. If all data should be imported into one Geo-File, specify the target Geo-File or create a new target Geo-File using the **NEW GEO-FILE** button. With the checkbox **CREATE ONE GEO-FILE FOR EACH TILE AND SPLIT OBJECTS** you can split the import data to the tiles defined in the tiling system. Each tile is saved as a separate Geo-File, where the name is composed of a **TARGET GEO-FILE PREFIX** you specify, and the X and Y coordinates truncated to kilometers.

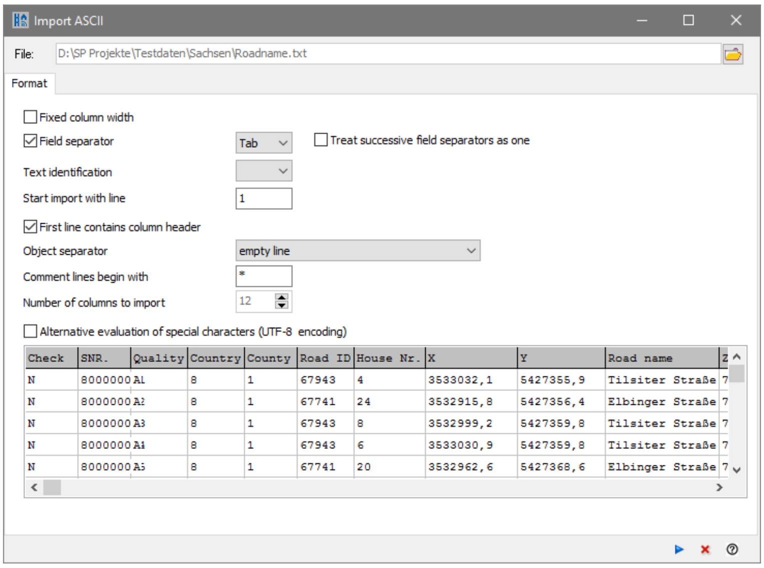
If you import the data into individual Geo-Files, these will not be automatically assigned to the Situation and displayed, as the data volumes could be too large. Load the Geo-Files you need into the Situation via **ADD GEO-FILE.**

ASCII import

Use the ASCII interface to import ASCII data (*.ASC, *.CSV, *.TXT) in SoundPLAN. As soon as properties are to be imported as well, it does not make sense if the source file contains several object types.

Properties that apply to all objects (for example, "Emission calculated" or "Input type" when importing roads) can be set in the default properties that are opened before the import.

Call **IMPORT | ASCII** and select the file to be imported.



SoundPLAN tries to determine the format settings from the ASCII file. The contents of the file are displayed in the file preview window; check the settings and modify them if necessary.

FIXED COLUMN WIDTH / FIELD SEPARATOR: The data can have a fixed column width as well as separated by semicolon, space, tab, comma or |. With fixed column width, the exact column width of the individual table cells is set in the table header with the left mouse button held down. Use **TREAT SUCCESSIVE SEPARATORS AS ONE** to avoid empty columns.

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

START IMPORT WITH LINE: Specifies how many lines in the file header should not be interpreted as regular data.

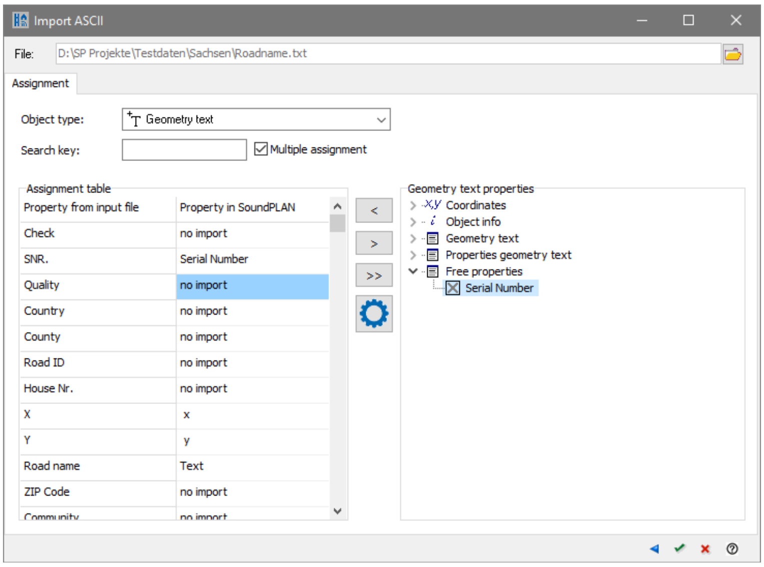
FIRST ROW CONTAINS COLUMN HEADERS: Determines whether the file contains column definitions in the first imported row. The table header is important for the correct assignment of data.

OBJECT SEPARATOR: Here you can select whether a new object starts by a **EMPTY LINE,** by a character or by a sequence of characters (**LINE STARTS WITH SPECIAL STRING**). If you select that the line starts with a special string, please enter it in the field next to it.

COMMENT LINES BEGINT WITH: Defines how comment or text lines are marked so that they can be filtered out.

If umlauts and special characters are not recognized correctly during import, check the **ALTERNATIVE EVALUATION OF SPECIAL CHERACTERS (UTF-8 ENCODING).**

If the format definition looks coherent in the preview, click on the "Next" icon, define the import settings, see "see "Import settings for ASCII tables, ESRI Shapefiles and CityGML" (page 68) and click on "Next" to enter the assignment table.



Select the object type to be imported - the corresponding object properties are listed on the right side. On the left side you see the assignment table. For ASCII import at least the x and y coordinates must be assigned.

In the column **PROPERTY FROM IMPORT FILE**, you see the column headers from the import file. In the column **PROPERTY IN SOUNDPLAN** the fields of the respective object type from SoundPLAN are entered. Initially, all fields are marked as "no import". Click on the property you want to import in the assignment table. Then select the property in the object properties on the right (expand nodes) and assign the property by double-clicking or using the arrow. To unassign, select the field on the left and click the arrow to the right. Unassign all assignments with the double arrow.

The **PREVIEW PROPERTIES** button displays the beginning of the first selected import file as a table, in order to verify the content of the column headings here for the assignment.

The assignments are stored in a database file in the Globdata directory where several column identifiers can be assigned to a SoundPLAN property (for example, if different data suppliers use different column identifiers). During the next import, the assignments stored there are suggested, and the assignment table is filled in accordingly. The proposed property assignments can be revoked at once using the double arrow.

Note: If the properties contain a unique identifier for the objects, import this as a free property in any case, see "Free properties of the objects" (page 216). You can use this ID to add further properties later, see "Adding properties using search keys" (page 74).

Click on the green check mark to first view the object properties of the first imported object. If necessary, you can enter additional properties here that apply to all objects to be imported. Check whether the assignments are correct and whether umlauts have been recognized correctly. If there is an error in the assignment or special characters are displayed instead of the umlauts, cancel the dialog with the red cross. You will return to the import dialog and can change the setting for evaluating umlauts or change the assignments and then restart the import.

After closing the dialog with the green check mark the data will be imported.

In case of import errors, the line in which an error occurs is output. Such errors in certain lines can occur, for example, if wrong key characters appear within the file or if a column is empty when separating columns with TAB. Using the line number, you can quickly identify and repair the error. A prerequisite is an editor that outputs the line numbers (for example Notepad++ - Download https://notepad-plus-plus.org/).

ASCII export

Via **EXPORT | ASCII GEOMETRY** you create a txt file with the coordinates and the height above sea level or the relative height above terrain and the DGM height. Depending on the Geo-File or object settings, all data in the Situation, the data in the current Geo-File or all objects of the current object type are exported. **EXPORT | ASCII DOCUMENTATION** creates a *.doc file in which, in addition to the coordinates, certain properties such as object name, distance emission lines or building height are documented.

ESRI Shapefile Import

[Module GIS Interface] The ESRI Shapefile Import allows you to import shapefiles from GIS software (coordinates + properties) into SoundPLAN.

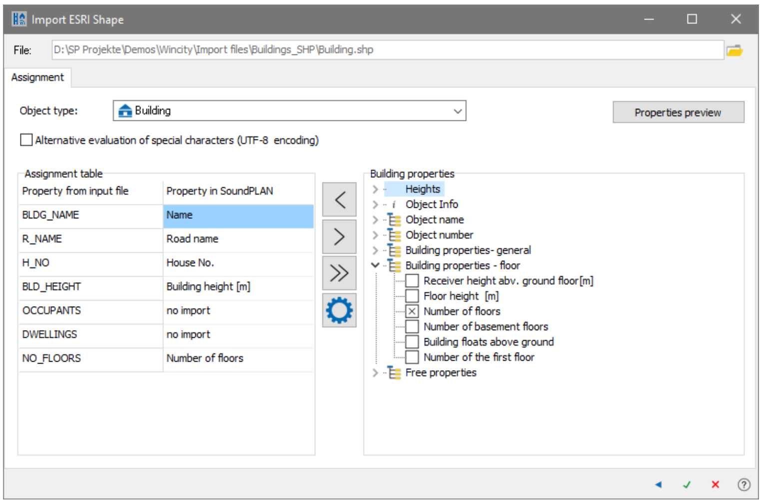
The import data for an object type usually contains at least 3 files:

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

DBF files can be opened and modified in the SoundPLAN Spreadsheet. This way you can save additional properties in a new column or use formulas to reformat a property that cannot be imported the way it is defined (e.g. a property that is contained in the import file as text, but is expected by SoundPLAN as an integer value). So, you can check which properties are defined how or save more properties in new columns. After opening the Spreadsheet, close the File manager and open the table via File **| OPEN DBF FILE**. Deleting rows and sorting is not possible with dbf files.

Properties that apply to all objects (for example, "Emission calculated" when importing roads) can be set in the default properties that are opened before the import.

Call **IMPORT | ESRI SHAPEFILE** and select the shapefile(s) (multiple selection via ***Ctrl*** or ***Shift key***). Selecting multiple shapefiles is not sensible unless all files contain the same object type. Define the import settings, see "Import settings for ASCII tables, ESRI Shapefiles and CityGML" (page 68) and click on the "Next" icon to enter the assignment table.



Select the object type to be imported - the corresponding object properties are listed on the right side. On the left side you will see the assignment table.

In the column **PROPERTY FROM IMPORT FILE**, you see the column headers from the import file. In the column **PROPERTY IN SOUNDPLAN** the fields of the respective object type from SoundPLAN are entered. Initially, all fields are marked as "no import". Click on the property to be imported in the assignment table. Then select the property in the object properties on the right (expand nodes) and assign the property by double-clicking or using the arrow. To unassign, select the field on the left and click the arrow to the right. Unassign all assignments with the double arrow.

The **PREVIEW PROPERTIES** button displays the beginning of the first selected import file as a table, in order to verify the content of the column headings here for the assignment.

The assignments are stored in a database file in the Globdata directory where several column identifiers can be assigned to a SoundPLAN property (for example, if different data suppliers use different column identifiers). During the next import, the assignments stored there are suggested, and the assignment table is filled in accordingly. The proposed property assignments can be cancelled at once using the double arrow.

Note: If the properties contain a unique identifier for the objects, import it in any case as a free property with see "Free properties of the objects" (page 216). You can use this ID to add further properties later, see "Adding properties using search keys" (page 74).

Click on the green check mark to first view the object properties of the first imported object. If necessary, you can enter additional properties here that apply to all objects to be imported. Check whether the assignments are correct and whether umlauts have been recognized correctly. If there is an error in the assignment or special characters are displayed instead of the umlauts, cancel the dialog with the red cross. You will return to the import dialog and can make changes to the settings for evaluating the umlauts or to the assignments and then restart the import.

After closing the dialog with the green check mark the data will be imported.

Shapefiles with triangle strips and triangle fans

If an object in the shapefile consists of triangle strips or triangle fans, they are usually bodies whose surface is defined by triangles. Except for the object types "Area" and "Building", triangle strips and triangle fans are ignored.

For the object type "area" all triangles are imported as independent areas, i.e. after importing SoundPLAN no longer knows which triangles originally belonged to an object.

For the object type "building" all triangles of an object are imported. In a second step, a hull is formed from all triangles projected to the terrain surface. As a result, balconies, for example, are also present in the building floor map.

If no more precise information is available, the lowest occurring z-coordinate is used as ground floor elevation when reading the geometry. Often a column for the ground floor elevation is included in the dbf file. You will obtain a more accurate model if you assign this column to h1 (check the values in the dbf file beforehand).

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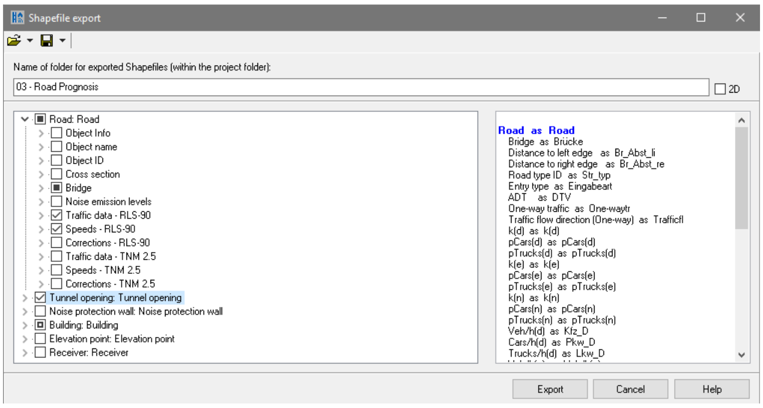
ESRI Shapefile Export

[Module GIS Interface] Call the shapefile export with **EXPORT | ESRI SHAPEFILES.** Define which properties should be exported in addition to the coordinates. Specify the name of the folder in which the shapefiles shall be written, by default the Situation name is suggested. The export files are stored in this subfolder in the project directory.

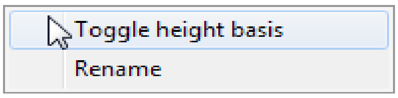
A tree structure lists all the object types contained in the Situation, together with all the properties available in SoundPLAN. Clicking on the node expands the tree structure and lists the properties of the objects.

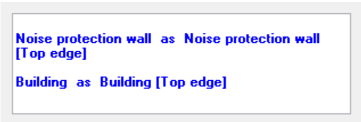


If you click on the object type, the geometry of the corresponding object type will be exported (marked by an unfilled square). Open the properties using the "Node icon". If you click on the property block, for example "Cross section", all properties stored in it will be exported (the property block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

The objects to be exported and their properties are displayed in the right window.

For buildings and noise barriers, you can choose whether to export the **object base height** or the **top edge** (right-click on the object type).



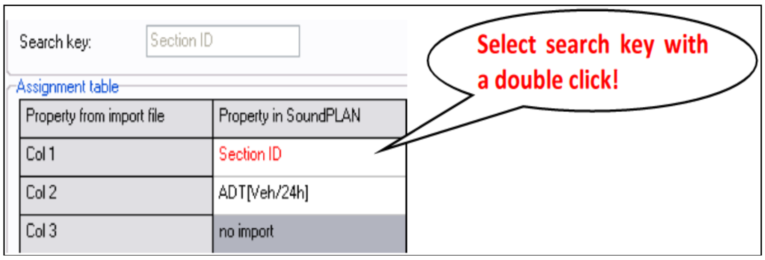


The field names that designate the properties may contain a maximum of 10 characters without special characters and spaces. This often truncates the names used in SoundPLAN. Press ***F2*** to give the field names sensible names. In the property selection you can enter a name as Short title (page 101), which then will be proposed as field names.

You can save and load the selection of the properties for the objects to be exported either for the project or in the global context.

Add properties via search key (DBF and ASCII import)

You can import further properties using a **SEARCH KEY** to already existing objects or existing properties can be updated. These properties can be contained in an ASCII file as well as in a DBF file (properties of a shapefile).



If the properties are in an ASCII file, call **IMPORT | ASCII TABLE**, for properties from shapefiles select **IMPORT | DBF**. Select the file and for ASCII data also the format.

In the assignment table, assign the column that uniquely identifies the objects (for example, name, section name or a free property). By **double-clicking** on this cell in the assignment table, the **SEARCH KEY** is defined and displayed in red. The search key is not imported, but only used to identify the objects.

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

With the checkmark **MULTIPLE ASSIGNMENT**, for line objects with variant properties, the additional properties are entered not only at the first point of an object, but at each point where the content of the search key column changes (e.g. different section names in the course of a road).

Once you run the import, only the newly assigned properties will be changed, all other properties will be retained.

Example: You have imported buildings without information about the building heights. Then you get data that contains the building heights. In the assignment table, assign the column that identifies the objects and the column that contains the building heights. Double-clicking on the column with the object identifier defines the search key and displays it in red. After the import, the building height is changed, all other properties remain unchanged.

QSI interface (DIN 45687)

The QSI format according to DIN 45687 was developed to exchange model data for noise propagation calculations between different calculation programs for the purpose of quality assurance. The abbreviation QSI stands for "Quality assurance for software products for immission calculation".

The QSI format is used to export or import complete data models. The corresponding QSI model file (*.qsi) describes the contained object types and the file names under which the generated shapefiles were saved, as well as additional information, if applicable.

Note: Properties that are not specified according to DIN 45687 cannot be processed. For example, the emission from roads and railways or sources in industrial halls. For industrial buildings, the facade sources are exported as area sources. The logbook provides further information.

Call **IMPORT | QSI** and select the QSI file you received together with the shapefiles. After loading the data, a postprocessing is started to generate the model.

The data is divided into different Geo-Files by object type with the prefix QSI_ during import.

EXPORT | QSI exports the loaded Situation into the QSI format. The exported shapefiles and the qsi file are stored in a subfolder of the project directory.

The exchange properties of the following objects are specified in supplement 1 of DIN 45687:2006-05:

- Road RLS-90, VBUS
- Traffic light RLS-90
- Parking lot RLS-90
- Rail with train category Schall-03 (1990), VBUSch
- Receiver
- Building
- Screen (noise barrier)
- Ground effects
- Attenuation area
- Industrial source (point, line, area source) with emission spectrum and day histogram (no Lmax)
- Elevation point, elevation line (noise berms are modeled with elevation lines)

Import of individual shapefiles from a QSI dataset

For noise protection walls and buildings, the top edges of the objects are output as the height. In addition, a shapefile with elevation points is generated, which contains the ground floor height or the base height at each input point. Import this shapefile additionally, calculate a DGM from the elevation points and use the GeoTool "Calculate wall height from object top edges"(page 123) to determine the building or wall height.

CityGML Import

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

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

There are different levels of detail (LoD) for city models in CityGML:

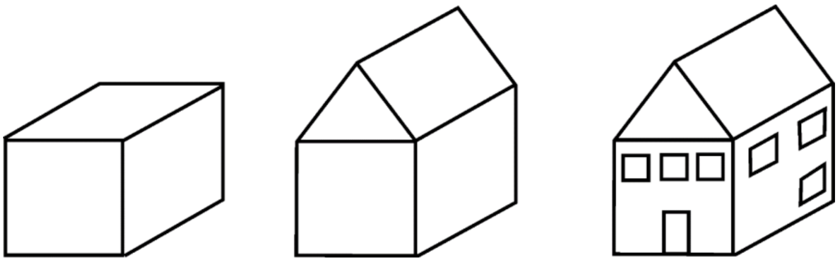
LOD 0: Terrain model with texture

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 (interior and exterior)



Simple examples for LoD1, LoD2 and LoD3

In SoundPLAN, LoD1 and LoD2 CityGML data are imported as a block model (LoD1).

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Import CityGML

Call the import via **IMPORT | CITYGML** and select the file(s). Via the multiple selection with pressed ***Shift*** or ***Ctrl key*** you can also import CityGML data that are available in several tiles at once.

The properties offered later in the assignment table (e.g. function ID, road name, ...) are only read from the first file, since reading is time-critical. If you know that other properties should actually be available, you can use the **READ ALL FILES** button to initiate all files to be evaluated. However, this may take some time depending on the number of files and the number of objects contained.

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

Set the import settings, see "see "Import settings for ASCII tables, ESRI Shapefiles and CityGML" (page 68) and click on the "Next" icon to get to the assignment table.

The assignment table displays the building properties contained in the CityGML data. Depending on the data provider, different properties can be included - or none at all, in this case the assignment table is empty.

We distinguish between "normalized" properties, which can be identified by a normalized keyword, and other (non-normalized) properties. The normalized keywords contain, for example, the building height (measured height), address data or the building usage (function ID).

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

In the column **PROPERTY FROM IMPORT FILE**, you see the column headers from the import file. In the column **PROPERTY IN SOUNDPLAN** the fields of the respective object type from SoundPLAN are entered. Initially, all fields are marked as "no import". Click on the property to be imported in the assignment table. Then select the property in the object properties on the right (expand nodes) and assign the property by double-clicking or using the arrow. To unassign, select the field on the left and click the arrow to the right. Unassign all assignments with the double arrow.

THE PREVIEW PROPERTIES button displays the beginning of the first selected import file as a table in order to verify the contents of the displayed properties for the assignment.

Use the gear wheel to define free properties, for example the function ID that can be assigned for import, see "Free properties of the objects" (page 216).

Click on the green check mark to first view the object properties of the first imported object. If necessary, you can enter additional properties here that apply to all objects to be imported. Check whether the assignments are correct. If there is an error in the assignment, cancel the dialog with the red cross. You will return to the import dialog and can make changes to the settings for evaluating the umlauts or to the assignments and then restart the import.

After closing the dialog with the green check mark the data will be imported.

Calculation of building heights

During the import SoundPLANnoise creates separate buildings from building parts defined by separate ground areas. As a CityGML-building can contain multiple ground surface areas, multiple partial buildings can be created, each with an individual building height. They all contain the CityGML building ID to identify building parts belonging together.

The building height value could be imported from one of the properties offered by CityGML - but don’t let yourself be fooled by misleading property names like “measured height”. We recommend importing the height offered by CityGML into one or more user-defined "free properties" for comparison purposes and **NOT** assigning a CityGML property to the SoundPLAN property building height. Only if this field is empty, SoundPLANnoise will calculate the building height from the roof surfaces above the ground surfaces themselves.

Additionally, SoundPLANnoise searches for building parts which are not properly defined and tries to transform the information sensibly to additional buildings or building parts.

Optimized building model

Due to the division of the data into partial buildings with different heights, it often happens that not all properties are contained in all partial buildings. These can be transferred via the CityGML ID. To do this, use the Geo-Tool "Merge properties from partial buildings" (page 120). To simplify the building model, you can combine the areas of partial buildings, see "Combine building areas" (page 121).

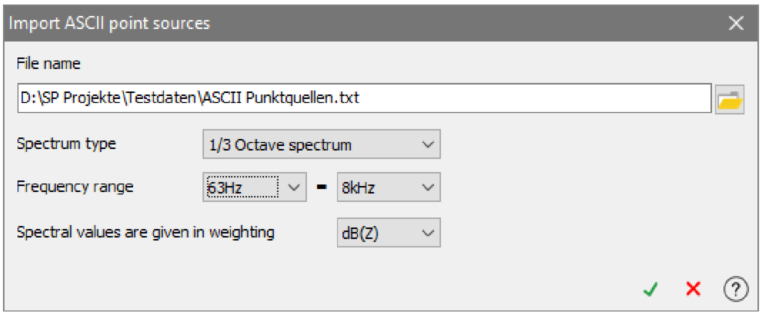
OpenStreetMap Import

[GIS Interface] OSM data can be automatically downloaded and imported via **FUNDAMENTALS | CONNECTION TO ONLINE MAP SERVICES** (see " Connection to online map services" (page 89). However, you can also import OSM files manually via **IMPORT | OPENSTREETMAP**.

Select the file(s) you want to import and additionally the desired object types. Some objects may be sensible only for orientation. The object types are imported into individual Geo-Files with the prefix "OSM_". Then click **IMPORT**.

Import point sources (ASCII)

IMPORT | ASCII POINT SOURCES imports, for example, measured point sources from a sound level meter. The import creates the point sources and the emission spectra.



The columns can be tab or comma separated, the decimal separator is either comma or dot.

The columns for the source name and coordinates must be the first 5 columns:

Source name,x,y,z1,z2

Even if there is no second elevation, this column must be present. After that the columns for the frequency values follow, depending on the setting third octave or octave values. The frequency range as well as the dB weighting will be imported to the emission library according to your definition.

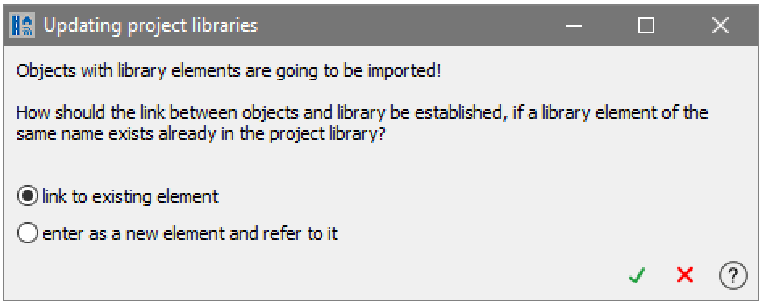
Import of SoundPLAN Geo-Files

Individual Geo-Files or all Geo-Files of a situation can be imported from other projects into the current project with **IMPORT | SOUNDPLAN FILES**. The **file filter** in the open dialog controls whether you are offered Situations or Geo-Files for selection. Select the files (multiple selection with ***Shift*** or ***Ctrl*** key). The Geo-Files are copied into the project, for objects with library references (spectra, day histograms, ...) these are also imported.

The data is selected so that it is easier to recognize and can be processed directly.

When importing **road and railway Geo-Files**, the corresponding libraries are also imported if there are no roads or railways in the project yet. If roads or railways already exist, the existing libraries are not overwritten. A message will then inform you that there might be inconsistencies. In this case, please check the emission calculation.

As soon as at least one **industrial object** with a reference to a library element is imported, you will be asked how SoundPLAN should handle any existing library entries in the current project.



The option you select will be used for all objects you import in this pass, even if they are contained in different Geo-Files.

With the first option, the existing library element (e.g. "Engine start") is used for all objects that refer to this element, with the second option, a new element is created once (e.g. "Engine start (1)") and used for all further objects.

The reference between the imported object and the library remains 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:

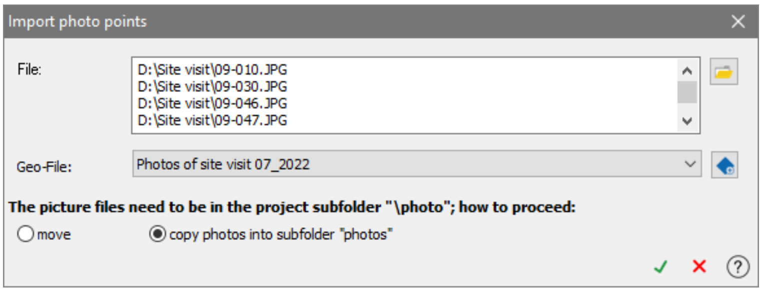
You have already completed an investigation study for a discount store and now want to process another one that has the same sources (e.g. delivery, exhaust air, ventilators for cooling shelves) and parking lots.

Import the "old" discount store into your new project. If objects of the new location are already part of the project, you will be asked if the new data should be moved to the screen section. Zoom out the plot of land on which the new discount store is to be built to full screen, so that you only have to adjust the location of the store itself slightly afterwards.

When working with relative elevations, the elevations automatically adjust to the new terrain.

Import of photo points with GPS data

[Cartography] If GPS data (coordinate and view direction) are included in the metadata of the photos, they can be imported. The geographic coordinates are converted to the coordinates of the selected project coordinate system.



Call **IMPORT | GPS PHOTOS**. Select the photo files and define the Geo-File into which the photos are to be imported. For the photo documentation the photos are expected in the project subdirectory \photo, therefore select whether you want to **COPY** or **MOVE** the photos to this directory if necessary.

CARD/1, Stratis, Verbund interface

Import from German road planning software. Select **IMPORT | CARD/1, STRATIS** and open the import file (file extension SCA). Since the data in the programs concerned has already been prepared for SoundPLAN via the export interface, the whole project can be imported at once and displayed on the screen. The object types are assigned automatically, you still have to check the object properties afterwards and edit them if necessary.

Kml export

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

The objects are exported in absolute heights. If the digital ground model in SoundPLAN has lower elevations than the ground model in Google Earth (which is often the case), the objects disappear in the ground. You can lower the terrain elevation in Google Earth (Tools | Options | elevation exaggeration).

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

Call **EXPORT | KML** and enter a file name. All relevant objects contained in the Situation will be exported. Click "yes" if you want to check the data directly in your KML viewer. Use the key combination ***Ctrl + K*** to load the data as a temporary file into the KML viewer.

Contour bands can be exported to kml in the Graphics (Edit map content | **CONTOUR LINE EXPORT**).

3

Filter and import elevation points

Elevation data are often offered digitally from laser scanning in a regular grid (e.g. 1x1 m or 10x10 m) or as a point cloud. In addition to the terrain model itself, the data sometimes also contain the top model for determining building heights, and sometimes elevation points on bridges.

SoundPLAN can read different formats and filter them efficiently to minimize the amount of data and thus the size of the DGM. The size of the DGM has an impact on the processing speed in the Geo-Database and especially on the calculation time.

The file formats ASCII, ESRI ASCII Grid, ESRI binary grid, GeoTiff, Scop-Winput or LAS (specification see "Import of elevation points in LAS/LAZ format", page 84) are filtered before the actual import.

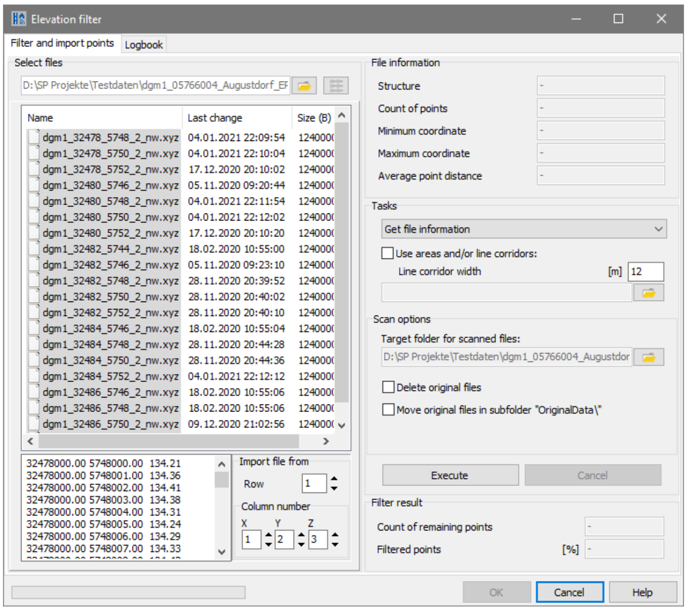
If elevation points are supplied in a different format (e.g. DXF), you must import the data unfiltered into the Geo-Database and then process the selected elevation points using **GEOMETRY TOOLS | FILTER ELEVATION POINTS.**

Start the import with **IMPORT | ELEVATION POINTS**.

*Note: For projects where the elevation points should not (and cannot) be processed further in the Geo-Database, for example elevation models for entire agglomerations or federal states, see "Additional options for large elevation models" (page 503). For these projects, call the import in the SoundPLAN Manager (**EXECUTE | IMPORT OF ELEVATION POINTS FOR LARGE DATA SETS**).*

If, during processing, you find out that the direct import in the Geo-Database is not suitable for the data volume after all, you can switch to the elevation import in the SoundPLAN Manager at any time, since the data is processed in the same way.

Use the **OPEN** button to select the directory where the elevation data is stored. The import data can be divided in any number of files.



Double-click on one of the files, all files with the same file extension will be taken over to the elevation filter.

On the left side the files are displayed and below them a preview of the first file. If necessary, select from which line the data should be imported and the column numbers (position) for the coordinates X and Y and the Z.

Before further tasks can be invoked, the elevation must know the data structure. Therefore, in the first step only the task **GET FILE INFORMATION** is available in the selection list.

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

You must have write permissions to the directory where the scanned data is stored, because SoundPLAN stores file information and intermediate results there. Therefore, you can specify a destination folder for the scanned files under the **SCAN OPTIONS.** If the destination folder is not changed, you can specify whether the original files should be deleted, moved to the "OriginalData" subfolder or remain in the same folder.

To read the file information, select the files with ***Ctrl+ A*** (if necessary, select individual files with Shift or Ctrl) and click **EXECUTE**. SoundPLAN loads the file(s), reads the structure of the data and saves it binary.

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

As soon as the file information is filled in, the task in the selection list jumps to "filter elevations" and the filter options are displayed.

If the elevation data is divided among several files, test the filter options on a selected file, see "Filtering a single elevation file" (page 82). Then use ***Ctrl+ A*** to select all files and click **EXECUTE**. Filtering many files takes some time, so it is best to start this in the evening or over the lunch break.

Filter elevations

For elevation points in a regular grid, the **GRID SPACING** is displayed. For point clouds, a grid that corresponds to approx. four times the average point spacing is preset. The finer the basic grid is selected, the fewer iterations have to be performed until all heights are within the maximum height difference.

Specify the **MAXIMUM HEIGHT DIFFERENCE** to the original points that must not be exceeded. **A too small height difference leads to much larger DGMs and thus significantly longer calculation times but not necessarily to higher accuracy!** With a maximum height difference of 0.5 m approximately 90% of the points are within a tolerance of 0.25 m, see also "Filter single elevation file" (page 82).

MAXIMUM POINT DISTANCE: It turned out that the maximum point distance shall not be too big because then fewer iteration steps are required, often even achieves better filter results and produces more uniform triangles. Decrease the maximum point distance if you are not satisfied with the filter result. If a tiled DGM is calculated, the point distance must not be greater than 80 m.

After first the points have been filtered out based on the settings, a DGM is calculated from the remaining points and compared with the original elevations. If points are outside the maximum height difference, points are inserted again according to a certain system. This is repeated iteratively until it is ensured that all differences are within the tolerance.

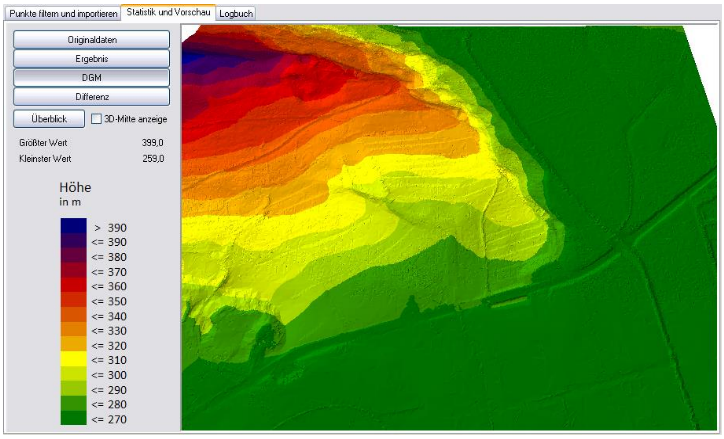
You can view the individual iteration steps in the "**Logbook**" tab.

The filtered data is saved in 10 x 10 km tiles in the "ResElev" subfolder. After all files have been filtered, the display jumps to the files in the "ResElev" folder and the task **IMPORT ELEVATIONS**. Click OK to import the filtered elevation points into the Geo-Database.

3

Filter single elevation file

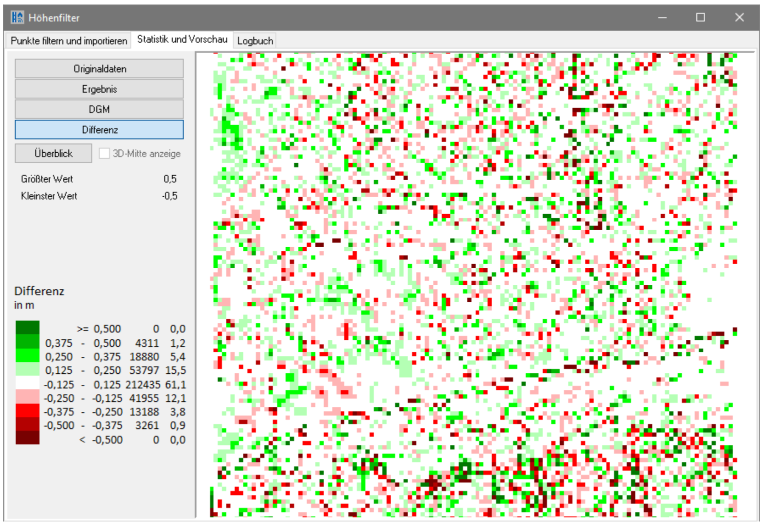
To get a feeling for the settings and the resulting DGMs, you can view the result of a filter run of a selected elevation file in the "**Statistics and Preview**" tab. (The tab is only visible when filtering a single elevation file).



You can choose whether you want to view

- the original data,
- the remaining elevation points in the site map (result),
- the DGM as a 3D model or
- the grid map showing the differences to the original points together with a statistic.

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



In the example above, the elevation points were filtered with a **MAXIMUM HEIGHT DIFFERENCE** of 0.5 m. The difference map shows that almost 90% of the remaining points are within a height difference of ± 0.25 m and that the maximum deviation is observed.

If you are not satisfied with the result, go back to the first tab, change the filter options and filter again.

The example below shows the same section as a 3D view and cross section, unfiltered on the left, filtered with a permitted height difference of 50 cm on the right:

The original number of points was 40326 grid points for a 1x1m grid (section of 300 x 150 m). Filtered, there were just 2027 grid points left, about 95% of the points were filtered out and the railway embankment is still shown almost true to the original.

If you want to test it yourself, the demo project "Wincity" includes a tile with laser scan data.

Use areas and line corridors

Restrict range of elevation data

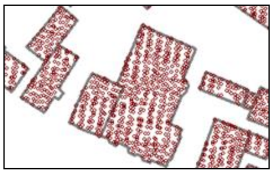
Often you will get elevation data that goes far beyond the actual investigation area. Enter an area in the Geo-Database that generously covers the investigation area and save it in a separate Geo-File. Select the Geo-File via **USE AREAS AND/OR LINE CORRIDORS** and filter the data as described above.

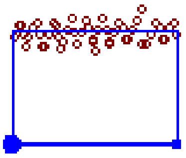
For an investigation area along a road or railway line, you can also specify a Geo-File or a Situation with the road/railway data and define the range of elevation data using the **CORRIDOR WIDTH [M]**.

If the area is already specified when the file information is read, the elevation points lying outside will be disregarded during further processing.

Unfiltered points inside buildings

If the roof heights within buildings are available as laser scan data, the mean building height can be determined most accurately with the GeoTool **EVALUATE ELEVATION POINTS FOR BUILDING HEIGHT** if all points within the building outlines are imported unfiltered. For this option, specify a Geo-File or Situation containing the buildings and select the **IMPORT ELEVATION POINTS** task.



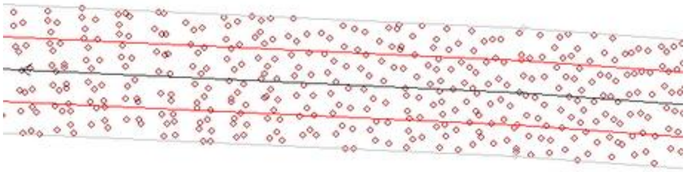


Since no height differences need to be checked, this import is very fast.

Important: If the top edge model was delivered in the same file folder as the terrain, but with a different file extension, you must specify a separate folder for the top edge data when reading out the file information, since the binary saved files of the terrain and top edge points would overwrite each other.

Unfiltered points in road/railway bands

If the terrain information within the road or railway bands is very accurate, it may be sensible to use the unfiltered elevation information within these bands as the basis for calculating the gradient heights. Specify a Geo-File or Situation containing the roads or railways and select the **IMPORT ELEVATION POINTS** task.



Since no height differences need to be checked, this import is very fast.

Then calculate a DGM from the unfiltered points and use the Geo-Tool **SET OBJECTS TO DGM** to determine the z-coordinate of the roads or railways. For railways, the rail head must be adjusted according to the standards.

If the elevations on bridges were supplied as separate files, the DGM for determining the z-coordinates is calculated from the elevations in road/railway bands and the elevation points on bridges.

Extract individual areas from an overall pool of elevation data

For example, you have received elevation data for an entire city, filtered it, and possibly already used it for a noise action map. Now you are asked to do detail investigations for single hotspots. Enter the area(s) that generously enclose the smaller investigation area(s) and select them under **USE AREAS AND/OR LINE CORRIDORS.** In the project containing the complete community elevation data, go to the ResElev subfolder and perform the **IMPORT ELEVATION POINTS** task. Alternatively, you can cut individual areas directly from an overall DGM, see "Clip DGM via an area" (page 255).

Delete duplicate elevation points

If duplicate points are contained in already filtered elevation points imported from an external source, select the elevation points and choose the Geo-Tool **ELEVATION TOOLS | FILTER ELEVATION POINTS**. Here you can select **DELETE IDENTICAL POINTS** from the selection list. If there are duplicate coordinates with different heights, the point with the higher value will be deleted.

Transform coordinates

The **TRANSFORM COORDINATES** task transforms the coordinates of the elevation points from the source coordinate system to the project coordinate system, see "Transformation between different coordinate systems" (page 85).

Import of elevation points in LAS/LAZ format

SoundPLAN implements the LAS specification version 1.4-R13 of 15 July 2013. The LAS format is a standard of the American Society for Photogrammetry and Remote Sensing for the exchange of elevation points from laser scanning. Compressed LAZ data is automatically decompressed to the LAS format.

These point clouds are raw data, which means that the points can be on the terrain, on buildings or on vegetation. Therefore, for the sensible use of this data, a classification of the points is necessary, which is normally part of the data file. Since this classification is more or less accurate depending on the LAS version, SoundPLAN only distinguishes between two classes of points: Terrain points and surface points.

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

The "Surface model" contains all other LAS classes. Starting from point format 6, the classes "railway" and "road surface" are also included in the surface model to have the possibility to import the points within roads or railway bands without filtering.

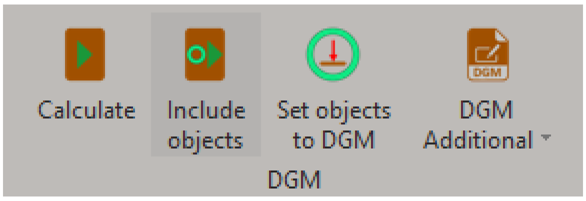
If you select a LAS file in the elevation filter, please also select whether you want to import the terrain model or the surface model. If you have already filtered and imported the terrain model, the scanned data will be deleted before importing the surface model.

After reading the file information, the logbook displays the point classes contained in the LAS files. The detail information shows the class ID, the meaning and the number of points per class.

Even though the LAS import already distinguishes between the classes for the terrain model and the surface model, the task "filter elevations" is offered after scanning the surface model, which is not sensible for the surface model. Please select another task.

DGM functions

The DGM functions are available in the **DGM** group in the **Fundamental** ribbon.



After you have imported and filtered or digitized terrain information (elevation points and / or contour lines), you calculate a Digital Ground Model. The DGM edges form the diffraction edges for the propagation calculation.

The elevations of further objects are derived from the DGM. With **SET OBJECTS TO DGM**, the coordinates of the objects receive the absolute height above sea level from the DGM. If you are working with relative heights, the height of the object coordinates will be relative to a DGM.

You can further refine the DGM in the course of project process or calculate different DGMs for different planning variants.

Often, a first DGM is calculated from imported (and sensible filtered) elevation points, then roads, railways or noise sources are set on the DGM. If necessary, bridges and tunnels are placed, possible elevation changes are identified and smoothed via front / side view. If the elevation model is accurate enough, the road or railway edges, bridges, tunnel portals, parking lots, area sources and berms are included in the DGM calculation for the DGM that will be used later for the calculation.

The DGM calculation can be triggered with **DGM CALCULATE** (***Ctrl+ D***) in the Geo-Database. The Calculation core is opened in the background, which also performs the calculation. The DGM is saved there as a calculation run. This has the advantage that all information about the DGM (involved Geo-Files and object types, version date, ...) are permanently logged, details about the calculation see "Digital ground model" (page 253).

A DGM calculated in the Geo-Database can also be recalculated in the Calculation core at any time. DGMs for large areas and tile DGMs are always best calculated directly in the Calculation core so that the Geo-Database is not blocked.

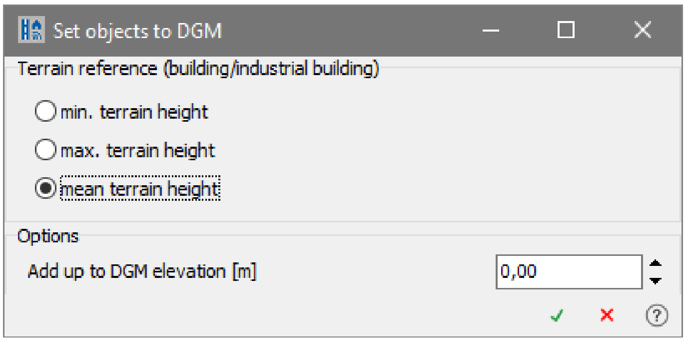
An area object can be created from the DGM hull under **DGM ADDITIONAL | CREATE AREA FROM DGM HULL.** Specify the desired object type and, if necessary, a buffer and the number of intermediate points. This object can be used, for example, to exchange the elevation information within a DGM.

Set objects to DGM

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 in the fundamentals ribbon. The elevation from the DGM is assigned to the z-coordinate.

If you want to set the rail head above the terrain or add a pedestal for buildings, enter the value in **ADD UP TO DGM ELEVATION**.

Additional options for building / industrial building

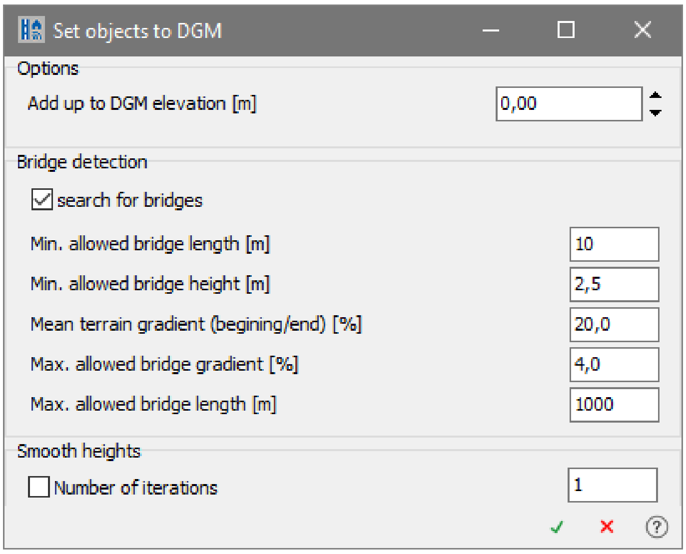


As soon as buildings or industrial buildings are selected, you can specify how the ground floor elevation is to be determined (lowest ground point, highest ground point or averaged ground elevation).

This allows you to determine where the entrance is located on slopes. Together with the building property "Number of basement floors", you can thus define the location of the receivers more precisely.

Additional options for roads and railways

If roads or railways are included in the data and the gradient height is not known, you can activate **SEARCH FOR BRIDGES** and then set the parameters for detecting bridges. If bridges are already included in the course of one of the roads or railways, the bridge detection is disabled.



The bridge detection automatically detects bridges based on the slope between object points, sets bridge beginning and end and adjusts the elevation of the coordinates within the bridge to the bridge level. The bridge width is 0.5 m wider than the road or railway. The bridge addition for railways must be assigned manually.

You can use **SMOOTH HEIGHTS** to smooth small height outliers from the DGM**.** The more **ITERATIONS** you run, the more the coordinates are adjusted.

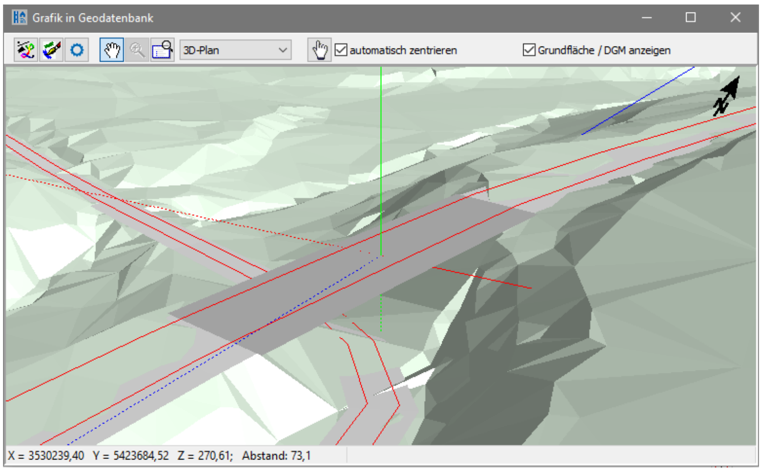
If the heights of the gradient are known, please use the Geo-Tool "Bridge detection" (page124).

Control bridges

The logbook records where bridges were found and additionally displays the bridge length and height.

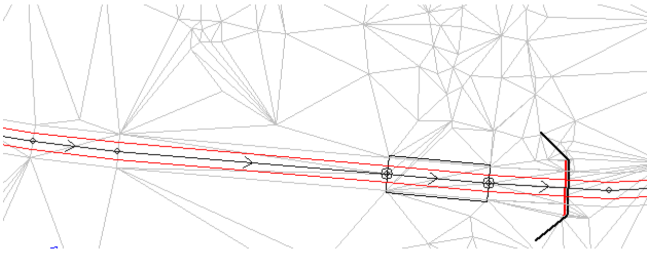
Bridges are entered as warnings if the length over minimum height is less than half the minimum length, one of the two slopes is consistently less than 30° or the length/height ratio is greater than 15. All other bridges are entered as hints, with bridges where the length/height ratio is greater than 10 but less than 15. You should at least check the bridges that have been entered as warnings.

If the 3D Graphics window is open in addition to the logbook, the 3D view jumps to the bridge position when you double-click on the logbook entry. The view automatically rotates so that you can see the bridge from the side.

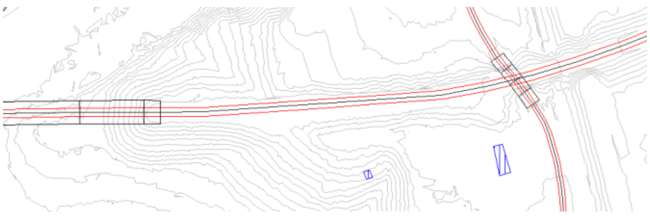


DGM views

By default, the outline of the DGM is drawn to visualize the area with elevation supply and to display the elevation at the cursor location in the status bar. The (+) or (-) indicates whether the elevations are increasing or decreasing in the direction of movement. Via **DGM ADDITIONAL | DISPLAY TRIANGLES,** the triangles are displayed in light gray for checking purposes.



To detect errors in the elevation model or to set the start and end point of a bridge, you can display the elevation lines of the loaded DGM via **DGM ADDITIONAL | DISPLAY CONTOUR LINES.**



Specify the spacing of the elevation lines in [m]. The closer the elevation lines are generated, the longer the screen buildup takes. Close the display of the contour lines and open it again to generate the contour lines at a different distance.

If you actually need the contour lines as lines in the Geo-Database, you can load the DGM in the Graphics and save it to a Geo-File in "Edit Content" via **EDIT | EXPORT CONTOUR LINES.** The spacing of the contour lines is controlled by the setting for the intermediate intervals in the DGM object type.

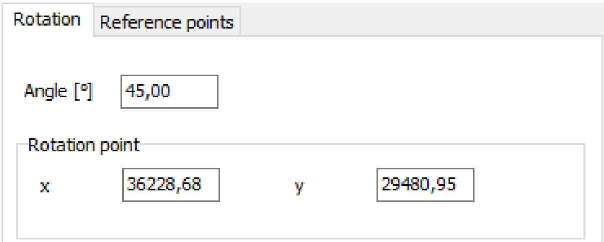
Coordinate transformation

In the **Fundamentals** ribbon in the **Coordinate Systems (CRS)** group, you can rotate objects around a rotation point and move them via a transformation vector. For data from different data sources with different coordinate systems, you can transform to or from the project coordinate system.

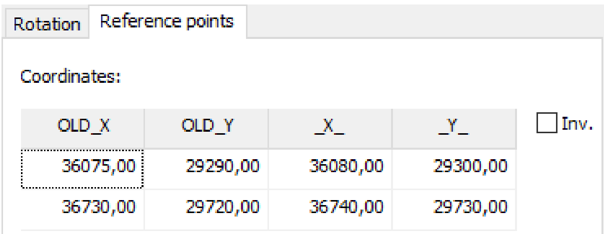
Coordinate transformation via rotation / reference points

The transformation via a rotation point can be used, for example, to rotate entire groups of objects, for example to reorient a planned commercial facility with buildings and sources.

Select one or more objects and choose **TRANSFORM | ROTATION/REFERENCE POINTS**. To rotate the selected objects, enter the rotation angle. By default, the position of the "pink diamond" is entered as the rotation point.



To move the data using a transformation vector, switch to the *reference point* tab and enter two reference points old and new.



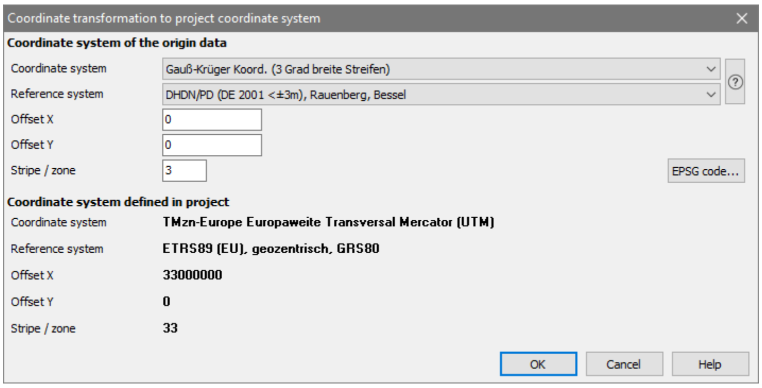
The check mark **INV.** inverts the control points old and new.

Transformation between coordinate systems

When working with SoundPLAN it is initially irrelevant which coordinate system is used as a basis. However, knowledge of the coordinate system is necessary if data from different suppliers is provided in different coordinate systems or if the client wishes to receive the data in a particular system.

Set the "Project coordinate system" (page 31), select the objects and choose in the **Coordinate Systems (CRS)** group (ribbon **fundamentals**) whether they should be transformed **TO THE PROJECT COORDINATE SYSTEM** or **FROM THE PROJECT COORDINATE SYSTEM** into a target system.

In the first case you specify the origin coordinate system in the following dialog, in the second case the target coordinate system. The coordinate system defined in the project is displayed for information.



You can check whether the transformation has achieved the desired result, for example, by viewing the position via the "Connection to online map services" (page 89).

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, a transformation may have to be performed during the import.

The following combinations are possible:

- Project coordinate system and coordinate system of the import data are the same or no project coordinate system defined: The import data are imported without transformation.
- Project coordinate system and coordinate system of import data differ: For transformation you can change the coordinate system of the import data.
- Project coordinate system and coordinate system in the import data are defined, but the coordinate system of the import data was not recognized: In the dialog you can select a coordinate system for the import data. If possible, the definition of the coordinate system in the import data is displayed as text, from which you can possibly conclude, which coordinate system is behind it.

Connection to online map services

[Cartography Module (connection to Google Maps + OSM) [GIS interface] (OSM import)]

Online map services in SoundPLAN are OpenStreetMap and Google Maps. The online maps are displayed in a separate window so that you can work in parallel in the Geo-Database and in the corresponding data service. The current map view can also be downloaded as a background bitmap. From OpenStreetMap you can also import the map viewport as geodata (see below). In addition, you can import rough elevation data for relatively flat terrain.

SoundPLAN only provides the tools, users are responsible for compliance with the license terms.

Google Maps

Google Maps is an online map service developed by Google. In SoundPLAN a component is integrated which can display satellite images or map data optionally with labels and download them as background bitmaps. In addition, where available, it is also possible to switch to the tilted view or to Street View.

To work with Google, you need to confirm the terms of use when you first open it. If you open the map services and the Google Maps map shows the watermark "For development purposes only" the API keys for Google are not valid, see "Accounts and API key for Google Maps" (page 90).

OpenStreetMap

"*OpenStreetMap is a project founded in 2004 with the goal of creating a free map of the world. We collect data about roads, railroads, rivers, forests, houses and everything else that is commonly seen on maps. Because we collect the data ourselves and do not copy it from existing maps, we have all rights to it. Anyone may use the OpenStreetMap data free of license fees and process it as they wish.*" Quoted and translated from: https://www.openstreetmap.de/faq/

Note: Because OpenStreetMap (OSM) is an "open source" project where the geometry data and additional information are entered by various "mappers", the quality of the data may vary. Please note that SoundPLAN only provides the tool to use the data but is not liable for the accuracy of the data. The license terms are linked on the export page of the OSM website.

There are certain "keys" documented by the initiators of the OSM project that should be used by the "mappers" for classification.

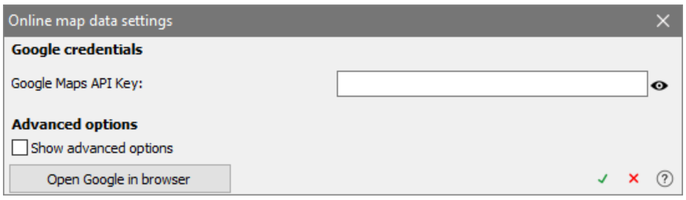
The key "highway", for example, stands for any kind of road or path. This is further classified by the "value", for example as a highway, main road or footpath. SoundPLAN only imports roads whose value indicates a road. Additional information about "keys" and "values", you can find on the website

http://wiki.openstreetmap.org/wiki/Map_Features

Accounts and API key for Google Maps

To use Google Maps, you must create a Google account and store the API key generated there in the **SETTINGS** after the first call of the online map services.

Click on the gear wheel to enter the settings**.** If you have received an API key from your organization, enter it here.



To create a new key or account, click **OPEN GOOGLE IN BROWSER**. You will be taken to the web site. First - if you don't have an account yet - you must create one via "SignUp". Follow the instructions on the web site. Once you have successfully created the account, you can generate the key.

Geocoding / address lookup

Under **ADVANCED OPTIONS** you can choose between the address search services of OSM (Nominatim API - does not require an API key) and Google Maps. The selection **AUTOMATIC** selects the Google search service if an API key is available.

After you close the setup dialog with the green check mark, the functions are enabled.

Google Maps account and key

To use Google Maps, you need a Google account in which payment data is stored in the form of a credit card (depending on the country also via debit card or bank account), which Google is allowed to access when the free quota of $200 per month is reached. This free quota allows for a quite high number of requests, so you will normally not exceed the free quota. An estimate of how much data you can use freely is provided by the website https://mapsplatform.google.com/intl/de/pricing/.

Category (API)	Function	Explanation	Example
Maps (Maps JavaScript API)	Static Maps	Each call to Google Maps in the Geo-Database is a query	10,000 views of Google Maps per month cost $20

Places (Geocoding API)	Geocoding	Address lookup	1,000 address entries per month cost $5
Places (Places API)	Autocomplete	Suggestions for address lookup	?
Places (Maps Elevation API)	Elevation	Elevation import from Google Maps - an elevation import to SoundPLAN is by default 8 requests	10,000 requests (3,750 elevation point imports) per month cost $150

APIs used in SoundPLAN / category in the above website and cost examples

The requests listed in the table will keep you within the $200 free quota. 10,000 views of Google Maps per month equals 500 views per business day.

To ensure that there are no costs for the use of Google Maps, you can limit the number of calls, see "Set up cost alert".

Related links:
New pricing sheet
Set up cost alert

Generate API key for Google:

Create a project and go to "Library". Enter "Maps Javascript" in the search bar, select "Maps Javascript API" and activate it. This API is mandatory for the use of Google Maps, without this API you cannot use image data from Google Maps. As an alternative SoundPLAN offers a connection to OpenStreetMap as a map service, this does not require any account data.

If you use Google to search for locations, search for "Geocoding", select the "Google Maps Geocoding API" and activate it. To get additional search suggestions when searching for locations with Google, enter "Places" in the search bar, select "Google-Places Web Service" and activate it.

To get elevation data from Google Maps, enter "Elevation" in the search bar, select the "Google Maps Elevation API" and activate it.

An elevation downloads 4096 height points with default settings, this corresponds to 8 queries of the Google API. (Status: 07 April 2020)

In the **ADVANCED OPTIONS** of the dialog you can decrease this value to reduce (possible) costs at Google or increase it to get a better resolution at larger areas.

Finally, go to "Access data" and copy the API key generated in the Google project into the form in SoundPLAN.

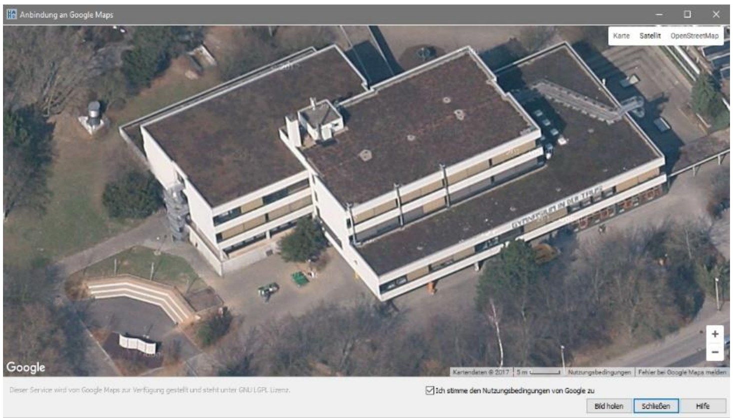
Working with OSM and Google Maps

A project coordinate system is necessary for the use of OSM and Google Maps. A second screen is highly recommended.

Call **OPEN OSM / GOOGLE MAPS** ***(Ctrl+Shift+O)*** in the **Fundamentals** ribbon. The online map services open full-screen in the coordinate range of the project data. If there is no data in the project yet, the map services are initialized at a default location (SoundPLAN office). Use the **ADDRESS LOOKUP** to navigate to your project area.

Select the **MAP BASE** Google Maps or OSM on the left side.

In Google Maps, the labels can be shown or hidden in the satellite view. Where appropriate data is available, a map tilt icon is displayed in the Google Maps satellite view so that you can switch to a tilted view.



This can be used, for example, to count floors or to check usages. Use the orange “Pegman” symbol to activate Street View or switch to 360° panoramic images (only if this information is available).

SHOW "POINTS OF INTEREST"(POI) indicates significant points.

With the button **GET IMAGE**, the map viewport is stored as background bitmap in the Geo-Database, except if the tilted view is active. The background graphic is stored with a fix name and overwrites itself every time a new image is requested. With **SAVE MAP VIEWPORT AS** you can specify your own file name to save the bitmap permanently.

In the Geo-Database interface, you can use the right mouse button to save the map viewport at the cursor position as a bitmap. In the ribbon **Fundamentals**, group **ONLINE MAP SERVICES** save the geometry viewport displayed in the Geo-Database interface. In both cases, the online map interface does not need to be open. Assign your own name in the Bitmap Manager to save the bitmap permanently.

Import OSM data

[Module GIS interface] Select the desired map viewport. Click on **DOWNLOAD & IMPORT OSM DATA** and select which object types you want to import.

Some objects may be sensible only for orientation. The object types are imported into individual Geo-Files with the prefix "OSM_". This makes it easy to delete object types that are not needed afterwards.

Additional information may have been added to the OSM data. Very often these are road names and house numbers, sometimes even the permitted speed of roads. This information is imported as well. If available, further additional information, for example the building usage, zip code and city are imported as free properties.

If object heights of buildings or walls are included, they are imported, otherwise the default values remain. In our tests, however, object heights were almost never included in the data.

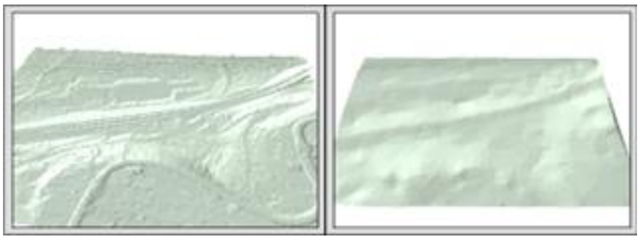
OSM data could for example also be used to generate geometry texts from the address data of buildings and map them to more accurate data.

Note: If you want to import an osm file manually, call the ***OSM IMPORT*** *in the* ***fundamental*** *ribbon.*

Elevations from Google Maps

Google Maps elevations are based on free SRTM elevation data. These have a resolution of about 90 meters. That means, every 90 meters is a measured elevation point, in between a spline interpolation is performed. Changing topography cannot be represented with these elevations.

Please check if the elevation data is sufficient for your project. Here is a 3D comparison between laser scan data and the elevations from Google Maps for changing terrain:



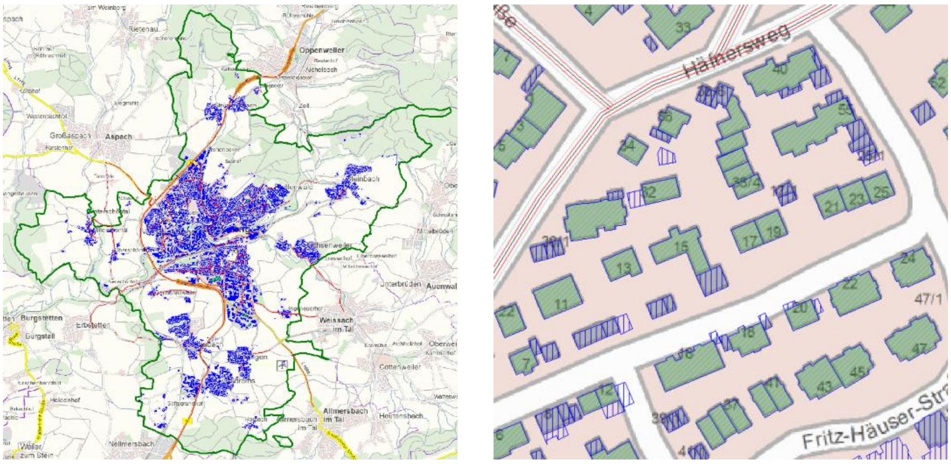
Click the **IMPORT ELEVATION DATA** button to import the elevations in the map viewport. Google allows a maximum of 512 points to be downloaded per request. In SoundPLAN, 8 requests are sent at the same time by default. This means that depending on the scale of the map viewport, the distances between the elevation points are closer or farther apart.

In the settings you can change the number of simultaneous requests under **ADVANCED OPTIONS.** Please remember that the number of requests affects the number of elevation imports possible within the free quota. The elevation data is filtered if the check mark **FILTER DOWNLOADED ELEVATIONS** is checked.

Connection to WMS server

[Cartography] With WMS (Web Map Service), a wide variety of maps can be loaded as background information to the geodata. These can be, for example, orthophotos or cadastral data provided by a data supplier or completely free WMS servers that publish data such as OpenStreetMap (OSM) in the network.

Unlike online map services, you do not draw a bitmap with fixed dimensions, but the data is requested directly from the corresponding server according to the selected viewport in different levels of detail. The connection may take a while depending on the download speed and server load. In order to be able to work with the background data even without an internet connection or if you only need the current viewport, you can also save the current viewport as a bitmap.



Different levels of detail depending on the selected section

Currently, the rights of use for the data are handled very differently by the various data suppliers. With some suppliers, the data are freely available, and the source only needs to be indicated, with others you have to register but can then use the data free of charge, and with still others the data have to be ordered and paid for from the relevant offices.

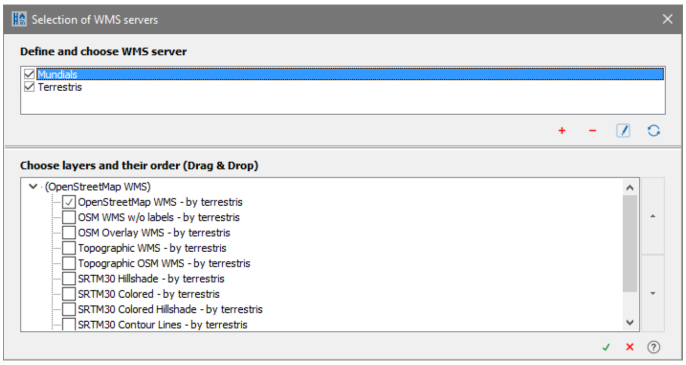
The best way to find out which background maps are available for your area is to do an internet search or ask your local data provider.

As an example, we deliver the WMS Server Terrestris, which provides rough OpenStreetMap data worldwide free of charge.

Note: The WMS server offers are still very much in flux. This means that a server that is available free of charge today may be chargeable or no longer active tomorrow. On the other hand, new offers can also be added continuously.

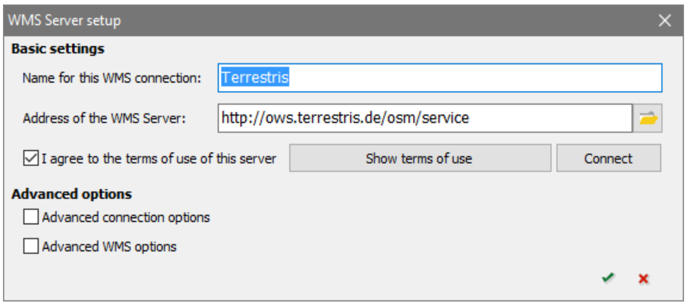
Set up WMS Server

WMS servers can be set up in the SoundPLAN Manager via **OPTIONS | SETTINGS,** node *WMS settings* globally for all new projects or in the Geo-Database for the current project.



The upper list shows the WMS servers you have already specified. The check mark means that this server is listed in the selection list Bitmap/WMS Server in the Geo-Database.

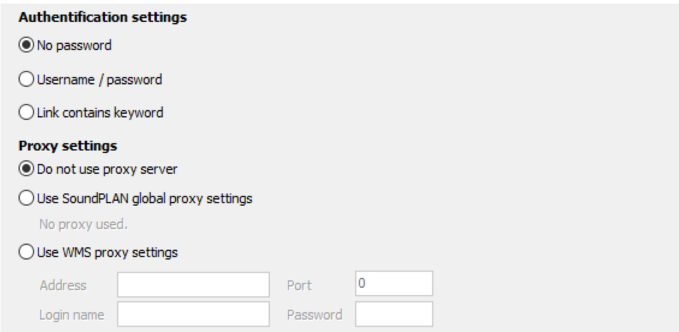
Click the **NEW** icon to set up a new WMS server or the blue pencil to edit the settings of an already set up server.



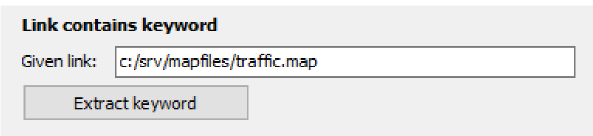
Enter a unique name for the connection. Copy the address from the server's website and paste it here. Some suppliers provide the connection data in a FastCGI file. In this case you can select the file via the **OPEN** icon and read the server address directly.

Agree to the terms of use and click **CONNECT**.

Click **ADVANCED CONNECTION SETTINGS** if the server requires authentication (password / keyword) or you want to specify a proxy server.

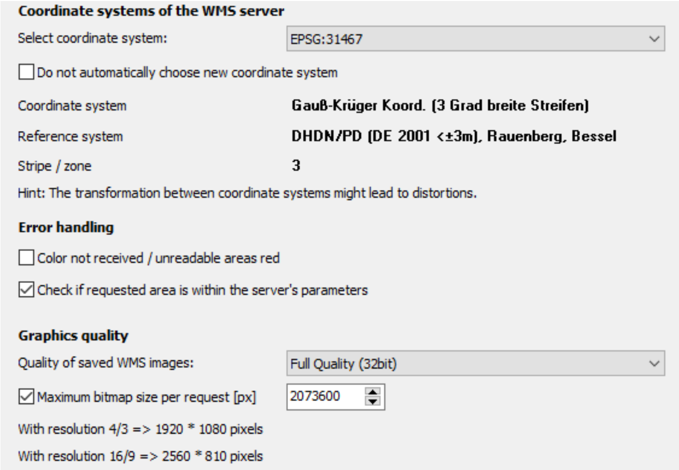


Select the appropriate option in the **AUTHENTICATION SETTINGS.** For some servers, the link to the WMS server also contains an activation code as a keyword that must be sent to the WMS server for each request so that you are authorized to use it. (This activation code can be free of charge or chargeable). SoundPLAN recognizes that a keyword is included and automatically reads it from the link.



If your organization uses a proxy server, the proxy server set globally in the SoundPLAN Manager is also selected here in the **PROXY SETTINGS.** If the WMS server uses its own proxy server, enter the connection data here.

Click **ADVANCED WMS OPTIONS** to get additional information about the WMS settings.



Coordinate systems of the WMS Server

The WMS servers are based on different coordinate systems which are described as EPSG code (page 32).

SoundPLAN automatically evaluates the EPSG code that best matches the project coordinate system and enters the identified system. If SoundPLAN does not find the best coordinate system, for example at strip or zone boundaries, you can select an EPSG code from the selection list and use it permanently by activating the check box **DO NOT AUTOMATICALLY CHOOSE NEW COORDINATE SYSTEM.**

Error handling

If the data of a server cannot be displayed, you can use the check marks to control how SoundPLAN should react in this case. With the first check mark, missing areas are drawn in red. Many WMS servers only provide data within a certain area or at a certain scale. Set the corresponding checkmark if you want SoundPLAN to display only the data within the server definition.

Graphics quality

Some WMS servers charge for the use of the server by the amount of downloaded data. This is done either by the amount of data in MB, then you can reduce the size by the **QUALITY OF SAVED WMS IMAGES** (for example color depth 24 bit instead of 32 bit) or by the number of pixels, then switch off **MAXIMUM BITMAP SIZE PER REQUEST** and enter the number of pixels. Informatively it is displayed which **RESOLUTION** the entered value corresponds to.

(De)activate layer

WMS servers can have any number of layers in which different information is kept. This can be information that overlaps each other, but they can also complement each other. If you enable multiple layers, you can create your own combination of the offered data.

Click on one or more layers in the layer list; you can use drag & drop to change the output order of the layers. The topmost activated layer will be drawn first, which means that the data of this layer will be covered the most by other layers. It is best to arrange the layers so that layers with transparent areas are placed at the bottom of the layer list and layers with orthophotos are placed at the top. This ensures that as much detail as possible is displayed.

You can also (de)activate the layers later in the Geo-Database interface with the right mouse button | **(DE)ACTIVATE WMS LAYER**.

Working with WMS servers

To work with WMS servers, the Situation must already contain geodata. If you don't have data yet, you could import data from OpenStreetMap and then call the WMS server.

All WMS servers that have been set up and activated for display are listed in the "Bitmap" selection list.

Select a server from the drop-down list. The WMS server connects to the Internet - this may take a moment depending on the connection speed. The Geo-Database status bar will display "SoundPLAN is loading WMS background image" during this time.

With the mouse wheel pressed, you move the viewport of the WMS Server; rotating the mouse wheel, you zoom the viewport. Each time you let go the mouse wheel, the background image is reloaded - which again may take a moment.

Click the right mouse button | **SAVE CURRENT WMS VIEWPORT TO FILE** to save the viewport under its own file name.

WMS Server in the Graphics

WMS servers are addressed as a separate data type in the Graphics. Select the data type and the server from which you want to get the background images. The background images are loaded dynamically. This means that as soon as you change or rotate the geometry viewport, the Graphics requests the current viewport as a bitmap from the WMS server. Downloading the WMS data may take a moment.

The WMS bitmap is controlled by the object type **GEOMETRY BITMAP.** In the 3D Graphics the WMS Bitmap can be used as usual, if a DGM or a grid noise map is loaded and the output in the 3D map is activated.

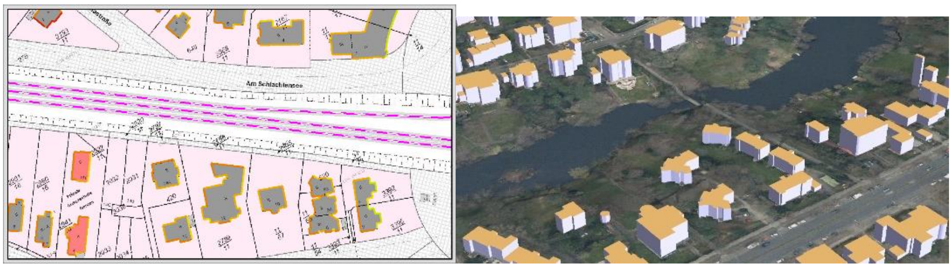


Image on the left: Colored facades on a cadastral map, the SoundPLAN buildings are switched off. Image on the right: 3D buildings on an orthophoto.

Editing the data

After data entry or import, the objects are further processed. SoundPLAN offers many different editing options. The editing tools are accessible via the **Start** and **Tools** ribbons and partly via the right mouse button. For all actions, the objects must be selected beforehand.

Undo

In the title bar or with ***Ctrl+Z*** you can undo changes to the coordinates and in the property definition until the last save.

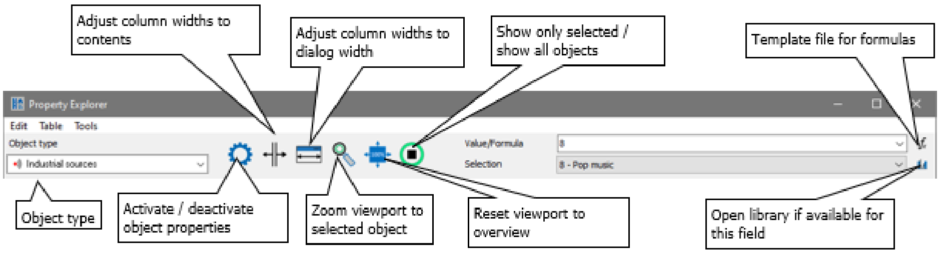
Property Explorer

The Property Explorer is a tabular representation of the object properties. On the one hand it allows a clear data control, on the other hand changes of the properties (also library entries) can be executed directly in the Property Explorer. You can also modify the properties using formulas, as in a spreadsheet.

Open the Property Explorer via ***Ctrl+E*** or **EDIT | PROPERTY EXPLORER** in the **Start** ribbon.

The objects of the current object type are loaded into the Property Explorer in tabular form with all selected properties. In order to see the Geo-Database interface and the properties of the objects in the Property Explorer at the same time, it is sensible to drag the Property Explorer to a second screen. As long as the Property Explorer is open, no changes can be made in the Geo-Database interface.

Toolbar



A double click on the "splitter" cursor between two columns optimizes the column width for the left of the two columns.

If objects are selected in the Geo-Database interface before you open the Property Explorer, initially only the selected objects are entered into the table.

Core functions

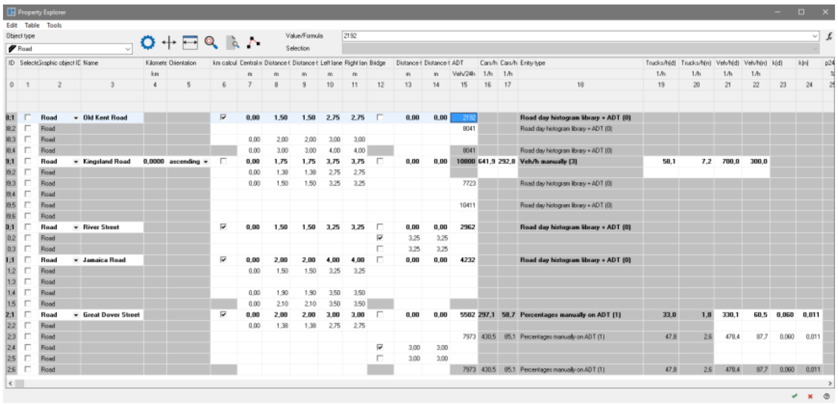
- Via the **column "selected"**, you can select objects via formulas (enter "1" for selected and "0" for not selected), with a mouse click in the box or with the space bar (also for several highlighted rows), for which you can then apply tools in the Geo-Database interface.
- Some of the objects have a large number of properties. The tabular view would be confusing if all properties were always displayed. Therefore, you can use the blue gear wheel to determine which property columns should be displayed, see "Selection of the displayed object properties" (page 101).
- If you do not need a particular column at the moment, you can remove it from the table by clicking the right mouse button on the column header **| REMOVE COLUMN PERMANENTLY.**
- Left-click on the column header to **sort** in ascending or descending order.
- Since the field names are often too long for the column header, you can display a self-defined **short title** instead. (The short title is also defined via the gear wheel).
- Using the **statistics functions** (right mouse button on the statistics row in the column header) you can display sum, average, smallest or largest value, number of rows or number of differences.
- Changing properties or selecting objects via **formulas**.
- Several rows can be highlighted, to which a text or value entered in the value/formula field is assigned together.
- Cells can be equated by dragging the contents of a cell at the bottom right corner to the following cells.
- Library references can be changed simultaneously for selected rows via a selection list containing the element name.
- The graphics object type is displayed as a separate column for each object type, so that you can select another graphics object type from the selection list.
- In the Geo-File column, the Geo-File assignment can be changed in the Property Explorer, also using a formula.
- With the **temporary column** (**TABLE | SHOW TEMPORARY COLUMN**) you can temporarily store calculated results to use them for further actions.

- **Search** for any properties and **search & replace** text or values.

Copy + Paste

The table content displayed in the Property Explorer can be copied to the clipboard with **EDIT | COPY** or ***Ctrl+C.*** You can copy the complete table, or only the current row, column or selection to Excel, for example. Changed content can be pasted into the Property Explorer with ***Ctrl+V.*** It is only important that the order of the objects match.

Objects with variant properties



Variant objects are automatically segmented at the coordinates where properties change when the Property Explorer is called.

- Properties of the first object point are displayed in bold.
- Non-editable cells are displayed in gray (calculated fields, fields that cannot change in the course, fields that do not match the selected input type).
- Blank cells - fields for which the property does not change at this coordinate.
- White cells - at this coordinate properties were changed in the course.
- Light blue row - cursor position (if the property is constant the font is italic).
- Last object point is displayed (lane width, bridge width).

When you exit the Property Explorer, the objects are rejoined.

Using formulas in the Property Explorer

Cells for which a command (formula) is to be executed must be *activated* beforehand (whole column with ***Ctrl+A***, right mouse button **| ACTIVATE WHOLE COLUMN**, cells standing below each other with the Shift key pressed the arrow keys - single cells with Ctrl does not work).

Selected are rows or objects that are identified by markers in the Geo-Database interface.

Example: If you want to select all buildings with a height of 6 m, the whole column 1 ("selected") is *activated* and then the buildings are *selected* via a formula.

The **formulas** correspond in syntax to the formula interpreter in the Spreadsheet. See “Calculating using formulas” (page 326).

The input for the values or formulas and the display of the selection lists is separated into two inputs. Enter the formula in the **VALUE/FORMULA** field.

Properties that are arranged in selection lists are based on an ID for the order in the selection list. For use in formulas, the ID must be used. This is displayed in the **SELECTION** field in the selection list before the text.

The Property Explorer expects an **equals sign ("=")** in front of the formula to recognize that a formula and no text or value is entered.

The column number is specified with **x+column number.** The column number is in the column header below the name. The columns are numbered consecutively, therefore the column number changes depending on the displayed columns.

You can access the "**own column**" with **x#.** With =x#+10 the values of the activated column are increased by 10. This is useful, for example, if you want to apply a formula to several columns.

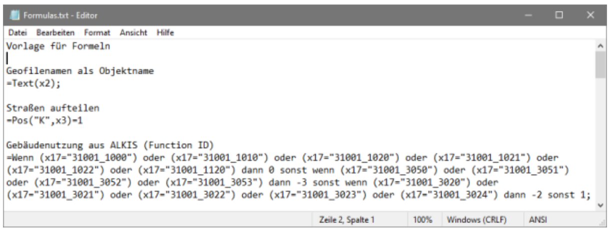
If an error occurs when executing a formula in a field, speaking error messages are output. The cursor jumps to the row where the error occurs. The object ID is output in the error description.

The result is saved, not the formula itself.

Template file for more frequently used formulas

The last formulas used in the current session can be recalled using the selection list in the **FORMULA / VALUE** field.

In a text file you can store more frequently needed formulas in the Globdata directory for all projects which can be copied to the formula field the next time using ***Ctrl+C*** and ***Ctrl+V***.


Formulas.txt - Editor

Datei Bearbeiten Format Ansicht Hilfe

```
Vorlage für Formeln

Geofilenamen als Objektname
=Text(x2);

Straßen aufteilen
=Pos("K",x3)-1

Gebäudenutzung aus ALKIS (Function ID)
=Wenn (x17="31001_1000") oder (x17="31001_1010") oder (x17="31001_1020") oder (x17="31001_1021") oder
(x17="31001_1022") oder (x17="31001_1120") dann 0 sonst wenn (x17="31001_3050") oder (x17="31001_3051")
oder (x17="31001_3052") oder (x17="31001_3053") dann -3 sonst wenn (x17="31001_3020") oder
(x17="31001_3021") oder (x17="31001_3022") oder (x17="31001_3023") oder (x17="31001_3024") dann -2 sonst 1;
```

Zeile 2, Spalte 1 | 100% | Windows (CRLF) | ANSI

Since the formula input in the Property Explorer is single-line, it is sensible to save the formulas also single-line in the template file. Enter x# for the own column instead of a column number, so that the formula will be executed correctly without changing the column number when it is executed for the activated column.

Tip: If the formula accesses a column other than the activated one, use Find + Replace (Ctrl + H) in the text file to change the column number.

Examples of use:

Set all buildings with a building height less than 2 meters to 4 meters:

Click on the column header in the building height column and sort in ascending order. Click the top row, hold down the Shift key and use the arrow keys to highlight all rows with values less than 2. Enter 4 in the **VALUE / FORMULA** field, the value will be applied to all rows.

Select all buildings with more than one dwelling:

Either: Sort the dwellings column in descending order, activate all rows with values > 1 in the "selected" column and select them with the space bar.

Or: Activate column "selected" via right mouse button on the column header or ***Ctrl+A*** and enter formula =x "*No. column dwelling*" > 1 and execute with the Enter key. (Example: =x7 >1)

Select building with area < 50 m²

Activate the column "selected" with Ctrl+A and execute the formula "=x "*No. 3D-dim [m/m²]*" <50. (Example: =x20<50)

Convert inhabitants to dwellings via statistical values:

Activate the column "Number of dwellings" with Ctrl+A and execute the formula "=x "*No. Number of inhabitants/statistical value*". (Example: =x6/2,1)

Change emission spectrum for all sources of a group

Sort sources by group. In the emission spectra column, activate all sources of this group with the left mouse button held down and assign the desired element of the project library from the selection list. You can access the libraries via the "Library" icon.

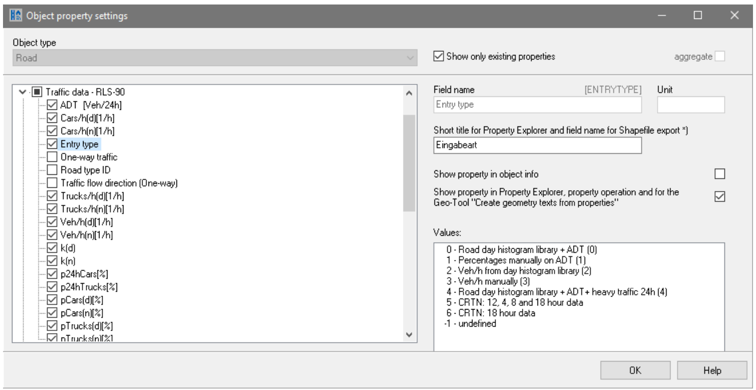
Derive distance emission bands from roadside

Activate column "distance emission band left" and execute the formula =if *x*"*No. lane width left*" <3.5 then 1.5 otherwise *x*"*No. lane width left*" -2 (Example: =if x6 <3.5 then 1.5 otherwise x6-2). This must be repeated for the distance emission band right.

Selection of the displayed object properties

At various places in the Geo-Database, you can check properties, change them, create texts from properties, select objects using properties or search for properties. Depending on the object type, the list of properties is sometimes very long. To keep the list or the number of columns clear, you can select which properties should be displayed in the different tools.

Call the property selection wherever the property definitions are used using the gear wheel.



The properties of the objects are stored in several data blocks. Each node stands for a record; you can see the contained properties when you expand the node. On the right you see the displayed field name for the individual properties. The original field name is in square brackets. For properties that are arranged in a selection list, the list entries are displayed. In addition, you can see the index on which the entries are based. This is important if you want to access the contents of a selection list via formulas in the Property Explorer.

Switch the desired properties on or off in the tree view. If the whole property block is selected, a check mark is displayed in front of the block, if individual properties are selected, a black rectangle.

For roads and railways, standard-dependent properties are always displayed according to the standard set in the SoundPLAN Manger.

When entering or importing data, only the properties that you have defined are saved with the objects. Sometimes, however, it is necessary to be able to access other properties in the Property Explorer. In this case, turn off **SHOW ONLY EXISTING PROPERTIES**, then all properties of an object type will be displayed.

Each object type can have free properties defined by you, see "Free properties of the objects" (page 216).

Short title

For the Shapefile export, the field caption must not be longer than 10 characters and must not contain special characters and spaces. Also, for Property Explorer, it is often sensible to define shorter column headings so that they are displayed in full. You can

3

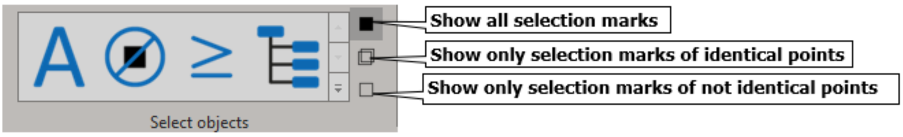
define shorter field names using the short title. The short title is stored in the Globdata directory for all projects.

Select points or objects

Objects or object points that have already been entered must often be selected in order to edit them or to run tools.

Selecting always refers to the data displayed on the screen. If Geo-Files or objects are hidden or in the background, they won't be not selected. Likewise, only the data that corresponds to the set view filter (current Geo-File, current object type) is selected.

It happens that objects with coordinates in the same position are contained in the data, for example due to multiple existing objects in an import file or copies of objects in the data. So that these can be identified, you can use the three buttons next to the selection icons to decide which selected points you want to see.



There are various options for selecting objects, which can also be combined.

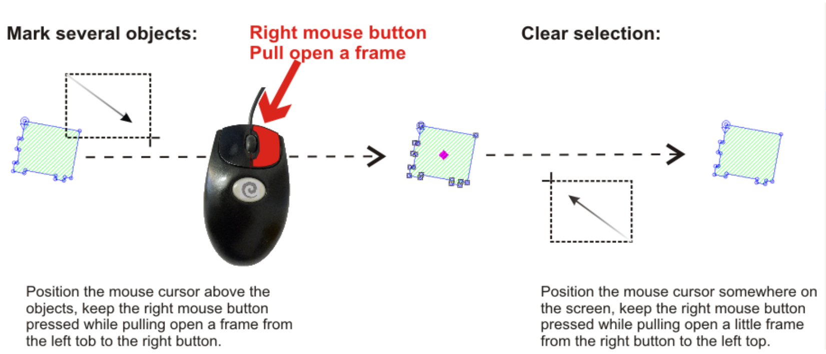
Select all objects

A **SELECT ALL OBJECTS** ***(Ctrl+A)***, selects all loaded objects. Switch the view filter to **CURRENT OBJECT TYPE** (***F6***) or **CURRENT GEO-FILE** ***(F5)*** if you want to select only certain objects.

Select points or objects using the right mouse button

Press the right mouse button at an object coordinate and select **SELECT POINT** or **SELECT OBJECT**. To select parts of line objects, for example the part of a wall base line that has no wall height after wall optimization, select the first point and select **SELECT INTERMEDIATE POINTS** for the last point using the right mouse button.

To select several objects or entire areas, press the right mouse button and draw a frame around the desired objects with the mouse from top left to bottom right. All objects of which at least 1 object coordinate is within the frame will be selected. Hold down the ***Ctrl key*** to select multiple areas.



Clear selections

Selections are removed via **CLEAR SELECTIONS (CTRL+Q)** or by pressing the right mouse button and dragging from the bottom right to the top left (see picture above).

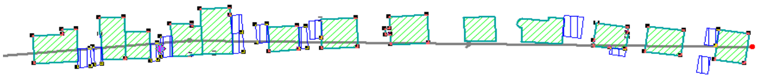
Select objects with Alt+ left mouse button

Objects can also be selected via ***Alt+*** left mouse button by clicking on the corresponding object (cursor changes to a hand with finger). To select further objects, additionally hold down the ***Ctrl key.*** Clicking again (still holding down ***Alt*** and ***Ctrl***) will undo the selection.

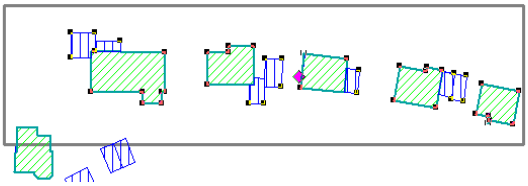
Select via line / area

Select a line or area and call **SELECT VIA LINE / AREA *(Ctrl+M)*** to select all objects that are intersected by this line object or lie within the area object. You can either use an existing object or enter an auxiliary line / area. The line or area object selected for this function remains selected, i.e. it would be deleted together with the objects selected by this function. If you do not want to include this object, deselect it with ***Alt+Ctrl+ left mouse click*** on the object before performing further actions.

Select via an intersection along a line:



Select within an area:



If the selection area cuts objects, decide whether to select only the objects that are completely within the area or also the intersected ones.

Invert selection

The **INVERT SELECTION** function ***Ctrl+W*** deselects the existing selections and selects all previously unselected loaded objects. This is an easy option, for example, to delete all objects outside the scope of the study.

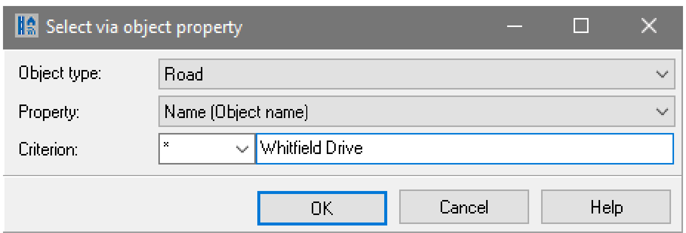
Selecting in the Property Explorer

Call the Property Explorer with ***Ctrl+E*** and select the desired object type from the drop-down list.

If you activate the column "selected", you can select objects via formulas ("1" for selected and "0" for not selected), with a mouse click into the box or with the space bar (also for several highlighted rows), to edit them further in the Geo-Database interface.

Select via object property

If you want to select all objects of an object type that have a certain property in common, call **SELECT VIA OBJECT PROPERTY** (***Ctrl+F***).



To find the search term, <, >, =, <>, <=, >= and * (contains) are allowed. Select the corresponding object type and the properties available for this object type from the selection lists.

If a property has the addition "Index" or "ID", you cannot enter a name directly as a criterion, but must first find the index number. This is because references are stored as numbers in a database.

Examples:

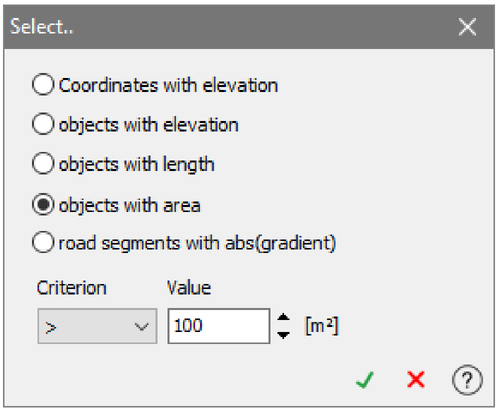
You want to select all buildings in Jamaica Road. But the building name also contains the house number. Enter * as a criterion and "Jamaica" as search term. Now all buildings are selected, which have the common text part "Jamaica" in the name (in this case, however, also the "Jamaica Hall " would be found).

Search for objects where a property is not defined: Enter = as the criterion and leave the search term field empty.

For properties assigned from the library (emission spectra, absorption spectra, day histograms, etc.) the criterion refers to the number of the element in the corresponding project library. The element number is displayed in the project library.

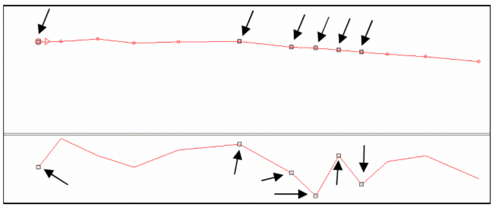
Select via geometry

≥ Objects can also be selected by their geometry, i.e. their size, length or elevation (z-coordinate, not the wall heights of buildings or walls).



Using the elevation options, you can quickly find objects with zero heights or individual zero heights within objects after an import, for example. These can then either be deleted or provided with elevations from the DGM. Objects with area is a tool to select, for example, buildings with a ground area of less than 40 m², like garages, declare them as auxiliary buildings and transfer them to another Geo-File.

Additionally, you can visualize road segments with upward and download slopes greater than a certain value.

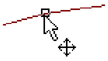


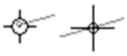
Select buildings from Spreadsheet

Via a Boolean column in the Spreadsheet you can assign buildings / receivers a criterion, to select the buildings (if the Boolean value is true the building is selected). For example, only certain buildings should be considered in a calculation for a detailed investigation, or you want to move these buildings to a different Geo-File.

Select the Spreadsheet and the Boolean column to be evaluated.

Move / capture selected point


If points or objects are selected, the cursor changes to the move cursor when you move to a coordinate. Move the coordinate to the desired position with the left mouse button.


If you drag the point onto an existing input point or object line, the point, or the position on the line, is captured. The cursor shows a capture circle. The large circle means that an object point, the small circle that the position on an object line is captured. This also applies to virtual lines for roads and berms.

You will be asked if you want to take over the elevation. The elevation must be equalized to create identical coordinates, for example for roads that shall be connected. For objects stacked on top of each other, for example floating buildings or area sources, you will not want to adopt the elevation if you capture coordinates to change the geometry. Since the same task is usually performed several times in succession, you can suppress the elevation query with **DO NOT ASK AGAIN AND USE SELECTION IN THIS SESSION.**

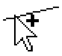
The **<** ***key*** temporarily switches off the capture mode.

Delete points or objects


If you want to delete a single coordinate, hold down the ***Shift key*** and click on the coordinate. A – is added to the selection arrow. You can also **DELETE POINTS** or **DELETE OBJECTS** using the right mouse button. Selected objects are deleted with **DELETE** ***(Del).***

Insert points

There are several ways to insert points into an already digitized object. If you want to insert a point centrally between two coordinates, click one of the two coordinates with the right mouse button and select **INSERT POINT AFTER** or **INSERT POINT BEFORE.** The z-coordinate will be interpolated from the two existing points. If the point is inserted before the first coordinate, the properties of the previously first point are transferred to the now first point.


To insert a point at any position in an existing object, hold down the ***Shift key*** and click on the object line. A + is added to the selection arrow.

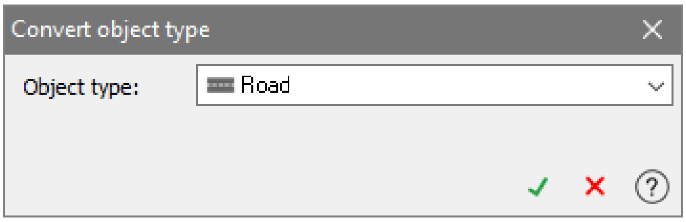
Change Geo-File assignment


Select the objects you want to move to another Geo-File and call **EDIT | CHANGE GEO-FILE ASSIGNMENT** ***(Ctrl + G)***. The Geo-Files present in the Situation are displayed in the selection list. The selected objects will be moved to the selected Geo-File. You can also change the Geo-File assignment of individual objects using the right mouse button.

In the Property Explorer (***Ctrl+E***) you can also change the Geo-File assignment. If necessary, you need to make the column visible via **TABLE | SHOW GEO-FILE AS COLUMN.**

Convert object type

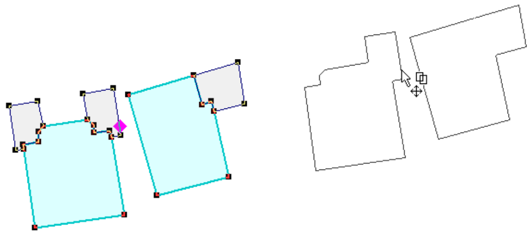
Select the objects you want to convert, call **EDIT | CONVERT OBJECT TYPE *(Ctrl + U)*** and select the new object type from the selection list. You can also convert individual objects using the right mouse button.



After conversion, the properties of the new object type will open to adjust them. If the object type of several objects is converted, the changed properties are applied to all objects.

Move, rotate and duplicate objects

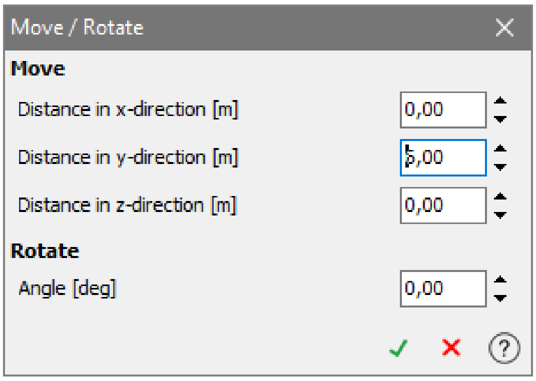
As soon as you have selected one or more objects, a **pink diamond** is displayed in the group's center of gravity in addition to the selection points. To **move**, hold down the left mouse button on the diamond and drag the group to the desired position. The new position is displayed as a contour.



If you hold down the ***Alt key*** and move selected objects, **duplicates** of the selection will be created at the new position.

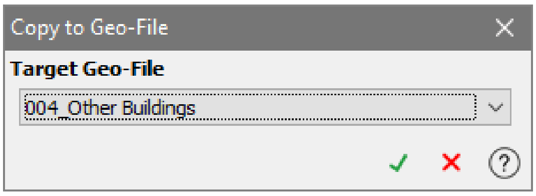
Hold down the ***Ctrl key*** to rotate the objects; they will be rotated around the center of gravity of the group. If the rotation is too fast, move the mouse towards the edge of the screen with the mouse button pressed, then the rotation will be slower. To **rotate** and **duplicate,** hold down ***Alt+Ctrl key.***

Objects can also be moved numerically in x, y, and z directions and rotated by a defined angle. Select **EDIT | MOVE / ROTATE OBJECTS**. A preview of the changed position is visualized directly in the Geo-Database interface.



Copy objects to Geo-File

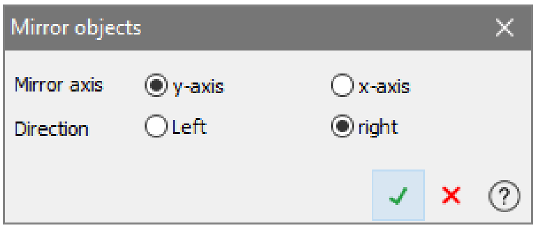
Select the objects you want to copy to another Geo-File and call **EDIT | COPY OBJECT**.



You can also copy selected objects via **EDIT | COPY *(Ctrl+C)*** and **EDIT | PASTE *(Ctrl+V)*.** With this procedure, the objects are pasted into the current Geo-File highlighted in green in the Geo-File Manager. After pasting, only the copy is selected.

Copy and mirror objects

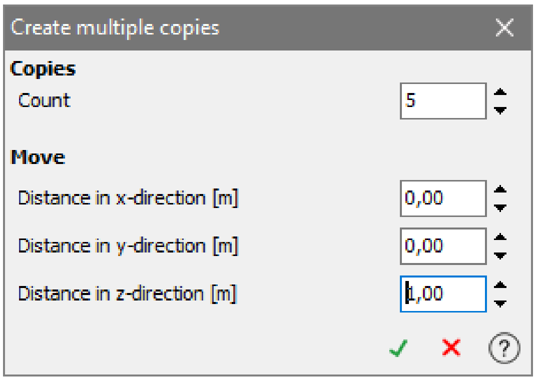
Select the objects you want to mirror and call **COPY AND MIRROR OBJECTS** from the **Edit list view**.



Set the mirror axis and select the direction left / right or above / below. The result is already displayed in the Geo-Database interface during the input.

Create multiple copies of objects

You can create multiple copies from one or more objects and move them in x, y and / or z direction. In this way, for example, several surface noise sources stacked on top of each other or construction windows with the same floor plans can be created at once.

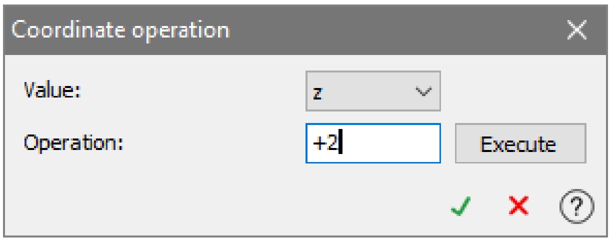


Select the objects you want to process, and call **CREATE MULTIPLE COPIES** from the **Edit list view**. Specify the number of copies and the distance in the different directions. The result in x- and y-direction is already visualized in the Geo-Database interface during the input, so that you can check the position. The properties are taken from the original object(s).

Coordinate operations

With the coordinate operations you can change the x and y coordinates or, the much more common use case, the height above sea level for one or more objects at the same time. Select the corresponding objects and choose **EDIT | COORDINATE OPERATION**. In the selection list, select the value to be changed, i.e. "x", "y" or "z", in the lower field enter the function, for example +0.5 or =125. The DGM elevation is entered via "Set objects to DGM " (page 85).

In very rare cases it can happen that with imported datasets first the y-value and then the x-value is given. In this case you would have to swap the x and y coordinates via the coordinate transformation, see "Coordinate transformation via rotation / reference points" (88).



The following operations are possible:

Equate (=), Add (+), Subtract (-), Multiply (*), Divide (/)

Property operations

The property operations require a comprehensive knowledge of the properties. It is therefore often quicker and clearer to use theUndo

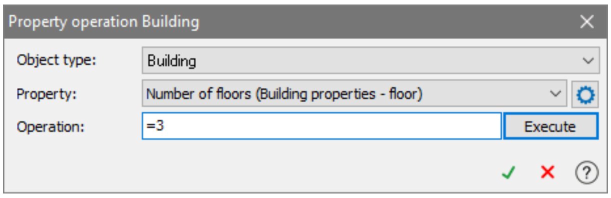
In the title bar or with ***Ctrl+Z*** you can undo changes to the coordinates and in the property definition until the last save.

Property Explorer.

The property operations are used to change the properties of several objects of the same object type at once.

You can add the properties you want to be displayed in the property operations or reduce the selection, see "Selection of the displayed object properties" (page 101).

Select the corresponding objects and choose **EDIT | PROPERTY OPERATIONS** (***Shift+E***). Select the property you want to edit from the drop-down list and enter the desired function in the field below. For example +3, =102.5 or =main road.

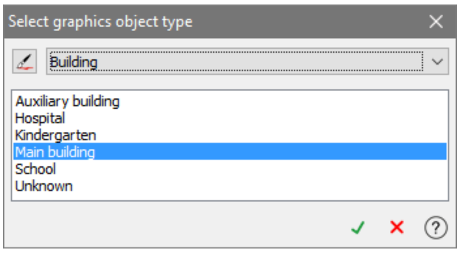


The following functions are possible:

Equate (=), Add (+), Subtract (-), Multiply (*), Divide (/)

Assign graphics object type

You can change the layout of the basic object types to other predefined layouts, for example, convert a noise barrier as a roof ridge for 3D or assign other building types. With Cartography you can additionally assign freely definable layouts to the Geo-Database objects.



Select the objects you want to edit and call **EDIT | GRAPHICS OBJECT TYPE** - you can also assign a different layout from the selection list to an individual object in the tree view of the object dialog or via the right mouse button. The list shows all available graphics object types in the project for this basic object. Assign the desired layout.

To change the display for the Graphics or to create a new layout [Cartography], click the **EDIT OBJECT TYPE** icon. This opens the project object types.

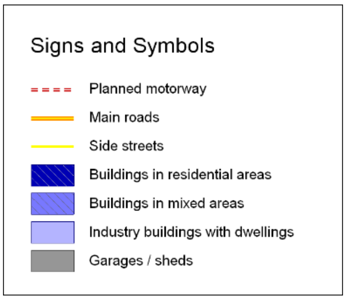
You can check the chosen layout if you open the 3D graphics window and switch to the 2D top view. The actual representation is only used in the Graphics.

Create your own object types

By duplicating object types, the same object type can be given different graphical characteristics. For example, to distinguish different types of roads or building usages.

Open the project object types using the **EDIT OBJECT TYPE** icon.

Activate the desired object type and press **DUPLICATE**. Give the new object type a name and define the legend text. Then change the layout as described in "Site map / geometry data" (page 418) and assign the new layout.



Search object by its object key (ID)

It is often possible to use the preflight instead of the object search, since the objects causing an error can be jumped to directly by double-clicking, see "Logbook and geometry check" (page 127).

In the calculation logbook, error messages or warnings often refer to an object in the Geo-Database. (E.g. "**Road properties of road no. 1793 missing**"). Here the search function helps to find the object in question. Select **SEARCH OBJECT** in the **Miscellaneous** ribbon and enter the object ID. The object will be displayed full screen.

Functions for individual objects in the context menu

There are functions that can only be applied to a specific object. Click an object coordinate with the right mouse button to execute it. In addition to these special functions, other selected functions are provided via the context menu, which then only apply to the current object and not to all selected ones as via editing.

Activate object

If you want to add more coordinates to an object, you must first reactivate it. Call **ACTIVATE OBJECT** with a right click. You will see that the object points already entered, the starting arrow and the last point in red are displayed. You can only continue digitizing at the last point. If you need additional coordinates at the beginning of the object, you must change the input direction.

Split object

This function is used to split an object into two separate objects. Right-click on the point where you want the new object to start and call **SPLIT OBJECT**. When the object points are activated, you will see that the property mark is repeated at the beginning of the new object and that new object has a start arrow between the first and the second coordinate.

Change input direction

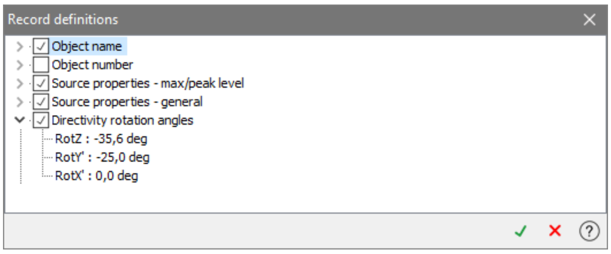
Sometimes it is necessary to change the input direction of a line or area. Call **CHANGE INPUT DIRECTION** via the right mouse button.

For industrial buildings, the input direction is automatically changed to counterclockwise.

Transfer properties

Properties can be transferred from one object to another. For example, the traffic data of a second railway line or spectrum, day histogram and directivity of a source.

Right-click the object from which you want to transfer properties and select **COPY PROPERTIES.** All properties of the selected object are copied. Now right-click the object to which you want to transfer the properties and select **PASTE PROPERTIES**. Select from the list which properties shall be transferred.



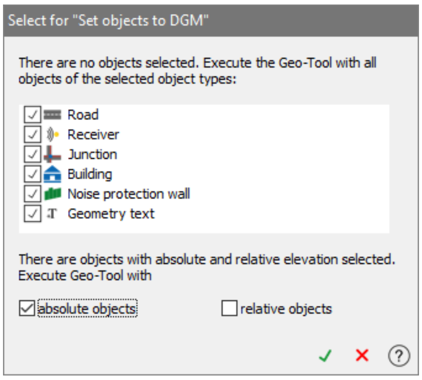
The function is repeatable, so you can apply the copied properties to multiple objects.

If you select different object types, only compatible properties are listed.

Geo-Tools and Tools

All Geo-Tools and Tools are provided in the **Tools** ribbon.

The **GeoTool dialogs** contain a preselection of the object types that are sensible for the individual Geo-Tools.



The Geo-Database only intervenes if nothing has been selected or if objects that are not compatible with the called Geo-Tool are selected or present, otherwise the dialog opens directly.

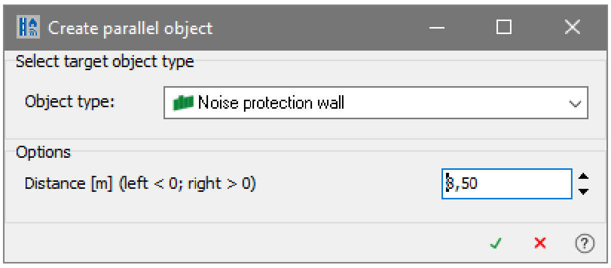
If objects with absolute and relative heights are included or selected, please select for which objects the Geo-Tool should be executed.

If no DGM is loaded and a Geo-Tool is to be executed for which a DGM is required, you will be prompted to load the DGM before executing the Geo-Tool.

Geometry tools

Create parallel object

Use parallel objects, for example, to generate the baseline for a noise barrier parallel to the road axis or edge, or for a 2-track railway line. Select the objects and call **GEOMETRYTOOLS | CREATE PARALLEL OBJECT** (***Shift+Ctrl+P***).



Select the object type from the list and enter the distance in [m] at which the parallel object is to be created to the left or right in the input direction. A positive value creates a new line to the right of the existing line (in input direction), a shift to the left is entered as a negative value. The result is displayed directly in the graphic interface. If the parallel line is on the wrong side, change the sign from + to – or vice versa. You can recognize the input direction by the small arrows when you switch on the object points for the object type.

For "parallel" objects made of areas, negative values will create a smaller object, positive values will create a larger object.

If parallel object and original object have the same object type, properties that have already been defined are adopted.

Parallel object from calculated object lines

Calculated object lines are lines that are calculated from the input of properties. For example, the berm top from the height and slope of the berm, or the edge of the road from the width of the road, which can change in the course of the road. For a single calculated object line, you can create a parallel object using the popup menu (right mouse button on an object point). With the distance 0 you can also copy a calculated object line in this way.

Connect lines and create areas

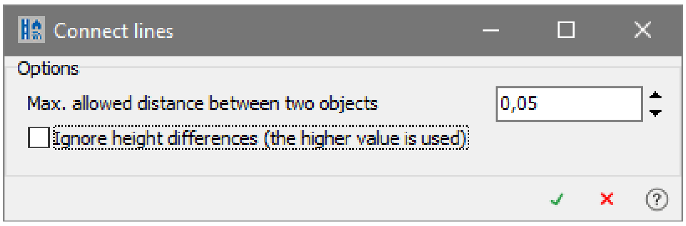
During import, the data is often present as individual lines and not as polylines or areas. (Switch on the **object points** to check the data).

For use in SoundPLANnoise, it is sensible or necessary that these individual sections are connected to polylines or areas.

During shape import, for example, roads are split at the coordinates where properties change. Since SoundPLANnoise can manage variant properties, the road sections should be connected to form one object.

Connect lines

Select all lines that should be connected to one or more objects and choose **GEOMETRY TOOLS | CONNECT LINES (*Shift+Ctrl+V*)**.



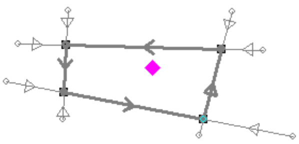
Enter the maximum permitted distance between the end and start point of the lines to connect lines with not completely identical coordinates to polylines. With the check box **IGNORE HEIGHT DIFFERENCE** the 2-dimensional distance is evaluated instead of the 3-dimensional distance. In this case, the upper elevation of the two objects is used.

If more than two lines are selected, lines will not be connected if both name or source group fields are not empty and different. In addition, for roads, lines are only connected if the road bends less than 60° and if the cross section definition does not change from single emission band to two emission bands. Please note the instructions in the logbook.

If only two lines are selected, these checks are not performed. Then the entries in the first second object are deleted.

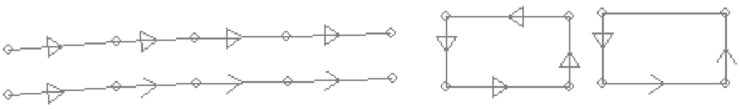
Create areas

Select all lines that are to be connected to areas and call **GEOMETRY TOOLS | CREATE AREAS**. The algorithm of this Geo-Tool processes lines into polylines or areas if the distance between the lines is within a distance of **10 cm.** If lines overlap, all lines are divided at intersections with other lines and areas are created from the line segments.



If the gaps between two objects are too large, it is necessary to close them manually. Either select the lines and drag the last coordinate of one line to the first coordinate of the following line. Or, if there is a larger gap between the two points, and you do not want to move the original point, activate the first object with **ACTIVATE OBJECT** (right mouse button), and capture the first coordinate of the following line with the ***Ctrl-key*** pressed.

This is what the result should look like after successfully executing these Geo-Tools:

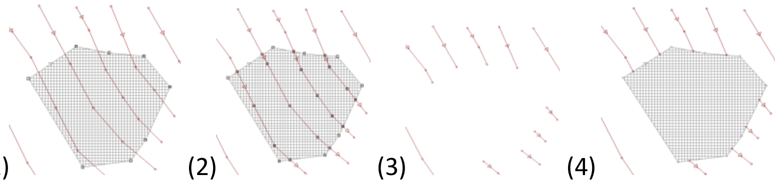


Insert intersections and split

If you want to cut data within a certain area or separate objects at a line, this Geo-Tool is a good choice. It creates points at the selected cut edge and splits the cut objects. The area itself, and the objects within the area are selected so that they can be deleted with ***Del.*** When inserting cutting points based on a line, the cutting line remains selected.

Procedure using the example of an area: you can either use an existing area or digitize an auxiliary area. Select the area and call **GEOMETRY TOOLS | INSERT INTERSECTIONS AND SPLIT** (1).

You can see from the start arrows that the elevation lines within the area are now individual objects and have been selected (2). The next step is to delete the selected objects with ***Del*** (3). If you want to keep the original area, first remove the selection for the area with ***Alt+ Ctrl+ Left click*** on the edge of the area (4).

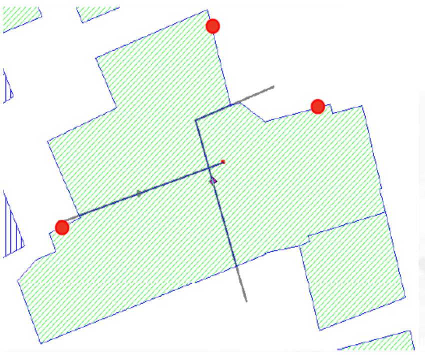


(1) (2) (3) (4)

If you want to edit all objects outside the clip area (e.g. delete or move them to another Geo-File), use **SELECT OBJECTS | INVERT (*Ctrl+W*)** from the **Start** ribbon.

Divide areas

With **GEOMETRY TOOLS | DIVIDE AREAS**, you can, for example, divide separate terraced houses entered as one structure into individual buildings, or divide area noise sources and parking lots into smaller homogeneous areas.

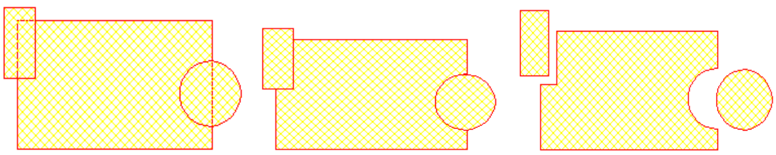


All properties of the original object are transferred to the sub objects. In the case of buildings, inhabitants and dwellings are distributed to the sub-buildings on the basis of the resulting area sizes.

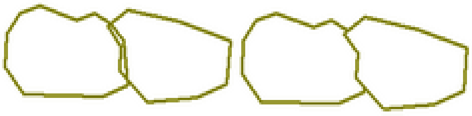
Enter lines at the points where you want to separate area objects. Select the lines and run **GEOMETRY TOOLS | DIVIDE AREAS**.

Clean up overlapping areas

With **GEOMETRY TOOLS | CLEAN UP OVERLAPPING AREAS** (***Shift + U***)) smaller area objects overlapping a bigger area are cut out. Define the size of the overlap area above which a new object will be created from the overlapping area.



This tool is also useful to clean up overlapping ground areas, attenuation areas, or area uses that cause errors in the calculation at the push of a button.



If the z coordinates of objects with variable elevation are different, the elevations of the inserted points may be wrong. Please check the result.

Filter

If the distance between the points of line objects is very small, unneeded points that have no influence on the accuracy can be deleted via the filter. Unneeded points on the facades of buildings can also be removed using the filter. A lower 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 normally not critical.

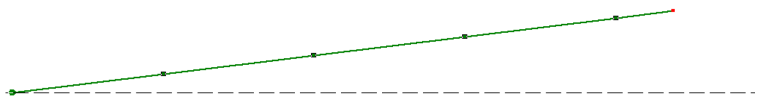
Note: the points that can be filtered out are selected by the filter - but **not** automatically deleted! Deleting the filtered points is subsequently an active action on your part.

Select the objects and choose **GEOMETRY TOOLS | FILTER** ***(Shift + Ctrl + F)***. Specify the filter width and click OK. The selected points in the above example are within a 3-dimensional distance of 10 cm in relation to the unselected points. Input points with properties are not selected, even if they are within the filter width.

Use the ***Del*** key to delete the selected points from the dataset. If you do not want to apply the filter, clear the selection.

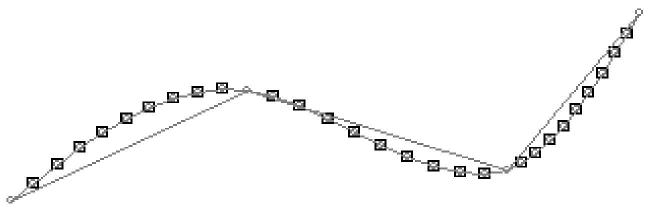
Divide into sections

Object edges of line and area objects can be divided into smaller sections, allowing to structure noise barriers or facades for example. The objects are not split.



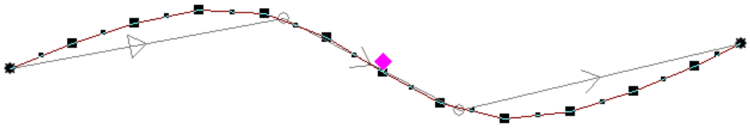
Call **GEOMETRY TOOLS | DIVIDE INTO SECTIONS** ***(Shift + Ctrl + L)*** and enter the spacing of the points to be inserted in [m]. The elevation of the inserted points is interpolated linearly, existing coordinates are not moved. If the length of the section between the inserted point and the next point is smaller than the specified value, no more points will be inserted.

Interpolation: n points per segment



Call **GEOMETRY TOOLS | INTERPOLATION: N POINTS PER SEGMENT** and enter the number of intermediate coordinates. The inserted coordinates are selected. For polylines with at least three points, the number of points you specified is inserted on an imaginary 3-dimensional spline. The original input points remain unchanged. The picture above shows the original line and the result.

Interpolation: Segments with constant distance



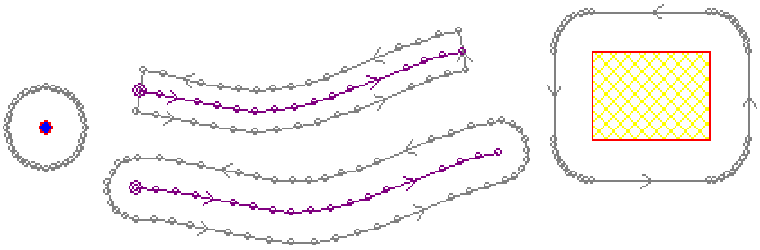
Call **GEOMETRY TOOLS | INTERPOLATION: SEGMENTS WITH CONSTANT DISTANCE** and enter the distance in [m]. The inserted coordinates are selected. For line segments with at least three points, coordinates are inserted at the distance you specified on an imaginary 3-dimensional spline. The existing points are moved and interpolated in height. The picture above shows the original line and the result.

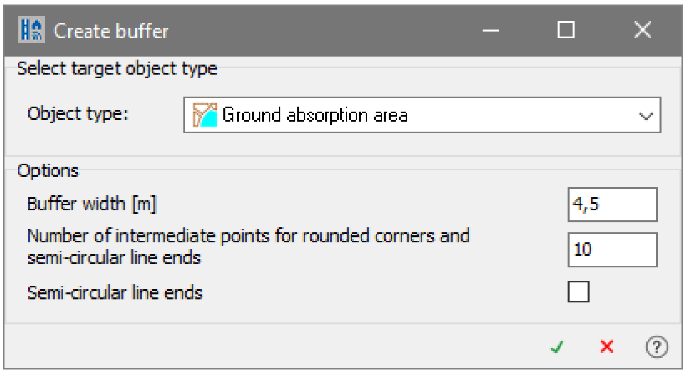
Interpolation: point with defined distance from starting point

The coordinates are connected by straight lines during input, which can lead to inaccurate kilometer data for a curved road or railway, for example. This Geo-Tool inserts a coordinate at the distance you specify from the starting point of the line segment on an imaginary 3-dimensional spline. Call **GEOMETRY TOOLS | INTERPOLATION: POINT WITH [M] DISTANCE FROM FIRST POINT**. The inserted coordinate is selected.

Create buffer areas

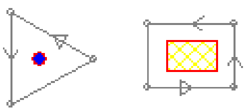
GEOMETRY TOOLS | CREATE BUFFER AREAS allows to generate buffers around points, lines and areas. The created buffer areas are selected so that further actions can be performed directly if necessary.





Select the target object type. The **BUFFER WIDTH** in [m] is the distance between the selected object and the edge of the buffer area (e.g. 4.5 m if you want a total area band of 9 m). The **NUMBER OF INTERMEDIATE POINTS** determines how detailed arcs are generated in relation to 360°. For example, if you enter 36 intermediate points, an intermediate point is set every 10 °.

Examples: With the setting 1 intermediate point for area-type objects, the corners are not rounded. The setting 3 for a point object creates a triangle.



The checkmark **SEMI-CIRCULAR LINE ENDS** causes an additional rounding around the line ends. This allows you, for example, to create a calculation area that follows the course of the road and does not end directly at the end of the road.

If the same object type is selected for the buffer area as for the original object, properties that have already been defined are adopted.

Combine areas

This Geo-Tool creates the hull area(s) of all selected areas (regardless of the object type), for example to create a calculation area from individual city district areas. Holes (interior areas) and overlaps are ignored. The resulting areas are always general areas; the original area objects are preserved. Select the areas and call **GEOMETRY TOOLS |COMBINE AREAS**.

Clean up area geometry

If the warning message *"Receiver x is within the assigned building, possibly due to right angle correction" appears in the* logbook, this is often due to the fact that the lines of a building were put together like an 8 after the import. This warning and also other errors in the calculation, for example, if area usages or ground effect areas intersect, can be repaired with the Geo-Tool **GEOMETRY TOOLS | CLEAN UP AREA GEOMETRY.** This Geo-Tool goes through all the area-type objects in a Situation and cleans up the geometry. The logbook shows how many areas were corrected, how many buildings with courtyards are included and if areas could not be corrected.

Calculate right angles

Selected area-type objects can be subsequently adjusted to right angles via **GEOMETRY TOOLS | CALCULATE RIGHT ANGLES**. You will get a message if the angle is outside a specified tolerance. You can also enter objects at right angles from during the input using the angle mode in the **Start** ribbon.

Clean multiple points

Especially with imported data it happens that objects with identical coordinates are present. The Geo-Tool **GEOMETRY TOOLS | CLEAN MULTIPLE POINTS** filters out coordinates with a preset minimum distance of 1 cm.

Adapt road/railway course

This Geo-Tool is used to correct the position of road or railway axes. Roads and railways are often available from different sources in different quality.

For example, road axes are often subdivided into traffic-relevant sections, with detailed traffic data and cross-section information but insufficient geometrical accuracy.

However, this inaccuracy can be improved by combining it with additional data, e.g. where only the position of roads and railways is recorded, but in high geometric quality. The geometrical accurate axes must be available as **lines** (or be converted into lines). For example, roads from OpenStreetMap or Navteq data (data from navigation systems) can be used for geometrical accuracy.

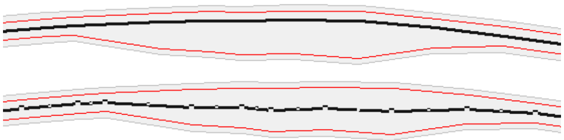
Divide the axes into small sections (5 - 10 m) (**GEOMETRY TOOLS | DIVIDE INTO SECTIONS**) so that they can be adjusted to the line.

Select the roads/railways and call **GEOMETRY TOOLS | ADJUST ROAD/RAILWAY COURSE *(Shift + Ctrl + S)***. Specify the maximum distance within which the axes are automatically corrected in position and adjusted to the geometric course of the lines. Points that could not be moved due to the distance will be selected. Afterwards thin out the axes again using the filter (**GEOMETRY TOOLS | FILTER**).

Left: Initial Situation, middle: road subdivided, right: result

Center road axis

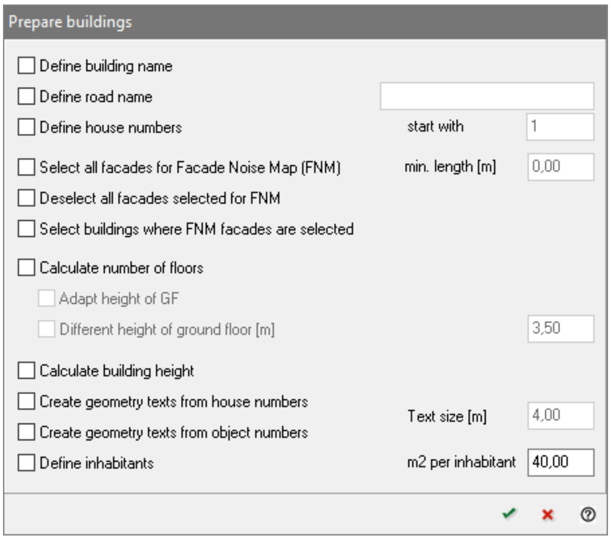
If you have moved road edges, you can use **GEOMETRY TOOLS | CENTER ROAD AXIS** to center the road axis between the road edges. The position of the emission lines and the road edge are not changed, only the emission and road distances in the tab *cross section*.



Building Tools

Prepare buildings

BUILDING TOOLS | PREPARE BUILDINGS is very useful to jointly define building properties in larger datasets and prepare them for a façade noise map calculation.



DEFINE BUILDING NAMES generates the building name from the building properties “road name” and “house number”. If road name and house number are not included in the data, you can generate a **ROAD NAME** and a consecutive **HOUSE NUMBER.**

SELECT ALL FACADES FOR FAÇADE NOISE MAP means that all facades of the selected buildings will be switched on for the calculation of the FNM. Use the **MINIMUM LENGTH** to exclude bay windows or small facades.

If you display the properties of the buildings in the object manager, you will see the selected facades as thick turquoise lines.

With **SWITCH OFF ALL FACADES FOR FNM,** no receivers are calculated for the selected buildings. For a quick selection of buildings with FNM facades switched on, use the check mark **SELECT BUILDINGS WHERE FNM FACADES ARE SWITCHED ON**.

Based on the building height, SoundPLAN can calculate the **NUMBER OF FLOORS** and thus determine the number of receivers. The calculation is carried out with the floor height entered in the building properties and the possibly deviating height of the first floor (check mark **DIFFERENT HEIGHT OF GROUND FLOOR**).

The height of the first receiver above the ground floor has no relevance for the calculation of the number of floors.

If the check mark **ADAPT HEIGHT OF GF** is also activated, the building height is changed to a multiple of the floor height and the ground floor of the building is corrected upwards so that the top edge of the building (diffraction edge) remains the same. If the building height is less than the "floor height", the ground floor elevation is adjusted downwards so that the diffraction edge does not change.

Vice versa, you can use **CALCULATE BUILDING HEIGHT** to calculate a generalized building height from the number of floors if the number of floors is known instead of the building height. The building height results from *floor height * (number of floors + ½ floor)*. The additional half floor height is used to find a mean height of the top floor. The building height can be calculated more individually in the Property Explorer, for example to take into account different floor heights for the ground floor and the upper floors.

HOUSE NUMBERS AS GEOTEXT creates a geotext within the building from the value house number.

OBJECT NUMBER AS GEOTEXT creates a geotext within the building from the value object number.

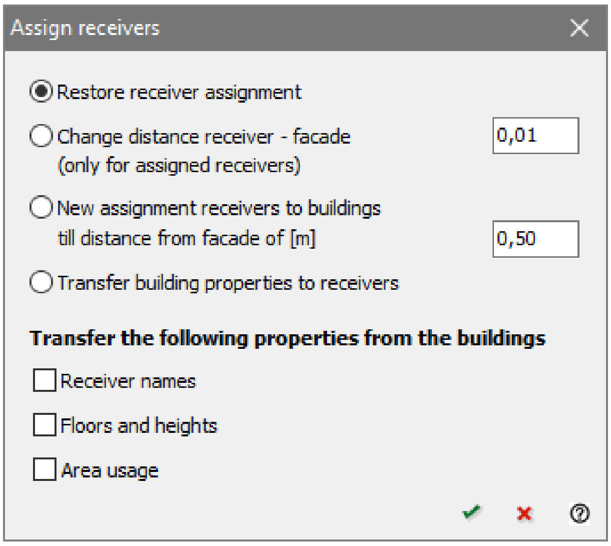
You can use **OTHER TOOLS | GENERATE GEOTEXTS FROM PROPERTIES** to display any property as text.

DEFINE INHABITANTS calculates the number of inhabitants per building from the floor area, number of floors and a user-defined area per inhabitant (for example for evaluations according to the EU Environmental Noise Directive).

Edit receiver assignment

With this Geo-Tool you can restore a lost receiver assignment to buildings, reassign receivers to buildings as well as transfer changed building properties to the receivers. The assignment to buildings is important so that the reflection of the own facade is treated according to the standard.

Call **GEOTOOLS | EDIT RECEIVER ASSIGNMENT**.



Receiver assignments can get lost, for example, if the buildings have been copied. Each object entered in the Geo-Database has a unique object ID. The copy of a building therefore has a higher ID. However, for the assignment between building and receiver, the original ID of the building was stored in the receiver properties. You can repair this via **RESTORE RECEIVER ASSIGNMENT.**

You can recognize lost assignments if receivers at buildings are displayed in red instead of green (unassigned receivers are drawn in dark yellow).

In the case of already assigned receivers, you can change the position of the receiver via **CHANGE DISTANCE RECEIVER - FACADE [M]**, for example, if the same receivers are to be used for calculations according to different standards with different requirements for position and calculation height (e.g. total noise assessment according to VDI 3722-2).

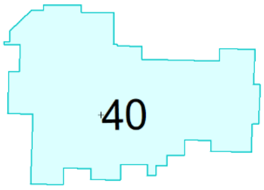
If you have imported receivers, these are not automatically assigned to the buildings. The assignment can be made via **NEW ASSIGNMENT OF RECEIVERS TO BUILDINGS.**

Use **TRANSFER BUILDING PROPERTIES TO RECEIVERS** to update changed building properties in the receiver properties. This concerns **RECEIVER NAME**, **AREA USAGE** and the information on **FLOORS AND HEIGHTS** (with this option, the object height of the receiver is also updated from the ground floor of the assigned building).

When restoring the assignment or a new assignment, the building properties can be transferred in the same step.

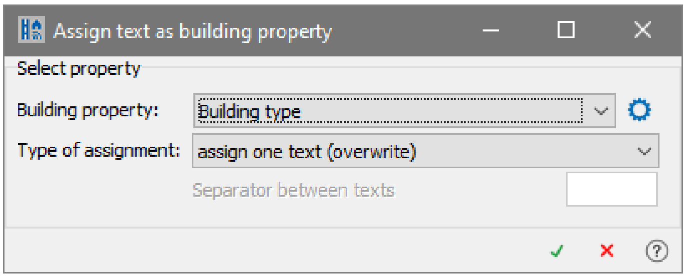
Assign text to buildings

Texts whose position cross is inside a building can be automatically assigned to any property of the buildings.

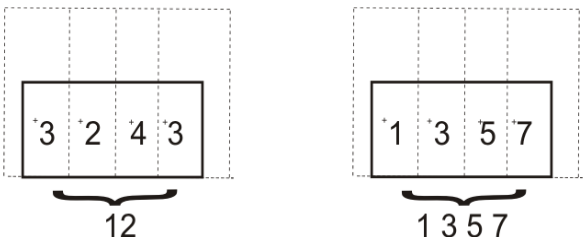


Buildings and texts do not have to be in the same Geo-File. Select the texts you want to assign to the buildings.


Call **BUILDING TOOLS | ASSIGN TEXT TO BUILDINGS**. The assignment type **ASSIGN ONE TEXT (OVERWRITE)** overwrites any existing content in the selected property. If there are several texts in a building, the first text found will be entered as a property.



If several texts are located in one building, they can be concentrated in one field. To do this, select the **ASSIGN MULTIPLE TEXTS (ADD UP)** assignment type.



If, for example, several terraced houses were digitized as one building, but house numbers or inhabitant figures are available for each building, the texts can be assigned to the building.

For value fields (inhabitants, dwellings) the texts are added up, for text fields (house number, name, ...) they are output one after the other with a user-defined separator. Existing texts are not overwritten but added. **RESET FIELD AND ASSIGN MULTIPLE TEXTS** deletes existing content from the corresponding field before the new texts are assigned.

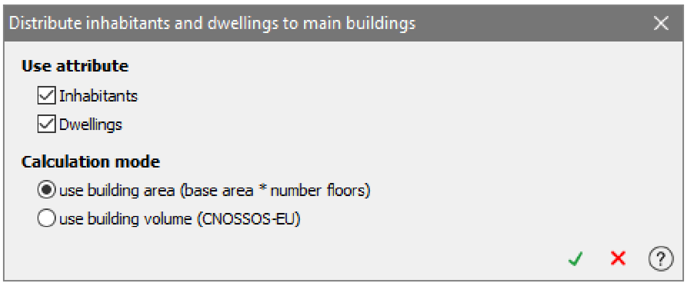
Transfer area usage to buildings

This Geo-Tool is used to transfer the area usage from the area usage object type to the selected buildings.

Select the area usages and the buildings for which you want to define the usage and invoke **BUILDING TOOLS | TRANSFER AREA USAGE TO BUILDINGS**. If no buildings are selected, the usage will be transferred to all buildings located in one of the areas usages.

Distribute inhabitants or dwellings

If you have imported inhabitant figures or the number of dwellings for areas or in grids as "area usage" or "value grid", you can distribute them among all main buildings within the areas / grids. Select the data and call **BUILDING TOOLS | DISTRIBUTE INHABITANTS AND DWELLINGS TO MAIN BUILDINGS**.

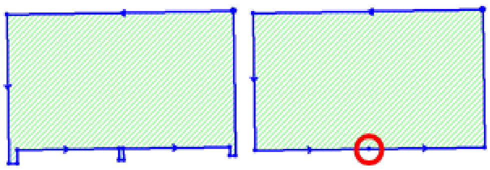


Via the number of buildings per area, their floor area * number of floors or their building volume (for evaluations according to CNOSSOS-EU) the inhabitants / dwellings are distributed. The square meters per inhabitant / dwelling are then documented in the logbook.

Clean up wall ledges

BUILDING TOOLS | CLEAN UP WALL LEDGES (*Shift + M*) cuts off wall ledges (for example on terraces) or small bay windows. This allows you to prevent unnecessary receivers for a façade noise map and thereby also reduce the calculation time.

Specify the maximum allowed width of the ledges in [m]. The maximum length is fixed at 1 m.



If the wall ledge is not at the edge of the building, a point is placed instead of the ledge to divide the facade.

Merge properties from partial buildings

When importing building data (e.g. CityGML) it can happen that buildings are subdivided into several partial buildings, but properties like road name or function ID are not contained in all partial buildings. The GML ID from CityGML is contained in each partial building and is automatically imported into the building name.

To merge the properties, the Geo-Tool **MERGE PROPERTIES FORM PARTIAL BUILDINGS** needs a unique characteristic to identify the related sub-buildings. For CityGML data, it makes sense to use the GML ID in the building name. However, you can also select a unique key from another building property.

If a property is not unique, e.g. because two partial buildings have different values in one property, the replacement for this (!) property is skipped and a warning is written in the logbook.

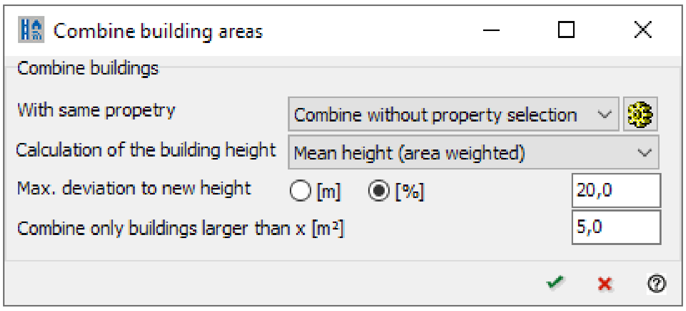
Completing lost properties should be done before combining building parts, otherwise properties may be lost completely.

Combine building areas

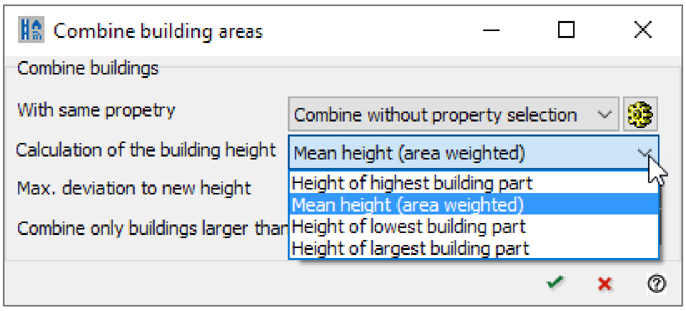
Use **BUILDING TOOLS | COMBINE BUILDING AREAS** (Shift + W) to combine for example annexes to main buildings or partial buildings from a CityGML import.

Sometimes the partial buildings form a CityGML import strongly differ in height (e.g. church tower and church nave) and should be kept as separate buildings. Sometimes they differ little (by number of dormers, by coincidence (laser points), by multiple floor plans under one roof, etc.) and can be combined. Still others are very specifically nested and may only be partially combined.

For this purpose, building parts that can be combined must first be grouped. You can use a key property for this, according to which the first grouping is done, and a minimum size, by which the group is reduced again and also divided.



Next define how you want to determine the height of the new, combined buildings.

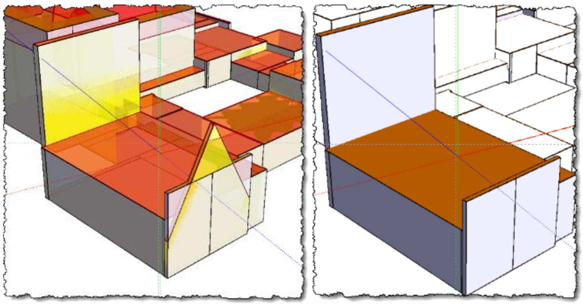


In order not to always automatically combine all building parts, additionally enter a height tolerance to the new height in [%] or in [m]. Buildings that are sorted out according to these criteria are not combined. For the combined buildings of a group, the properties (except building height) are determined from the largest partial building of the group.

Starting the procedure, first the buildings will be grouped, if they match to the settings, and combined.

It is not always sensible to blindly use a mean height, because in almost every inspected CityGML file we found walls and other building types which were set in front of the façade with a fantasy height and fantasy roof type, e.g. inspired by a nearby tree. Such errors point on photogrammetric work without any quality control.

3



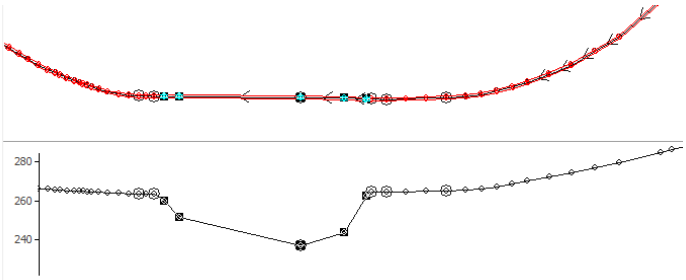
In reality the shown building is one simple, rectangular flat roof building. To correct the result, you can e.g. combine the 4 partial buildings using the setting “Height of lowest building part” and a max. deviation of 100 m. So you will get all parts together with a sensible height. To combine saddle roof parts, instead you should prefer “Mean height (area weighted)” and a sensible deviation.

The areas must not overlap. Therefore, if necessary, first run the Geo-Tool "Clean up overlapping areas".

Elevation tools

Interpolate elevations

The elevations of selected points can be interpolated linearly. For example, for ramps if the start and end heights are known, to smooth elevation jumps within an object or for roads and railways located in bridge areas on the terrain (see also "Search for bridges" in "Set objects on the DGM").



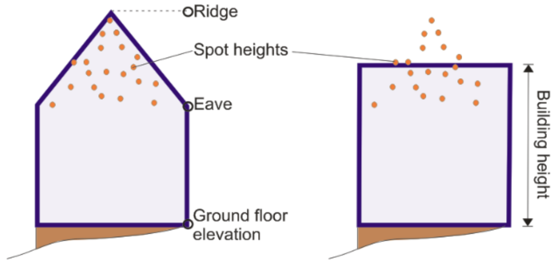
Select the object, or within an object in the top view, the front view or the side view**,** the points to interpolate (right-click the first point | **SELECT POINT**, subsequently right-click the last point | **SELECT INTERMEDIATE POINTS**) and then execute **ELEVATION TOOLS | INTERPOLATE ELEVATION** (***Ctrl+H***).

With **SELECT OBJECTS VIA GEOMETRY** in the **Start** ribbon, you can select all coordinates below a certain elevation and then interpolate the elevation.

You can also interpolate elevations in the coordinates list in the object dialog by highlighting the coordinates you want to interpolate in the z-column and clicking on the symbol or pressing ***Ctrl+H.***

Evaluate elevation points for building height

This Geo-Tool evaluates all elevation points within a building floor map to determine the average elevation or the median of the elevation points and places the difference between top elevation and ground floor in the building property “building height”.



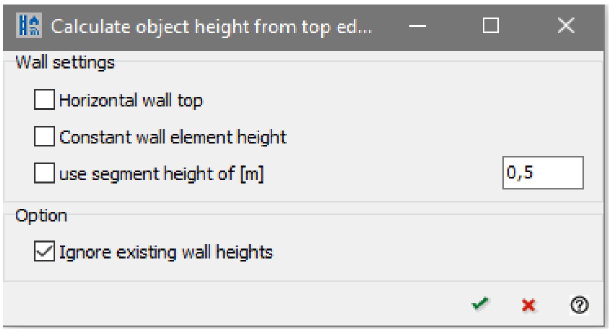
Select the buildings and import the elevation data unfiltered within the building outlines (see "Use areas and line corridors" page 83). Then run **ELEVATION TOOLS | EVALUATE ELEVATION POINTS FOR BUILDING HEIGHT**.

Calculate wall height from object top edges

If the z-coordinate of noise protection walls or buildings / industrial buildings contains the eaves height or wall top edge, this Geo-Tool calculates the wall height by intersecting the object top edges with the terrain. The result is placed in the object properties “wall height” or “building height”. The terrain DGM must be loaded in the Situation.

Select the corresponding objects and choose **ELEVATION TOOLS | CALCULATE WALL HEIGHT FROM TOP EDGE**. For buildings and industrial buildings, you can choose whether the highest / lowest value of all corner points or a value averaged from all corner points should be entered for the ground floor elevation.

For walls there are three settings that can be combined with each other.



If you select **HORIZONTAL WALL TOP**, if necessary, an additional point will be inserted at the end of a segment, to ensure the horizontal top of the wall. The base height of the wall is set so that the largest possible wall area is created. **CONSTANT ELEMENT HEIGHT** sets the end height of the wall elements in such a way that the element has the same height throughout. The top edge of the object can change accordingly. **USE SEGMENT HEIGHT** uses a height you specify for the individual segments stacked on top of each other and adjusts the base height of the wall so that the segment height is a multiple of the entered value. The remaining height between the lowest element and the DGM is considered as a non-reflective base. The three parameters can be combined.

In addition, there is the option **IGNORE EXISTING WALL HEIGHTS.** This sets the wall top edge (diffraction edge) at the height of the original z-coordinate, even if a height is already entered in the wall properties. If you deactivate the checkbox and the wall already has a wall height, the wall top edge is corrected upwards by the entered wall height.

Take a look at the result in the 3D model or in the front view.

Interpolate elevations on bridges

The Geo-Tool **ELEVATION TOOLS | INTERPOLATE ELEVATIONS ON BRIDGES** interpolates the elevations of all bridges of all selected roads and railways between the beginning and end of the bridge. If you have several bridges in the course of an object, but only want to interpolate the elevations of one bridge, select the bridge points of the desired bridge except the bridge beginning and end points and execute the Geo-Tool **INTERPOLATE HEIGHTS** (***Ctrl+ H***).

Smooth elevations

If the DGM is too inaccurate, some of the road sections have jumps the in elevation that result in an undesired incline addition in the emission calculation.

The elevations of the existing input points are adjusted iteratively. Call **ELEVATION TOOLS | SMOOTH ELEVATIONS** and specify the number of iteration steps.

This function is also suitable for adapting a road as an animation track in the 3D Graphics.

Bridge detection

The Geo-Tool bridge detection (**ELEVATION TOOLS | BRIDGE DETECTION**) searches for bridges in the course of roads or railways whose gradient is known. This means that the elevation of the given coordinates will not be changed.

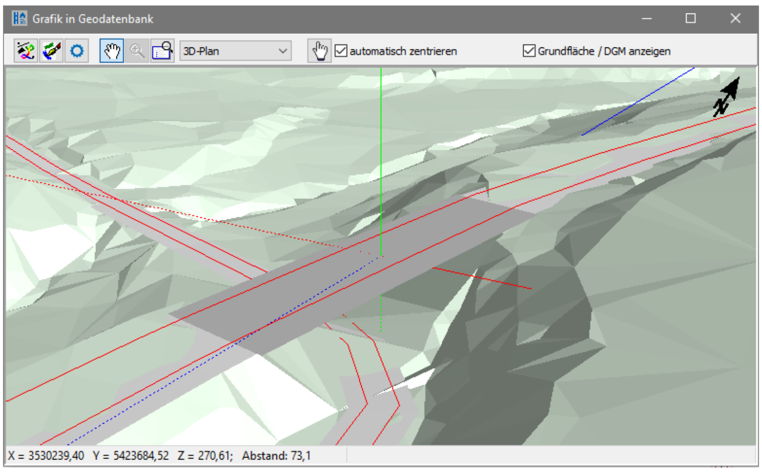
Enter the **MINIMUM BRIDGE LENGTH** and the **MINIMUM BRIDGE HEIGHT** as search criteria.

Control bridges

The logbook records where bridges were found and additionally displays the bridge length and height.

Bridges are entered as warnings if the length over minimum height is less than half the minimum length, one of the two slopes is consistently less than 30° or the length/height ratio is greater than 15. All other bridges are entered as hints, with bridges where the length/height ratio is greater than 10 but less than 15. You should at least check the bridges that have been entered as warnings.

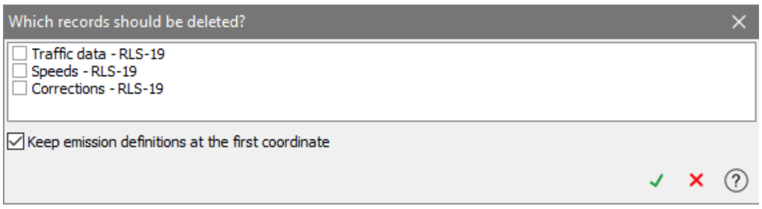
If the 3D Graphics window is open in addition to the logbook, the 3D view jumps to the bridge position when you double-click on the logbook entry. The view automatically rotates so that you can see the bridge from the side.



Other tools

Reset emissions from roads and railways

Via **OTHERS | RESET EMISSION** you can delete the properties for the emission calculation for roads and railways, separated by the different emission records (for road for example traffic data, speeds, corrections). You can keep the properties at the first point. If no objects are selected, the emissions of all roads or railways will be reset.



Estimate multiple reflections

Multiple reflections as correction of the emission level are included in the standards RLS-19, RLS-90 and Schall 03:1990. Since the definition of the multiple reflection addition is standard-dependent, the multiple reflections are estimated according to the standard set in the SoundPLAN Manager. If RLS-19 is set, buildings and reflecting noise barriers are considered for the estimation, otherwise only buildings. For some other older standards, multiple reflections can be estimated according to the definition in RLS-90. Multiple reflections are estimated only for roads, not for railways.

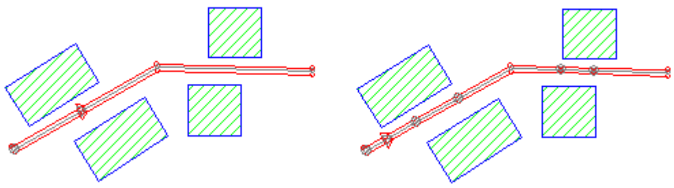
OTHER | ESTIMATE MULTIPLE REFLECTIONS determines the parameters mean height of the lower building (hBeb) and mean distance of the buildings (w) for parallel buildings on both sides ($\alpha < 5°$) and automatically enters them into the corresponding fields of the emission dialog. The resulting multiple reflection addition is taken into account in the emission calculation.

The wall height for multiple reflection is considered for buildings / walls only above the road level. For objects located completely above the road, this is the difference between the top edge and the z-coordinate; for objects located lower, it is the difference between the top edge and the road level.

To determine the distance between the walls, the nearest wall in the propagation path with a height > 1 m is used. Under certain circumstances, this could also be a retaining wall in front of a building which is not relevant for the multiple reflection addition.

RLS-90 requires a check line for the calculation. Enter the length of this check line. Values between 10 and 50 m are sensible depending on the situation. RLS-19 does not use a check line.

At the position where the multiple reflection addition changes, points are inserted and assigned the property. The elevation is interpolated between the given points. At building gaps and objects with reflection loss > 1.5 dB the addition ends.



Left: Initial Situation, right: with inserted points

Multiple reflection additions can also or additionally be entered manually in the object dialog, *Emission* | *Speeds, surface, …* tab.

Already entered information can be removed from the data with **OTHER | RESET MULTIPLE REFLECTION ADDITION**, this is mandatory before running the multiple Reflection estimation again.

Separate multiple existing objects

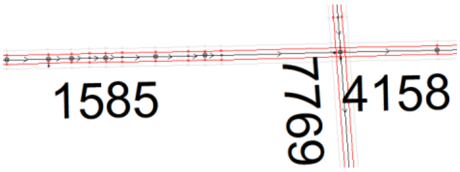
If identical objects are present twice or more in the data, the duplicates can be separated into different Geo-Files using the **OTHER | SEPARATE MULTIPLE OBJECTS** tool. The first occurrence of the objects (by ascending object ID) remains in the original Geo-File, a Geo-File is created for the second occurrence. If other objects are contained three times in the data, the third occurrence is again saved in a new Geo-File. After running the tool, you can go through the Geo-Files and decide which processing state is the correct one and which data can be deleted.

By default, the duplicates are saved under the following name:

smo_1.geo - duplicate objects
smo_2.geo - objects occurring three times
...

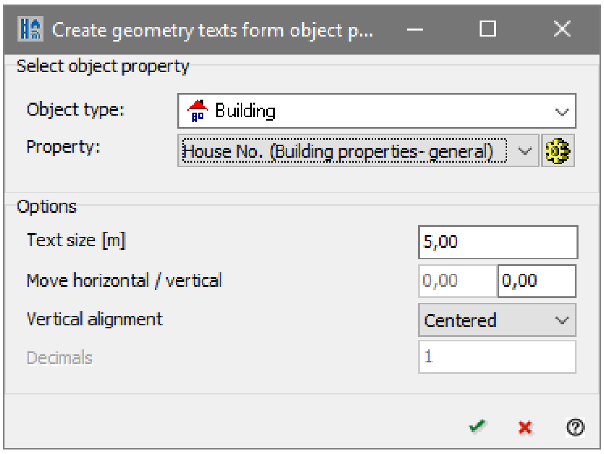
Create geometry texts from properties

[Module Cartography] With this tool you can create texts from any properties of the different object types (also for variant objects).



This tool is also helpful to check the input data. In the image above, the average daily traffic was output as text.

Select the objects for which you want to generate a property as geometry text and call **OTHER | CREATE GEOTEXTS FROM PROPERTIES**.



Select the object type and the desired property. If the property is not listed in the selection list, click on the gear wheel and add the desired property.

Enter the **TEXT HEIGHT** in [m] under **OPTIONS.** For area objects, all other options are grayed out - the reference point of the text is always in the center of gravity of the area. For line objects, you can select the **VERTICAL ALIGNMENT** of the geometry texts along the line, relative to the input direction, as well as additionally **MOVE** the texts **VERTICALLY**. For point objects, the texts are written to the right of the point by default, and the vertical alignment is centered. You can change both the **VERTICAL ALIGNMENT** and the **HORIZONTAL / VERTICAL SHIFT** for point objects.

The created geometry texts "know" the object and the property from which they were created. If a geometry text is generated again for the same object and property, the existing text is deleted beforehand (the texts must be loaded in the Situation). This allows you to run the tool multiple times without creating duplicate texts.

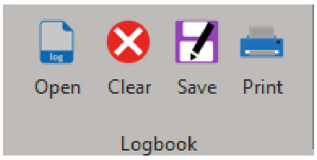
Regenerate new object numbers

The object number can be assigned for selected objects or for all objects contained in the Situation using the format string.

1 Call **OBJECT NUMBER | RENUMBER** and select whether to renumber receivers, buildings, sources, photo points or indoor sources. SoundPLAN knows the last assigned object number of this object type and offers the next one. You can enter any number that matches the format string. If the number does not correspond to the format string, a message will tell you what the format string is.

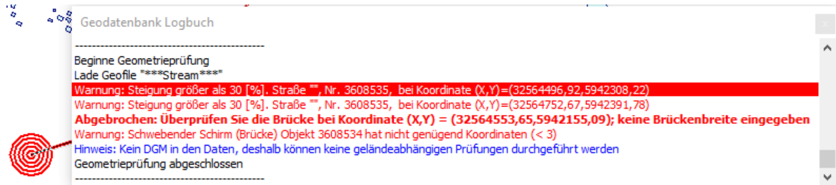
Logbook and geometry check (preflight)

The logbook is an important component for checking the data. When errors or warnings occur during data entry, import or data editing, the logbook docking window opens automatically. If the logbook window is open, a ribbon is added for the actions in the logbook.

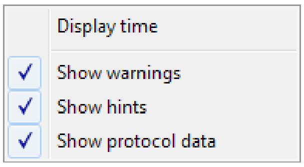



The preflight tool checks the geometry in the Geo-Database for possible warnings and errors that could lead to incorrect results or errors in the calculation. Call the preflight in the Geo-Database title bar or via **MISCELLANEOUS | PREFLIGHT**.

When you click on a warning or error, the coordinate where the problem occurs is highlighted with circles. Double-click to zoom in on the object.



Use the right mouse button to select the level of detail for the displayed logbook entries. Errors are always displayed, warnings, hints and the protocol are optional.



Load stored logbook

In the Geo-Database logbook a stored logbook of the preflight or a logbook from the Calculation core can be loaded. This allows better control and cleanup of errors that occur only during calculation.


Open the logbook and load the log file of the calculation run in which errors occurred from the results subdirectory in the project folder. The file has the same

name and number as the calculation run, for example RSPSxxxx.log in case of an incorrect single point calculation.

Overview of the shortcut keys in the Geo-Database

View	
View selected objects	F3
View current Geo-File	F5
View current object type	F6
View All Objects	Depending on previous selection, again F3, F5 or F6
Top view	F7
Front view	F8
Side view	F9
3D view	F10
Select	
Select all	Ctrl+A
Clear marks	Ctrl+Q
Select via line / area	Ctrl+M
Select via geometry	Ctrl+T
Select via properties	Ctrl+F
Invert selection	Ctrl+W
Edit	
Copy	Ctrl+C
Insert	Ctrl+V
Delete	Del
Undo	Ctrl+Z
Save	Ctrl+S
Finish object	F2 or double click
Property Explorer	Ctrl+E
Change Geo-File assignment	Ctrl+G
Copy objects to Geo-File	Shift+Ctrl+G
Convert object type	Ctrl+U
Coordinate operations	Shift+Ctrl+K
Rotate and move objects	Shift+Ctrl+R
Create multiple copies	Shift+Ctrl+M
Copy and mirror objects	Shift+Ctrl+U
Assign graphics object type	Shift+Ctrl+T
Angle mode on/off	F11
Crosshairs on / off	+
Area fills off / on	-
Switch off any additional mode (selection, capture) temporarily	< | (depending on the keyboard layout)
Delete last entered point during input	Esc
DGM	
Calculate DGM	Ctrl+D
Set objects to DGM	Shift+Ctrl+D
Include objects in DGM	Alt+Ctrl+D
Geo-Tools	
Filter	Shift+Ctrl+F
Interpolate elevations	Ctrl+H
Divide line into sections	Shift+Ctrl+L

Parallel object	Shift+Ctrl+P
Connect objects	Shift+Ctrl+V
Adapt road/railway course	Shift+Ctrl+S
Clean up wall ledges	Shift+M
Clean up overlap areas	Shift+U
Combine building areas	Shift+W
Transformation	
Transform to project coordinate system	Shift+Ctrl+I
Transform from project coordinate system	Shift+Ctrl+A
Miscellaneous	
Connection to online map services	Shift+Ctrl+O
Bitmap Manager	Ctrl+B
Rotate geometry	Arrow keys right / left
Zoom geometry	Page up / down
Switch on zoom mode temporarily	Shift and pressed mouse wheel
Refresh view	Ctrl+R
KML geometry export	Ctrl+K

4 Objects and their properties

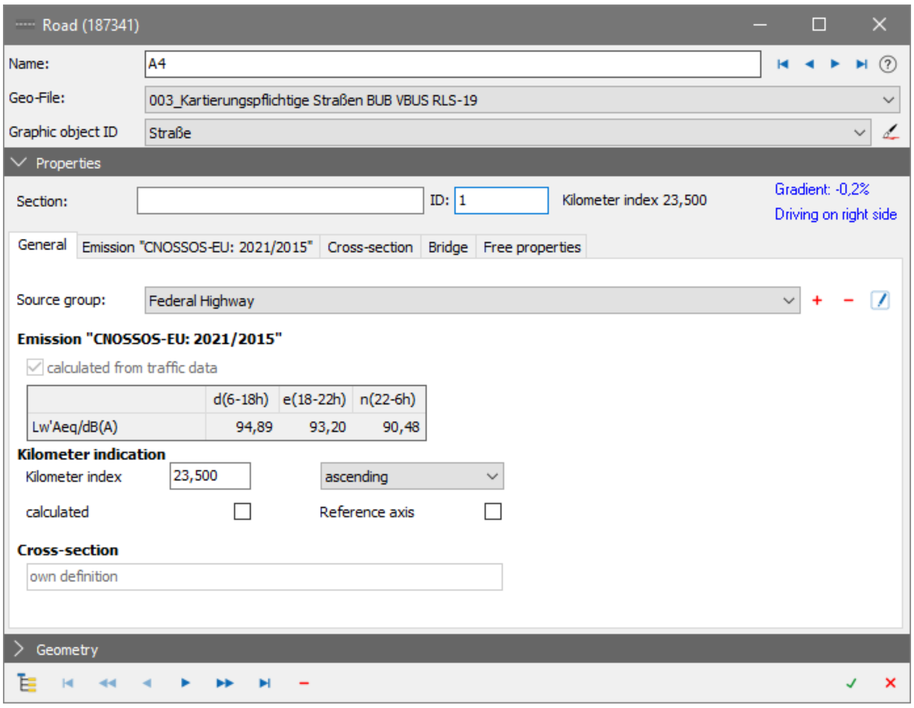
Each object type has specific predefined properties. For example, the traffic data for roads or the number of inhabitants and the reflection properties for buildings. Apart from these properties, you can add your own free properties and thus enter or import additional information about the objects, see "Free properties of the objects" (page 216).

Some objects, especially the noise sources, noise barriers and ground effects, have special standard-dependent properties. For more information, please refer to the relevant standards.

Road axes

Roads are linear noise emitters. The road axis is entered with the x and y coordinates and the elevation of the road surface above sea level. The width of the roadway and the distance between the emission bands are defined in the tab *cross section*. The elevation of the emissions bands is automatically calculated from the elevation of the road axis, according to used standard and is considered for the propagation calculation.

Road properties



Road properties include the emission calculation as well as other features such as kilometer post, cross-section, and bridge definition. The emission parameters differ depending on the used standard.

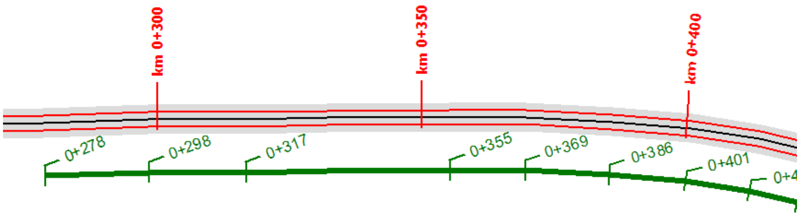
Name, section and group

The **NAME** describes the object, the **SECTION NAME** is used to further describe sections of a road. Both are displayed in the road emission documentation. The **SECTION ID** can be used to assign a unique key to road sections for the assignment of traffic data to already entered roads. The road name can only be entered at the first coordinate of a road. If the road name changes in the course, please define a new road.

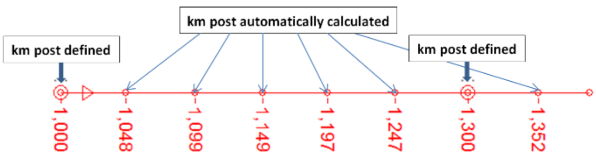
With the group assignment, roads can be assigned to **SOURCE GROUPS**, e.g. roads under different road authorities, see "Using the group assignment of sources" (page 187).

Stationing and reference axis

The stationing (kilometer post) is used in the SoundPLAN Spreadsheet, the road emission documentation and in Wall Design and can be displayed in the Graphics, if desired together with the reference kilometer of a noise barrier. [Cartography]



A kilometer post is assigned to each road coordinate and the further course in input direction (descending or ascending). You can enter the kilometers manually for each point or let SoundPLAN calculate them automatically, optionally setting an initial kilometer. For automatic calculation, activate the check mark **CALCULATED**. As the road sections are included in the kilometer calculation as straight lines, there may be discrepancies between the calculation in SoundPLAN and the reality. If necessary, switch off the automatic calculation in between and enter a corrected value. The automatic calculation is continued using the manually entered value.



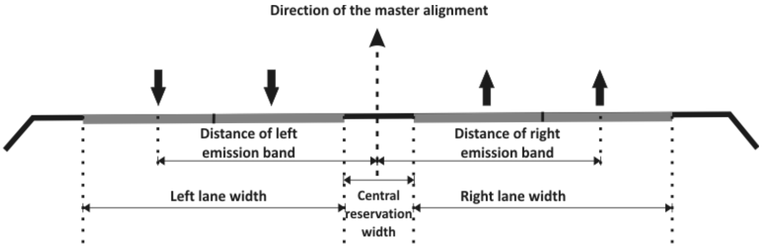
» Turn on the display of the properties for the roads in the Object Manager, then among other things the kilometer will be displayed .

For the output of the kilometer and the orthogonal distance receiver/road axis in the Spreadsheet and for the display in the Graphics, a road axis must be defined as **REFERENCE AXIS** . Activate the check mark at the first point of the polyline.

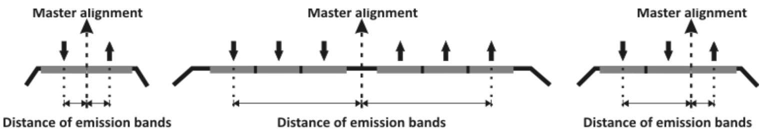
If a reference axis is defined, it is automatically loaded in the Spreadsheet. If you want to load a reference axis later, use **FILE | ADD ADDITIONAL COLUMNS | COLUMNS WITH ADDITIONAL INFORMATION**. Use **FILE | TABLE CONTENTS** to select another file (Situation or Geo-File) that contains the reference axis.

Cross section and road width

Roads are digitized as polylines, whereby the **road axis** is entered. For the calculation, the traffic is distributed to the two outer lanes via the **DISTANCE EMISSION BAND** left / right.



Either select one of the predefined cross sections from the selection list or enter the distances in the corresponding fields. The road cross sections can also be asymmetrical, for example to define turning lanes or roads with three lanes.

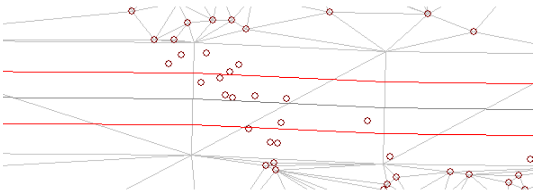


Examples of different cross sections and the spacing of the outer lane centers.

The **ROAD WIDTH** is important for the standards where the roads are included as hard surfaces in the propagation calculation. With the setting **CREATE GROUND EFFECT AREAS FROM ROAD SURFACES** (Calculation run properties, tab *settings*), all roads are automatically regarded as hard ground without the need to enter ground effect areas.

The lane width is also used for the display of the roads in the Graphics.

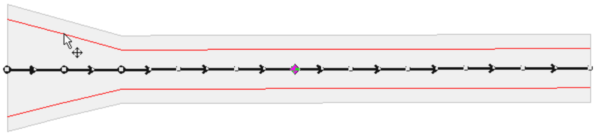
The location and elevation of the road edges above sea level can be included in the digital ground model; elevation points within the road bands are omitted from the meshing so that the emission line cannot be below the terrain.



DGM meshing with road edges, elevation points within the road band are omitted

The **CENTRAL RESERVATION** is added symmetrically to the right and left of the input axis.

Change road cross-section graphically: When a road is selected, you can manually move the emission bands and the road edge. Emission and edge lines themselves are not displayed "selected", but the cursor changes to the move arrow. The emission or edge line is moved on the angle bisector between the previous and following point. The width of the road or the emission line is automatically adjusted as well. If **HIGHLIGHTED** is selected for the road, the road band is also displayed as an area.



Hold down the ***Shift key*** to move road edge and emission line independently.

Single emission band

If you do not want the emission to be split between two emission bands, jump to the first coordinate in the navigation bar of the properties dialog and activate **SINGLE EMISSION BAND**. Roads with one emission line cannot be continued as roads with two emission lines. In such cases, a new road must be defined. Therefore, **SINGLE EMISSION BAND** is only active at the first road point.

Enter the **LANE WIDTH** to the left and to the right, which will be evaluated for the ground effects and the graphical display.

Emission calculation road

The input for the emission calculation differs depending on the used standard, for example different vehicle types or corrections. The emission height is evaluated automatically according to the standard.

The emission level is calculated from the traffic data. In some (old) standards, it can be entered directly in the corresponding fields.

At road points where the emission changes due to changes in traffic volume, speeds, etc., the changed emission properties are stored. All properties that do not change are still valid. The emission definition is valid until a new change is stored or at the end of the road.

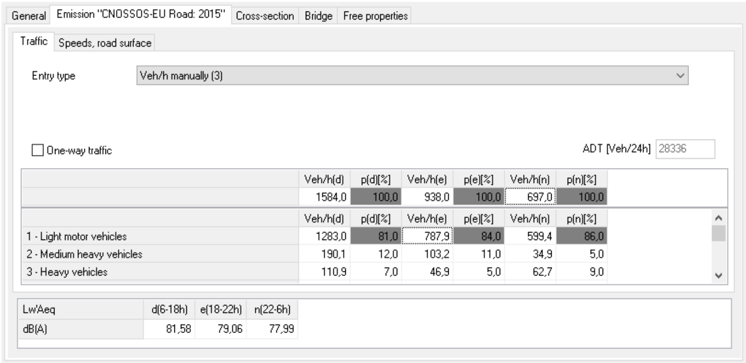
For roads with two emission bands, SoundPLAN assumes that the emission is distributed evenly between the two emission bands. If this is not the case, please digitize the two emission bands separately and specify “single emission band” in the road properties.

Enter traffic data, speeds and corrections in the *Emission* card. The number of time slices is set in the **OPTIONS** (**File** ribbon).

Depending on the used calculation standard, different entry fields are displayed with the parameters needed for this standard. Please read the standard for details on the individual standards.

For NMPB 2008 the Nord 2000 road can be selected as emission standard. This way it is possible to define own vehicle types with corresponding emission coefficients (for example to define 2-stroke and 4-stroke driven motor rickshaws for Southeast Asia). Please refer to the Nord 2000 road documentation (https://forcetechnology.com/en/-/media/force-technology-media/pdf-files/projects/nord2000/nord2000-users-guide-road).

Entry of the traffic volume



Check **ONE-WAY TRAFFIC** if a road is defined with a single emission band (either one-way road or separate roads for each direction) and select whether all traffic on this road flows **IN** or **VERSUS ENTRY DIRECTION.** This is important for standards where different gradient and slope formulas are used in the emission calculation.

For a road with two emission bands, the traffic is divided symmetrically, meaning that half of the traffic flows uphill and the other half flows downhill.

Gradient or slope are determined from the coordinates and displayed in blue text at the top right. For some standards, the slope can also be set manually in the second tab.

The information whether left or right traffic is in force in a country is important for roads with two emission bands to assign the correct emission band to the uphill or downhill gradient (program setting in the **options**). For your information, the setting is displayed in blue letters in the upper right corner of the dialog.

Parameters for 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.

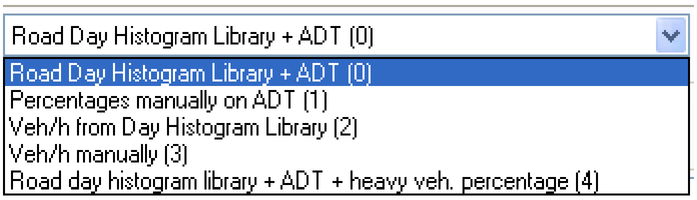
k: Factors for the calculation of the hourly traffic volume from the ADT: k*ADT=vehicles/h for each of the time slices

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 "Road day histogram library" (page 232). There you can add any kind of time sequences of the traffic volume.

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.

4

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.

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.

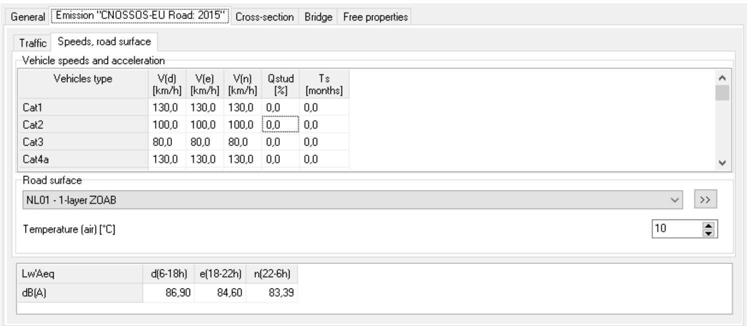
Road Day Histogram Library + ADT + HT (4)

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 by a suitable factor.

There are two additional entry types for CRTN (UK): **12, 4, 8,** and **18-hour data.**

The entry dialog 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.

Input of speed, road surface and additions



Enter the additional parameters for the calculation of the emission level in the fields of the next tab index card.

The **SPEED** is defined for each vehicle type and time slice. All other parameters (e.g. driving conditions, studded tyres, corrections for different road surfaces, age of road surface) are standard dependent, please read the standard.

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 slice definition.

CoRTN Australia (North South Wales)

The emission input gives the user the possibility to split the emission of the trucks 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.

Multiple reflections

According to RLS-90 and RLS-19, **MULTIPLE REFLECTIONS** in street canyons can be taken into account by an addition to the emission level (Drefl). In some other older standards, multiple reflections can be entered similarly to the definition in RLS-90.

The multiple reflections can be estimated automatically for larger areas using the GeoTool "Estimate multiple reflections" (page 125) if the multiple reflection addition is included in the emission dialog of the standard.

Multiple reflection addition according to RLS-90

Enter the average height of the walls on the lower side of the road (hBeb[m]), the distance between the walls (w[m]) and *absorbing* for absorbing linings of barriers or *reflecting* for reflecting walls.

Reflective: $D_{refl} = 4 * H_{Beb} / w =< 3.2$ dB

Absorbent: $D_{refl} = 2 * H_{Beb} / w =< 1.6$ dB

Make sure that the propagation calculation only contains the 1st reflection if you assign multiple reflections to the emission level via this addition.

Multiple reflection addition according to RLS-19

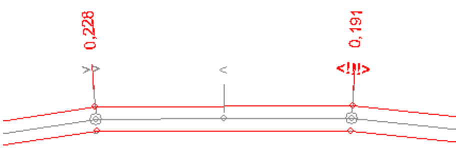
For calculations according to RLS-19, the 2nd reflection order must be considered. The definition of the multiple reflection addition has been adjusted accordingly. Multiple reflections may only be used if the angle of the opposing buildings / reflecting walls is < 5° to the road axis. The multiple reflection addition is assigned up to a distance of 100 m between the reflecting surfaces.

$D_{refl} = 2 * H_{Beb} / w =< 1.6$ dB

Gradient addition

The slope is usually calculated from the coordinates of the road.

Since, depending on the standard, the slope may lead to high additions and thus to incorrect calculation results, the slope is visualized in the Geo-Database (switch on the road properties):



The Calculation core returns a warning message when the gradient exceeds 30%. Also use **SELECT OBJECTS BY GEOMETRY** to find sections with implausible gradient.

For the propagation calculation gradients can be averaged over a user-defined distance.

Road emission documentation

The emission calculation is documented in the **Miscellaneous** ribbon. The output format of this table cannot be changed. You can preview and print the emission table for all roads or only for selected roads.

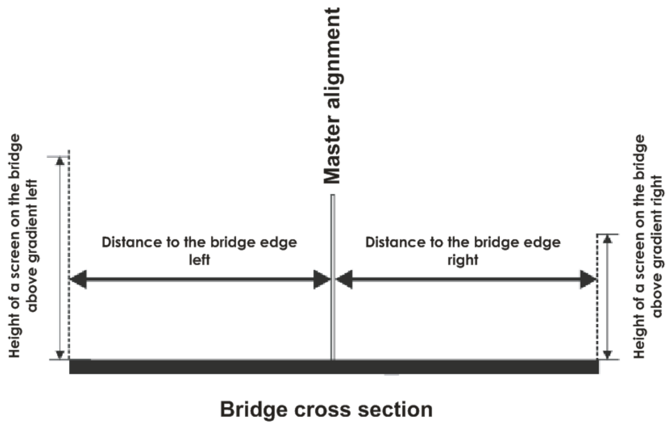
Preview

Station km	ADT Veh/24h	Vehicles type	Traffic values day Veh/h	Traffic values evening Veh/h	Traffic values night Veh/h	Speed day [km/h]	Speed evening [km/h]	Speed night [km/h]	Road surface ID	Road surface Temp.Air [°]	Gradient Min / Max %	Emission level day dB(A)	Emission level evening dB(A)	Emission level night dB(A)
B96									Traffic direction: Both directions					
0+000	12820	1	753	495	117	50	50	50	2	10,0	-4,7 / 6,3	80,9 - 81,8	78,4 - 78,9	73,0 - 73,9
		2	22	7	4	50	50	50						
		3	28	9	5	50	50	50						
		4a	9	9	-	50	50	50						
		4b	-	-	-	-	-	-						
0+518	12820	1	753	495	117	50	50	50	1	10,0	6,1 / 8,6	84,0 - 84,5	81,4 - 81,8	76,1 - 76,7
		2	22	7	4	50	50	50						
		3	28	9	5	50	50	50						
		4a	9	9	-	50	50	50						
		4b	-	-	-	-	-	-						

When calculating road noise, a table with the emission parameters is stored, which is displayed in the Result Tables in the tab "*Roads*".

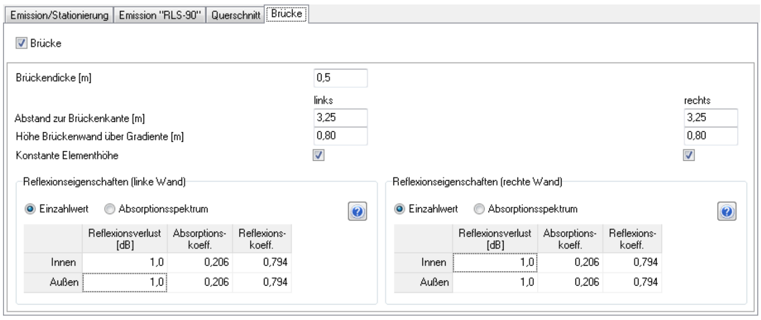
Road bridge

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 **relative to the gradient**.



Deactivate the bridge check box at the end of the bridge again.

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.



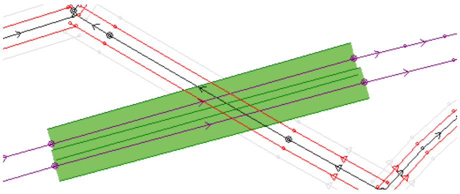
Please observe the following characteristics:

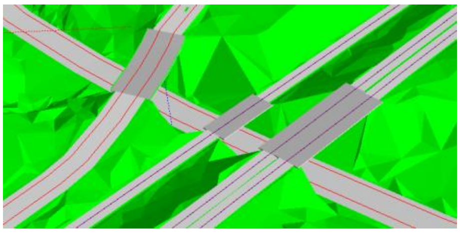
- Elevations below the bridge are recognized as terrain for the DGM calculation.
- Bridge bottom and bridge thickness are not reflective (except for ASJ Japan).
- If **CREATE GROUND EFFECT AREAS FROM ROAD SURFACES** is checked in the calculation run properties, the bridge surface is recognized as hard surface.

Bridges are displayed in green in the Geo-Database.

Bridge modeling

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.





Bridge wall

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 "Wall properties" (page 196).

The reflection properties of bridge walls correspond to those of the noise barrier. For the spectral assessment of reflection losses (only for standards supporting frequency-dependent calculations), the absorption spectra from the library are used.

Maximum level road

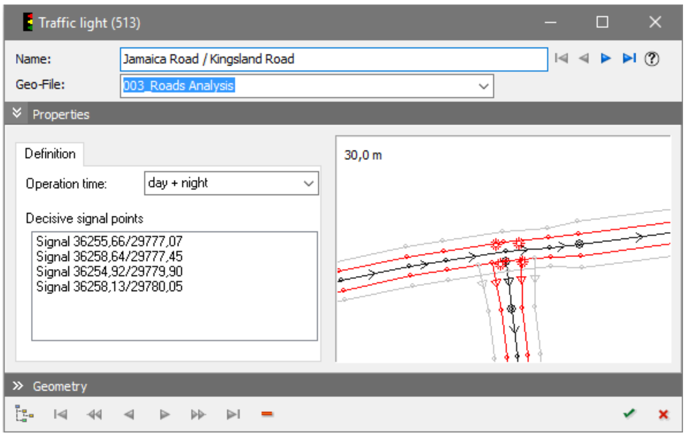
LMAX-ROAD: This represents a maximum noise level of a single vehicle pass by (in general a truck). Depending on the receiver location the maximum noise level can be caused by different roads. At present, Lmax-road exists only for certain standards, e.g. "Statens planverk report no. 48; 1980" and "Road Traffic Noise - Nordic Pred. Method; 1996", as well as "Nord 2000".

Signal - junction 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 “capture coordinate” on a coordinate in the intersection).



Specify the operation hours of the traffic light: daytime (6 a.m. to 10 p.m.), nighttime (10 p.m. to 6 a.m.), or daytime and nighttime.

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)

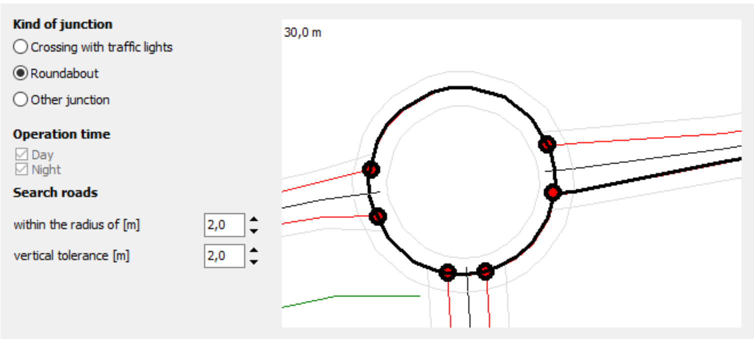
All roads connected with the traffic light by the signal marks get the addition of the nearest signal mark.

Delete signal marks: click on the signal mark in the list and press the delete key.

Junction CNOSSOS-EU based standards and RLS-19

The junction correction accounts for the increased annoyance of traffic noise caused by starting and braking at traffic light-controlled junctions and roundabouts. The correction is added to the emission level of the road depending on the distance to the junction. up to a distance of 100 m (CNOSSOS-EU, BUB) / 120 m (RLS-19).

Set the junctions **at the same elevation as the road** at the intersections of the road emission lines.



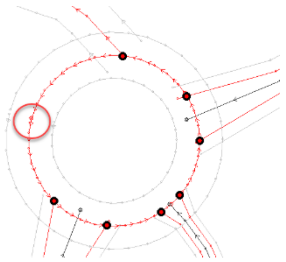
The **KIND OF JUNCTION** determines the distance-dependent addition KKT. Other junctions do not get an addition but can be entered for documentation purposes.

The preview window highlights the emission lines for which this junction contributes to a distance-based addition in the calculation. **For the additions to be found for the full length, the roads must be present as one object.** If necessary, use the Geo-Tool **CONNECT LINES** to connect road segments.

According to the standards, the junctions must be entered at each intersection of crossing or merging emission lines. However, as an approximation, you can also set one junction and increase the radius accordingly. The accepted error is in the distance of the junction object from the actual intersection of the emission bands.

However, you must check whether roads near the junction that should not be considered, for example the bypass of a roundabout or a parallel road, are actually not taken into account. If this is the case, you must work in more detail.

The road segment that is closer to the junction is considered for the junction correction. Make sure, that the first and last point of the roundabout are centered between two merging roads.



If necessary, you may need to split the roundabout between two merging roads and connect them at the original beginning of the road.

For traffic light-controlled intersections, you can restrict the operating time to specific emission time slices. Normally, the traffic light should be in operation during the day and at night to represent the "worst case".

Change the values for searching for emission lines **WITHIN A RADIUS** / **WITHIN A VERTICAL TOLERANCE** to influence the automatically found emission lines, for example if

- the junction is not exactly on the intersection of the emission lines,
- the emission lines do not intersect,
- the elevation of the intersecting / merging emission lines is different,
- the bypass of a roundabout or a parallel road must not be considered,
- Emission lines of an overpass or underpass are not to be considered.

The junction correction is documented in the road documentation in the Geo-Database and in the result tables in the tab *Roads.*

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 a parking lot is used by different vehicle types or if the number of parking moves is not uniform, subdivide the parking lot into smaller homogeneous units, for example with the Geo-Tool “Divide areas”.

Enter a **NAME** and, if necessary, an **OBJECT NUMBER** for sorting, see "Object numbering" (page 39).

Entries in the tab *Notes* are written to the comment column in the results tables (source or parking lot table).

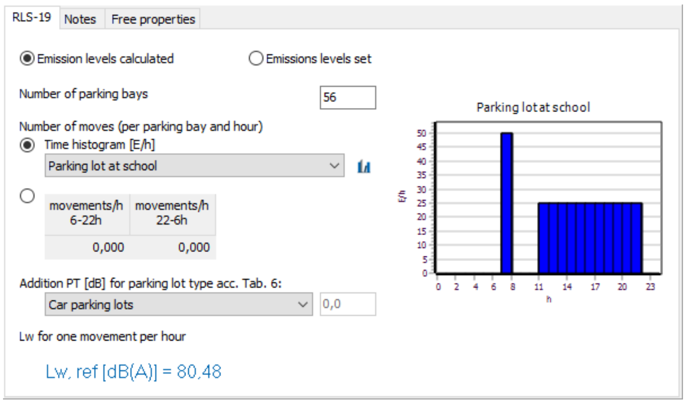
With the group assignment parking lots with emission according to parking lot study 2007 can be assigned to **SOURCE GROUPS**, see "Using the group assignment of sources" (page 187).

Calculation of emission levels of parking lots

Depending on the selected propagation calculation, the emission is calculated according to RLS-19, RLS 90 or Bavarian parking lot study (all other calculation methods). For the Bavarian parking lot study, the propagation is calculated according to the selected standard. It is not possible to mix the calculation standards (parking lot A according to RLS-19, parking lot B according to the Bavarian study).

Parking lot RLS-19, RLS-90

This procedure is usually used for public parking lots and for an assessment according to the 16th and 18th German federal immission regulation.



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.

If the movements are entered for each time slice, the resulting emission level is output for each time slice. If a day histogram is used, the number of parking movements is taken from the day histogram during the calculation.

Parking in and out = 1 parking process = 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 emission level of the parking lot is automatically increased by these values when you select one of these parking lot types. The user-defined selection allows to enter and document your own values.

Parking lot study 2007

The 6th 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 can be downloaded from the web (www.laerm.ch/dokumente/Parking_Area_Noise.pdf).

Hint: In this manual and in SoundPLAN we use the terms "parking lot" and "parking bay" instead of "parking area" and "car park".

Parking in and out = 1 parking process = 2 parking movements

The emissions depend on the type of vehicles, the number of parking moves during the different time slices, the behavior of the parking lot users 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".

he **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.

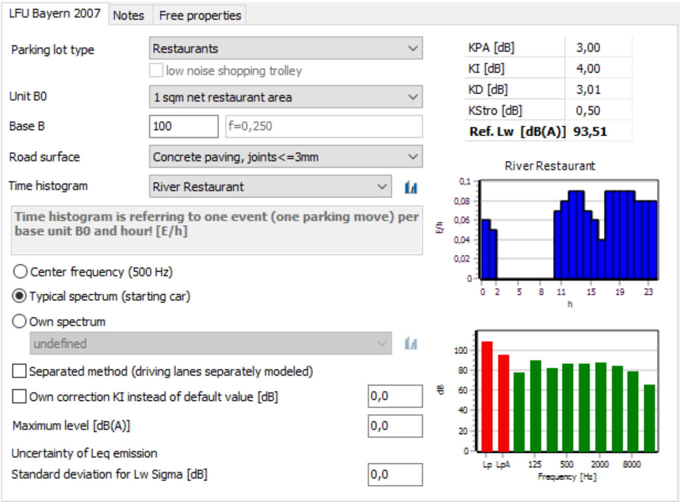
The base value for one car parking move per parking bay and hour is a sound power of L_{W0} = 63 dB(A). Additions for the parking lot type K_{PA}, noise peak K_I (e.g. German TA-

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 considered from the day histogram during the calculation.



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.

The formula for calculating the noise emission of parking lots includes the adjustment factor "f". It is a conversion factor that relates the number of parking movements, which depends on the size of the facility in question, to the number of assigned parking bays.

This factor is needed because the authors of the parking lot study considered a broad spectrum of different parking lots (documented in the parking lot study) and found out that the number of vehicles is not always linked to the number of parking bays. Supermarkets often have more parking bays than they need. This way the parking lot 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 does not 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 refer to 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 set how many parking moves take place on each parking bay in one hour.*

B_0 = 1m² net sales area: The values of the day histogram set how many parking moves take place per m² sales area and hour.

The estimated values from the parking lot study (table 33) can be entered directly into the time 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).

	Sum	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	16 kHz
dB(A)	63,00	46,34	57,94	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 dB(A)/m for cars (referring to the RLS-90) or L_{WA} = 63 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.

In the **STANDARD DEVIATION FOR LW SIGMA** field, you can enter a value for the “Estimating the uncertainty of a prognosis“(page 163).

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.

Enter the parking lot surfaces additionally as ground effect areas.

Additions

Additions for parking lot type and noise peak:

Parking lot type	**Addition in dB(A)**	
	K_{PA}	**K_I**
Car parking lots P+R parkings, parkings at house estates, visitors and staff parkings, parkings at the city border	0	4
Parking lots at shopping centers Normal shopping trolley on asphalt Normal shopping trolley on cobbles Low noise shopping trolley on asphalt Low noise shopping trolley on cobbles	 3 5 3 3	 4 4 4 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 Busses with natural gas engine	 10 7	 4 3
Parking lots for trucks	14	4
Parking lots for motorbikes	3	4

The traffic is calculated according to:

$K_D = 2{,}5 \cdot \lg (f \cdot B - 9)$ [dB(A)] for $f \cdot B > 10$

$K_D = 0$ dB(A) for $f \cdot B \leq 10$

Additions for parking lot surfaces:

Lane surface	Additions K_{StrO} in dB(A)	
	Integrated method *)	Separated method **)
Asphaltic lanes		
Concrete paving with joints ≤ 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

*) 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.

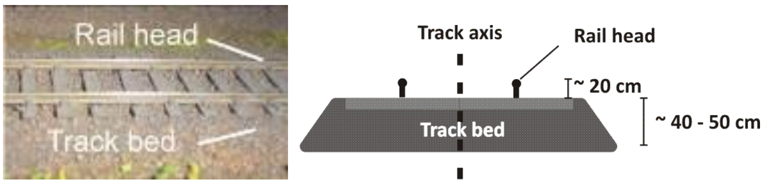
The Bavarian parking lot study includes information on typical maximum levels at parking lots:

	$L_{WA,max}$ in dB(A)			
	Accelerated pass-by	Closing doors	Closing tail gate/ boot lid	Noise from compressed air
Car	92,5	97,5	99,5	-
Motorbike	98,5	-	-	-
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.



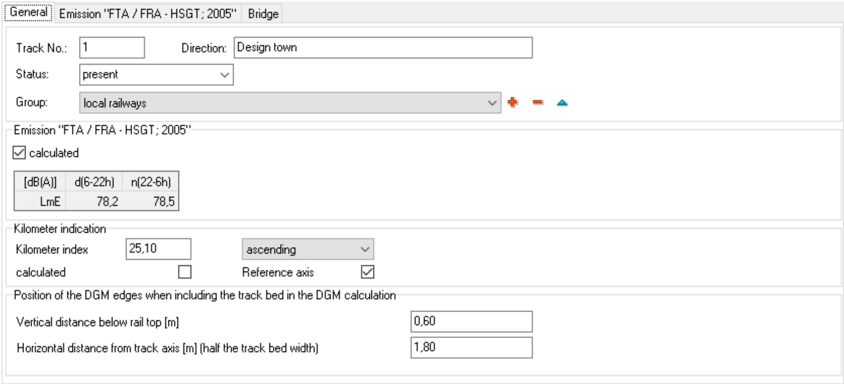
The emission elevation(s) are calculated from the elevation of the rail head according to the terms in the standard.

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 Geo-Tool "Create a parallel object" and adjust the number of trains for the duplicated tracks.

4

Railway properties



Aside from the emission level calculation with the vehicle and track specific correction factors you also define the kilometer posts, the definition as reference axis as well as the DGM parameters in the railway properties.

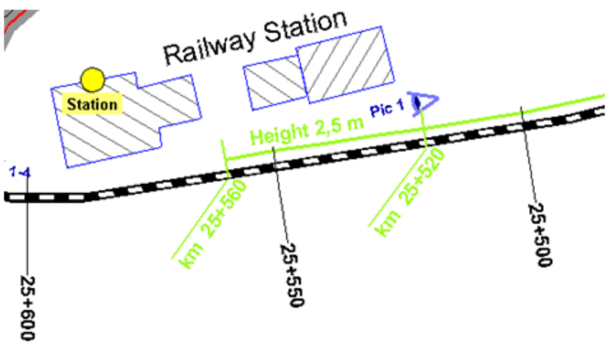
With the group assignment, railways can be assigned to **SOURCE GROUPS**, see "Using the group assignment of sources" (page 187).

For the documentation of the emission calculation, you can enter the name of the railway, the track number, the direction and the status present or future.

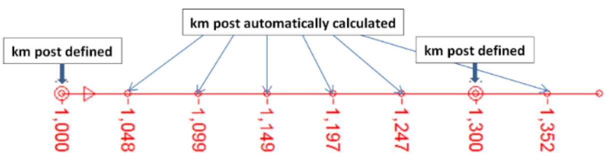
The rail track can be included in the calculation of the digital ground model. You need two additional DGM parameters for this, see "Embankment alignment for road and railway in the DGM" (page 254).

Stationing 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.



» Turn on the display of the properties for the railways in the Object Manager to display the kilometer.

For the output of the kilometer and the orthogonal distance receiver/railway in the Spreadsheet and for the display in the Graphics, a railway must be defined as **REFERENCE AXIS** . Activate the check mark at the first point of the polyline.

If a reference axis is defined, it is automatically loaded in the Spreadsheet. If you want to load a reference axis later, use **FILE | ADD ADDITIONAL COLUMNS | COLUMNS WITH ADDITIONAL INFORMATION**. Use **FILE | TABLE CONTENTS** to select another file (Situation or Geo-File) that contains the reference axis.

4

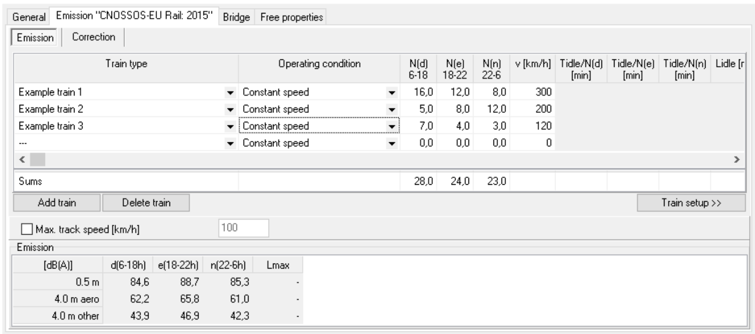
Railway emission calculation

The parameters for the emission calculation differ depending on the used standard, for example different train types, emission heights or corrections. For further information please read the standard or ask your local distributor.

For some (older) standards, the emission level can also be entered directly.

At railway points where the emission changes as a result of changes in corrections, speeds, etc., the changed emission characteristics are stored in the course of the rail. The emission definition is valid until a new emission definition is stored.

Train data



Depending on the standard, there are already predefined trains in the project library, or you have to assemble the trains in the **TRAIN SETUP** first.

If predefined trains are available, open the "train type" selection list in the first row of the table and select the trains. Complete the emission table with the number of trains N per time slice, the speed, the length and, if necessary, other standard-dependent, vehicle-specific additions for the train.

You can enter a maximum **TRACK SPEED** for the track. As soon as a train speed in the emission table is higher than the maximum track speed, the speed is lowered, and the emission is calculated for the track speed.

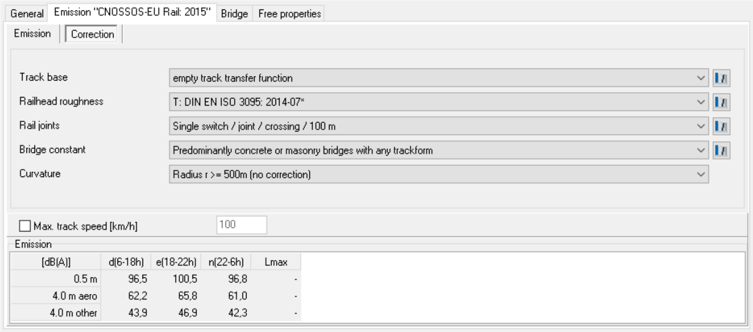
Track dependent additions

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]



Emission documentation railway

The emission calculation is documented in the **Miscellaneous** ribbon. The output format of this table cannot be changed. 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 or copy them to the clipboard.

4931 Ludwigsburg - Backnang | Rail track: 4931 | Direction: | Section: 2 | Km: 2+112

	Train type Name	Number of trains day	Number of trains night	Speed km/h	Length per train m	Max	Emission level L'w [dB(A)] day 0 m	day 4 m	day 5 m	night 0 m	night 4 m	night 5 m
1	4931-P : GZ-E* | 7-Z5 A4*1 | 10-Z5*24 | 10-Z2*6 | 10-Z18*6 | 10-Z15*1	10,0	12,0	100	715	-	85,7	65,9	40,9	89,5	69,7	44,7
2	4931-P : S | 5-Z5-A10*2	64,0	18,0	140	135	-	83,6	61,6	59,2	81,1	59,1	56,8
-	Total	74,0	30,0	-	-	-	87,8	67,3	59,3	90,1	70,1	57,0

Track Station km	Track type c1	Track condition c2	Track speed km/h	Curve noise dB	Track braking noise dB	Prep. against squeaking noises dB	Other noise dB	Bridge KBr dB	Bridge KLM dB
2+112	Standard track	-	-	3,0	-	-	-	-	-

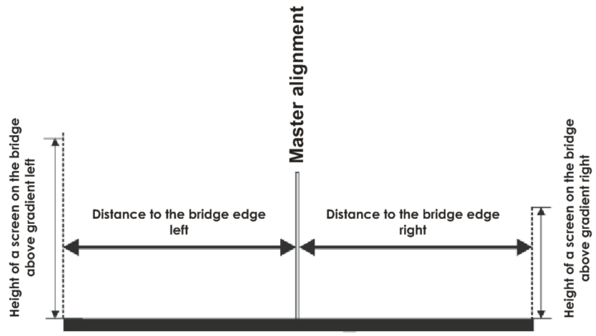
4931 Ludwigsburg - Backnang | Rail track: 4931 | Direction: | Section: 3 | Km: 2+024

	Train type Name	Number of trains day	Number of trains night	Speed km/h	Length per train m	Max	Emission level L'w [dB(A)] day 0 m	day 4 m	day 5 m	night 0 m	night 4 m	night 5 m
1	4931-P : GZ-E* | 7-Z5 A4*1 | 10-Z5*24 | 10-Z2*6 | 10-Z18*6 | 10-Z15*1	10,0	12,0	100	715	-	91,7	65,9	40,9	95,5	69,7	44,7
2	4931-P : S | 5-Z5-A10*2	64,0	18,0	140	135	-	89,5	61,6	59,2	87,0	59,1	56,8
-	Total	74,0	30,0	-	-	-	93,7	67,3	59,3	96,0	70,1	57,0

When calculating railway noise, a table with the emission parameters is stored, which is displayed in the Result Tables in the tab "*Railways*".

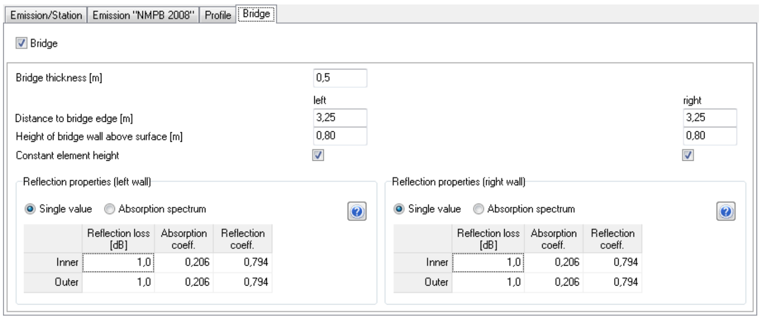
Railway bridges

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.



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.



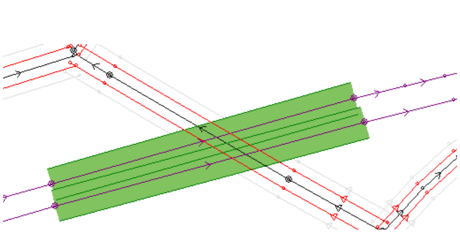
Please observe the following characteristics:

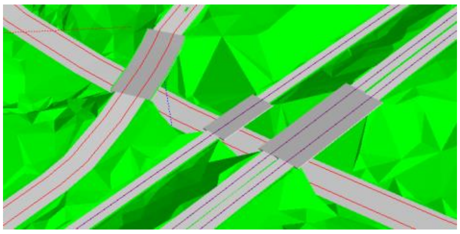
- Elevations beneath the bridge are recognized as terrain for the DGM calculation.
- Bridge surface, bridge bottom and bridge thickness are not reflective (except for ASJ Japan).

Bridges are displayed in the Geo-Database as green bands.

Bridge modeling

In case you want to model bridges for multiple lane railway tracks, SoundPLAN expects the **bridge definition for each track**. The individual bridges should overlap if it is one bridge in the model.





Bridge wall

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 "Wall properties" (page 196).

The reflection properties of bridge walls correspond to those of the noise barrier. For the spectral treatment of reflection losses (only for standards supporting frequency-dependent calculations), the absorption spectra from the library are used.

Lmax railway (pass-by level)

The pass-by level Lmax can be calculated for all railway standards where the Lmax checkmark 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).

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**.

You can also calculate the pass-by of the train as a Grid noise map and display it as an animated noise map with 3D Graphics Animation, see "2D and 3D animated noise map" (page 494).

For the calculation, the track should extend at least 3x the length of the train for which the maximum level is calculated beyond the last receiver, even if the track leads into a tunnel.

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.

$$L_{max} = L_{eq} + 10\log\left(1000 * \frac{V}{N * L}\right) = L_{eq} + 10\log\left(\frac{v}{n * L}\right)$$

whereby

V, v: Train speed [km/h], [m/s].

N, n: Number of trains per hour, second

L: train length [m]

L_{eq} , L_{max} : L_{eq} , L_{max} -Emission of a train type.

For standards which allow the emission calculation separately for engine and wagons, the emission is calculated in train sections. 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.

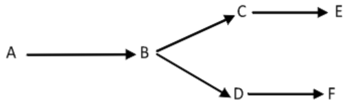
Generating tracks for calculation of Lmax-Rail

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.

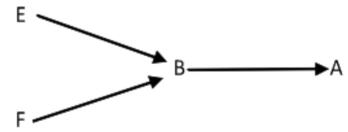
Trains always travel in the direction of entry. The direction of traveling is very important because the speed of trains and the speed of sound are taken into account (except Nord2000 simplified Method).

Tracks are built up by following the node links, starting at a knot which has only outgoing links.

Examples (the letters stand for nodes; the arrows are links to nodes):



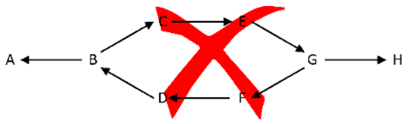
Will lead to the two tracks: A > B> C > E and A > B > D >F



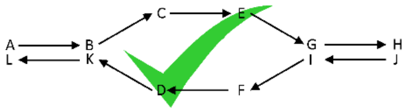
Will lead to the two tracks: E > B > A and F > B > A

The node B represents a switch.

If the rails were entered in such a way that there is no node with only outgoing connections, no track will be found for the Lmax. Thus, these trains also do not contribute to the maximum level!



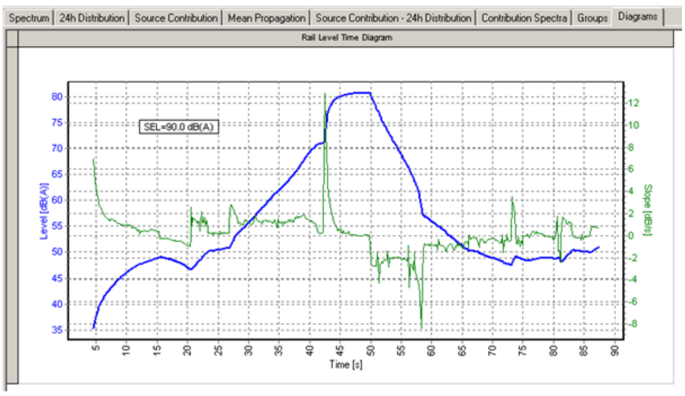
If a train object is travelled by trains in both directions you should actually create a parallel train object (with a distance of more than 1 cm) and invert direction of entry. This is mandatory for tracks with switches.



The best way to check that all train objects are correctly recognized is to use a grid noise map or an animated noise map.

Level-time diagram

The level-time diagram is available in the Results Tables.



Open the level-time diagram in the tab ***Details + Graphics***. Using the right mouse button | **DIAGRAM PROPERTIES,** you can manually change the automatically adjusted scale for the level and the time and disable the curve depicting the speed of the noise increase.

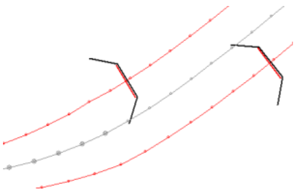
You can save the diagram in different graphic formats by right clicking | **SAVE DIAGRAM.**

Tunnel opening

The tunnel opening object is used to calculate the radiation of the tunnel opening caused by the emission of a road or railways. From the geometry of the tunnel opening, the length of the tunnel and the absorption properties of the portal area, a sound power level is determined, which is assigned to four point sources in the tunnel opening. The directivity is considered. Details on the calculation of the equivalent sound sources, the directivity as well as literature references can be found in section “Formulas for the calculation of tunnel openings", page 154.

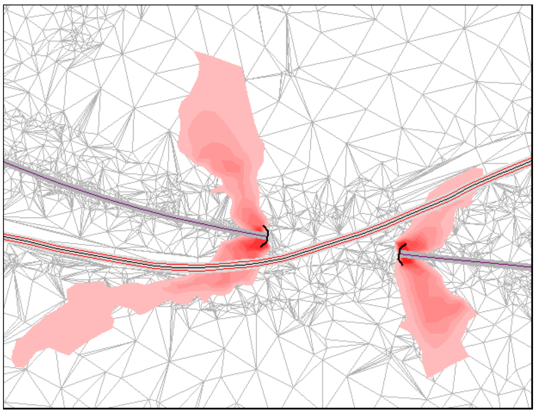
The tunnel opening is not suitable for underground car park openings or similar. Such objects should be modeled with area sound sources at an industrial building.

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**.



Tunnel portal with two separate tunnel tubes

This image shows the level increase due to a tunnel opening:



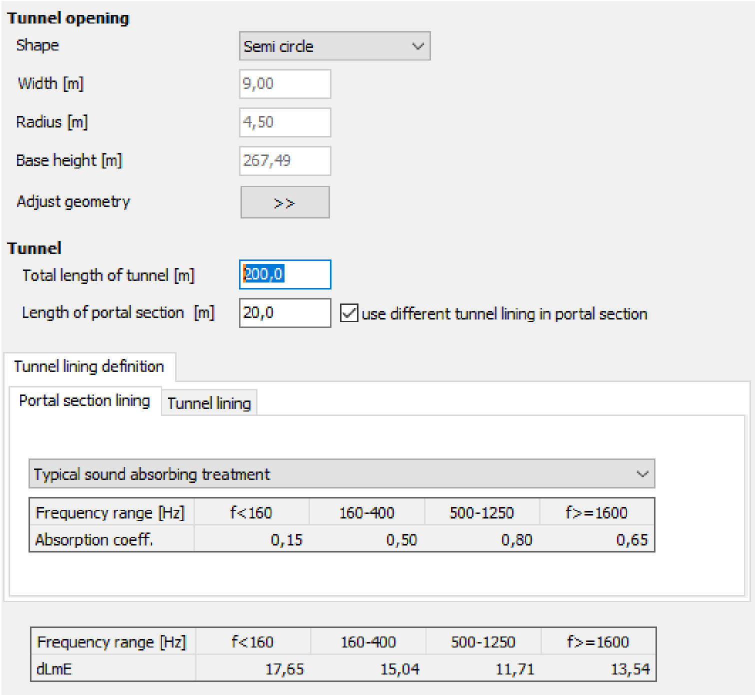
The calculation is performed separately for roads and railways due to the different directivity effects.

All roads or railways intersected by the tunnel object contribute to the emission at the tunnel mouth. For this purpose, the local emission at the tunnel opening is used. I.e. the emissions, however defined, are converted into a summed length-related sound power L'w. A coordinate is automatically inserted at the intersection with the tunnel mouth. Road and railway segments inside the tunnel do not contribute to the propagation calculation. Four point sources with the sound power LwT - 10 log(4) are placed in the tunnel opening.

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

The tunnel opening is defined with a line consisting of two points. This line must intersect the road or railway axis(es) (multiple axes are possible) so that the emissions and geometry is transferred to the tunnel opening.

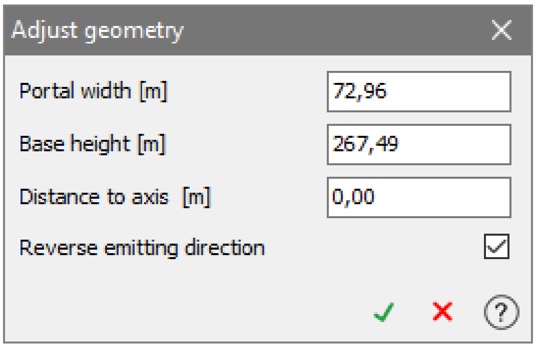


Select either semicircle or rectangle as the **SHAPE** for the tunnel opening. The **WIDTH OF** the tunnel opening is initially taken from the length of the line but can be specified exactly via **ADJUST GEOMETRY.** With the "semicircle" shape, the **RADIUS** is calculated automatically; if you have selected the "rectangle" shape, you can also specify the **HEIGHT.** The **BASE HEIGHT** is calculated from the intersection with the road or railway axis.

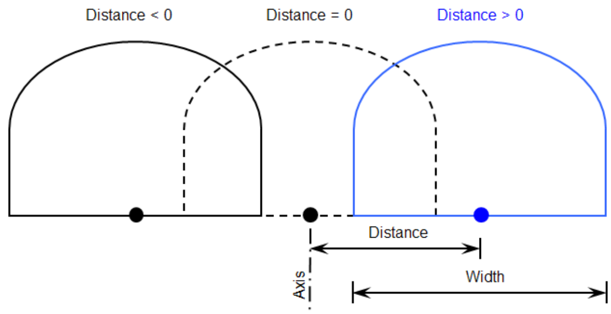
The tunnel can be divided into two different areas, the portal area, which is often absorbing lined, and the inner area of the tunnel. Four typical values for the sound absorption coefficient α are available for the lining, see "Formulas for the calculation of tunnel openings" (page 154).

In the case of two separate tunnel portals of a two-lane road, these are entered as separate objects. First, the tunnel portal is placed over the road axis and then moved using **ADJUST GEOMETRY**. The moved portal no longer intersects the road axis.

Adjust geometry



The **PORTAL WIDTH** is extracted from the length of the digitized tunnel opening, the **BASE HEIGHT** from the averaged elevation of the two coordinates. Both values can be adjusted here. If the **DISTANCE TO THE AXIS** is 0 m, the tunnel opening is centered over the road or railway. In the case of two separate tunnel portals, specify the position of the portals with a distance to the axis with a positive or negative value.



You can change the input direction of the tunnel opening here with the check box **REVERSE EMITTING DIRECTION**.

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 a different symbol for the tunnel opening (for example, a semicircle), you must change the factor to 1 so that the size of the tunnel opening is displayed correctly.

In the 3D Graphics, a semicircle or a rectangle is displayed depending on the selected shape 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_T:	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 α is the sound absorption index of the walls of the tunnel.

Typical values for α

Frequency range [Hz]	<160	160-400	>400-1250	>1250
Smooth concrete surfaces; Roads or reflecting ballast bed Reference case for directivity	0.08	0.08	0.08	0.08
Rough concrete surfaces; Roads or reflecting ballast bed	0.08	0.11	0.14	0.14

Concrete surfaces; Ballast beds for railways	0.1	0.2	0.3	0.3
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]

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 (0..x1)
a2: Absorption parameter in area 2 (x1..L)
x1: distance between tunnel opening and the transition from area 1 and 2

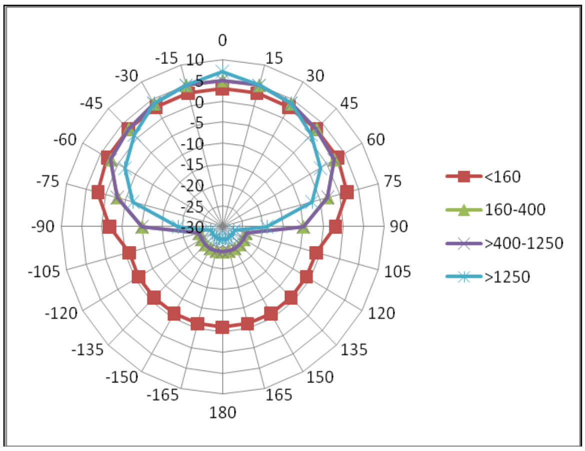
When L'w is constant within the tunnel:

$$L_{WT} = L'_w + 10 \log \left[2dP_T(a1,x1) \int_{x1}^L dP_T(a2,x-x1)dx + \int_0^{x1} dP_T(a1,x)dx \right]$$

Directivity

For roads a directivity correction factor (Φ) is calculated. For the reference case (smooth concrete surfaces) this correction is:

Angle Φ [deg]	Frequency range [Hz]			
	<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
105..180	-6	-24	-26	-27



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 Φ [deg]	Frequency range [Hz]			
	<160	160-400	>400-1250	>1250
0	3	5+0.15dL_{WT}	6+0.15dL_{WT}	7+0.15dL_{WT}
15	3	5+0.15dL_{WT}	5+0.15dL_{WT}	5+0.15dL_{WT}
30	3	4-0.15dL_{WT}	4-0.35dL_{WT}	4-0.4dL_{WT}
45	3	3-0.15dL_{WT}	2-0.35dL_{WT}	1-0.4dL_{WT}
60	3	2-0.15dL_{WT}	0-0.35dL_{WT}	-2-0.4dL_{WT}
75	2	-3-0.15dL_{WT}	-6-0.35dL_{WT}	-7-0.4dL_{WT}
90	-2	-10-0.15dL_{WT}	-17-0.35dL_{WT}	-19-0.4dL_{WT}
105..180	-6	-24-0.15dL_{WT}	-26-0.35dL_{WT}	-27-0.4dL_{WT}

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

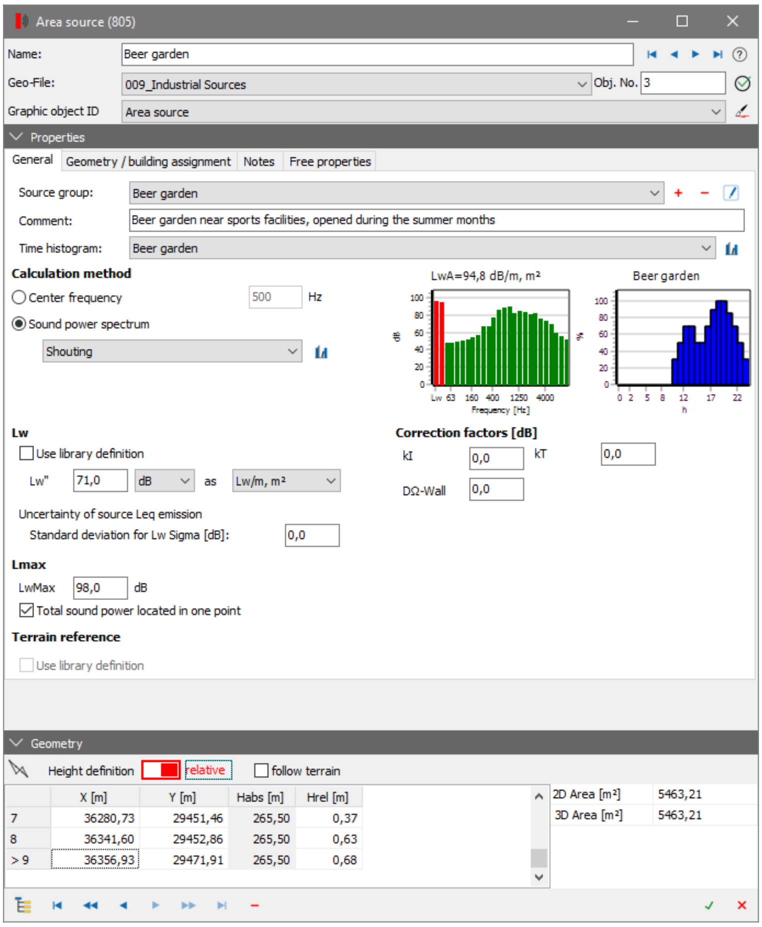
The noise sources for industry noise and leisure facilities represent point, line and area emitters.

For **point sources,** the coordinates refer to the noise source itself. **Line sources** are approximated by a polyline. If the sound power level changes, you normally enter a new line source. For special cases, for example for pipelines, you can simulate decreasing sound power levels using formulas, see "Define emissions via formulas" (page 533).

For **area sources,** the coordinates refer to the outline of the areas. Area sources can be placed in any shape or orientation, but should form a plane, unless they are defined as "terrain-following", see "Terrain following height" (page 57). Inaccuracies will be compensated automatically. Divide areas with different slopes that do not follow the terrain into individual subareas. Areas sources can also be vertical. It is possible to nest area sources with different sound power.

Source properties

The source properties are described for point, line and area sound sources together.



Specify a **SOURCE NAME** to document your project data.

The **OBJECT NUMBER** see "Object numbering" (page 39) is used to label the sources in the Result Tables and can be displayed as text in the Graphics.

With the group assignment several sources can be assigned to **SOURCE GROUPS**, see "Using the group assignment of sources" (page 187).

You can use a **COMMENT** to describe the noise source in more detail. This comment can be placed in the Results Tables. Write additional information in the tab *Notes*. These can also be added as a column in the results tables. Line breaks are not considered.

For the **CALCULATION TYPE** you can choose between the calculation of the center frequency and the entire spectral calculation.

If you want to calculate with one **center frequency**, enter the value in the field **CENTER FREQUENCY**. If more precise emission data are not known the center frequency 500 Hz is usual. Enter the sound power level, the dB weighting and, in the case of line or area sound sources, whether the sound power is a level per meter or per unit.

Note: When calculating with a center frequency, the dB weighting in the source properties and the dB weighting in the settings in the calculation run must match, otherwise the calculation will abort.

For **spectral calculations,** the corresponding spectrum is defined in the Emission library (page 224). You can either select an element provided in the system library or enter your own spectrum. The emission library is assessed by clicking on the library icon or by clicking on the spectrum graphics.

Assigning a day histogram: Day histograms are defined in the [Day histogram library](page 231) (page 231), and can be assessed here directly via the library symbol or by clicking on the day histogram graphics. All noise sources which do not operate 24 hours a day with a constant sound power require a day histogram. The day histogram is evaluated according to the assessment method specified in the calculation run.

In the **STANDARD DEVIATION FOR LW SIGMA** field, you can enter a value for the Estimating the uncertainty of a prognosis (page 163) or take it from the library (if **USE LIBRARY DEFINITION** is switched on).

USE LIBRARY DEFINITION: If a noise source is assigned a spectrum from the library, you can choose whether the library element is adopted with all its properties (including sound power level) or whether the spectrum is used as reference spectrum, and you enter a different sound power level. Please also check the settings for dB weighting and unit or meter level.

Level per meter or unit

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,M²** (square meter).

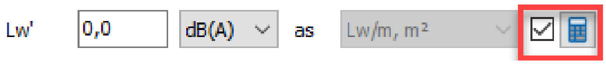
If the sound power is defined per **LW/UNIT**, the total emission of the entire source is entered and will be distributed evenly over the entire source line / area.

The setting per **LW/M,M²** 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).

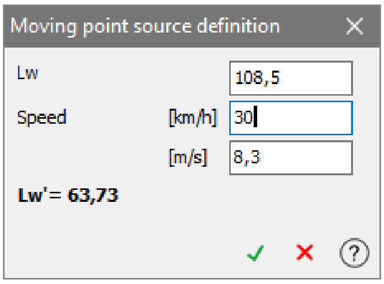
The library includes elements that result from measurements. These elements are referenced as sound pressure levels with the reference **LP/LEVEL**. Either use the spectrum as reference spectrum with a manually entered sound power level except if you want to use an element as indoor level Li or transform the spectrum in the library to a sound power level, see "Convert sound pressure to sound power" (page 225).

Moving point source / Haul road

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.



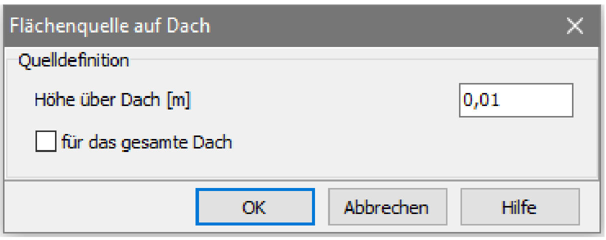
Click on the calculator and enter the **LW** and the **SPEED** in km/h or m/s.



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).

Sources on the roof

If a source is entered within the outline of a building, the building height is evaluated for the source height above ground. Specify the height above the roof. For area sources, the checkmark **FOR THE ENTIRE ROOF** adjusts the source geometry to the building geometry.



Sources on the roof

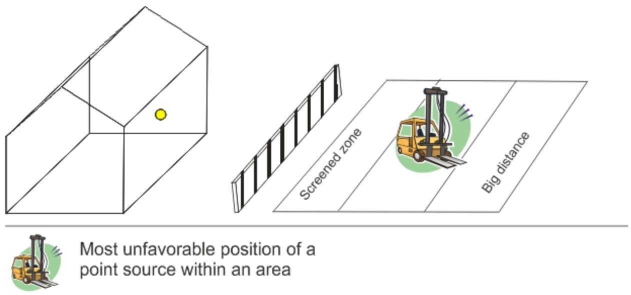
If a source is entered within the outline of a building, the building height is evaluated for the source height over terrain. Specify the height above the roof. For area sources, the check mark **FOR THE COMPLETE ROOF** adjusts the source geometry to the building geometry.

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.

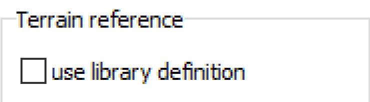


As shown in the sketch above, the maximum noise level of an area source is caused by moving the entire sound power to the spot on the line/area that produces the highest noise levels. SoundPLAN determines the worst possible position and the corresponding maximum level.

Source height above the terrain from an emission spectrum

Noise sources often emit sound at a fixed height above the terrain, for example a fork lifter a quarry vehicle or a truck (often relating to coordinates that follow the terrain).

You can therefore define a **HEIGHT ABOVE TERRAIN** in the emission library under the tab "*values*". When you select a spectrum from the library that has been given this attribute, the check box **USE LIBRARY DEFINITION** will become active, so that you can use this value.



Solid angle index DΩ

The solid angle index DΩ according to DIN 12354-4 (corresponds to k0 according to VDI 2714) is a correction value that represents the directional sound radiation of sources (point, line and area sources). For outdoor sources (sound radiation in all directions), the solid angle index is 0 dB. For sound radiation through openings, components or sources on facades, the solid angle index depends on the radiation angle Ω (in steradians).

Source in or directly in front of a reflecting facade ($\Omega = 2\pi$): DΩ = 3 dB

Source in or directly in front of two reflecting facades (corner, $\Omega = \pi$): DΩ = 6 dB

If a free field source (without building assignment) is defined in SoundPLAN, DΩ is usually to be set to zero. Reflections from (near and far) objects are explicitly calculated and must not be assigned again as a lump sum value.

However, if a source is assigned to a building facade or is located outside an industrial building (also transmissive areas), the reflection of the respective facade is suppressed for perpendicular distances smaller than 20 cm and a DΩ must be assigned instead. SoundPLAN automatically sets DΩ = 3 dB for the radiating areas (because this corresponds to the most common case), manual adjustment by the **user** may be necessary.

Alternatively**,** or additionally, a directivity can be assigned to the sources. It is important whether this directivity already contains the solid angle index. If the directivity is averaged over the radiation angle with a value of 0 dB, the solid angle index DΩ must also be assigned. However, if the mean value corresponds (approximately) to the value DΩ, then this is already included in the directivity and must not be assigned twice. Often the DΩ is already included in the directivity (e.g. for openings according to ÖAL 28), so that SoundPLAN automatically sets the value DΩ to zero when using a directivity (assigned to the spectrum in the emission library), if necessary a manual adjustment by the user is necessary.

Note: in the VDI 2714 the K0 consists of a Kwall and a Kground. In the property dialog of the noise source, a DΩ,floor (which corresponds to the Kfloor) only appears if the propagation standard for industry noise is set to "VDI 2714:1988". For more modern standards (e.g. ISO 9613-2), it is not necessary to enter the solid angle index for the ground, since the ground influence is calculated in a different way.

Correction factors kI and kT

The correction factors kI and kT take account of the increased annoyance of impulsiveness and tonality if these are already assigned to the source. Physically, but hardly practicable, both additions should be added to the assessment level at the receiver, since impulsiveness and tonality are justified for some receivers, but not for others with a different propagation geometry.

DΩ wall is considered in the maximum level calculation, but kI and kT are not.

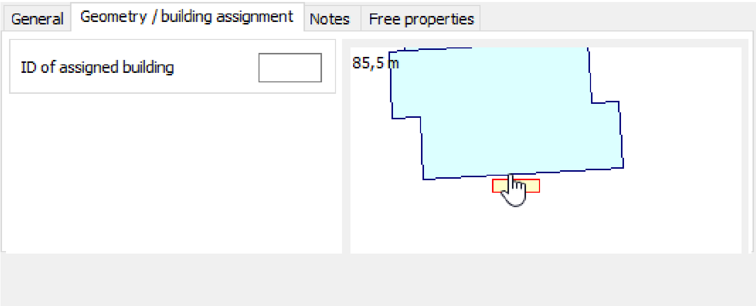
Source documentation

The spectra and day histograms of the industrial sources and parking lots included in the Situation are listed in the ribbon **Miscellaneous** in the Geo-Database. In the Result tables the sources used for the calculation are documented.

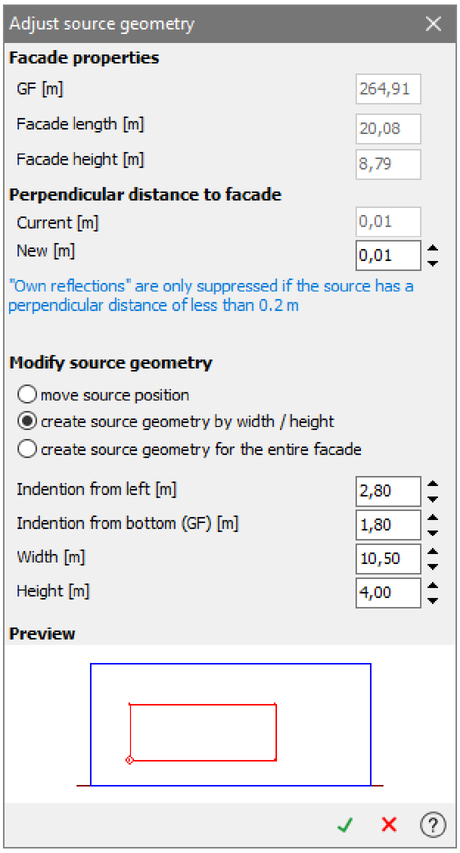
Assignment of noise sources to buildings

Point, line and area sound sources can be assigned to buildings (e.g. windows or fans). Depending on the task, it may be more convenient to use the industrial building, see " Industrial building / room" (page 164).

Set the source or at least the first coordinate near the building. Click the coordinate you just entered again if the object dialog does not open automatically. In the tab *Geometry/Building Assignment* you see a preview of the geometry section.



In the preview image, click the facade to which you want to assign the source. A dialog for entering the source geometry opens.



In the upper area, the facade length and height as well as the distance at which you have set the source coordinate in front of the wall are displayed informatively.

The value entered as the **DISTANCE FROM THE FACADE [M]** is the value specified in the SoundPLAN Manager under **OPTIONS | SETTINGS.** You can change this value if required.

For point sources, enter the position on the facade using the **INDENTATION FROM THE LEFT** or **FROM BOTTOM (GF)**.

For line and area sources, you can also generate the source geometry using the option **SOURCE GEOMETRY BY WIDTH / HEIGHT**. If the entire facade should radiate, select the option **SOURCE GEOMETRY FOR THE ENTIRE FACADE** for area sources.

Define the source geometry using the **HORIZONTAL** and **VERTICAL LENGTH** for line sources or, for area sources, the **WIDTH** and **HEIGHT**.

If a line source is not parallel to the ground floor of the building, enter the height of the second coordinate as vertical length. For vertical line sources, the horizontal length is 0 m.

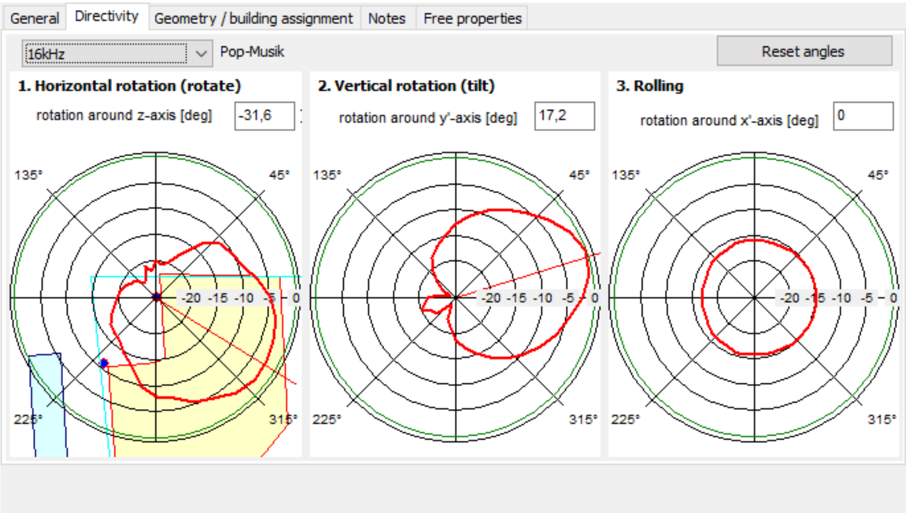
If a spectrum with a 2-dimensional directivity was assigned to the source before the assignment, the rotation angle is set so that the 0° axis of the directivity diagram points perpendicular to the facade.

A solid angle index of DΩ = 3 dB is automatically set for the sound radiation if the source has no directivity. For sources with directivity, DΩ = 0 dB is set. If necessary, manual correction by the user is required, see "Solid angle index DΩ" (page 160).

Assignment of directivity to sources

The directivity is assigned to a spectrum in the Emission library (page 224) via this spectrum the directivity is transferred to the noise source.

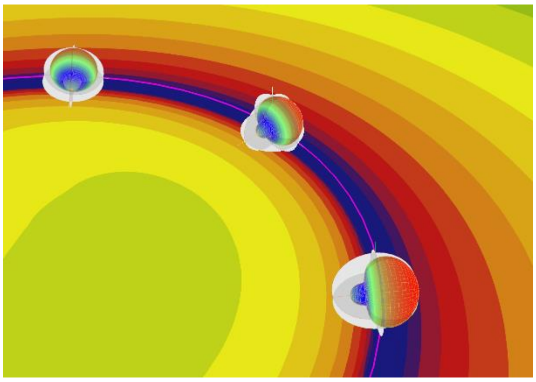
Under the tab *Directivity* in the source properties, you define the main direction of radiation (horizontal rotation (rotate)) and the inclination (vertical rotation (tilt)). or in the diagrams (rotationally symmetrical and full 3D directivity). A rotation around the x'-axis (Rolling) should be relevant only in very rare cases.



Ctrl+ left click on one of the charts to set the rotation angle with one click. With the ***right mouse button,*** you can freely rotate the directivity. In addition, a direct entry of the numerical rotation is possible. In the case of frequency-dependent directivities, you can 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.

Define whether the directivity refers to **THE CENTER OF GRAVITY** or to **EACH SUBSTITUTE SOURCE**.

For line sources, there is also the option **DIRECTIONALITY FOLLOWS / ROTATES WITH LINE**. The radiation direction of the directivity is defined with respect to the first segment of the line source and rotates 3-dimensionally with the change of direction of further segments.



If a directivity is to be used to represent the directional sound radiation of a component (transmission) or an opening (outside sources or transmissive areas on industrial buildings), it must be checked whether the interaction of directivity and solid angle index DΩ correctly represents the radiation characteristic. If necessary, manual correction by the user is required, see "Solid angle index DΩ" (page 160). If the directivity already takes the directional radiation into account, DΩ Wall is normally set to zero dB.

» If you activate the source properties in the Object manager, the main direction is visualized.

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.

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 slice t (only Leq-time slices!) is calculated with the following equation:

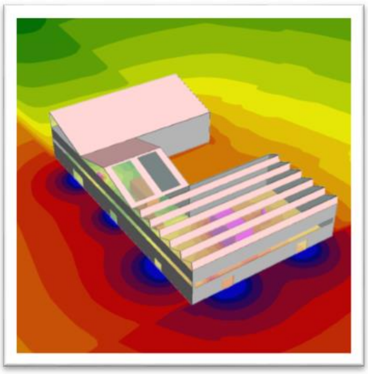
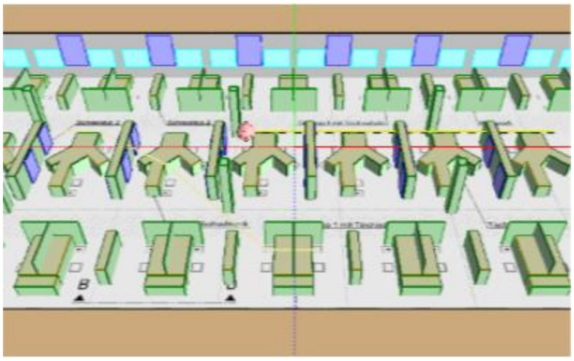
$$\sigma_{L_p}(t) = \frac{1}{10^{0.1 L_p(t)}} \sqrt{\sum_k \left(\sum_i 10^{0.1 L_{ki}(t)} \right)^2 \sigma_k^2 + \sum_j \left(10^{0.1 L_j(t)}\right)^2 \sigma_{LW_j}^2}$$

Whereby

$L_p(t)$	Noise level at the receiver for the time slice t
$\sigma_{L_p}(t)$	Standard deviation at the receiver for the time slice t
σ_k	Standard deviation of the sound power of all sources in the correlation group k
$L_{ki}(t)$	Partial noise level of the source i of the correlation group k in the time slice t
σ_{LW_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 slice (for each Leq-time slice) in the result documentation or the Grid Noise Map as long as this has been requested in the calculation settings (tab for noise assessment).

Industrial building / room

The industrial building is a special 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).

If the floor map 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 with values found in literature.

[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 shop or the machine house of a power plant with its multiple floors. 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 limited functionality in accordance with the VDI 3760.

Room acoustic descriptors such as STI or EDT as well as measurement paths according to VDI 2569:2019 or ISO 3382-3 can be calculated with the additional module Room Acoustics.

Input of the outer shell of the factory / room

Enter the floor map 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 general parameters such as the height of the building or the shape 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 building / 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!

Building / room properties

On the tab *Building/Room*, enter the outside properties and, if necessary, the inside properties, see "Inside properties of the building" (page 182).

Enter the lowest **EAVE HEIGHT** of the building or the **ROOM HEIGHT** for the properties outside.

The **REFLECTION LOSS** is the reduction in level that occurs with each sound reflection in the outdoor calculation. For sound-reflecting surfaces, a reflection loss of 1.0 dB per reflection is generally assumed (corresponds to an absorption coefficient α of 0.21). This flat-rate factor includes scattering losses that occur in structured facades through windows, balconies, etc. **The reflection loss applies to all vertical outside surfaces (facades). Sloping roof surfaces or the floor of a floating building do not reflect.**

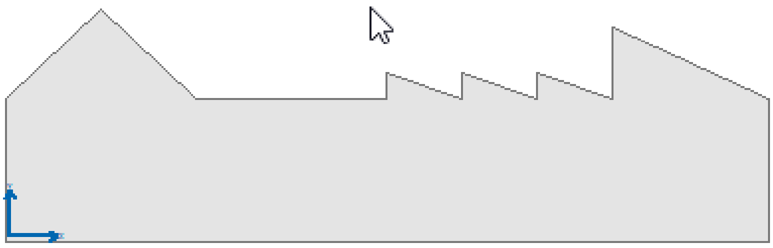
If you check the box **BUILDING FLOATS ABOVE GROUND**, sound can pass under the building and you can place sources outside on the ground. The height difference between the ground floor level and the terrain is not considered a reflective base, see "Floating buildings and industrial buildings" (page 194).

Definition of the roof

For industrial buildings with a floor map that **only has rectangular corners**, the roof can be generated using one of the roof forms:

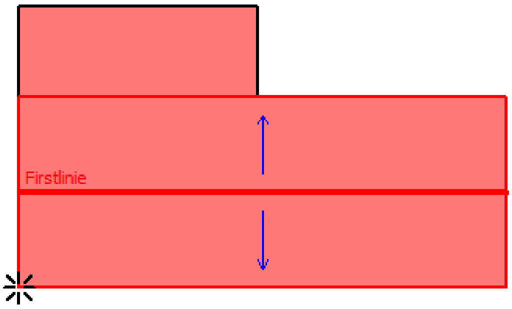
- Flat roof
- Saddle roof
- Shed roof

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.

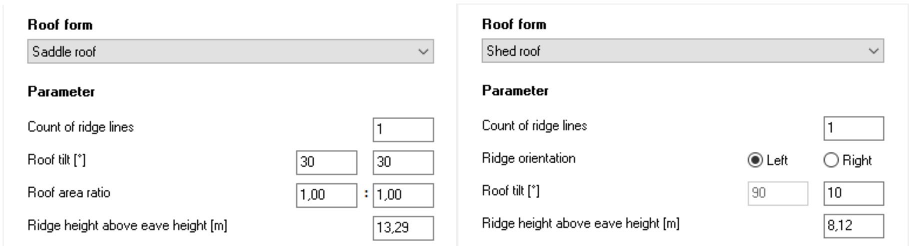
Select the roof form from the picklist. Next click on the facade that is perpendicular to the ridge of the roof. In order to generate a roof for this position, the marked facade must be smaller or equal to the facade opposite of the selected position. If this is the case, the program will show the area 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:

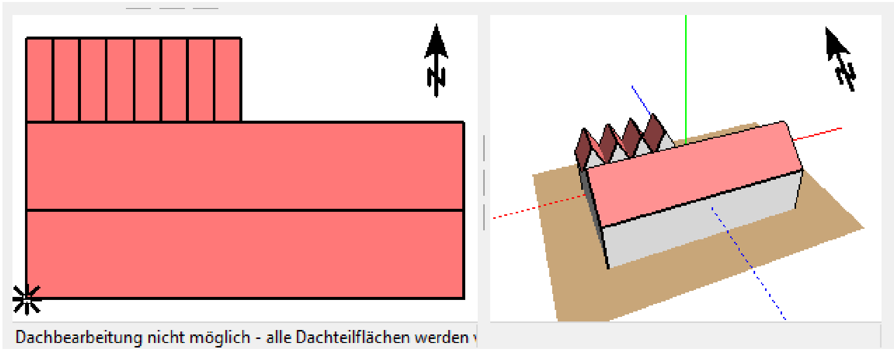
- the number of ridge lines
- the tilt of the roof [°], respective the ratio of roof areas or the orientation of the ridges
- height of the roof ridge above the eve height in [m]

Please also observe that these parameters can influence each other and therefore entering one parameter may change others.



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).

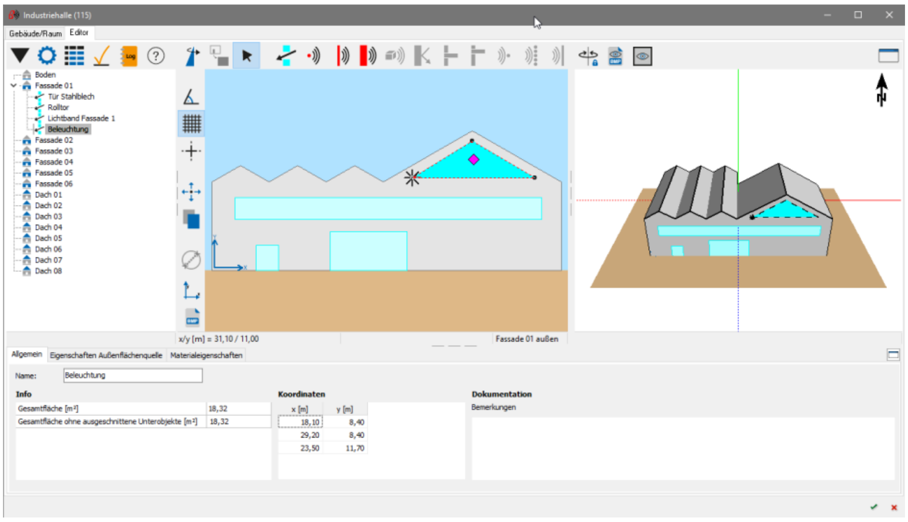

Click on the icon **GENERATE ROOF PART**, before editing the next section of the roof. Once the roof surfaces have been generated, the lines are switching from red to black and the 3D view will show the roof in the new form.




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 building floor map, the bitmap is always aligned with the first façade of the building, see "Use background bitmaps” (page 173).

Industrial building / room 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 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:

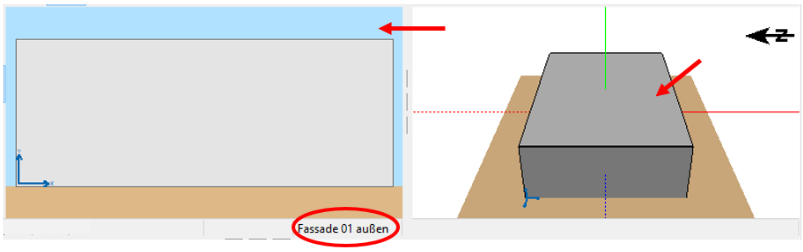
- with the pressed mouse wheel, you move the view
- rotating the mouse wheel will zoom in/out
- only in 3D-view: press the mouse wheel while pressing the <***Ctrl***>-key of the keyboard (left <-> right movements => rotate around z-axis) and (up and down movements => change the tilt of the model)
- only 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.

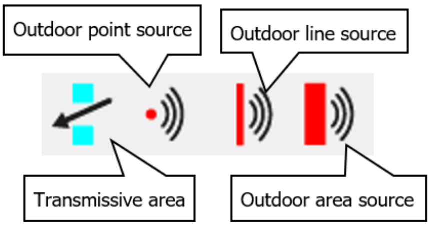
View of outside/inside

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“.



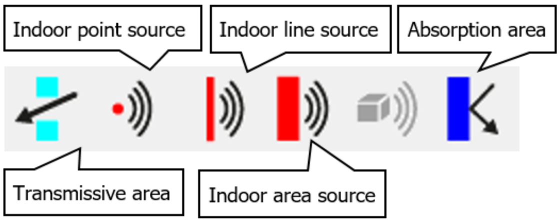
In the **outside view** you enter the objects within or on the outer facades, these are either transmissive areas such as doors and windows or point, line and area sources. Complete facades, too, can radiate sound with the checkbox **ENABLE AS SOURCE**. The sources can be attached with the sound power definition on the outside façade for example a loudspeaker or a pipe.

The following object types are available in the outside view:

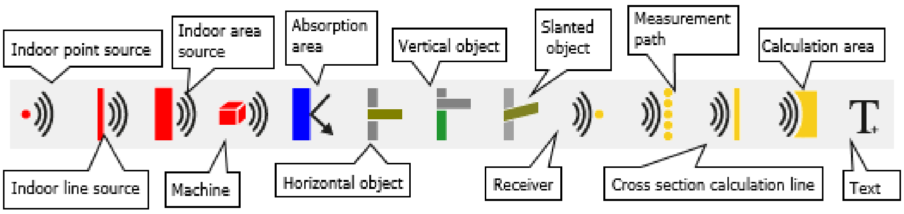


Transmissive areas can have outdoor or transmission properties as well as material properties (absorption spectrum) for the calculation of the indoor noise level [indoor noise]. Outdoor sources have outdoor or transmission properties. The properties are described under "Properties of outside sources and transmissive areas" (page 179).

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.

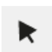


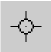
On the floor of the industrial building and along the horizontal walls enter the objects for noise simulation and later visualization in the graphics:



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.

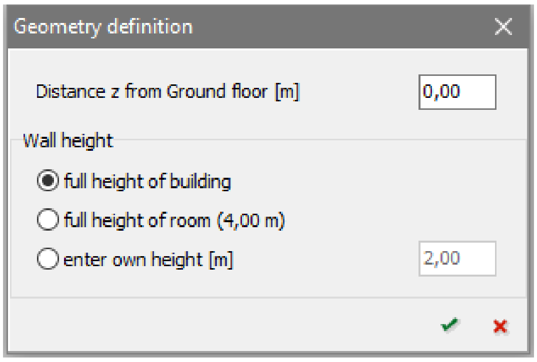
Angular increment and grid spacing is defined in the settings. Both modes are mutually exclusive. When one of the modes is active, it can be temporarily deactivated for the next coordinate by pressing the <***Ctrl***>-key, i.e. you can place a free coordinate of capture another coordinate or a line. 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.


You can also have a crosshair displayed to assist you with the input of the geometry data.

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.

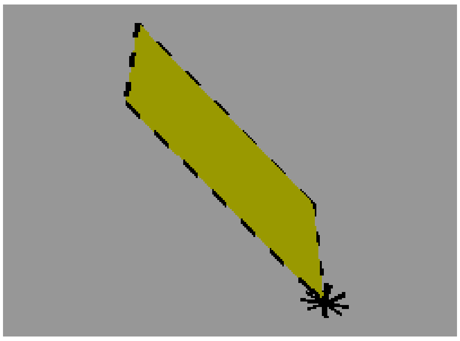
For a rectangular area type object aligned to the x-axis for example a window on a facade, you can generate this object by pulling open the rectangle with the left mouse button pressed.



For **slanted objects** fix 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.

4

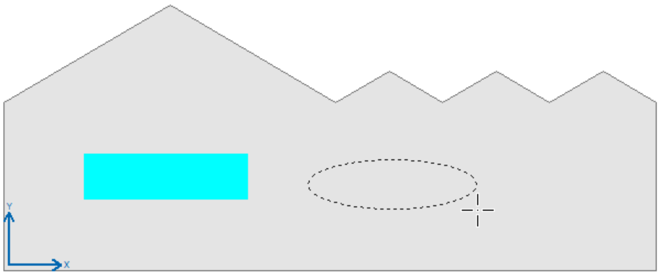
It is also possible to uncheck the checkmark „fixed“ to raise or lower the entire object. If additional coordinates are inserted, the elevations will be set by the program so that all coordinates remain on a plane.



Coordinates

x [m]	y [m]	z [m]	fixed
12,900	2,400	0,01	☑
10,600	2,400	5,00	☐
10,600	3,300	5,00	☐
12,900	3,300	0,01	☑

 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.

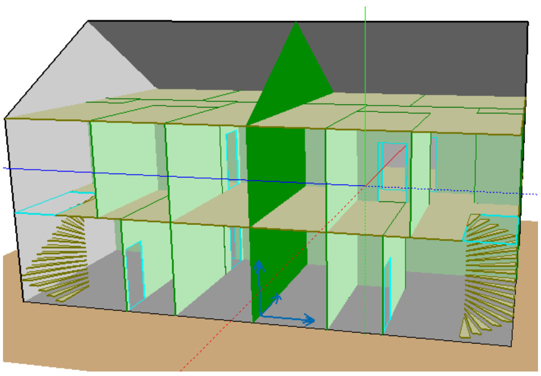


Enter the area and the distance to the ground. In the second step you

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.

Object hierarchy

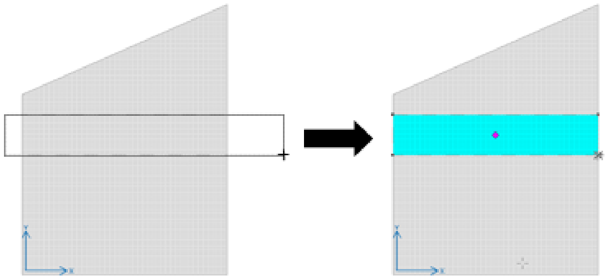
The highest hierarchy is the buildings envelope, i.e. the facades, the roof surfaces and the floor for interior calculations.

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.

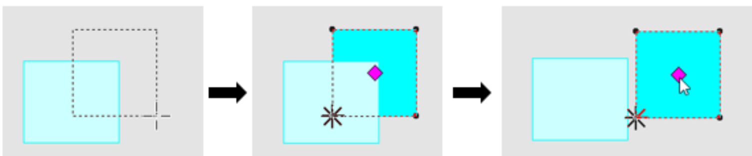
On the outside building shell, it is possible to define transmissive objects (e.g. windows and doors) and point, line and area sources that have different acoustical properties. Within inserted objects it is possible to have others nested on the same surface. For example, the door with an open window 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.



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 overlapping or embedded objects (for example a window in a door) the object listed first in the tree overlays the objects listed below. In the tree you can change the order of the objects and object groups via the right mouse button popup menu with **MOVE UP** / **MOVE DOWN** or the key combinations ***Ctrl+ Page up / Ctrl + Page down***.

Object groups and Machines

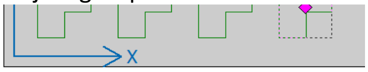
Vertical objects with more than 2 coordinates are gathered to form object groups. This way you can quickly enter the enclosure for a source or a closet.

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 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.

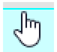
It is not possible to insert extra coordinates into machines and object groups, existing coordinates however can be grabbed and moved. Moving one coordinate will automatically move the coordinates for all three surfaces where this coordinate is part of. If you have already inserted child objects that 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 grouped elements.



Select one or multiple objects

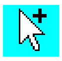
 Select the objects on the tree structure, the 2D view or the 3D-view. In the 2D-view mode, the **SELECTION MODE** must be activated.

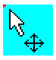
 In the tree click on the desired object to activate it. In the 2D-view the cursor changes to the **POINTING HAND**, when you are moving over a coordinate or an edge of the object, in the 3D-view the pointing hand appear when your cursor is on top of the object

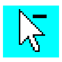
If there already is a selected object, it will be de-selected. To avoid this, keep the <***Ctrl***>-key pressed before activating other objects.

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.

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.

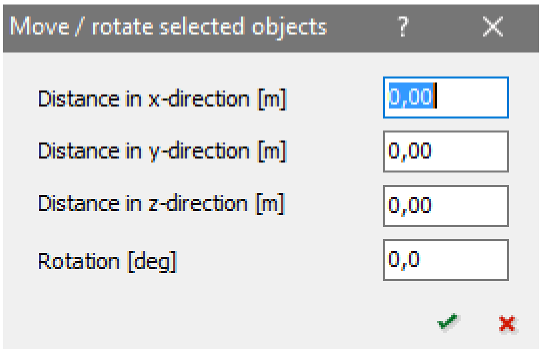
You can modify the coordinates manually under the register tab *general* in the section **COORDINATES**. If you enter a value that is not in valid range, the program corrects it or ignores it.

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, rotate and duplicate one or multiple objects

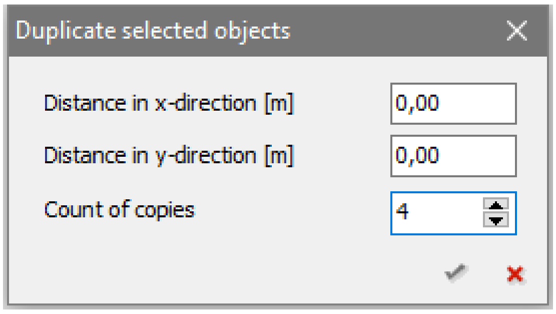
You can always move objects when the object has the purple diamond and you move the cursor onto this diamond, keep the left mouse button pressed and then move the mouse.

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.



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.



Move the origin

This tool is used to 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***>.

Use background bitmaps

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.

If a bitmap has already been georeferenced in the Geo-Database, the referencing is also used within the editor. In the inside view the bitmap is assigned to the floor, in the outside view to the roof if it is a flat roof with a roof area.

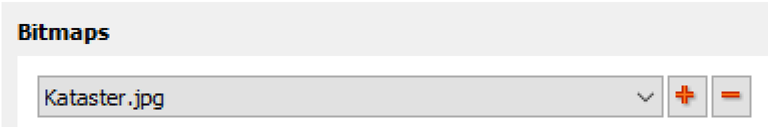
With **BITMAP LOAD / FIT IN OR REMOVE** you select the desired bitmap. If you fetch it from another folder, it will be copied into the project. The bitmap is first fitted so that it lies exactly in the rectangle surrounding the building. But you are still in "Fit Bitmap" mode. Press the left mouse button 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.

In addition, you can hold down the ***Shift key*** and click the left and right corners of the first edge in the bitmap. This method can also be used to fit rotated bitmaps. A readjustment of bitmaps with a rotation is not possible, please delete the referencing and assign it again.

If you have accidentally clicked on the button, you can cancel the action with <ESC>.

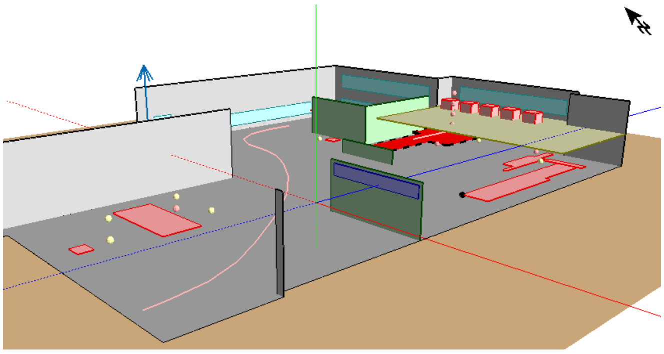
The bitmaps can be exchanged via the selection list.



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 verse. 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).



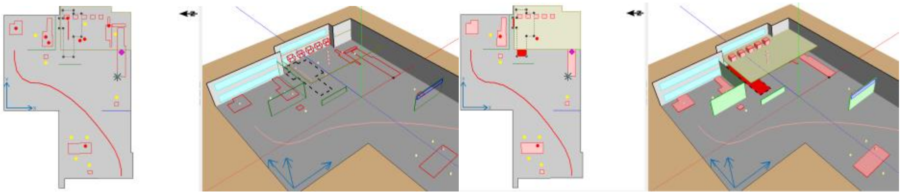
With the left mouse button select an object. If the <***Crtl***>-key is pressed along, objects already selected are staying marked.

 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** you can 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.



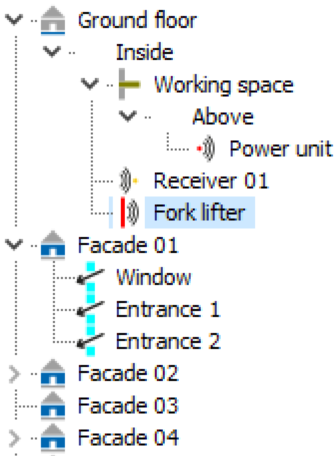
When the mode **SHOW OBJECTS TIL HEIGHT**, the slider to its right is active. By clicking on the slider, you set the height from which on the objects are cut away. After letting go of the mouse button, the 2D and 3D views are redrawn.

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**.

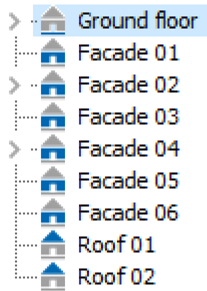
The object tree

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.

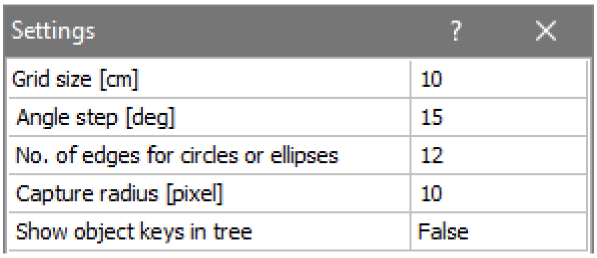
If the object tree is closed, only the top level is shown. The triangles in front of the shells object indicate that the object contains other objects.



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 as soon as hints (blue), warnings or errors (red) are present.

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.

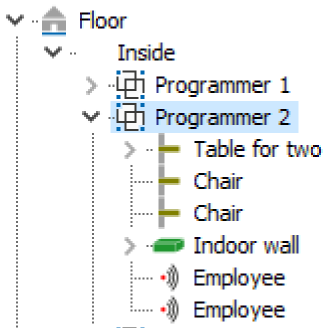
You can select one of the displayed columns as the **FILTER COLUMN** and enter the desired value as the **FILTER VALUE.** This allows you to quickly filter to "undefined" to find objects with undefined properties.

With a click on the column header you can sort the table in ascending or descending order.

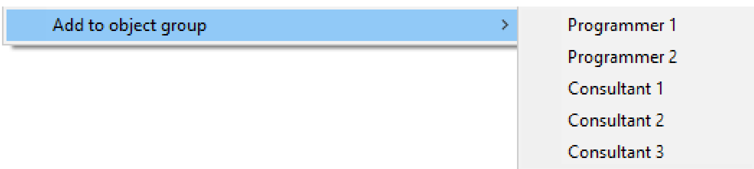
In the *General* tab, you can enter any information about the individual objects under **NOTES**. In the case of sources, the first row of comments is documented in the results tables in the **COMMENTS** column.

Object groups in the industrial building / room

In the tree, select the objects you want to group by holding down the ***Shift*** or ***Ctrl key*** and right-click to call **GROUP OBJECTS**. The objects are now listed within the corresponding group and the object group is marked with the group symbol .



If you want to assign further objects to an existing object group, select the desired objects in the tree (several objects with ***Shift*** or ***Ctrl key***) and select **THE** corresponding object group with the right mouse button -> **ADD** to **OBJECT GROUP**.



Accordingly, the group assignment of objects is cancelled with the right mouse button -> **REMOVE FROM OBJECT GROUP.**

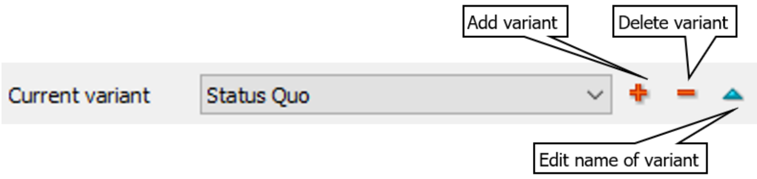
Select the object groups in the tree. Using the functions in the 2D editor, the object groups can then be moved, duplicated or rotated together.

Variant concept in the industrial building / room

Several variants can be managed in an industrial building / a room, for example to compare different planned sound insulation concepts in an office or the acoustic improvement by enclosing loud machines in a factory hall.

All objects and components of facades (except transmissive areas and facades) can be assigned to different variants.

When you open the industrial building, a basic variant 0 is always created, to which all objects and components of facades (except transmissive areas) are first assigned. The variant is displayed above the tree view.

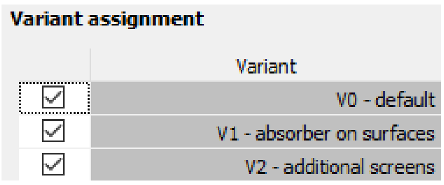


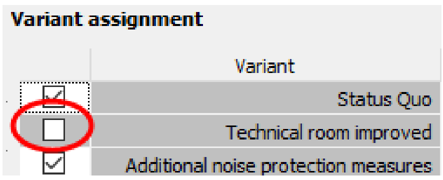
You can use the symbols to change the variant name, add variants, and delete variants.

Add variant

Enter the name of the new variant and the variant on which it is based. This means that all objects and parts contained in this variant are also contained in the newly created variant.

You can assign the individual indoor objects and facade components to another or additional variant at any time in the *General* card. It should only be noted that objects in object groups can only be contained in the variants assigned to the object group. However, not all objects in an object group must be contained in all assigned variants.



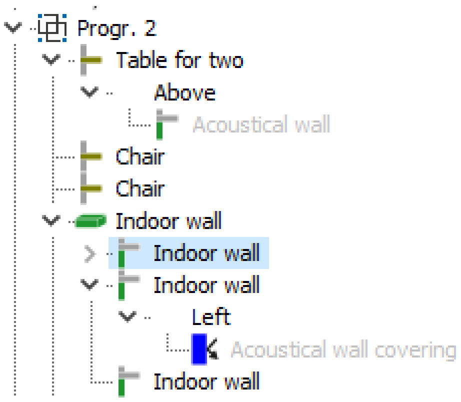


On the right the existing variants are listed, on the left the checkmarks which variant they are assigned to. If an object cannot be assigned to a variant because the object group is not assigned to this variant, the row is deactivated (right picture).

Example: An object group contains all objects of a workplace: chair, desk, roll container ..., but also planned measures. The object group is assigned to all variants, as are chair, table and roll container. The acoustic partition wall and the wall cladding are only assigned to the "improvement" variant.

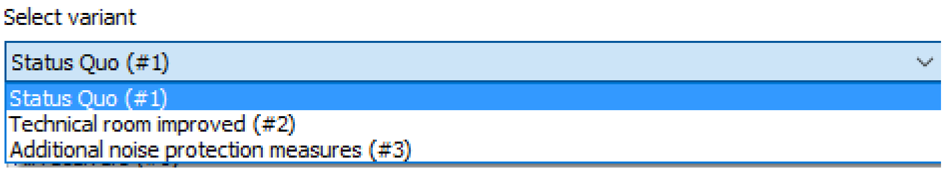
Use the right mouse button to select whether only the objects of the current variant or all objects should be displayed. In the latter case, the objects that are not assigned to the current variant are displayed in gray (default setting).

4



If you select the **ONLY THE OBJECTS OF THE CURRENT VARIANT** option, the objects not assigned to the current variant are not displayed in the tree, in 2D and 3D.

In the calculation kernel, you select the variant to be calculated in addition to the data and the hall in the *General* card for internal calculations.

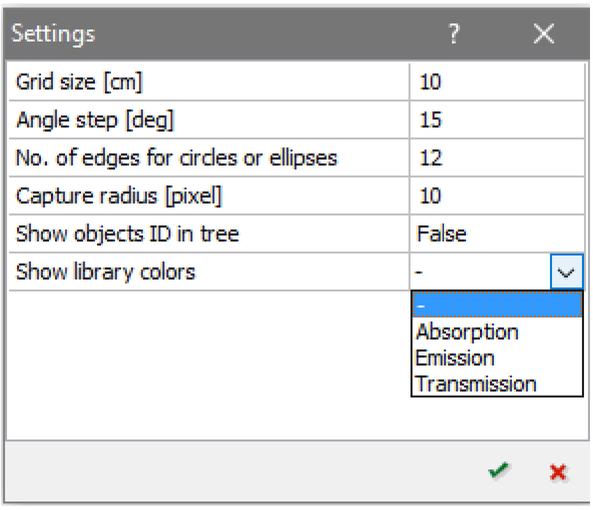


In the Graphics, you select in the object type "industrial building" which variant is to be displayed. If the check mark **GEOMETRY FROM FIRST RESULT IS** active in the file selection, the variant is automatically evaluated.

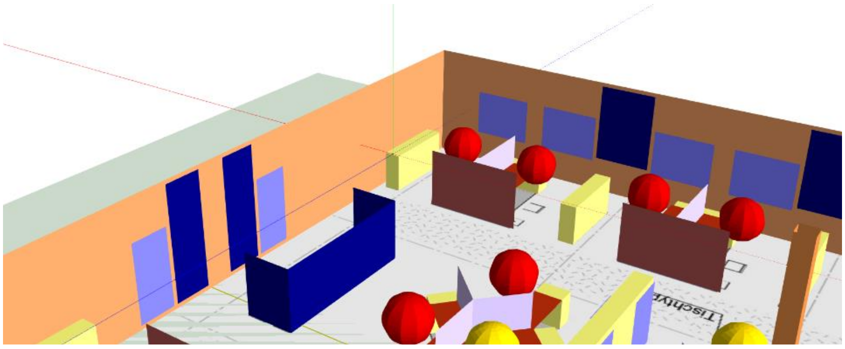
Assign colors from the library

Instead of the object color (blue for absorption area, red for source) you can assign different colors to the different absorption, emission and transmission spectra in the project library in the tab index card *values.* This serves the better visualization of different materials in the 2D and 3D editor as well as in the graphic sheets.

In the editor you then select in the settings whether and for which spectra the library colors are to be displayed.



In the Graphics, use the selection list in the object type **INDUSTRIAL BUILDING / ROOM** to select whether the objects should be output in the color defined in the object type or in the color of the spectra.

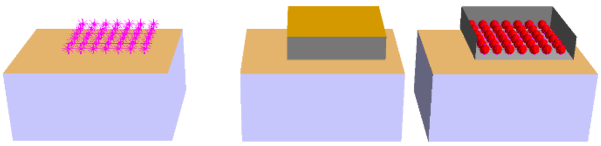


The absorption spectra of windows and wall cladding are displayed differently here.

Import outside geometry into an industrial building

For example, to design an enclosure as a measure for fans on the outside of the facade or on the roof of a building, you can import exterior geometry into an industrial building. To do this, draw an industrial building around the required data. Adjust the elevation so that all exterior data is above the floor height of the industrial building.

Switch from the tab *General properties/roof* to the *Editor*. Click on the **IMPORT** icon. All point, line and area sound sources as well as buildings, walls and floating screens that are completely within the industrial building in terms of both position and height will be imported.

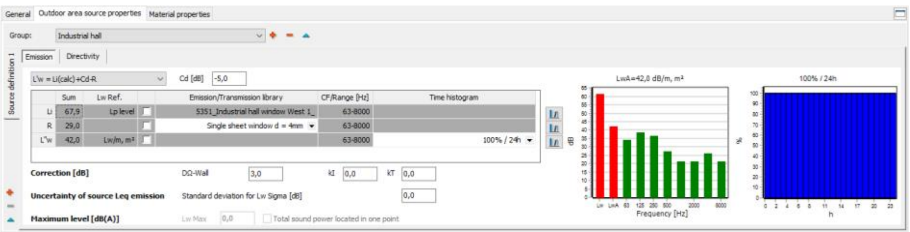


Spectrum and day histogram are imported for the noise sources. The buildings are imported as wall groups from vertical and horizontal objects. You still have to enter the material properties of the wall groups.

Properties of outside sources and transmissive areas

In the *General* card you can assign an **OBJECT NUMBER**, see "Object numbering" (page 39), which is used to label the sources in the Results 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.

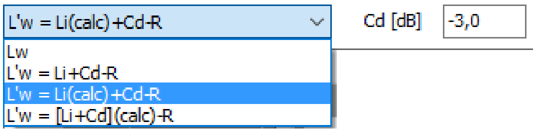


With the group assignment several sources can be assigned to **SOURCE GROUPS**, see "Using the group assignment of sources" (page 187).

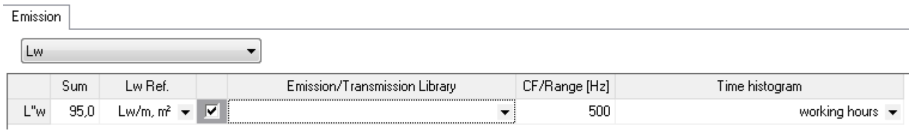
The lower area contains the actual input of the source properties with the definition of the emission, the facade directivity selected in the second card, if applicable, as well as information on corrections, standard deviation and maximum level. On the right, spectrum and day histogram are visualized.

Emission definition

Select how the emission shall be defined.



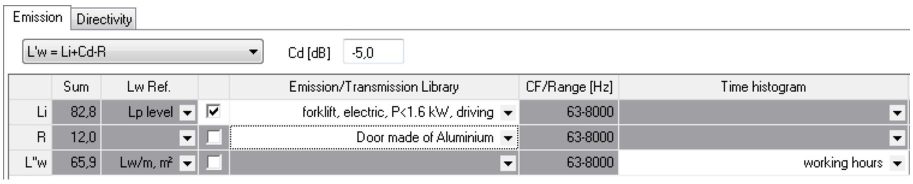
Select **LW**, if you want to enter the sound power directly. The sound power can either be entered as a mean frequency in the left field or selected as a spectrum from the library. The spectrum can contain the final values or can be used as a reference spectrum which will be converted into a full spectrum with the sum level that the spectrum is supposed to represent. In this case all levels of the reference spectrum are only relative levels.



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,m²" (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.



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 12354-4 this term is dependent on the room properties and on the surface properties of the inner side of the building (Table B.1):

Situation	**Cd 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

In the equation 7a of the German VDI 2571 the diffusion term Cd is -6.

By selecting **[LI+CD](CALC)-R**, 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.

For point, line and area sound sources on the outside of industrial building facades as well as for transmissive areas, a solid angle index of DΩ = 3 dB is automatically set for the sound radiation if no directivity has been assigned to the source. For sources with directivity, DΩ = 0 dB is set. If necessary, a manual correction by the user is required, see "Solid angle index DΩ" (page 160). The façade directivity is selected in an additional tab and already has the main direction of the sources set to the surface normal of the wall.

It is possible to assign a day histogram to the sound power radiated from the building.

4

Overlapping area sources

Areas directly on the facade / roof (distance z = 0):

The order displayed in the tree determines the "visibility". The topmost area is on the top. Every other area is hidden in the overlap area by the one above. If you push an area completely into an area above it, it wil be ignored in the calculation and you will get an appropriate warning message.

Areas with distance (z > 0):

Areas that are not embedded in the facade or roof are not cut, neither with the embedded nor with other surfaces at a distance! If e.g. 2 sources with the same distance overlap or even lie in each other, both radiate completely, as well as the possibly underlying facade/roof source. To make this clear, the border lines are drawn in bold.

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.

Note: There is a function in the day histogram library to invert a day histogram.

Procedures with calculated indoor levels

+ 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 indoor level from a spectrum

+ 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 open gate from 9:00 to 12:00 is 100% open, for all other hours it is closed = 0%. 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 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 embedded point and line sources as an area

Often the exact geometric shape of a source is not known or irrelevant. Therefore, there is the possibility to enter a point or line source and assign an associated area to it. This area is then used to calculate the emission (for levels per m², e.g. for calculations from inside to outside).

Properties for indoor calculations

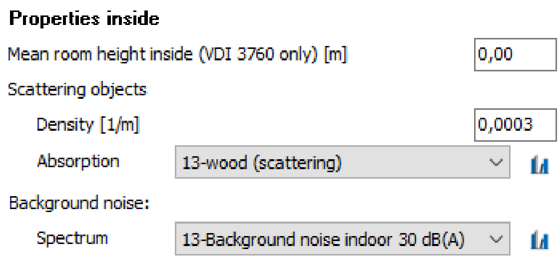
In addition to the geometry of solid objects and the positions of sources and receivers, you will need to define the emission spectra for all the sources, along with absorption spectra for all surfaces and sub-surfaces. Bear in mind that the frequency spectra that we perform the calculations with takes 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 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 ±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 is worth bearing these things in mind when setting up an SPD situation.

Inside properties of the building

[Indoor noise] Enter the indoor properties of the building in the *Building/Room* tab.



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.

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_l 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^{-1}

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 a_S

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)

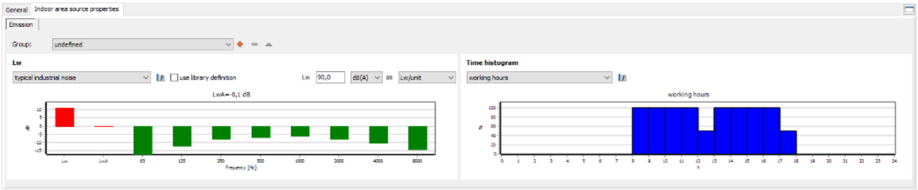
The only other source for absorption spectra we know is the book „Technischer Lärmschutz (technical noise protection)“ (Springer Verlag, ISBN-10: 3-540-25507-9) with the following suggestion:

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-map office):	as = 0,7– 0,9

Indoor source properties

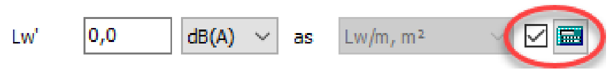
With the group assignment (see “Using the group assignment of sources”) sources can be assigned to **SOURCE GROUPS**.

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.

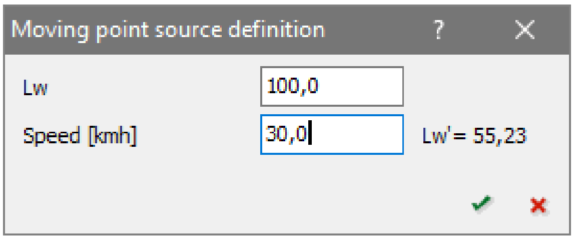


Single values are not possible for indoor sources, always select a spectrum from the library. You can apply the settings from the library or use the spectrum as reference spectrum. In this case define the dB-weighting and the reference (emission per 1 m² area size, or per 1 m line length or in relation to the total source). On the right side, select the daily histogram from the library (important only for Leq calculations, not for room acoustics).

Moving point source / Haul road

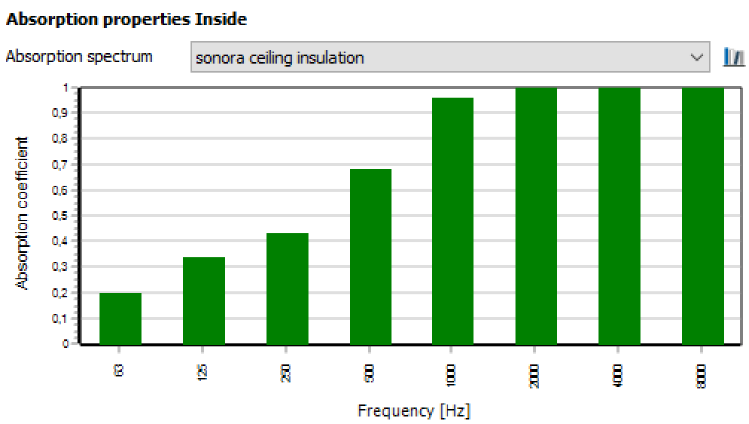


When the sound power level of a vehicle and the speed are known, SoundPLAN calculates a sound power level per meter - e.g. to enter the sound power per meter of a truck only once regardless of the track the truck took.



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).

Absorption properties

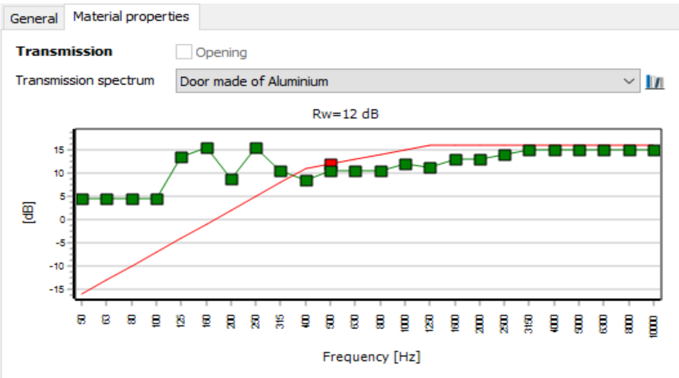


For indoor calculations all facades, ceilings inner walls and inner ceilings etc. mandatorily need an absorption spectrum. Therefore, select a spectrum from the library.

The button „Library“ takes you to the library (either to select an element from the system library or to edit a selected element).

In the absorption spectra, the scattering coefficient must be defined for each frequency in the absorption library (minimum value 0.005), otherwise the calculation is aborted. With the button in the absorption library the scattering coefficient can be quickly estimated from the surface roughness.

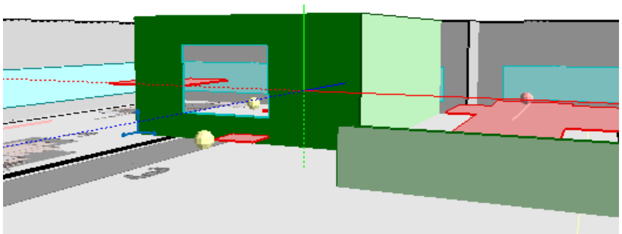
Transmission properties



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**.

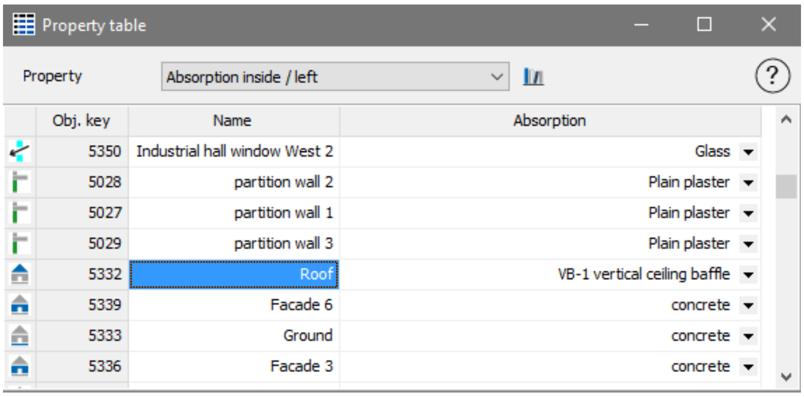


In the 3D view, objects lying behind the opening are visible.

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.

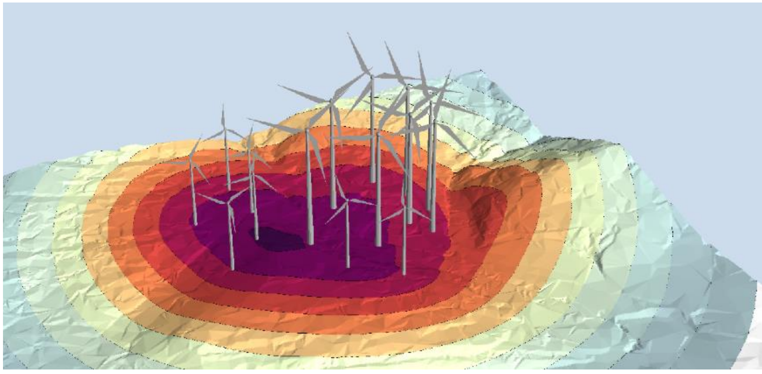
The property table is another possibility to quickly edit the properties of multiple objects as well as to get an overview of the properties.



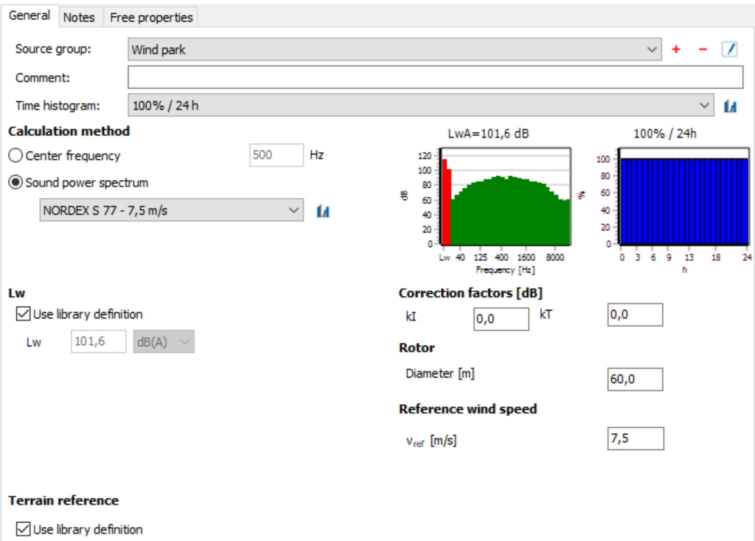
Select the property you want to edit or view. You will see a table with all objects with this property (e.g. absorption inside / left). A click on the column header sorts the table accordingly. Properties can be transferred from one object to another. Place the cursor on the lower right corner of an entry field and pull it with pressed left mouse key downwards.

Wind turbines

Wind Turbines can be evaluated in accordance with different standards, see selection list for the selection of the standards in the SoundPLAN Manager.



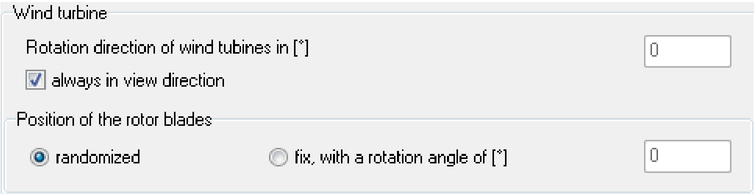
The source of a wind turbine is defined in height of the hub. In the wind turbine library elements, the height above the terrain is already stored from the manufacturer's data in the emission library. This value is transferred to the source as delta h if you activate the check box **USE LIBRARY DEFINITION** for the **TERRAIN REFERENCE** In this case the height definition is fixed to relative elevation.



With the group assignment wind turbines can be assigned to groups, see "Using the group assignment of sources" (page 187).

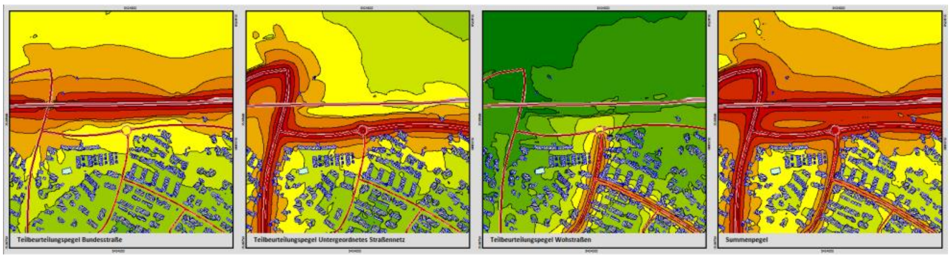
In addition to sound power level and day histogram, define the **ROTOR DIAMETER** (for calculations according to the IoA Windturbines and for the presentation) and for calculations according to BEK nr. 135 the **REFERENCE WIND SPEED**.

To get a realistic visualization in 3D you can use the object type „Wind energy“ to set the direction of the rotor.



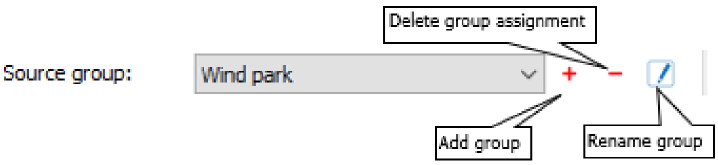
As a nice add on, you can let the wind turbines rotate with ***Ctrl+T*** in the 3D view, (***Ctrl+1 - Ctrl+9*** will change the rpm of the wind turbine in 9 steps).

Using the group assignment of sources



All sources (roads, railways, parking lots, industrial sources, wind turbines and sources associated with an industrial building) can be assigned to groups. Results for individual groups can be saved separately in the calculation. The tables (Result Tables and Spreadsheet) and the Graphics can present the results of the groups separately. The Graphics lists all groups in the result manager ***F8*** so that you can quickly load the sheet of a single group or print or export the group results jointly for several groups.

In the **Geo-Database** assign the sources to a **GROUP**.



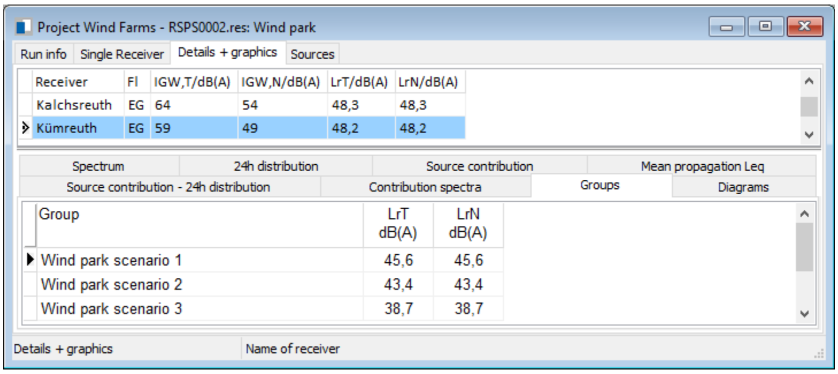
In the **Calculation core** in the definition of the calculation run for single receivers and Facade Noise Maps check the box for **GROUP-RESULTS**.

For Grid Noise Maps use the double arrow to select the groups for the calculation.

The **ALLOWED TOLERANCE** in the tab *Settings* in any case needs to be set **VALID FOR EACH GROUP CONTRIBUTION LEVEL**, so that the levels for the other groups do not change when groups are added or removed. If detail tables are switched on, the tolerance is calculated on the basis of the source contribution level.

For the table type (Result Tables and Spreadsheet) and the graphical documentation of the results, you can present the results for individual groups or for the sum level.

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*.



In the **Spreadsheet** (receiver table) select whether group contribution levels should be part of the spreadsheet and if desired, which ones. Depending on your selection there are additional columns.

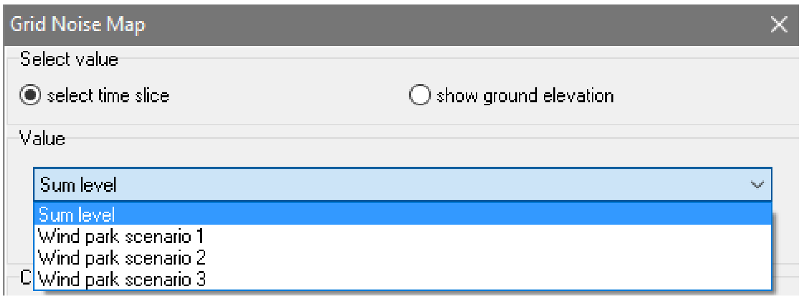
Project Wind Farms
Sum level and group contribution levels

Name	Limit Day	Limit Night	Sum level Wind park LrD	Sum level Wind park LrN	Wind park scenario 1 LrD	Wind park scenario 1 LrN	Wind park scenario 2 LrD	Wind park scenario 2 LrN	Wind park scenario 3 LrD	Wind park scenario 3 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 Size [km²]		Federal highway Size [km²]		Municipal roads Size [km²]		Local roads Size [km²]	
	[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 file selection manager in the **Graphics** select if sum levels or group levels shall be displayed in the map.



Accordingly, also the grid operations and the operations for Facade Noise Maps can be performed for groups.

Measuring points

[Tools Industry Noise] The measurement point is an object to calculate the sound power level from measured spectra. See "Calculate sound power from measured data" (page 531).

Stage

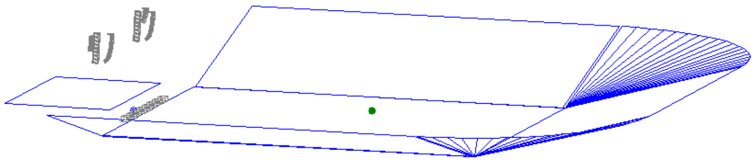
The environmental noise at a festival created by one or multiple stages can be calculated in SoundPLAN in accordance with either the Nord2000 or ISO 9613-2.

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.

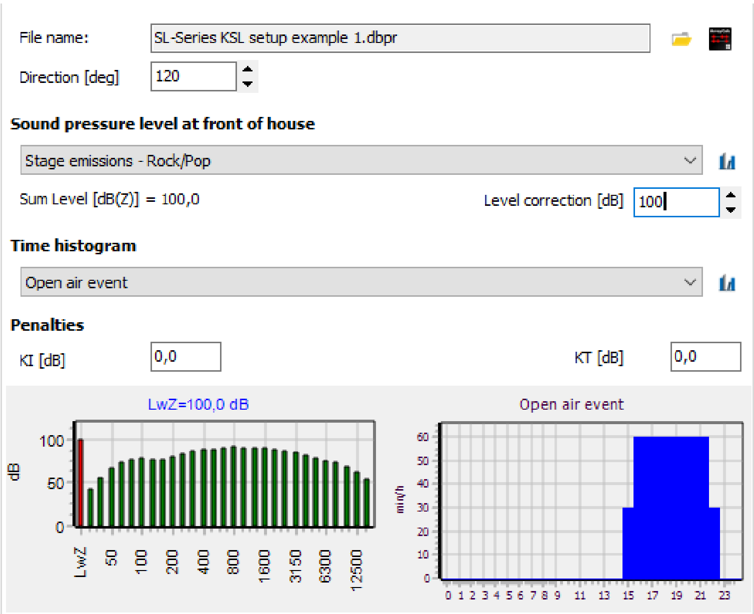
A stage is a combination of the position of the noise sources, the properties of the loudspeaker array and the area for the spectators. The data are defined in the ArrayCalc file.

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 spectators. You can download the software for free from the website of d&b audiotechnik under (http://www.dbaudio.com).

In SoundPLAN, only the complete stage is read in from the ArrayCalc file as a point object.



Select the Stage icon in the object bar and place the stage with a left mouse click. The input point is the zero point of the stage.



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).

» Display the properties for the stage so that you see not only the point object, but the stage with all the objects defined in ArrayCalc.

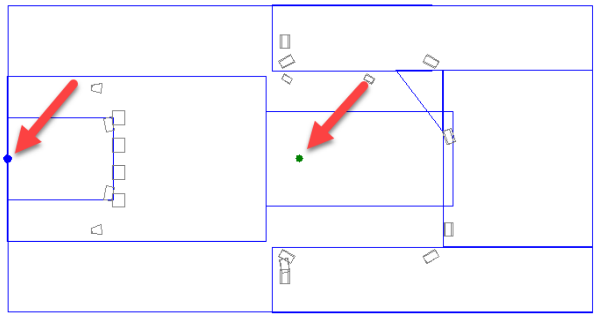
Adjust the **DIRECTION** of the venue.

Select a frequency spectrum via the library icon. Since the spectra are often normalized to a LAeq =0 dB, enter the level at the sound mixing booth "Front of House" in the

4

LEVEL CORRECTION field. A non-normalized spectrum, for example from a measurement, can be corrected to the desired sum level 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 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 (e.g 1.7 m if the audience stands). 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 in the Graphics 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.

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.

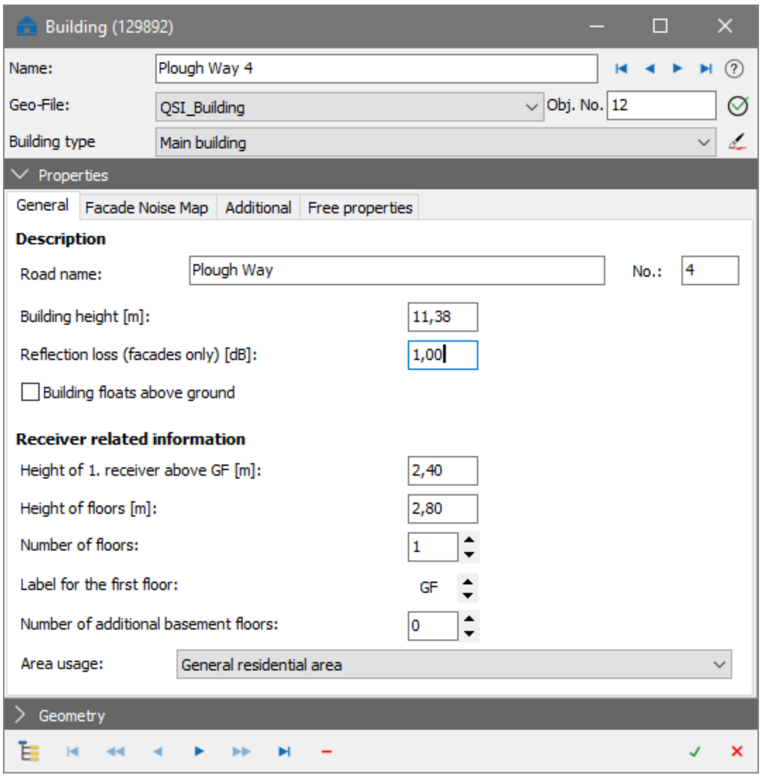
The positions of receivers and the building height are measured from the ground floor elevation.

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 and close the building with F2, double-click or the **FINISH** button. The building is automatically closed and displayed filled in turquoise (main building, hospital, school, kindergarten) or filled in gray (auxiliary building). The fill for the building type "Unknown" is a bright orange, for example, to better visualize buildings that have not yet been processed.

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.



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 Geo-Tool **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** 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, see "Object numbering" (page 39).

Select the **BUILDING TYPE** "main building" (residential building), "auxiliary building" (garages, industrial building) "School", "Hospital", "Kindergarten" or "Unknown" for different display in the Graphics. The building types "school", "hospital" and "kindergarten" are evaluated for the statistical evaluations for EU environmental noise.

To set the building type by a formula in the Property Explorer, you need the number with which the building type is stored in the selection list:

0 Main building
1 Auxiliary building
-1 Unknown
-2 School
-3 Hospital

4

-4 Kindergarten

The **BUILDING HEIGHT** is relevant for screening and reflection during the propagation calculation. It is entered relative to the ground floor elevation. If top edge elevations are available from laser scan data, the building height can be calculated with the Geo-Tool ”Evaluate elevation points for building height” (page 122).

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 eave 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 each time sound waves are reflected from an object. The reflection loss depends on the material of the wall, the impact angle, the frequency, and the size of the wall.

The **reflection loss** is entered in **dB**. For sound-reflecting surfaces, a reflection loss of 1.0 dB per reflection is generally assumed (corresponds to an absorption factor α of 0.21). This flat-rate factor includes scattering losses that occur in structured facades due to windows, balconies, etc. For highly structured facades a reflection loss of 2 dB (α = 0.37) can be used.

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 194).

Information on the receivers in the building properties

If receivers are assigned to a building (single point receivers or Façade Noise Map receivers), the **RECEIVER RELATED PROPERTIES** of the building are transferred to the receiver. 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.

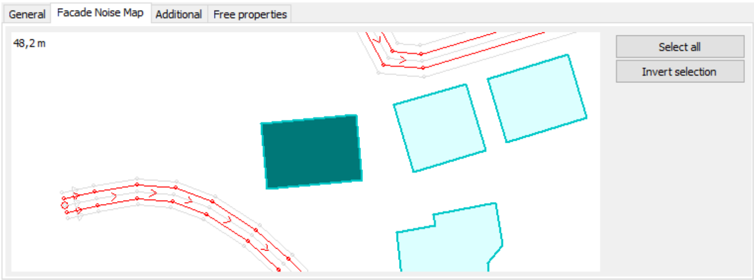
The parameter **NUMBER OF BASEMENT FLOORS** is used to take into account receivers below the ground floor for buildings on a hillside.

The **LABEL OF THE FIRST FLOOR** for floating buildings makes it possible to correctly label the floors for nested buildings, see "Floating buildings and industrial buildings" (page 194) or for buildings with basements.

The **AREA USAGE** is used to compare the resulting noise levels (assessment levels) with the noise limits. The area usage is used to map the noise excess as a conflict in the tabular documentation (Result Tables and Spreadsheet) and in the graphical presentation. When dimensioning a noise protection wall (Wall Design), a wall that keeps the limit values for each receiver is proposed based on the area usage and the associated limit values.

Use **BUILDING TOOLS | TRANSFER AREA USAGE TO BUILDING** in the **Tools** ribbon if the area usage is provided in the object type "area usage".

Façade noise map - turn on facades

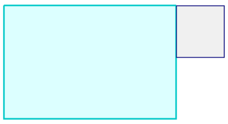


The module Facade Noise Map allows calculating automated single points without the need to enter single receivers. All facades where receivers should be placed need to be “switched on”. The position of the receivers (in the center of the façade, distance in meters …) is later defined in the calculation properties. In the preview window in the tab index card *Façade Noise Map,* you see the building and its surrounding. The facades can only be switched on at the currently open building. This is visualized with in dark turquoise. The cursor changes to a small hand as soon as you move over a valid facade; with one click the facade is switched on or off.

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 GeoTool “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.

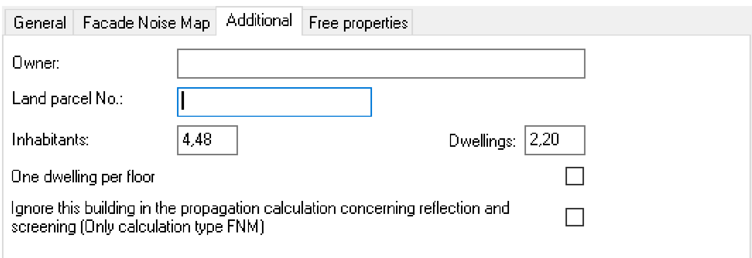
» Activate the object properties of the buildings to view selected facades in turquoise and in double line width.



If two buildings have a common façade the receivers within this façade will not be calculated. Receivers are only calculated if they are located 0.5 m above the lower building.

Inhabitants, dwellings and additional properties

In the *Additional* tab you can assign further characteristics to the buildings, such as **OWNER**, **PARCEL NUMBER** or **INHABITANTS** or **DWELLINGS** per building.



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 "m² per inhabitant" in the Geo-Tool “Prepare buildings” roughly estimate.

If information on inhabitants or dwelling is available in an area in the object type "area usage" or in a value grid, you can use the GeoTool "Distribute inhabitants or dwellings" (page 120).

For the inhabitant statistics according to CNOSSOS-EU, all inhabitants of buildings with only one dwelling per floor may have to be assigned to the loudest facade (e.g. Austria). Mark the corresponding buildings with the checkbox **ONE DWELLING PER FLOOR**. Please refer to the implementation into national law for your country.

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.

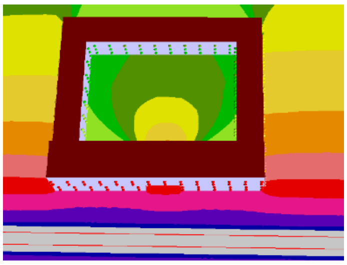
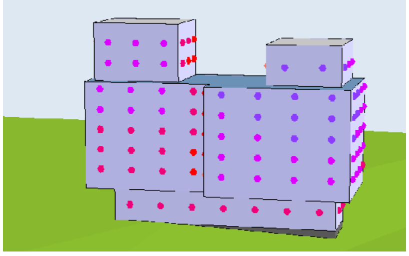
In order to supply the calculation core with the required information and to facilitate this, some extra controls are introduced:

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**.**

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.

Floating buildings and industrial buildings

If you check the box **BUILDING FLOATS ABOVE GROUND**, the base of a building is not connected to the terrain.

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 check box 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)

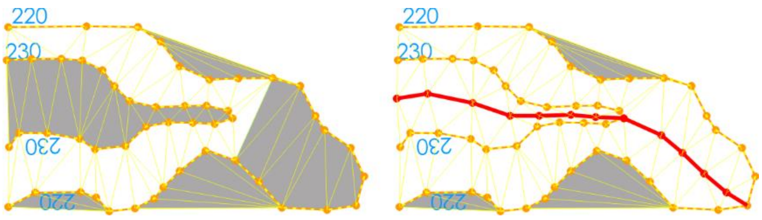
In order to allow receivers in stacked buildings to be labeled continuously, enter the label for the lowest floor in the building and receiver properties.

Elevation lines and · Elevation points

Elevation lines and elevation points 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.

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:

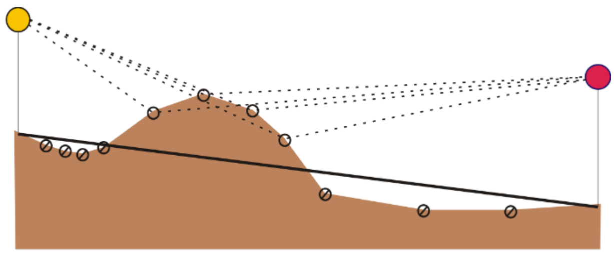


Elevation points are singular elevation information. Elevation grids or point clouds from laser scanning, which ensure the supply of elevation information in the investigation area, are imported using **IMPORT | ELEVATION POINTS** in the ribbon **Fundamentals**. The elevation points are thinned out during the import in order to minimize the number of points and the size of the DGM, see "Filter and import elevation points" (page 79).

Terrain points which are available in a DXF file as a text can be converted to spot heights, see "DXF Import" (page 66).

Calculation of the negative extra path length

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.



Terrain baseline

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.

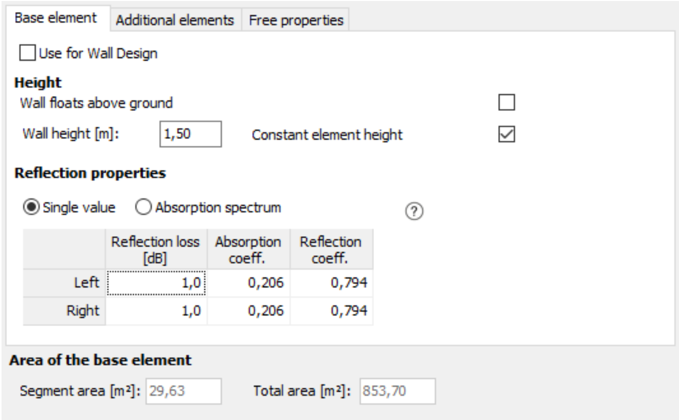
Noise barriers

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.

Coordinates, heights, segment lengths, volumes and kilometers of walls and berms can be documented in the Spreadsheet, see "Wall / berm documentation" (page 345).

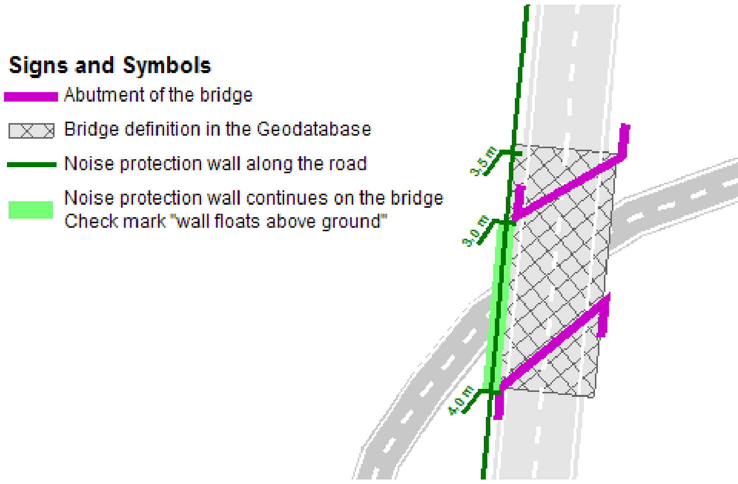
Wall properties



Activate the check box **USE FOR WALL DESIGN** if you want to use a wall for wall optimization with the Wall design module, see "Wall design" (page 355). Walls that are to be used for optimization must be saved in a separate Geo-File, i.e. no objects other than the walls to be optimized may be contained in this Geo-File. Walls with additional elements cannot be used as baseline for wall dimensioning.

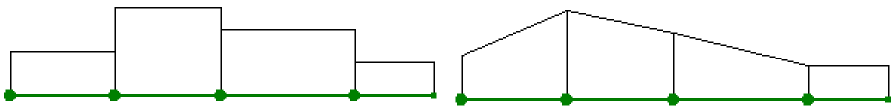
Check mark **WALL FLOATS ABOVE GROUND** if the wall does not extend to the ground but actually ends at the entered object elevation of the wall and noise can propagate under the wall.

This makes it easier to model noise barriers on bridges and use them for wall optimization. In this way, you can also graphically document the height and reference kilometer of noise barriers on bridges.



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.

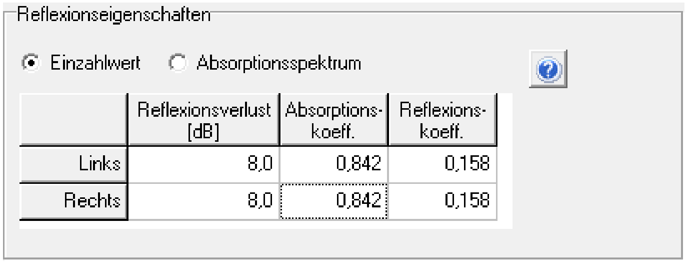
For noise barriers that have height jumps, the wall height must not be interpolated for the calculation of the diffraction edge. Check mark **CONSTANT ELEMENT HEIGHT** if height jumps occur in the wall.



With constant wall elements the wall is parallel to the terrain and the wall always has the same height within an element. If the checkmark "constant" is not set, then the height of the wall element is adjusted to the wall height of the next point. This means that the wall height of these wall elements is different within the element. You can check the input via **F8** or **VIEW | FRONT VIEW.**

Reflection loss for noise barriers

Walls can reflect differently to the right and left in the input direction. The reflection loss can be entered either as a single value or as an absorption spectrum from the SoundPLAN library.



The reflection properties are dependent on the material of the wall. You can enter the reflection properties as reflection loss in dB, as absorption coefficient or as reflection coefficient. The respective input is converted into the other two values.

"No reflection" is indicated with a reflection loss >15 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 loss in dB**	**Absorption-coeff. α**	**Reflection-coeff.**
Hard (fully) -reflective surfaces (concrete, glass)	1	0,206	0,794
Absorbent noise barrier	4	0,602	0,398
Highly absorbent noise barrier*) **)	8 - 11	0,842 - 0,921	0,158 - 0,079

*) For Schall 03-2012, a maximum reflection loss of 8 dB is calculated.

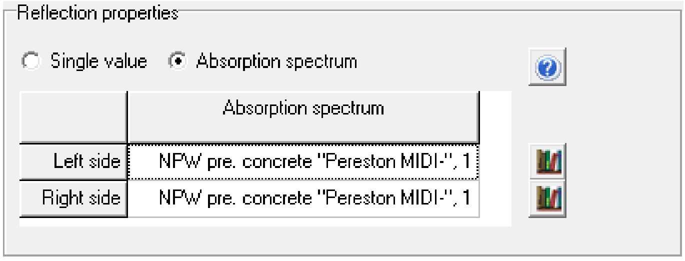
**) RLS-19 prescribes a reflection loss of 0.5 dB for reflective noise barriers, 3 dB for reflection-reducing noise barriers and 5 dB for strongly reflection-reducing noise barriers. To allow the same noise barriers to be used for different types of noise, reflection losses are interpreted accordingly via a checkmark in the guideline settings (up to 1.5 as 0.5 dB, >1.5 ... <=4 as 3 dB and >4 ... <=15 as 5 dB).

Schall 03-2012: The treatment of low noise barriers according to paragraph 6.5 is done automatically due to complex geometric checks.

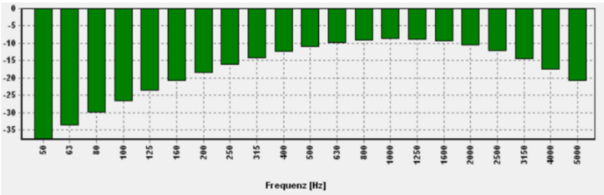
If a search beam finds a diffraction edge, the height of the intersection is obtained from an interpolation of the two end points of the diffraction line. For the sound-relevant diffraction edge, the total height is evaluated, which results from the base point plus the **WALL HEIGHT.**

For spectral treatment of reflection losses (only for standards that support frequency-resolved calculations), the library is accessed. Call the absorption library via the icon button.

4



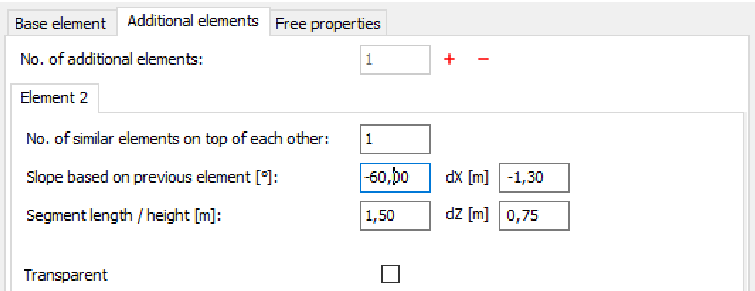
If you switch to the absorption spectrum, the entered single-number value is not evaluated in the calculation! For calculations that include both spectral sources and sources without spectrum, SoundPLAN proceeds as follows: If an absorption spectrum is specified for a wall, this is used for reflections of the spectral sources; for reflections of the sources without spectrum, an average absorption value from a road noise reference spectrum is used. The road noise reference spectrum is taken from the Japanese road guideline ASJ 2008 (third octaves in dB(A)):



50Hz	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
-37,8	-33,8	-30,2	-26,8	-23,8	-21,1	-18,6	-16,3	-14,4	-12,7	-11,2	-10,1	-9,3	-8,9	-9	-9,6	-10,7	-12,4	-14,7	-17,7	-21,1

Additional wall elements (slanted walls)

Go to the *Additional elements* tab and click + to request a new element.

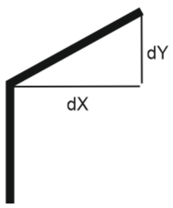


As soon as one element is not perpendicular to the previous one, reflection properties are no longer taken into account.

You can define several identical elements at once by specifying the number of **SIMILAR ELEMENTS ON TOP OF EACH OTHER.**

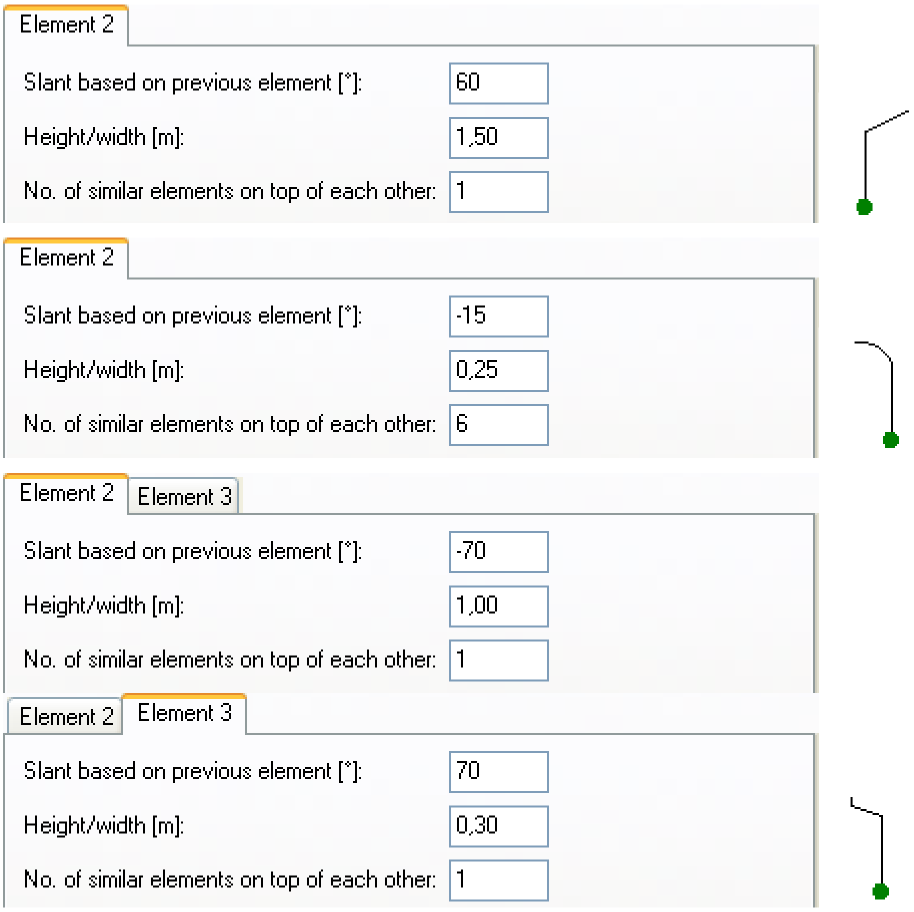
The **SLOPE BASED ON PREVIOUS ELEMENT** tilts the noise protection wall. A positive value will tilt it to the right (in the direction of entry of the object); a negative value will tilt it to the left. **HEIGHT/WIDTH** defines the size of an element in meters.

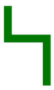
If only one additional element is present, you can define the slanted element with the parameters dX and dY. For several cantilevered elements in one additional element, the slope and the segment size are calculated from the number of elements and dX and dY.



The data is automatically converted to the angle and height / width.

Examples:





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.

TRANSPARENT is exclusively a graphic property to be able to display transparent wall surfaces differently in the "transparent wall surfaces" subobject type. The reflection properties are not changed.

Ridges

You can enter roof ridges as noise barriers with a wall height of 0. The object height (ridge height) must be defined as height above sea level. In addition, assign the Graphics object type "Ridge" in the Properties dialog if you want to display the roof in cross sections and in the 3D Graphics.

Useful GeoTools for walls

With "Create parallel object" (page 111) you can, for example, generate a parallel noise barrier wall from a road. If you click with the right mouse button on a calculated line (roadside, top width of a berm) and call up **CREATE PARALLEL OBJECT** there, you can, for example, generate a wall that follows the course of the roadside.

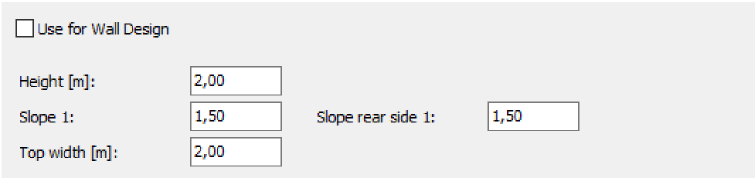
With "Divide into sections" (page 114) a noise barrier is divided into equal sections, for example for Wall Design.

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.

Coordinates, heights, segment lengths, volumes and kilometers of walls and kilometer posts can be documented in the Spreadsheet, see "Wall / berm documentation" (page 345).

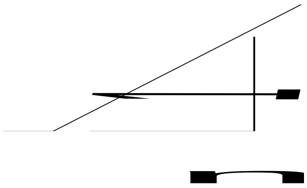
Berm properties



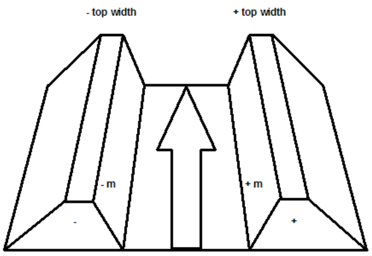
Activate the check box **USE FOR WALL DESIGN** if you want to use a berm for wall optimization with the Wall design module, see "Wall design" (page 355). Optimization berms must be saved in a separate Geo-File. When restoring a dimensioned berm with different element heights, the height differences are smoothed.

Enter the height of the berm, the slope and the top width. The slope of the rear side is irrelevant for noise control calculations but is used for assessing the mass to be moved when constructing the berm.

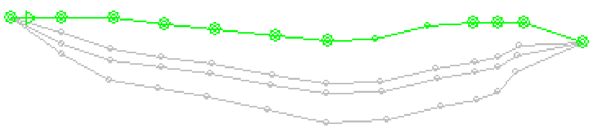
The berm tilt is calculated using the factor of 1:m:



The slope and the top width are entered as positive or negative values depending on the input direction. Slopes that rise from the base point to the right in the input direction must be entered with a positive slope, while slopes that rise to the left must be entered with a negative slope:



The berm lines calculated from slope, height and top width are displayed in gray.



Right click on the calculated berm lines and select **CREATE PARALLEL OBJECT** to place for example a wall on the wall top.

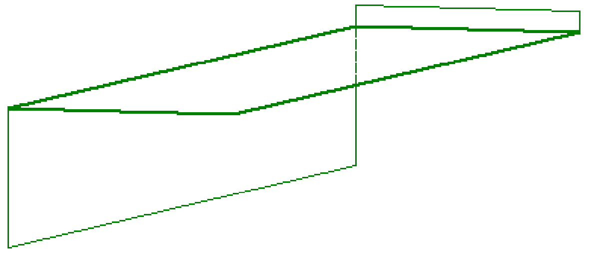
Berms can be included in a DGM.

Floating screen

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.

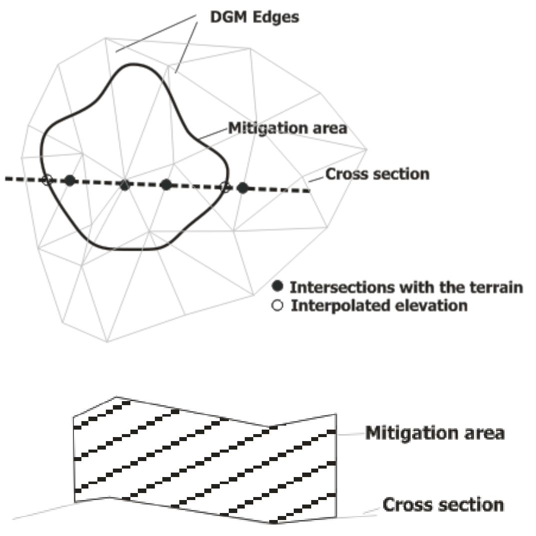
You can define a wall height for the floating screen which may change within the object, e.g. if you want to define a wall only at one edge of the floating screen. The wall height can be negative to model, for example, the backside of a gallery.



The properties of the walls of a floating screen correspond to the wall properties of the noise barrier, see "Wall properties" (page 196). Enter the reflection properties differently for the inside and outside, if necessary. **The reflection properties apply only to the walls, not to the screen itself**. The **CONSTANT ELEMENT HEIGHT** checkbox defines how the wall elements should be connected. The reflection loss for the walls is specified in the same way as for noise barriers, see "Reflection loss for noise barriers" (page 197).

Volume attenuation areas

Enter the polygon enclosing the volume attenuation area. Volume attenuation areas are referenced to the terrain (DGM):



This means that the exact course is evaluated from the profile. In the Geo-Database graphics, the evaluation is only done for the entered points of the volume attenuation area. Locally occurring terrain unevenness is therefore not always displayed.

Seen from the emitter, the first row of houses should be defined with buildings for the attenuation areas "Industrial site" and "Built-up area", for "forest" enter the whole area as volume attenuation area. Nesting of areas with different effective heights or at-

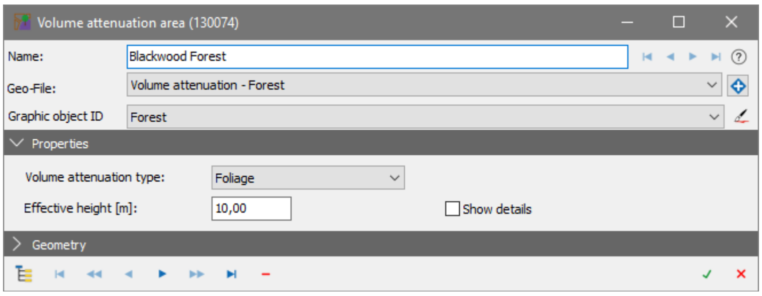
4

tenuation coefficients is possible. In the Graphics, nested volume attenuation areas are displayed as "holes" if the effective height is 0 m.

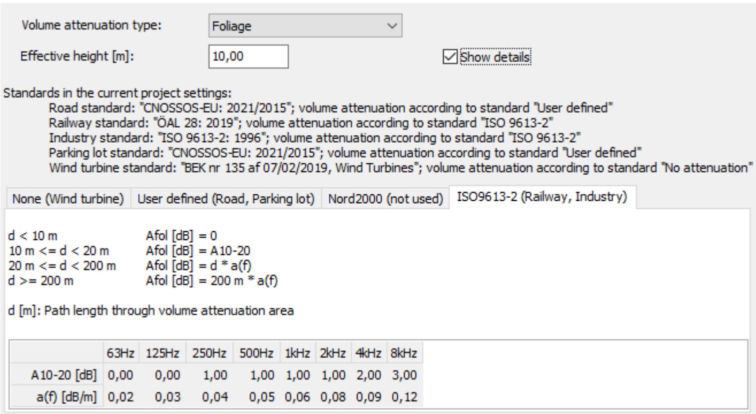
In principle, there are three different types of attenuation areas:

- Foliage (forest, bushwood): Afol
- Build-up areas (buildings that are not entered in detail, but only statistically): Ahouse
- Industrial site: Asite

The name, attenuation type, and effective height (mean height above terrain) are specified in the attenuation area properties in the Geo-Database.



Depending on the selection of the standard for road, railway, industry and parking lot and the selection of the standard for the attenuation area, the corresponding input parameters are displayed in the object properties if you click on the **SHOW DETAILS** checkbox.



In principle 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

  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

d < 10 m	Afol [dB] = 0
10 m <= d < 20 m	Afol [dB] = A10-20
20 m <= d < 200 m	Afol [dB] = d * a(f)
d >= 200 m	Afol [dB] = 200 m * a(f)

A10-20 and a(f) are fixed.

- 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) <=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

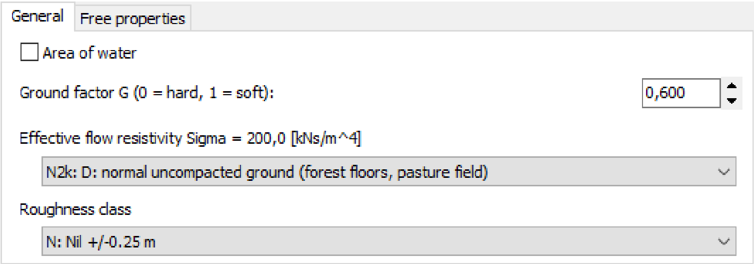
Asite [dB] = d * a(f) <=10 dB

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 effect areas

Ground effect areas describe the acoustic ground properties (absorbing - reflecting). They are important for the acoustical model because they influence the sound propagation especially near the source and the receiver.



Almost all standards evaluate different ground properties of hard and soft ground in the propagation calculation, most of them use the ground factor G. TNM (USA), ASJ (Japan) and Nord 2000 describe the ground effect by the "effective flow resistance", Nord 2000 additionally uses the parameter "roughness class".

The settings for the different standards are listed below, with the default values used when no ground effect area has been entered highlighted in gray. So, you only need to enter ground effect areas where the ground properties differ 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 N2k:

N: Nil ± 0.25 m

S: Small ± 0. 5 m

M: Medium ± 1 m

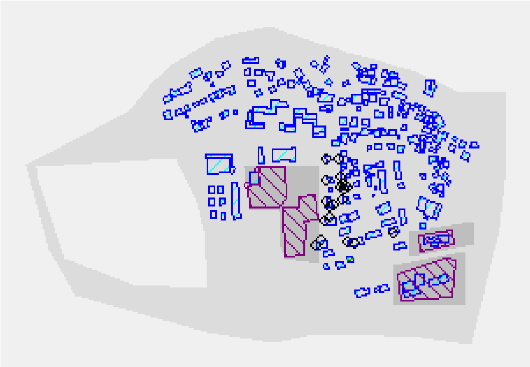
L: Large ± 2 m

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.

The checkmark **AREA OF WATER** evaluates the parameters of the ground effect according to Schall 03-2012, IoA Windturbines and BEK nr. 135 (wind turbines). For all other standards, a water area is evaluated as a sound-reflecting area (G=0).

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**).

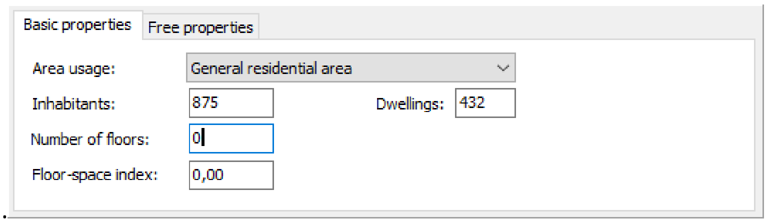


In the Graphics inserted ground effect absorption areas are presented as „holes“, if the ground absorption areas are defined with a ground factor of 1.

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 the German 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. The names of the area usages and the short title for the tabular documentation as well as time slices, noise limits and penalties are defined in the assessment library.



In addition to the usage, you can specify the number of inhabitants and the number of dwellings for area usages for evaluation, annoyance analyses or noise mapping. The population figures can be read into the area table (Spreadsheet) and used as criteria for statistical evaluations.

With the GeoTool "Distribute inhabitants or dwellings" (page 120), the inhabitants and dwellings from area usages can be transferred to the buildings.

With the GeoTool "Transfer area usage to buildings" (page 120) you can transfer area usages from an area usage object to buildings.

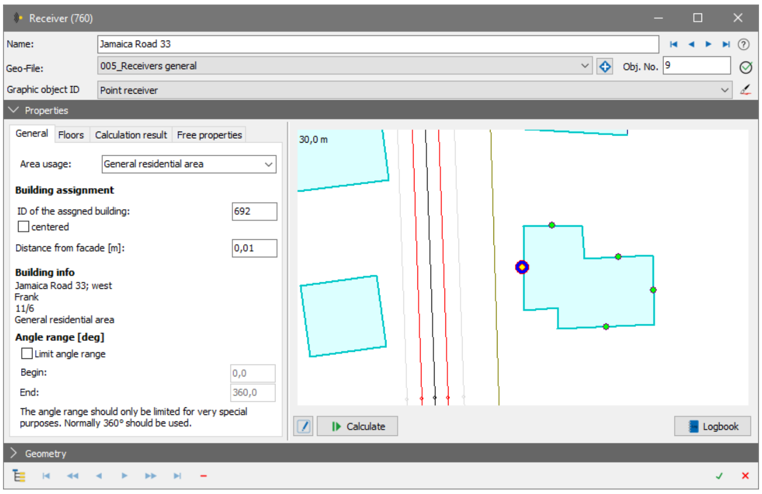
For the calculation according to the Swiss Cost-Benefit Index, see "Calculate noise costs (Swiss cost-benefit index)" (page 349), the fields **NUMBER OF FLOORS** and **FLOOR SPACE INDEX** are evaluated.

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 receiver 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).

Receiver properties



Use the **OBJECT NUMBER** for individual numbering of the receivers, if the automatically assigned serial number (alpha-numerical numbering according to the receiver name) is not sufficient, see "Object numbering" (page 39).

The **AREA USAGE** is used to compare the resulting noise levels (assessment levels) with the noise limits. The area usage is used to map the noise excess as a conflict in the tabular documentation (Result Tables and Spreadsheet) and in the graphical presentation. When dimensioning a noise protection wall (Wall Design), a wall that keeps the limit values for each receiver is proposed based on the area use and the associated limit values.

Limit angle range

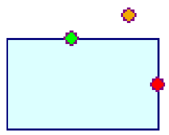
Usually, you will calculate with 360° to consider noise sources behind the building, but there are certain applications where you want to limit the angle range, for example to calculate a single angle segment for the detailed calculation report.

Activate the check box **LIMIT ANGLE RANGE**, click on the start of the angle (counter-clockwise) and then on the end of the angle.

In the case of receivers assigned to buildings, you can assign the receiver to the facade by holding down the ***Shift key*** if you explicitly want to view only the sector not shield-ed by the building.

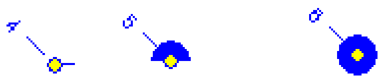
Representation of the receivers

Assigned and not assigned receivers are displayed in different colors. A yellow dot indi-cates a receiver without assignment, a green dot shows receiver with building assign-ment and a red dot shows that a receiver was originally assigned, but the building with this building reference number no longer exists.



If you see red receivers in your Situation or the warning message *"Receiver name" as-signed building not found" is displayed in* the geometry check or in the Calculation core, update the building reference with the GeoTool "Edit receiver assignment " (page 118).

Switch on the object setting "Show properties" to see the entered angle range:



Receiver with 360° (right),180° (center) and 5° (left)

Receivers assigned to buildings

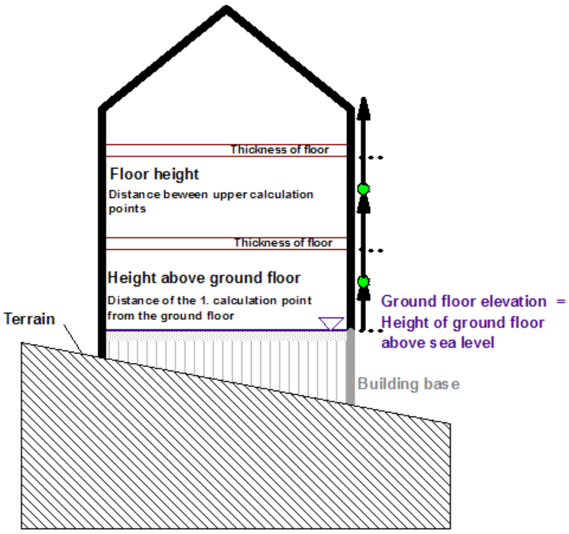
SoundPLAN uses the building reference to recognize that a receiver is connected to a building. This is necessary to correctly consider the reflection at the assigned façade according to the used standard (no reflection or façade correction).

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 pre-view picture. 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.

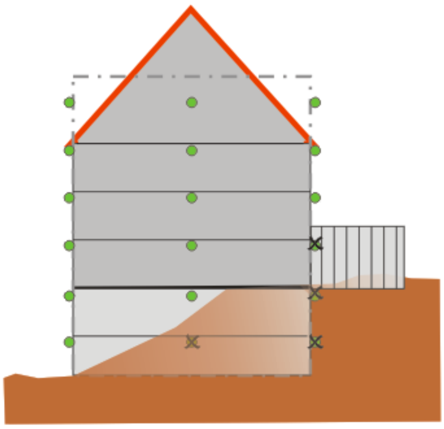
The standards specify at what height the noise should be calculated. For example, be-neath the floor ceiling or in the middle of the window. The distance to the facade also depends on the standards.

4



Sketch of the position of receivers

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.



Floors of receivers below terrain 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. If such receivers are present you will get a hint during the calculation.

Receivers located in the area of a gable roof are not indented. In order for these receivers to be calculated correctly, the building should be raised by half the roof height (gray dashed line).

Assign receivers without transferring building properties

A receiver can be assigned to the building but without assigning the building properties (in order to process imported measuring points, for example), if you hold down the ***Ctrl key***. It is important that the check mark **CENTERED** is switched off. The height of the receiver is used as calculation height, the height above ground level is set to 0 and the number of floors is set to 1.

If there are several receivers, you can do this with the Geo-Tool "Edit receiver assignment " (page 118) for all receivers together.

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.

Free-field receivers

The object elevation is the height of the first calculation point above sea level. In the tab *Floor* you define the number of floors and the vertical distance between the calculation points (**FLOOR HEIGHT**).

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.

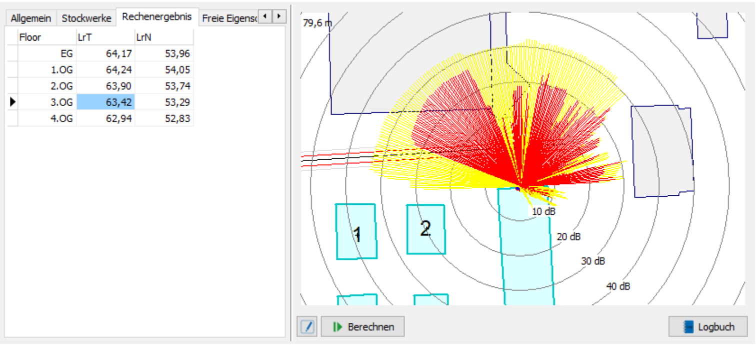
Calculate assessment level in the receiver properties

Click the **CALCULATE** button in the receiver properties. When calculating for the first time, the calculation properties will open first so that you can check the parameters for the calculation, the standards used and the assessment and change them if necessary.

The next time you calculate, the parameters you selected will be used. You can open the calculation properties via the **EDIT** icon to change parameters.

The Calculation core is opened in the background and the current point is calculated. The values and the level chart are displayed so that you can quickly check whether, for example, a planned noise protection wall is sufficient to keep the noise below the limit. Click on another floor in the table of calculation results to see the level chart of this floor.

The values are only displayed temporarily, as long as the receiver properties are open, because the geometry might have changed the next time they are opened. This ensures that no inconsistent results are displayed.



The logbook for the calculation is called via a button. If notes, warnings or errors occurred during the calculation, the font changes to blue-italic (notes), red-italic (warnings) or red-bold (errors).

Calculation line for cross section noise maps

Cross sections are used to define the calculation line for cross sectional grid noise map calculations; at this line the vertical grid is calculated.

Enter two coordinates for the cross section. Elevation lines, elevation points, roads, railways and berms are used to determine the terrain elevations for the calculation. The elevation profile is automatically calculated from the highest and lowest terrain points. The cross section must lie within the elevation supply.

Representation of the objects in the cross section

Point objects are displayed and used for the calculation if the distance between the point and the cross section does not exceed a maximum point distance user-defined in the Calculation core or Graphics.

There are two types of line objects. One has a wall height, namely the wall. The other line objects are only a line, for example line sources, emission bands and so on. Walls are drawn as vertical lines, all other line objects as horizontal lines with a length of 10 cm.

There are also two different definitions for areas. Areas with heights (buildings, attenuation areas) are shown as a section through the area, areas without heights (road and railway bands) are shown with a thickness of 10 cm.

Calculation area

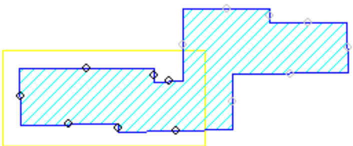
Calculation areas are used to define the area to be calculated. The calculation area can have any shape.

The calculation area must be within the area supplied with elevations (DGM), unless the whole project refers to 0 m.

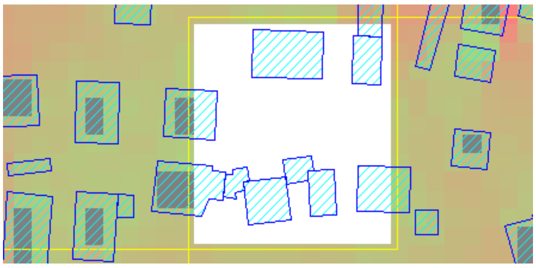
Within the calculation area, a receiver grid is created for Grid Noise Maps at a user-defined height above the DGM and in a selected grid size, which defines the location and calculation height of the grid receivers.

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.



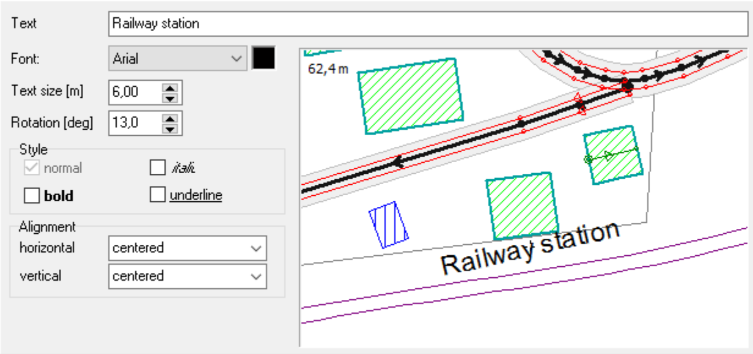
Except for Meshed Noise Maps, several calculation areas may be included in the calculation data. If one calculation area is inside of another or overlaps, no calculation is performed in the overlapping area.



Geometry texts

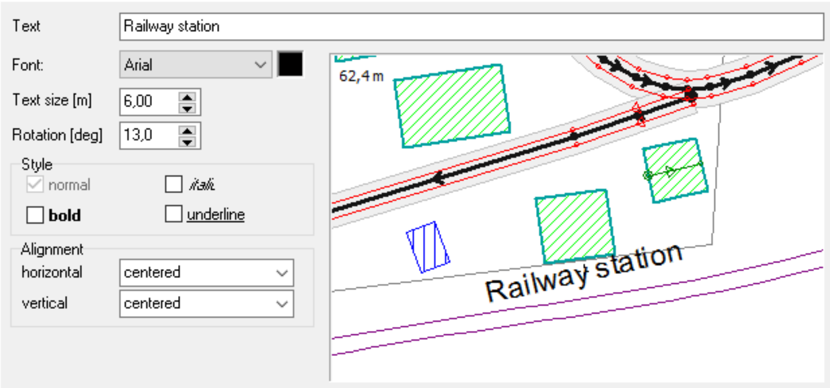
Enter geometry referenced texts such as road names, house numbers and other describing texts as geometry texts. They are positioned at a location fixed in world coordinates and adjusted to the map in the graphical presentation (length scale and rotation). Texts describing particular elements of a plot are entered in the Graphics in sheet coordinates.

Text properties



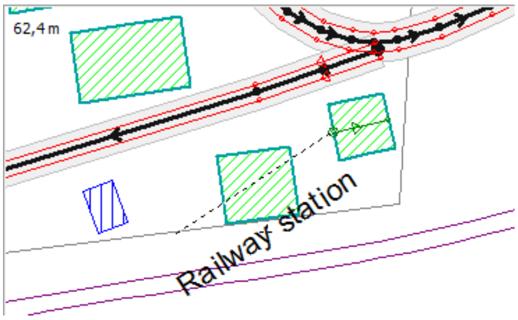
Enter the text and click in the graphics window to place the text. You will see the text in the graphics window on the right. The cross indicates the coordinate of the text, which is in different places depending on the orientation of the text. The text size is entered in [m]. In addition, you can select the font, the font color and the font properties normal, bold, italic and underlined.

The angle (**ROTATION**) can be entered manually in degrees as well as set in the graphics window via mouse movement. Hold down the right mouse button and rotate the text until the angle is correct. The dashed line helps to align the text.

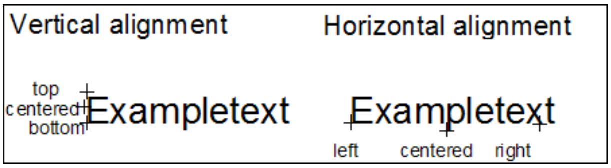


Enter the text and look at the text in the graphics window. The cross marks the text coordinates. The text size is shown in [m]. Define the text font, character size, color and attributes (normal, bold, italic, underlined). Click the appropriate field. Clicking the color selection field opens the color palette.

The **ROTATION** can be entered manually in degrees or by dragging it with the mouse. Move the mouse with the right button pressed until the text is suitably aligned. The dotted line helps with the alignment of the text.



The **ALIGNMENT** determines the text direction from the text anchor:



The position of the cross on the text is decisive for the text position and for the rotation axis around which the text is rotated during angle input.

If there are many geometry texts in the data, the output speed decreases. Click on the "Hide properties" icon next in the object manager to view only the cross.

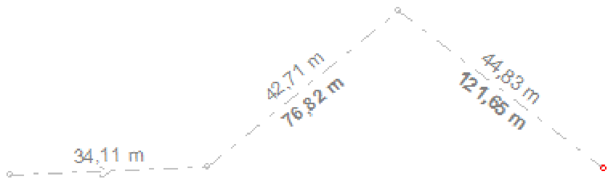
Points, lines, areas

Points, lines and areas are general objects that do not have any calculation-relevant properties, but can be provided with heights above sea level. Especially with the DXF import, the layers are read in from AutoCAD as points, lines and areas, then converted into SoundPLAN objects and provided with the corresponding acoustical properties.

Furthermore, you can assign a Graphics object type to the general objects, so that the object is represented in the Graphics accordingly (for example, the border of the investigation area or a river), see “Assign graphics object type” (page 108).

Measuring tape

You can digitize measurement chains using the measuring tape measure object.



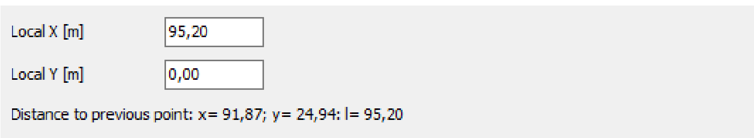
The 2-dimensional distance between the individual coordinates is displayed, as well as the sum of the distances in each case. You can capture a point or an object line exactly if you additionally press the ***Ctrl key.***

With the module Cartography you can additionally display and format the dimension chains in the Graphics.

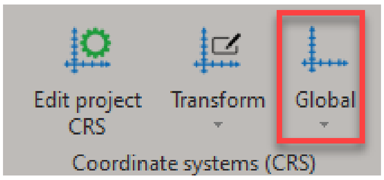
Local coordinates

With a local coordinate system, you can more easily enter objects within a certain area of which you know the dimensions. For example, you have an industrial building with superstructures on the roof. You know the dimensions of the building and the position of the objects on the roof relative to the edge of the roof.

Take over the corner coordinates of the longer facade of the industrial building as local coordinates. In the object dialog, enter 0/0 for the first coordinate and the length of the facade as the x-coordinate for the second (displayed in the object dialog at the second coordinate), y remains 0.



In the **Fundamentals** ribbon, switch from **GLOBAL** to the local coordinate system. Now you can enter the roof superstructure exactly in the measured position.



For objects in a local coordinate system, the local and world coordinates are displayed in the object dialog.

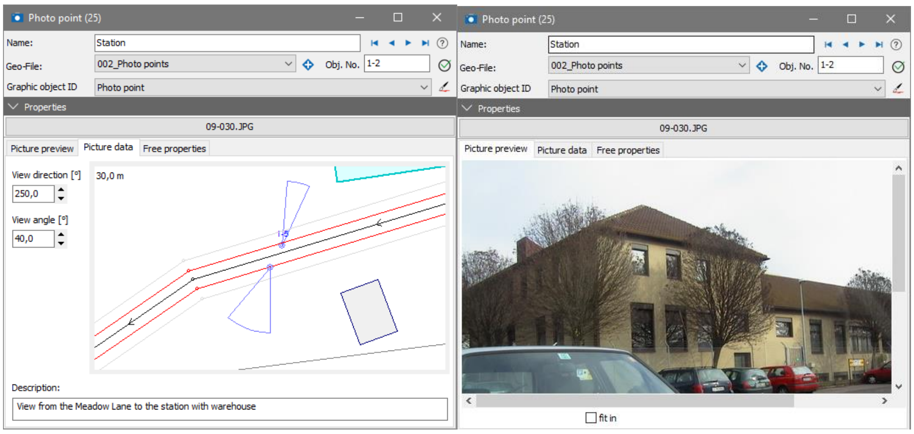
Geometrie

Höhendefinition absolut

	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

Photo point

Photo points describe the locations of photos taken during a site visit. Photos with GPS data can be imported georeferenced, see "Import of photo points with GPS data" (page 78).



Enter the photo point at the location where the photo was taken. In the object dialog, click the bar to open the photo file. If the photo is not in the project, you will be asked if the image should be copied or moved. The photos are always kept in a subfolder called "Photos".

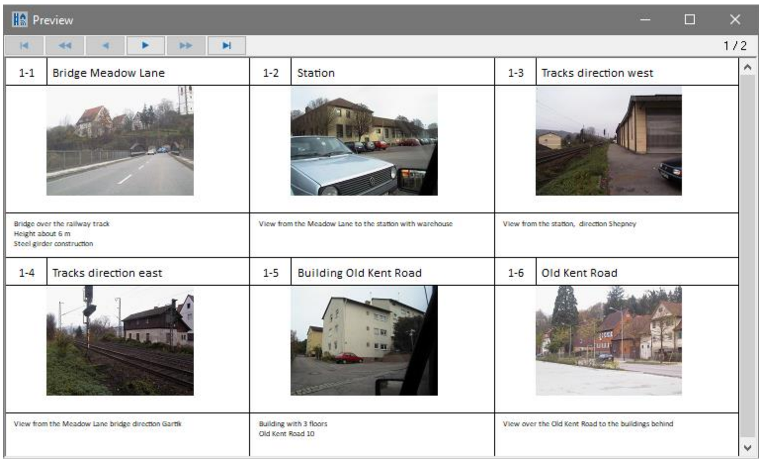
You can enter the **VIEW DIRECTION** and the **VIEW ANGLE** as numerical values in the tab *Picture data*. You can also click with the left mouse button in the graphics window in the direction in which the photo was taken to enter the view direction or drag the view angle with the right mouse button.

The photo locations can be displayed in the site map in the Graphics as well as in a photo documentation (see below). If you assign object numbers to the photo points, an assignment between the graphical output and the photo documentation is possible, see "Object numbering" (page 39).

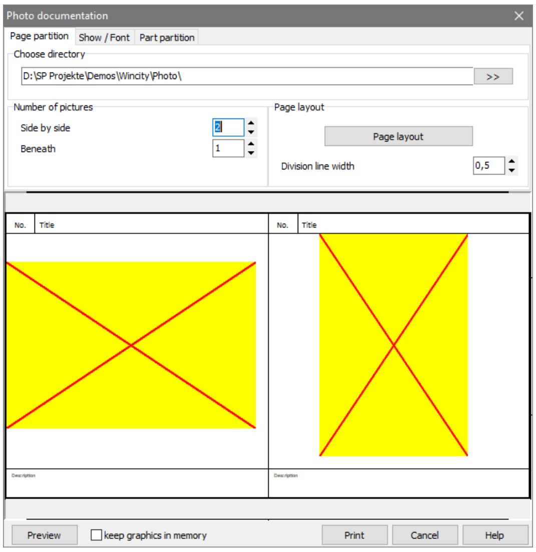
Since the SoundPLAN page layout is also used for this printout, the photo documentation can easily be included as an appendix in the report.

Photo documentation

Call up the photo documentation in the Geo-Database via **DOCUMENTATION | PHOTO**. This is what the result might look like:



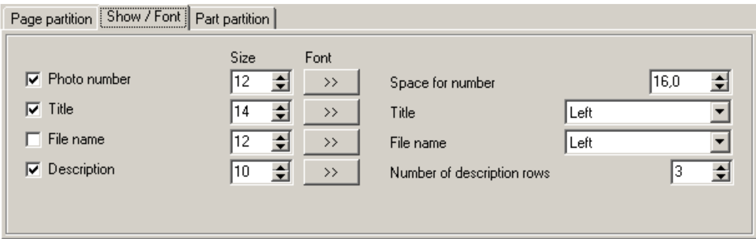
You have various options for changing the layout of the printout. The placeholders for the images each show how the ratio of portrait and landscape images within the image frame changes when you change the number of images next to and below each other. You can see the actual layout on the page in the preview.



Above the photo, the photo number and title (name) from the photo point properties as well as the file name can be displayed. Below the photo, the description entered in the photo point properties can be output.

The **WIDTH OF THE SEPARATOR** line determines the border line around the image with all the information.

Use the button **PAGE LAYOUT** to define the layout of the header and footer of the page as usual in SoundPLAN.



In the tab *Show/Font*, you define which information should appear in the printout and in which font and font size. You can see the effects in the preview.

Define the distances between the frame, text, and photo, as well as the lines between the individual areas in the tab *Part partition*.

Tree

The tree object type has the properties tree type and tree height. Representation as a rotation body or in planes as well as the trunk thickness at the top and bottom is defined in the object types. The tree height that you specify is used as a reference for the trunk thickness.

Map section

With the object type map section you can enter map sections in the Geo-Database or save them from the Graphics, see " Map sections, overview map and sheet tools" (page 471) .

Camera track / animation track

[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 Geo-Tools for the spline interpolation to generate a smooth flight from a few sampling points. You can view an example in the demo project "Wincity" in the graphics sheet 7-1.

Traffic network

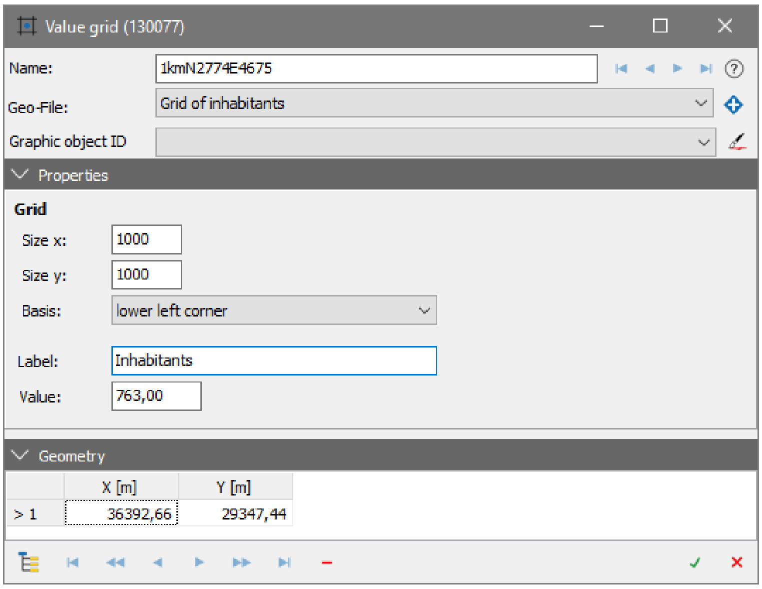
[Tools NMP] The object type traffic helps to visualize road networks together with their section ID. This is especially useful for keeping track of the imported roads in larger road projects.

Value grid

[Tools NMP] Population figures that are available in grids, for example in an ASCII file, can be imported via the value grid object and then transferred to the buildings. In the value grid, a point represents a certain area, for example 100 x 100 m or 1 km x 1km. This point contains the inhabitants of the area it represents.

The coordinates in the table are often not contained as actual coordinates, but as Grid_ID (e.g. 7197_61835) or CellCode (e.g. 1kmN2774E4675). This column must be converted accordingly in a spreadsheet so that the table can be imported with the ASCII import.

4

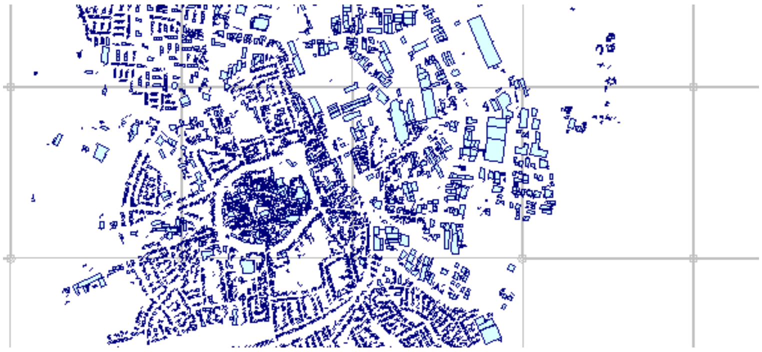


During the import enter the grid size, the base to which the coordinate of the value grid refers (lower left corner or grid center), and a description for the value in the default properties.

Note: If the data contains several values, for example, inhabitants and dwellings, the file must be imported twice, as the value grid can only manage one value.

» Switch on the properties of the value grid, then the grids will be displayed instead of the points.

The population in each grid cell is transferred to the buildings using the Geo-Tool **SPLIT INHABITANTS AND DWELLINGS**. Select the buildings and the value grid.



Buildings that are not clearly located in a grid cell are added to the grid cell in which the building's center of gravity is located.

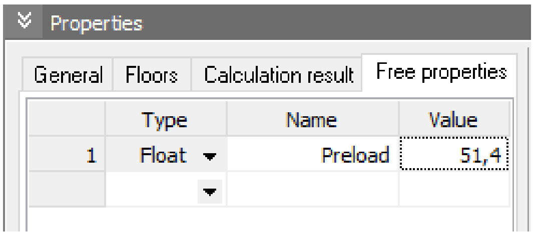
Free properties of the objects

With the free properties you can store any additional information about the individual object types. This is particularly useful for importing additional or non-SoundPLAN-compliant data (e.g. a property is available as a value, but SoundPLAN expects a text) and evaluating it later in the Property Explorer. The free properties can also be imported into the Spreadsheet, for example to consider a preload at the receivers.

The free properties can be defined in different places in the Geo-Database:

- During the import in the assignment table via the gear wheel, tab "*Free properties*"
- In the properties dialogs in the tab "*Free properties*"
- In the Property Explorer via the gear wheel, tab "*Free properties*"

From the **TYPE** drop-down list, select whether the property is a text, an integer, or a float value, and specify a name.



The free properties are saved with the objects in the project.

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 own and frequently used library elements 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 loudspeakers. 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.

Organization

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**.

By default the path for the global libraries is "..\Documents\SoundPLAN Globdata x.x\libs" as soon as you store own library elements globally.

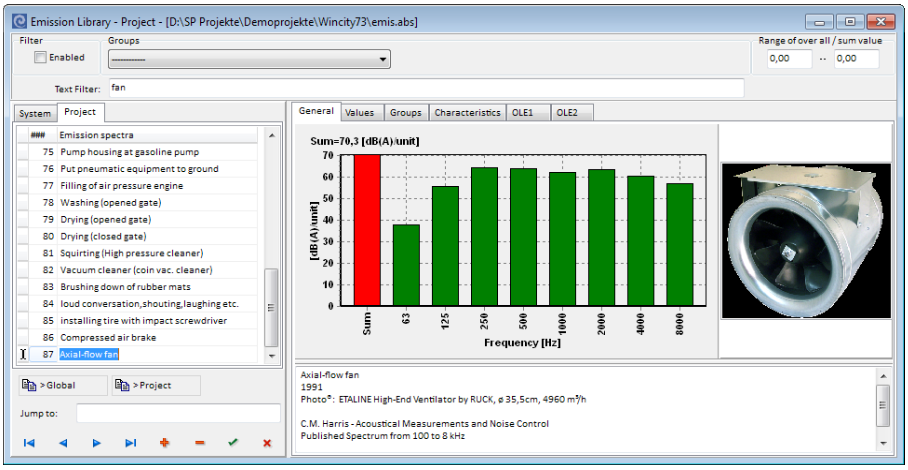
You can change this path in the library via **LIBRARY | GLOBAL PATH**. The global path may also be on a network drive to enable the access to the same system library to all SoundPLAN users in your company.

As data on the server may be changed or the network may be down, always a local copy of the used libraries with the needed elements is automatically stored in the project.

Only when you open a certain library, for example the emission library, in a new project this library will be created in the project folder. This ensures that no unnecessary data waste is accumulated in your project.

General information about all libraries

In most of the cases you will not open the libraries from the SoundPLAN Manager but by a click on the library symbol. 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.

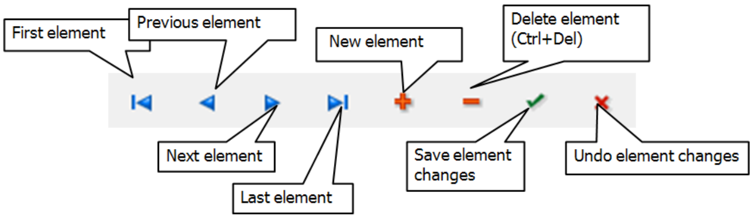


The libraries consist of two parts. In the left area all existing elements are listed, and new elements are inserted. The right area is fitted with several tabs that are specific to the library type (for example spectrum or absorption coefficient).

In this section general features are described, then in further sections the special features of the individual libraries.

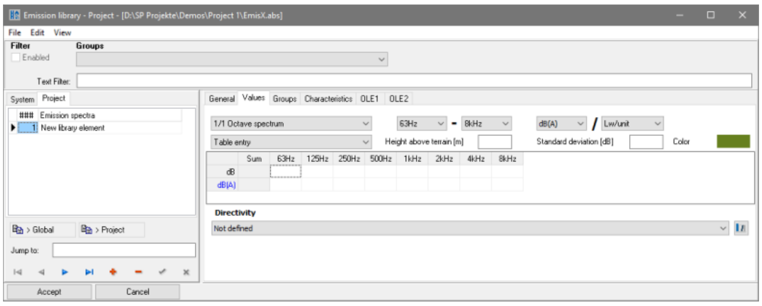
Create library elements

The library elements are managed in databases. Each element is a record that can be edited, created or deleted. This is done via the symbols:



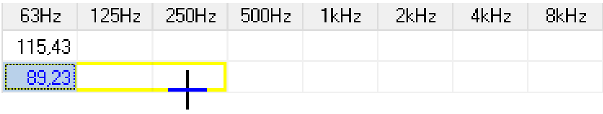
You will often transfer required library elements from the system library to the project library, see "Copy library elements" (page 221) or, for example, import them from measured values, see "Importing library elements" (page 234).

To create a new library element, click on the +, assign an element name (due to the database structure, the element name in the library must not be empty or already used in the library) and then switch to the tab *Values*.

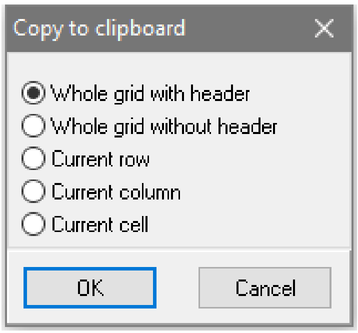


Here you first select what you want to enter, for example a spectrum or a single value and the frequency weighting in the emission library or whether a day histogram is for example to be entered in minutes per hour or events per hour. Then enter the values, depending on the library, for example the dB(A) values of an emission spectrum or the sound absorption coefficients of an absorption spectrum.

As soon as you press the Enter key in a field, the cursor moves to the next cell. If values in several cells are the same, you can transfer them to other cells by moving the mouse to the bottom right-hand corner of the cell and, as soon as the cursor changes to a cross, dragging it into the desired cells while holding down the left mouse button.



Values can be pasted from external programs (e.g. an Excel table) or another library element into the current library element via the clipboard using ***Ctrl+C*** and ***Ctrl+V***. If you copy values from another library element, select what you want to copy.



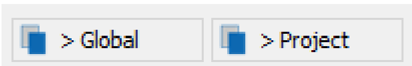
The option **WHOLE GRID WITH HEADER** is only used to copy to an external program.

Copy library elements

You can copy library elements from one library to another, even from one project to another. The only exception is the system library, which cannot be changed by the user.

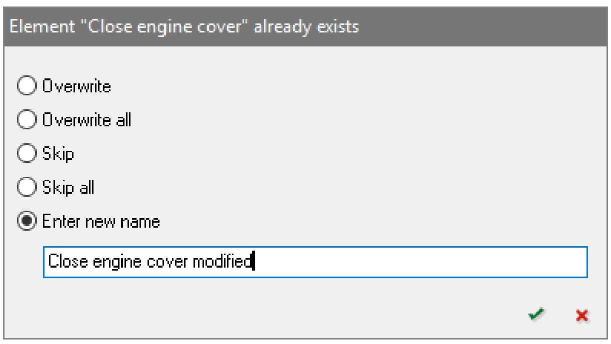
To assign **an element** from a library directly, click on the library icon, select the element and assign it with **ACCEPT**. If it comes from a library other than the project library, it is automatically copied to the project library.

To copy **several elements** at once, select the elements to be copied with ***Ctrl***+ left mouse button (single elements) or ***Shift***+ arrow key (element block). With **COPY TO PROJECT** or **COPY TO GLOBAL** (or by using the right mouse button) the elements are copied to the corresponding library. A global library is not created until you have copied an element to global.



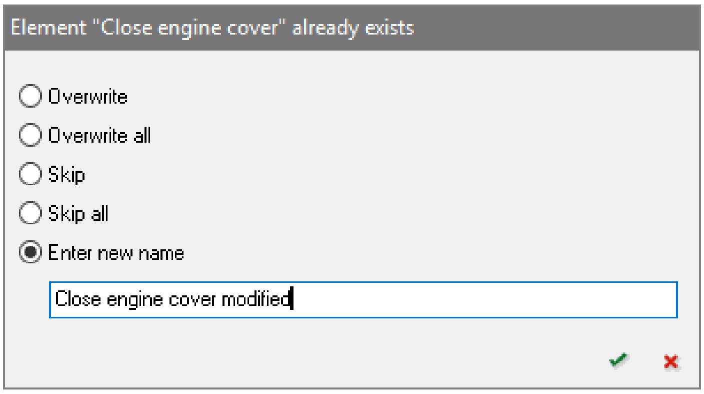
To copy **elements from a library that is not open,** first open the source library via **FILE | OPEN OTHER LIBRARY**. This is then displayed in the tab *Project2*.

If an element already exists in the target library, you will be offered several options on how to handle it:



Comment

For each library item you can enter a comment of any length and additional characteristic values in the tab *General* or in a separate tab *Comment*, for example, literature references, composition of frequencies or special features.



The comment of the library elements in the system library contains all important information from the literature or the manufacturer.

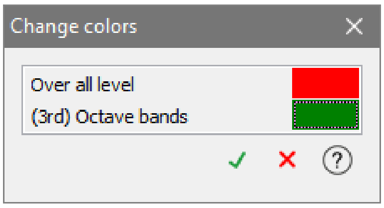
Y axis scaling

For the graphical display of spectra (emission, absorption, sound attenuation and transmission library), the range of values is optimally displayed in the window via an autoscaling of the Y-scale. If you want to compare a spectrum, for example, to a representation from the literature, it may be sensible to switch off the autoscaling and select the value range yourself. Call **VIEW | Y-SCALE**, switch off the autoscaling and enter the minimum and maximum value in the Min and Max fields.

Colors

For the printout from the libraries or the printout of the Graphics within the result table and the screen display, you can adjust the colors for the respective values.

Call **VIEW | COLORS**. If the menu item is not occupied, then a library is currently active in which there is no graphical representation of the values (evaluation library). You will see a window with the selected colors. With a double click on the color, you can select another color.

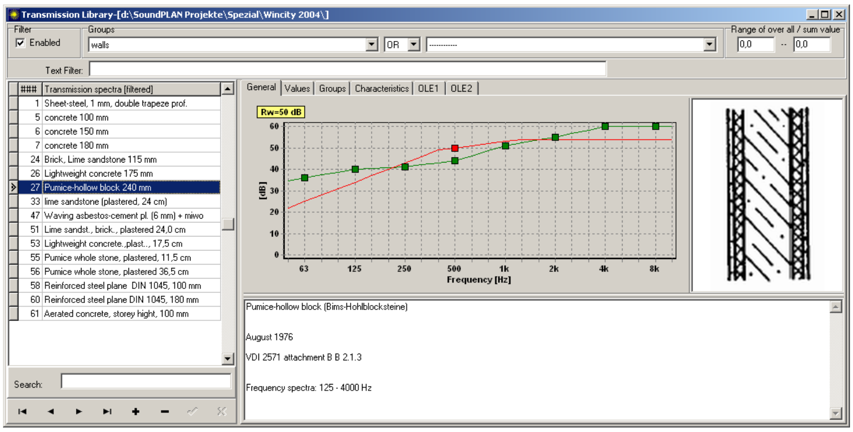


Element name length

You can change the maximum length of element names separately for each library under **EDIT | MAXIMUM LENGTH FOR ELEMENT NAMES.** By default, the maximum length is 80 characters.

Emission, absorption, transmission, attenuation - general

On the first tab, you will see the graphics of the diagram, the sum level, a picture of the element (if available) and a comment about the origin of the spectrum.



Filter function

The library elements can be filtered by group membership (additionally with AND / OR links by two groups) as well as by a text occurring either in the element name or in the description.

Insert pictures

In the picture area you can assign your own images or sketches for the individual elements. The pictures are saved directly in the library - therefore the files should not be too large. The pictures are not adjusted to the picture area. Without changing the image area, Graphics with 250 x 250 pixels are displayed completely - we recommend that the pictures do not exceed this size, so that the library does not become too large. You can change the sizes via the splitter between the individual areas.

Press the right mouse button and select **LOAD** to select a file or **PASTE** to insert a picture from the clipboard. **CLEAR** removes the picture again.

Insert OLE links

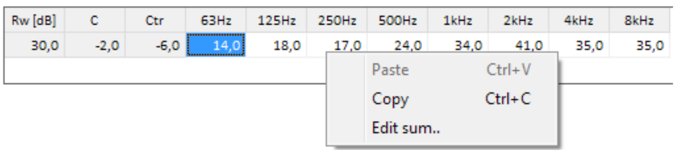
In addition to the direct storage the program offers 2 OLE connections to connect library elements with any information such as a recording of the sound of the source, a measurement protocol in a word file or an Excel spreadsheet.

The files you are connecting via OLE will be copied into the project respectively the Globdata folder. 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.

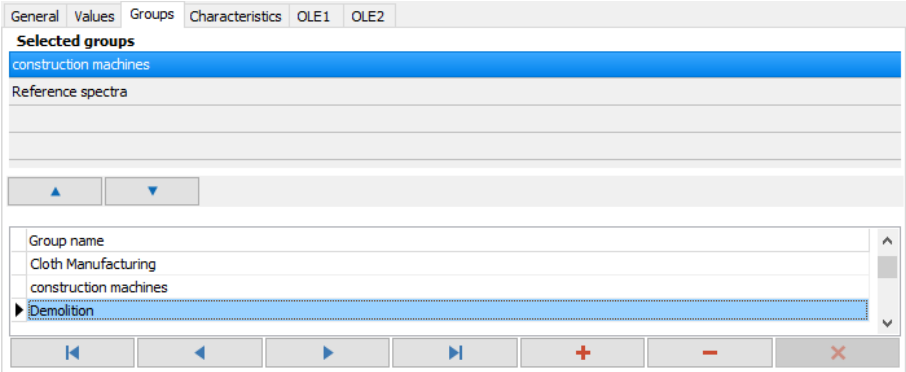
Edit sum

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 assignment

Up to four groups can be assigned to the elements of a library. The groups are evaluated as search criteria and for the documentation of noise sources. Please go to the tab *Groups*.



In the lower part you see the existing groups, in the upper part you define the group assignment to a library element. Click on + to enter a new group name. Use the blue triangles to create or remove the assignment.

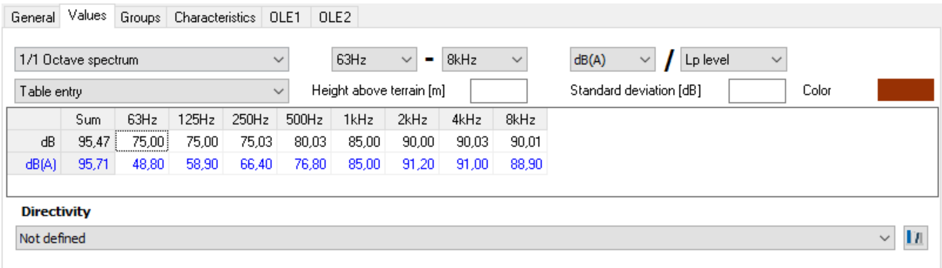
If several colleagues in the office use SoundPLAN, precise agreements should be made with regard to the use of group names.

To delete a group, click the minus sign. **Attention**, when deleting a group, all assignments to this group name in the elements of the library will be deleted. Please think first and delete later!

Assign colors

In the project library, colors can be assigned to the emission, absorption and transmission spectra, which can be output in the Industrial building editor and in the Graphics for the corresponding sources and components instead of the colors defined in the object types, see "Assign colors from the library" (page 178).

Emission library



Select whether the values are available as **THIRD-OCTAVE** or **OCTAVE SPECTRUM** or as **SINGLE VALUE** and determine the lower and upper limits of the frequency range or the center frequency.

Depending on how the data is available, select the appropriate weighting filter (linear (unweighted) or in A, B, C or D weighting) from the drop-down list.

If you have the values in [dB], but you want to use [dB(A)], then enter the levels unweighted as specified and then switch to dB(A) in the selection list. You will be asked whether you want to convert the spectrum to the new weighting filter. If **YOU SELECT YES,** the spectrum will be converted, if you select **NO,** only the display will be changed, but the linear spectrum will not be changed.

Above the entered emission spectrum with the selected weighting, the unweighted spectrum is displayed. The entered spectrum and the selected weighting filter are displayed in blue text. You can change values in both the weighted and unweighted spectrum. The values are immediately converted to the other spectrum.

Enter whether the spectrum is a sound pressure level (Lp level), a total sound power level (Lw/unit), or a length/area-related sound power level (Lw/m, m²).

HEIGHT ABOVE GROUND: For spectra whose emission is always at the same height above ground, the emission height relative to the ground can already be defined in the library. When transferring the spectrum, the source height is also taken over. In the properties dialog of the noise source, the checkbox **USE LIBRARY DEFINITION** must be activated under **TERRAIN REFERENCE.**

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.

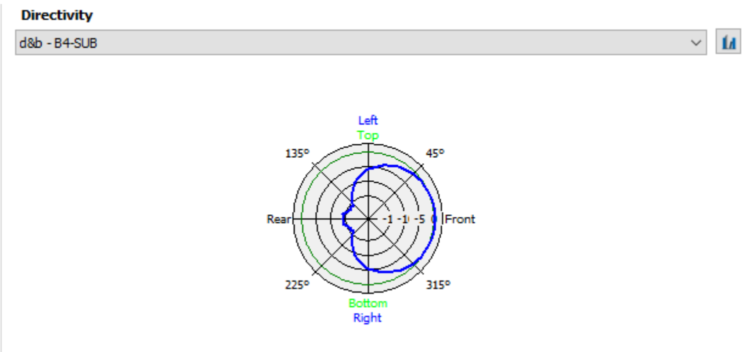
Low frequency noise

The wave length is the only parameter for the screening, it can be calculated for any frequency. The air absorption in accordance with 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

In addition, a 2D or 3D directivity from the directivity library can be assigned to the elements of the emission library. Select an element contained in the project from the selection list or use the library icon to go to the Directivity library (page 227).

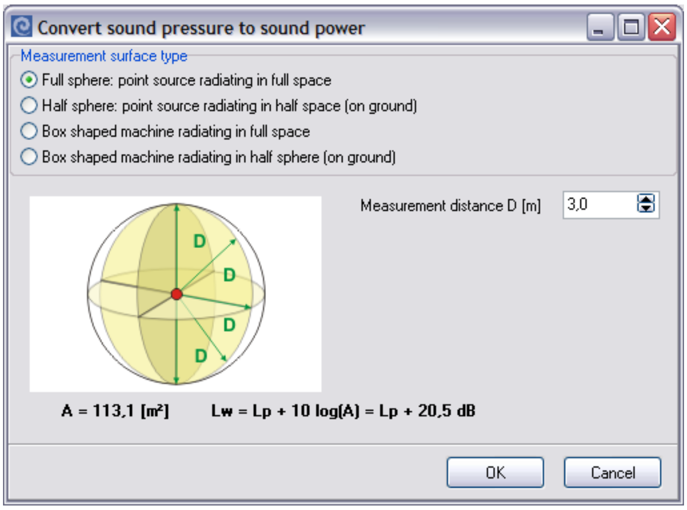


Convert sound pressure to sound power

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.

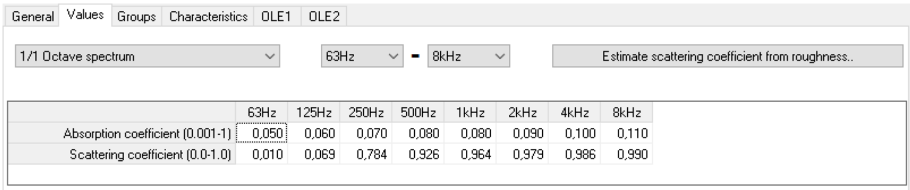
Call **EDIT | CONVERT SOUND PRESSURE TO SOUND POWER** (or right mouse button on the spectrum).

Note: The reference for the spectrum must be "Lp/Level", after conversion it is referenced as "Lw/unit".



Select which type of surface was used as the basis for measuring the sound pressure level. Enter the measuring distance and, for rectangular machines, the dimensions of the machine. Press OK to convert the spectrum into a sound power level using the displayed formula.

Absorption library



	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz
Absorption coefficient (0.001-1)	0,050	0,060	0,070	0,080	0,080	0,090	0,100	0,110
Scattering coefficient (0.0-1.0)	0,010	0,069	0,784	0,926	0,964	0,979	0,986	0,990

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. 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.

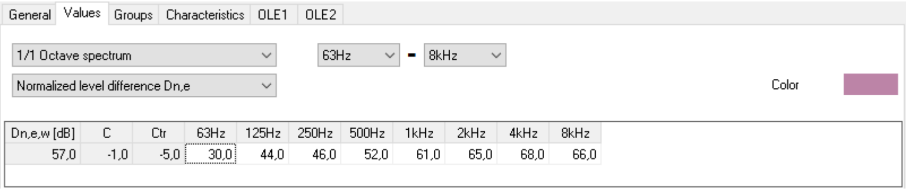
If the scattering isn't high enough, unphysical structures can emerge in the sound field; zero scattering is for academic purposes only.

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").

The information required for the calculation of the flank transmission according to ISO 12354-3:2017 (element type, surface-related mass, ...) is entered in the tab index card *Characteristics*, see "Flanking transmission ISO 12354-3:2017" (page 585).

Transmission library



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 ISO 12354-3:2017).

The correction factors C and Ctr are used calculations according to EN ISO 12354-3:2017 and DIN 4109:2016/2018.

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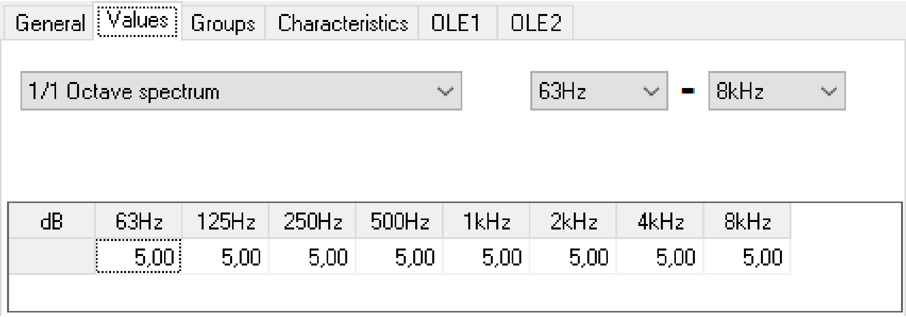
Attenuation library

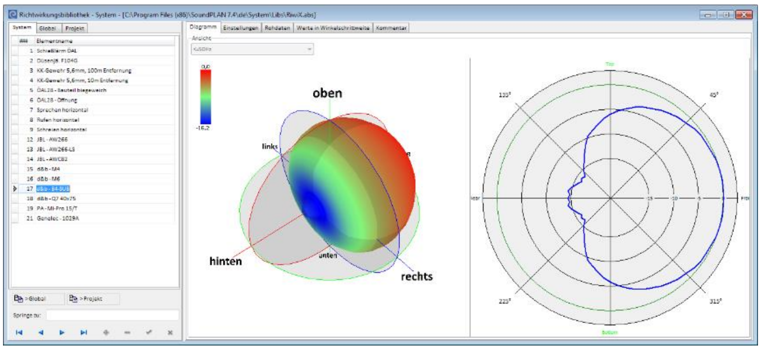


The attenuation library is used with the module Expert System Industry. Select either **octave** or **third octave** spectra and determine the lower and upper boundary of the frequency range.

Costs for the evaluation in Expert Industry can be entered in the tab index card *Characteristics*.

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.



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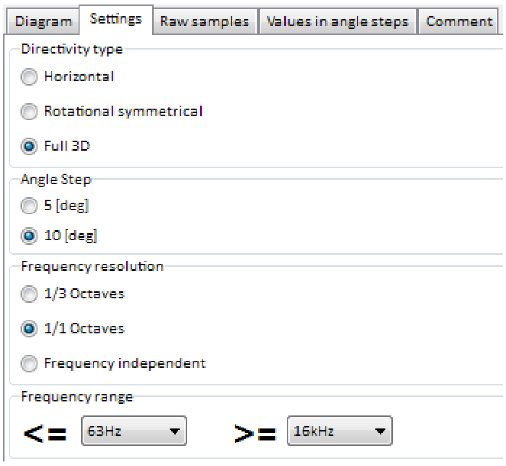
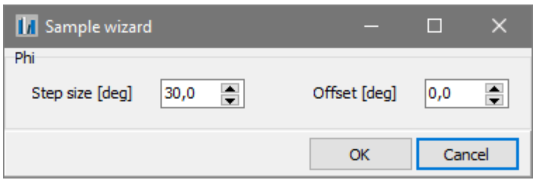
Enter directivity

Under the tab *settings* select the directivity type, the rate of angular increment and the frequency resolution.

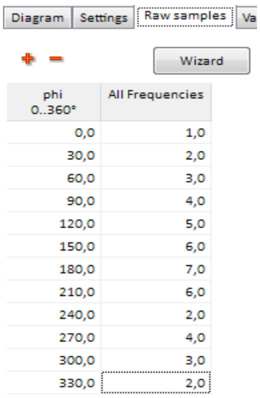


If the angle/value pairs are given for angle step size 5 or 10° steps selected in the settings, then enter the values in or copy them to the tab *Values in angle step size*. If the angle/value pairs are available in other increments, you can interpolate the values in 5 or 10° steps from the available values in the tab *Raw data*.

Add single lines with the red + button or create multiple angle/value pairs using the **WIZARD**.



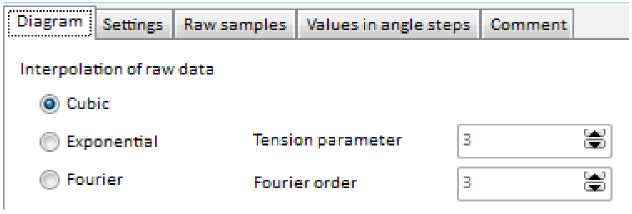
Enter the **STEP SIZE** of the pairs to be generated and, if necessary, an **OFFSET** of the first pair with respect to 0°.



Depending on which directivity type you have selected, enter the values for the angles Phi and/or Theta. For frequency-dependent directivities, you need one value per 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 (with at least 4 value pairs). The **cubic spline,** the **exponential spline** and the **Fourier spline**.



The tension factor or the Fournier order 1 to 30 influences the smoothing of the spline. The tension factor/Fournier order 1 corresponds to the cubic spline. The interpolation line is displayed in color.

0° is the axis of the noise source. When assigning noise sources to buildings, this is the normal of the building facade.

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°.

Input example for 2-fold symmetry

Angle	Delta [dB]
30	5
60	5
90	4
120	3
150	2
180	1

Input example for 4-fold symmetry

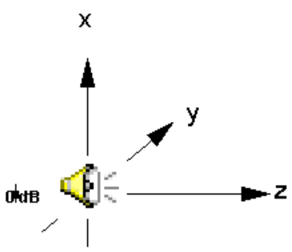
Angle	Delta [dB]
20	5
40	3
60	1
80	-1
90	-2

Then switch 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 "[CLF Import (Common Loudspeaker Format)]" (page 235).

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.



Emission in z-direction

If you do want to compile your own 3D directivity, SoundPLAN provides a wizard to generate the phi and teta values.

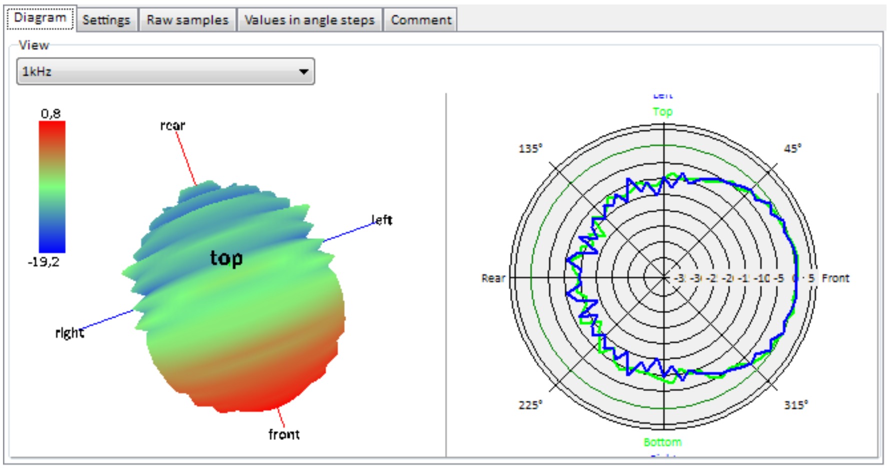
3D of horizontal and vertical directivity

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.

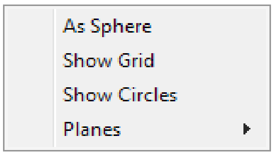
3D-presentation under the tab Diagram

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.

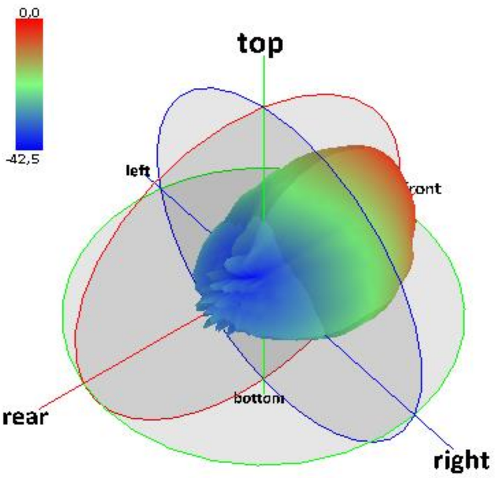


With the ***left mouse button,*** you can rotate the 3D-view into the horizontal ***shift+left mouse button*** rotates around the vertical axis and ***Ctrl+ left mouse button*** has all degrees of movement active.

With the right mouse button toggle between the displays:



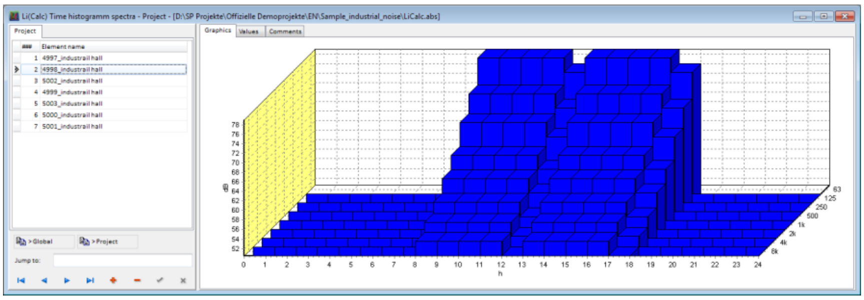
AS SPHERE shows the values of the directivity as a color-coded sphere. The coloring indicates the addition to the average that makes up the directivity. The display tools **SHOW RASTER**, **SHOW CIRCLES** and **PLANES** help with the checking of the data for the directivity.



Li(Calc) day histogram 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.

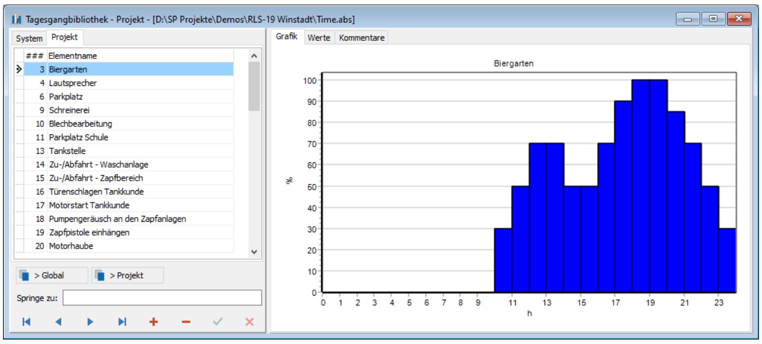


This lib contains the day histogram frequencies as a calculation result of an indoor simulation (Hallout). You cannot enter own elements in this library.

Day histogram library

The day histograms or operating times are used in industrial noise projects and in sports and leisure noise if sources do not radiate with a constant sound power over 24 hours. Some assessments prescribe quiet periods during the day in which surcharges must be added to the contribution levels of these quiet hours. Often, the loudest night hour is evaluated instead of the assessment level over the entire night period. Single descriptors similar to SEL, LDN and others can be created and customized only if the sound power is known for the entire day.

Therefore, for each hour the information is needed whether a noise source is in operation or not, or whether it is partially in operation. The case "partially in operation" can be defined in different ways, for example a noise source is in operation 50% of the time, or 30 minutes per hour, or 1800 seconds per hour. If you specify the day histogram in " events per hour", the sound power level refers to the unit 1 event per hour.



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 create a new element and go to the tab **VALUES**. For each hour, enter the duration of the event.

You have the possibility to enter the operating times in different modes:

- Minutes / hour [min/h]
- Seconds / hour [sec/h]
- Events / hour [E/h]
- % [%]
- dB [dB]

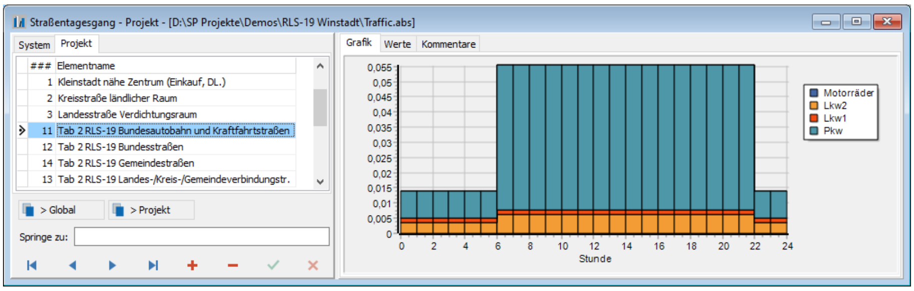
The values in a dB day histogram are always added to the sound power level of the source. If, for example, when you enter measured values that refer to the total sound power, the sound power level of the noise source must be set to 0 dB.

For hours when a source is not active, -1000 dB must be entered for the dB day histogram.

A day histogram with the units %/h, min/h and sec/h can be inverted with the **INVERT** button at the push of a button. This is particular helpful to generate for example “door closed“ from the day history of “door open“.

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.

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.

0.00;-;-	Shows positive values with two decimal places and 0 as "-".
0	Displays all values without decimal places

The ranges are separated with semicolons, the decimal separator is a point.

SELECT the appropriate standard from the Standard drop-down list. Standards with the same motor vehicle types have been grouped together.

Activate **DO NOT NORM** if the sum of all 24 values is not 100%, as for the table 2 of the RLS-19.

Assessment library

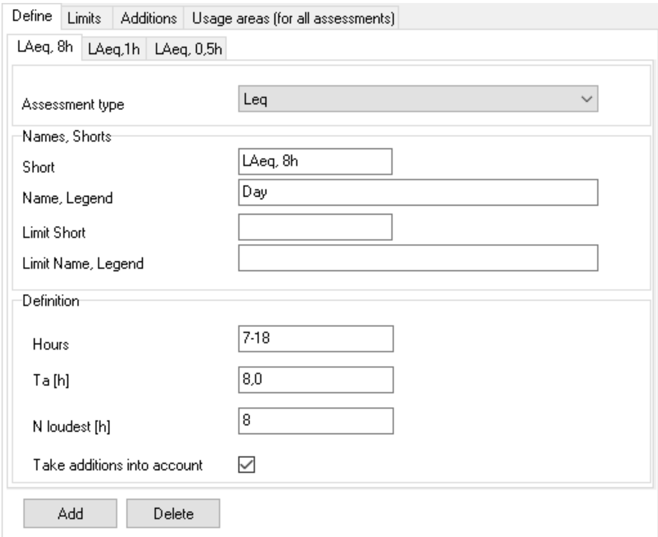
The assessment library contains the noise limit values of the common regulations for the assessment of noise and can be extended by further elements (assessment regulations) at any time.

The noise limits vary according to noise type, assessment regulation and area usage. The abbreviations for the area usage are mainly taken from the German Building Use Ordinance (Baunutzungsverordnung). Area abbreviations and names are adapted for all assessments in the tab *Area Usages*. If you need other designations depending on the standard (for example, for the Swiss StL 97), enter them here and check the associated limits. The abbreviations you enter will be displayed wherever the area usage is output (Results tables, Spreadsheet, Wall design and Level tables in the Graphics).

Create a new assessment

Creating a new assessment

Create a new element. In the tab **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 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 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 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

5

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.

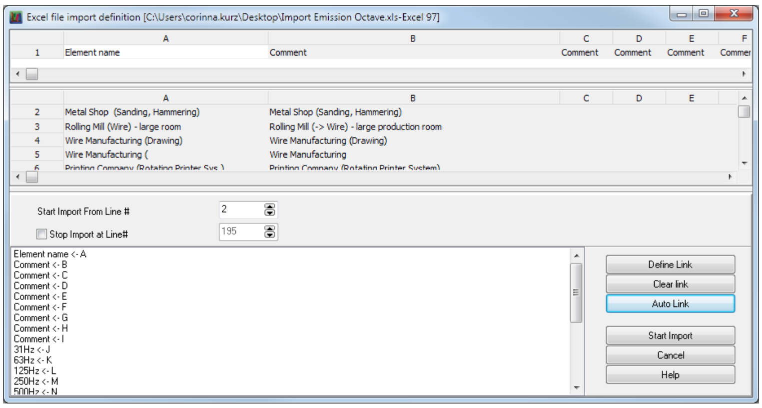
LMAX-INDUSTRY: Here the peak noise level that is caused by one or by multiple sources is calculated. If multiple sources are involved, the contribution levels of these sources at the receiver are considered as not coincided.

Importing library elements

If you already have libraries in Excel or in an ASCII format, you can use them in SoundPLAN with little effort. For point sources that are available with coordinates and an octave spectrum in ASCII format, there is a special import in the Geo-Database, see "Import point sources (ASCII) " (page 77).

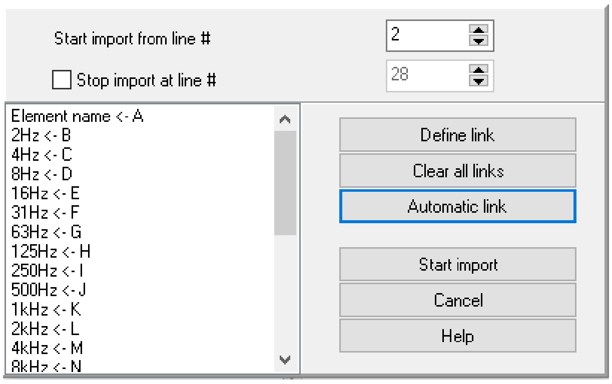
After you opened the library, first select the library into which the data is to be imported, for example, the emission library.

Call the import via **FILE | IMPORT** and select the import file.



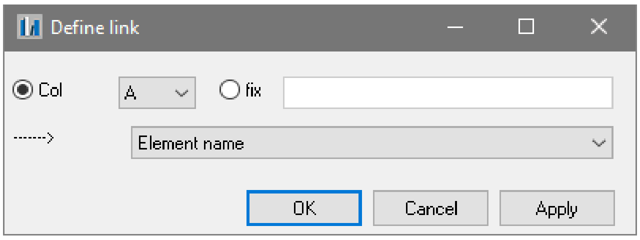
The columns of the Excel or ASCII file must be assigned to the fields in the library. SoundPLAN offers an **AUTOMATIC LINK TO** compare the terms in the column definition of the source file with the fields in the library. The list of assignments found is displayed in the field at the bottom left of the screen.

***Note:** Templates for Excel files are supplied in the SoundPLAN installation directory (..\de\System\Libs\). If you arrange your Excel library exactly as in the template, you can import the library almost at the push of a button 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.



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.

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 an associated directivity element (with the same name) is created in the directivity library.

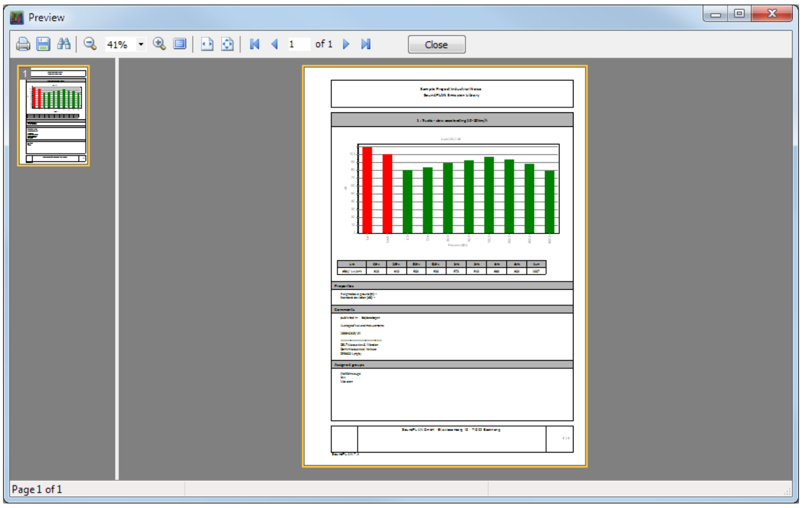
Print library elements

From the library, the element list of the respective library and the individual element data can be printed in detail.

The element lists contain all elements of the corresponding library and the associated values in tabular form. In the element data, the active element with all details (chart, values, comments ...) is printed on a DIN A4 page.

Call **FILE | PAGE SETUP** for the **ELEMENT LIST** or the **ELEMENT DATA** to define the appearance of the headers and footers.

With **FILE | PRINT PREVIEW** you call up the preview window in which you print the element data or the element lists.

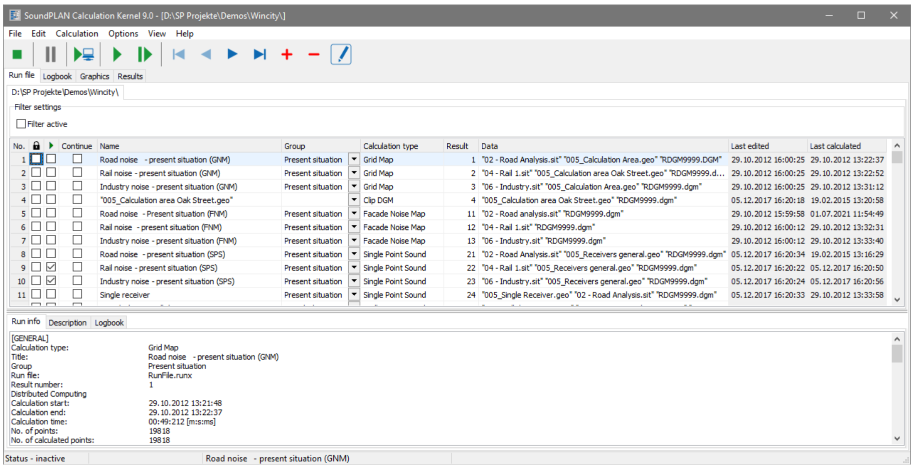


6 Calculations

Open the **Calculation core** from the SoundPLAN Manager. The interface of the calculation core is structured in tabular form so that you always have an overview of the calculations in your project and can quickly recalculate individual calculations if data has changed.

Run file and calculation runs

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.



You see at a glance 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”).

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 "Start or cancel a calculation run" (page 242).

A detailed logbook informs you of warnings and error messages that happened during the calculation and 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.

Create and edit calculation run

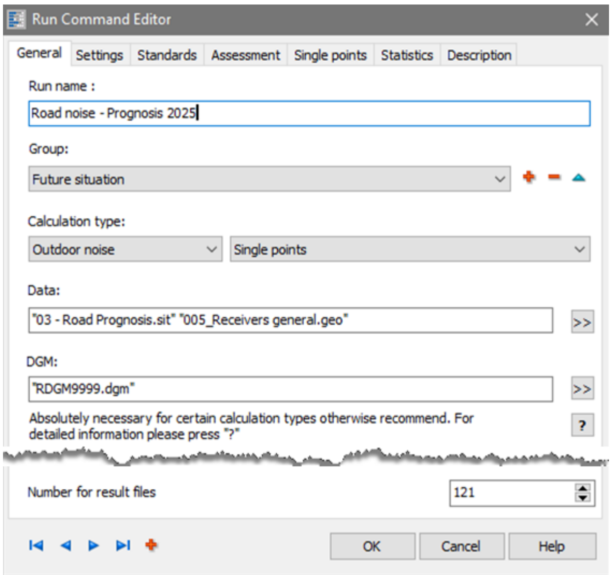
+ When you open the calculation core for the first time in a new project the run properties are opened. In the course of project work you will generate multiple more calculations, to request a new one click on the icon + on the navigation bar.

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.

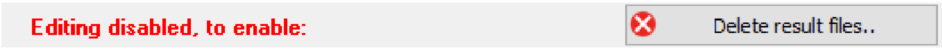
If you change certain parameters each time, it is sensible to change the defaults via **OPTIONS -> DEFAULT STANDARDS** and **OPTIONS -> DEFAULT CALCULATION SETTINGS** globally for the future.



The 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 "Calculate tile projects" (page 501)".

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 guarantees, that calculation info and calculation result have the same parameter settings.



Calculation types

Select a category and a calculation type from the drop-down lists Depending on the calculation type, the calculation run properties are extended with boxes for necessary settings:

Geometry

- ➔ Digital ground model (page 253): The DGM calculation can be triggered in the Calculation core or in the Geo-Database. Elevation points, contour lines and, if necessary, elevation information from roads, rails, tunnel portals and other objects are meshed as the basis of the 3D model and for the noise calculations.
- ➔ Clip DGM via an area (Page 255): Cuts out a partial area from an existing DGM.
- ➔ Calculate objects in DGM (page 256): Calculates objects into an existing DGM.
- ➔ DGM Import (page 257): Imports DGMs in ITF format into the SoundPLAN data structure.

Noise propagation outdoors

- ➔ Single point calculation (page 257): Calculates manually set receivers (free field or at the building) for any number of floors.
- ➔ Grid noise maps (page 258): The grid noise map calculates a receiver grid within a calculation area in a specified height above ground.
- ➔ Façade Noise Maps (page 262): 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 266): 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 262): The Cross-sectional Noise Map is a vertical Grid Noise Map.
- ➔ Noise allotment - Noise allotment (page 543): 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).
- ➔ Wall design - Wall design (page 355): Pre-calculation of a wall matrix with information of the efficiency of each wall element.

Indoor noise and room acoustics

- ➔ Single points, grid map, sectional noise map, sound propagation curve, measurement path, see "Noise in rooms and from inside to outside (Indoor noise and room acoustics)" (page 272): Calculates the levels in industrial buildings from indoor noise sources and the properties of the industrial building
- ➔ Hallout (inside to outside): 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

- ➔ Aircraft noise (page 551): Single points, grid noise maps and cross-sectional noise maps and façade noise maps can be calculated.

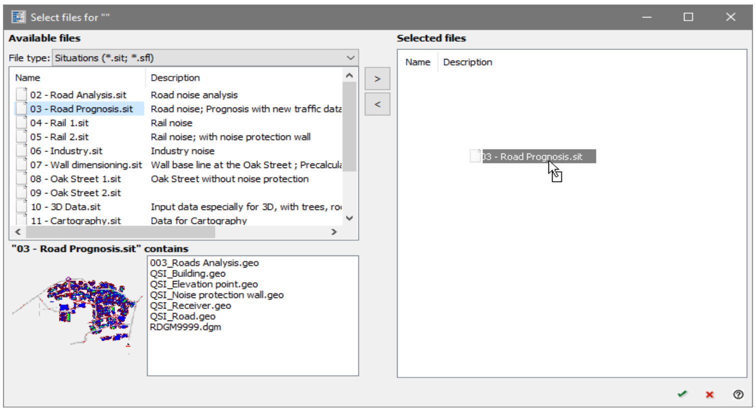
Tools

- ➔ File operations as calculation run (page 267): 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 store the result of a file operation, it is mandatory to use the calculation core.
- ➔ Import of Grid noise maps (page 271): I Import of ASCII data from grid noise maps for example to overlay different noise types.
- ➔ Hotspot calculation (page 269): Determines the areas in which a particularly large number of people are affected by noise on the basis of grid or facade noise maps, for example using noise indicators.

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 for the calculation data, you open the window for the file selection where the data are selected and assigned to the calculation run.



Select the Situation(s) with the mouse and move them to the right field by double-clicking, using the arrow key or "Drag & Drop". A DGM assigned to the Situation is automatically taken over as well.

It can also be sensible to add individual Geo-Files. For example, for a Grid noise map a calculation area or for a single point calculation a Geo-File with the receivers can be taken over separately. First select "Geo-Files (*. geo)" from the **DATA TYPE** selection list. To select several files, press the Shift or Ctrl key.

In the same way you can select DGM’s, attenuation files from Expert Industry or. All different file types can be used in one calculation.

If you want to remove a file from the calculation, click the file in the field on the right and move it back to the left field.

File number for 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.

Grouping calculation runs 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.

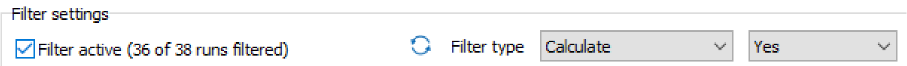
The run file can be filtered or sorted by these groups.

Filter settings

Click **FILTER ACTIVE** and select the filter option:

- Group name
- Calculation type
- Calculate checked yes/no
- Text filter

As soon as a filter is active, you will be informed how many calculation runs are not displayed due to a filter.




If 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 refresh button.

Duplicate calculation runs

Right click on an existing calculation run to duplicate it with all settings and used data via **COPY + PASTE INTO NEW LINE(S)** ***(Ctrl + Alt + V).*** The cursor jumps to the cell **RESULT;** enter a result file number that has not yet been assigned. You can duplicate several calculation runs simultaneously with ***Shift + arrow keys*** or ***Ctrl*** + ***left mouse button.***

Restore calculation run from a result file

Assuming you have accidentally deleted a calculation run, the calculation run can be restored from the results file. Click on **EDIT | IMPORT RESULT FILE**. Select the appropriate file from the list of result files and press **OK**. If you want to import several files, press the ***Shift*** or ***Ctrl*** key and select the result files.

Append run file from another project

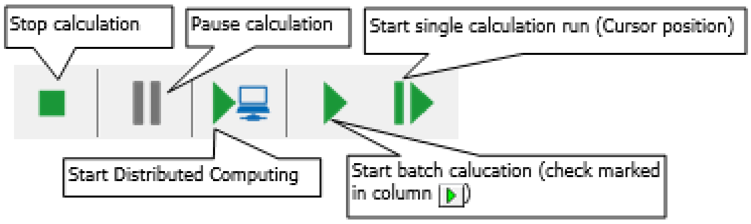
It is possible to calculate several run files from different projects successively. This is useful if you work on different projects and your PC could deliver more than one result over night or over the weekend. Or if different colleagues use a joint computer pool for example for distributed computing. 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.

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 cancel a calculation run

With the symbols below the calculations are controlled:

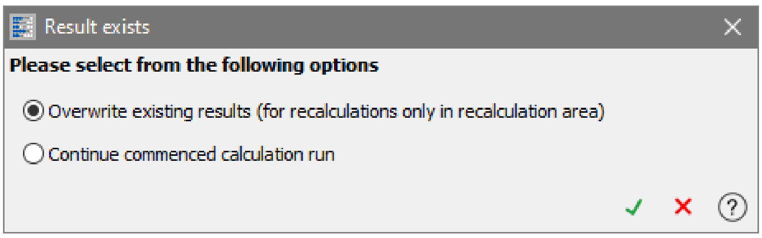


You can also execute these functions via the **CALCULATION** menu or via the short cuts keys specified there.

Furthermore, you can use ***F7*** to calculate a calculation run **STEP BY STEP,** i.e. the next receiver is not calculated until you press ***F7*** again.

At the end of the calculation, a message is displayed in the status bar so that you are informed about the end of the calculation even if the calculation core is not in the foreground.

All calculations can be stopped during the calculation and continued later. If a calculation run has already been calculated or partly calculated, you will see this message during a single calculation run:



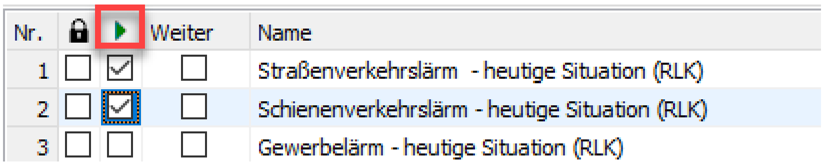
You can choose whether you want **OVERWRITE EXISTING RESULTS** or **CONTINUE** a calculation run that you had cancelled during the calculation. For a recalculation, also select overwrite results, only the results in the recalculation area will be overwritten.

If you select **CONTINUE** in the table, **CONTINUE** is the default setting as soon as results are available.

Details on distributed computing are described in a separate section, see "Distributed computing" (page 284).

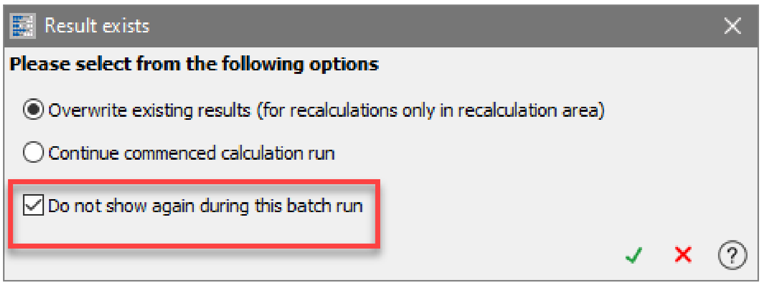
Calculate calculation runs successively (batch mode)

A batch run calculates all calculation runs that are marked in the second column (green triangle) with a check mark.



The calculation is triggered with the **START ALL CALCULATION RUNS CHECKED FOR CALCULATION ICON**.

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 SHOW AGAIN DURING THIS BATCH RUN.** The setting you select is used for all calculations during the batch run.



Logbook, error messages and calculation specifications

The logbook logs all actions during the calculation run. For example, what data is loaded, what is calculated, whether warnings or errors occurred, etc. The logbook is saved for each calculation run. You can clear, save and print the logbook manually.

Calculations can produce errors! Most errors are caused by faulty data or missing parameters and attributes, 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. Hints and information are logged with blue writing, warnings with red italic writing; exceptions are printed in magenta and fatal errors are in bold red writing.

If you want to check hints, warnings and errors without seeing the calculation protocol click the right mouse button and deactivate **SHOW PROTOCOL DATA**.

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.

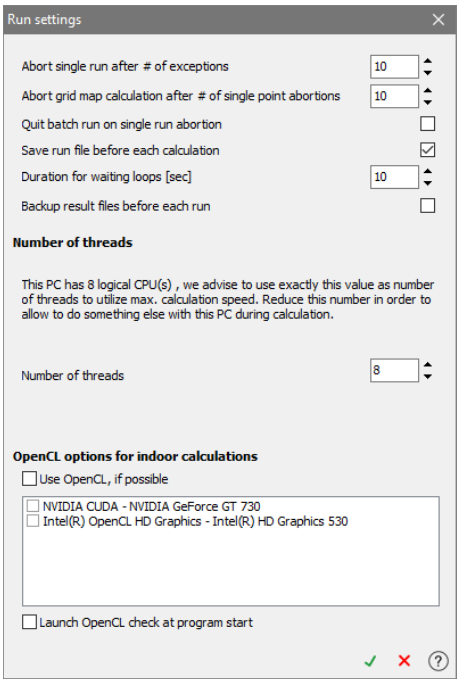
When **WARNINGS** are given, the calculations are continued as normal and for the most part the results are reliable. For example, the warning message "Grid elevations could not be calculated for all receivers, x receivers were not calculated" means that the elevation data did not make it possible to 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 to reproduce the error they need the data.

ERRORS 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 attributes". Use **PREFLIGHT** in the **Miscellaneous** ribbon in the Geo-Database to find conflicts in beforehand.

You can open the calculation logbook in the Geo-Database logbook for finding errors caused by a specific geometry object, see "Logbook and geometry check" (page 127).

Calculation settings



In **OPTIONS | CALCULATION SETTINGS** you set general defaults for all calculation runs across all projects.

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.

QUIT 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.

Note: *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.

The **DURATION FOR TIME LOOPS** controls the time in which you can choose from several options.

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).

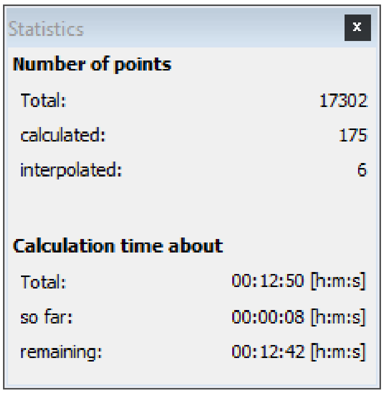
SAVE PREVIOUS RESULT BEFORE EACH CALCULATION creates a subfolder in the project where the result files of the last calculation are saved.

Multithreading: The Calculation core automatically detects how many cores (logical CPUs) the PC has (**NUMBER OF THREADS**) and uses all cores for the calculation by default. Decrease the number of threads if other tasks become slow due to CPU utilization while SoundPLAN is computing.

The defaults for OpenCL are described in "OpenCL support for indoor calculations with SPD", page 282.

Statistics

After you started a calculation run, SoundPLAN displays status information about the calculation that is running.



The statistics shows you the number of points to be calculated and an approximate indication of how long the calculation will take. The calculation time can only be an approximate indication because geometric conditions or possible interpolation can change during the calculation, which strongly influence the calculation speed. The approximate calculation time is updated in a time loop.

Calculation run info

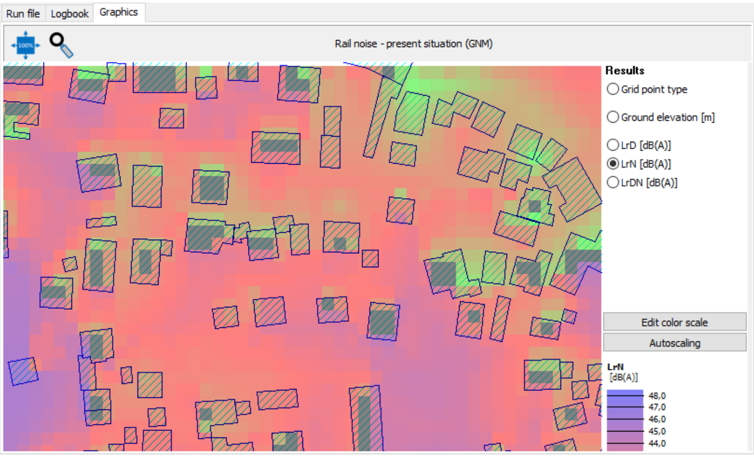
The Calculation run info logs all settings and standards used during the calculation as well as the used input data and the calculation core version. This ensures a complete documentation of a calculation. The calculation run info is output below the run file. It is also displayed in the results tables and can be printed there.

Graphical output in the calculation core

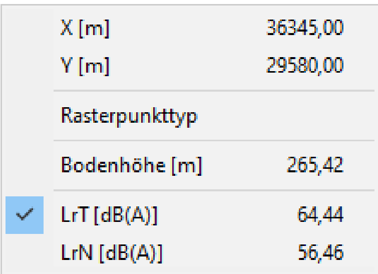
To check the calculation results graphically, you can already view them during or after the calculation in the Calculation core, tab *Graphics*. In case of single points, Facade Noise Map and triangle noise map the level diagram and the result for all floors are displayed, in case of grid map and cross section map you can switch on the right side between the ground height, the grid point type and the calculated values, also group results, frequencies or room acoustic parameters. Depending on the selection, the color scale or the legend changes.

A printout is not provided at this point, for this purpose load the results into the Graphics.

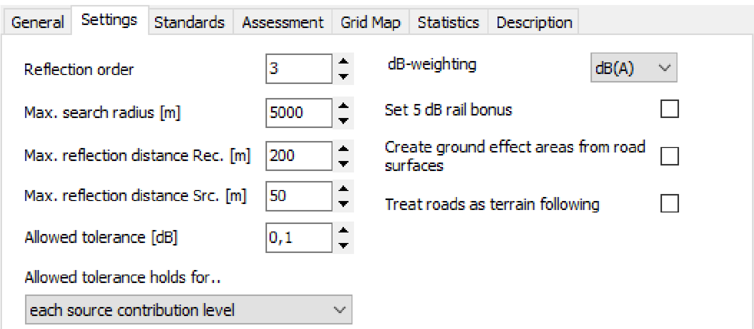
Note: The graphical output during the calculation may increase the calculation time, even with distributed calculation!



The **GRID POINT TYPE** visualizes interpolated, calculated and grid points in buildings. To view numerical values, right click on a point of the grid map.



Calculation settings for noise calculations



The calculation settings are preset with defaults that are stored for the current project and as a global setting via **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 "Statistical accuracy" (page 289).

The parameter **REFLECTION ORDER** specifies how many reflections are to be calculated. Please refer to the standards and regulations used in your country to determine which reflection order you must set. The reflection order influences the calculation time.

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 the road width. Activate this check box for all standards that use this option.

If the DGM elevation from the road edge has been included in the DGM, the checkbox **TREAT ROADS AS TERRAIN FOLLOWING** in the tab *Settings* is set and displayed informatively grayed out. This has the effect that the height of the emission lines for roads with cross slopes are adjusted so that both emission lines are at the height above the DGM defined in the standards.

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 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

$$10*\log((10^{(0.1*R)}+10^{(0.1*F)})/ 10^{(0.1*R)})<T$$

with

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:

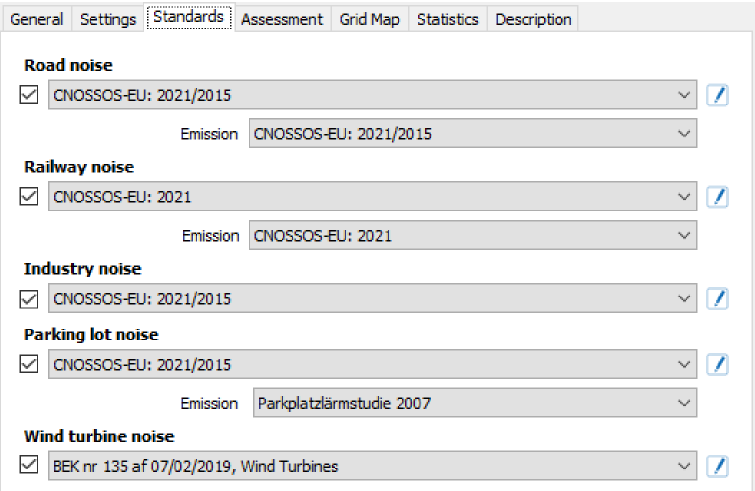
0.5 - 0.8 dB + **TOTAL RESULT (GROUP CONTRIBUTION LEVEL)**: Noise mapping projects, calculations in accordance to the END.

< 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.



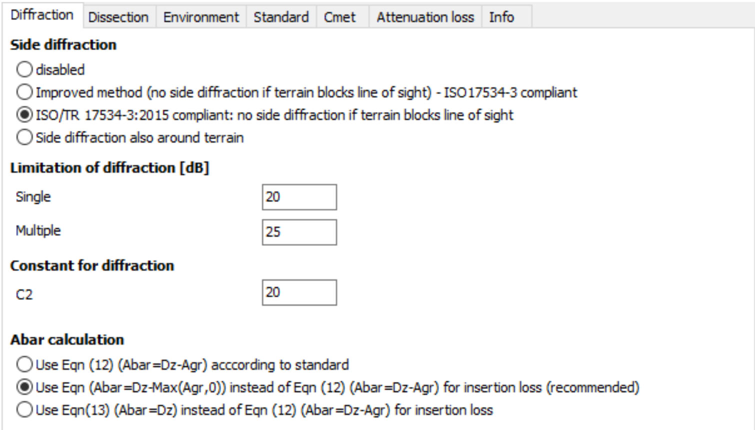
If different calculation methods are required in one project, you can change the standards for propagation calculation and the corresponding emission calculation for specific calculation runs. The calculation can only be successful, if the correct emissions have been entered in the properties of road, railway or parking lot in the Geo-Database.

If there are different emitters in the Situation, but they are not to be calculated together, you control the emitters to be calculated via the check mark. In this way, you can, for example, consider bridge structures of a railway track for a road noise calculation, industrial buildings as pure obstacles or hard road surfaces also for other calculation types as ground areas.

Standard details

Check the standard details. Depending on the standard some options will be available or not.

Tab "Diffraction"



Without side diffraction, only paths in a vertical plane (EV), which contains the source and the receiver, are searched around obstacles. With side diffraction, paths are also searched in a plane perpendicular to it (EL), which also contains the source and the receiver.

Side diffraction can be used even if it is not a part of the guideline. For standards where this is possible, but which do not use side diffraction, it is turned off by default.

The algorithms for ISO 17354-3:2015 compliant and ISO 17354-4:2020 compliant are essentially identical.

ISO 17354-3:2015 COMPLIANT: This variant is compliant for calculations according to ISO 9613-2.

Side diffraction paths are neglected if the lateral distance of the side diffraction path is more than 8 times the direct distance source - receiver. Side diffraction paths are also neglected if the terrain interrupts the line of sight.

ISO 17354-4:2020 COMPLIANT: This variant is compliant for calculations according to CNOSSOS-EU.

Only objects that penetrate the plane EV, or are connected to such objects, are considered. Side diffraction paths are neglected if the terrain interrupts the line of sight.

SIDE DIFFRACTION ALSO AROUND TERRAIN: Same as ISO 17354-3:2015 compliant, but side diffraction paths are also searched around terrain (DGM edges), provided that the terrain interrupts the line of sight. This calculation is very computation intensive and should therefore only be used in exceptional cases.

LIMIT OF DIFFRACTION: For single and multiple diffraction, a certain maximum diffraction loss can be specified. These values refer to the vertical diffraction loss, only.

CONSTANT FOR DIFFRACTION: According to VDI 2720 / ISO 9613-2, the diffraction loss Dz is calculated with the following equation:

$Dz=10\lg[3 + (C2/\lambda)\ C3\ z\ Kmet]$

C2 is equal to 20 and includes the effect of ground reflections; if in special cases ground reflections are taken into account separately by mirror sources, C2 = 40; extract from ISO 9613-2.

ABAR CALCULATION: There are 3 options for calculating the insertion loss

Abar=Dz-Agr according to eq. (12) of ISO 9613-2

Abar=Dz-Max(0,Agr) a modified form of eq. (12) of ISO 9613-2

Abar=Dz according to eq. (13) of ISO 9613-2

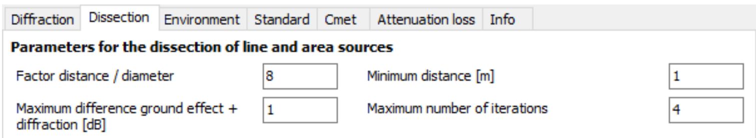
There are two different versions of the ground effect in ISO 9613, the regular method and the alternative method. In the alternative method there is a k0, describing the effect of a constructive reflection on ground, leading always to a rise in level in the range of 0..3 dB. Furthermore, there is a destructive 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.

Tab " Dissection"

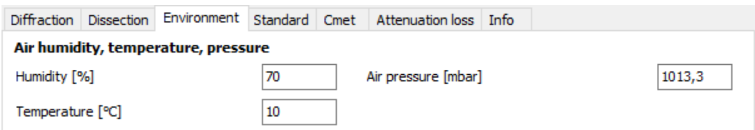


These parameters define how line and area sources are dissected in a number of point sources.

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]**.

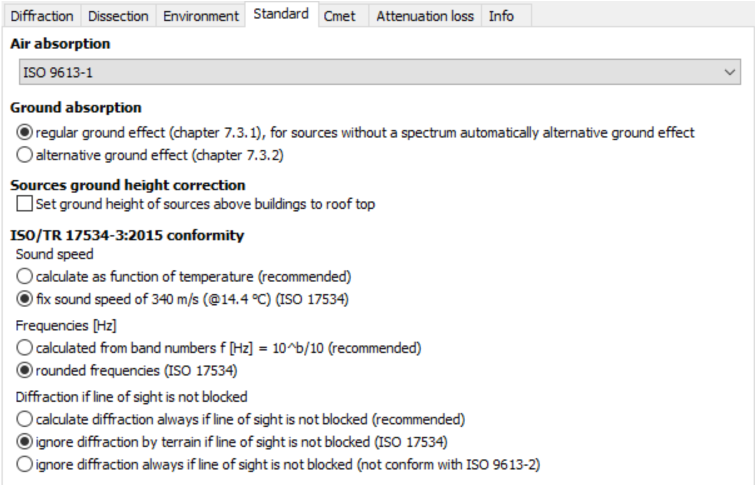
Next the ground effect and screening loss for the extremal points of the source segment are calculated. Is the maximal difference of ground effect + screening loss of these extremal points larger than **MAXIMUM DIFFERENCE GROUND EFFECT + DIFFRACTION** the source segment will be divided and the check repeated for both sub segments until the condition is fulfilled or the iteration depth is larger than the **MAX. NO. OF ITERATIONS**.

Tab "Environment"



HUMIDITY, AIR PRESSURE, TEMPERATURE: The environmental parameters are important for the calculation of air absorption. Moreover, the sound speed is a function of temperature, influencing the wave length and therefore the screening calculation.

Tab "Standard



AIR ABSORPTION: Select the standard according to which the air absorption is to be calculated.

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.

CALCULATION OF THE FREQUENCIES: The frequencies can be calculated either at rounded one-third octave frequencies or from band numbers.

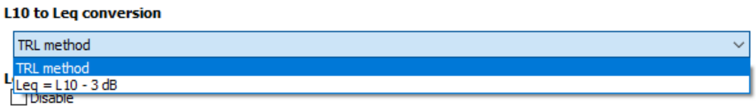
Here, the frequency f [Hz] = 10 ^ (0.1*b), with band number b.

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
10^(0.1*b)	501.19	630.96	794.33	1000.00	1258.93	1584.89	1995.26	2511.89	3162.28	3981.07	5011.87	6309.57	7943.28	10000.00

For **BUB:2021 Road and Railway**, a checkmark controls that the ground effect is calculated according to the BUB specifications for noise mapping (G=0 for buildings, otherwise G=0.6). This checkmark is switched on by default for new calculation runs.

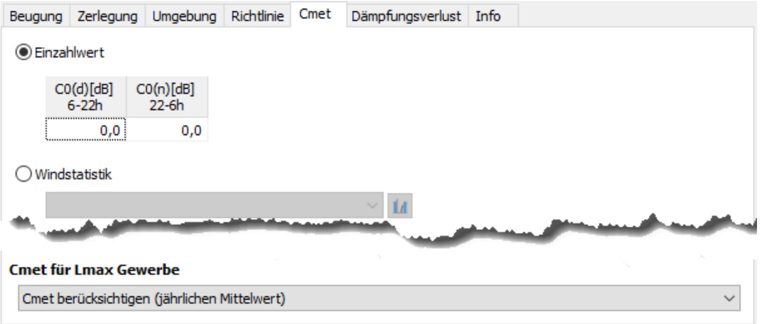
For the noise propagation calculation according to **CoRTN:1988** two options to convert L10 to Leq are available:



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.

6

Tab "Cmet" and "favorable / homogeneous"



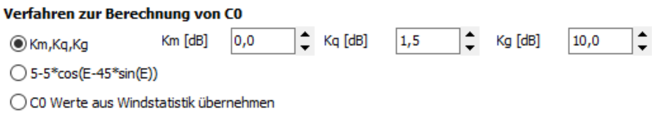
The calculation of the meteorological correction **Cmet** for the determination of the long-term average level is described e.g. in ISO 9613-2

Cmet=Max(0, C0[1-10(hs+hr)/dp])

The factor C0 can either be set as a single number value for the time slices or calculated from wind statistics.

For the **maximum level industry noise,** you can choose whether Cmet should be considered or not.

If wind statistics are used for calculation, C0 is displayed for information for the individual wind directions. In Germany, two main methods are used to calculate C0, depending on the federal state:

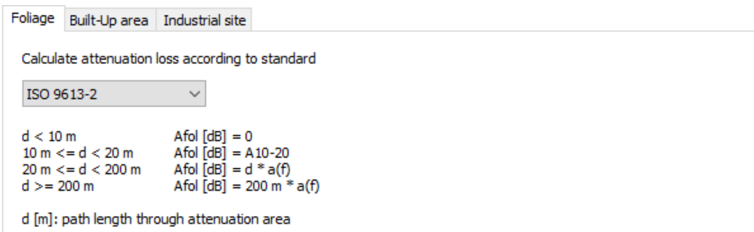


You can also specify fixed values per wind direction in the C0 library.

For other standards (e.g., CNOSSOS-EU), the frequency of propagation conditions **homogeneous** and **favorable** is entered as a percentage of favorable propagation conditions per time slice.

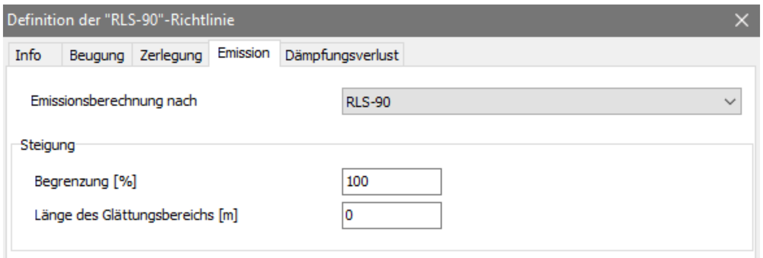
The time slices for Cmet are defined in SoundPLAN Manager, **OPTIONS | SETTINGS**, node "Traffic time slices Emission and Meteorology".

Tab "Attenuation loss"



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. See object type "Volume attenuation areas" (page 201).

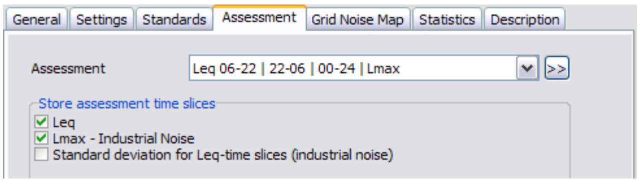
Tab index card "Emission" in the road standards



Slopes can be averaged over a reference distance to ignore small height unevenness for dense point distances. The settings are documented in the logbook. The road slope can also be limited to an upper limit in order to prevent unrealistic local level peaks if the DGM is not quite good.

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.

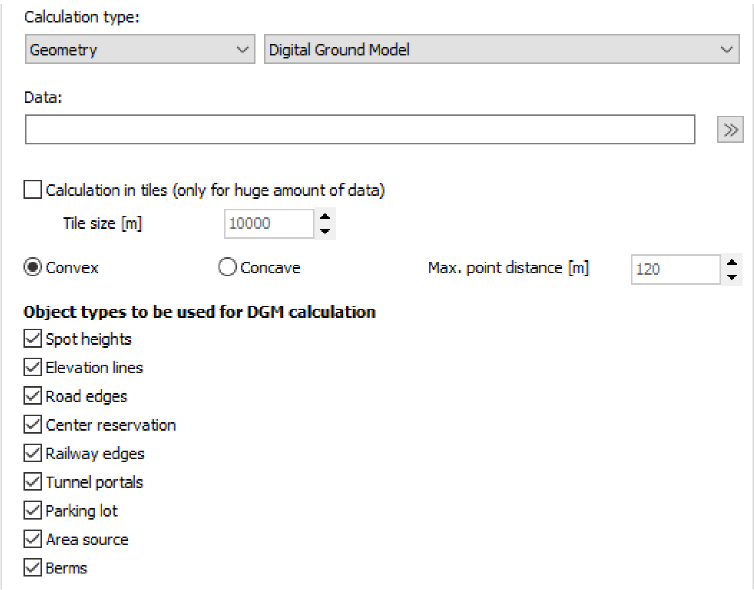
Calculation types

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.

Elevation lines and elevation points that are part of a situation but not included in the DGM are ignored!



Select the **calculation type GEOMETRY | DIGITAL TERRAIN MODEL**. Enter the data for the DGM calculation. In the lower part, select which object types shall influence the DGM calculation. Next to elevation points and elevation lines, it might be sensible to use roads and railways, tunnel portals, parking lots, area sources as well as berms.

The following geometry is included in the DGM (only objects entered with absolute elevation):

Roads	Edges of the carriageway resulting from the road cross-section
Railways	Edges and deltaH of the track bed (DGM parameters in the object dialog)
Tunnel portals	Width of the tunnel and the height
Parking lots / area sound sources	The input points of the edge lines
Walls	The calculated lines of the top roll and the calculated backwards wall line

In addition, you can use the "Center reservation" checkbox to specify whether the heights in the area of a center reservation should be included in the DGM or not.

After entering tunnel portals, create a new DGM again with these tunnel portals so that they are included correctly.

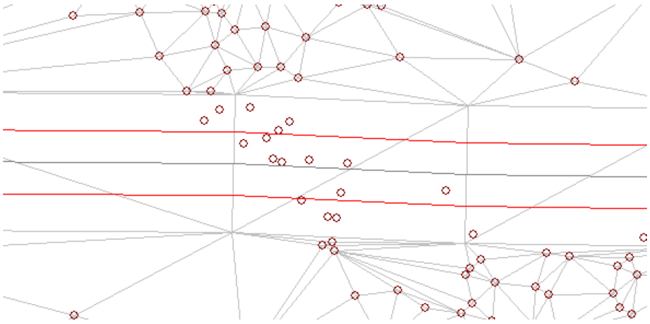
Points on bridges that are higher than the bridge surface are not included in the DGM. As a result, the emission line is not buried even in the case of imprecise bridge beginning / bridge end and in hillside situations.

In the case of large elevation point datasets, prepared via "Additional options for large elevation models" (page 503), select a file from the files stored in the "ElevData" subfolder; all *. elv files in this folder will be included in the DGM calculation.

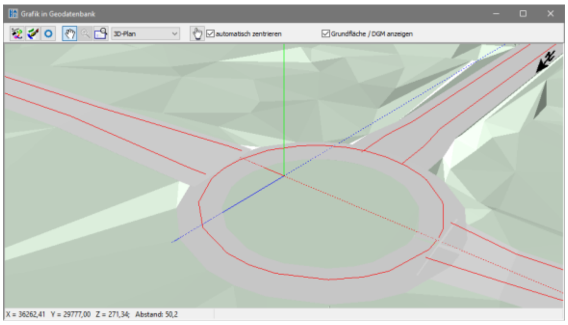
Activate **CALCULATE IN TILES** for large DGMs (complete urban areas or counties) and select the tile size in [m].

Embankment alignment for road and railway in the DGM

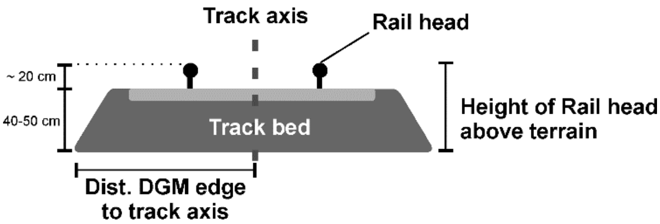
Elevation points within the carriageway of the road, or the track bed (see below) are not included in the DGM meshing.



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.

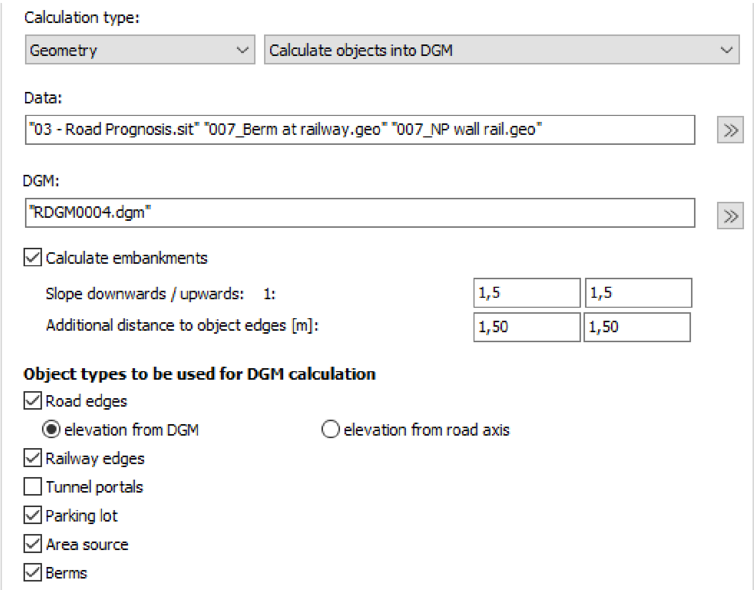
Clip DGM via an area

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**.

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 to assure the elevation supply for the part DGM.

Calculate objects in DGM

With the calculation run "Calculate objects in DGM" you can subsequently modify an existing DGM with the information of additional objects (road edges, railway edges, parking lots, area sound sources and walls).

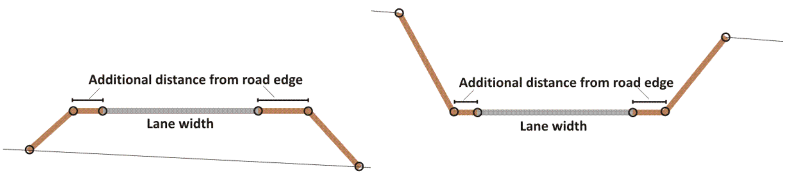


For the calculation of the road edges, you can choose whether the elevation comes from the z-coordinate of the road axis or from the DGM elevation at the road edge. This way it is possible to consider the cross slope of a road in a curve. This option is only sensible if the DGM accurately represents the road edges.

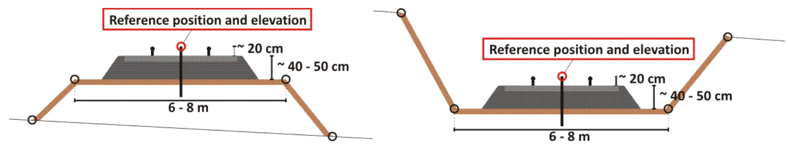
Check **CALCULATE EMBANKMENTS** to additionally incorporate embankments for roads and railways. The program will search for embankments up to a distance of 100 m from the road/railway edge. In order to create the embankments, the height of the fill/depth of the cutting must be greater than 0.5 meters for a distance of 5 meters along the road/rail edge.

Cutting and embankment slopes can have different inclinations. The inclination is calculated from the factor 1:m.

Embankment definition for roads:



Embankment definition for railways:

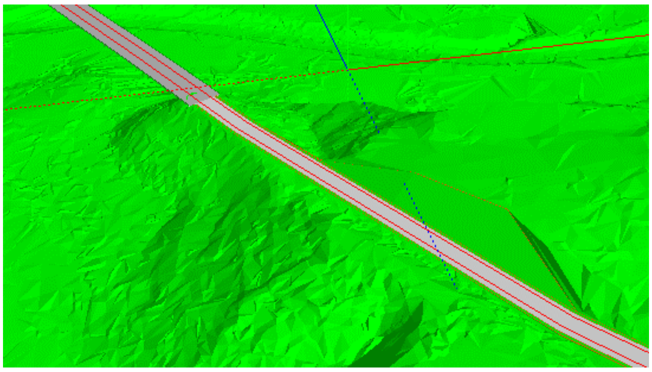


Forced edges in DGM

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 in the ribbon **Fundamentals** via **DGM | CALCULATE OBJECTS IN DGM.** (***Shift+Ctrl+D***)

3D control of the created DGM in the Geo-Database (***F10***):



DGM Import

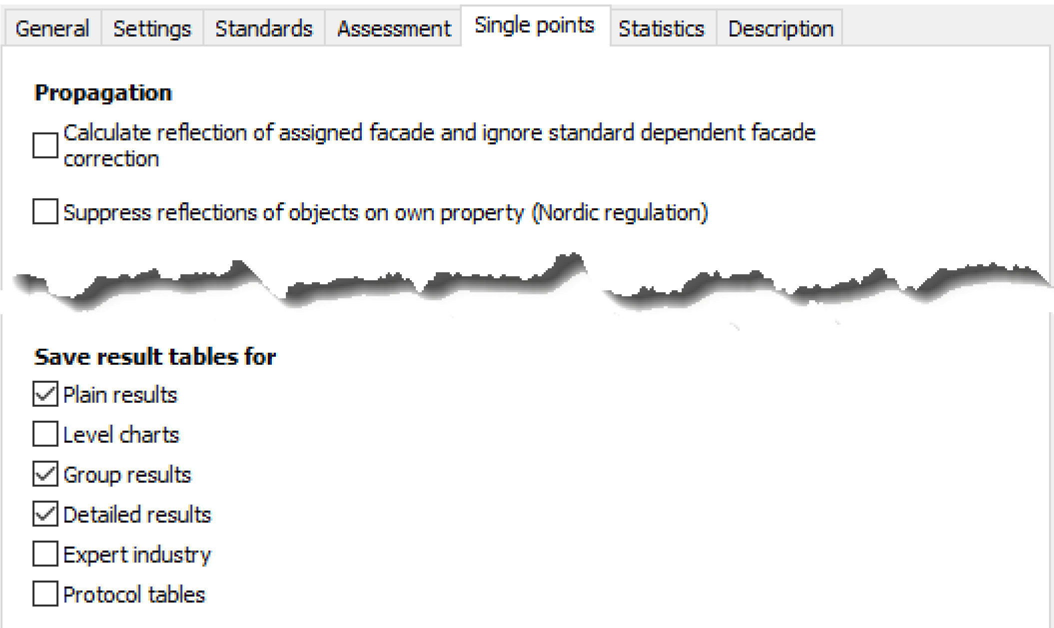
Choose from the category **GEOMETRY** the calculation type **DGM IMPORT**.

In SoundPLAN, DGMs can be imported in ITF format. ITF (**I**ntermediate **T**IN **F**ormat) is a format described on the Internet for exchanging DGMs.

Single point calculation

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].

Click on the tab "*Single points*" to set additional parameters:



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.

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 objects. The checkbox **SUPPRESS REFLECTIONS OF OBJECTS ON OWN PROPERTY (NORDIC REGULATION)** evaluates the area usages and where needed the reflections are suppressed.

If a calculation area is in the data, only the receivers inside the calculation area are calculated.

Single point calculation tables

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 contribution noise levels.
- Result table of assessed contribution level spectra (if industrial sources are in the data)

Tables for Industry Expert

- Result tables for the Industry Expert Spreadsheet (generates vast amount of data!)

Protocol Tables

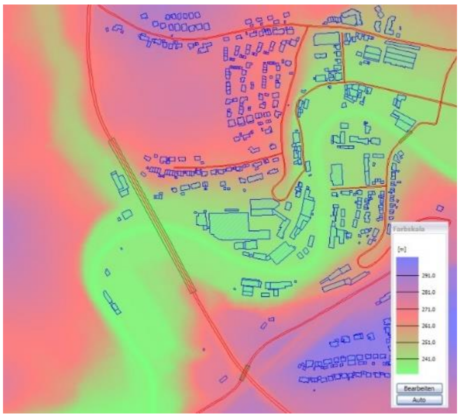
- Protocol tables detailing the intermediate values for each standard. The protocol tables generate huge files and will slow down any calculation, therefore this option should be used only for selected receivers where every detail of the calculation needs to be checked. For answers that look implausible 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 maps

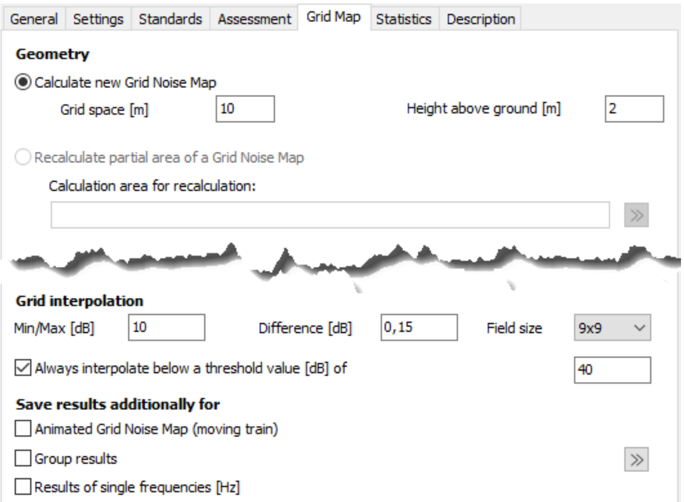
Grid Maps and the derived contour maps are the tools to visualize the noise at street level outside buildings and in nature. As the Grid Noise Map calculates reflections from all buildings, the levels can be up to 3 dB higher than Single Point Receivers Sound at the buildings. SPS receivers often suppress reflections at the "own façade". 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 an elevation supply by a DGM.

If you select the graphic output at the beginning of the calculation, the terrain elevations the are displayed 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.



Define the parameters under the Tab *Grid Noise Map*.

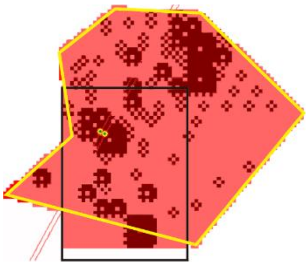


CALCULATE NEW GRID NOISE MAP is used if you want to calculate a Grid Noise Map, continue a Grid Noise Map that is already partially calculated or recalculate it after changes in the data. **THE GRID SPACE** determines the accuracy of the calculation and influences the calculation time. In un-congested landscape a grid spacing of approx. 20 to 50 m (aircraft noise) is sufficient, whereas in a city environment 5 to 10 m are sensible. The **HEIGHT ABOVE GROUND [M]** determines the calculation height above the used DGM.

RECALCULATE PARTIAL AREA OF A GRID NOISE MAP used to recalculate a part of the noise map, for example, because the input data has changed, but this does not affect the entire map. Select the recalculation area, exit the calculation run properties and start the calculation with the **OVERWRITE EXISTING RESULTS** option **(IF SELECTED ONLY IN THE RECALCULATION AREA)**.

The existing grid map is loaded, with the grid cells within the recalculation area deleted.

The results are calculated within a rectangle of the original calculation area. In the picture the original calculation area is marked in light color, the calculation area for recalculation in dark color. 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.



Interpolation during grid calculation

.The calculation of the Grid Noise Map is organized section by section. From the total number of receivers, partial grids (cells) with preset 81 points are read in, calculated and saved. The four corner points and the center point are always calculated. Within a cell an interpolation of intermediate values is aimed at, if the following conditions are fulfilled:

6

- 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:

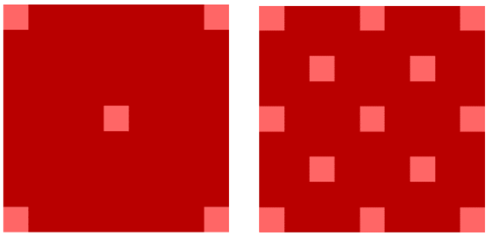
1x1 no interpolation

3x3 interpolation block maximal with 9 receivers

5x5 interpolation block maximal with 25 receivers

9x9 interpolation block maximal with 81 receivers

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 further speed up the process, you can check the box **ALWAYS INTERPOLE BELOW A THRESHOLD VALUE OF [DB]** then the interpolation criteria are always met. **By default, values below 40 dB are always interpolated.**

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 area statistics in the Spreadsheet and the graphical documentation of the results, the results can be presented either based upon group contribution levels or the sum level.

6

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. The railway emission must be entered with a standard that can calculate maximum levels. In addition, a time slice for the maximum railway level must be created in the assessment and the calculation of the maximum level must be activated in the tab *Assessment*.

! In the animated noise map, a level-time diagram is stored for each grid point. It therefore generates large amounts of data. In addition, the interpolation is automatically switched off, so that the calculation time increases.

Tables stored for Grid Map calculations

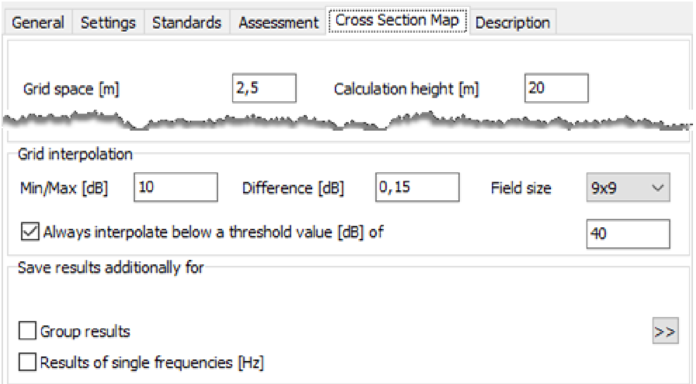
The results of Grid Noise Maps are only documented in graphical form, not in the format of single receivers. However, to check the calculation tables detailing the emission of the different noise types are generated:

- 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.



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, see "Interpolation during grid calculation" (page 260).

For Cross-Sectional Maps, too, you can additionally store the group results and the frequencies for individual results, see "Store additional results" (page 261). Check the desired results. For the groups, use the double arrow to select which groups are involved.

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.

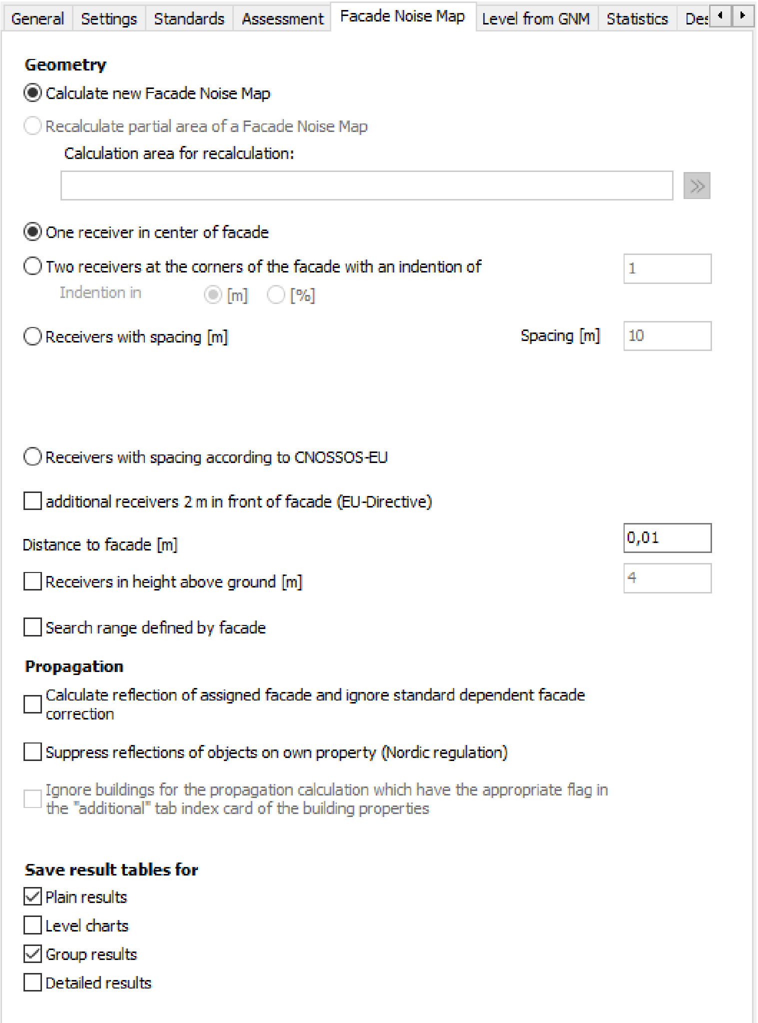
Façade Noise Maps

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 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 inside the calculation area, receivers on the outside are suppressed.

Adjacent facades are recognized and not calculated, or if one facade is higher than the other, an receiver is only calculated 0.5 m above the upper edge of the lower facade.

Define the parameters under the Tab *Façade Noise Map*.



CALCULATE NEW FACADE NOISE MAP is used when you want to start a new calculation, continue a partially calculated Façade Noise Map or recalculate the entire map again.

RECALCULATE PARTIAL AREA OF A FACADE NOISE MAP is used to recalculate a partial area because the input data has changed, but this does not affect the entire map. Select the recalculation area, exit the calculation run properties and start the calculation with the **OVERWRITE EXISTING RESULTS** option **(IF SELECTED ONLY IN THE RECALCULATION AREA)**.

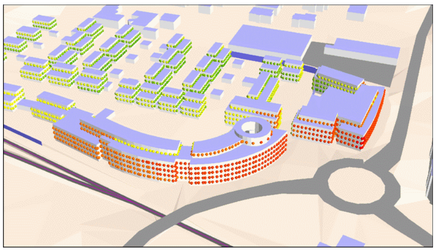
The existing Facade Noise Map is loaded, whereby the receivers within the recalculation area have been deleted. As soon as changes have been made to the buildings to be calculated, the Facade Noise Map cannot be recalculated!

Position of the receivers

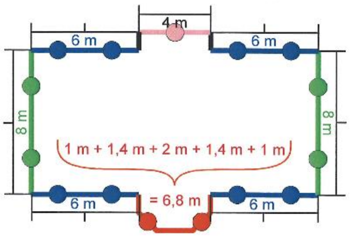
With the setting **ONE RECEIVER IN THE CENTER OF THE FACADE,** one receiver is assigned to each facade to be calculated. For aircraft noise calculations, you can further restrict the number of points using the checkbox **ONLY FIRST FACADE PER BUILDING.**

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.

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:



Cnossos-EU defies for projects within the scope of the Environmental Noise Directive how the receivers at the building are to be generated. The distribution of the receivers has proven to be very useful also for other types of investigations. Select **RECEIVERS ACCORDING TO CNOSSOS-EU** to automatically generate the receivers accordingly:



CNOSSOS-EU receivers are generated for all facades of a building as soon as one facade has been activated in the Geo-Database 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…**

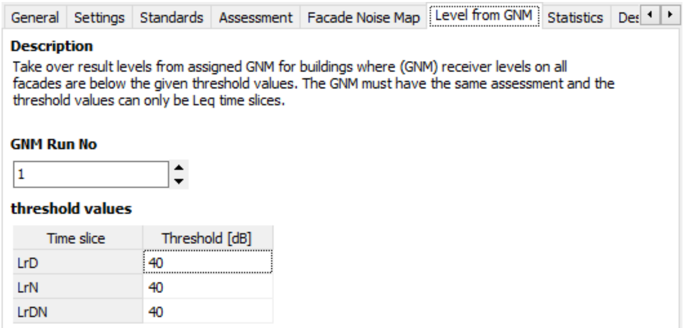
A Nordic acoustics standard demands that reflections on objects on the “own” property shall not be part of the noise evaluation. The properties are entered as an area usage objects. The checkbox **SUPPRESS REFLECTIONS OF OBJECTS ON OWN PROPERTY (NORDIC REGULATION)** evaluates the area usages and where needed the reflections are suppressed.

Transfer levels from a grid noise map

For a Façade Noise Map calculation, you can transfer levels below a defined threshold from the grid noise map instead of calculating them. This is especially interesting for projects in the context of noise mapping or large planning projects, as this significantly reduces the calculation time of the FNM.

A prerequisite for the transfer of the levels is that the associated grid noise map has already been calculated and that the same assessment is set for both calculations. Furthermore, only Leq time slices can be used.

In the tab *Levels from GNM*, enter the result number of the grid noise map and the threshold values for each time slice.



During a pre-calculation, the list of facade points to be calculated is compared with the GNM result. As soon as <u>all</u> receivers of a building are lower than the entered threshold value, the level of the GNM is entered in the receiver table.

Reset building IDs

If the presentation of the **Facade Noise Map** in the Graphics 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. Confirm the query with OK, then the building IDs in the result file will be reset to the IDs of 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:

- If the group results are also stored, you can evaluate the results of individual groups in the tabular and graphical documentation in addition to the sum levels.

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!

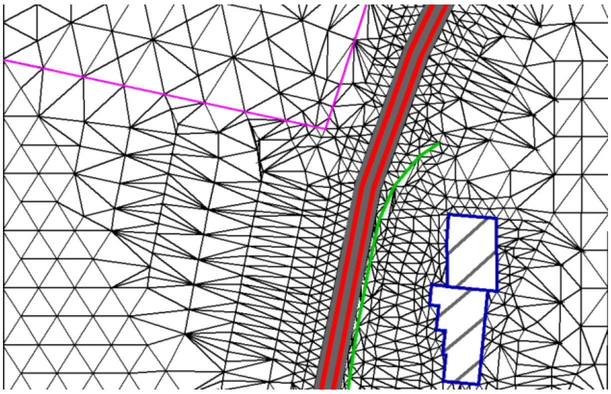
Meshed noise map

[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 wire-mesh 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.



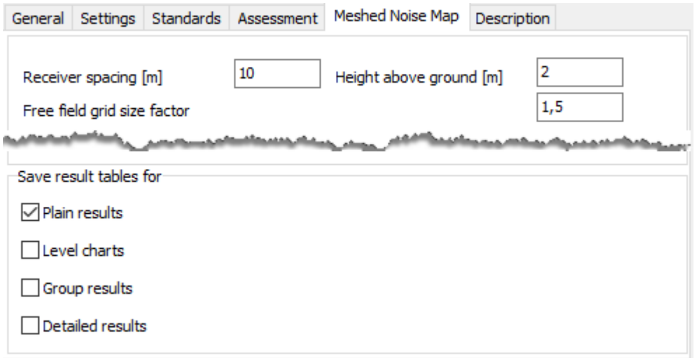
around buildings, barriers and the source lines.

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.



In the first step the Meshed Noise Map sets the mandatory receivers from the above table in **HEIGHT ABOVE GROUND.** Subsequently, the triangles are further subdivided until the edge length reaches the **RECEIVER SPACING**, or in the free field the larger distance, which is defined by the **FREE FIELD GRID SIZE FACTOR**.

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:

- If the group results are also stored, you can evaluate the results of individual groups in the tabular and graphical documentation in addition to the sum levels.

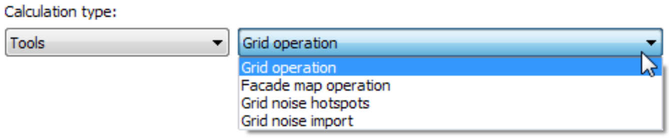
Detail tables:

- 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.

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.

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.

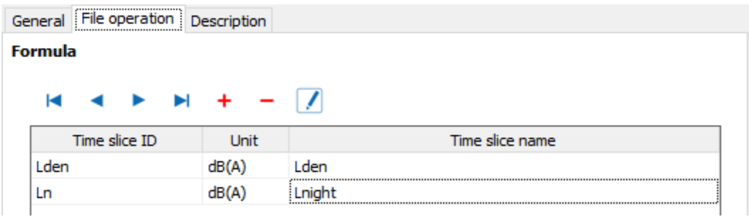


Go to the calculation core and add a new calculation run. In the tab index card *General* enter a run title and select from the calculation type **TOOLS** the **GRID OPERATIONS** or the **FAÇADE MAP OPERATIONS**.

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.

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.

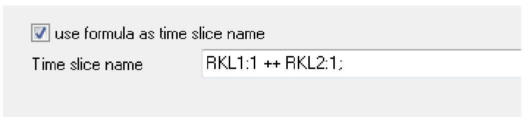


The dialog to define the file operations is opened automatically. Fill in the file operation as described in "File operations" (page 460).

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 the "pen" to edit the file operation of the current time slice. With + you create a new time slice and access the dialog where you define further operations. With - you 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.

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.

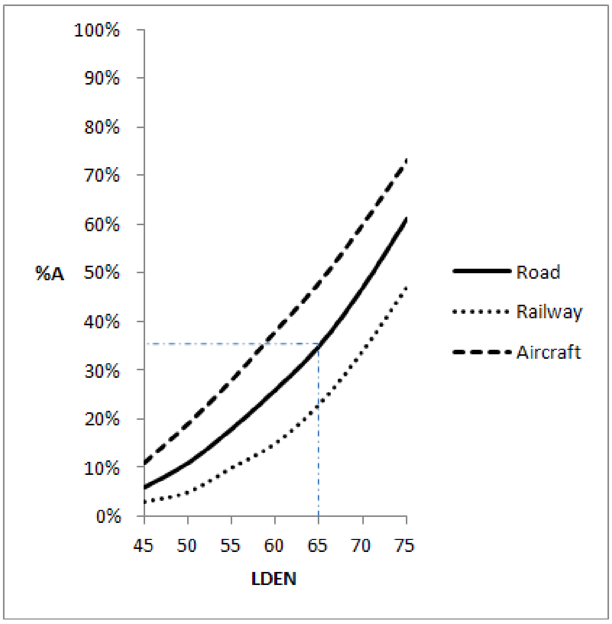
If the basis is a Façade Noise Map the inhabitants are distributed to the calculation points at the building. If a Grid Noise Map is used instead, VBEB points are generated at all buildings with inhabitants and the inhabitants are distributed to the generated points.

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 x 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/km²".

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

$$\% A = 1{,}795 * 10^{-4} (L_{den} - 37)^3 + 2{,}110 * 10^{-2} (L_{den} - 37)^2 + 0{,}5353 (L_{den} - 37)$$

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:

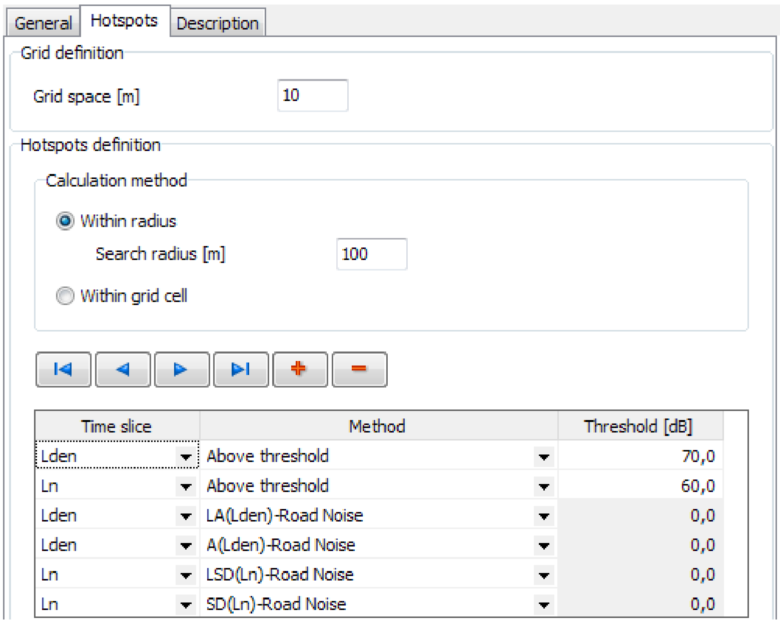
- Calculated Façade Noise Map (recommended) or Grid Noise Map
- Situation (or Geo-File) with buildings and assigned inhabitants
- Calculation area

- DGM (for the 3D presentation)

Select in the run properties the **CALCULATION TYPE** "Grid Noise Hotspots" in the category "Tools".

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*":



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 which calculation method you want to use. For the method **WITHIN RADIUS**, the **SEARCH RADIUS**, within which the inhabitants are summed up, is preset to of 100 m. This is a sensible default for action planning because the result is normalized to inhabitants/km². 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 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 514). Please refer to the section on modified formulas extrapolated beyond the actual scope of the formulas.

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

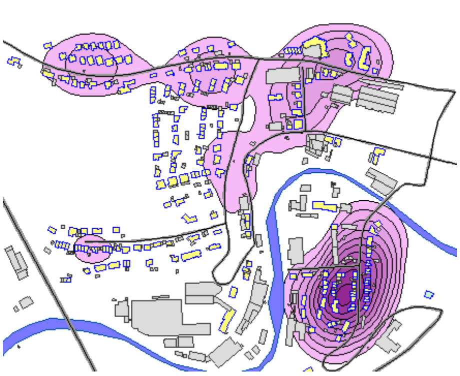
- above threshold
- LA - little annoyed
- A - annoyed
- HA - highly annoyed
- LSD - little sleep disturbance
- SD - sleep disturbance
- HSD - high sleep disturbance

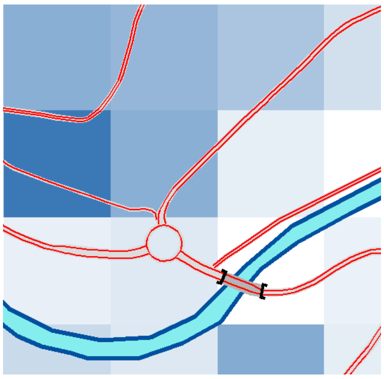
Whereby "LA" contains all inhabitants of the categories "A" and "HA" as well as "LSD" contains all inhabitants of the categories "SD" and "HSD". “Little annoyed” also contains the figures from the “annoyed” and the “highly annoyed” tally.

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 types of noise types can be superimposed using the grid operations.

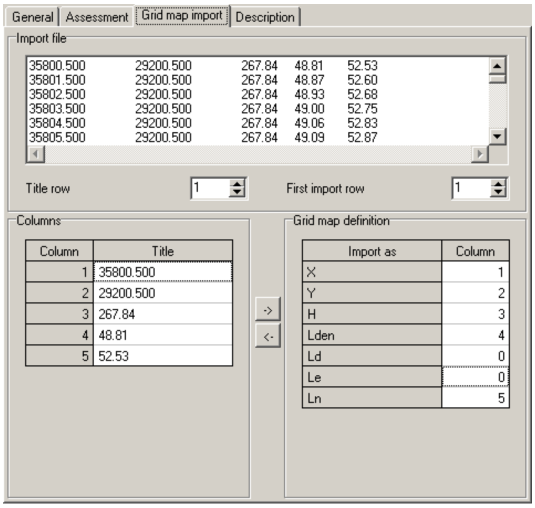
Import of Grid noise maps

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 SoundPLAN's format; Grid Noise Maps generated this way can be overlayed with other SoundPLAN data.

To trigger the import function, select the calculation type “tools” and the select the sub-type “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.

Noise in rooms and from inside to outside (Indoor noise and room acoustics)

The Indoor noise module can be used to perform the following calculations:

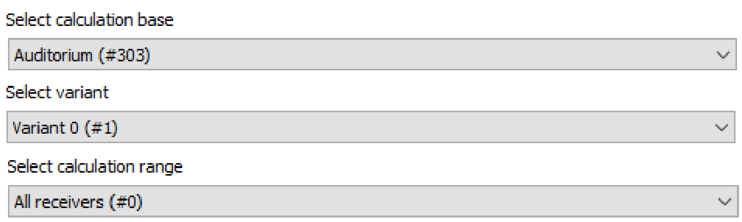
- Single point sound. Day histograms and assessments are considered.
- SPC calculation (sound propagation curve). Enter a sound propagation curve with 2 points (VDI 3760)
- Measurement path (SPD)
- Indoor Noise + Industry Noise: Calculation from inside the industrial building to the outside. All components, defined as sound sources must have the setting "Li(Calc)+c-R". The operating hours of the indoor sources are considered with an Li(Calc) day histogram .
- 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.
- Indoor Noise + Cross Section Map: Calculation of a cross section within the industrial building.
- With Indoor Noise + Room Acoustics you can use an SPD calculation to calculate room acoustic parameters for individual receivers or measurement paths and evaluate the rooms assessment (e.g. for open-map offices) according to different standards.

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.

General calculation run properties

Select the category "Indoor calculations" and additionally the calculation type. You can choose between single point calculation, sound propagation curve, measurement path, Grid noise map, sectional noise map and an indoor calculation that generates emission data for outdoor calculation (Hallout (Indoor -> Outdoor)).

Specify the data to be included in the calculation. In addition, select which information should be included in the calculation.



Select the **CALCULATION BASE**. Your situation may include several industrial buildings / rooms, but only one industrial building / room can be calculated per calculation run.

If you have entered several variants (see "Variant concept in the industrial building / room", page 177), select the **VARIANT** to be calculated.

Depending on the calculation type, the **CALCULATION RANGE** can be the building itself, a calculation area in the building, a measurement path, an intersection line for the cross-section map, a specific receiver or all receivers.

At the very bottom you enter the calculation run number under which the results are to be saved.

Calculation according to VDI 3760

The calculation method according to VDI 3760 implemented in indoor noise is an extension of the standard method "mirror source method with scattering" (according to Kutruff & Jovicic) used by VDI 3760.

The calculation of the sound pressure is considering the room parameters (sound power of the source, density of scattering objects, absorption properties, etc.) is carried out separately for the direct and the scattered noise components.

Direct noise component

$$E_D = \left(\frac{P}{4\pi c r^2}\right) e^{-(q+m)r}$$

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

$$E_S = \left(\frac{3qP}{4\pi c r}\right) e^{-r\sqrt{3qa}}$$

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.

$$E_{Ges} = \sum_{nx=-\infty}^{nx=+\infty} \sum_{ny=-\infty}^{ny=+\infty} \sum_{nz=-\infty}^{nz=+\infty} \rho_{nx}\rho_{ny}\rho_{nz}E_D + \sum_{nx=-\infty}^{nx=+\infty} \sum_{ny=-\infty}^{ny=+\infty} \rho_{nx}\rho_{ny}E_S$$

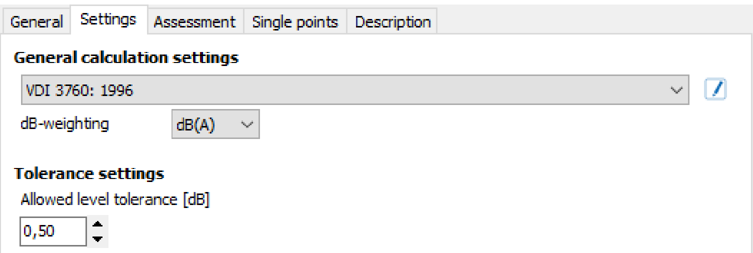
ρ = absorption coefficient of the walls

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. (f_D , f_S).

Calculation parameters VDI 3760 in the Calculation core



Enter the tolerance and the dB-weighting in the tab index card *Settings*. The **TOLERANCE** for VDI 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 “pen” to open the properties of VDI 3760 (humidity, air pressure and temperature).

Select the assessment in the tab index card *Assessment* for calculation types where an assessment is required. For industry noise this could also be an own assessment which in the case of multi-shift workplaces, reflects the assessment levels for the individual shifts, see "Assessment library", page 233.

The calculated indoor noise level is an assessment level averaged according to the assessment periods (time slices). Short-time peaks cannot be calculated.

Calculation according to a sound particle model with diffraction

Introduction

Sound Particle Diffraction (**SPD**)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 (“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. In some cases, sources can be merged. Please bear in mind that a machine typically consists of several sources and introduces geometrical complexity. If acquiring levels close to the machine is important, this level of detail may be appropriate, but in our experience, some users find that they can substitute machines for point sources and still obtain adequate results while reducing run times.

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.

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, the calculations have a break mechanism when some receivers have received large signals and some have received nothing whatsoever. In this case the calculation assumes that the run is being held up by an insignificant receiver that will take a very long time to converge, if at all, and will terminate. Because of this, it 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. In cases where some receivers might be expected to receive significantly less signal than others it may be worth considering a “double calculation run” approach. For example, if some receivers are placed within a room with no opening and thick walls, and some receivers are outside this room, it may be worth first doing a calculation where only the region outside the room is considered and then using this information to estimate the sound transmitted through the walls. And second calculation run for inside the room can then be performed by setting up suitable area sources.

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. Low tolerances can serve two purposes – making noise maps look smoother for aesthetic purposes and making calculations run longer to try and get more signal to difficult-reach receivers.

There’s no point in spending time nailing down accuracy below a situation’s natural noise floor (even a very quiet room typically has a background level of around 20-30 dB). For this reason, we offer a default setting of deactivating receivers that are below the background noise threshold. It’s therefore worth setting background noise levels (either for individual receivers or the building/room as a whole in the Geo-Database). The background noise is added to the level results of all calculation types except measurement paths.

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.

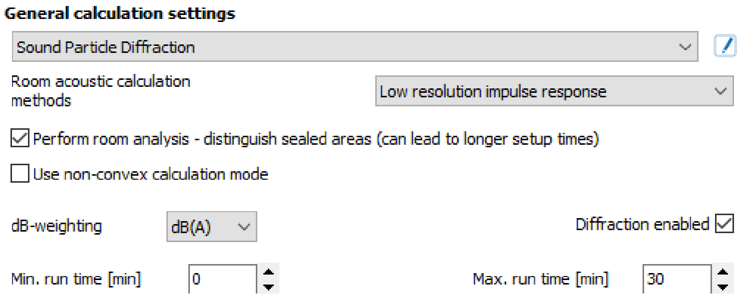
(For those with Room Acoustics licenses) If you’re interested in doing speech intelligibility with STI, don’t forget to define all sources and absorption spectra with the 7 octave bands 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz. If the value for 8000 Hz is missing it is extrapolated.

The octave center is evaluated for the air absorption.

Calculation parameters for SPD calculations

The calculation parameters in the *Settings* tab index card are divided into different areas, which are described in separate sections, so that the description and screenshot are not so far apart.

General calculation settings



There are four possibilities for **ROOM ACOUSTIC CALCULATION METHODS**, which are described below. The differences relate primarily to reverberation times. For all other room acoustic parameters, the differences are small, except that the time estimation when the sound first arrives at a receiver is dynamically refined in the course of the calculation in the case of single particle analysis.

<u>Single particle analysis</u>
In this method, all room acoustic parameters are calculated by analyzing individual sound particles - in contrast to the echogram. This method has the advantage that it requires much less memory and is therefore suitable for the calculation of grid maps. Furthermore, the method places more emphasis on the early part of the sound field and less on the late sound when calculating the reverberation times. This can be advantageous as there are sometimes problems obtaining accurate information for the late sound field, which can affect the results. The late sound field may be below the natural noise floor and can therefore be of limited importance when comparing with reality.

<u>Low resolution impulse response</u>
In this case, reverberation times are calculated using an energy impulse response (echogram), sampling the sound field at a relatively small number of time points (the time slots actually increase in size for later times, allowing for more accurate estimates of the late sound, where high time resolution is less important). Other parameters are calculated using the single particle analysis. This allows for a Schroeder-style analysis with much lower memory requirements than the full echogram, which may allow for grid calculations to be done this way too. The impulse response will be output to the results tables. In addition to the calculation, a text file with the individual results is also saved in the results folder, which you can import into Excel, for example, for further analyses.

For calculations with OpenCL support, the reverberation times are always calculated with the low-resolution impulse response.

<u>High-resolution impulse response, weighted</u>
Here, echograms are calculated with sufficient resolution to pick out individual reflections. All room acoustic parameters are calculated using these echograms, which again are output to the results tables and as a data file. Reverberation times are calculated using the usual Schroeder analysis. The linear regression is performed with weighted errors for the time slots which typically means the earlier, more accurate part of the sound field is given greater weight. The heavy memory requirements of this method mean it is typically unsuitable for grid calculations. Users are encouraged to inspect echograms in case there are anomalies or non-linear elements. In such cases, longer run times and/or a custom analysis may be appropriate.

<u>High-resolution impulse response, unweighted</u>

Same as in the previous case, however, the reverberation times are calculated without error weighting for the time slices.

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). In these circumstances, a calculation may run faster.

The **NON-CONVEX CALCULATION METHOD** can be used for complicated Situations that contain a large number of areas. It is a normal SPD simulation that uses a different form of geometric preprocessing. In general, this preprocessing runs faster and has lower memory requirements. The main simulation often runs faster with this method (but not always).

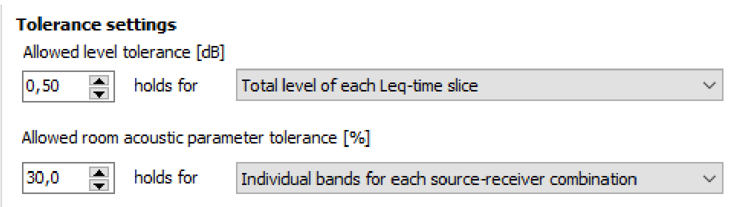
Unlike the standard method, this pre-processing does not implicitly include comprehensive spatial analysis, which is used to identify acoustically closed spaces, allowing better documentation of acoustic materials and allowing inaccessible receivers to be disabled. Surface documentation is also available in non-convex mode, but it includes surfaces within enclosed spaces (e.g., cabinets) that do not contribute acoustically.

It is possible to ask for an additional full **ROOM ANALYSIS** in non-convex mode by checking the box in the run settings. This, of course, will re-introduce the run times and memory requirements of the standard pre-processing, on top of the non-convex pre-processing. However, if the main particle simulation runs faster in non-convex mode, this may be worth considering.

Specify a **MINIMUM RUN TIME** if higher accuracy is required. This may be necessary if, for example, an interesting receiver was ignored due to a very low signal or improved accuracy is required for the late sound field of an echogram.

An SPD calculation will finish and save the results obtained up to this point after the **MAXIMUM RUN TIME** has been reached, even if some results have not converged within the requested tolerance. Especially with grid maps it can occur, that the results are adequate after a short time with only a small number of insignificant points preventing the calculation from ending. Setting the maximum run time prevents such calculations from running indefinitely without any significant improvement. If the tolerance is not completely reached within the maximum run time, this is recorded in the logbook. Please check the result.

Tolerance settings



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 so-called “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 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”.

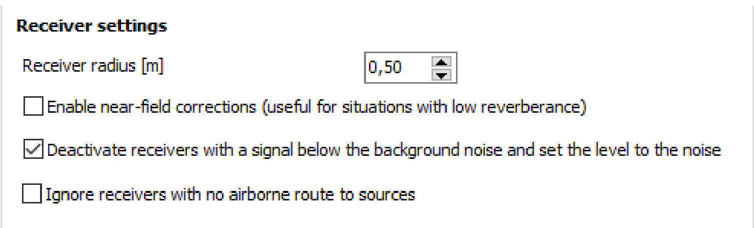
The **TOLERANCE** setting specifies how much the results should converge before the calculation stops. If you halve the tolerance from 1.0 dB to 0.5 dB, the calculation will take about 4 times as long, the number of particles received by the receivers will go up roughly by a factor of 4, and the level 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.

The **ROOM ACOUSTIC TOLERANCE** specifies the minimum level of estimated uncertainty in the specified room acoustic parameters that the calculation should ideally reach. If sound level and room acoustic parameters are selected, both the level tolerance and the room acoustic tolerance must be satisfied for the program to end before reaching the maximum run time. The method used to estimate the uncertainty varies depending on the room acoustic parameters selected, and the preferred room acoustic method. Users should bear in mind that these uncertainties are based purely on the statistical quality of the received signal and do not take other systematic uncertainties into account. In cases where the sound field in a room is not fully diffuse, or there are partially enclosed areas, or the surface absorption varies significantly in different parts of the room, the estimation of the uncertainty is more complicated and may be underestimated by the program. In such cases, a custom analysis of the impulse response is recommended.

Receiver settings



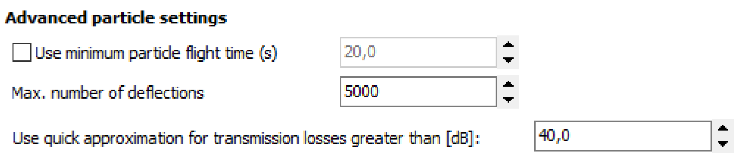
With the **RECEIVER RADIUS** you define the size of the receiver sphere. Sound particles must work with finite-sized receivers (we use spheres) and the general rule is to go as big as you can justify. If you halve the receiver radius, the calculation can take up to 8 times as long because the receiver 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.

Advanced particle settings



For more advanced users, there are now options to change the **MINIMUM PARTICLE FLIGHT TIME** and the **MAXIMUM NUMBER OF DEFLECTIONS.** Increasing the particle flight time can sometimes be useful when there are long-lived modes in a situation (increased memory requirements). A possible influence of this setting can be seen in the echogram.

Increasing the maximum number of deflections makes sense if some deflections in a situation are due to diffraction events. This setting can lead to longer running times. However, since particle flights are automatically terminated when the particle falls below a certain energy threshold, the extension of the computing time is put into perspective.

The threshold **FAST APPROXIMATION FOR TRANSMISSION LOSSES HIGHER THAN** is used to speed up calculations where the room-to-room transmission is important. This sets the minimum probability with which particles can transmit to ensure a sensible particle flow.

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 two-dimensional maps for display in Graphics

Grid and cross-section map in rooms

For grid and cross-section maps, a uniform horizontal or vertical grid is generated. Enter the **GRID SIZE** and, for grid maps, also the calculation **HEIGHT ABOVE GROUND** (floor of the building).

To speed up the calculation, you can specify a **MINIMUM DISTANCE** between the grid point and closed surfaces.

Triangle map in rooms

The indoor meshed map (Indoor MNM) creates a triangulated horizontal mesh of receiver points which can be used to create a continuous sound map. Two categories of receiver points are employed: those placed close to vertical walls and those placed in object-free areas. The resolution of both categories can be adjusted. As such, the Indoor MNM is a more flexible and (potentially) more efficient version of the grid noise map because it is designed to place more receivers where sound levels vary rapidly (close to walls, for example) and fewer where the sound field remains flat. This can allow accurate mapping with fewer receivers.

Note that for the grid to work properly, it is necessary to place receivers at both ends of each wall segment placed in the situation. If structures with very small segments have been modelled, this will result in a high density of receivers, and this cannot be controlled with the resolution settings. This is another reason to use the iterative modelling approach (see SPD tips) and keep geometries as simple as possible.

Calculation of room acoustic parameters

The Room Acoustics module allows you to estimate room acoustic parameters for calculations based on the sound particle model.

The following parameters can be calculated:

- Reverberation time (T60, via the T20 or the T30 method)
- Speech Transmission Index (STI) - male voice, female voice and averaged.
- Early Decay Time (EDT)
- Clarity (C80, C50)

- Clarity (D50)
- Focus time (TS)
- Starch (G)
- Early side sound level (LF and LFC)

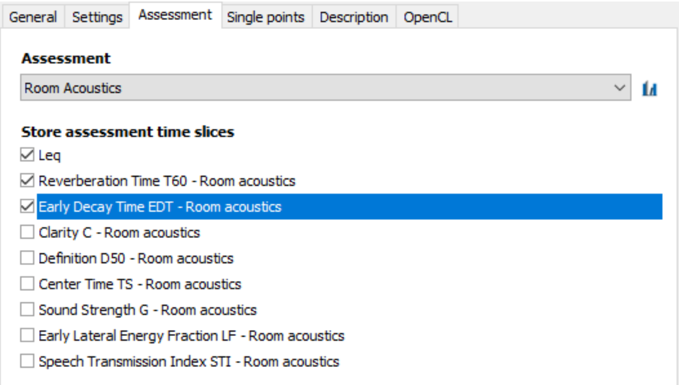
From this, SoundPLAN determines and documents the parameters required for the evaluation of buildings and rooms according to the standards ISO 3382-3, VDI 2569 and DIN 18041, for example confidence interval, speech intelligibility or equivalent sound absorption area.

Room acoustic parameters can be calculated for indoor single-point calculations, indoor measurement path and indoor grid maps.

Single points

For single-point calculations, the room acoustics parameters that are to be calculated must be defined in the assessment library and selected for the calculation in the tab index card *Assessment*.

Select the parameters you want to calculate:



In the tab *Single points* select whether the results you want to store. This can be plain results, detailed results or auralization.

Measurement path calculations

Measurement path calculations are tailored to the requirements of the standards ISO 3382-3, VDI 2569 and DIN 18041. The required room acoustic parameters are automatically activated.

The reverberation times are determined using method T20.

Please note that background noise is not added to the sound pressure level-based results when doing measurement path calculations since the relevant standards concentrate on the signal level of the “speaker”. Furthermore, introducing noise can result in complications when calculating e.g. the D2S parameter. Background noise should still be defined for measurements paths, however, because it is used in the STI calculations.

For measurement paths, the room acoustics parameters that are to be calculated must be defined in the assessment library and selected for the calculation in the tab index card *Assessment*.

In the tab *Single points* select whether the results you want to store. This can be plain results or auralization.

Important notes

The standard method for calculating room acoustic parameters is a linear regression analysis of the level decay curve performed without saving the echogram. This drastically reduces the storage requirements and, in our experience, converges with less computational effort. Part of the early sound field is ignored as this may affect the analysis. The Schroeder method is still available (for single point and measurement path calculations, not for raster calculations) and can be selected in the PLC section of the run settings card. When this option is selected, the program calculates the room acoustics using stored echoes and backward integration. In addition, the echoes are output in the results tables and as text files in the results folder.

Please note that the Schröder method, although widely used, may have problems in the context of sound particles. In particular, if the late "tail" of the echogram is sparsely described with only a few particles, there is a tendency for the method to overestimate reverberation times, even if the estimated statistical uncertainty is small. In these cases, a warning is issued. We recommend running calculations several times with different tolerance levels to get a feel for how the results respond (lower tolerances lead to longer run times and therefore better result statistics).

For the calculation of **echograms** according to the Schroeder method for single points and measurement path calculations, set the corresponding check mark in the *EPS* card.

For DIN 18041, we do not explicitly give an "A" classification for the results tables. This is because the "A" category is not defined by strict limit values, but by recommended values that depend on the intended use of the room. However, the reverberation times are available for users to make an appropriate assessment here.

The calculation results are documented in the results tables.

OpenCL support for indoor calculations with SPD

OpenCL *(Open Computing Language) is an interface for non-uniform parallel computers that are equipped, for example, with main, graphics or digital signal processors. This includes the programming language "OpenCL C". OpenCL was originally developed by Apple to harness the power of today's GPUs for non-graphical applications. Source Wikipedia*

Most graphics cards today support OpenCL, so that the GPU of the graphics card can be used for the calculation. OpenCL-enabled processors are also available, but their drivers are not (yet) mature and can lead to aborted calculations, which is why caution is required when using CPUs.

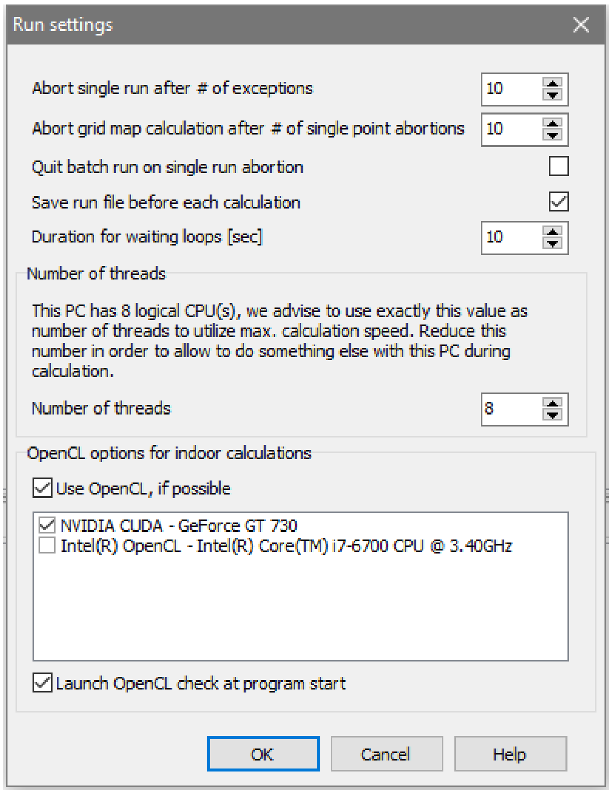
When using OpenCL, individual calculation steps can be outsourced so that calculations can be performed in parallel. The better utilization of the hardware resources shortens the calculation time considerably in some cases. For indoor calculations with SPD, this has a particularly positive effect on the calculation of sound levels, reverberation times and speech intelligibility, so that so far only these parameters are available for the calculation with OpenCL.

The calculation of imported free-field situations or situations with very high absorption is not efficient with OpenCL.

In order to be able to continue working sensibly during an SPD calculation, the computer should be equipped with two graphics cards, for example an on-board graphics card (which is not included in the calculation) and an external graphics card. This is the case with most computers today. The external graphics card should be equipped with sufficient video memory (recommended 4 GB or more).

Configuration of the OpenCL calculation in the run settings

You define the OpenCL settings in the run settings of the calculation core (**OPTIONS -> RUN SETTINGS).**



Check mark **USE OPENCL IF POSSIBLE,** to use the OpenCL-enabled devices for the calculation of Leq, reverberation time and STI for every calculation with SPD, regardless of the type of calculation.

The list below lists all OpenCL-enabled devices available on the computer. Tick the components that are to be used for OpenCL in the calculation. If your computer is equipped with an external and an on-board graphics card, it makes sense not to use the on-board graphics card, so that the computer can perform other tasks during an SPD calculation without or with only a slight delay.

The check mark **LAUNCH OPENCL CHECK ON PROGRAM START** is normally activated and is automatically deactivated by the program if errors are detected during the check of the OpenCL functionality that is executed when the calculation core is started. See the troubleshooting section.

Regardless of the setting you have made in the run settings, you can use different settings for individual calculation runs if necessary. This might be the case if OpenCL in general runs without problems, but a special calculation run produces errors with OpenCL.

Select, whether you want to use the settings from the run settings, switch off OpenCL or use OpenCL with different hardware settings.

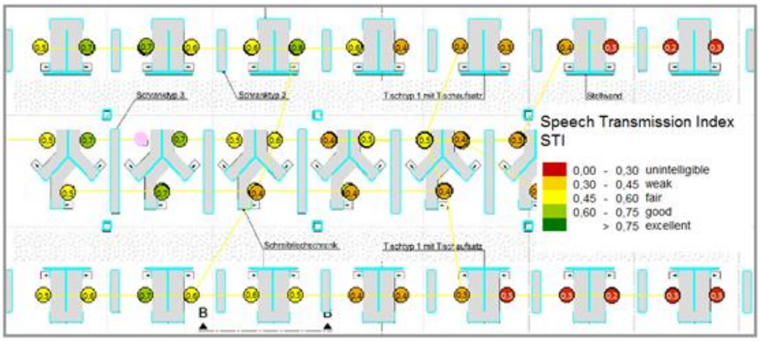
Troubleshooting

If an error of the OpenCL functionality is detected when starting the calculation core, an error message is issued, and the calculation core closes again. OpenCL is deactivated in the run settings. Such a critical error can have various causes, sometimes even only temporary missing communication, which can be fixed by restarting SoundPLAN or restarting the computer (in the run settings, the check of the OpenCL functionality must be activated manually). However, a critical error often occurs if the OpenCL drivers are missing or outdated. In this case, update/install new current drivers and try again. Even after a driver update, you must manually reactivate OpenCL.

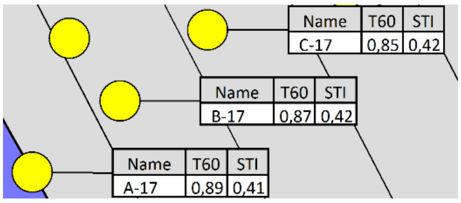
If one or all components fail during an OpenCL calculation, the calculation is performed with the remaining components or, if possible, automatically with the conventional method. If this is not possible, the calculation is aborted.

Graphical output of receivers

The receivers can be loaded in the Graphics as data type **RECEIVER REPRESENTATION** and colored using a scale. In addition, the values, the serial number or the object number can be output as text. These settings and the appearance of the receivers is controlled using the object type "Indoor receivers " in the "Results" node.



Indoor receivers can be displayed as **TABLE FLAGS** in the Graphic. The basis for the table flags is a Spreadsheet. For detailed description of the handling please refer to the manual.



For further information e.g. on the output of grid maps and cross section maps, please refer to chapter "Graphics" (page 373).

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.

We highly recommend using SoundPLANnoise 64 Bit for the calculation.

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 **TCP/IP** protocol must be active. If you use PCs for distributed computing that are not used for working with SoundPLAN it is sensible to install the **demo version**. This way no license or hardlock problems will occur.

Note: Updates can be installed from one PC to any number of other PCs at the same time, see "Install updates on multiple computers at the same time" (page 22).

It is not sensible if the performance of the computers is too far apart. The slower PCs require just as much administration effort as the faster PCs, but hardly contribute to the calculation.

Control program "Socket Server" on the slave

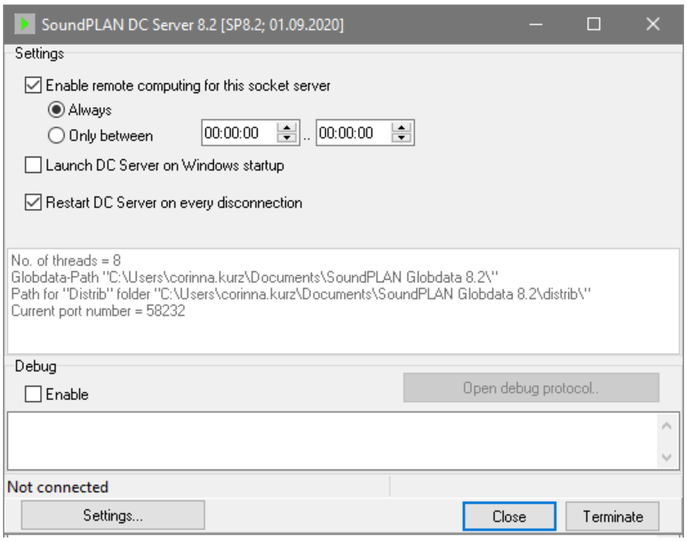
In order that the master PC finds the other PCs in the network and to make sure that the users of these PC agree in the use of their PC for distributed computing, a control program must run **on all participating PCs**. Open the control program in the start menu with **ALL PROGRAMS -> SOUNDPLAN XX -> 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**.

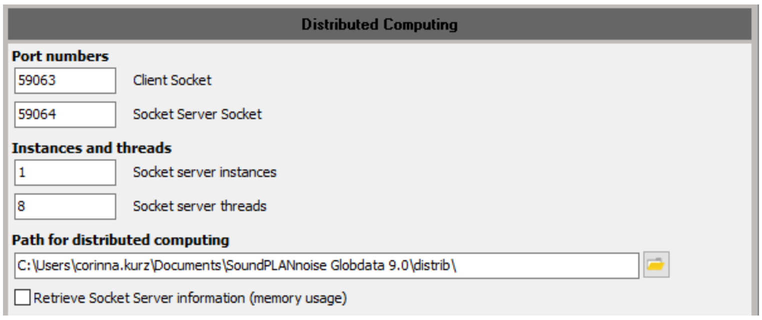
In order that a computer can be connected the Socket Server must be enabled for distributed computing. Via a timer you can activate PCs for certain time periods (PCs that for example at night would be idling). You can select here whether the Socket Server should be launched on Windows startup. A third option (restart DC server on every disconnection) tries to reactivate the Socket Server after unexpected malfunctions during a calculation.



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.

Settings of the Socket Server

The button **SETTINGS** opens another dialog (this can also be accessed via **OPTIONS | SETTINGS** in the SoundPLAN Manager).



The communication area in the network (port) for the job administrator and the VR controller must be the same for all computers involved.

By default, the version number is used as an identifier in the port number. Normally the port numbers should not be changed. If this is necessary, the highest possible port number is 65635 and must be different for each version and 32/64 bit.

(V 9.0 32 bit
Port job administrator: 59031
Port VR Control: 59032)

V 9.0 64 bit
Port job administrator: 59063
Port VR Control: 59064

After an initial installation of SoundPLANnoise, it may happen in rare cases that not all available threads of the PC are detected. To check this, right-click on the distributed computing icon in the taskbar and open the properties. If the number of threads is 0, click **SETTINGS**. After closing the settings, the socket server is restarted with all threads.

Threads and instances

Set the **NUMBER OF THREADS** equal to the number of threads of the computer if it is only used for computing. If other tasks are also to be processed on the computer, reduce the number of threads (often it is sufficient to reduce the number by 1).

In addition to the number of threads, you can specify the number of instances. The **NUMBER OF INSTANCES** specifies how often the VR controller is started.

The higher the number of instances, the more often the project data must be packed and copied, and the more disk space is required. Therefore, the first approach would be to start all computers with one instance and all threads recommended by SoundPLAN.

Then perform a test calculation. If the calculation ends with "out of memory" (or greatly reduced computing speed for 64 bits), double the number of instances and halve the number of threads for the PCs causing the problem. Continue this way until all the computers are working satisfactorily.

The threads are always divided equally among the instances; for example, on a 32-core machine with hyperthreading, 1 instance of 64 threads, 2 instances of 32 threads, or 4 instances of 16 threads.

Exit the VR control (right click on the icon in the taskbar | **EXIT**) and start it again (**EXECUTE | SOCKET SERVER** in the SoundPLAN Manager) if you have changed the number of instances. The Socket Server will then open twice with different port numbers for a computer with 2 instances, for example.

If the memory runs out, the calculation becomes extremely slow because the swap file is used. To avoid this, it might be sensible, at least for slower hard disks, to set the size of the swap file to 0 so that the calculation is aborted.

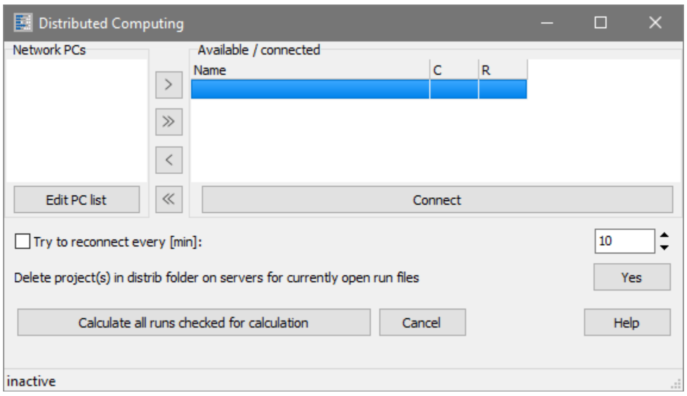
Project data directory

If a computer is used as a calculation slave, the required project data is stored on this computer during the calculation. The calculation slave cannot calculate if the hard disk on which the data is to be saved is full. In this case, change the path here. The project data will be deleted automatically after 4 weeks.

RETRIEVE SOCKET SERVER INFORMATION may help you or the support in case of problems with the memory behavior and should normally be set to "no".

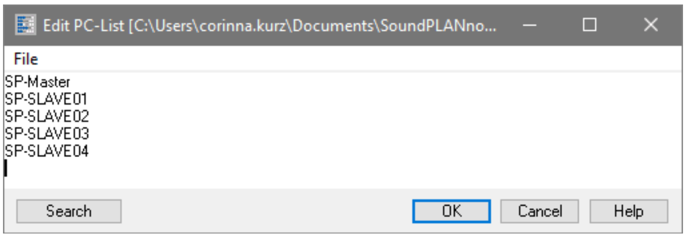
Establish communication between computers

In the Calculation core, call **CALCULATION | DISTRIBUTED CALCULATION** (or click the icon button).



Edit PC list

Click **EDIT PC LIST** below the left panel and enter the names of the PCs that should help with the calculation. The computer names are displayed in the Windows Explorer when you call Network | Entire Network.



The button **SEARCH** lists all computers available on the network, regardless of whether the Socket Server is running. However, this may take some time depending on the size of the network! Then delete the computer names of the never used computers from the list. The PC list is saved globally and displayed again at the next startup.

Select PCs

Select the PCs that should participate in the calculation and transfer them to the right window using the arrows or drag & drop. 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 a computer with **several instances** is addressed, transfer it to the right window several times (depending on the number of open instances).

The connected computers are displayed with computer name, IP address and port address.

Common trouble with the connection

- <unknown> is listed instead of the IP address and both connection and reconnection show “nc”: The computer has not been recognized, for example, because the name resolution in the network was not successful. Try to establish the assignment via the IP address of the computer.

  Find out the IP address of a computer

  *Go to **START | EXECUTE** (taskbar). Enter "cmd" in the **EXECUTE** field and the command "ipconfig" in the following DOS window. The IP address is displayed in the DOS window.*
- If the "C" field says "version mismatch", then an update with a different date is installed on the slave than on the master computer.
- If the "R" field still states "nc" (not connected), click on the line containing the computer name. If the display then changes to "OK" everything is OK, otherwise the return connection could not be established. In this case, first check the firewall on the slave. "SPCalc.exe" and "SPSktSrv.exe" must be enabled as exceptions.

6

- Check the port addresses - they must be the same for all computers involved.

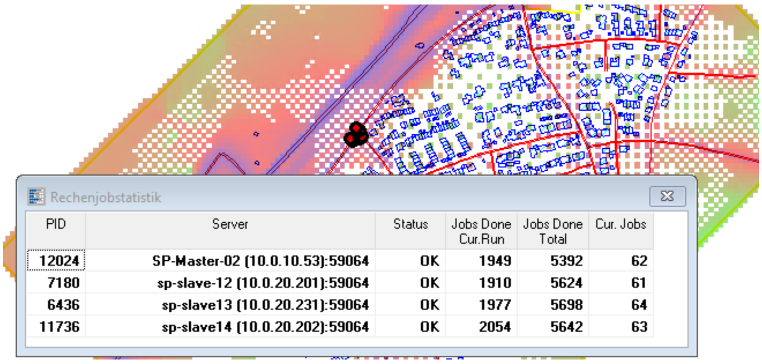
The master computer can try to reconnect a slave automatically for which the connection broke down for any reason. Activate the checkbox **TRY TO RECONNECT EVERY [MIN]** and select the time interval.

Deleting **PROJECTS IN THE DISTRIB FOLDER ON SERVERS FOR CURRENTLY OPEN RUN FILES**, you can clean up the directory where the projects are transferred to the servers ("distrib"). Delete the project you are working on after you have finished the calculations. You can also use this function to force all project data to be transferred to the servers again. To delete several projects from the servers at once, open the run files of all these projects with **FILE -> ADD RUN FILE FROM ANOTHER PROJECT** (***F12***).

Start calculation

Start the distributed calculation by clicking the **CALCULATE ALL CALCULATION RUNS CHECKED FOR CALCULATION** button**.** SoundPLAN packs the project files required for the selected calculation runs and sends them to all slaves. A red arrow is displayed in the taskbar for the Socket Server instead of the green arrow, when you hover over the icon you will see "Status: Connected to "*Master computer name*".

Each slave unpacks the data, reports to the master that it is ready, and then receives a calculation job from the master. Once the slave has completed its job, it transfers the result to the master and receives the next job.



The calculation job statistics shows which computer has delivered how many results and the number of jobs that are currently in progress. Initially, this is approximately the number of threads. Towards the end of a calculation there are not enough jobs left for all threads, so the number decreases. If a computer is displayed in italics, the connection is currently interrupted, for example if it was switched off.

For tile calculation runs, you can see which tiles have already been calculated via **VIEW | TILES.**

If the communication between the master and a slave is interrupted, for example because the service computer was switched off and could not send back the last result, the master sends this block to another slave to ensure that all points were calculated at the end.

Add / remove slave

You can easily remove a slave from the calculation or include another one during the calculation.

Call **CALCULATION | PAUSE** or click on the corresponding icon. Now you can add or remove the PCs as you like or edit the PC list.

When you are done, click **CONTINUE** to continue the calculation**.** If new computers are included in the calculation, the necessary project data will be copied to the additional computers, then they will get calculation jobs.

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)

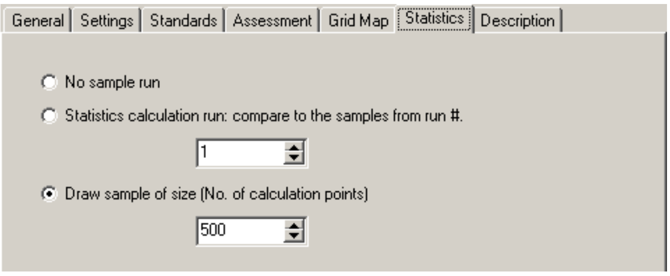
6

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.



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)

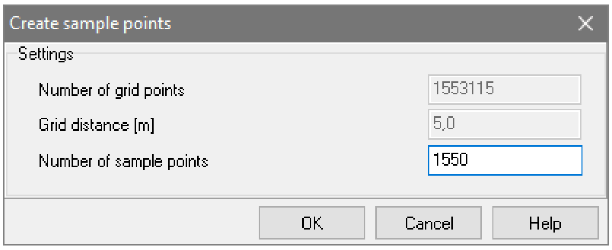
The samples from grid calculations can be drawn either in the Calculation Core or the Graphics. Reference receivers can only be generated if a DGM was used in the calculation.

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.

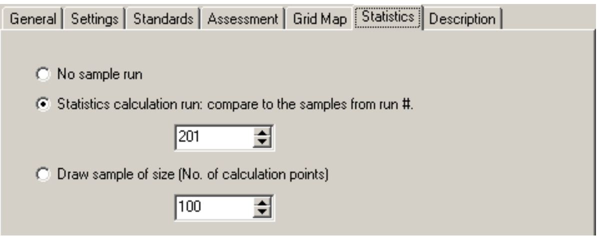
Open **EDIT MAP** and open **EDIT -> CREATE STATISTICAL SAMPLE FROM GRID MAP**.

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.



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.

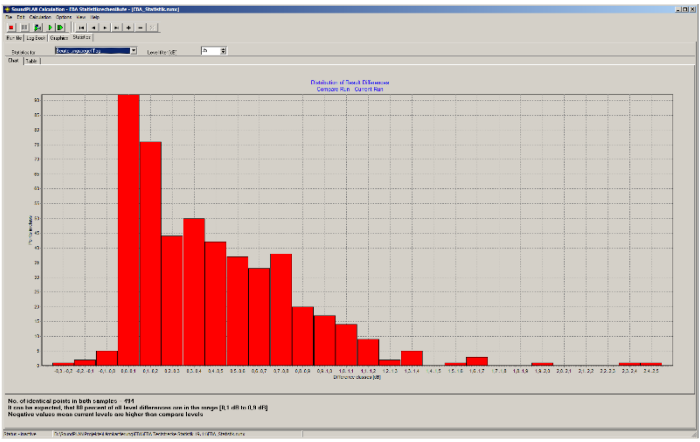


For statistical samples from the Calculation Core enter the number under which you saved the reference statistics results, for samples in the Graphics the results are saved under the same number as the original results.

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.



The processing of the statistics is done in accordance with DIN 45687. As the result you will get the confidence interval (deviations up or down) in which 80% of all results will lay.

7 Results tables

Overview results tables

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.

Working with the results 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.

- 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:

- 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:

- Run-Info
- Receiver table
- Source spectrum and source day histogram

If you stored the detail result tables, additionally the intermediate results for each receiver are displayed:

- Day histogram at the receiver
- 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)
- Table with all propagation parameters for each time slice for the Lmax levels
- Group table
- Charts of the day histogram and the spectrum at the receiver

7

For indoor noise and room acoustics, depending on the calculation type and the selected room acoustic parameters other / additional tables are displayed:

- Surfaces
- Reverberation times
- Average reverberation times
- Measurement path
- Auralization

With detailed results additionally:

- Room acoustics descriptors
- Echogram
- Background noise
- 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 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 tables

Depending on the level of detail of the results 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.

Calculation 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.

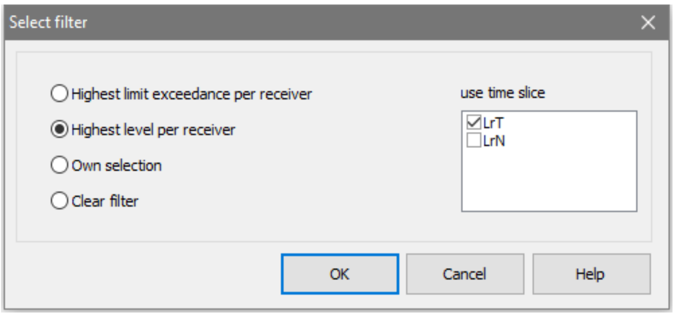
Depending on the settings in the table settings for the run info (right mouse button -> **TABLE SETTINGS**) the different parts of the run info can be printed for your records. Use the **TAB WIDTH** to define the width of the first column.

As for all other tables, you can also enter the table title and if needed additional texts.

Single receivers

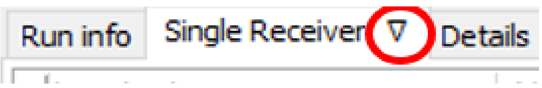
The single receiver table is stored for all calculations.

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**.



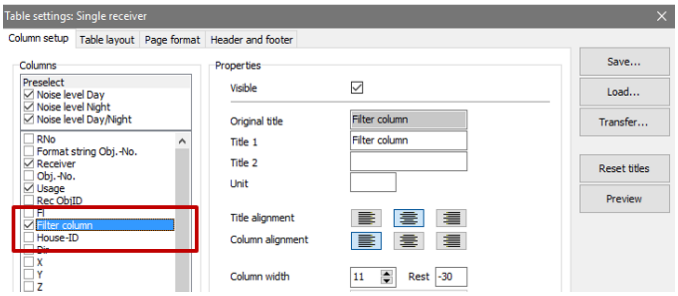
With the right mouse button -> **USE FILTER** respective **SHOW ALL** you switch the view.

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.



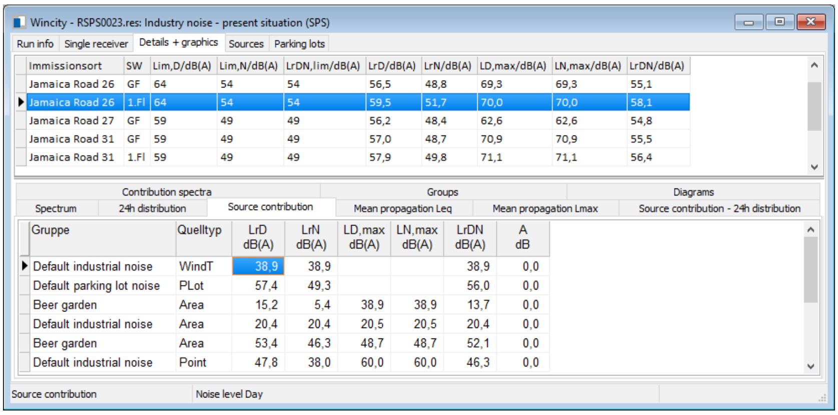
Filter to own selection

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.



Details and Graphics

Under the tab "*Details and Graphics*" the bottom table presents different details for the receiver selected in the top list.



Immissionsort	SW	Lim,D/dB(A)	Lim,N/dB(A)	LrDN,lim/dB(A)	LrD/dB(A)	LrN/dB(A)	LD,max/dB(A)	LN,max/dB(A)	LrDN/dB(A)
Jamaica Road 26	GF	64	54	54	56,5	48,8	69,3	69,3	55,1
Jamaica Road 26	1.Fl	64	54	54	59,5	51,7	70,0	70,0	58,1
Jamaica Road 27	GF	59	49	49	56,2	48,4	62,6	62,6	54,8
Jamaica Road 31	GF	59	49	49	57,0	48,7	70,9	70,9	55,5
Jamaica Road 31	1.Fl	59	49	49	57,9	49,8	71,1	71,1	56,4

Gruppe	Quelltyp	LrD dB(A)	LrN dB(A)	LD,max dB(A)	LN,max dB(A)	LrDN dB(A)	A dB
Default industrial noise	WindT	38,9	38,9			38,9	0,0
Default parking lot noise	PLot	57,4	49,3			56,0	0,0
Beer garden	Area	15,2	5,4	38,9	38,9	13,7	0,0
Default industrial noise	Area	20,4	20,4	20,5	20,5	20,4	0,0
Beer garden	Area	53,4	46,3	48,7	48,7	52,1	0,0
Default industrial noise	Point	47,8	38,0	60,0	60,0	46,3	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 day dB(A)	Contribution level night dB(A)	Attenuation dB(A)
4a, Jefferson Street LrD,lim 52 dB(A) LrN,lim 40 dB(A) LrD 49,5 dB(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) LrN,lim 50 dB(A) LrD 51,5 dB(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

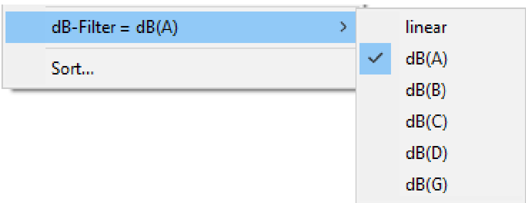
The columns of the top list look so squeezed on the screen, because they are formatted for the header rows in the printed table. The column widths refer to the distances of the column contents in the header row. The texts "title 1" and "Unit" are considered as "text before" and "text after" the column contents. Delete the text in "title 1" for columns in which the contents doesn'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.



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.

7

Mean propagation table - formula for Ls

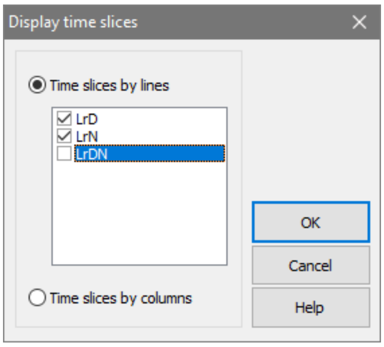
In the mean propagation table, the unweighted sound pressure at the receiver Ls is calculated using the following formula.

Ls=Lw+Co+ADI+Adiv+Agr+Abar+Aatm+Afol_site_house+Awind+dLrefl

Mean propagation table: Switching time slices on and off

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.

Right click on **TIME SLICES** to change the selection of the time slices and to change the display type.



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.

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 considered 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.

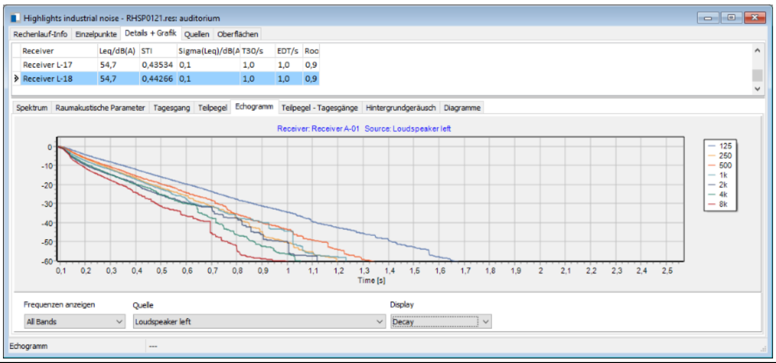
The source spectra can be displayed in third octaves or octaves and in different dB weightings.

Tables for room acoustics

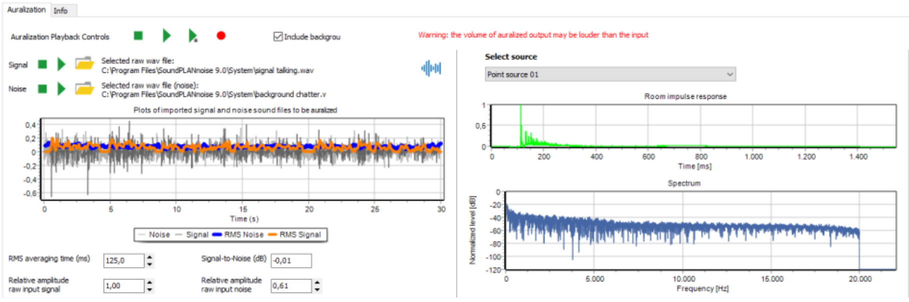
For room acoustics calculations, the indoor sources are provided as a source table as well as a separate table for the documentation of surfaces.

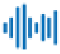
Depending on the room acoustic parameters included in the calculation, additional cards are created to document the measurement paths, reverberation times (table and diagram), user-defined and source-defined noises and signals, and auralization.

The echogram of the room impulse response is offered as a diagram in the results table. You can select whether you want to see the raw data, the decay time or additionally the regression line. Furthermore, select whether you want to view a single frequency or a single source, or all frequencies / sources.



Auralization



 Select the wav files for signal / background noise. Example are supplied for both signals. Select hem via the icon **USE SUPPLIED DEMO FILES**. You can select your own signal and background noise files using the **OPEN** buttons. Use the **START** and **STOP** icons to play the files or stop the playback.

If you select both, signal and background noise, these files will be mixed togethere with the relative volumes corresponding to the signal and background noise levels from the calculation. If only one file is selected, this will be auralized on its own at an unadjusted volume. If both files are selected, you can disable the background noise with the checkbox **USE BACKGROUND NOISE**.

The signal and background noise should have the same volume, so that an output has the same balance as in the SPD calculation. Therefore, both signals are normalized via an RMS average (Root-Mean-Squared), where the averaging occurs over short blocks of time. The time length of the blocks used for averaging is adjustable in the settings.

If the automatic procedure does not give a satisfactory result (for example, because an input signal has long gaps), you can then employ the “Relative amplitude” fields for signal and noise to adjust the signals and observe the relative strength of the signals by eye in the graph so that the volumes of the input signals are similar to a reasonable approximation.

Select the source(s) for auralization. This allows you to simulate a loudspeaker system where multiple sources deliver identical signals. You will notice the delay between the arrival of the signals with speakers located at different distances from the receiver. "All sources" is not useful for a mixture of loudspeaker sources and noise sources, because the noise sources will be treated as speaker sources. The diagrams display the room impulse response and the spectrum of the sources.

In the auralization playback you play the auralized original signal (green arrow), or the overall audio signal (green arrow with asterix). The red recording icon saves the auralization as a wav file.

Note: Auralized signals are normally listened to with headphones to avoid incorporating acoustic effects from the room the listener is currently in when playback occurs. The impression of the audio output and speech intelligibility can vary significantly between different playback devices and setups.

The output of the signals is normalized during processing and may be louder than the input signals. Please perform an initial test with the computer audio volume set very low to prevent damage to the ears.

7

Table settings and page layout

Wincity
Assessed receiver levels
Road noise - present situation (SPS)

Annex 2
Project No. 0387-01

Receiver	Usage	Floor	Dir	LrD,lim dB(A)	LrN,lim dB(A)	LrD dB(A)	LrN dB(A)	LrD,diff dB(A)	LrN,diff dB(A)
Jamaica Road 36	MI	GF	W	64	54	52,1	43,4	---	---
Jamaica Road 30	MI	GF	W	64	54	52,6	43,9	---	---
Jamaica Road 36	MI	1.Fl	W	64	54	53,1	44,3	---	---
Jamaica Road 30	MI	1.Fl	W	64	54	53,4	44,6	---	---
Old Kent Road 12	MI	GF	W	64	54	54,4	44,6	---	---
Jamaica Road 30	MI	2.Fl	W	64	54	54,8	45,9	---	---
Old Kent Road 12	MI	1.Fl	W	64	54	55,7	45,8	---	---
Old Kent Road 12	MI	2.Fl	W	64	54	56,7	46,8	---	---
Jamaica Road 26	MI	GF	W	64	54	57,3	47,3	---	---
Jamaica Road 26	MI	1.Fl	W	64	54	58,8	48,8	---	---
Old Kent Road 12	MI	GF	N	64	54	59,1	49,0	---	---

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page 1/5

SoundPLAN 8.2

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 presettings 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.

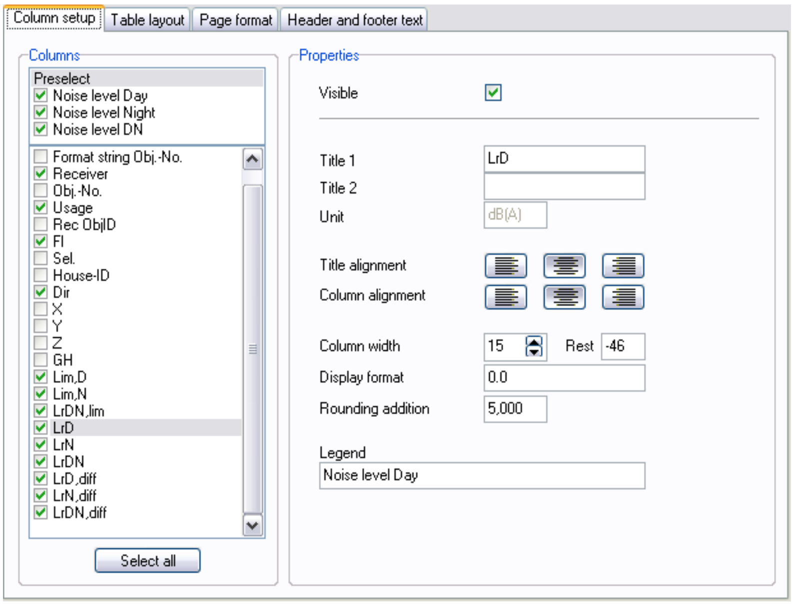
You can individually customize the selection of columns, their titles and units, and all settings for the table layout such as the font, size and color, and also set the texts for the table headers and footers. These settings can be saved globally to serve as templates for future tables.

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

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.



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.

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** of a table column can be configured individually.

;	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.

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.

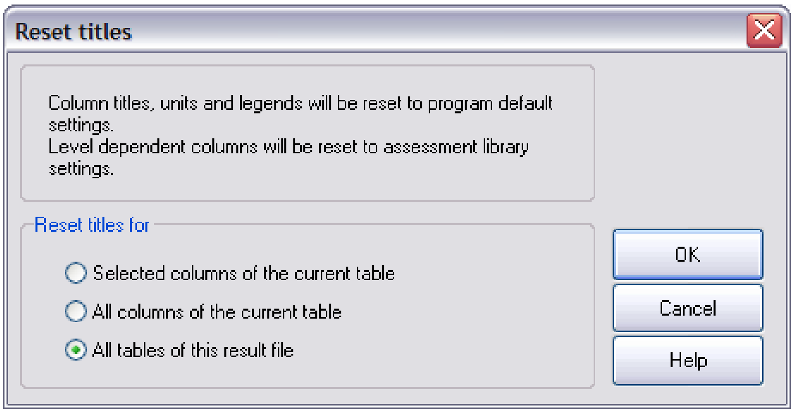
Detail header setup

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



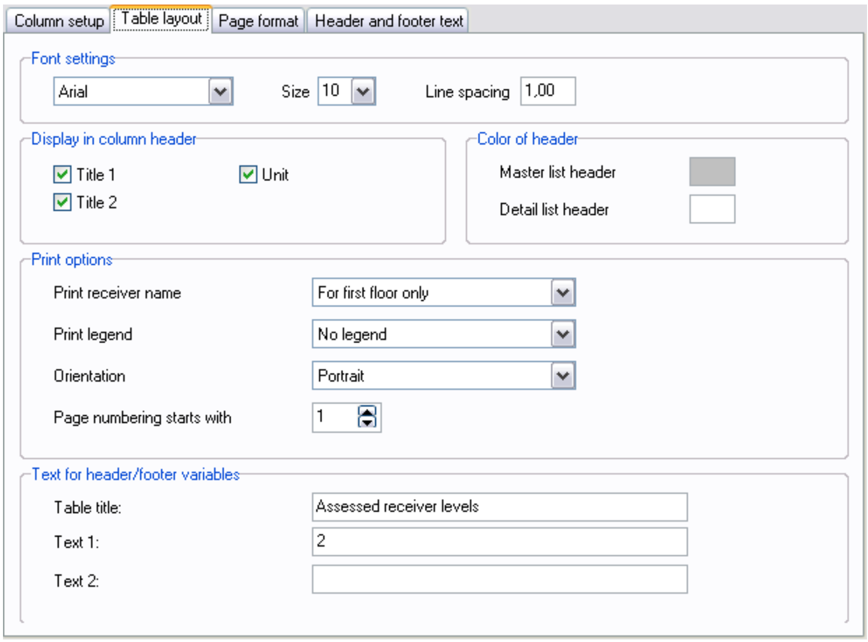
The assessment used during the calculation is also stored in the format file (*.fmt). If the assessment columns in the format file and the assessment used during the calculation do not correspond (for example after a recalculation with another assessment); you will get a warning message. Please use reset 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 layout



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.

Delete and store result files

Many different tables are stored during the calculation depending on the calculation type and result documentation depth.

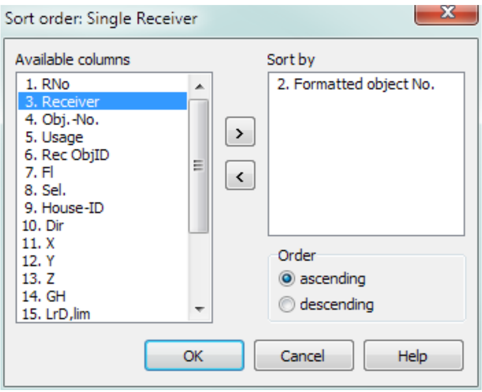
Go to **FILE -> OPEN,** click on the result file (*.res) you want to delete and press the ***Delete*** key. For security reasons, the selected results are displayed in a message. Please confirm the action.

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

You can sort in the single point table, in the source tables and in the detail tables (but not in the upper table for the detail tables).

Click on the column header of a column to sort that column in ascending or descending order. The selected column is then inserted into the sort dialog. The next time you click on this column header, the sorting will be reversed. If you click on another column header, the sort dialog will open, so that your set sort order is not accidentally changed.



In the sorting dialog, click on the column you want to sort by on the left-hand side and use the arrow to transfer to the right-hand side. If necessary, you can also select a second column to be used as a lower-level sort. Choose whether you want to sort in ascending or descending order. All selected columns are sorted in the same order. You can also call **SORT** using the right mouse button.

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 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.

Since the appearance of the headers and footers should be the same for all printed tables, there is the option to apply a page layout defined once to all tables. The header and footer texts are based on text variables, for example for project title, project number or table title, so that these, once edited and saved in the global format file, can be used individually for each printout without manual work.

When loading the layout for new calculation results, all settings are read from the global Tab_Layout file, but not the column titles and legend texts of the evaluation-dependent level columns. These are read from the texts of the used rating from the library. This initialization corresponds to the **RESET TITLE** function in the Table Settings dialog.

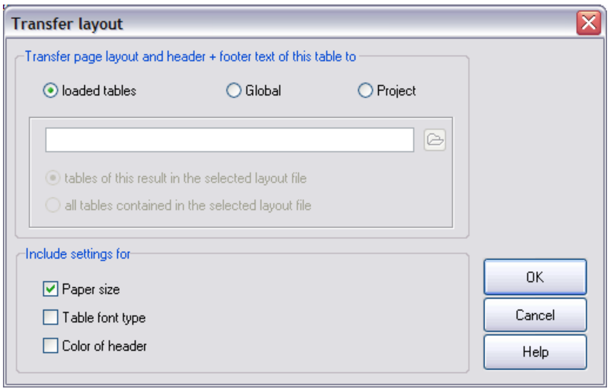
Save, load and transfer formats

With these functions you can overwrite changes to the column setup (displayed columns, column widths, column headers, ...) of selected columns, and additionally changes to the table layout (alignment, font size, ...) of the current table or all loaded tables in the global format file, or create any new format file.

Creating a new format file is sensible, for example, if you need different layouts for different clients or different table headers for different tasks.

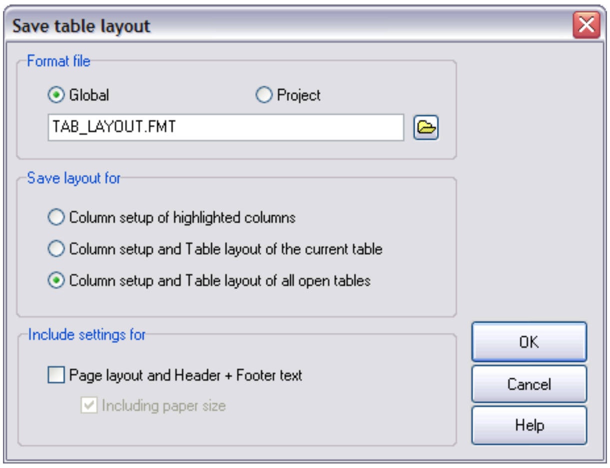
You have adjusted the column and table settings of all tables (visible columns, table alignment, additional texts for the page frame) for a calculation with detail results and additionally edited page format and header and footer texts for the single point table. Now you want to use these settings for new tables. The appearance of the single point table is to be used for all tables.

Click the **TRANSFER** button in the page format or in the header and footer texts:



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.

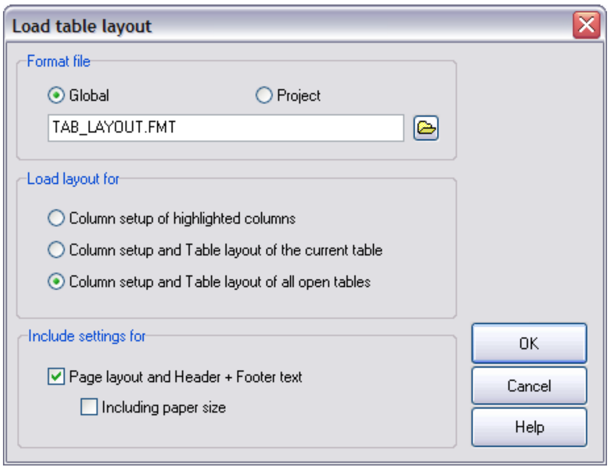
Afterwards, click **SAVE** in the column setup or the table settings:



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.

Page layout, header and footer texts previously transferred to all active tables are saved globally for each of the tables.

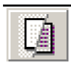
If you want to modify a result table for which an fmt already exists, load the appropriate file:



Transfer table settings to open results

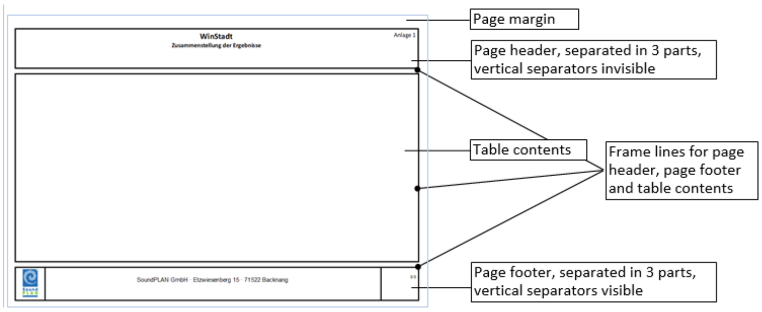
Transfer column setup, table layout, page format and headers / footers in one step from the active result to all other open results with **FILE -> TRANSFER TABLE SETTINGS TO OPEN RESULTS**.

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.

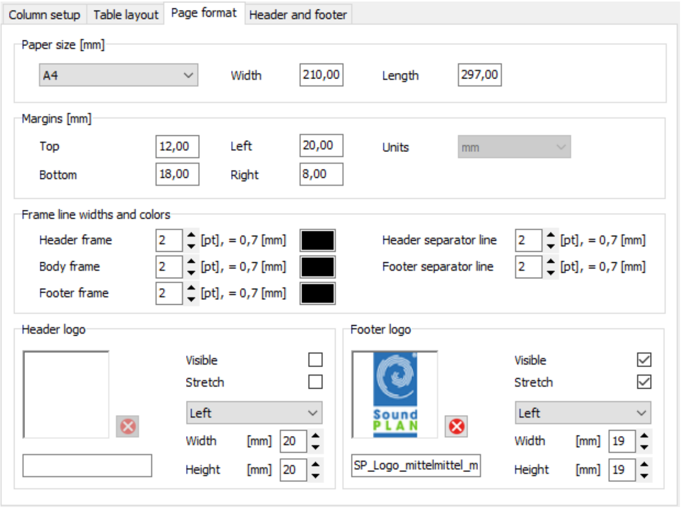


The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

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"*.

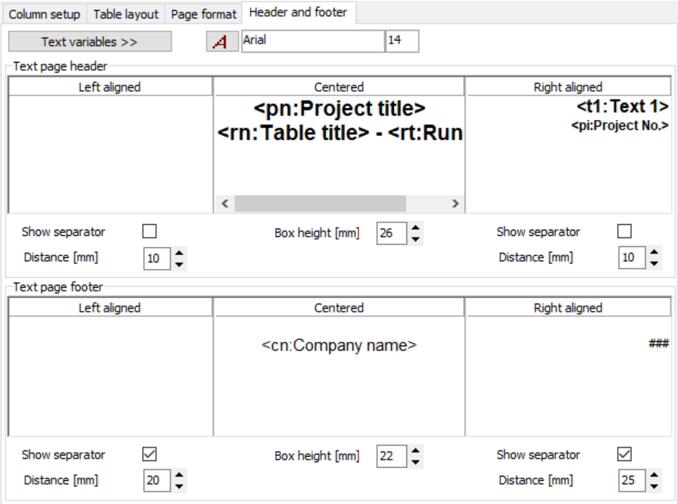


Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

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.

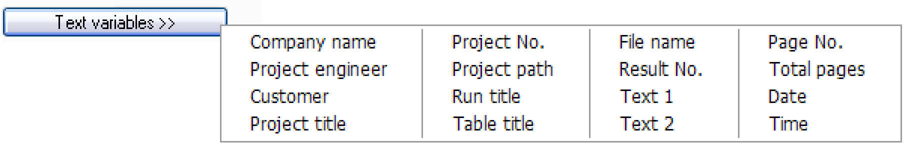
Format the content and the size of the page frame in the tab index card "*header and footer texts*". The texts can be text variables, automatically updated with information stored in the project or own texts.



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:



Variable name	**Origin**
Company name	License file
Project engineer	Project info
Customer	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 pages	
Date + Time	
Text 1 + 2 (only Result Table)	Text defined in the table layout

The variables can also be combined:

<pp:Project path><fn:File name>

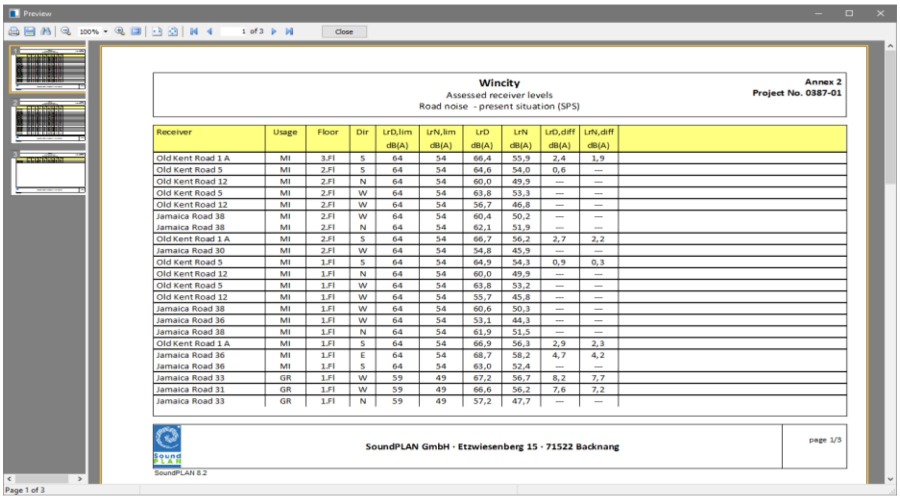
will be displayed as

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.

The Print Preview



Wincity
Assessed receiver levels
Road noise - present situation (SPS)

Annex 2
Project No. 0387-01

Receiver	Usage	Floor	Dir	LrD,lim dB(A)	LrN,lim dB(A)	LrD dB(A)	LrN dB(A)	LrD,diff dB(A)	LrN,diff dB(A)
Old Kent Road 1 A	MI	3.Fl	S	64	54	66,4	55,9	2,4	1,9
Old Kent Road 5	MI	2.Fl	S	64	54	64,6	54,0	0,6	---
Old Kent Road 12	MI	2.Fl	N	64	54	60,0	49,9	---	---
Old Kent Road 5	MI	2.Fl	W	64	54	63,8	53,3	---	---
Old Kent Road 12	MI	2.Fl	W	64	54	56,7	46,8	---	---
Jamaica Road 38	MI	2.Fl	W	64	54	60,4	50,2	---	---
Jamaica Road 38	MI	2.Fl	N	64	54	62,1	51,9	---	---
Old Kent Road 1 A	MI	2.Fl	S	64	54	66,7	56,2	2,7	2,2
Jamaica Road 30	MI	2.Fl	W	64	54	54,8	45,9	---	---
Old Kent Road 5	MI	1.Fl	S	64	54	64,9	54,3	0,9	0,3
Old Kent Road 12	MI	1.Fl	N	64	54	60,0	49,9	---	---
Old Kent Road 5	MI	1.Fl	W	64	54	63,8	53,2	---	---
Old Kent Road 12	MI	1.Fl	W	64	54	55,7	45,8	---	---
Jamaica Road 38	MI	1.Fl	W	64	54	60,6	50,3	---	---
Jamaica Road 36	MI	1.Fl	W	64	54	53,1	44,3	---	---
Jamaica Road 38	MI	1.Fl	N	64	54	61,9	51,5	---	---
Old Kent Road 1 A	MI	1.Fl	S	64	54	66,9	56,3	2,9	2,3
Jamaica Road 36	MI	1.Fl	E	64	54	68,7	58,2	4,7	4,2
Jamaica Road 36	MI	1.Fl	S	64	54	63,0	52,4	---	---
Jamaica Road 33	GR	1.Fl	W	59	49	67,2	56,7	8,2	7,7
Jamaica Road 31	GR	1.Fl	W	59	49	66,6	56,2	7,6	7,2
Jamaica Road 33	GR	1.Fl	N	59	49	57,2	47,7	---	---

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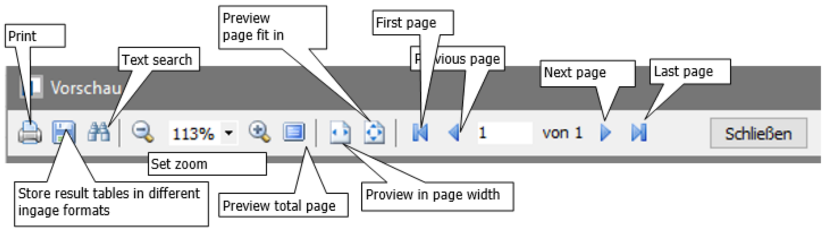
page 1/3
SoundPLAN 8.2

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 or in the table layout with the button Preview.

The functions of the icons are as follows:



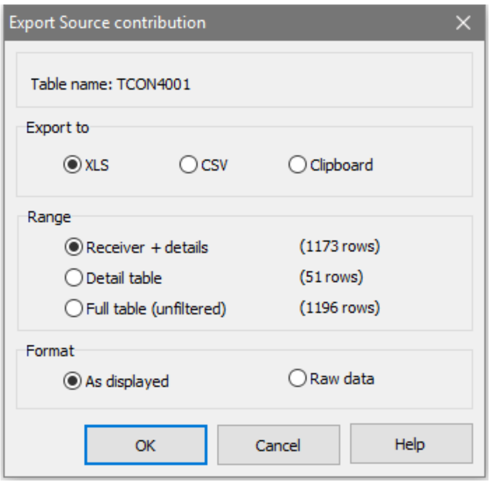
With the text search you can search for any text string contained in the table, for example to search for a specific receiver. Under the tab *search results* you will find all pages where the search string was found. With the check box **CASE SENSITIVE** checked, only texts are found with identical upper/lower case.

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**).

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.



If you choose the export as xls file, the table is directly opened in Excel.

7

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		Prognosis		Difference		Limit exceeded	
Floor	Direction	LrD	LrN	LrD	LrN	Day	Night	Day	Night
		[dB(A)]		[dB(A)]		[dB(A)]		[dB(A)]	
Oak Street 1		**Usage: GR**							
Limit day / 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	O	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	-	-
1	S	56,2	46,4	56,3	46,7	0,1	0,3	-	-
1	W	53,8	45,1	55,8	49,3	2,0	4,2	-	0,3

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.

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.

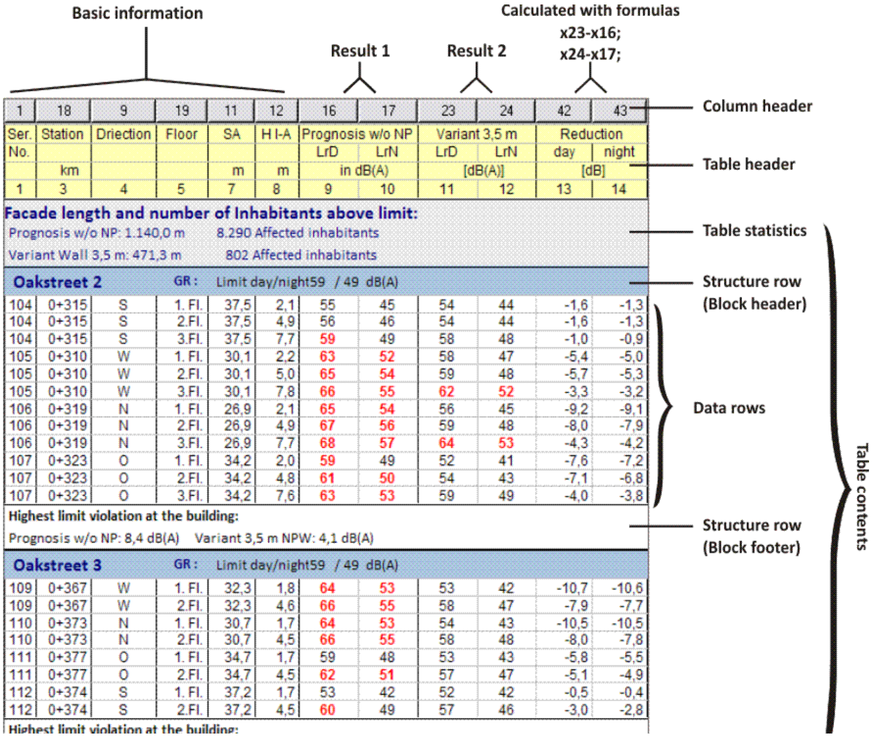
It is not necessary to export the data and after a result has been recalculated you get updated results and evaluations by just pressing a button.

The Spreadsheet executes different table types, which can also be linked together:

- **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**).
- **Wall / berm table** (*. wal) for the documentation of walls and / or berms.

8

Structure of a Spreadsheet table (here using the example of a receiver table):



1	18	9	19	11	12	16	17	23	24	42	43
Ser. No.	Station	Driection	Floor	SA	H I-A	Prognosis w/o NP		Variant 3,5 m		Reduction	
						LrD	LrN	LrD	LrN	day	night
	km			m	m	in dB(A)		[dB(A)]		[dB]	
1	3	4	5	7	8	9	10	11	12	13	14
Facade length and number of Inhabitants above limit:											
Prognosis w/o NP: 1.140,0 m			8.290 Affected inhabitants								
Variant Wall 3,5 m: 471,3 m			802 Affected inhabitants								
Oakstreet 2			GR :	Limit day/night59 / 49 dB(A)							
104	0+315	S	1. Fl.	37,5	2,1	55	45	54	44	-1,6	-1,3
104	0+315	S	2.Fl.	37,5	4,9	56	46	54	44	-1,6	-1,3
104	0+315	S	3.Fl.	37,5	7,7	59	49	58	48	-1,0	-0,9
105	0+310	W	1. Fl.	30,1	2,2	63	52	58	47	-5,4	-5,0
105	0+310	W	2.Fl.	30,1	5,0	65	54	59	48	-5,7	-5,3
105	0+310	W	3.Fl.	30,1	7,8	66	55	62	52	-3,3	-3,2
106	0+319	N	1. Fl.	26,9	2,1	65	54	56	45	-9,2	-9,1
106	0+319	N	2.Fl.	26,9	4,9	67	56	59	48	-8,0	-7,9
106	0+319	N	3.Fl.	26,9	7,7	68	57	64	53	-4,3	-4,2
107	0+323	O	1. Fl.	34,2	2,0	59	49	52	41	-7,6	-7,2
107	0+323	O	2.Fl.	34,2	4,8	61	50	54	43	-7,1	-6,8
107	0+323	O	3.Fl.	34,2	7,6	63	53	59	49	-4,0	-3,8
Highest limit violation at the building:											
Prognosis w/o NP: 8,4 dB(A)			Variant 3,5 m NPW: 4,1 dB(A)								
Oakstreet 3			GR :	Limit day/night59 / 49 dB(A)							
109	0+367	W	1. Fl.	32,3	1,8	64	53	53	42	-10,7	-10,6
109	0+367	W	2.Fl.	32,3	4,6	66	55	58	47	-7,9	-7,7
110	0+373	N	1. Fl.	30,7	1,7	64	53	54	43	-10,5	-10,5
110	0+373	N	2.Fl.	30,7	4,5	66	55	58	48	-8,0	-7,8
111	0+377	O	1. Fl.	34,7	1,7	59	48	53	43	-5,8	-5,5
111	0+377	O	2.Fl.	34,7	4,5	62	51	57	47	-5,1	-4,9
112	0+374	S	1. Fl.	37,2	1,7	53	42	52	42	-0,5	-0,4
112	0+374	S	2.Fl.	37,2	4,5	60	49	57	46	-3,0	-2,8
Highest limit violation at the building:											

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 …).

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.

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

Procedure 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.

- 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.

Procedure to create an area table [module Cartography]:

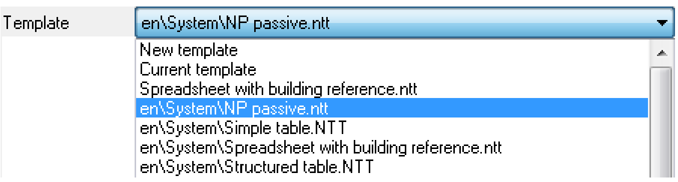
- Open the Spreadsheet from the SoundPLAN Manager, the Spreadsheet file manager is opened.
- Choose the table type "area table (conflict map)".
- Click the **NEW** button.
- Select a Situation or a Geo-File containing areas (object type area usage in the Geo-Database). For the EU statistics it is sufficient 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 statistical evaluations, 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 "Statistical evaluations" (page 505).
- 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 conflict map (see “Conflict map / Summed-up conflict map” (page 476)) 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.

Procedure for creating a building table [module Tools SIP]:

- Open the Spreadsheet from the SoundPLAN Manager, the file manager opens.
- Select the table type "Building table".
- Click on **NEW**.
- Select a result and in the settings whether only the loudest floor or all floors of the loudest point per building should be loaded.
- With OK the table is generated.

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.



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.

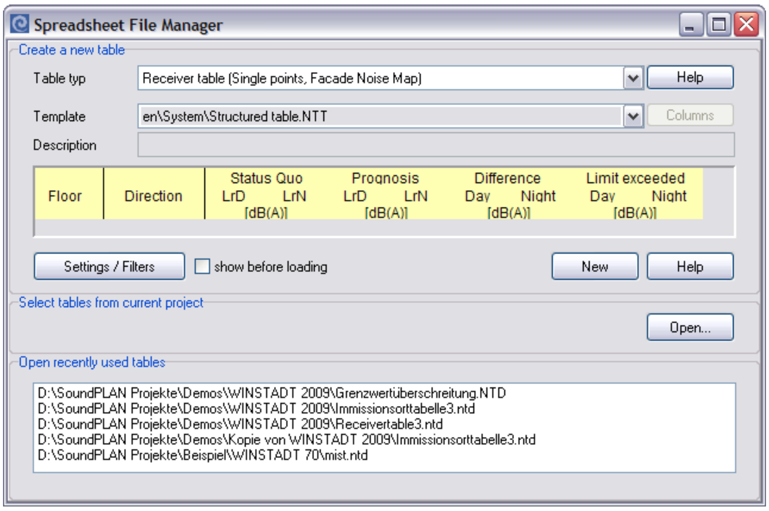
CURRENT TEMPLATE uses the columns and the layout of the currently opened table. When you start the Spreadsheet, the current template is the same as the new template.

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.

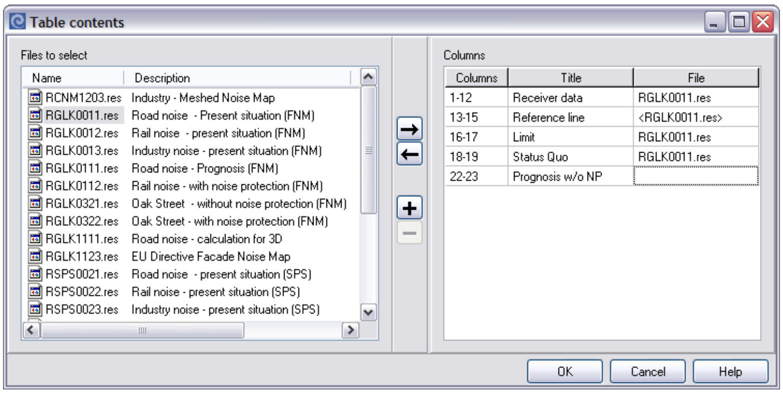


If you want to generate a new spreadsheet, first select the table type. If you want to open one of the spreadsheets you worked on last, go to the bottom of the dialogue and open an existing file.

Generate a new Spreadsheet with an existing template

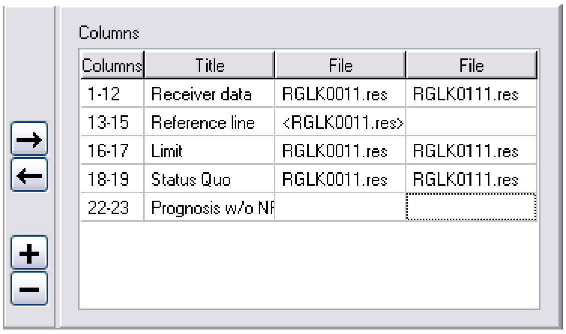
After selecting the table type (receiver table, area table), you are presented with all templates fitting the selected file type. The current template is shown in the preview window. Select the desired template and continue with **NEW**.

The box **TABLE CONTENTS** opens where you assign all connections simultaneously.



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 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.



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 "Settings and filters" on page 319. The document settings are automatically displayed before the table is opened if the template contains customized filter.

Tables with group results can also be used as templates for new tables. The group columns created are also displayed in the table contents for assigning the data. Assign the data as usual with a double click or the right arrow. If the group names in the template differ from those in the result file, a window for selecting the current group opens.

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 "Settings and filters" on page 319.

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 attributes 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:

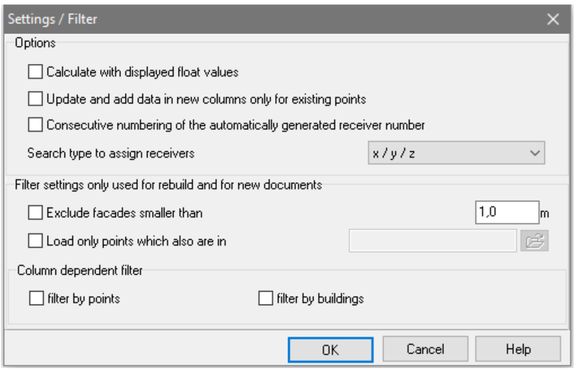
- Load and save (save as is not offered as the dBase-table must have the same name as the rest of the Shapefiles, safety copies can be generated using the Windows-Explorer).
- Generation of extra columns.
- Entry and calculation of formulas.

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.

Settings and filters

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.**



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 decimal place: **51.**5 (51.541) **- 51.5** (51.450) results in a difference of 0.0 when switched on, when switched off the difference is 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.

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

See also "Process receivers with non-identical position" (page 518).

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.

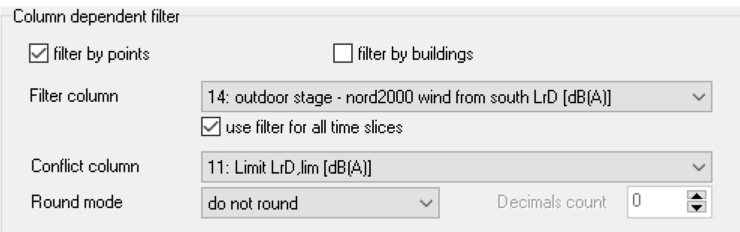
Column dependent filter

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



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.

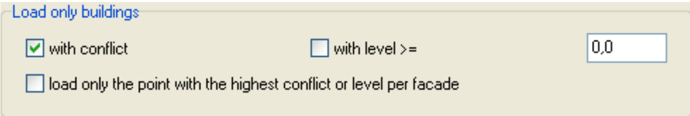
Please be aware that this is not necessarily the receiver point with the highest noise level.

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.

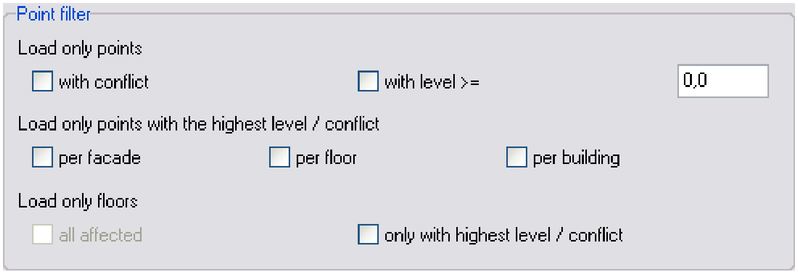
The setting "calculate with displayed float values" is **not** used for the filtering.

Filter by buildings



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



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**

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.

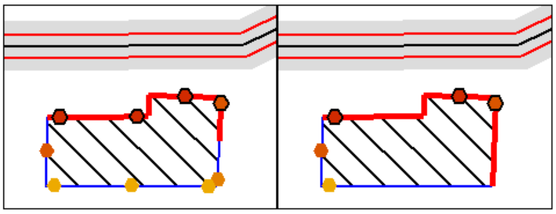
Effect of the filtering upon calculations

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.

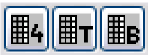


Similarly, the display of the Facade Noise Map in the object settings will use scale colors to paint the facade either for a single receiver or for the entire facade.

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.

Add results and columns

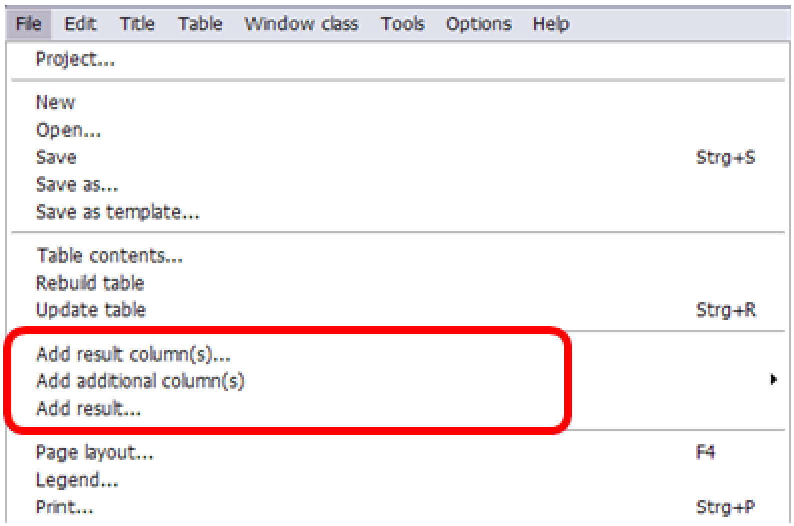
Add new (empty) columns



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 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

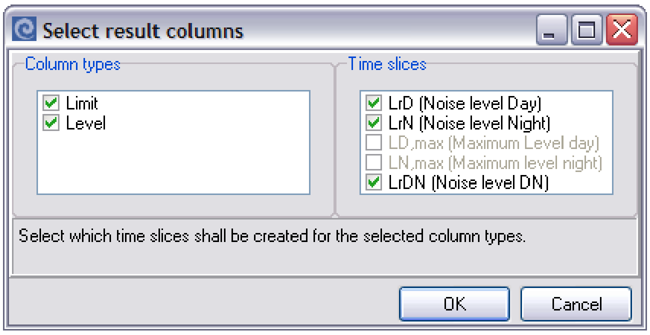


Add result columns

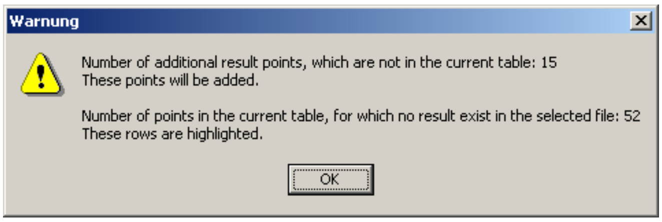
For the documentation of the results of several calculation runs e.g. different noise sources or different states of investigation (analysis, forecast), add columns with **FILE | ADD RESULT COLUMNS** to the existing table. If the coordinates of the receiver locations are the same as in the previous result file ("same" is specified by the **SEARCH TYPE TO**

ASSIGN RECEIVERS, see "Settings and filters" (page 319), 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.



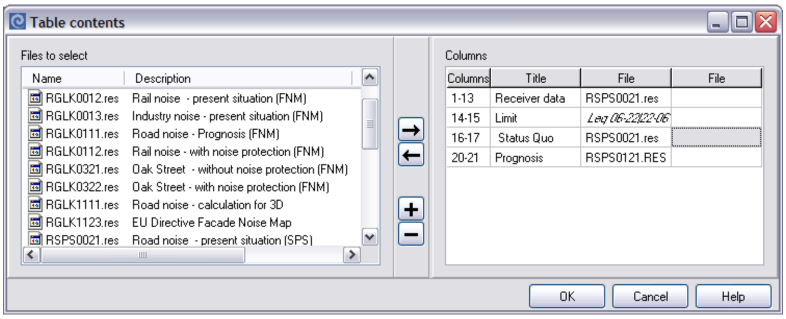
Receivers that have not been included in the first result file are appended at the end of the table. For these receivers only the new column can be filled in. You are informed about the number of receivers that do not match:



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:

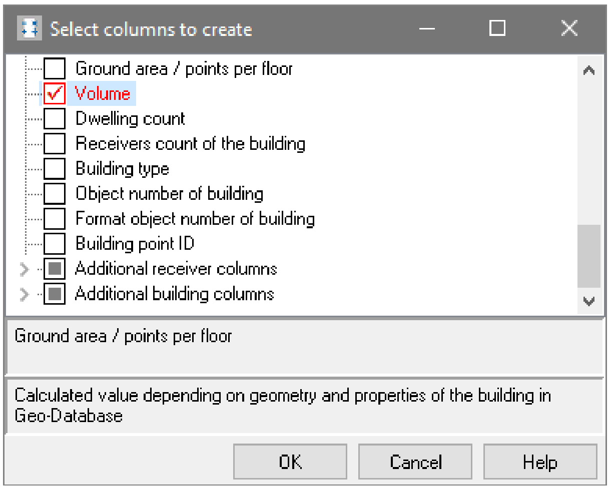


Click on the right-hand side on the variant for which you want to add results and select the file on the left-hand side. Select the file with the right arrow or with a double click. To further add a result to a variant, click on the +.

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. Additionally, you can add any column with free properties of receivers or buildings you entered or imported in the Geo-Database. The origin of the information for the area table is area usage properties.



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.

8

The calculated columns can be summarized per building or per area in structure and statistics blocks, as well as used for further calculations, see "Table structure and table statistics" (page 341).

Add columns from IO tables or area tables

In an receiver table, reference can be made to columns of an area table, whereby the information that is available in the area table on an area basis is entered as a column for the receivers.

Conversely, information that is available point by point in the immission sort table can be summed up to the areas in the area table.

Reference axis for stationing

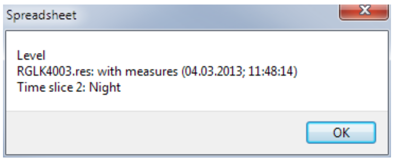
If a reference axis of a road or rail has been defined in the properties of the Geo-Database (check mark “reference axis), the kilometer for the assignment of a receiver can be output. In addition, the distance of a receiver from the axis and the height of a receiver above the axis can be output via the reference axis.

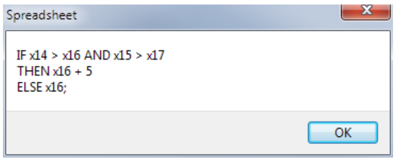
The reference axis is automatically assigned from the geometry data used for the calculation. If you want to use the reference axis of another Situation, go to **FILE | TABLE CONTENTS** and select another Situation.

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 dependent columns

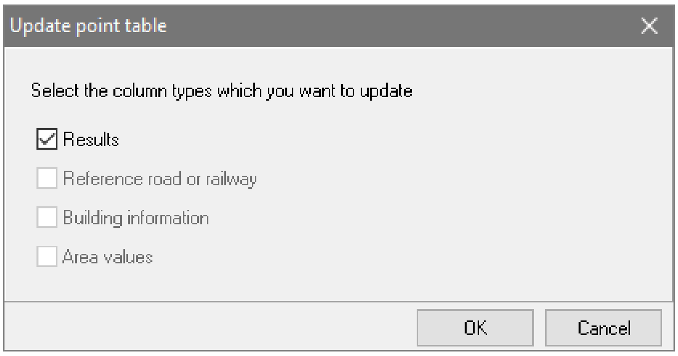
When you generate a new Spreadsheet using existing templates, the current result file is always marked as the data source. For the geometry dependent columns, the Situation used in the calculation run is used as the data source.

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.

Update or create new Spreadsheet

During the program session you can access newly calculated results with **FILE | UPDATE TABLE *(Ctrl+ R)*** and **FILE | REBUILD TABLE** (***Ctrl+N***).

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.



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. Manual cell layout, inserted text rows and manually hidden rows are lost.

UPDATE TABLE only updates the results already contained in the table, i.e. no receivers are added or removed. The results cannot be updated once filters have been applied in the table, because then filter settings and results might not match anymore. Manual cell layout, inserted text rows and manually hidden rows are retained.

Table settings

The table setup is accessed via the symbol button or **TABLE | TABLE SETTINGS**.

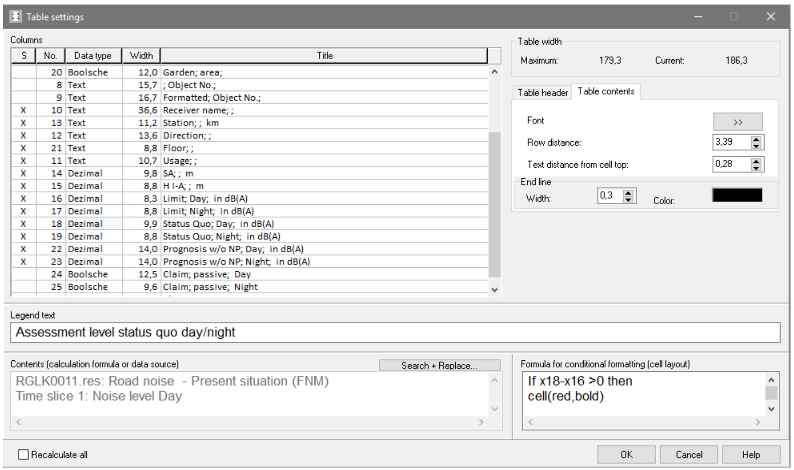


Table Settings

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.

8

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

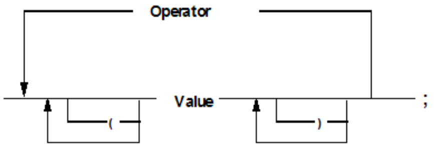
The structure of the formulas is described using syntax charts. Please read these charts always from left to right. If branchings are used in the syntax chart, select the branch needed. If a branch leads back, it is marked with an arrow. When returned to the main branch, read further to the right. Such a construction is called a loop.

The instruction is such a loop (see chart below):

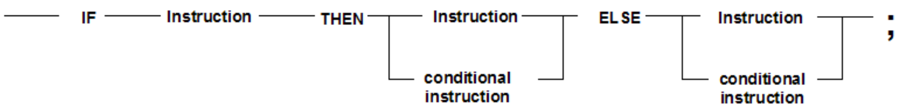
Enter a value in the main branch, e.g. 5, in the backwards branch an operator has to be entered, e.g. +. Back in the main branch a value is needed again, e.g. 4. The instruction therefore is: 5 + 4;

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 is normally marked with a semicolon ;.

Creating formulas - commands and keywords

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

Arithmetic operators	+, -, *, / (division), ^ (x^y power)
Relational operators	<, <=, =, >=, >, <>
Boolean operators	AND, OR, AND NOT
Assignment	:=

Instructions

	Simple instruction *Value 1* Arithmetic operator *Value 2* Example: Evaluation of a level exceeding the limit x17-x15;
IF, THEN, ELSE	Conditional instructions check the truth value of an instruction. If the instruction in the IF branch is true, the result of the THEN branch is displayed

otherwise the result of the ELSE branch.

Example 1: Evaluation of a level exceeding the limit; values < 0 shall be displayed as 0. Add a value column.

IF x17 - x15 > 0 THEN x17 - x15 ELS 0;

Example 2: If the limits day and night are kept a dash shall be displayed otherwise the limit exceedance day and night. (The limits are in the columns x14 (day) and x15 (night) and the levels day / night are in the columns x16/x17.) Add a text column.

IF (x11 - x7 <=0) AND (x12 – x8 <=0)
  THEN "-"
  ELSE TEXT(x11-x7) + “/” + TEXT(x12-x8) ;

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;

8

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, 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"

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 the text functions

You can combine different text functions for example if you want to extract a set of values from the receiver name.

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);

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
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(x18..x22) >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

Arithmetic functions (- Function (instruction) -

ROUND

ROUND (column number [,decimal places])
Results the arithmetical rounded value. You can optionally determine which decimal should be rounded. Without specifying decimals results the rounded integer value.

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^2

SQRT result is square root of x

EXP result is x^y

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))

RLS90(x12);

KM Converts the km post calculated in the Geo-Database into km+meter (in GeoDB; 0,665 | 0+665). KM(x10);

++ (LEVELSUM) x17++x18 energetically sums up the levels in the assigned columns.

You can also use LEVELSUM (x17..x21) for the level addition of more than two columns

-- (LEVELDIFF) x17--x18: the result is the energetical difference of the assigned columns.

You can also use LEVELDIFF(x17..x21) for the level difference of more than two columns

CONFLICT-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)
60,3	59	1,3
58,7	59	0
60,3	0	0

CONFLICT Enter a Boolean column to check for example whether levels are exceeding the limits.

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"
x19=58, x17(limit)=59, Result "false"
x19=60,3, x17(limit)=0, Result "false"

FIRSTROW
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 **TABLE | ADD COLUMN** and write the following formula for column 28

If FIRSTROW then 1
else if x7 =PR7 then PR28
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*column number* 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 …“

With this new keyword the keywords „Firstrow“ and „PR“ can often be replaced.

BH
BF
STAT

Assign fields of structure lines.

BH*number* Block begin- or Header line

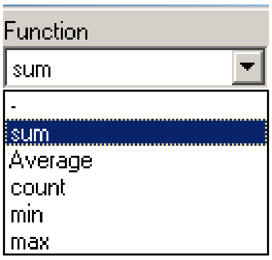
BF*number* Block end- or Footer line

STAT*number* Statistics row

"*number*" refers to the position of the column in the list of block header or block footer; see "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:

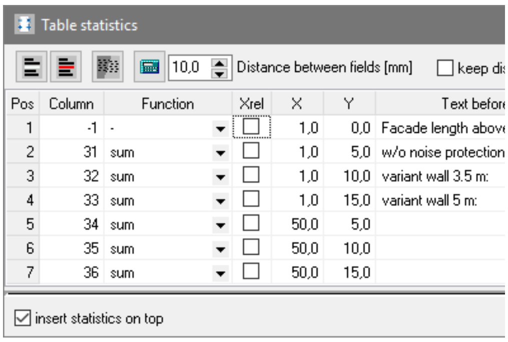


If the column setup has been set to **„- FOR VALUES <= 0“**, then values < 0 are ignored for statistics. For the calculation of the averaged level reduction due to a noise protection measure you can this way omit levels that have already been within the limits without the measure.

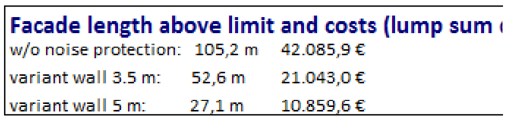
The function “count” sums all displayed rows in a block.

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:**



Effect in the Spreadsheet:



Usage of structure fields in formulas" (page 344).

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-COUNT	Counts the number of conflict values CONFLICTCOUNT(*column number*)
SUMX	SUMX*statisticsscolumn* (no blanks permitted) in a value column: sums up the contents of a statistics column

File operations – extended formula entry (fyi entry with double click on the file in the table)

GNM - GOP

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

Facade Noise Map– Façade Map Operation

RFNM(*No[,group No.],time slice No.*

MNM

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 number of the time slice.

If the groups and/or frequencies were stored during calculation, these results are entered as optional parameters. The group or frequency number is according to the order in the selection list. As the sum level is the first entry in the list, the first group / frequency in the selection list is assigned with “2”.

The number of the time slice is the order, the time slices are defined in 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 time step for the delay of one of the grid maps. One time step corresponds to approx. 0,125 seconds.

For Meshed Noise Maps the parameter selection is slightly different. The parameters are assigned in brackets. Here you can do operations with single frequencies or frequency bands and specify the dB-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 third-octave or the frequency band, e.g. 63-8000

dB-weighting: _, A, B, C, D

Conditional formatting (formulas for highlighting cells)

CELL

Defines text color, text style and the cell background color. It is defined using special key words or RGB values.

If the settings from the column layout are to be used for "false", the ELSE branch can be omitted for conditional formatting.

Example:

```
IF X19>x17
  THEN CELL(CC=lightred, bold, italic)
```

Keywords

Keywords for text and colors:

bold, italic, underline, strikeout

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 use

255 and 200, the dark colors use 200 and 0.

TC — **Text color**: The parameter TC is needed if you use RGB values, otherwise the keyword is sufficient.

Example: CELL(red, bold), CELL(strikeout)

CELL(TC(r,g,b),text style)

Example CELL(TC(255,150,0), bold)

CC — **Cell color:** To set the cell color, it is always necessary to add the instruction CC.

CELL(CC=color[, text settings])

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 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);
```

CONFLICT

```
If CONFLICT (X19-X17)
   then CELL (ZF=lightred, bold);
```

Data types and variables (Example see "Variables in formulas for Spreadsheet and file operations")

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 … end;	Formulas must be enclosed in a begin – end block, each command must be ending with a semicolon;

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 „var“, commands must be made visible as a block with the commands „begin“ and „end“. Each command needs to be ended with a semicolon („;“).

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 exceedance day
   dPGwN := x17-x15;     //  noise limit exceedance night
   if  dPGwT > dPGwN
       then  dMax := dPGwT
       else  dMax := dPGwN;
  // the result is written into the column where the formula 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.

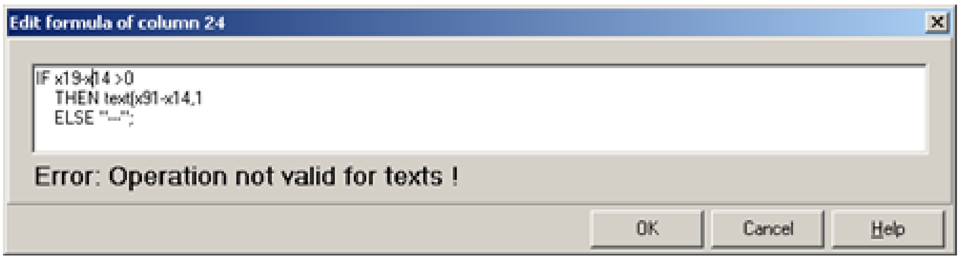
8

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 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.



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.

Circular references in formulas

When calculating formulas, the system checks for circular references and the use of the “own” column. The formula interpreter tries to calculate all formulas correctly by rearranging them, if necessary. If this is not possible, the calculation is aborted and a description on the problem is added to the logbook. You can invoke the check manually using the **DATA CHECK** icon.

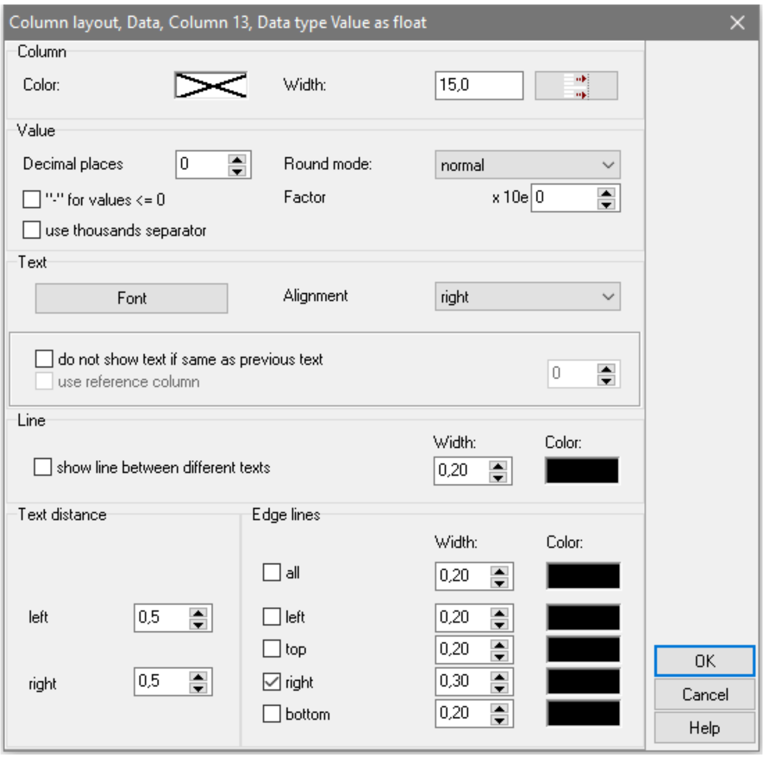
Designing Spreadsheet tables

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 different 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.



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.

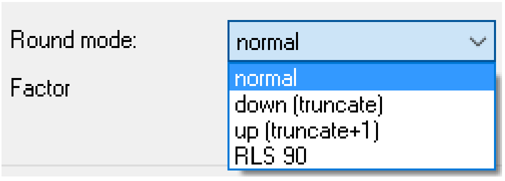
The background color of the columns can be set to highlight a column. The background color is set to transparent by default for the table contents.

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.

Enter the number of decimal places and the round mode:



The round mode **NORMAL** rounds according to the mathematics standards. The round result depends on the numbers of decimal places defined in the field **DECIMAL PLACES.**

1 decimal place	0,3499 | 0,3	0,3500 | 0,4
2 Decimal place	0,3499 | 0,35	0,3500 | 0,35

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 | (0,3 + 0,1) = 0,4	0,3500| (0,3 + 0,1) = 0,4

The rounding type **RLS90** adds the rounding number 0.95 to the actual value. The values are displayed without decimal places.

RLS90	49,04+0,95 = 49,99 => 49	49,05+0,95 = 50,00 => 50

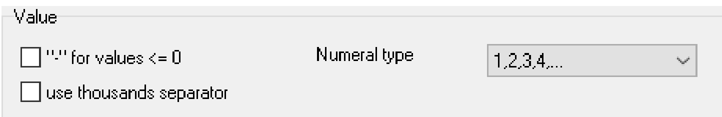
Values <= 0 can be displayed with a minus (-) instead of the value. Activate the check box **"-" FOR VALUES <= 0**.

If the column setup has been set to „- for values <= 0“, then values < 0 are ignored for table statistics (i.e. for the average).

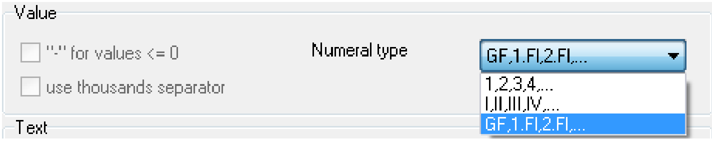
USE THOUSANDS SEPARATOR groups values > 1,000 to groups of three figures and inserts a comma (or a point, if the decimal separator is a comma).

The **FACTOR** can be used to rescale the unit for the display, e.g. -3 to display [km] instead of [m].

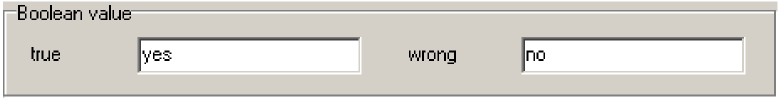
There is no round mode for **Integer columns**. If a value in an integer column comes from a float column, it is rounded arithmetically. You can change the display of the numbers from Arabic to Roman numbers.



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.



Boolean columns distinguish between true and false. Enter the text that shall be displayed in the table for true statements and for false statements.



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. No.	Receiver name	Station km	Direction	Floor	Usage	SA m	H I-A m	Limit in dB(A) Day	Limit in dB(A) Night	Status Quo in dB(A) Day	Status Quo in dB(A) Night
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	O			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	O			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	O			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	O			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 way to make a large table easy to read is to define a table structure in which recurring information is output in a header line, see "Table structure and table statistics" (page 341).

The **TEXT SPACING** defines the distance of the text from the left or right margin of the cell. This function can be used, for example, to output values right-aligned but with a defined distance from the right margin.

The **BORDER LINES** can be entered separately for each border line (right, left, top, bottom). Specify whether the border lines should be drawn and if so, in which width and color.

Adjustments in the table header

You can join cells in the table header to make the headings more meaningful.

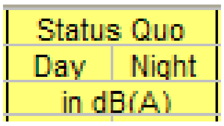
Define the font, the text style and the text color via the button **FONT** and the **ALIGNMENT** of the text. All settings hold for the complete column. Enter a **TEXT DISTANCE** left or right if you want to have a distance from the cell edge. (Use conditional formatting to highlight single cells).

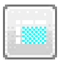
8

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 "Printing the legend" (page 348).

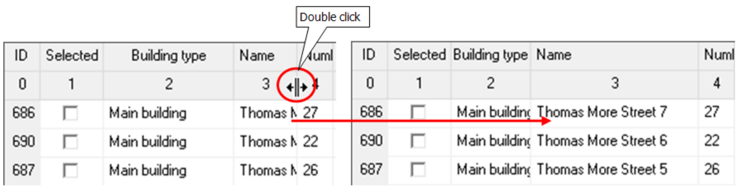

You can delete the column numbering with ***Ctrl+ Del*** or with the symbol **DELETE LINES** from the column header.

Tools for adjusting column widths

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.



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.**

EQUAL COLUMN WIDTHS sums the widths of the selected columns and distributes the total evenly among these columns.

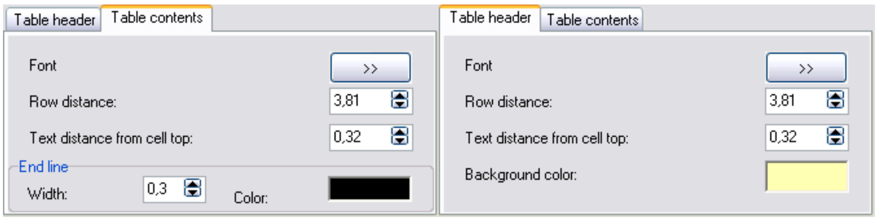
Or you can adjust the column widths of all columns so that all columns fit in the selected page format (portrait or landscape). Select **TOOLS | FIT IN COLUMN WIDTH IN PAGE WIDTH.**

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

The tabs on the right-hand side of the dialog box **TABLE SETTINGS** handle table header, table contents and table width definitions.



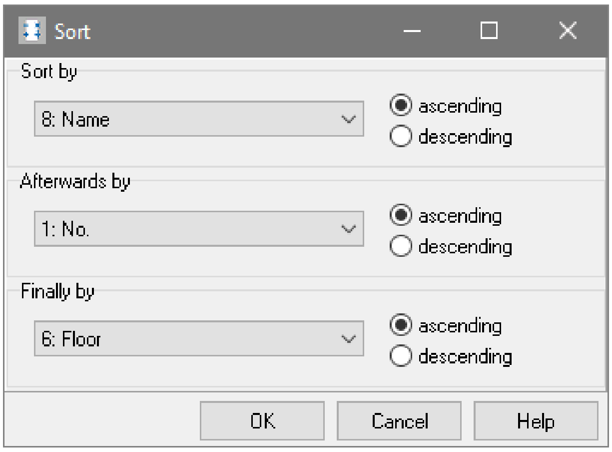
The **FONT** definition is the same for table header and table contents. Once the fonts and text sizes have been modified, the texts can be proportionally enlarged or shrunk via the text size field on the right hand of the tool bar . The text size displayed is the table contents text size.

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.



If columns are highlighted, the sorting is only valid within the range of the highlighted columns.

With **TOOLS | RENUMBER RECEIVERS,** the serial number of the receivers is numbered consecutively from 1 according to the current sorting.

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 - Highlight cells with color

The analysis of results and statements must often answer to the following questions:

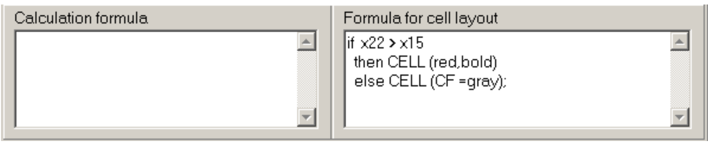
- Where do we have limit violations?
- What are the highest levels?
- Where are most of the inhabitants affected?

Use conditional formatting to easily highlight interesting cells or unusual values and make them visible with different colors.

1, Keyland Road Usage: Residential

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.



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. You can determine the text color as well as the background color of the cell.

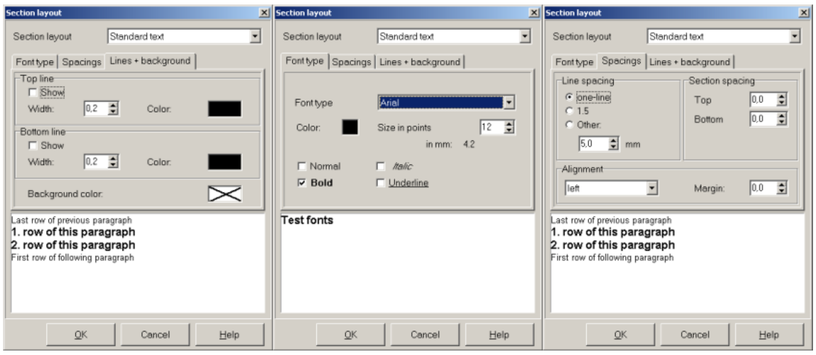
CELL (font color[, font style]) defines the style of the text

CELL(CC=background color) defines the cell background color

Example: IF x13>60 THEN CELL(CC=gray, red, bold) sets the cell background to gray and the cell text to red and bold if the condition is true.

The key words are described in the section Conditional formatting (Formulas for highlighting cells), see "Calculating using formulas" (page 326).

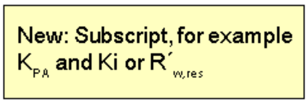
Section layout



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 the table headers of an Spreadsheet, you can subscript texts. Write the text as usual, select it and click the **SUBSCRIPT** icon. Since you are still editing the line, the subscript text is indicated with control characters.



$R'_{w,res}$, for example, is displayed as "R'@\l+w, res@\l-". As soon as you finish editing the text, the subscript will be effective.

If you need a different highlighting, you can change the control characters manually:

@\l+text@\l-	= subscript
@\h+text@\h-	= superscript
@\i+text@\i	= italic
@\b+text@\b-	= bold

More tools and shortcut keys

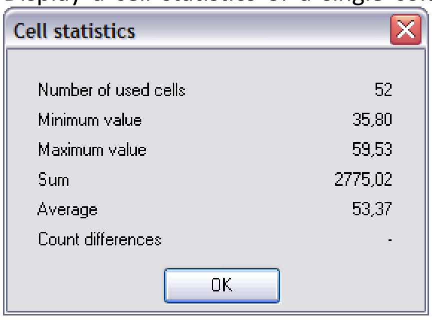
Via **EDIT | OPERATION** you can make manual changes in a finished table. However, if the column originates from a calculation, the changes will be reset when updating.

Select the cells you want to change (or select the whole column with right mouse button on the column header | **HIGHLIGHT**) and enter the value or text that will be transferred to all selected cells.

Use **EDIT | SEARCH AND REPLACE** to correct for example a spelling mistake in the receiver name without a recalculation.

With **TABLE | HIDE ROWS** you can hide the selected rows or unselected rows, for example to check receivers at the end of long tables. Via **TABLE | SHOW HIDDEN ROWS** these are displayed again. To do this, individual cells can be highlighted with a formula by right-clicking on the column header | **CALCULATE AND HIGHLIGHT**.

Display a cell statistics of a single column or selected cells with **TOOLS | STATISTICS.**



TOOLS | LEVEL SUM calculates the level sum of a column or the selected cells.

With **TOOLS | RENUMBER RECEIVERS,** the serial number of the receivers is numbered consecutively from 1 according to the current sorting.

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.

Table structure and table statistics

1	13	12	14	15	18	19	22	23	26	27
Serial. No.	Station	Direction	SA	H I-A	Status Quo		Varian Wall 3.5 m		Variant Wall 5 m	
					Day	Night	Day	Night	Day	Night
	km		m	m	in dB(A)		in dB(A)		in dB(A)	
1	2	3	4	5	6	7	8	9	10	11
Facade length above limit and costs (lump sum of 400 € per m facade length)										
w/o noise protection:	105,2 m	42.085,9 €								
variant wall 3.5 m:	52,6 m	21.043,0 €								
variant wall 5 m:	27,1 m	10.859,6 €								
Oak Street 13			**GR**		Limit Day / Night 59 / 49 dB(A)					
625	0+469	S	46,43	0,32	58	49	58	48	58	48
625	0+469	S	46,43	3,12	59	49	59	49	59	49
625	0+469	S	46,43	5,92	60	50	60	49	59	49
626	0+477	E	42,34	0,02	61	52	60	51	60	51
626	0+477	E	42,34	2,82	63	53	62	53	62	53
626	0+477	E	42,34	5,62	64	55	64	55	63	55
627	0+470	N	37,38	0,30	63	51	55	45	53	44
627	0+470	N	37,38	3,10	64	53	58	48	55	47
627	0+470	N	37,38	5,90	66	55	62	53	59	52
628	0+463	W	41,38	0,55	60	49	53	43	51	42
628	0+463	W	41,38	3,35	61	50	55	46	53	45
628	0+463	W	41,38	6,15	62	52	58	49	55	48
Highest limit exceedance per building:										
w/o noise protection: 6,3 dB(A)			variant wall 3.5 m: 4,2 dB(A)				variant wall 5 m: 3,8 dB(A)			

Example with table statistics and table structure for block beginning and block end

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.

8

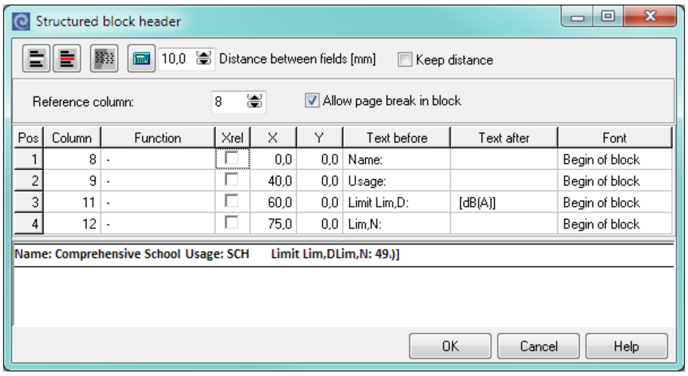
Create format table structure and table statistics

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. No.	Receiver name	Station	Direction	Floor	Usage	SA	H I-A	Limit		Status Quo	
								Day	Night	Day	Night
		km				m	m	in dB(A)		in dB(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	O	GF	GR	120,25	1,29	59	49	51	41

Select **TABLE | STRUCTURED TABLE | DEFINE BLOCK HEADER**, the dialog box might look like that:



Block definition – not modified

The first column is the column number in the table. In the column "function", "Statistical functions" (page 343) can be stored (except for text lines). X and y position show the position of the text in the header row in mm. It is automatically 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.

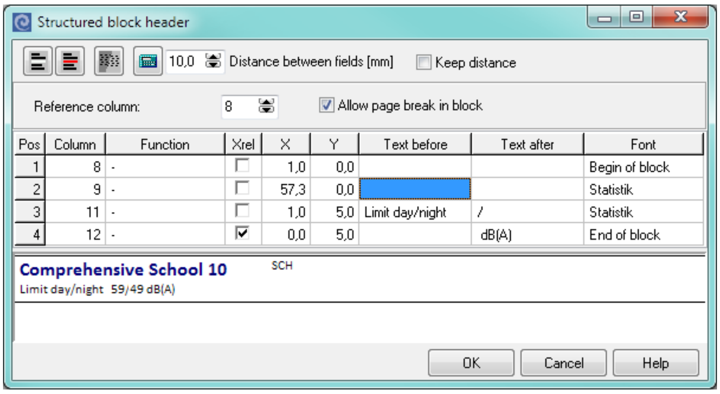
You can also define the x position manually. With the check box **KEEP DISTANCES** activated, distances that have been defined before are proportionally adjusted.

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.

Floor	Direction	Status Quo LrD [dB(A)]	Status Quo LrN [dB(A)]	Prognosis LrD [dB(A)]	Prognosis LrN [dB(A)]	Difference Day [dB(A)]	Difference Night [dB(A)]	Limit exceeded Day [dB(A)]	Limit exceeded Night [dB(A)]
Jamaica 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 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:



Block definition - modified

The different section layouts are modified with the symbol button, see "Section lay-out" (page 339).

If more than one column is displayed in the block header, it is necessary to define a **REFERENCE COLUMN** i.e. which receivers belong to a block, normally the receiver name or the house ID.

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 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**.

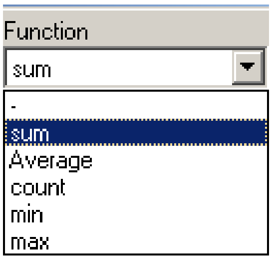
Hint: Once a structured table has been defined, this definition can be stored as a template so that the definition is available for other projects and tables. In the new project, open the table structure once to adjust it with the pocket calculator to the longest entry in the field definition.

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:

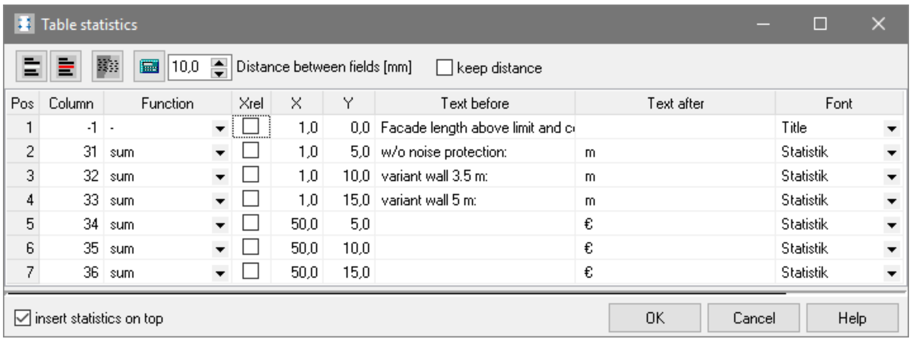


If the column setup has been set to „**- FOR VALUES <= 0**“, then values < 0 are ignored for statistics. For the calculation of the averaged level reduction due to a noise protection measure you can this way omit levels that have already been within the limits without the measure.

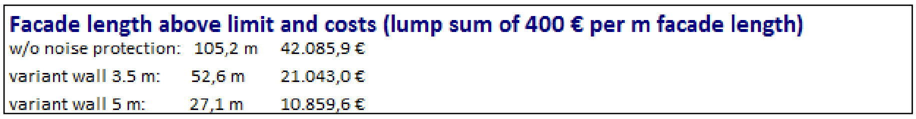
The function “count” sums all displayed rows in a block.

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:**



Effect in the Spreadsheet:



Usage of structure fields in formulas

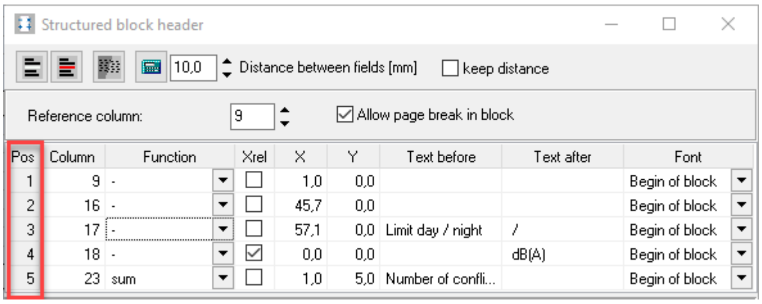
You can assign fields in structure lines to formulas, too. This way the contents of a column for which an operation has been carried out per unit (e.g. per building) can be written back to a table cell in a new column.

BH*position* Block header

BF*position* Block footer

STAT*position* Table statistics

„position“ refers to the row number of the field the table of the block header footer or statistics:



The field "No. of conflicts" in the block header for example is evaluated in a formula with "BH5".

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** "sum" for this column. Click OK and add another Boolean column (noise control subsidies) and enter the formula

„BH*position* > 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:

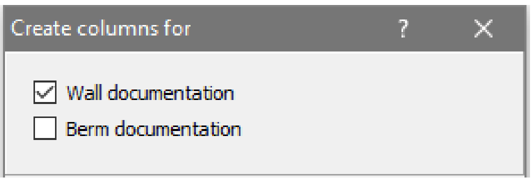
The total number of exposed people should be used within a formula.

x32/STAT2*100;

Wall / berm documentation

Coordinates, heights, segment lengths, volumes and kilometers of walls and berms can Coordinates, heights, segment lengths, volumes and kilometers of walls and berms can be documented in the Spreadsheet.

Call the Spreadsheet, select the table type **WALL TABLE** and tick whether you have walls and/or berms in the data. The required columns are automatically created according to your selection.



Confirm your selection with the green check mark and then select the Situation or Geo-File with the noise protection structures to be documented. The DGM assigned to a Situation in the Geo-Database is automatically loaded as well and displayed in the title bar for information.

If the Situation contains the road or railways selected as reference axis, the distance and height to the nearest axis is calculated for the walls and berms and displayed in the table.

Coordinates							Noise protection wall			
				Distance from	Height above	Element	Wall height		Canti-	Wall
X	Y	Z	Station	next axis	next axis	Length	Beginning	End	lever	surface
	[m]		[km]	[m]	[m]	[m]	[m]	[m]	[m]	[m²]
03b - Noise barrier 3,0 m on berm										
36349,654	29323,573	266,00	25+896	7,69	1,65	28,88	3,00	3,00	-	86,65
36324,462	29337,703	266,00	25+926	7,32	1,65	10,28	3,00	3,00	-	30,84
36315,724	29343,117	266,00	25+936	7,55	1,65	10,31	3,00	3,00	-	30,92
36306,478	29347,672	266,00	25+945	7,28	1,65	10,05	3,00	3,00	-	30,16
36297,258	29351,680	266,00	25+955	7,09	1,65	9,94	3,00	3,00	-	29,82
36288,240	29355,858	266,00	25+965	7,26	1,65	10,13	3,00	3,00	-	30,38
36279,074	29360,163	266,00	25+975	7,43	1,65	10,42	3,00	3,00	-	31,26
36269,383	29363,987	266,00	25+985	7,47	1,65	10,62	3,00	3,00	-	31,87
36259,064	29366,514	266,00	25+994	7,35	1,65	10,60	3,00	3,00	-	31,80
36248,500	29367,370	266,00	26+004	7,24	1,65	10,46	3,00	3,00	-	31,37
36238,054	29366,928	266,00	26+013	7,24	1,65	10,33	3,00	3,00	-	30,98

Using **TABLE -> TABLE SETTINGS,** you can hide columns that are not required and change the table according to your requirements.

If the DGM has been loaded, the rear line of berms is intersected with the DGM so that the volume is calculated from the terrain. If another DGM is to be used or if you want to perform the volume calculation without DGM, call **FILE -> TABLE CONTENTS** and assign another DGM or unassign it by clicking on the arrow to the left.

Use the table structure (**TABLE -> TABLE STRUCTURE -> DEFINE BLOCK HEADER) TO** document, for example, the wall length and the visible area of the entire wall or the volume of the entire wall.

Coordinates				Distance from	Height above	Element	Wall height		Wall
X	Y	Z	Station	next axis	next axis	Length	Beginning	End	surface
	[m]		[km]	[m]	[m]	[m]	[m]	[m]	[m²]
03b - Noise barrier 3,0 m on berm									
Length: 488,61 m	**Wall surface: 1465,82 m²**								
36349,654	29323,573	266,00	25+896	7,69	1,65	28,88	3,00	3,00	86,65
36324,462	29337,703	266,00	25+926	7,32	1,65	10,28	3,00	3,00	30,84
36315,724	29343,117	266,00	25+936	7,55	1,65	10,31	3,00	3,00	30,92
36306,478	29347,672	266,00	25+945	7,28	1,65	10,05	3,00	3,00	30,16
36297,258	29351,680	266,00	25+955	7,09	1,65	9,94	3,00	3,00	29,82
36288,240	29355,858	266,00	25+965	7,26	1,65	10,13	3,00	3,00	30,38
36279,074	29360,163	266,00	25+975	7,43	1,65	10,42	3,00	3,00	31,26
36269,383	29363,987	266,00	25+985	7,47	1,65	10,62	3,00	3,00	31,87

You can save the table as a template for further projects as usual.

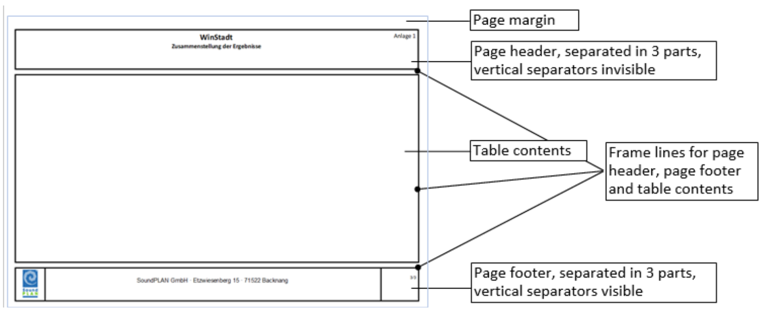
Print Spreadsheet

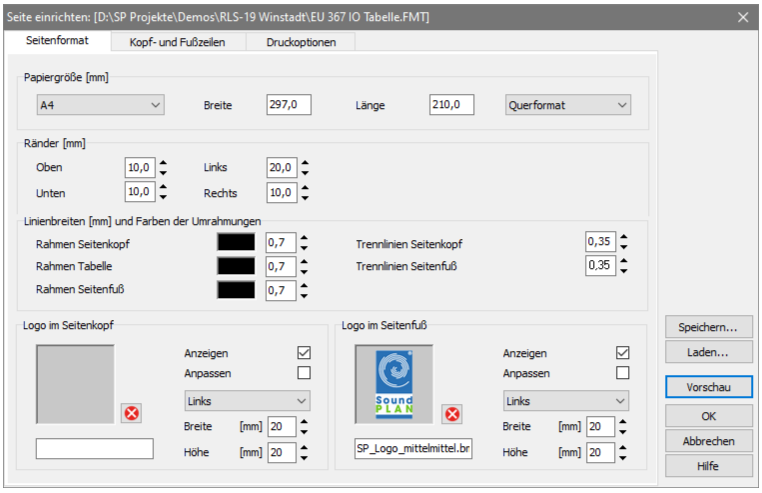
Page layout

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"*.



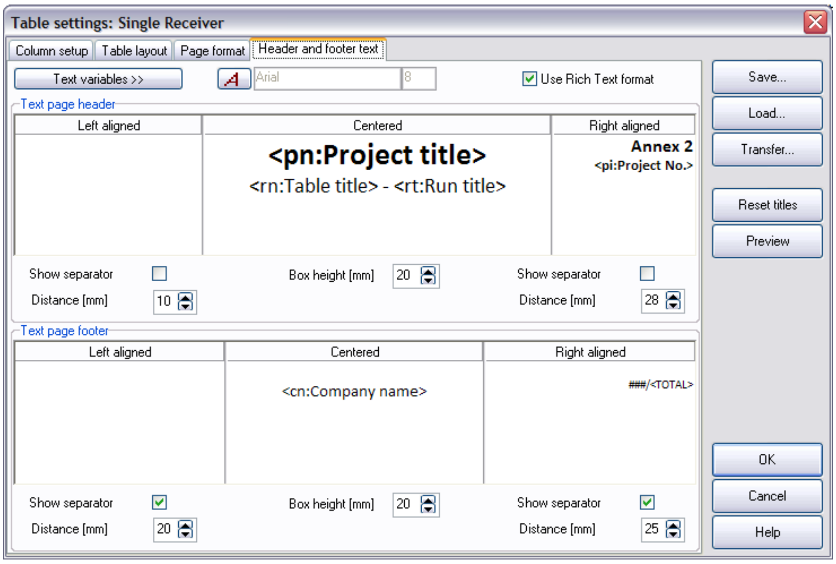


Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

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.

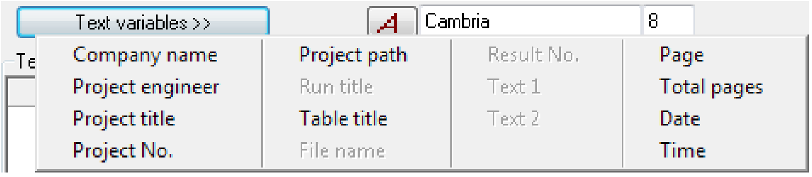
Format the content and the size of the page frame in the tab index card "*header and footer texts*". The texts can be text variables, automatically updated with information stored in the project or own texts.



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:

8



In the tab index card "*print options*" you can select the first page number for the printout.

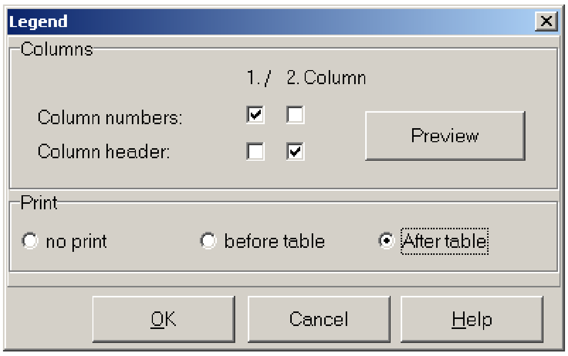
Click on the button **PREVIEW** to check the page layout.

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 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**.



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:

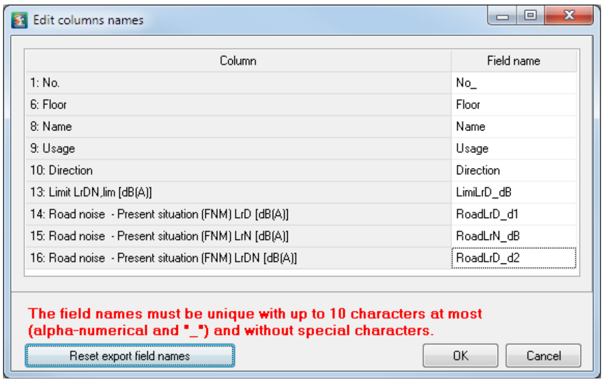
Select the print options for the legend in the lower part of the legend definition (before table, after table or no printout). The page number of the legend is automatically adapted.

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:

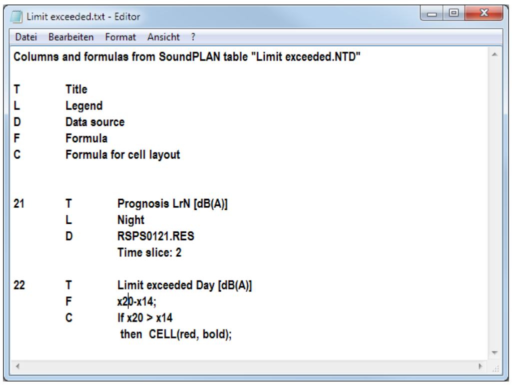


When you export building tables to ESRI Shape files, you can select whether you want to export the outline of the buildings or one reference point per building in the center of gravity.

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.



Calculate noise costs (Swiss cost-benefit index)

The Swiss cost benefit index for the calculation of the economic damage caused by noise (according to "Wirtschaftliche Tragbarkeit und Verhältnismässigkeit von Lärmschutzmassnahmen", Schriftenreihe 301, Bundesanstalt für Umwelt BAFU, Switzerland), 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.

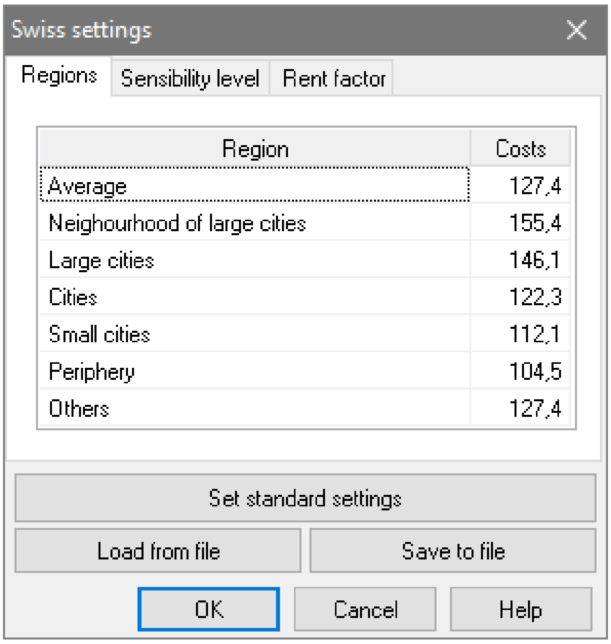
2. If you know the maximum area for the buildings and the size of the buildings, digitize them and calculate the costs on the basis of a facade noise map.

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 Glob-data folder (1 - costs of noise.bft, 2 - costs of noise variants.bft, 3 - noise costs FNM.ntt).

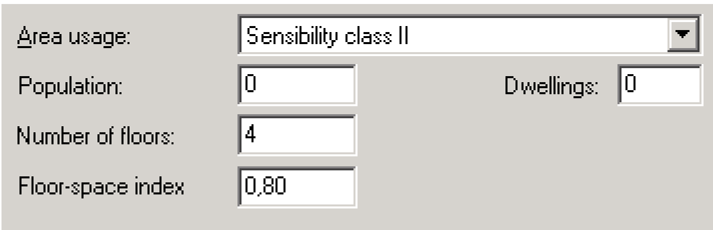
Base settings

In the dialogs for the Swiss Cost-Benefit Index, the **BASIC SETTINGS** button takes you to the default settings, where the annual rental prices of the individual regions, AW, PW and IGW for the various sensitivity levels and the rental price factor for the four noise classes are kept. The calculation of the economic damage is based on this information.



Estimation of costs via RLK / area table

Enter the areas in the Geo-Database using the area usage object type. Subdivide the areas according to sensitivity levels, number of floors and floor space index. Define the **AREA USAGE** (for the sensitivity level), the **NUMBER OF FLOORS** and the **FLOOR SPACE INDEX**.



You can calculate the grid noise maps in the free field or, if necessary, also taking existing buildings into account. It is important that you need one grid noise map per floor and that the grid noise maps are numbered consecutively from the lowest to the highest floor.

In the Spreadsheet, you can either build the area table using the provided templates or create your own table.

In the File manager, select the file type **Area Table (Conflict Map)** and from the template selection list either one of the supplied templates or "new template".

Two templates are provided for the area table:

1 – Costs of noise - template for one variant
2 – Costs of noise - template for two variants

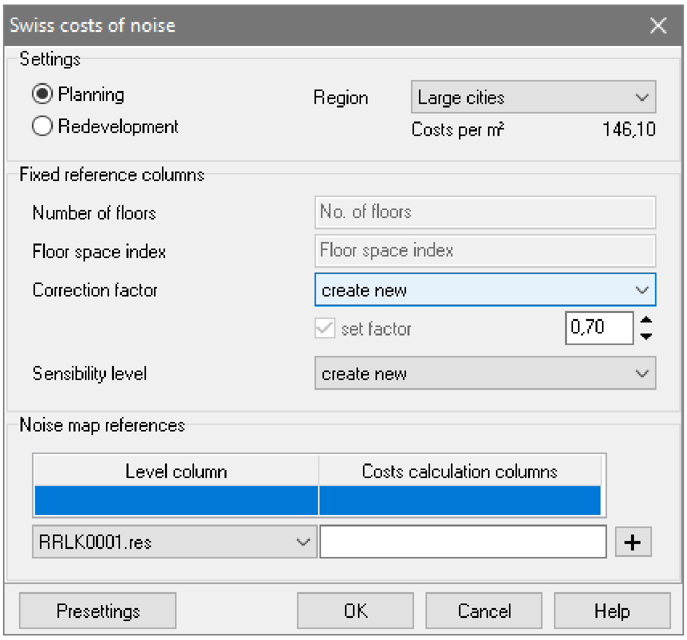
Select the appropriate template and fill the **TABLE CONTENTS** dialog with the Situation in which the areas are defined and the grid map calculated for the first floor.

In the next dialog, select whether it is planning or redevelopment (depending on your selection, the planning value or alarm value is used and the classification into noise classes is made) and the region for the average annual rent per m² and, if necessary, the correction factor to the gross floor area.

Click OK, the table will be built, and the total costs will be displayed in a statistics row.

If you create the table with "new template", click on "Columns" and tick the number of floors and the floor space index, so that this information is also loaded into the area table.

After you have created your area table, call **FILE | ADD ADDITIONAL COLUMNS | SWISS COST/BENEFIT INDEX**.



Here you define the calculation settings and column assignments. You can preset the **CORRECTION FACTOR** for the gross floor area with a value. The **SENSITIVITY LEVEL** is an integer column that is automatically assigned a formula based on the area usage.

In the selection box at the bottom left, you will be offered the grid noise map that can be used to cover all the floors that have been defined in the areas. For example, if you have a maximum of 4 floors, you will see only the grid noise maps where there are 3 other noise maps with consecutive numbers.

Select the noise map of the first floor, enter a heading on the right (this is displayed in the table) and insert the noise map with the [+]. If you now finish with OK, the necessary fixed columns will be created, as well as 10 additional columns for each variant:

- the affected noise zones in [m²] and
- the noise costs

for each noise class and a total column.

You can hide noise classes that are not needed (please never delete!).

You can calculate and output the total costs for the entire table via the statistics line.

Description of the columns of the area table for the KNI

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
							Lärmkosten									
Name	Typ	Größe	SZ	AZ	KF	ES	Betroffene Lärmzonen in m²					Kosten in SFr				
		[m²]					LK1	LK2	LK3	LK4	Gesamt	LK1	LK2	LK3	LK4	Gesamt
Gesamtkosten (SFr):		126.019														
A1	II	3200	2	0,50	0,70	II	140	980	0	0	1120	3.528	12.942	0	0	16.470
A2	II	2200	2	0,50	0,70	II	0	350	420	0	770	0	2.714	1.960	0	4.674
B1	II	3600	2	0.80	0.70	II	336	1680	0	0	2016	8.467	24.384	0	0	32.851
B2	II	4500	4	0,80	0,70	II	0	2016	504	0	2520	0	22.313	2.352	0	24.665
C1	III	4200	2	0,70	0,70	III	343	1029	686	0	2058	6.243	10.264	3.398	0	19.905
C2	III	3150	3	0,70	0,70	III	0	515	1029	0	1544	0	4.094	2.216	0	6.311
C3	III	2100	2	0,70	0,70	III	0	0	0	0	0	0	0	0	0	-
D	II	5400	1	0,50	0,70	II	140	1330	420	0	1890	3.528	15.656	1.960	0	21.143

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):

```
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 m²

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 m².

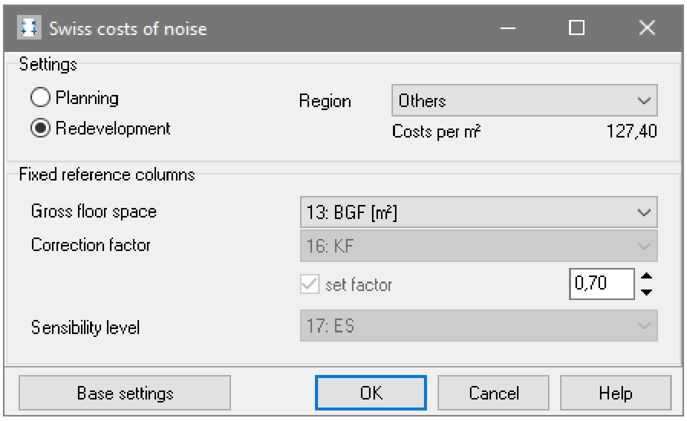
Noise costs using Facade Noise Map and receiver table

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 m² and if different the column for the gross floor space.



Click OK, the table will be filled in and the total noise cost will be displayed in a statistics row.

For tables without a template, you must create the column "Floor area / points per floor". This column assigns the floor area to the point based on the facade section length assigned to the point, which is used as the gross floor space (GFS).

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

Description of the columns for the cost /benefit index (receiver table)

6	1	11	12	13	14	15	16	17	18	19	20
					Pegel				Lärmkosten		
Stockwerk	Nr.	Nutz.	Richtung	BGF	LrT	LrN	KF	ES	>IGW	LK	Kosten
				[m²]	[dB(A)]				dB[A]		SFr
Gesamtkosten:	119.855,00 SFr										
A1-1	4.948,05 SFr										
1	1	II	W	30.00	64.4	0.0	0.70	II	9.4	2	227.26
	2	II	W	30,00	66.0	0,0	0,70	II	11,0	2	264.32
	3	II	S	45,00	69,2	0,0	0,70	II	14,2	2	512,11
	4	II	S	45,00	69,2	0,0	0,70	II	14,2	2	512,39
	5	II	E	30,00	66,1	0,0	0,70	II	11,1	2	267,23
	6	II	E	30,00	64,6	0,0	0,70	II	9,6	2	231,60
	7	II	N	45,00	57,6	0,0	0,70	II	2,6	3	84,00
	8	II	N	45,00	57,6	0,0	0,70	II	2,6	3	83,19
2	1	II	W	30.00	66.3	0.0	0.70	II	11.3	2	272.57
	2	II	W	30,00	68.1	0,0	0,70	II	13,1	2	315.78
	3	II	S	45,00	71,1	0,0	0,70	II	16,1	1	647,48
	4	II	S	45,00	71,1	0,0	0,70	II	16,1	1	647,71
	5	II	E	30,00	68,2	0,0	0,70	II	13,2	2	317,03
	6	II	E	30,00	66,4	0,0	0,70	II	11,4	2	274,71
	7	II	N	45,00	59,4	0,0	0,70	II	4,4	3	142,66
	8	II	N	45.00	59.6	0.0	0.70	II	4.6	3	148.03

Column 11: area usage → 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 → see column 6 (area table)

Column 17: SC → 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 m².

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. for 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 m² living space. The default sensibility class is II which represents more or less a residential area.

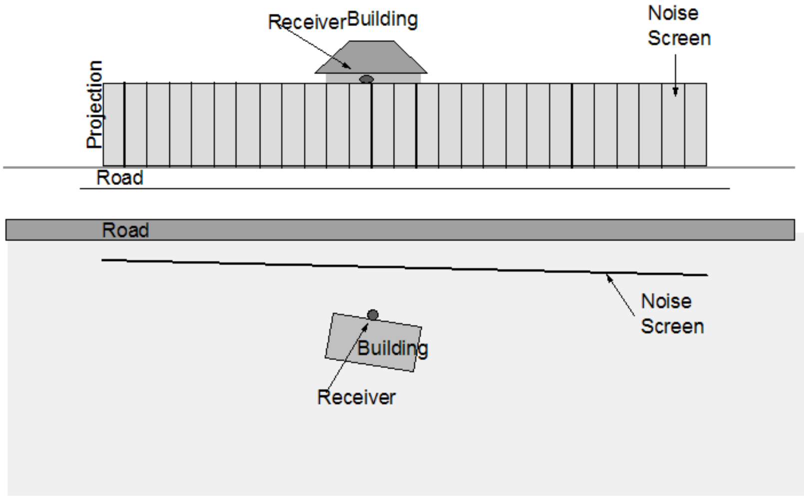
8

9 Wall design

9

Overview wall design

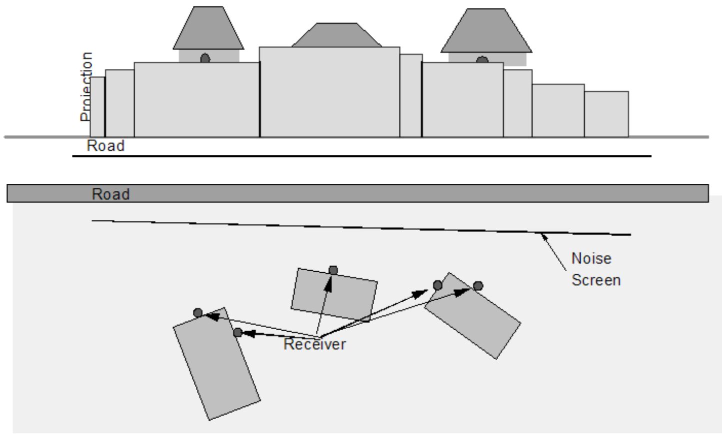
Calculating and optimizing the dimensions of noise protection walls is a time-consuming task. Designing the wall for one receiver is manageable if the source is just one line. Usually, the permitted height is selected and the barrier length needed to shield the receiver to the proper noise level must 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!



Optimizing a noise screen by hand for multiple receivers

9

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.

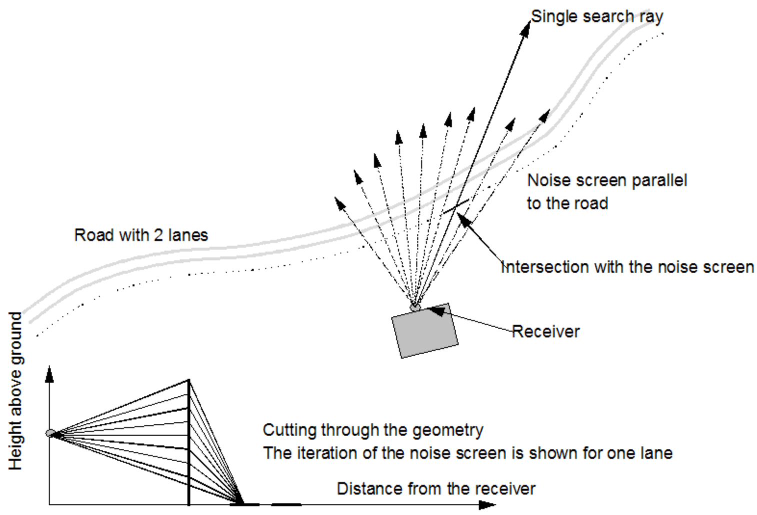
The optimal noise screen might be the least expensive solution, but it may also be the least aesthetic. The structure of noise protection walls should fit into the landscape. Beginning with the minimal solution, you can modify the noise screen design while keeping the noise control objective.

SoundPLAN can optimize complicated areas with multiple sources (road, rail, industry) and receivers in areas having different requirements (residential or industrial).

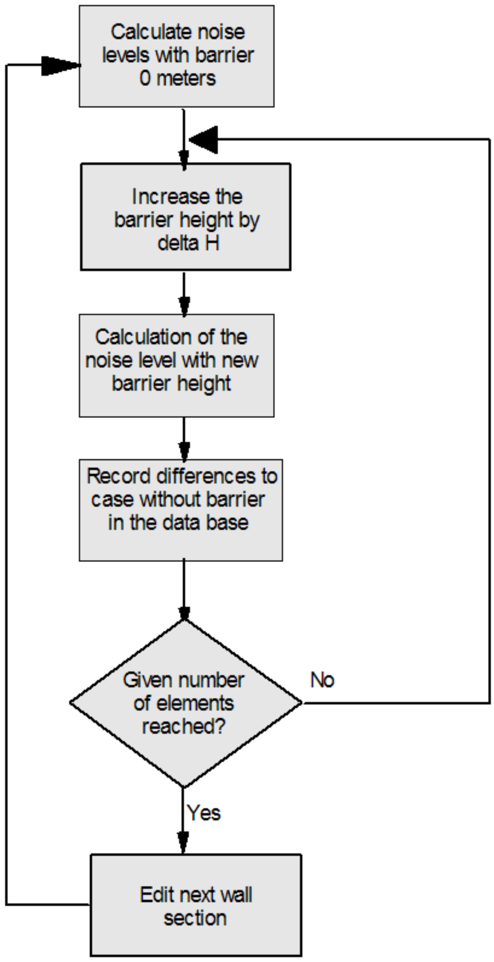
Wall Design's Internal Organization

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.



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.

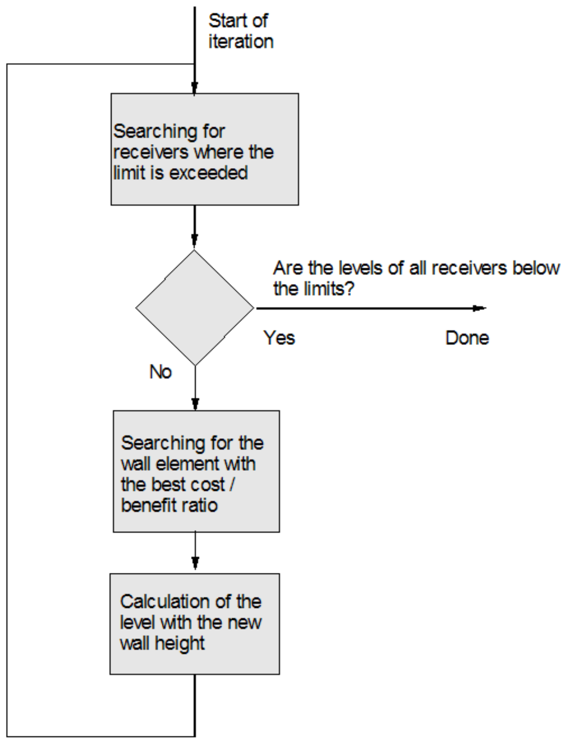


Flow chart of optimizing calculations

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 calculated has been recorded. SoundPLAN stores all energetic reductions in a matrix for every receiver and as wide as the total wall elements.

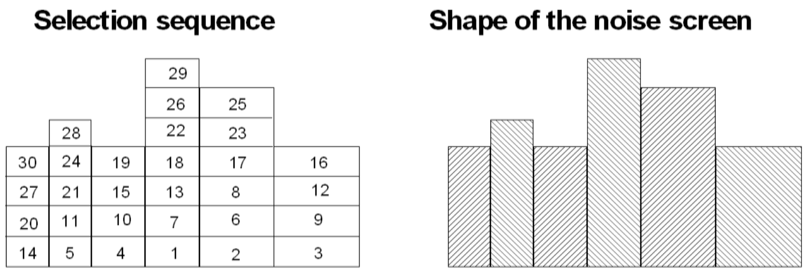
Wall design loads this matrix and searches for the barrier elements yielding the highest reduction of sound energy per surface (or per cost). The barrier selection uses an iterative process.



Selecting the barrier elements in an iterative process

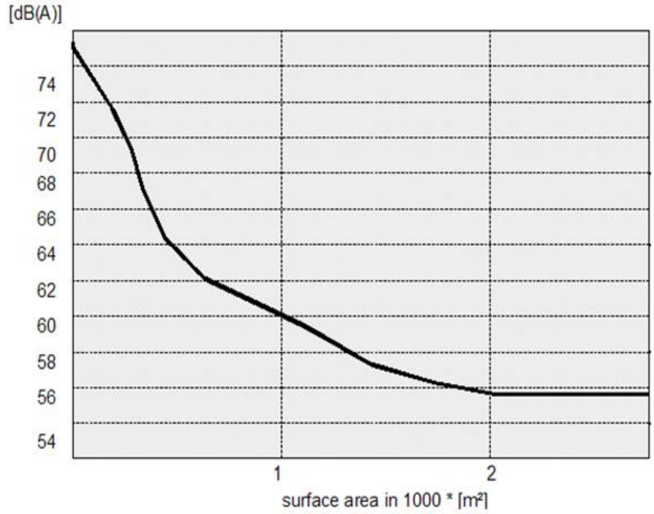
As documented in the flow chart, receivers are included in the barrier selection process only if their noise level exceeds the set limit. For all improperly shielded receivers, SoundPLAN searches for the element resulting in the highest reduction of noise energy (stored in the matrix) for all receivers. 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.



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 m² 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.

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.

- 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, they 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.
- 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.
- 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.
- 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:

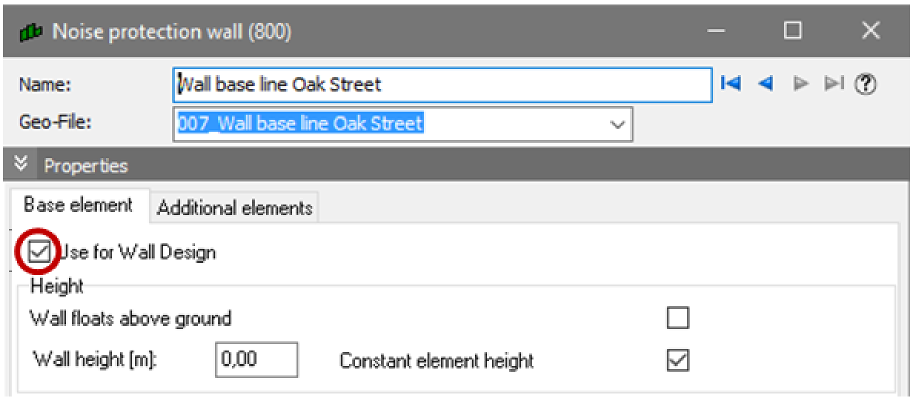
- Automatic calculation of the lowest wall height or the least cost. The selection can be all at once or step by step.
- Definition of the minimum and maximum wall height so that the wall can aesthetically fit into the landscape.
- View the optimized noise screen as a graphic in the top view and as a 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 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.

9 Using Wall Design

Wall Design requires work in different SoundPLAN modules:

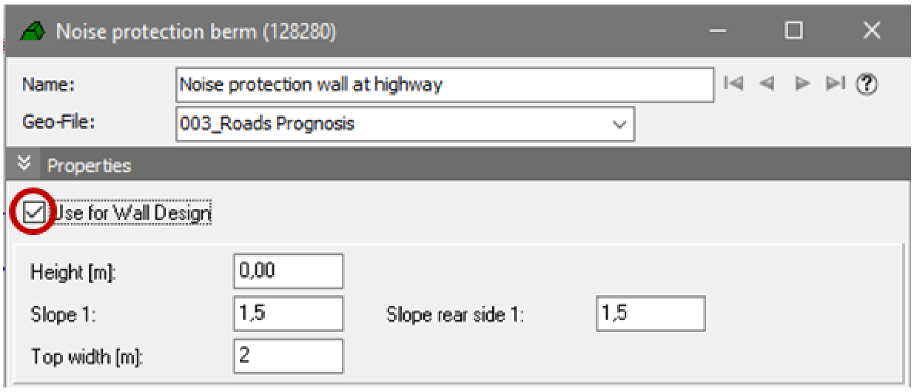
Additional Properties in the Geo-Database objects

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 **USE FOR WALL DESIGN** in the properties dialog.



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.



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 GeoTool **DIVIDE SECTIONS** to divide the wall base line into several sections. The elevation information will be interpolated.

Precalculation in the Calculation Kernel

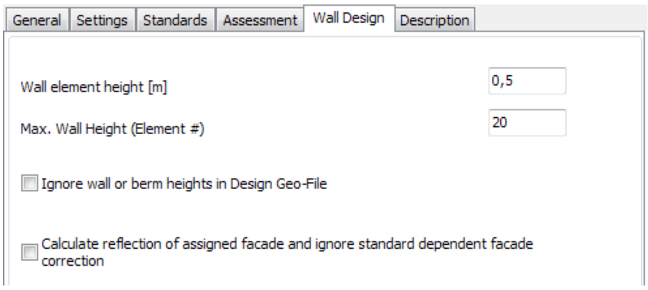
In the next step execute a pre-calculation in the Calculation Kernel to obtain all information about the efficiency of the wall sections.

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:



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.

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).

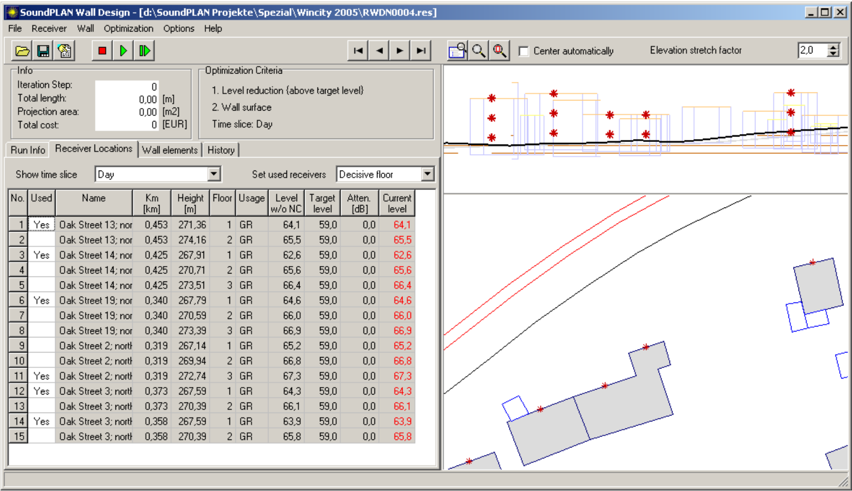
Some standards suppress the reflection for the façade levels other use specially described corrections and yet others calculate the assigned façade.

Start the calculation with the start arrow.

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

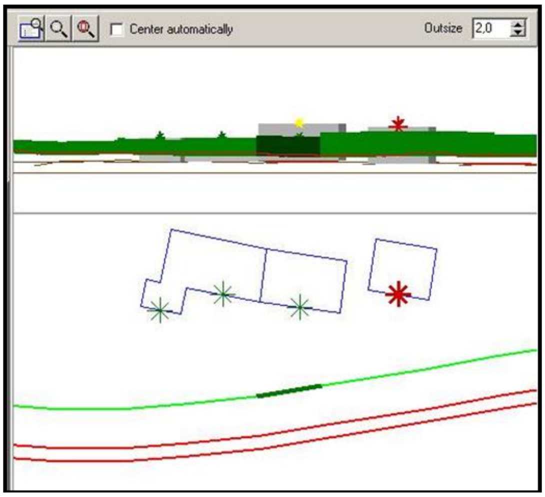
The four tab index cards on the left hand side provide information on the calculation run, the receivers, the wall segments and the iteration history. On top of the window, information on the surface, length and costs are shown. Additionally, the used optimization criteria are displayed.

Note: You can change the contents of all columns in the tables with a white background. Columns with a gray background come from the precalculation or are calculated during the optimization

Graphics section

The right section of the screen shows the geometrical situation with the wall base line in the site map and in the front view.

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).



Additional options:

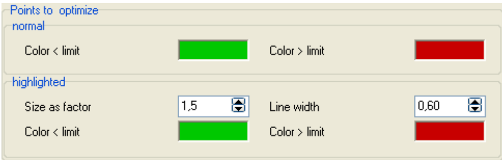
- **OPTIONS | SHOW ONLY BUILDINGS WITH RECEIVERS** removes buildings without assigned receivers from the graphics.
- It is possible to enter a stretch factor for the front elevation.
- To speed up the optimization, the building process of the wall is no longer displayed (**OPTIONS | DISPLAY WALL BUILDING 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.

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.



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.

9

Receiver locations

The tab index card "*receiver locations*" gives detailed information on the receivers.

No.	Used	Name	Km [km]	Height [m]	Floor	Usage	Level w/o NC	Target level	Atten. [dB]	Current 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

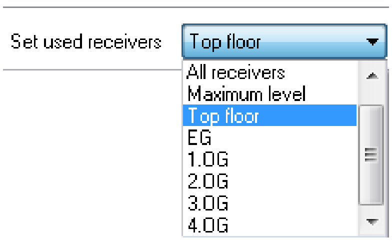
If a reference axis of a road or railway has been defined in the road or railway properties of the Geo-Database, the kilometer post is shown for the exact location of a receiver. The next columns display the receiver height above ground, the number of floors and the area usage.

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.

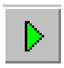
Starting the optimization

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.

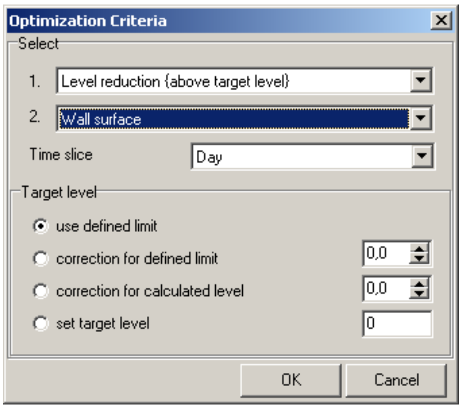


As all floors are contained in the receiver table, the current level and how much the receiver exceeds the limit is always visible for all receivers, even for the receivers that are not activated for the optimization.

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 the start arrow 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.



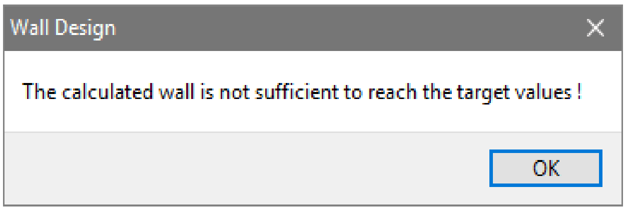
The first criterion is

- 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:



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.

A step by step iteration with constant observation of the selection of the wall elements can be done by clicking 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 .

Wall segments

Run Info | Receiver locations | Wall elements | History

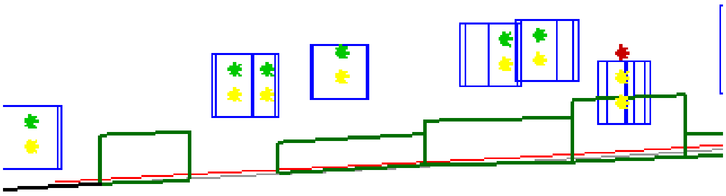
No.	Km	Base height [m]	min	max	Elem.	Wall height [m] [m]	Length [m]	Cost group	Cost []
1	0,262	265,90	0	20	0	0,00	19,75	1	0
2	0,281	266,12	0	20	8	4,00	18,31	1	47595
3	0,300	266,01	0	20	9	4,50	15,43	1	43196
4	0,315	266,39	0	20	9	4,50	23,09	1	64648
5	0,338	266,01	0	20	8	4,00	14,19	1	36898
6	0,353	266,34	0	20	2	1,00	15,90	1	22258
7	0,369	266,39	0	20	3	1,50	14,49	1	23185
8	0,384	266,78	0	20	3	1,50	12,24	1	19576
9	0,397	266,50	0	20	0	0,00	9,26	1	0
10	0,407	266,89	0	20	5	2,50	15,70	1	31392
11	0,423	267,71	0	20	4	2,00	13,38	1	24082
12	0,436	268,14	0	20	5	2,50	11,08	1	22155
13	0,448	268,47	0	20	5	2,50	8,92	1	17836
14	0,458	268,86	0	20	5	2,50	10,02	1	20036
15	0,468	269,08	0	20	5	2,50	9,94	1	19886
16	0,478	269,68	0	20	5	2,50	9,13	1	18267
17	0,487	270,39	0	20	0	0,00	8,64	1	0
18	0,493	270,11	0	0	0	0,00	0,00	0	0

For your information this section shows the assigned km post and the base elevation of the wall.

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.

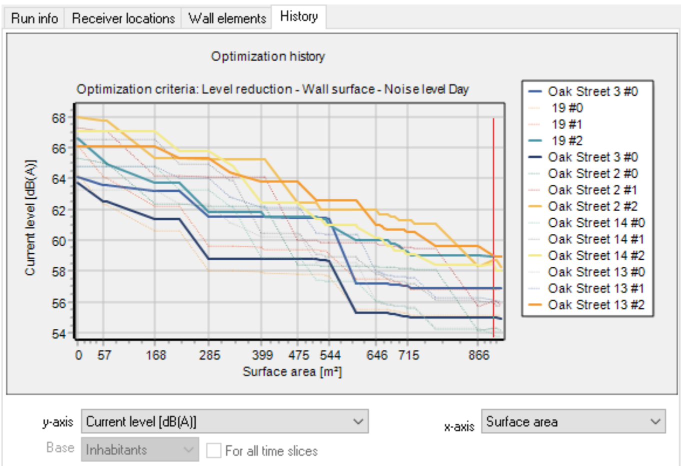
After the first calculation the wall might look like that:



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

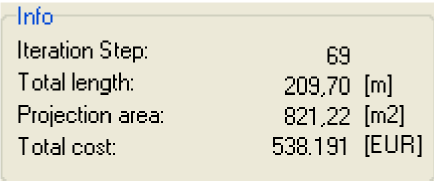


If the objective of dimensioning the noise screen to the set noise limits cannot be met, or if Wall Design requires an excessive amount of wall surface, the situation can be analyzed using the cost to performance diagram.

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.

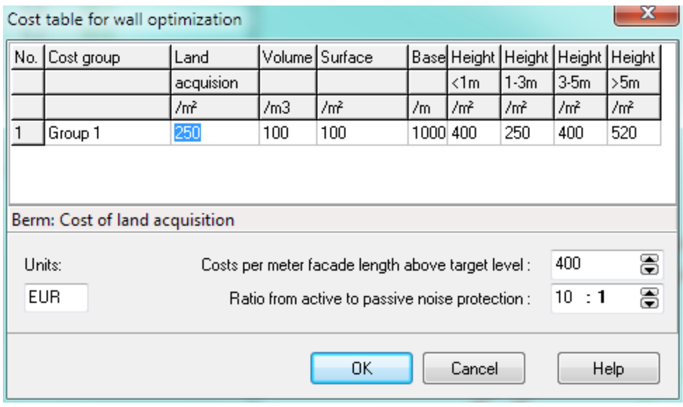


The navigation buttons are used to move in the diagram to view every state of the wall – the wall elements built are displayed in the graphics, costs, length, surface area and so on are displayed in the table.

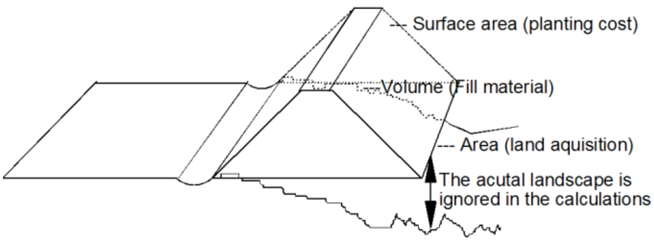
The x-axis either shows the wall surface or the total costs. The y-axis either shows the absolute levels over the surface of the wall (current level), the level reduction (difference to the start level), or the level difference to the target level. When optimizing according to other characteristics, 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***).



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 material must be transported, compacted, etc. Sometimes there is a demand to deposit excavation material and the charges to dump that location allow the 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
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

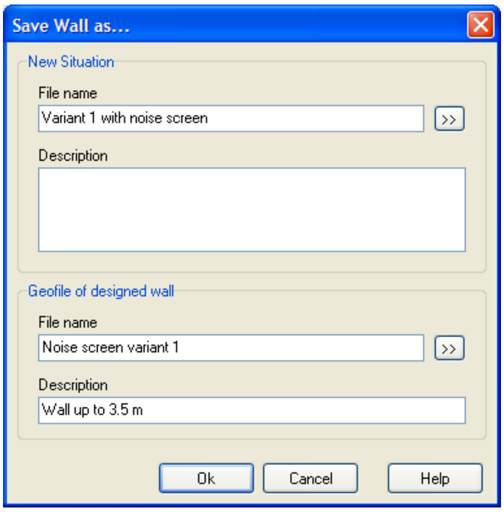
Print wall table

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.

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**.



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 precalculation 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 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.

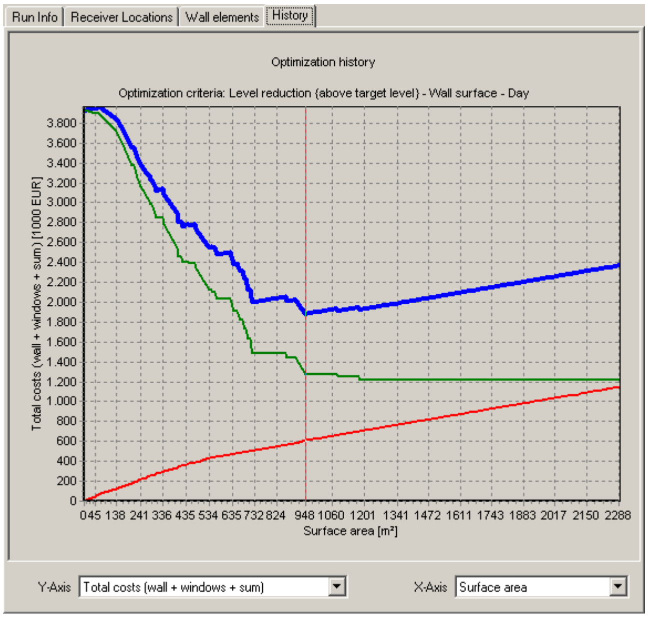
When saving back a berm with different wall heights to the Geo-Database the berm heights will be smoothened.

Using Wall Design for areas

9

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 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:

- The benefit of the noise protection wall
- The efficiency of the wall, i.e. the benefit/cost ratio
- The effectivity, indicating the percentage of how much the target value is reached in %
- The WTI (Wirtschaftlicher Tragbarkeits-Index= Economic feasibility index according to the Swiss (BAFU) EPD)
- 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:

- inhabitants
- dwellings
- 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_m²

- A = square meters of entire floor divided by number of receivers calculated on that floor
- B = Correction factor for A to adjust for non-inhabited areas such as staircases etc.
- Conf = conflict the damages are based upon
- RentF= rent factor per noise class
- Cost_per_m² = rent price per m² 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
II	> Threshold value+5
III	> Threshold value

The rental cost per m² 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

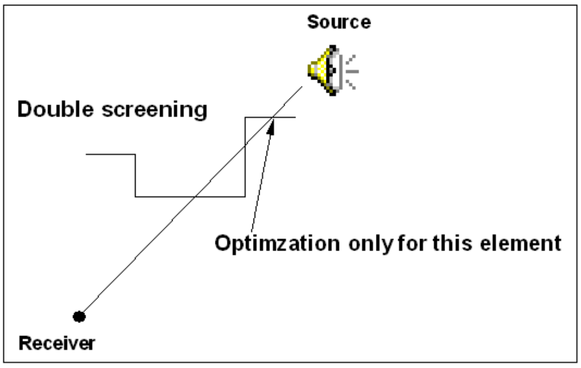
Cost per solved conflict case:

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).

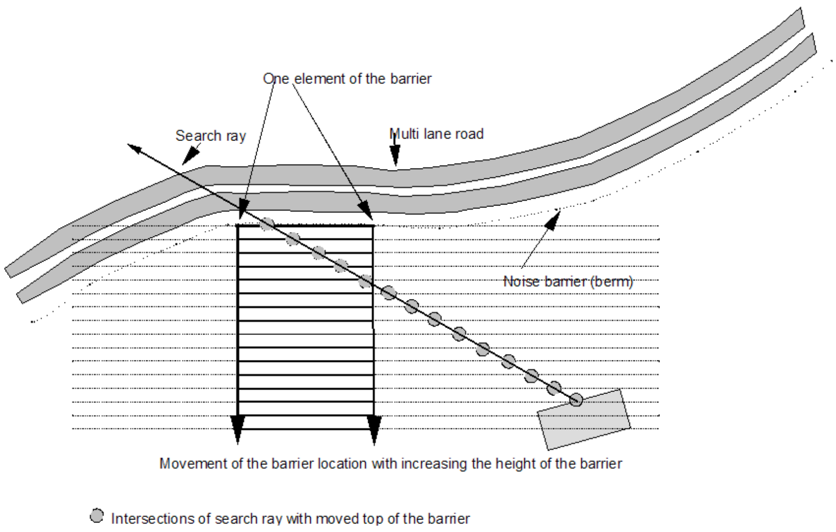
Model restrictions of Wall Design

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.

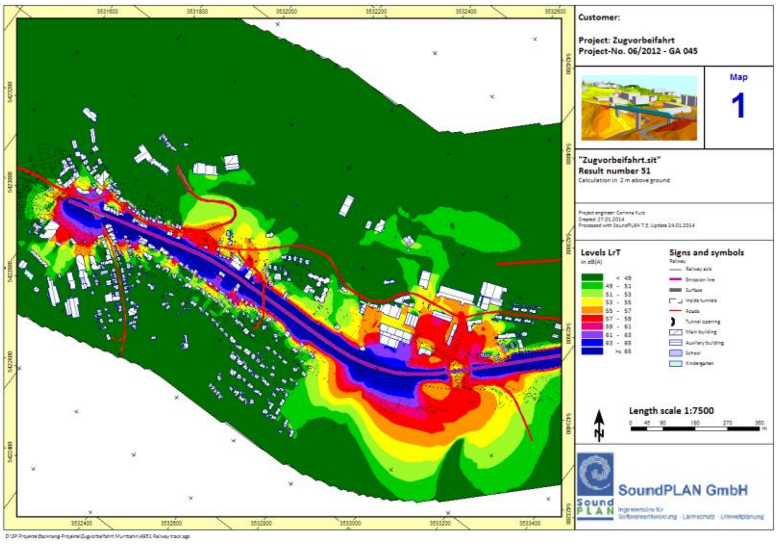


After optimizing a berm, it is mandatory to check the results with an extra calculation run!

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.

10 Graphics

Overview Graphics



Graphics sheet automatically created on the basis of one of the provided standard templates.

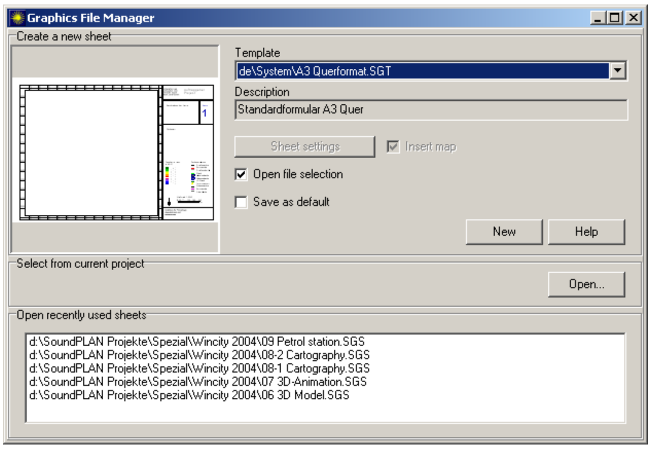
SoundPLAN Graphics combines the geometry data and calculation results with supplemental elements such as north arrows, scale bars, legends, color scales and textboxes to form dynamic maps and drawings to be printed on printers and plotters, or saved on disk for use in other forms of documentation. The 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.

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.



- 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.

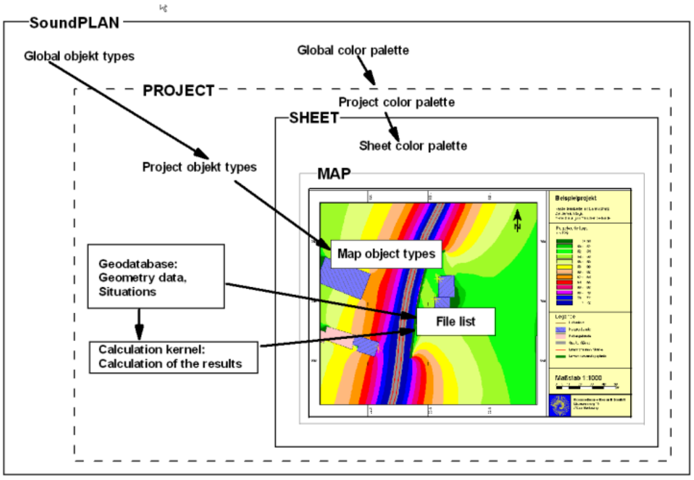
  Click on a situation (or geo-files) and move the file(s) using drag and drop, by double clicking, or clicking the arrow symbol from the left box to the right box representing the map. Select the proper legend and decide if descriptive text attributes shall be generated automatically from the geo-data (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.

- 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:

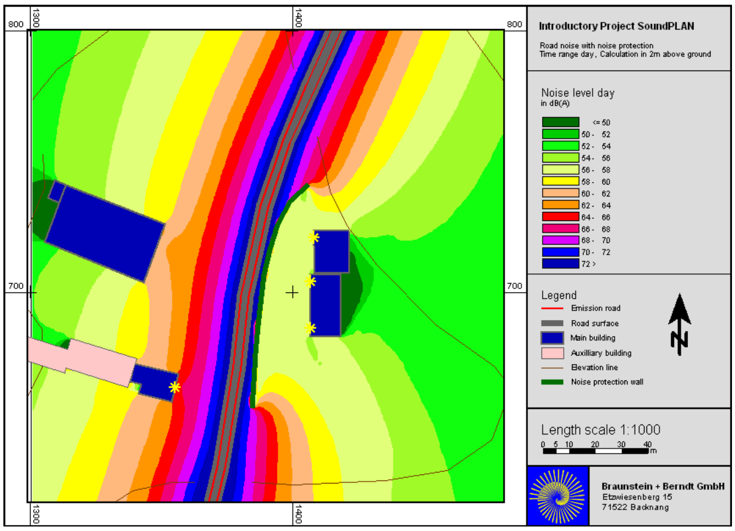


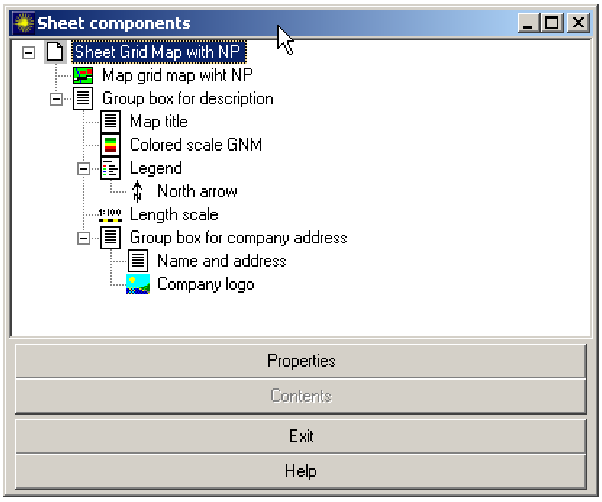
- SoundPLAN is delivered with a global color palette which is copied into every project and every sheet. Changes made to the global color palette do not modify the appearance in current projects or existing sheets. This palette is only the template for future projects.
- Every object has an entry in 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.





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.

10

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:

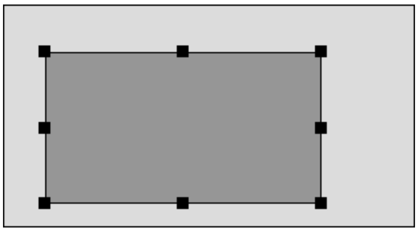
- Map
- Text box
- Color scale
- Legend
- Scale bar
- Graphics box (for jpegs...)
- Text
- Symbol
- Spreadsheet box

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 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.

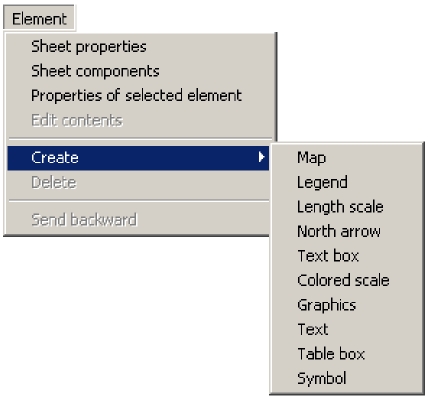
You can undo the relationship of parent and child element by copying the element from the parent to the next ancestor. Here is the process. Cut the element from the parent box by activating the child box and then typing Ctrl+ X. Now click on the background and insert the element with Ctrl+ V. The parent/child 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.

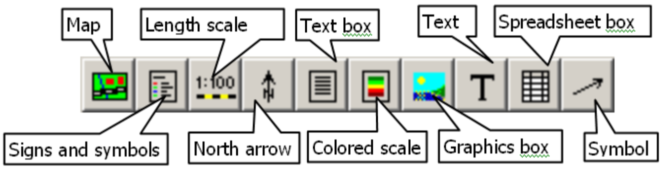
In addition, elements can be aligned (anchored) to their parent element and thus fixed in position, see "Alignment" (page 391).

Create New Elements

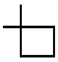
Some elements are automatically generated when the data for the map are loaded. For example, when geometry data are loaded, a legend is automatically generated from the object types contained in the situations and geo-files. Likewise, a color scale is generated for file types that require color scales. 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**.





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 information on how to change the properties and contents of elements, see the section "Element properties" (page 389) and in the sections describing the individual elements.

Activate elements


Move and locked cursor: The active element (“grab” points around the frame visible) can be edited. Aligned elements cannot be moved in all directions, therefore the stop cursor is displayed, see "Alignment" (page 391).

When an element is active, only a parent or sibling element on the same hierarchy can be activated directly or via the Sheet components (page 383).


If you want to activate a stored element, you must first reset the cursor to the arrow. To do this, click on the arrow at the top right of the screen or press <ESC> (clicking on the gray border next to the drawing area also works).

Especially for sheets with nested elements, it is sensible to identify the individual elements using the Sheet components (page 383) to select them directly. You can also use the keyboard to activate the elements by pressing the ***space bar*** to scroll through the elements one after the other, activating the respective element. In the status bar you can see the name of the active element. With ***Shift+ Spacebar*** you activate the next higher element.

Delete elements

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	Only the box (not the content) is zoomed
<Shift>+ left mouse button	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.

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 map 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.

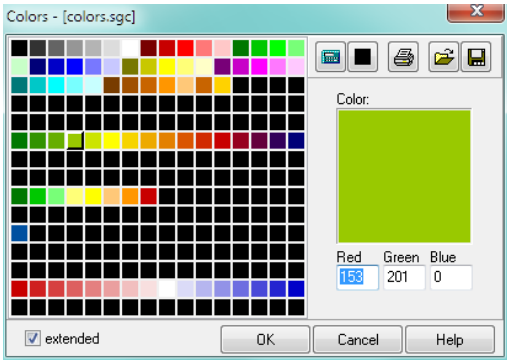
Central Editing Tools

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 **PARAMETERS | 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.

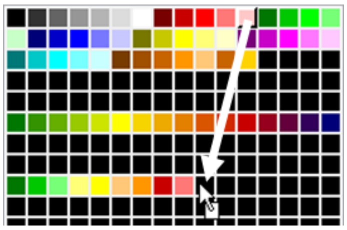
Define colors /compile scale colors

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.

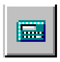
With OK the color from the color field is assigned the object type or element. To save a color in the favorites, move it with Drag&Drop to the desired position.

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.

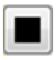


Click on the pocket calculator symbol to fill the gap with interpolated colors. Color sequences can also be defined stretching across lines.

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 “Color scale” (page 400).

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.

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 you can have the program generate the standard palette for noise maps in accordance with 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 yet present. 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 DIN object colors, use the shortcut ***Ctrl+Shift+O***.

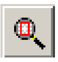
You can still manually generate the color scales. Some standard color scales are delivered with the global settings, they are selected when you choose the scales with the ”System\” in front of the scale name.

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.

Sheet manager, sheet components and result manager

Sheet manager and sheet components offer on the one hand the possibility to clearly display all sheets or all elements of a complex sheet in a tree structure and on the other hand to make changes for several sheets or several elements in a sheet at the same time.

For example, you can correct a spelling mistake in the description once and then transfer it to all sheets or you can change the geometry viewport of several sheets together, see "Transfer properties and content to other elements" (page 384).

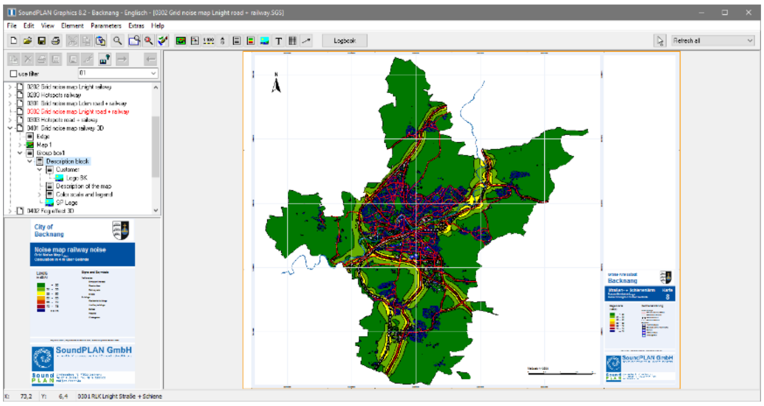
In addition, selected sheets can be printed or exported together.

The sheet manager, sheet components and result manager are displayed in a tree structure on the left. Call **FILE | SHEET MANAGER (*F5*)**, **FILE | SHEET COMPONENTS (*F6*)** or **FILE | RESULT MANAGER (F8).** You can enlarge or reduce the area in which the tree structure is displayed using a splitter.

When you work with map sections, they are also displayed as a tree on the left of the screen (***F7***), see " Map sections, overview map and sheet tools" (page 471).

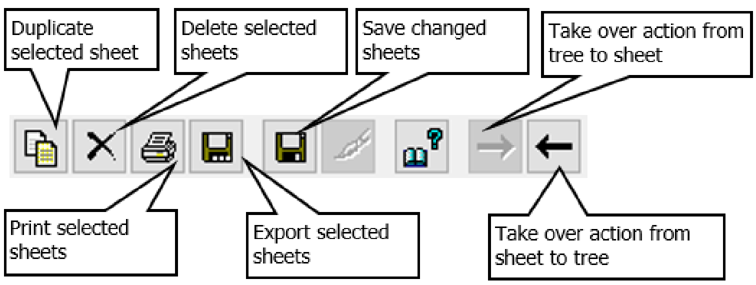
Sheet manager

The sheet manager is switched on/off via menu **FILE | SHEET MANAGER** or with ***F5***. All sheets saved in the project are listed in the tree structure. To load a sheet, double-click it or hold down the left mouse button and drag it from the tree onto the graphics pane (Drag&Drop).



The elements contained in the sheets are managed as sub nodes. The loaded sheet is output in red without the sub nodes.

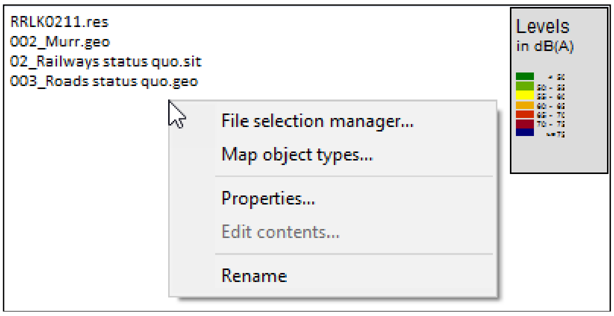
Above the tree several buttons are placed.



The preview window below the tree displays the active element in the tree. For sheets this is the preview bitmap and for elements this is the content and its child elements. Since it is not possible to load the data of all sheets, for maps the file list is displayed.

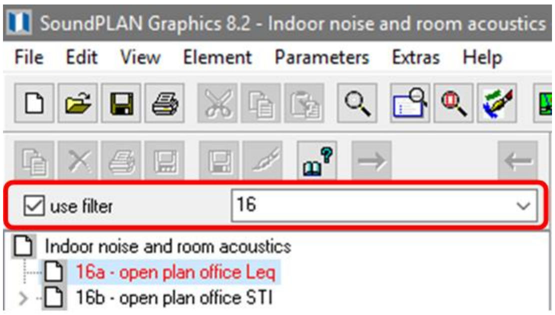
The preview window in the sheet tree is saved with 400 px for the longer side by default. You can change the setting via **PARAMETERS | BASE SETTINGS FOR ELEMENTS** in the *Sheet* tab index card. For existing sheets, the size is only updated after loading and saving the sheet.

Except for the sheet itself, you can access the properties and contents in the preview window by clicking the right mouse button, and in the case of the map, the file selection and the map object types. In the file selection you can only change settings of the loaded data and exchange data for the existing data types.




In the toolbar in the sheet tree, you can duplicate sheets using the "Duplicate" icon. This way you can save a sheet under a new name and then, for example, change the time slice by right-clicking on a map in the sheet | **FILE SELECTION** without loading the sheet.

The **FILTER** controls the sheets offered for selection. This increases the clarity especially for projects with many sheets or a long project duration.



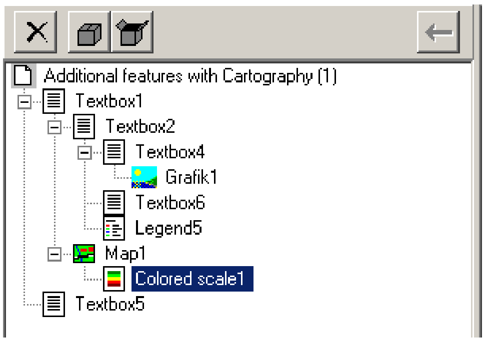
The filter evaluates the file name and the description (sheet name) and displays only the sheets that match the filter. Each project remembers the filters already used, which you can then select from the selection list.

Notes:

- Sheets that have been changed are highlighted in bold in the tree.
- For all actions in the tree there is no "undo". However, the actions are initially only performed in the tree. In order for the changes to take effect, you must save the sheets in the tree, i.e. you can close the tree at any time without saving, but all changes will be lost.
- Your changes may cause the preview bitmap to no longer correspond to the sheet content. Therefore, you can also have the preview bitmap recreated with the brush icon.

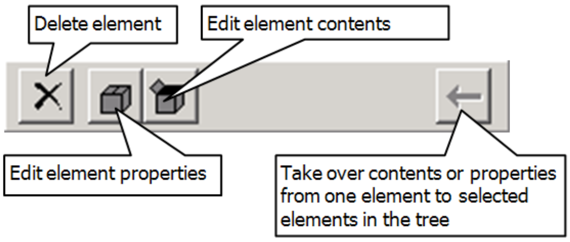
Sheet components

The sheet components are switched on/off under menu **FILE | SHEET COMPONENTS** or via <***F6***>. A tree structure is created for the sheet components, which displays all elements available in the sheet in their hierarchy level.



The tree structure and the sheet itself are coupled with each other, i.e. if you click on an element in the tree, it is also active in the sheet and vice versa.

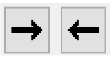
There are 4 buttons above the tree:



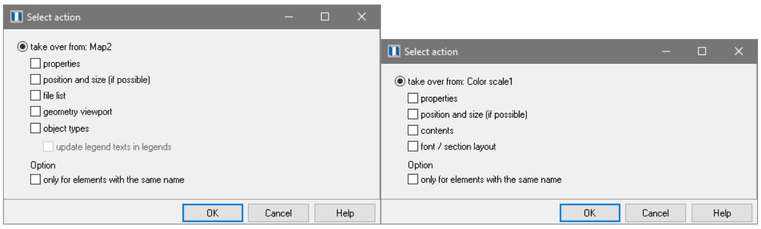
The buttons **DELETE ELEMENT, EDIT CONTENT** and **EDIT PROPERTIES** are only active as long as only one element in the tree or sheet is active. Transfer over content or properties is only active if multiple elements in the tree are clicked.

Transfer properties and content to other elements

Transferring properties and content to other elements is used to make changes and corrections only once and then efficiently apply them to all other affected elements in one or more sheets in one step.

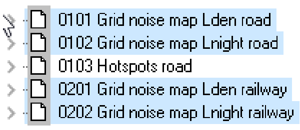


Select the sheets or elements in the tree to which you want to assign properties or content from an element in the loaded sheet by holding down the ***Ctrl key*** (all or adject sheets or elements with the ***Shift key*** pressed). **FINALLY** click on the element from which you want to apply properties or content (in the loaded sheet with the left mouse button). Use the "left arrow" to transfer the information to all compatible elements of the sheets selected in the tree. In the sheet manager you can use the “right arrow” to transfer the information to the loaded sheet.

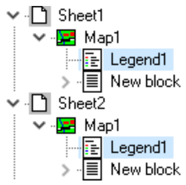


Example:

You have changed the font in the legend of the opened sheet. If you now select the sheets in the tree, this change is applied to all legends, color scales, text boxes, etc.



To explicitly apply the font of the open sheet that has been changed in the legend only to the legends in other sheets, open the branches of the sheets in the tree and select them.



As soon as you transfer the content or position, the option **ONLY FOR ELEMENTS WITH THE SAME NAME** is checked by default to prevent accidentally overwriting data. You can also enable this option for all other actions.

The selection of possible actions to be transferred depends on the selected elements.

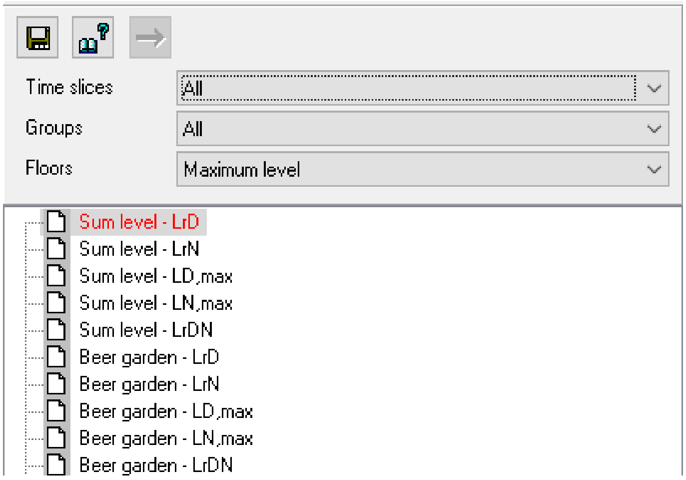
- In the case of transferring properties, only the layout of the relevant properties, i.e. the box color or the line settings, for the map the frame settings, etc. are transferred, but not the alignment, size and name.
- The section layout of text boxes, texts, color scale, legend or graphic boxes is not transferred together with the content but are selected separately.
- If you drag an element from the tree to the loaded sheets, you can also choose whether you want to transfer the whole element.
- When transferring map object types to other maps, optionally modified legend texts can be updated from the map object types for supplemented object types. Manual changes to legend texts already contained in the legend are retained.
- If you only want to copy selected object types, open the map object types and select the desired object type(s). Then select the sheets / maps in the tree and press the "left arrow" to transfer them to the tree.

Results Manager

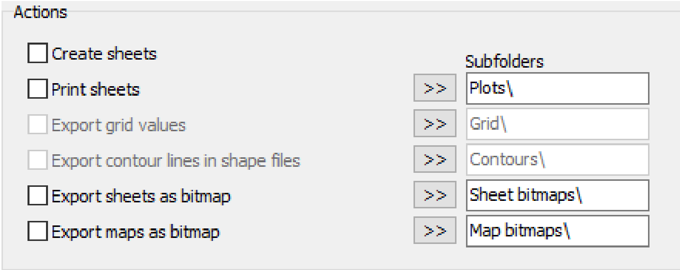
The result manager (***F8***) lists all stored partial results of a result file. The selection changes depending on which data type was loaded and which partial results were saved during the calculation run:

- Time slices (also the time slices of room acoustic parameters)
- Floors
- Group results
- Frequency results

Use the selection lists to specify which partial results are to be listed in the tree.

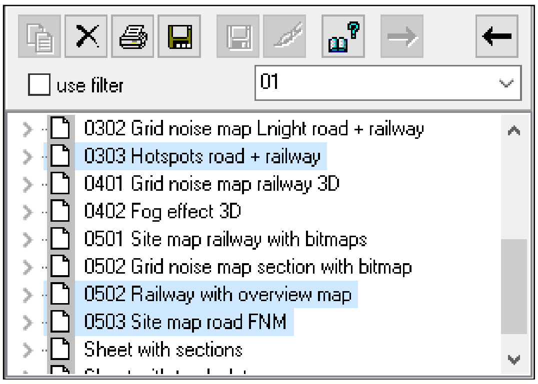


All selected partial results can be printed and exported together via the **SAVE AS** button. You can also create your own sheets for partial results.



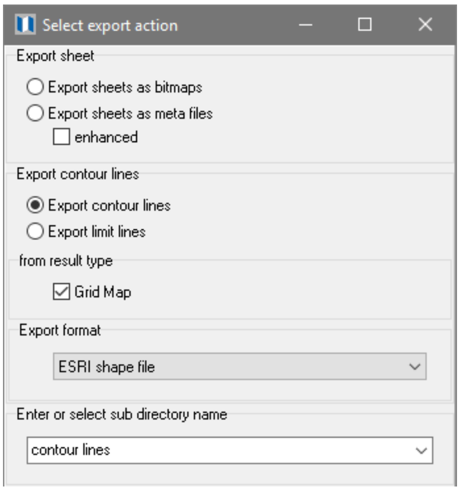
Print or export several / all sheets

You can select multiple sheets and print, export (as bitmap, WMF or the contained contour lines) or delete them together.



Since the printer settings, e.g. the sheet size, apply to all sheets, only sheets with the same format can be printed. If you print in PDF, the file names of the sheets are entered as pdf file name.

Export



When exporting, you will be taken to a selection where you choose what you want to export. When exporting coutour lines and limit lines, you must also specify for which data type and in which format they are to be exported. The export files are written in a subfolder of your project, the program suggests a name that you can alter, or you select an existing folder.

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 re-draw 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>.

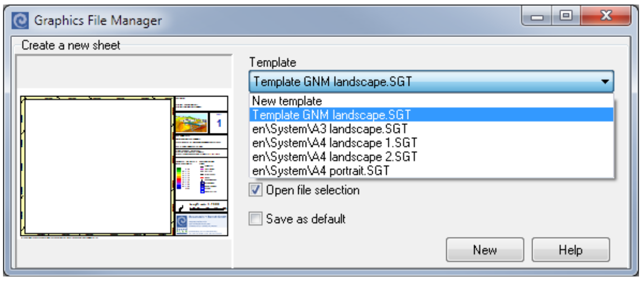
Sheet Templates

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 Text variables (page 395).

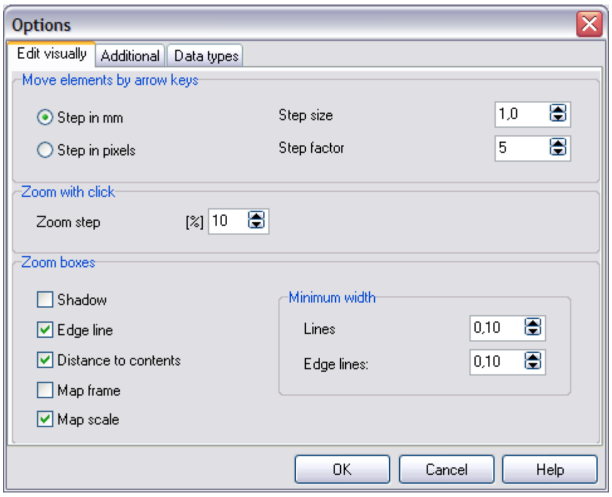
We assume you have a standard layout for your office's plans, with the unique logo, colors, etc. of your company. Use our templates to help create your own company templates for the three standard formats, with predefined map description boxes, company logo, etc. Map folding schemes are regarded the 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.

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.



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



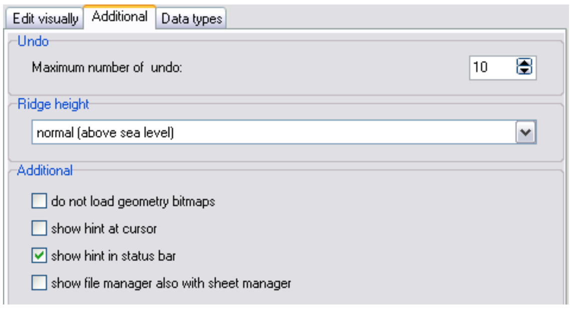
Under **PARAMETER | OPTIONS,** select the **STEP SIZE** the elements are moved in the map. The **STEP FACTOR** determines how far elements are displaced from the original element when they are copied and pasted.

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.

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:*



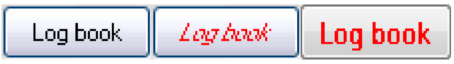
- Number of „undo“ steps .
- Definition of ridges of roofs in the Geo-Database (absolute elevation above sea-level or height above building reference plane or height above the upper edge of the building walls).
- Geometry bitmaps may be excluded from loading if there is not enough memory.
- The hints 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.



Element properties

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**.

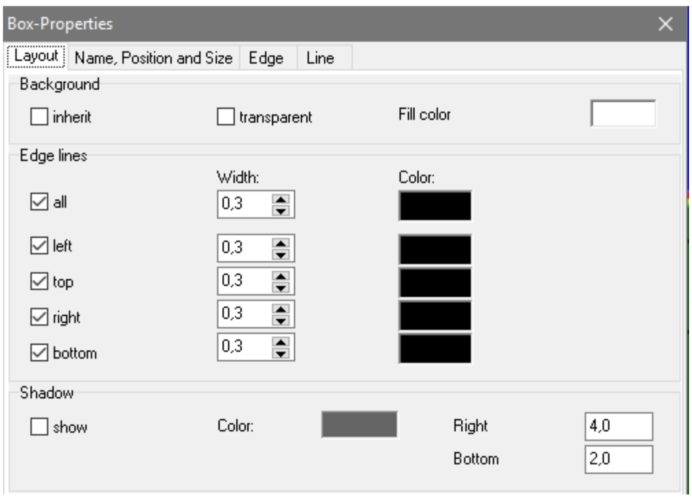
Activate the element with the space bar on the keyboard and use ***Shift+ Ctrl+ Return***.

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.

Layout



Box properties - layout

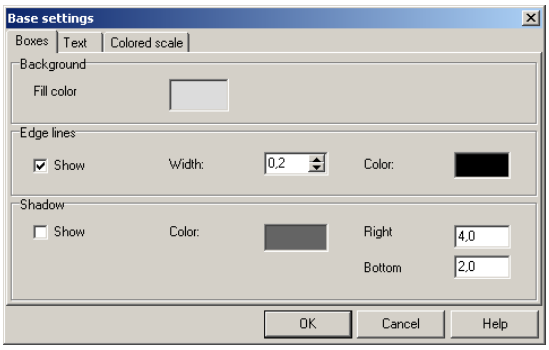
The **BACKGROUND COLOR** can be inherited from the parent element. This is especially useful if you want to place multiple elements in the parent element and want the background to be the same color. If you decide to change the background color, you only need to set the background on the parent element 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.

The Cartography module allows shadows behind the boxes. The shadow is half-transparent.

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.



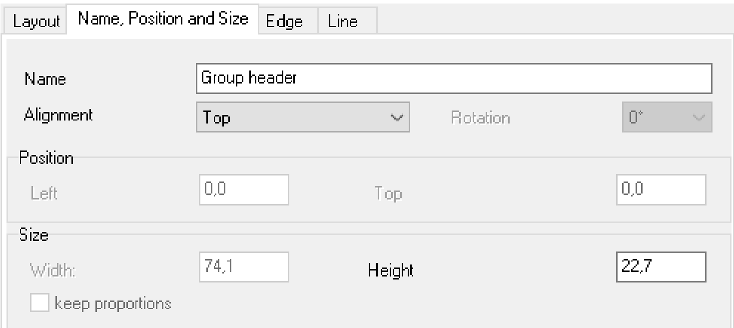
Base settings for all elements

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*.

Name, Size and Position



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.

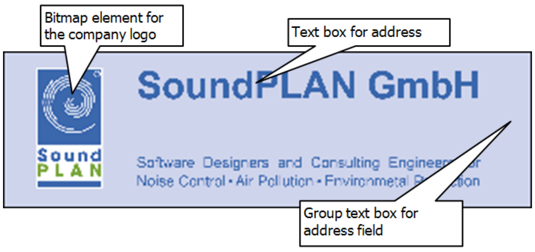
The element name is presented in the sheet components and when moving between element with the space bar. The name appears in the status line at the bottom of the screen.

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.



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”.

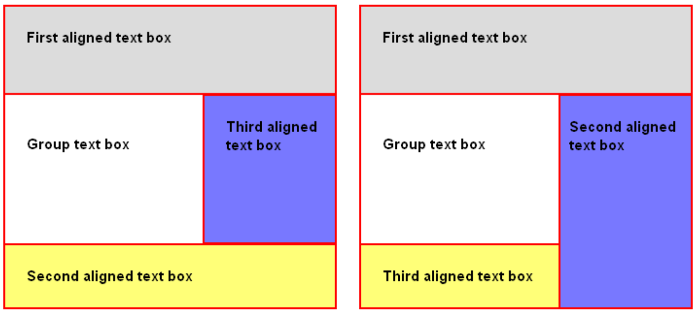
The following possibilities exist to anchor a child element within the parent box:

- 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.

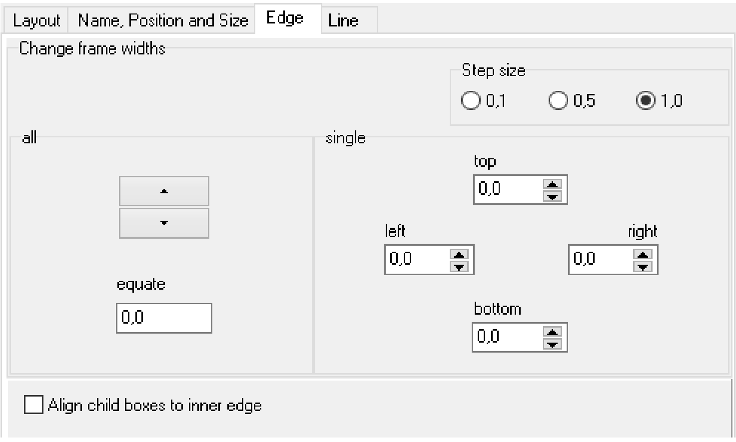
The sequence of anchoring and fitting boxes inside the parent box is crucial. The first box will use the remaining width of the parent box. The sizes of the next boxes will use the remaining space. Please observe the following samples.



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.

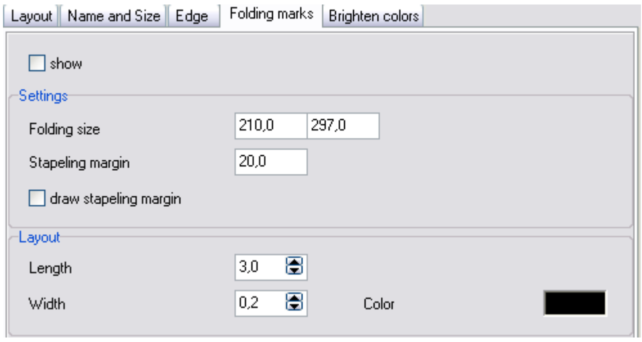
The entire text in text boxes can be centered horizontally and vertically even if the text contains complex paragraph layout, see "Text boxes" (page 397).

Features of the 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.

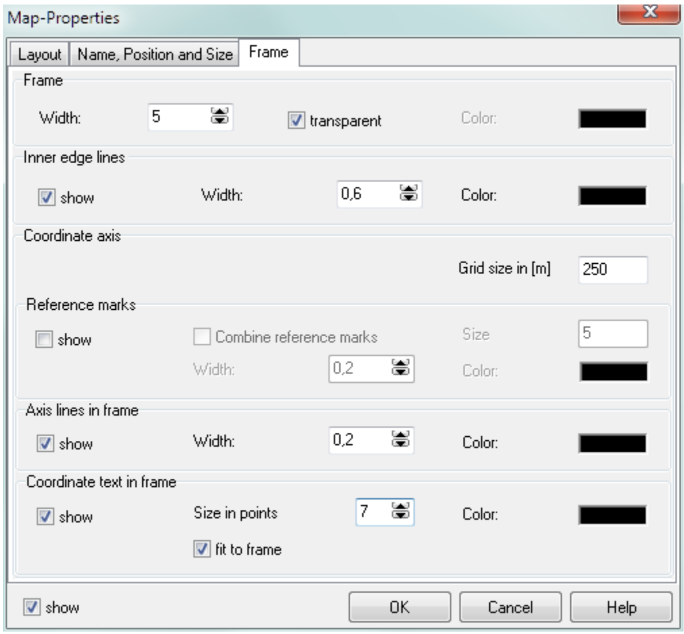


Specialties of the map properties

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.



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 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.

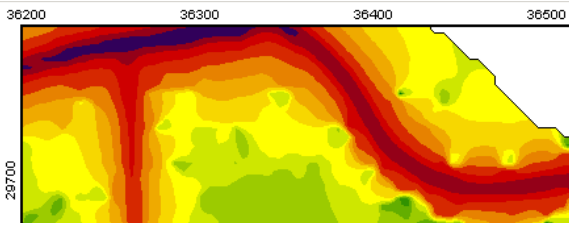
SoundPLAN pre-selects the spacing of the coordinate grid inside the frame according to the scale selected for the map. Use the field **COORDINATE AXIS - GRID SIZE IN [M]** to change the settings. Aside from the grid in the frame, this value also controls the coordinate raster reference.

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 map presentation

Use the individual design options in SoundPLAN Graphics to create meaningful and professional map displays. Changes in the geometry data or the results are immediately passed on to the graphics output. An export to an external graphics program is not necessary in most cases.

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

The section layout includes two predefined layouts: one for the layout of the **STANDARDTEXT** and for the **TITEL**.

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.

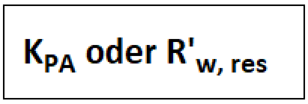
Use the red + button to add own section layouts.

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.

10

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.



$R'_{w,res}$ for example will be displayed as "R'@\l+w, res@\l-". As soon as you finish editing the text, the subscript will be effective.

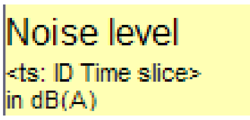
In case you need other text attributes, e.g. to write a word in a paragraph in bold, you can manually insert them:

@\l+text@\l-	= subscript
@\h+text@\h-	= superscript
@\i+text@\i	= italic
@\b+text@\b-	= bold

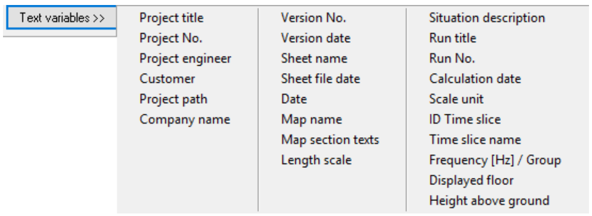
Text variables

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 slice day and another sheet with a grid noise map for time slice night, you can insert the variable <ID time slice> in the scale. If you save the sheet under a different name, open the file selection again and select the time slice 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.



In 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 - Attribute 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-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 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)

As soon as you leave a line, the variable is processed so you see the variable content rather than the variable name.

You also can concatenate multiple variables, for example <Project path>\<sheet name>.

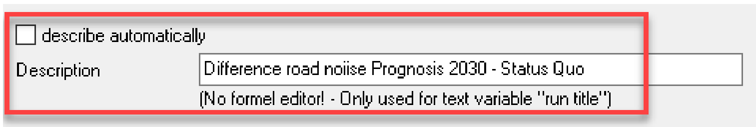
Multiple files or maps on a single sheet and the file operations

If multiple results or situations are loaded into a map, 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).

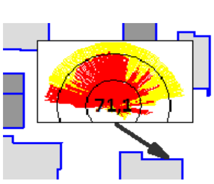
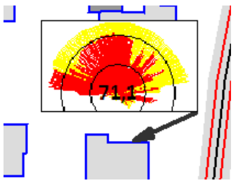
For file operations, the variable for run title will display the formulas found in the field description of the file operations.

Deactivate **DESCRIBE AUTOMATICALLY** if you want to write your own description for the run title instead of the formula.

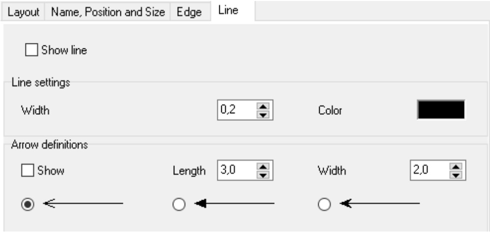


Connection lines

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.

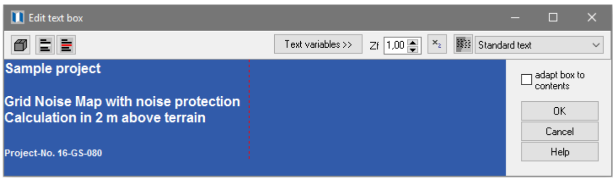



When the box is selected, you can grab the connection line and move it, grab either the beginning or the end of the line. The default position of the start point of the line is the middle of the box. When the entire box is moved, the line is adapting. You can change the position of the start point, for example to one of the corners.



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

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.

Use the symbol buttons to insert lines 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.

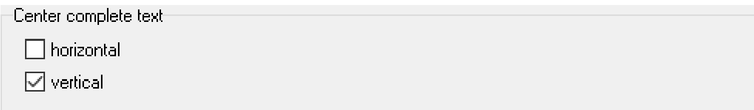
Use **ADAPT BOX TO CONTENT** to adjust the size of the text box to the size of its content. With nested elements, any adjustment may mean you need to refit boxes within the parent box. If the option to adjust the box to the content is not used and the content has increased, the excess content will be truncated.

Use the **ZOOM FACTOR** (Zf) to increase the size of the legend for editing.

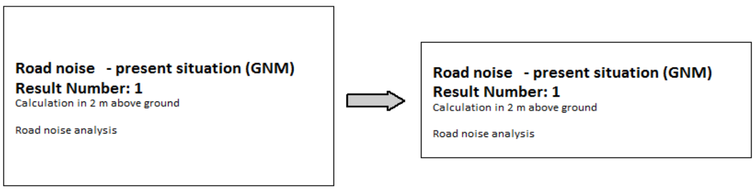
Section layout, subscripted texts and text variables are described in "Common features for text boxes, legends and color scales" (page 394).

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.



When enlarging shrinking the text box, the text font is adjusted accordingly.



10

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.

Free Text boxes

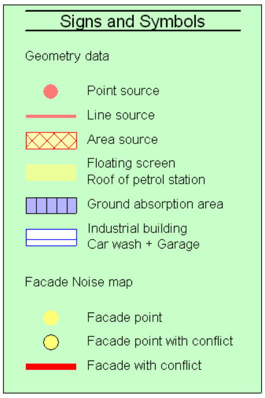
For text boxes, additional properties can be defined under the tab „name, position and size “. The **ALIGNMENT** can be „free“. This allows you to place information on the frame (for example, the version number of the sheet).

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.

Legend / signs and symbols

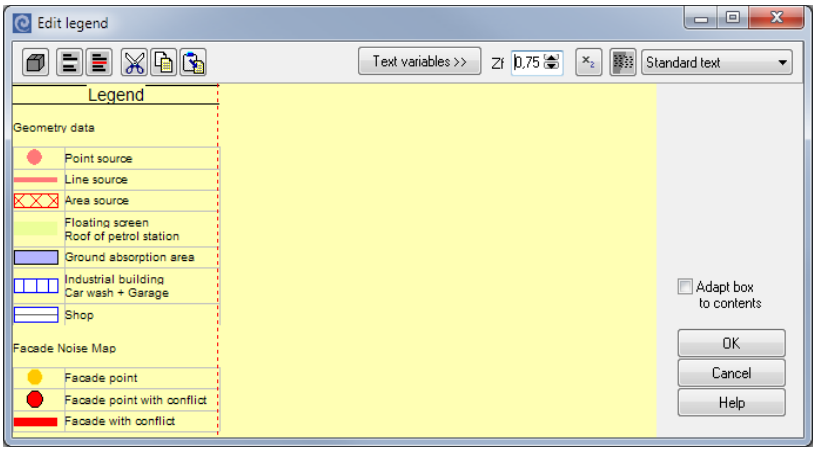
SoundPLAN creates the legend from the object types present in the data and the drawing settings from the object type setup.



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.

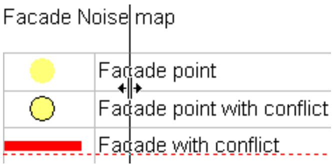
The legend contains the object type and the legend text. How an object type is presented in the legend depends on the current layout setting of the object type setup. If you change the color of an object type, the color in the legend is automatically adjusted.

Activating / deactivating the legend text in the map 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.



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 "Common features for text boxes, legends and color scales" (page 394).

Change the positioning of the layout entries

The legend entries sequence is determined by the sequence of loading of the geo-files. Result types are sequenced according to the sequence of the files loaded. Use 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.

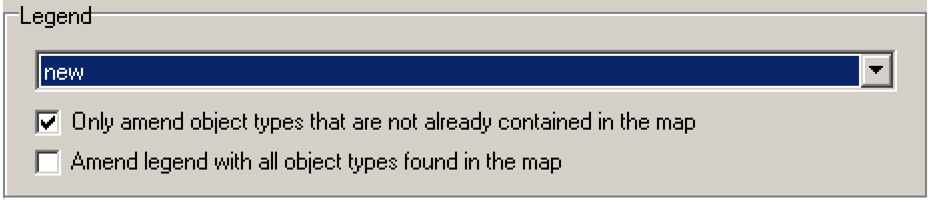
Make sure the desired object type in the object type settings is checked for insertion in the legend. Open a new legend box. The content is initially empty and is filled when you double click the legend box or select **EDIT CONTENT** from the right click mouse menu.

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.

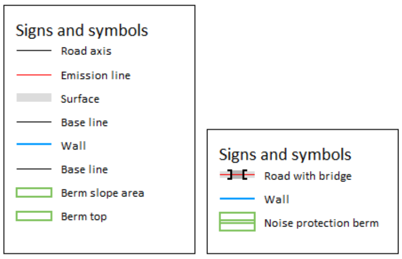
Activate the menu entry **COMPLETE LEGEND WITH ALL DATA FOUND IN MAP** and click OK. If needed, you can always delete undesired entries from the legend.



The second way of amending the legend is more useful if many object types were missing in the legend.

Presentation of total objects in the legend

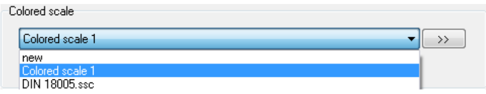
[Module Cartography] For object types that consist of multiple sub-objects, for example road or noise protection wall, the entire object type is presented in the legend when the main object type is activated for presentation and all the sub-object types are not activated for the presentation in the legend.



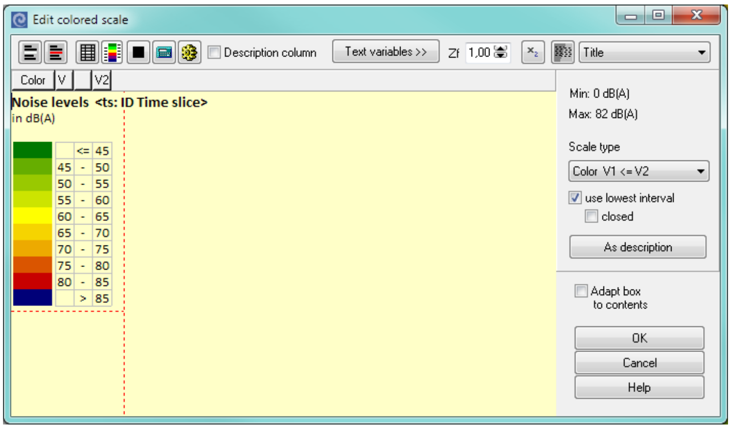
Color scale

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**.

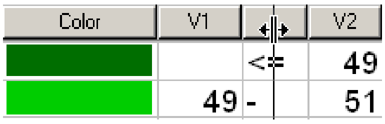


The basis for the color scale is the color favorite matrix in which the colors are defined and grouped together to color scales.



The start color defined under **PARAMETER | BASE SETTINGS** is used as the beginning of the color sequence.

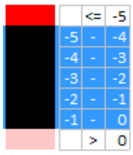
The scale intervals are generated as a table. You can enlarge columns by left clicking the column header after the cursor is displayed as the splitter cursor. Use the splitter cursor with the left mouse button pressed to change the column width to the desired size.



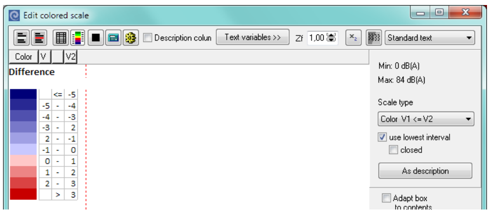
You can also insert data and text lines in the scale to mark additional intervals and include comments in the scale. This could be done to indicate from which level the noise limit has been exceeded. Use the symbol ‘delete line’ to delete both text and data lines.

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 to black.



Now click on the symbol for the calculator.

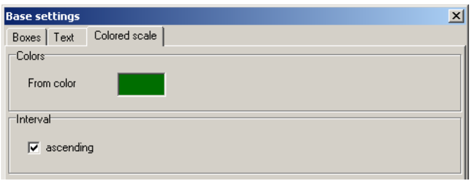


When the number of columns in a scale or the width of the scale is increased, use **ADAPT BOX TO CONTENT** to resize the box around the scale. With nested elements, however, this may force you to rearrange some of the elements or to resize the scale again. If you do not click „adapt," the box will remain 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 "Common features for text boxes, legends and color scales" (page 394).

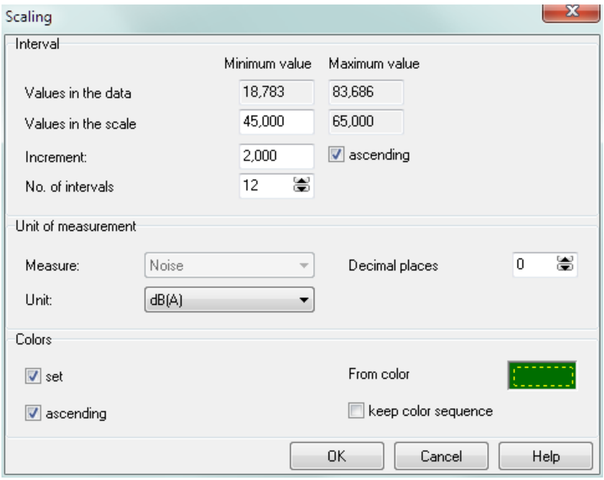
Base settings for the color scale



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. Click on the **AUTOMATIC SCALING** button.



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 380).

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 will not make a complete reset necessary which in turn would reset any of your custom color definitions. With the checkbox **RESCALE** you can force a full re-scaling.

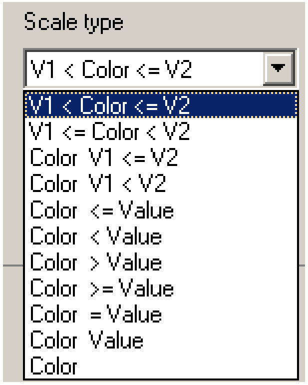
Designing the scale

It is possible to have a scale generated automatically and customize it later

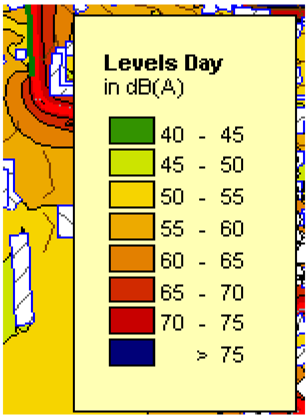
You are not bound to restrictive interval sizes. You can assign the left value field any value and the right-side value will adjust to it. This allows you to create "speaking" scales. For example, use green colors up to the target value, yellow colors to the noise limit, and red and purple colors to highlight the problems.

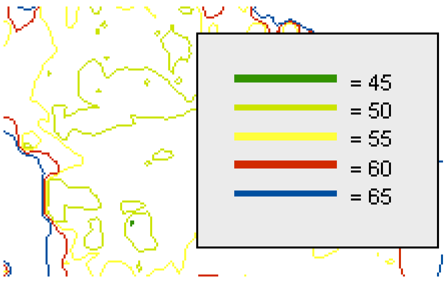
Single scale colors can be changed by clicking the color field and selecting a new color from the palette.

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).

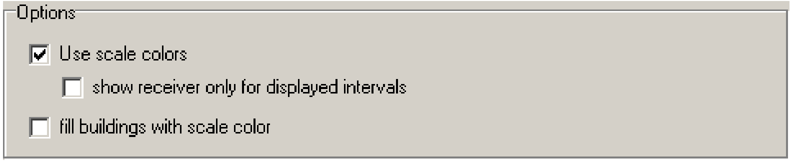




SCALE TYPE defines if the color shall represent an interval (the first 8 scale types) or if the color shall represent a discrete value.

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.

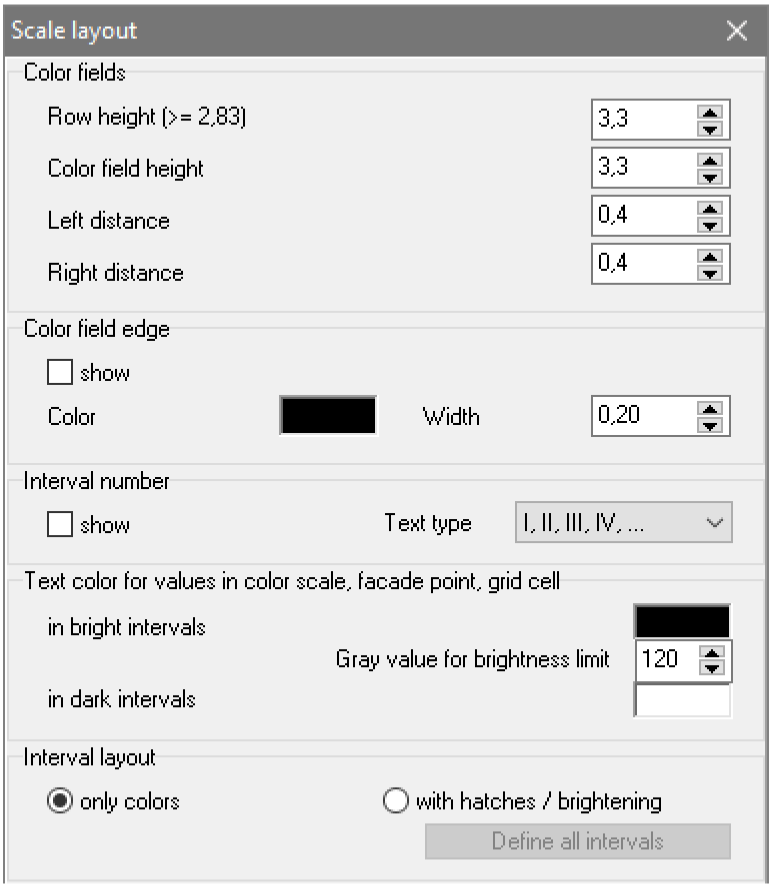


If you use the lowest interval, you can convert the interval from an open interval of the type >= into a closed one of the type =. This may be useful for conflict maps that always would show, for example, <= 3. A closed interval would show 0 < color <= 3.

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.

Scale layout

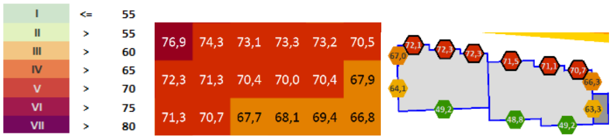
To add to the flexibility of the display of the scale, you can further customize the scale in the **SCALE LAYOUT**:



- 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.

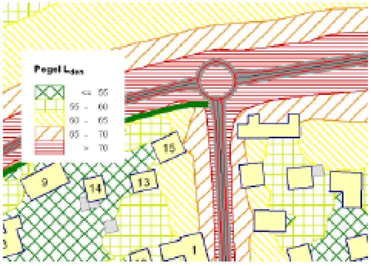
  This setting is also used for grid point values and texts of the facade noise map receivers.

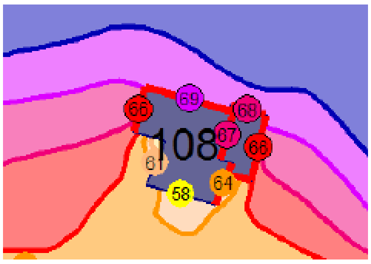


- The interval layout, see "Scale with color brightness and hatch patterns" (page 405)

Scale with color brightness and hatch patterns

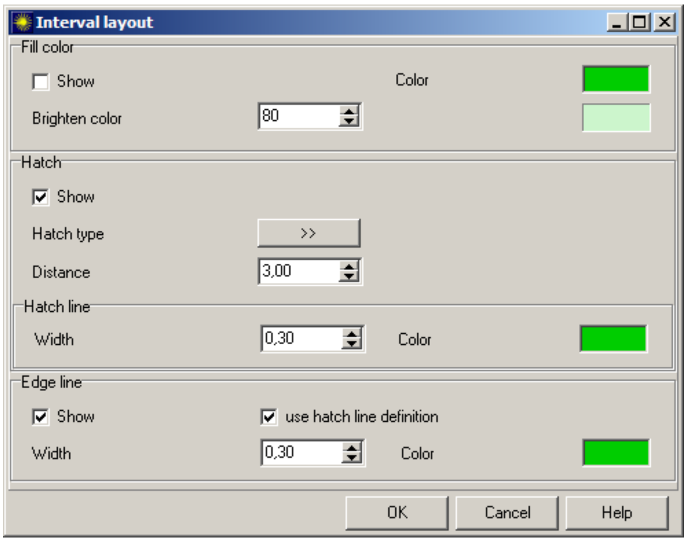
In addition to solid colors, the isophone bands can also be output with hatching and color brightening. However, the screen build-up takes much longer with lightened or hatched colors.





Since the contour lines themselves and the scale color in the facade points are not brightened, additional design options are available.

In the scale layout, click **WITH HATCHES/BRIGHTENING** and open the interval layout via **DEFINE ALL INTERVALS.**



Brighten fill colors: Click **SHOW FILL COLOR** and activate **BRIGHTEN COLORS.** Specify the brightening in percent (the fill color of the lowest interval and the resulting brightening are displayed for information).

Hatched contour bands: Click **SHOW HATCH** and select the hatch type. Additionally, you define the distance, the width and the color of the hatching lines.

Brightened fill colors and hatched contour bands can also be used in combination.

Edge line (border line): The contour lines themselves are not brightened. You can take the color and width definition from the hatch line or define them separately. For brightened contour bands, it is often useful to highlight the contour lines with a wider border line.

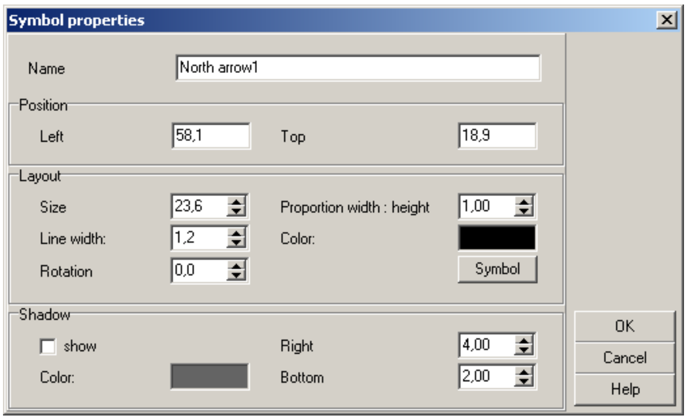
As soon as you activate the scale with brightening or hatching, the contour line settings in the object types for area-type results in the "main interval" sub object type are ignored.

10

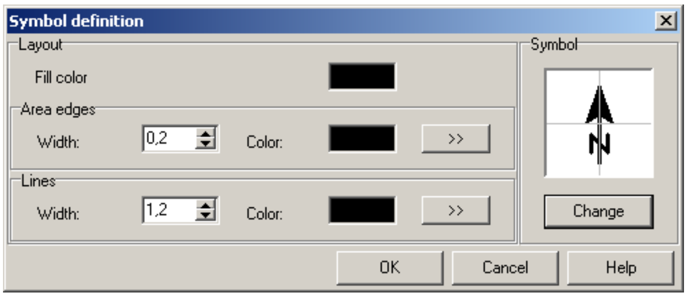
North Arrow

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.



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.



Graphic box

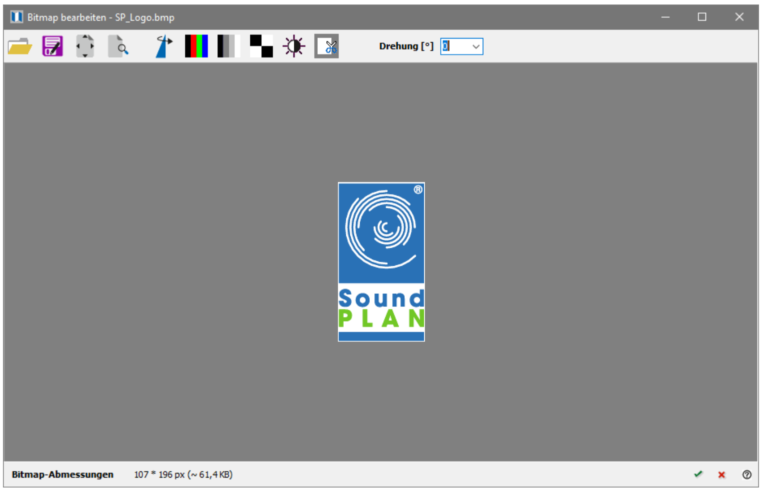
Use the graphic box to include company logos or additional information (map description, photos of machines, photo locations ...) from a graphic file or a pdf file in a sheet. You can create at least one graphic box for your company logo. Multiple graphic boxes are only allowed if Cartography is licensed. A pdf file is first converted into a bitmap.

Bitmaps can also be pasted from the clipboard directly into a graphics box by pressing ***Ctrl+V.***

Click on the symbol **GRAPHIC BOX** and drag a frame on the map. Double-click the graphic box and select the file from the drop-down list. If the image is not in your project, you will be asked if you want to move or copy the Graphics, or if you want to link to the file.

The Graphics will be fitted into the frame without changing the aspect ratio.

Edit the bitmap with a double click or right mouse button | **EDIT CONTENT**.



Via the symbol buttons you can adjust the bitmap (for example rotate, lighten or convert to grayscale). Drag a frame inside the bitmap to cut out a section of the original bitmap. The section can be saved under a new name.

Brightness, contrast, sharpness and color components of graphic files in a graphic box can be further edited.

Adjust bitmaps in graphic boxes with alignment:

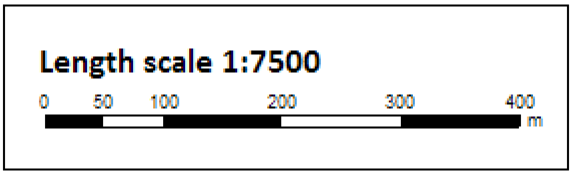
If an alignment is selected in the properties of a Graphics box, for example for the company logo in the description block, the checkbox **KEEP PROPORTION OF GRAPHICS BOX** is active so that no distortions occur when the height or width of the elements in the description block is changed.

For the top and bottom alignments, the image is centered horizontally; for the left and right alignments, it is centered vertically accordingly.

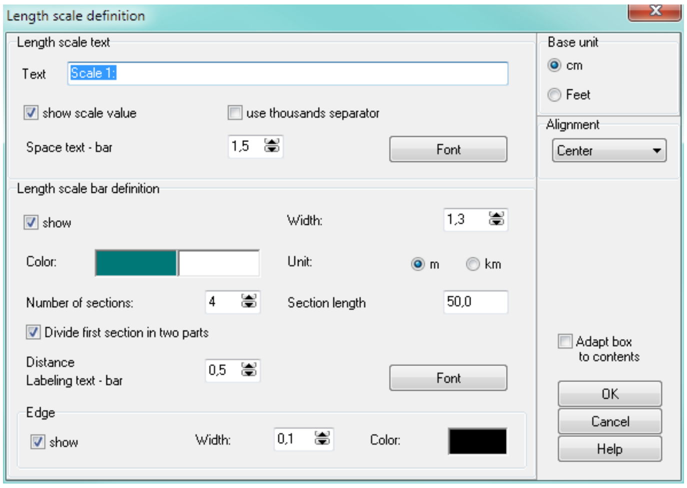
Changing the height or width of an element, the size of the bitmap remains the same when enlarged and is centered in the element; when reduced, the bitmap is reduced proportionally.

Scale bar

The length 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.



You can choose if you want to present the scale as the scale factor or as the length scale bar or both.



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.

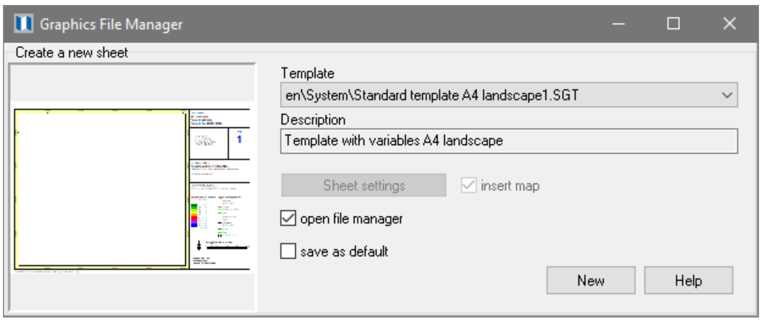
Use **ADAPT BOX TO CONTENT** to adjust the size of the text box to the size of its content. With nested elements, any adjustment may mean you need to refit boxes within the parent box. If the option to adjust the box to the content is not used and the content has increased, the excess content will be truncated.

The map

First the map is filled with data via the file selection manager. Use **EDIT MAP CONTENT** to select the geometry viewport. Customize the individual objects and the display of the results in the map object types (right mouse button). In addition to the properties and content, editing a map also includes selecting the data displayed in the map (file selection) and the display of the geometry objects and results (object types).

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 **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.

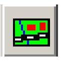
If you click the button **SAVE AS DEFAULT,** the next time you open the graphics this template will be suggested as the standard.

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.

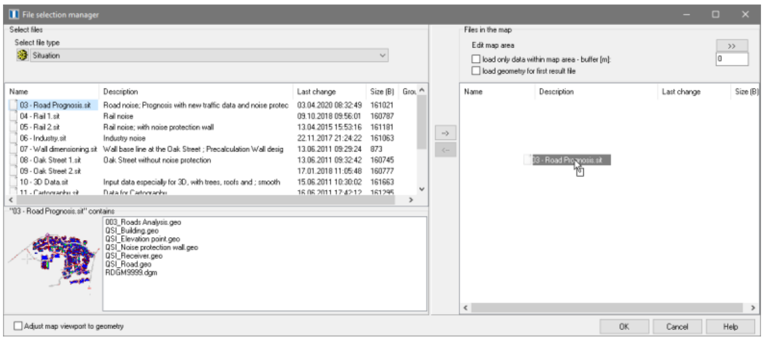
To leave the graphics file selection manager, click **NEW**, which opens the file selection or moves to the main graphics level, or **OPEN,** which loads an existing sheet of the current project, or select one of the graphics sheets processed recently.

File selection

The file selection fills the empty map on the screen with data. When you create a new sheet, you normally enter the file selection automatically after selecting the template.


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.”



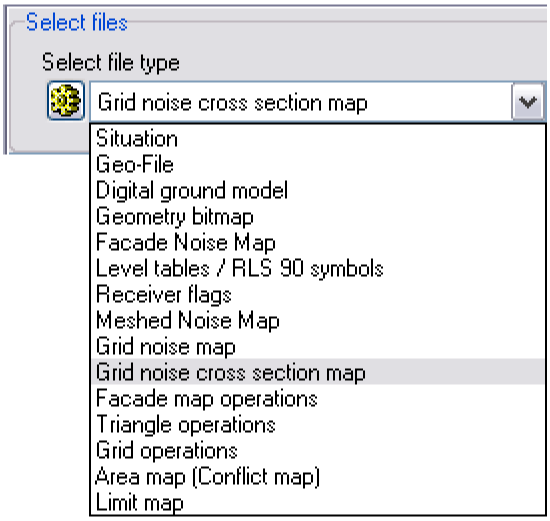
File Selection

Using the list next to the preview graphic, you can drag individual Geo-Files of a Situation into the plan. A DGM contained in the situation is also displayed but must be loaded using the corresponding data type.

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 the check box **ADJUST MAP VIEWPORT TO GEOMETRY** at the bottom of the main screen to define if the geometry view port shall be used or recalculated from the geometry in the situation. When you open a template, the check box is checked by default to show the correct geometry viewport.

Proceed the same way with other file types from the selection list. Use the arrow symbol or Drag & Drop to move a file into the 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.

For the individual data types, further parameters are requested during loading, which are explained in the description of the data types. After you have specified and confirmed the content to be displayed, press OK in the file selection to display the data in the Graphics main level.

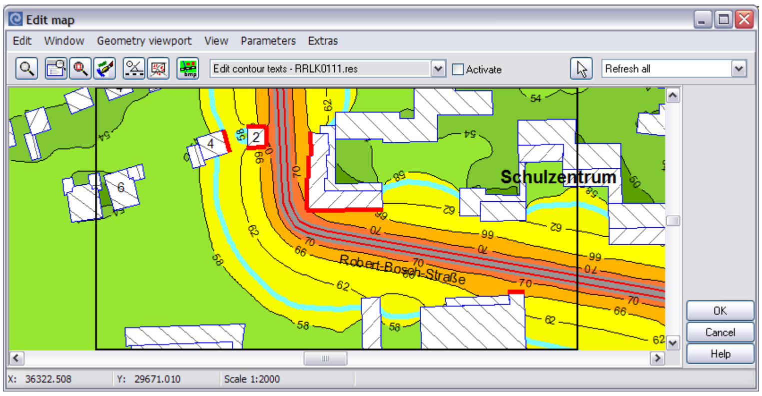
Geometry from first result file

In the file selection, if you load a result as a data type, you can automatically load the geometry data that is stored in this result. To do this, check **GEOMETRY FROM FIRST RESULT FILE** at the top right and load the desired result. In this case, no query is opened for the geometry data.

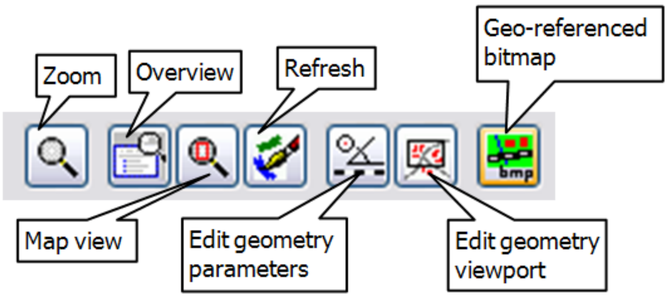
Load data only in the map area

[Tools NMP] For larger projects, the loading and drawing times may take longer. If you are only interested in a subarea, you can reduce these times by opening the file selection again and checking **LOAD DATA ONLY IN MAP AREA.** In addition, you can define a buffer around the geometry section where the data will also be loaded. As soon as you change the section in “edit map content”, the loaded data will be adjusted accordingly.

Edit map content



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.



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:

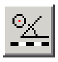
- Edit grid values.
- Export of contour lines and grid values.
- Position level tables and receiver flags.
- Move contour line texts.
- Store the map view of one or multiple (loaded) bitmaps in a new file. For example, to crop a large geometry bitmap or to compile one bitmap from multiple, single bitmaps.

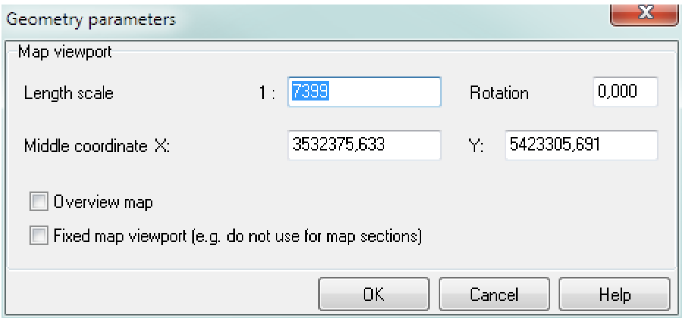
10

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.

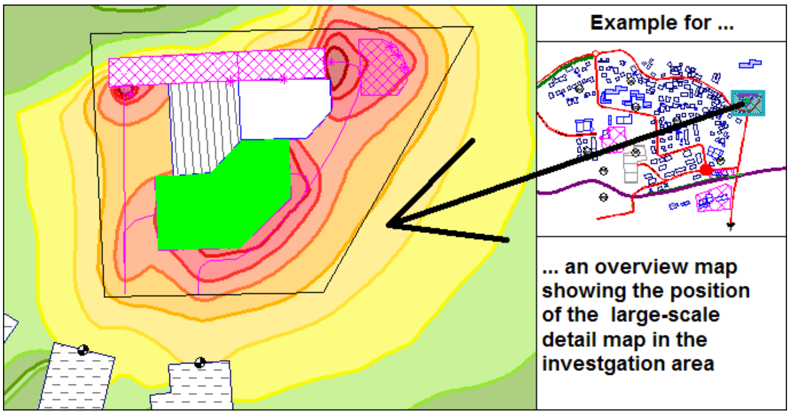
Elements positioned in the map are not displayed in "Edit map content". For your information activate the elements with **PARAMETERS | SHOW CHILD BOXES**.

Geometry parameters


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.



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**).

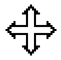
In the map object types select how to format the frame. The object type **CURRENT MAP SECTION IN OVERVIEW MAP** determines how the frame section shall be highlighted in the overview map.

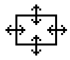
Change viewport graphically

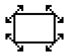
The geometry viewport can also be edited graphically. To do this, it is best to first display the entire input data on the screen using the **OVERVIEW** icon button. A black frame shows the map viewport.


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.


zoom - <Shift>- keep left mouse button pressed. Move up=zoom out, move down=zoom in.


rotate - <Ctrl>- keep left mouse button pressed and move.

The button remains pressed until you click the icon button again to apply the changes to the map.

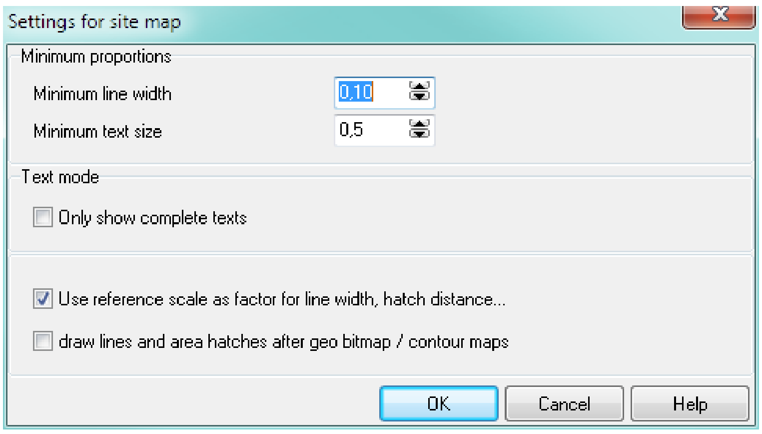
Site View, Cross Section or 3D-View

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 Cross-sectional Noise Map).


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.



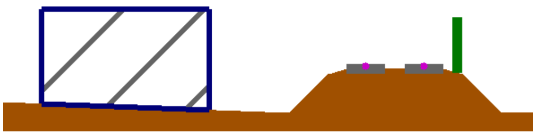
The **MINIMUM LINE WIDTH** defines the pen thicknesses. Line widths, which for a selected scale factor would be smaller than the set minimum size, will be drawn with the minimum line width. The **MINIMUM TEXT SIZE** ensures texts will be suppressed when their size falls below the minimum text size when 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.

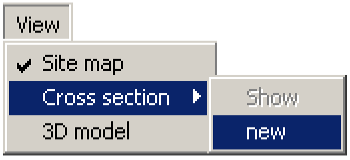
USE REFERENCE SCALE AS FACTOR FOR LINE WIDTH, HATCH DISTANCES... adjusts the spacing of the line width and distance of the hatch lines when the scale of the map is increased or decreased (see "Reference Scale" on page 418). If you deactivate this setting, the objects are always drawn with the same hatch 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.

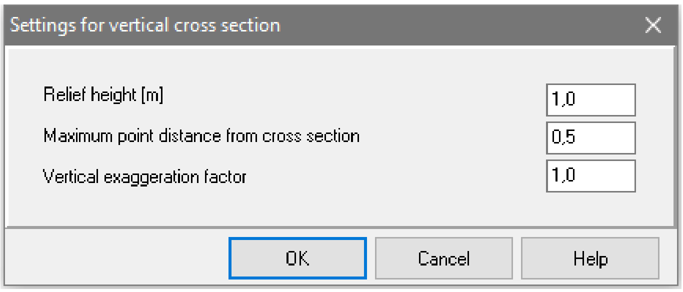
Geometry Cross Section



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.



For the cross section, you can adjust the following settings under **PARAMETER | CROSS SECTION SETTINGS:**



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).

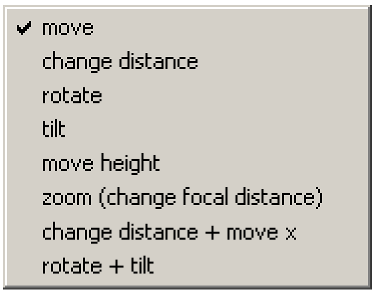
The **VERTICAL EXAGGERATION FACTOR** controls the ratio of the vertical to the horizontal scales (stretch of the height).

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.

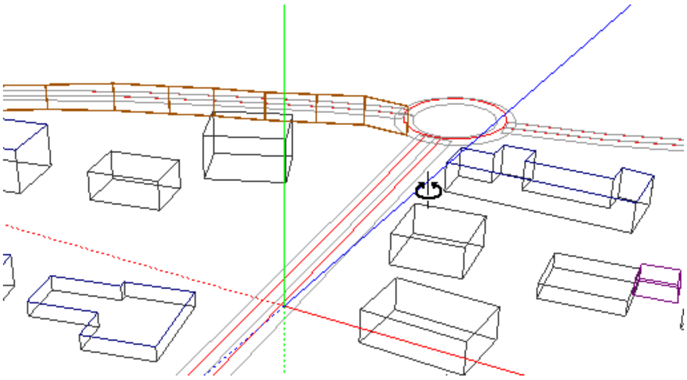
3D-Wire Frame Model

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:



“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.



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 Graphics* in the map object types. See also "3D Graphics" (page 481).

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

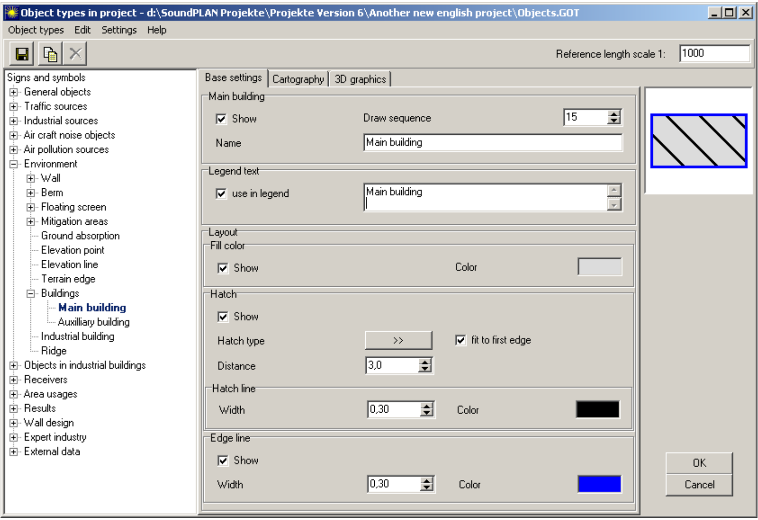
After you have recalculated results or have changed the geometry files you can update the map data without opening the file selection manager: **FILE | UPDATE MAP DATA** or ***Ctrl+ R***.

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.

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 properties as text.

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.



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 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 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, you call up the project object types via the **EDIT OBJECT TYPE ICON** in the properties dialogs.

You edit the global object type file via **PARAMETERS | PREFERENCES** with the **EDIT OBJECT TYPE** icon.

Transfer the layout to other object type files, maps and sheets

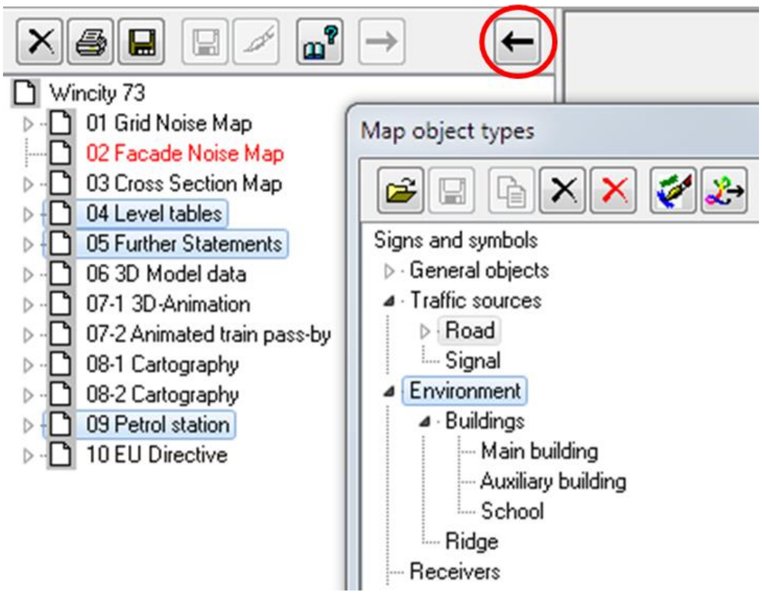
If you have customized the layout of a map's object types and want to use it for the entire project or for all projects, you can move the customized object types from the map-object types to the project-object types or to the global object types. To do this, open the map-object types with the right mouse 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.

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.

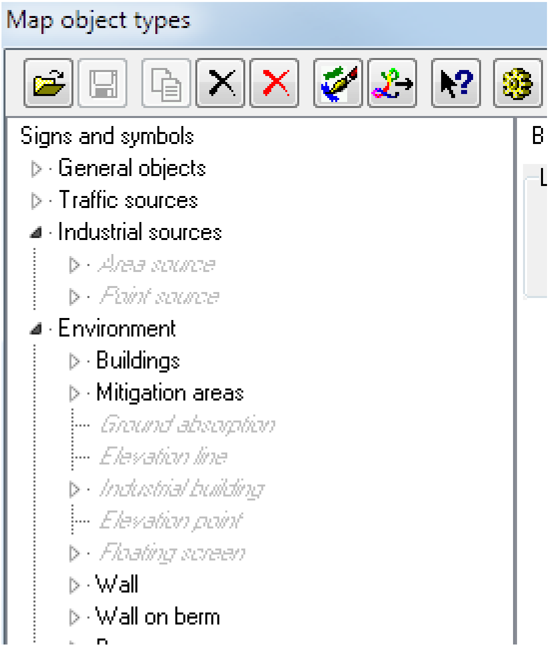


The layout of the object type road and all object types in the branch „Environment" are to be transferred to the marked sheets on the left


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 italic*.

10



 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).

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.

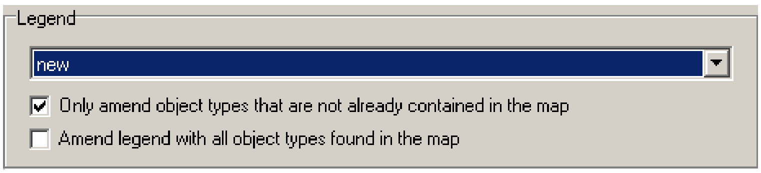
The reference scale can also be used to increase or decrease all line thicknesses, patterns and hatches.

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…**

10 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.

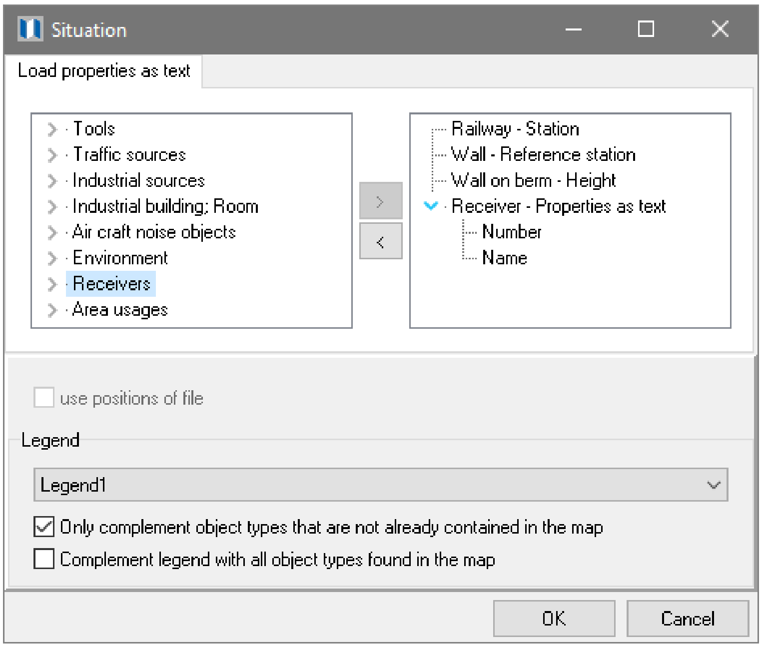
An existing legend will only be present if you are developing the current map from a template or if you are reloading data. The options are only relevant for these two situations. If this is not the case, do not change the default settings.



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.



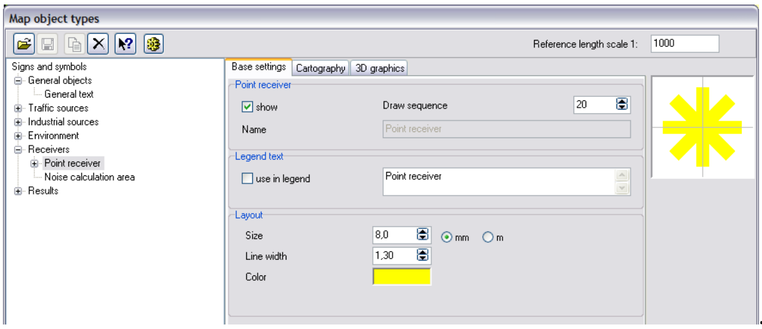
If you want to display properties of objects as text for example, stationing a reference kilometer of a noise protection wall load these by double clicking, using Drag & Drop or by clicking the arrow between the file windows. The properties as text are formatted via the object types. See "Display properties as text" (page 470).

The properties are displayed for all object types contained in the project, so you can load other properties for your own 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.

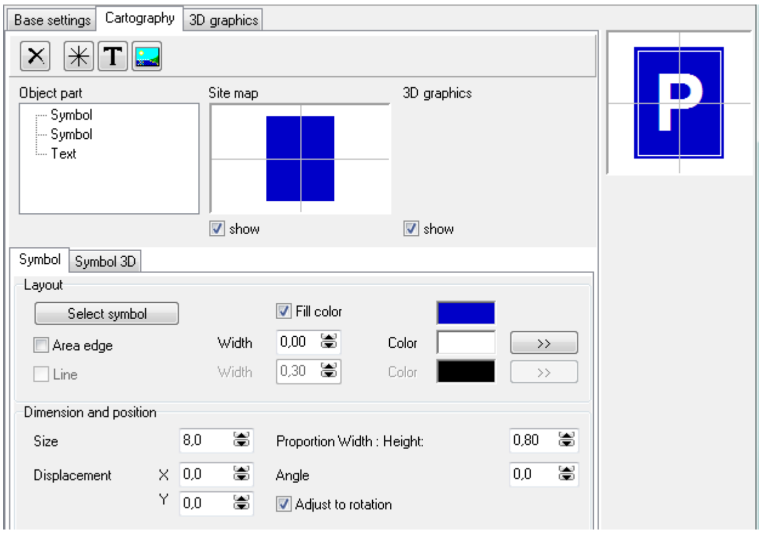
Point object types



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.

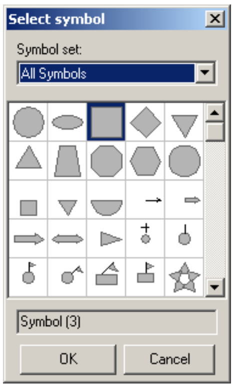


In this example, two signs and a text were combined to form the parking lot symbol. In the preview under "site map" you will see the part of the symbol highlighted in the tree, and to the right you see the entire symbol.

Symbol definition

Click the asterisk to insert a symbol and select a symbol from the symbol selection matrix.

10



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" (page 466)).

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**.


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.

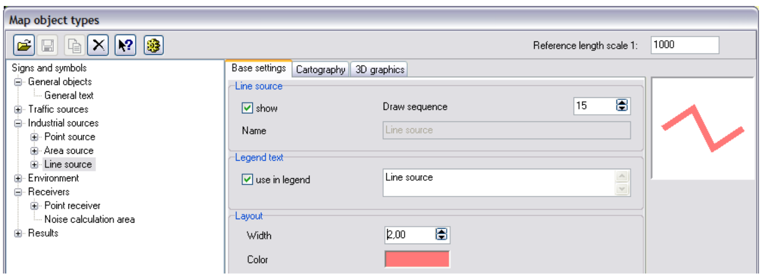

Symbols available as graphics (as files of the type *.bmp, *.jpg, *.gif, *.tif, *.png, *.wmf , *.emf…) can be integrated into symbols for point type objects. Select if the graphics is available in bitmap format or as a Windows metafile, and then choose the file.

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.

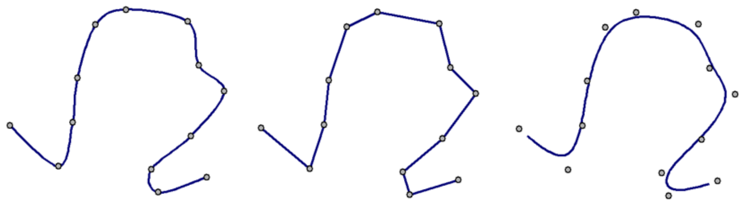
Line object types



Enter the line thickness and color.

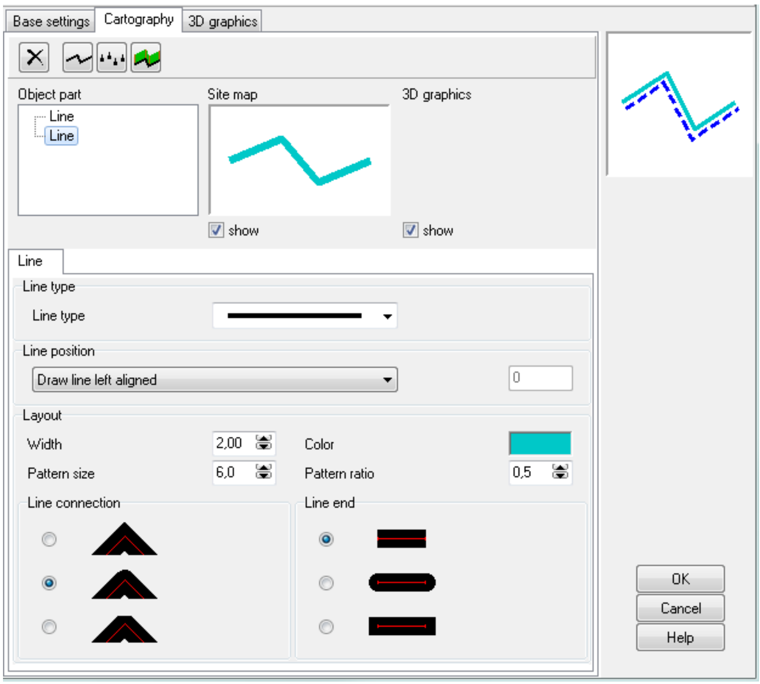
Line definition

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.



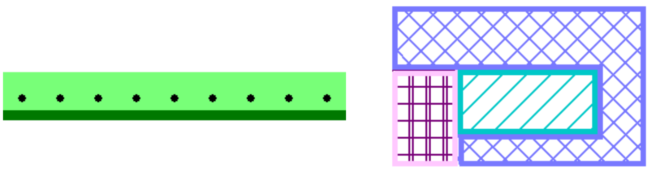
Left shows "no Bezier," the middle, "exact Bezier," and the right, "smooth Bezier."

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.

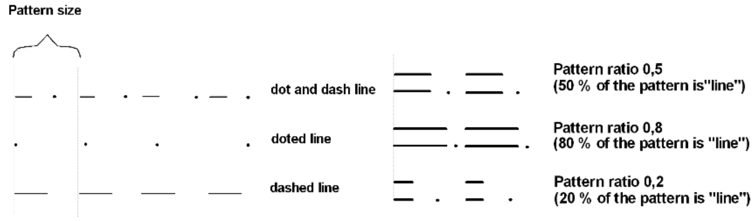


Customize the layout of lines, selecting from different **LINE TYPES** (solid, dashed, pointed or dash point...).

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 improves when the lines are remaining completely inside the area (example on the right below).

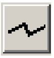


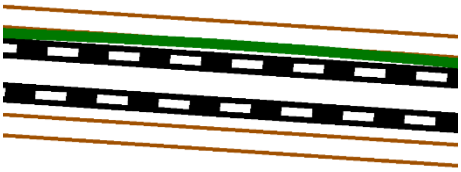
Enter the line thickness and color, and for non-solid lines, the **PATTERN SIZE** (pattern length includes the space between the line elements) and the **PATTERN RATIO**.



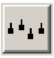
For dash point lines, the points are always placed in the middle of the space between the patterns.

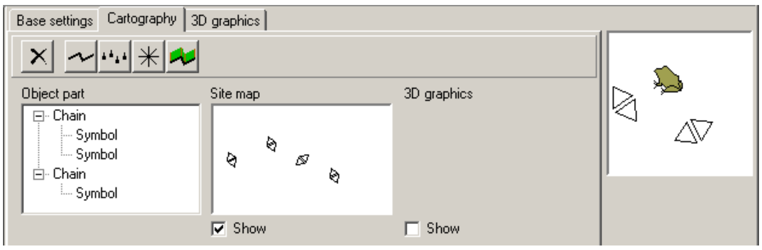
For **LINE CONNECTIONS** and the **END OF THE LINE,** select from the options shown.

 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.



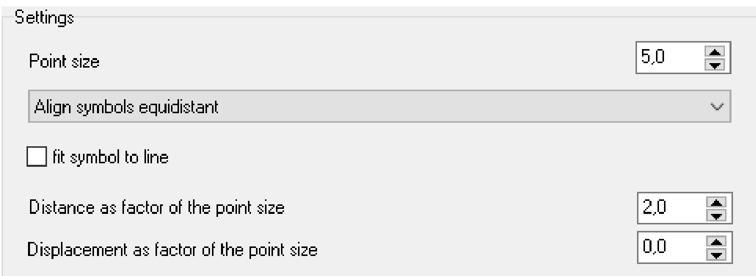
Hint: Lines are drawn in the sequence listed in the “components of the objects” box. If you need to change the sequence, simply Drag & Drop the components where you need them.

 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.



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" (page 420) and "Line definition" (page 422).

Select the symbol spacing in the symbol chain of the object component chain.



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

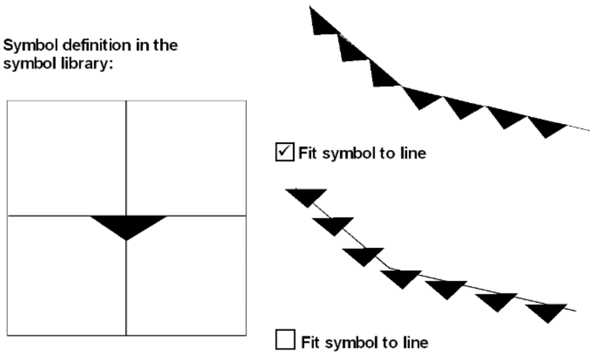
With all 3 possibilities it is possible to customize the symbols along the line.

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 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.



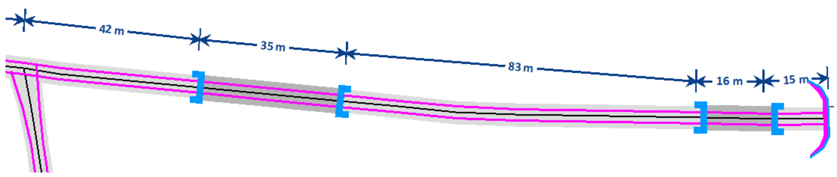
SYMBOL AT LAST POINT displays a symbol at the last line point, even if the entered distance cannot be kept.

For all line types, you can insert a 3D wall that is only visible in the 3D-graphics (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.

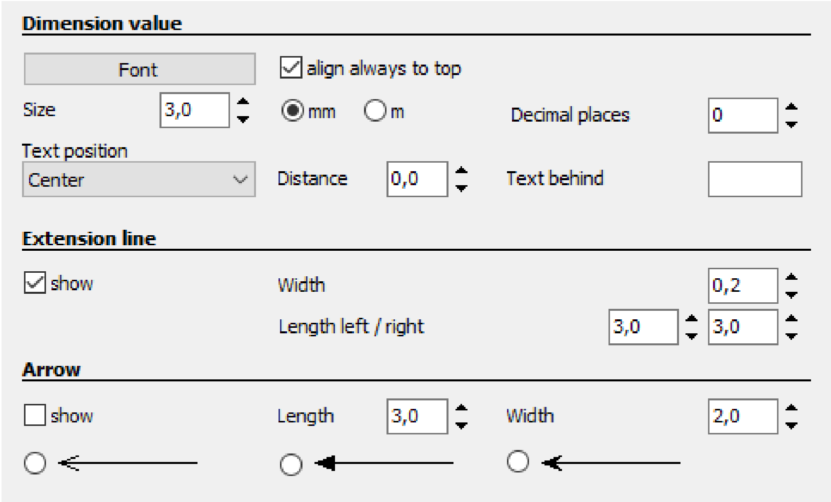
To delete individual symbol components of composite symbols, highlight them and click the X-button.

Dimensioning

You can use a tape measure entered in the Geo-Database to display dimensions in the map.

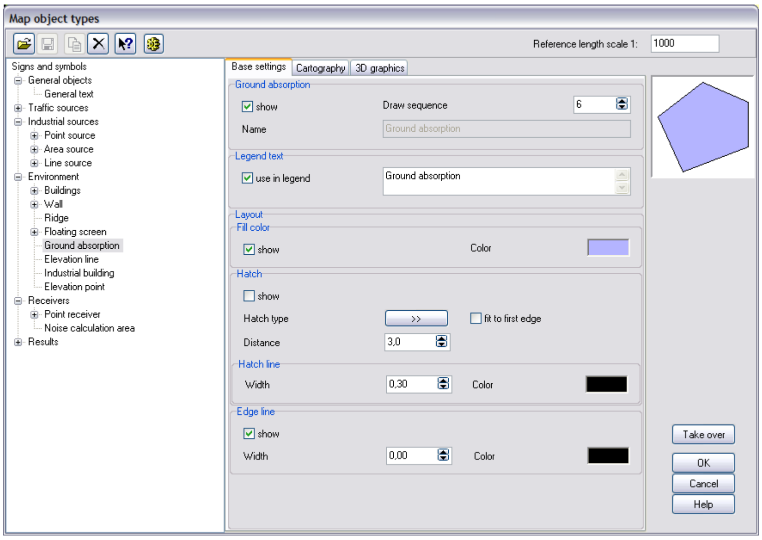


You define the layout of the dimension line in the tab *Cartography* in the **LINE** object component, and the display of the dimension number, dimension help line and arrows in the **DIMENSIONING** object component. The extension line and the arrows adopt the color of the dimension line.



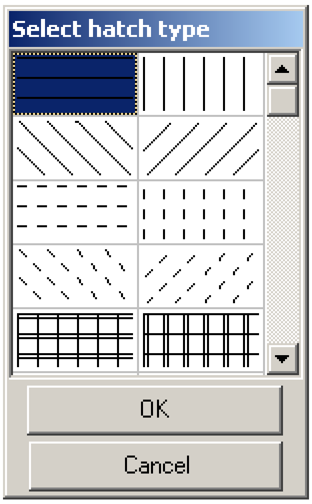
Area object types

For area type objects, define fill color, borderline and hatch separately from each other.



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.

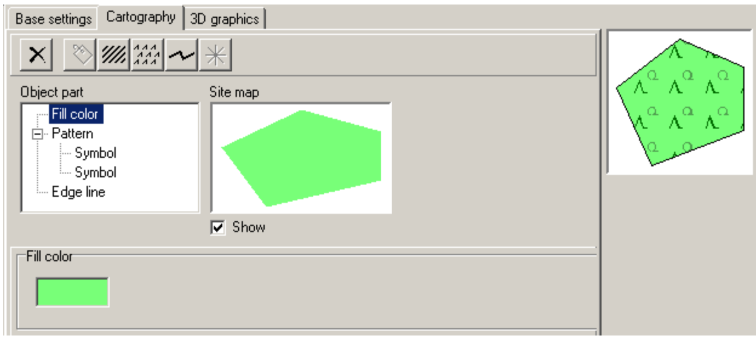


When the box **FIT TO FIRST EDGE** is marked, the pattern will be oriented on a line going through these first two coordinates.

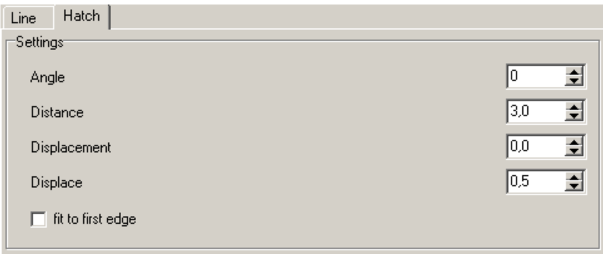
Area Definition

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.

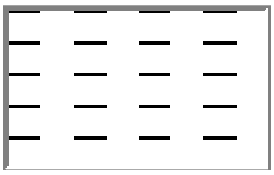



In addition to the standard hatches, you can also generate composite hatches. This can be a useful tool if you want to display hatches with different colors. Define the line type (see "Line definition" (page 422)) the parameters for angle, spacing, displacement (sideways offset) and the displacement (offset of the beginning of the line).

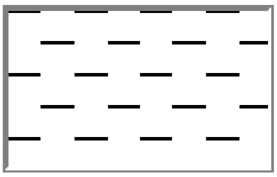


Use **DISPLACE** to generate a pattern of dashed and other non-solid lines:

Displace = 0,0



Displace = 0,5

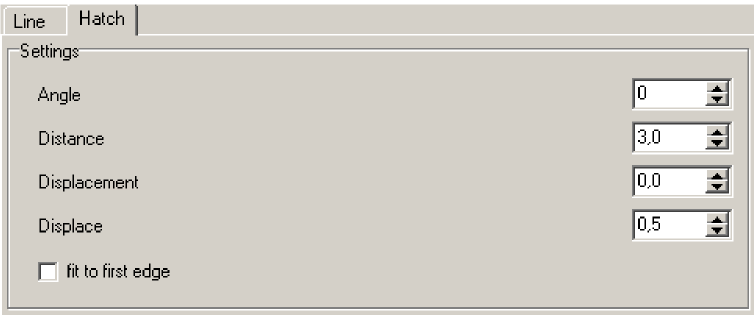



Use the pattern definition to assign any shape and any number of symbols to fill the shape. The shape can also have a background fill color.

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 "Symbol definition" (page 420)).

To define the symbol spacing, click on the pattern in the component list.

10



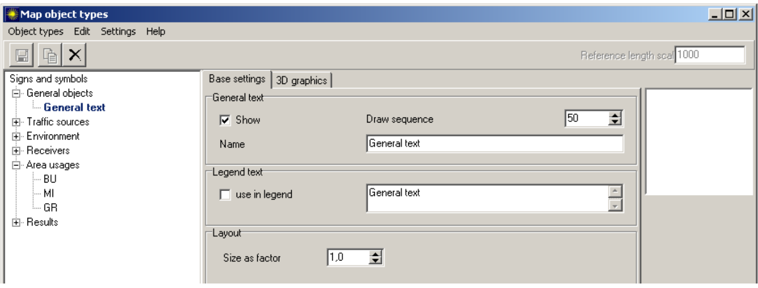
For the **POINT SIZE,** first enter the size from the symbol definition. This field may have to be customized if you have chains comprised of multiple symbols. For multiple symbols, the point size is the pattern size (i.e. the size of all symbols together).

DISTANCE and **DISPLACEMENT** of the symbols are defined in [mm].

Use **DISPLACE** to offset individual symbol chains.

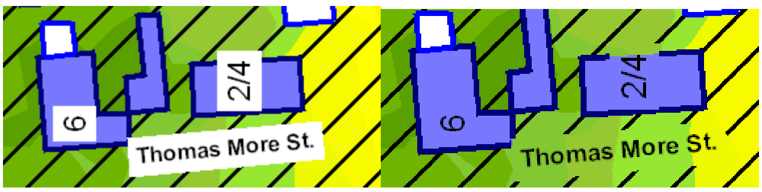
Use the X in the symbol bar to delete individual object components of object definitions.

Object type geometry text



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.

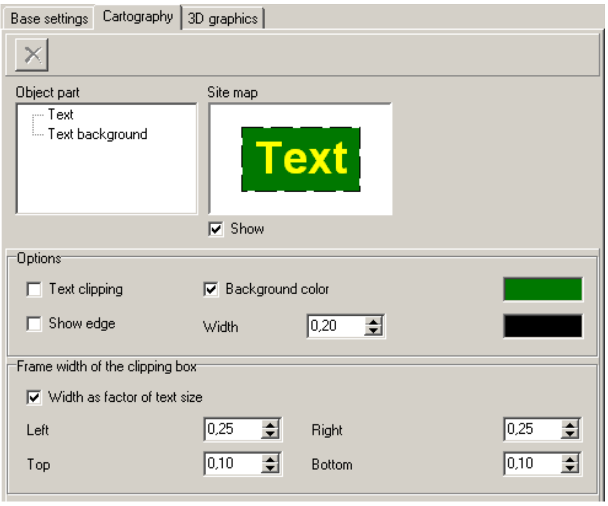
Hint: If texts included in the geometry data are not displayed, check the site map settings in the object types with the wheel symbol. Texts smaller than the minimum text size are suppressed, so check the minimum text size and make changes as needed.

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.

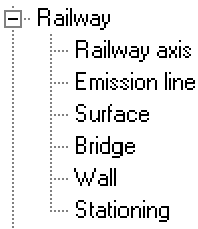


Use **TEXT CLIPPING** to clip the text background from the geometry. One of the text clipping options in **SETTINGS | SITE MAP** must be activated.

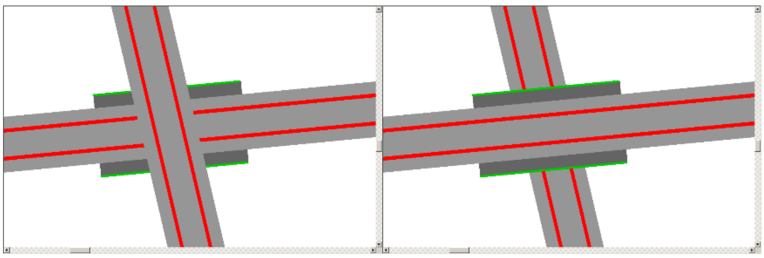
The box **DISPLAY FRAME** creates a frame around the text with the frame color and width of your choice. The frame width can be defined for all four individual sides as a factor of the text size or in [mm].

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.

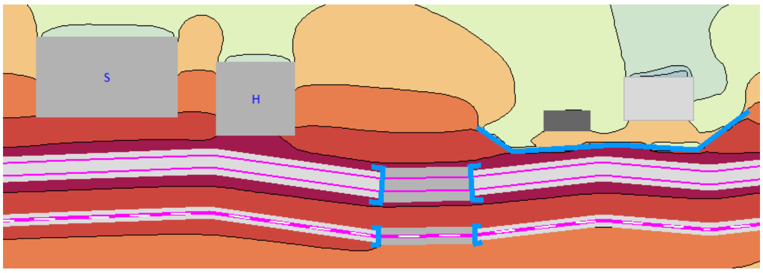


Each object type (with all sub-object types) is printed in the same output sequence; the only distinction is the order the object is read from the file. Files read first will be printed first, which allows you to control the drawing sequence of objects within the same object type. For example, you can use the sequence of loading and drawing to influence how the intersection is drawn and which road is drawn last. If 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 in noise immission control



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.

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
- DGM
- Measurement Map
- Grid Operations (for example: Difference map)
- Triangle Operations (for example: Difference map)
- Area Maps (Conflict Map)
- Contour Map Aircraft Noise

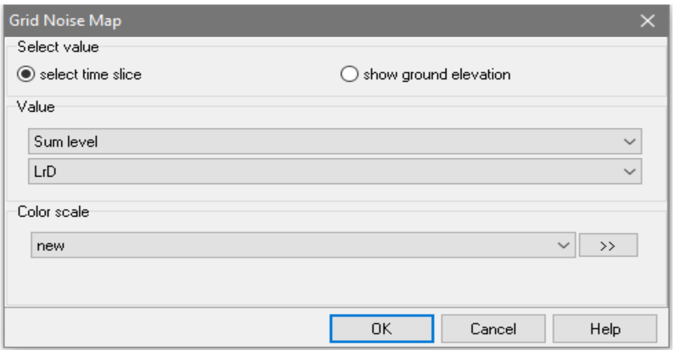
Select the needed **FILE TYPE** in the file selection. Depending on the type of results selected, additional information may be requested at loading time.

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.



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 the right mouse button. Editing scales is described in section “Color scale”.

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.

Change loaded data

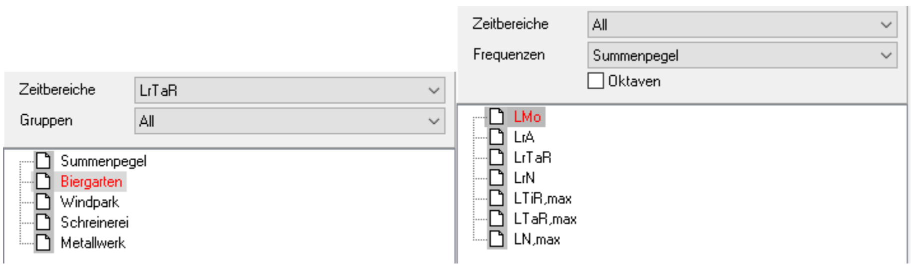
If you want to change the loaded data (time slice, result, or color scale) call the file selection manager again and click on the result file with the **right mouse button**. The result request will be opened.

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.

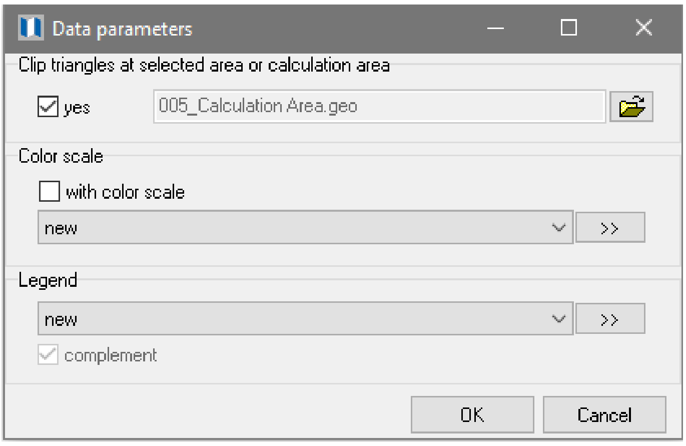
For Meshed Noise Maps calculated frequency by frequency, you can select an individual frequency or a frequency band in addition to the sum level. The detailed result tables must have been stored in the calculation run settings.

Via **FILE | RESULT ACTIONS** ***F8*** you can filter on individual groups or frequencies for results calculated with groups or with frequencies as well as load the results from the tree without detour via the file selection with drag & drop.

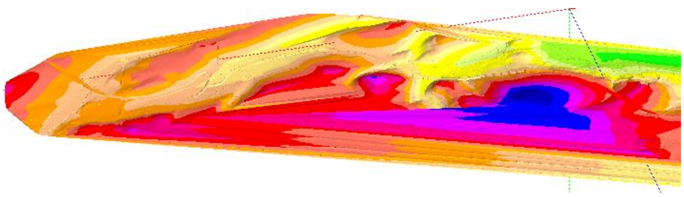


Load DGM with a colored scale

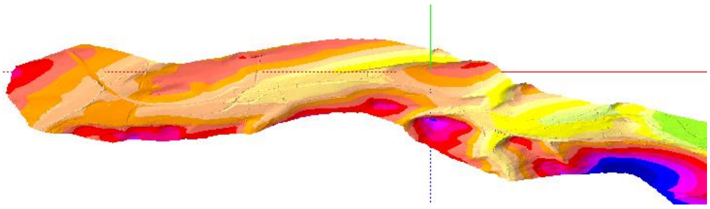
For DGMs with a colored scale, you can optionally clip triangles out of a selected area or calculation area, e.g. to filter border triangles that are very narrow and do not represent the geometry. Select a Geo-File containing the area.



Unfiltered:



Edge triangles filtered using a selected area:

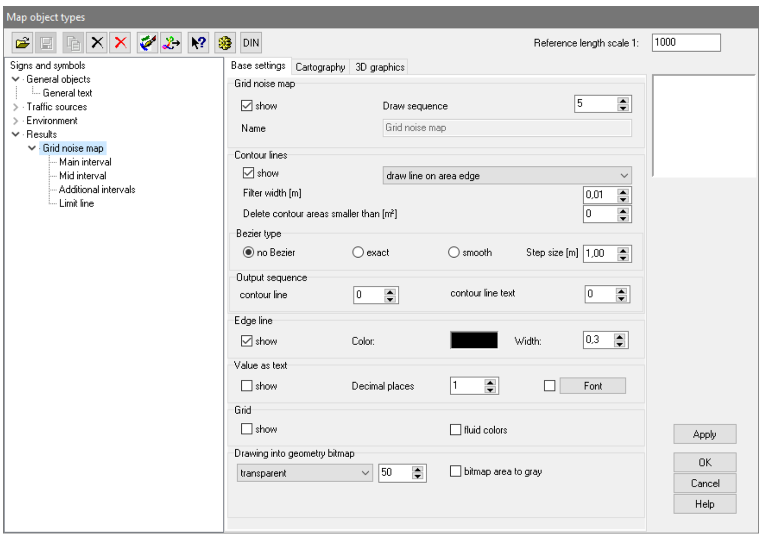


Difference grid maps

Difference maps and other arithmetic operations are created using the data type grid operations, see "File operations" (page 460).

Object types for area type results

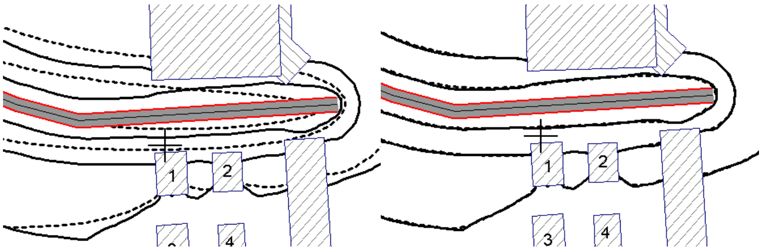
The layout of area type results can be customized using the settings found in the object type file. Each file type has a primary object type.



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 "Line definition" (page 422).

Filter width

The **FILTER WIDTH** defines the bandwidth where the contour points are interpolated, resulting in a smoothing of the contour lines.

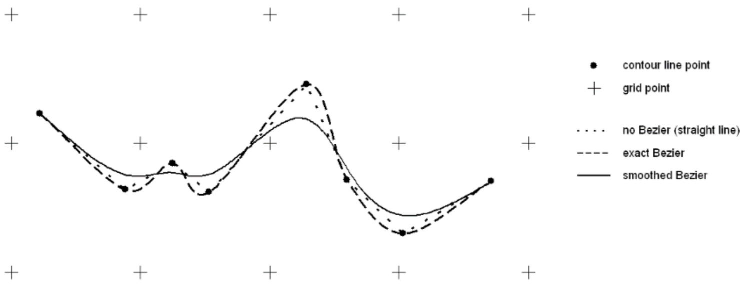


The comparison above shows that a filter bandwidth of 1 meter is not correct, while the result with a filter bandwidth of 0.1 meters is almost the same as the unfiltered contours. In order to not falsify the results, the filter width is limited to 1/10 of the grid size.

For the display of the noise contour lines it is possible to **DELETE CONTOUR AREAS SMALLER THAN X [M²]** in order to omit not relevant small color changes.

Bezier type

The **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.



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!

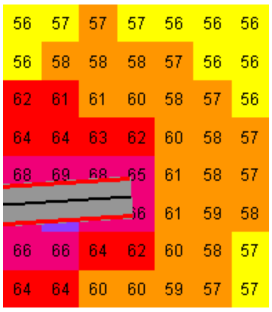
The **OUTPUT SEQUENCE** for contour lines can be set independently from the main object type. Additionally, the optional contour line texts can be set so they are always printed on top of all other objects. Forcing the contour line labels to be printed over the other objects means you do not have to reset the output sequence.

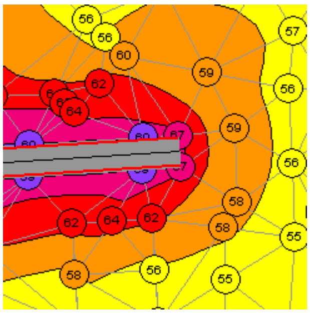
The **EDGE LINE** (border of the calculation area) is not a contour line, so you can choose if you want to display it and choose which line color and width it should have.

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**.

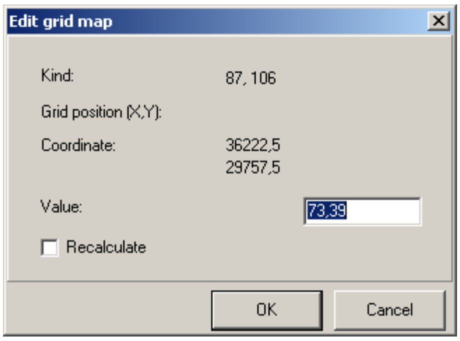
The values of the base grid/triangulation can be presented by marking **VALUES AS TEXT**. This is not a sensible presentation option, but it can be very helpful to check the model results. With the checkbox in front of the font, you can force the program to automatically fit the font size to the size of the grid cell.

10





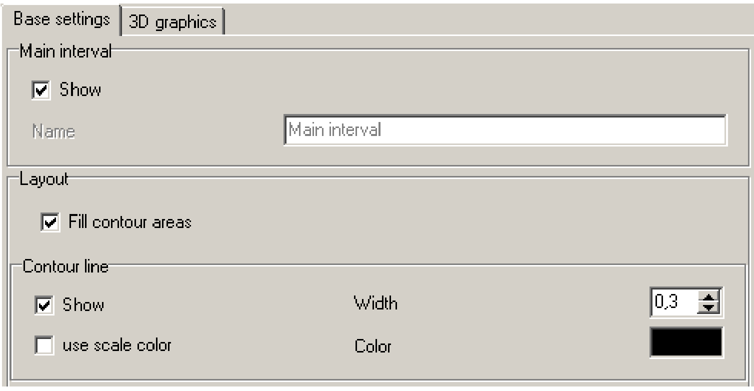
Edit Map includes an option to edit the grid values. Select **EDIT GRID VALUES** from the selection list.



The entered corrections will be lost with a new calculation or if the grid file is not stored.

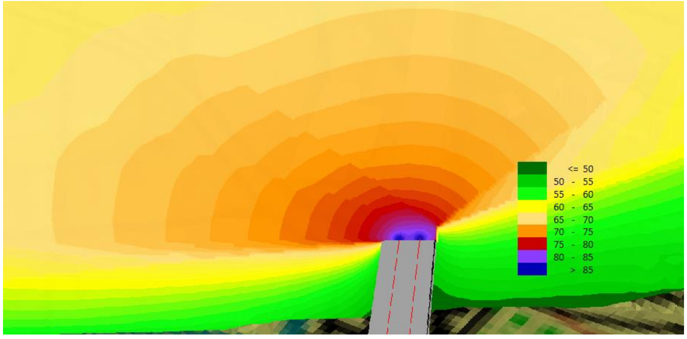
Definition of the intervals

Definition of intervals



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 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.



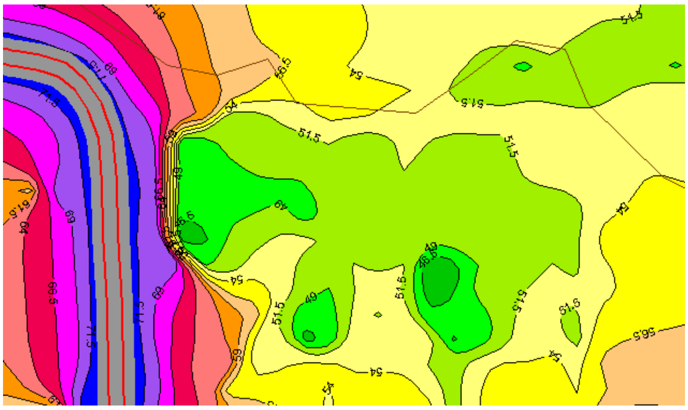
With extra intervals (example in 3D)

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 "Designing the scale" (page 403).

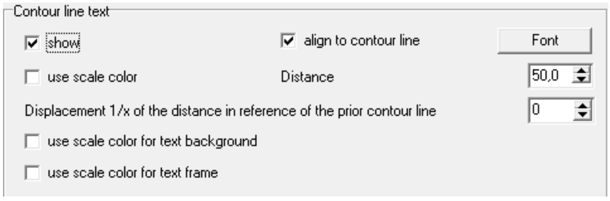
The settings for mean and additional intervals are used for the contour line export as the distance between the contour lines.

Label contour lines



Activate the labels for the contour values for area type results in the sub-object types.

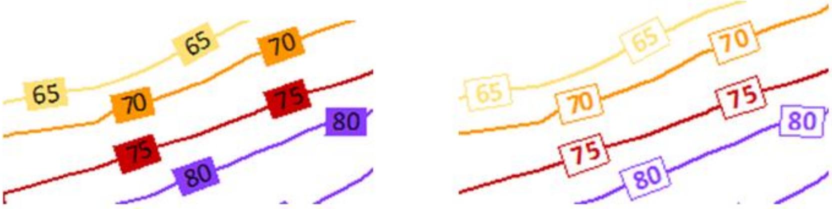
Activate the **SHOW** button and select the **DISTANCE** between the text labels.



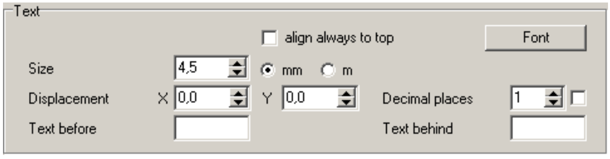
With the switch **ALIGN TO CONTOUR LINE** the text labels can be either aligned with the contour line or aligned with the sheet.

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.

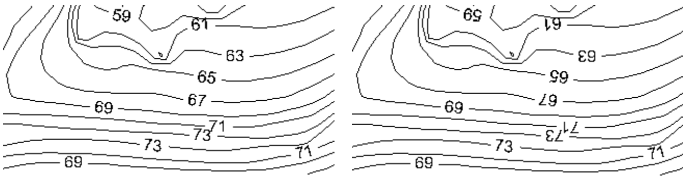
Optionally set the text background or text frame in scale color:



Under the *Cartography* tab, further customize the objects of the contour line text labels (contour line, text, text background).



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.

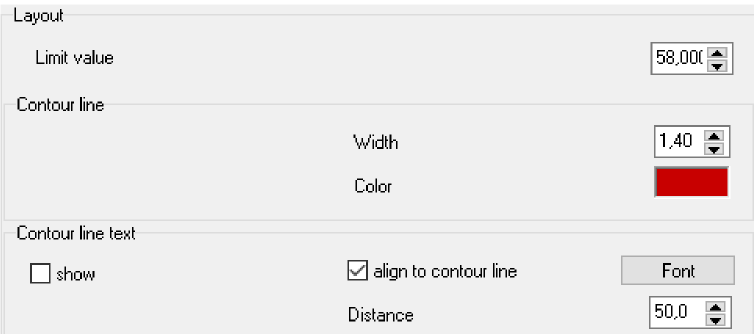
The texts are inserted horizontally and maintain the existing angle when moved. Use Ctrl + left mouse button to rotate the texts to a different angle.

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.

10

Limit 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.



Just as with the scale dependent contour lines, the noise limits can be assigned text labels indicating the dB value.

The Cartography module allows you to duplicate object types and sub-object-types creating multiple noise limit lines in the same map.

The limit lines can be exported in “Edit map” via **EDIT | EXPORT LIMIT LINES** "Contour line and grid value export" (page 439).

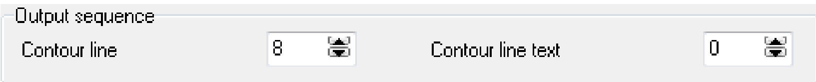
Draw Grid Maps and Meshed Noise Maps in geometry bitmap

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

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.



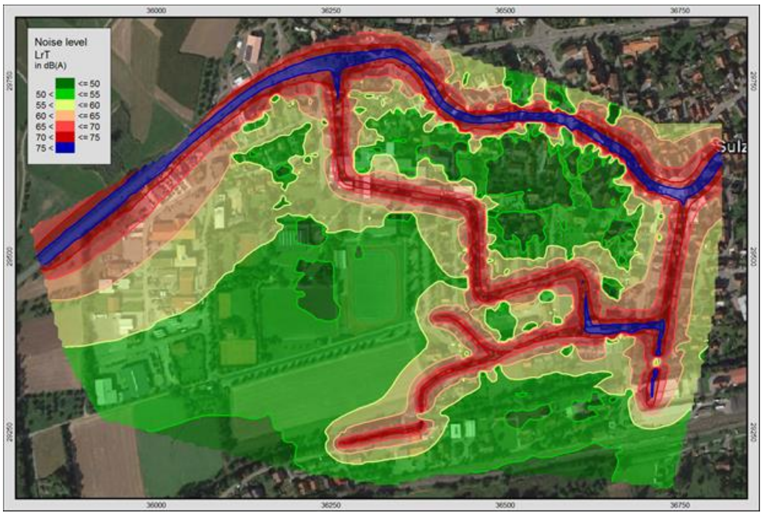
TRANSPARENT is a good option for full covering darker bitmaps such as aerial photography.

For **SHADED** the colors of the resulting noise map are presented darker than the original. **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).

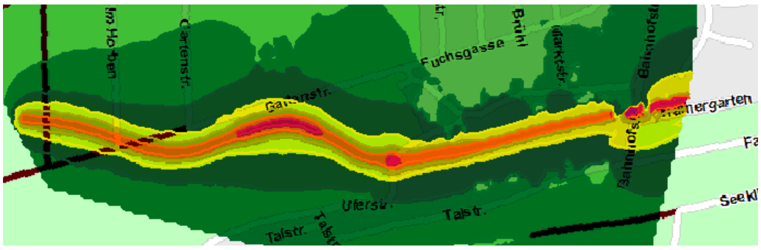
For both settings you can also select if the color component of the bitmap is to be used directly or first converted into a gray scale value.

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 reprocessing of the map.

If the result colors are too falsified, you can additionally **BRIGHTEN** the geometry bitmap in the object type "Geometry bitmap" (good for aerial photos) or increase the **CONTRAST** (recommended for symbolic maps). The draw type in the object type geometry bitmap must be set to **NORMAL**.



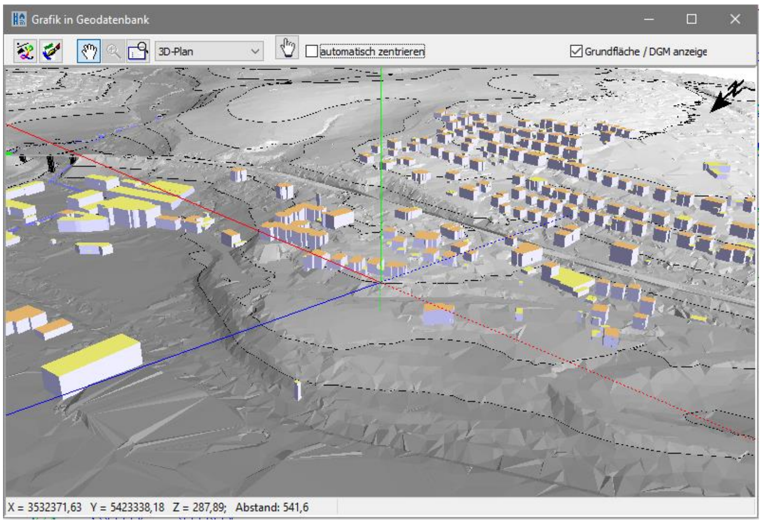
Transparent output of contour areas – contour lines are drawn with a higher output sequence



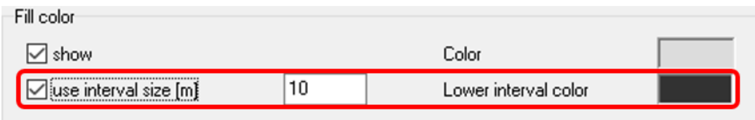
Shaded output of the contour areas

DGM with continuous color flow and 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.



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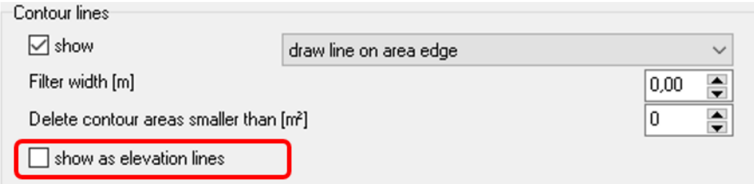
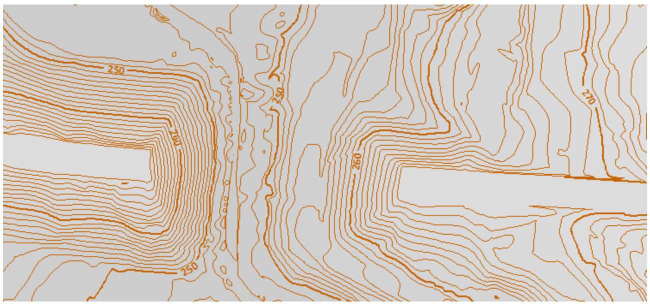
Check mark **USE INTERVAL SIZE** and define the interval size in meter. SoundPLAN calculates the number of intervals on the basis of the lowest and highest elevation and interpolates the colors.

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*.

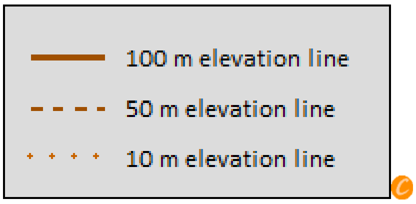


Define the step size in the sub object type „Additional intervals". The step size 10 displays an elevation line every 10 m in the layout of the contour line in the additional intervals. An elevation line in the layout of the contour line in the main interval is displayed all 10 times of the step size (here every 100 m). The contour line of the mid interval can also be displayed in a separate layout.



If the DGM is displayed as elevation lines in the Graphics, separate legend entries can be created for the main, mid and additional intervals.

If the DGM is displayed as elevation lines in the Graphics, separate legend entries can be created for the main, mid and additional intervals.

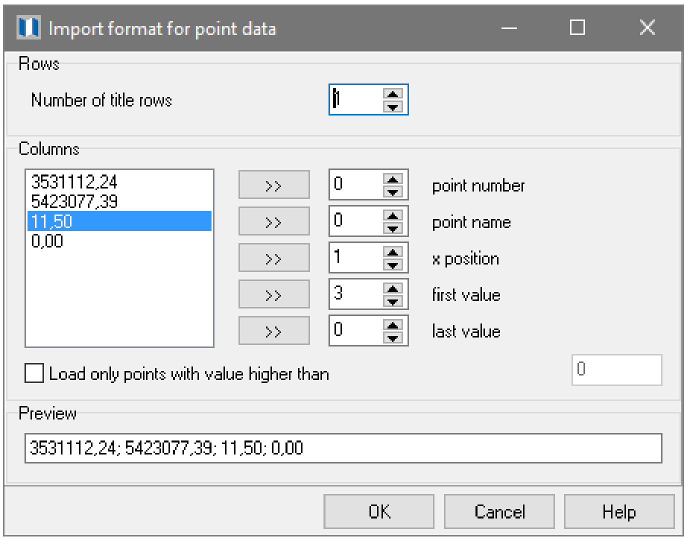


10

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:



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 (**position of the x-coordinate**), FIRST VALUE** and **LAST VALUE**. The y-coordinate must be in the column next to the x-coordinate.

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.

Contour line and grid value export

Grid values and/or contour lines in the area type presentation can be exported to various file formats:

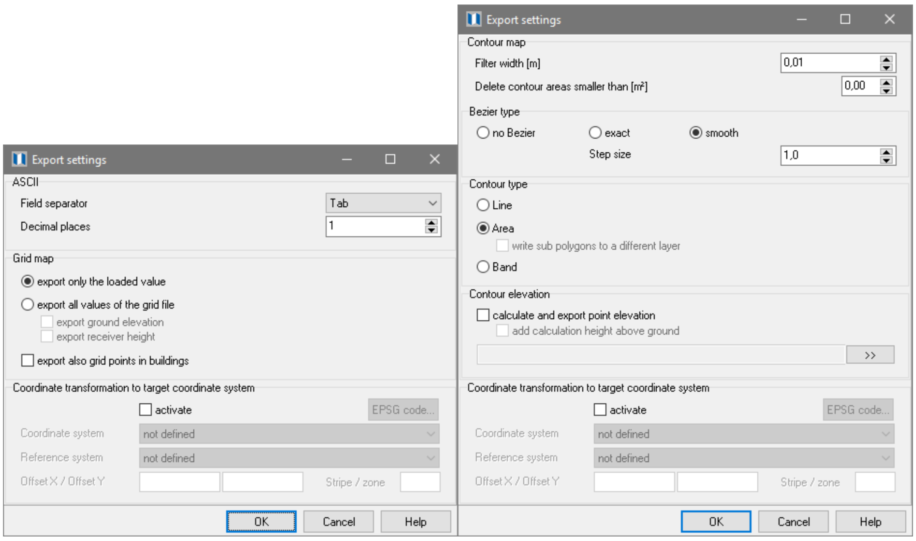
- ASCII (grid values and contours)
- DXF (grid values and contours)
- ESRI ArcView Shapefile (grid values and contours)
- CARD/1 (contours)
- Contour lines as kml
- SoundPLAN Geo-File – elevation lines / poly-lines (contours)

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.



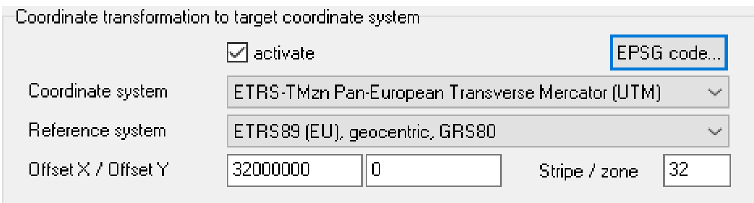
Example: Export settings in ASCII-export

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.

For contour line export Filter width (page 432) and Bezier type (page 432) are requested, since the two parameters 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.

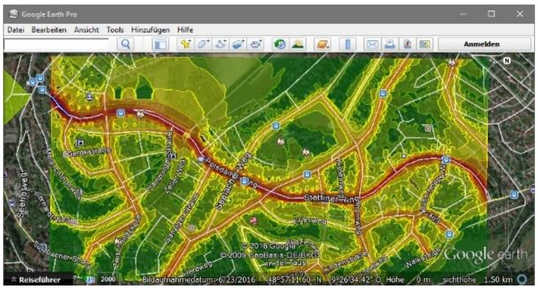
Contour lines can be exported as areas or individual lines. Exporting to SoundPLAN elevation lines or poly lines using the setting "area" is not sensible.

For the export of grids and contour lines you can transform the data into another coordinate / reference system, see "Coordinate and reference systems" (page 31).



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.

For the presentation of contour lines in a kml viewer only the contour type **BAND** is sensible.



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 (**I**ntermediate **T**IN **F**ormat) is an exchange format for DGMs, described in the internet.

Presentation of the Facade Noise Map

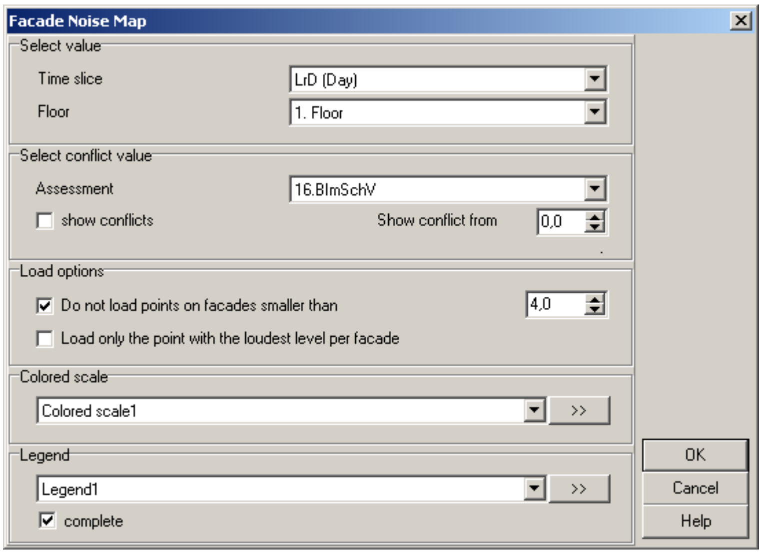
The following results can be presented as a Facade Noise Map with the Facade Noise Map license:

- Calculation type Facade Noise Map
- Calculation type Single Receivers
- Spreadsheet (receiver tables)

10

Results queries Facade Noise Map

After selecting one of the results, additional parameters are requested for display and layout:



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.

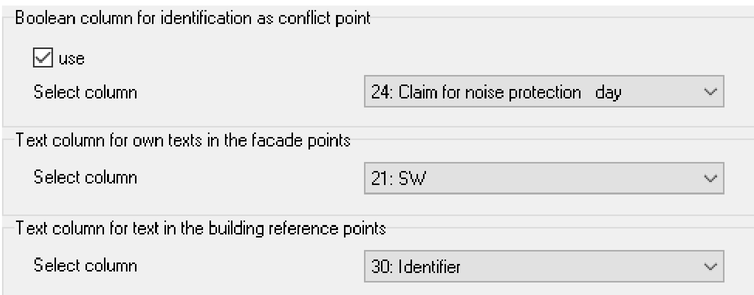
The noise assessment used in the calculation is needed in order to display receivers with conflicts (depending on the setting in the object-type Facade Noise Map) and for the conflict map of receivers with limits violations. In the field **CONFLICT FROM,** select the threshold noise level from which 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.

Click OK to return to the graphics screen.

Load Spreadsheet as Facade Noise Map



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

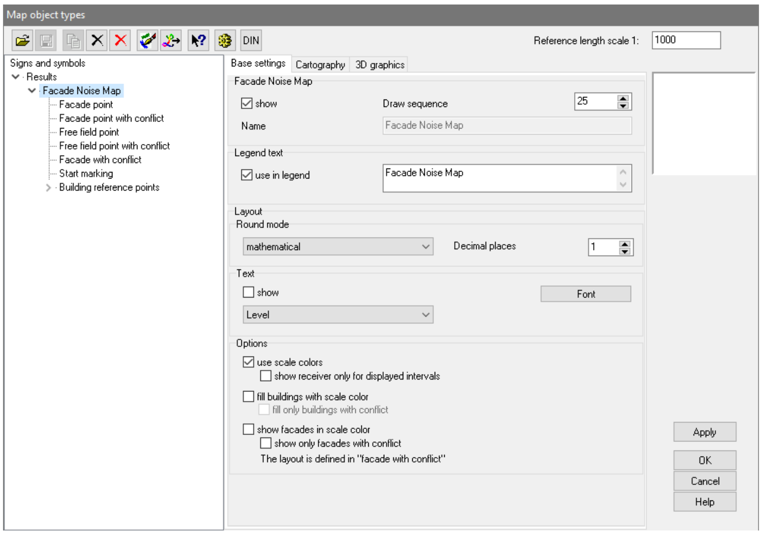
For Façade Noise Maps select from the selection list, whether you want to display the sum level or an individual group. For a Spreadsheet receiver table, select the appropriate column from the level column selection list.

Via **FILE | RESULT ACTIONS** ***F8*** all floors are displayed, for results calculated with groups also the individual groups. You can load the results without detour via the file selection with drag & drop from the tree.

Difference Facade Noise Maps

Difference maps and other arithmetic operations are created using the Facade Noise Map operations data type, see "File operations" (page 460).

Object type Facade Noise Map



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.

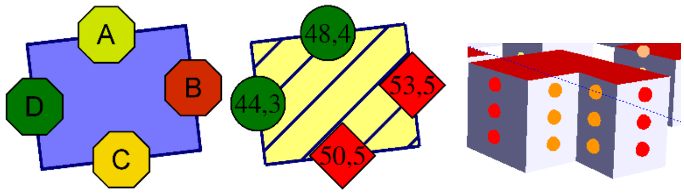
In addition to, or instead of the color coding, the values can be presented as a text for example to get a reference between spreadsheet and graphics:

- 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

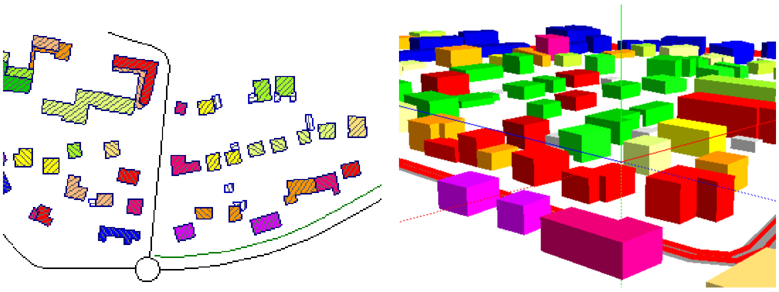
The following options are also available:

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.

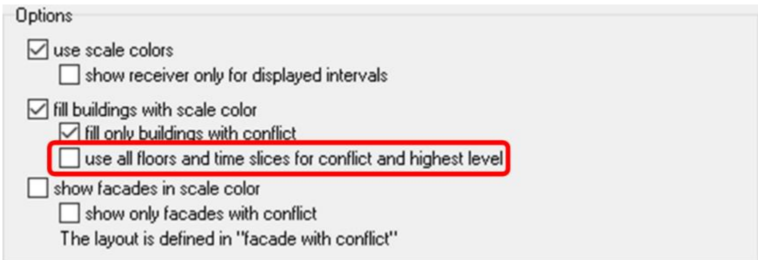


If you selected a “closed” scale type (the lowest interval is not used), you can prevent the receiver symbols below the lower end of the scale from being drawn.

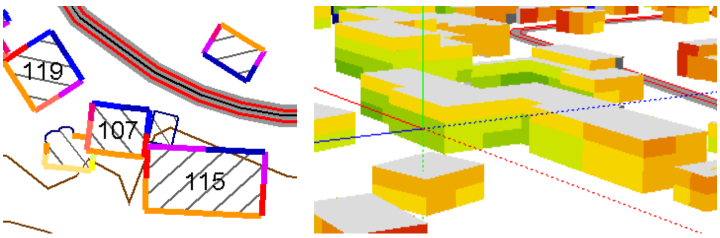
FILL BUILDINGS IN SCALE COLOR fills buildings with the color representing the highest noise level found on the facade of this building. This display variant is especially helpful for zoom factors where the individual façade points are no longer visible. In 3D-Graphics the buildings are also filled in 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.



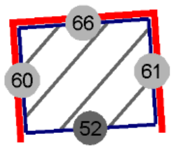
The layout of the color bars (width and distance from the facade) is determined by the sub-type "Facade with noise level exceeded." As there is a display conflict between the modes "Show facades with scale color" and "Show only facades with conflict," only one of the settings can be active at a time. 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 Reset building IDs **in the Calculation Kernel.**

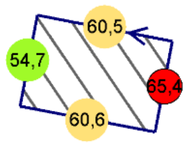
The receivers are separated into **FACADE POINTS, CONFLICT-FACADE POINTS, FREE FIELD POINTS** and **CONFLICT-FREE FIELD POINTS** so you can give the different receivers a different layout. In the sub object types for the facade and free field points you define:

- Show yes/no
- Symbol and symbol size
- Fill color, if not determined by the scale color
- Show border line and border color

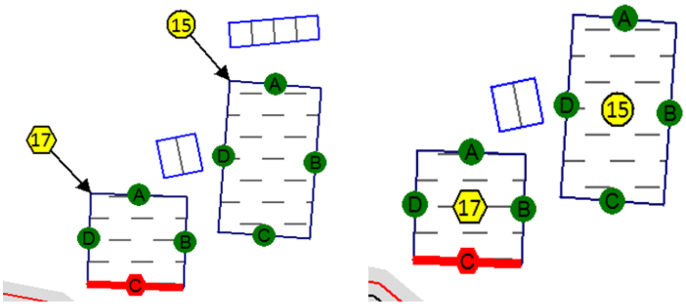
If you select **FACADE WITH CONFLICT**, all facades and floors with a conflict in the assigned time slot will be highlighted by a bar using your choice of color, line thickness and spacing. Under the Cartography tab, customize line joints and line endings. You can also extend the conflict facade to cover all floors and all time slots.



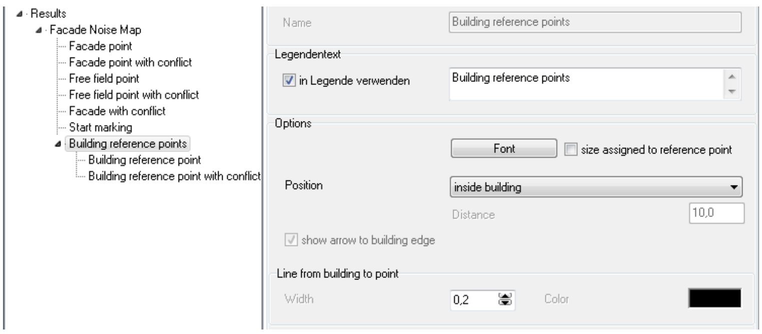
The sub-object type **START MARKER** (via a small arrow) shows the entry direction of the corners of the building and marks the first corner. This reference makes it easier to understand the tabular form of the grid noise map. The receiver names are generated sequentially in the data entry direction starting with the first receiver, “A.”



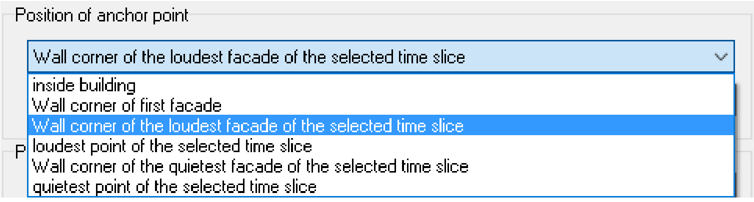
For the presentation you can present the object number of the processed building as a **building reference** in addition to the receiver points.



In the map object types of the Facade Noise Map activate the sub-object-type **BUILDING REFERENCE POINT**.



Select the position of the reference point:



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 reference point can be moved at will.

shall be positioned **IN THE BUILDING** or on a line **PERPENDICULAR TO THE FIRST FACADE** or **THE BISECTING LINE BETWEEN THE FIRST AD THE LAST FACADE**. For the last 2 options define the **DISTANCE** between the building reference point and the building corner and additionally the **LINE WIDTH**. 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.

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	Limit		Prognosis		Exceedance	
					Day	Night	Day	Night	Day	Night
	km				in dB(A)		in dB(A)		in dB(A)	
3	4	5	6	7	8	9	10	11	12	13
Obj.-No.: 42										
Jamaica Road 27										
A	0+769	N	EG	GR	59	49	65	55	6,0	5,6
B	0+768	W	EG	GR	59	49	67	57	7,7	7,1
C	0+772	S	EG	GR	59	49	53	43	-	-
D	0+773	O	EG	GR	59	49	53	44	-	-

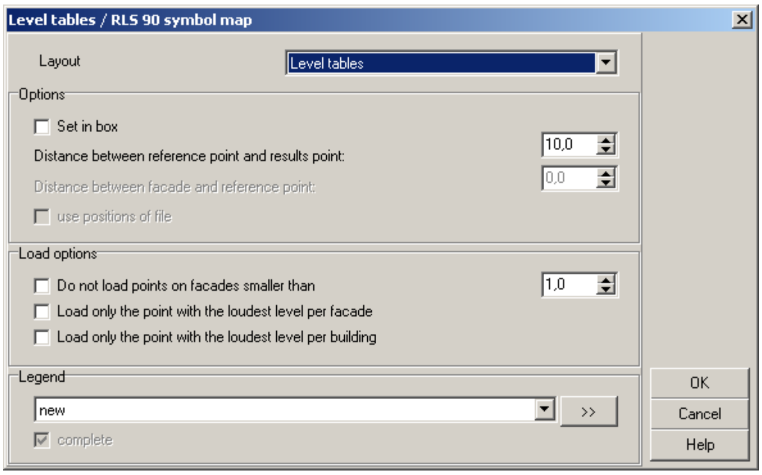
Representation as level tables, RLS-90 symbols, planning guideline Austria

The following calculation results can be displayed as level tables, RLS-90 symbols or Austrian planning guideline:

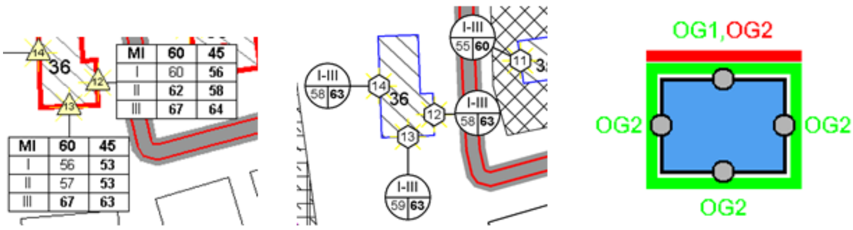
- Single point receivers
- Façade Noise Map
- Spreadsheet tables (receiver tables)

File selection of level tables / RLS-90 symbols

After selecting the calculation results, additional parameters are requested for layout and display details.



Select the layout from the layout list. The layout can be customized later in the object type level tables/RLS-90 symbols.

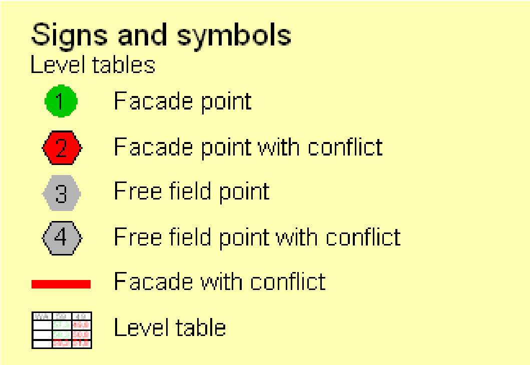


From left to right: Level tables, RLS-90 symbols, noise control measures Austria

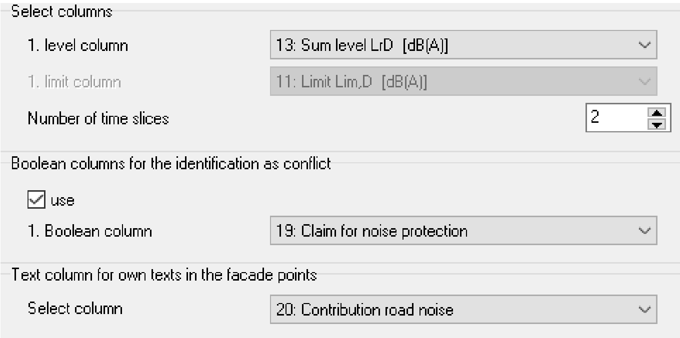
In the map, you can attach the level tables and the RLS-90 symbols directly to the façades, or they can be located in a result box where a reference point is placed at the façade or in a defined space in front of it. The result box is then detached from the façade.

To make the map more readable, use the **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 content ".

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.



Load spreadsheet as a level table/RLS-90 symbols



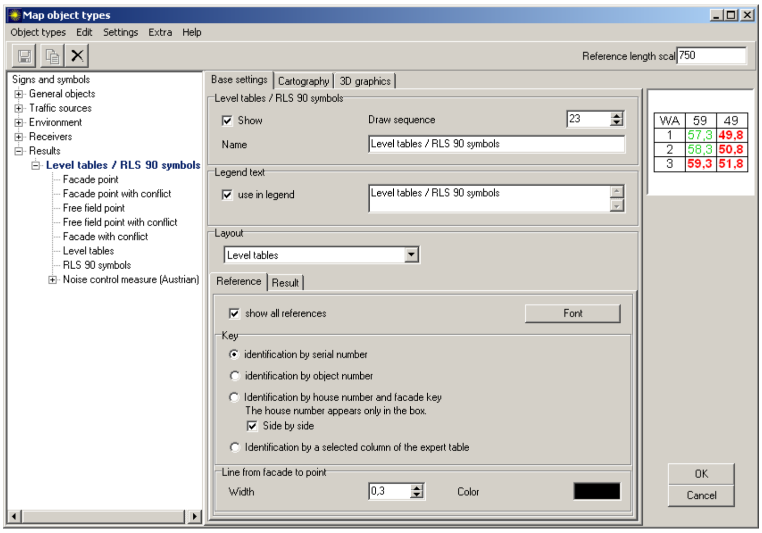
When you load a SoundPLAN spreadsheet as a level table/RLS-90 symbol, additional parameters are required. Enter the first level column and the first noise limit column. The spreadsheet can contain multiple sets of answers, so carefully choose the variant you want displayed.

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.

Object type Level tables/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 subtypes 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:

- 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

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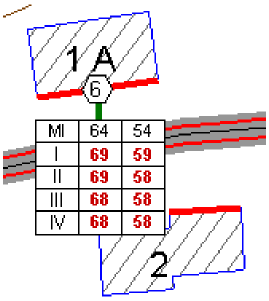
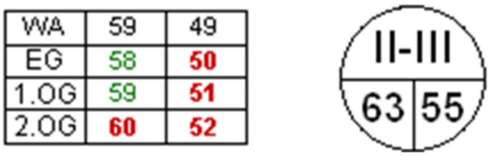
Use the sub-type **FACADES WITH CONFLICT** to highlight the facades with a special color when the noise level of the receiver exceeds the noise limit defined for that type receiver. Use the file type "façade noise map" to limit the façade marker to display only a single time slot and a single selected 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.

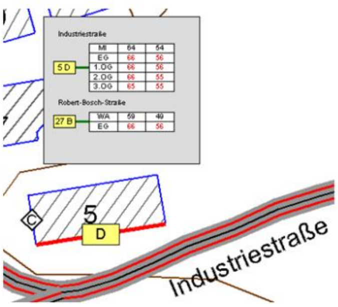


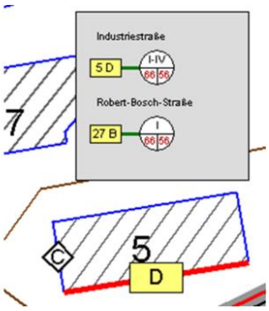
For RLS-90 symbols, the top unit shows which floor exceeds the limit, and the bottom units show the highest level at the receiver during the day and night. If the top unit is empty, no level violations were found at the receiver.

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.

Level tables / RLS-90 symbols in a result box






When loading the data, you can specify that the results are entered in a result box; only the reference point is then output at the facades. You can delete individual points that you do not want to display in the results box (double-click or right mouse button | Edit content) using the **DELETE LINE** icon.

The assignment between the reference point and the result in the result box is made using the key that you selected in the main object type. If you select "Identification via house number and facade identifier", the facade identifier is entered at the reference

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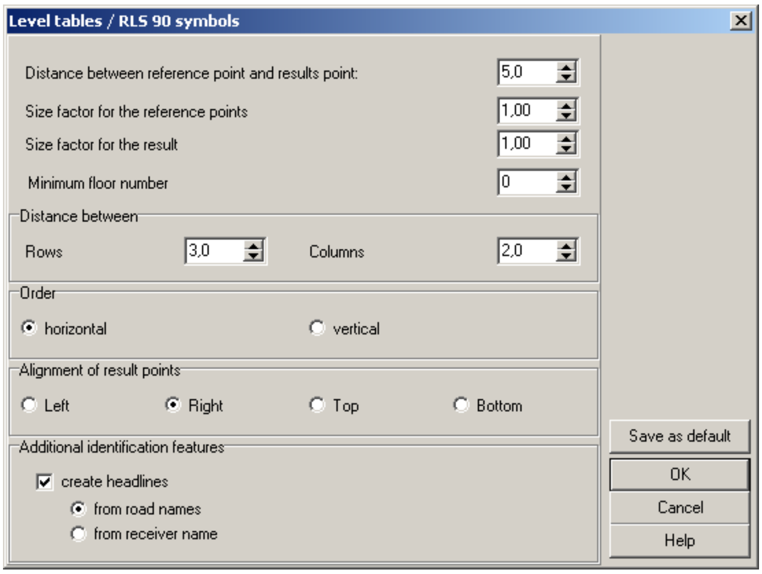
point and the house number and facade identifier are entered in the result box. The checkmark **NEXT TO EACH OTHER DETERMINES** whether the house number and facade identifier are entered below each other or next to each other in the reference point. Depending on the selection, you must adjust the symbol for the reference point in the cartography card (change the width to height ratio or select a different symbol).

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.



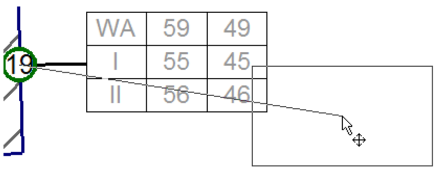
Headers generated from street or receiver names are always inserted in front of the first receiver for which the reference fits. The header lines structure the result box.

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 planning guideline for noise protection, the exceedances output refer to the night time range. For the display, an evaluation guideline with 2 time slices (Lden and Lnight) is expected, with SoundPLAN automatically selecting the second time slice.

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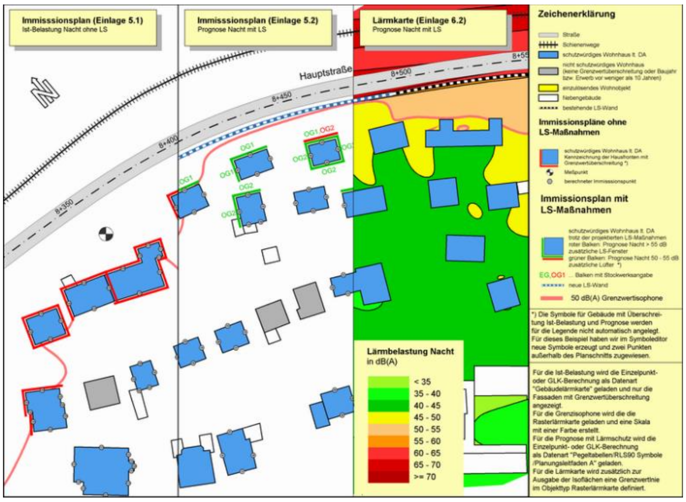
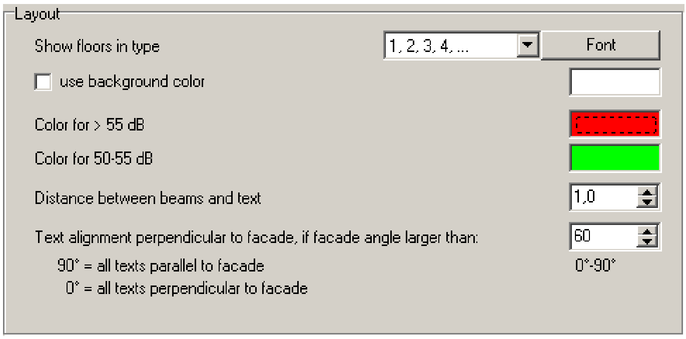


Load the status quo of the current situation (either as single receivers or as a Facade Noise Map) for the time slice LrN and have the program display only the facades currently exceeding the noise limit (map-object types | Façade Noise Map | activate facades with noise limit violation and select the 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".

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.

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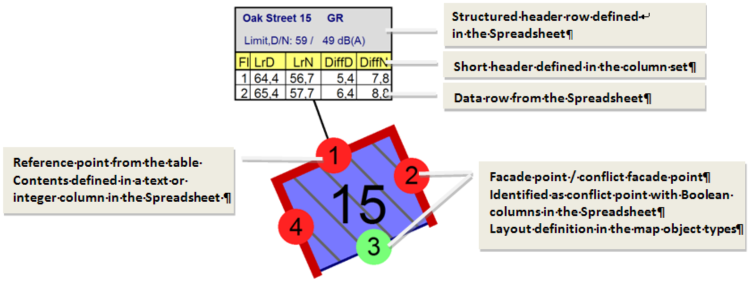
Display as receiver flags

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 number	Floor	Dir.	SA [m]	H I-A [m]	Level LrD [dB(A)]	Level LrN [dB(A)]	Exceedance day [dB(A)]	Exceedance night [dB(A)]	Display in Graphics	Conflict
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	X	X
1	2	NW	23,30	5,37	65,4	57,7	6,4	8,8	X	X
2	1	NO	27,66	2,17	60,0	52,3	1,1	3,4		X
2	2	NO	27.66	4.97	61.6	53.9	2.6	4.9		X
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	3,9		X
4	2	SW	29,98	5,65	61,2	53,5	2,2	4,5		X

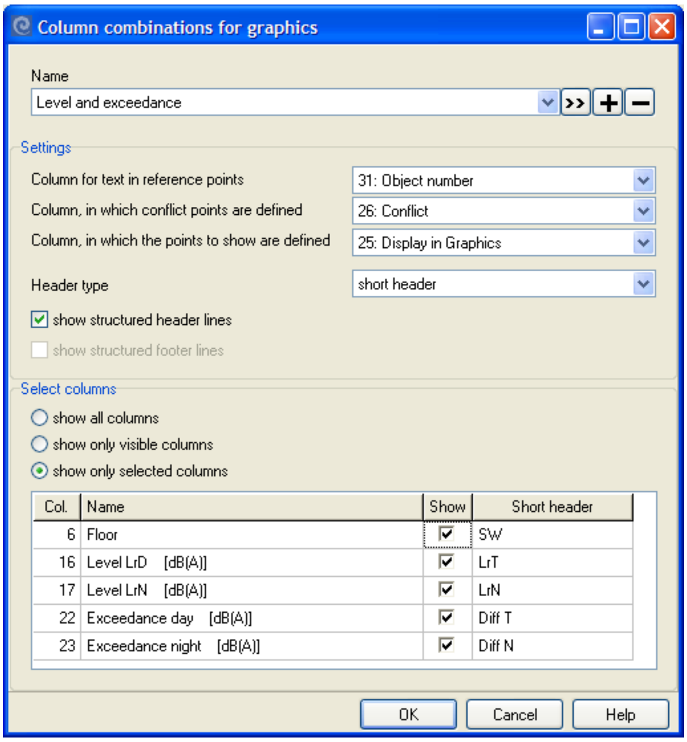


The receiver flags are connected with a reference line to the receiver point in the map. With Boolean (logical) columns generated in the spreadsheet you define which receiver points shall be represented with receiver flags and which points and facades shall be marked as conflicts (columns 25 and 26 in the table above). Apart from the any column you can also display structured rows you have defined in the spreadsheet.

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.

Column combinations and data 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.



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

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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).

31	24	12	28	29	16	17	22	23	25	26
Object number	Floor	Dir.	SA [m]	H I-A [m]	Level LrD [dB(A)]	Level LrN [dB(A)]	Exceedance day [dB(A)]	Exceedance night [dB(A)]	Display in Graphics	Conflict
Oak Street 13 GR Limit,D/N: 59 / 49 dB(A)										
26	1	N	37,38	1,98	55,8	46,2	-	-	X	
26	2	N	37,38	4,78	58,7	49,0	-	-	X	
26	1	O	42,34	1,66	57,8	47,6	-	-		
26	2	O	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 GR Limit,D/N: 59 / 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	X	X
2	1	O	38.13	2.00	54.4	44.6	-	-		
2	2	O	38,13	4,80	55,4	45,6	-	-		
2	3	O	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		X
2	3	W	36.27	7.99	59.9	50.4	0.9	1.4		X

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.

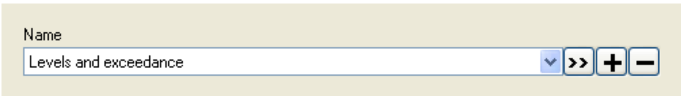
Choose the **HEADER TYPE** for the column combination. You can select to use the column headers from the SoundPLAN Spreadsheet or define your own short title.

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.

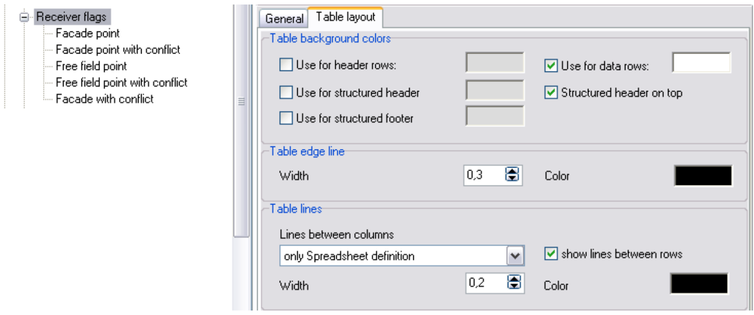
Is there a column missing, you want to display? Then switch to **SHOW ALL COLUMNS**. **SHOW ONLY SELECTED COLUMNS** gives you a better overview if there are columns already selected.

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!



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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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.

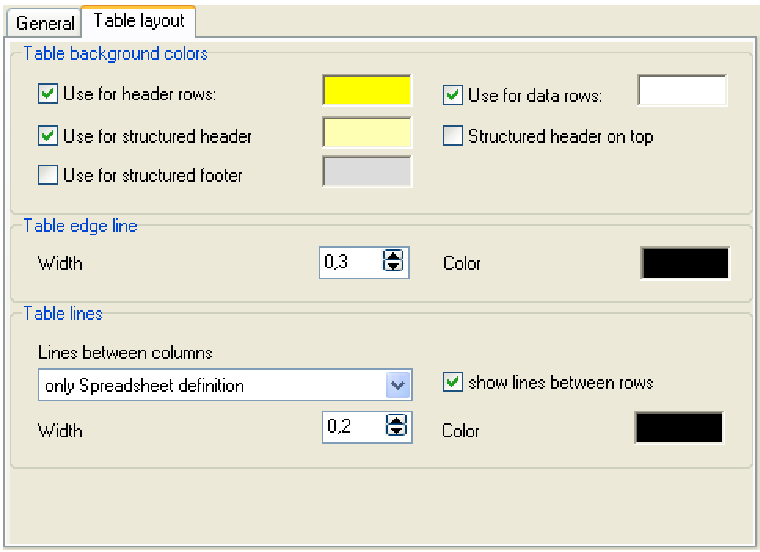
Name	Fl.	L w/o NP, D/N		L w NP, D/N	
Oak Street 34	1	59	56	49	45
	2	59	55	52	49
	3	60	56	55	53

Name	Fl.	L w/o NP, D/N		L w NP, D/N	
Oak Street 34	3	60	56	55	53

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.



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.

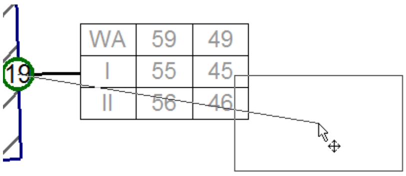
Often the lines between the time slice columns are switched off in the Spreadsheet. Therefore, you can define the **TABLE LINES** in the object types. You can select, whether you want to keep the settings from the Spreadsheet (then only lines between rows can be additionally displayed), display lines 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 receiver flags

Individual tables can be moved under "Edit map content". 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.

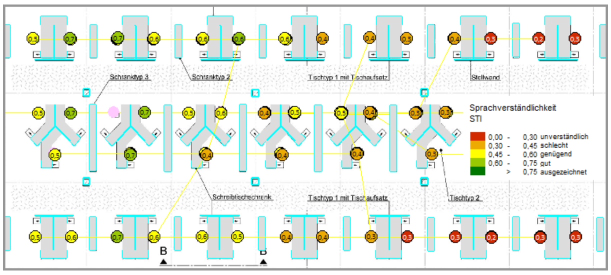


SoundPLAN remembers the position you have moved results to. When you load another result file into your plan, you can force the program to use the same position as was used in the result file xxx. First select the spreadsheet to be loaded (the original table must be still part of the plan), then mark the **USE THE POSITION FROM FILE xxx** and then take the original table out of the plan.

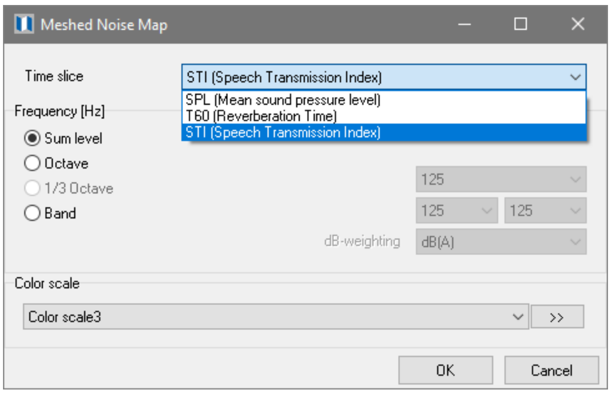
The anchor position of the line connecting the facade receivers to the receiver flags will not be moved if you press the ***Ctrl*** key when moving the table.

Receiver display for indoor calculations

The receivers (interior single point calculation) can be displayed in the Graphics and colored via a scale.



Result request for receiver display



Select which of the calculated room acoustic parameters should be displayed. Since the results were calculated in octaves, you can also select a single octave or a specific octave band.

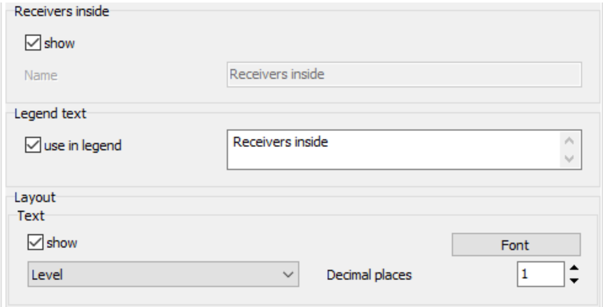
You can use the double arrow to edit a new color scale or one contained in the template right at this point, or you can accept the default setting and edit the scale later with "Edit content" via the right mouse button or double-click.

Click OK to confirm the parameters, click OK again to exit the file selection.

Object type receiver representation

The values or levels, the sequence number or the object number of the output as text.

You control these settings and the appearance of the receivers via the "Receiver inside" object type in the "Results" node.



Display 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:

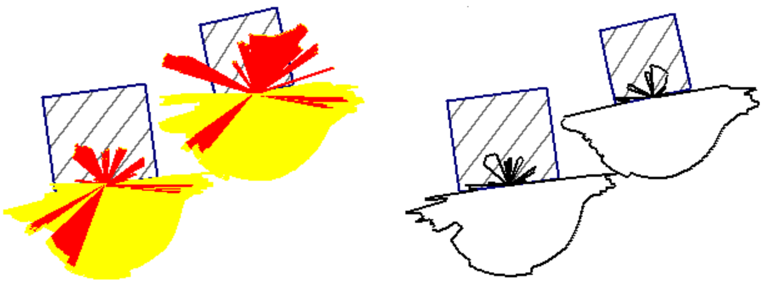
- Single receivers
- Façade Noise Maps

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.

Result request level chart

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.

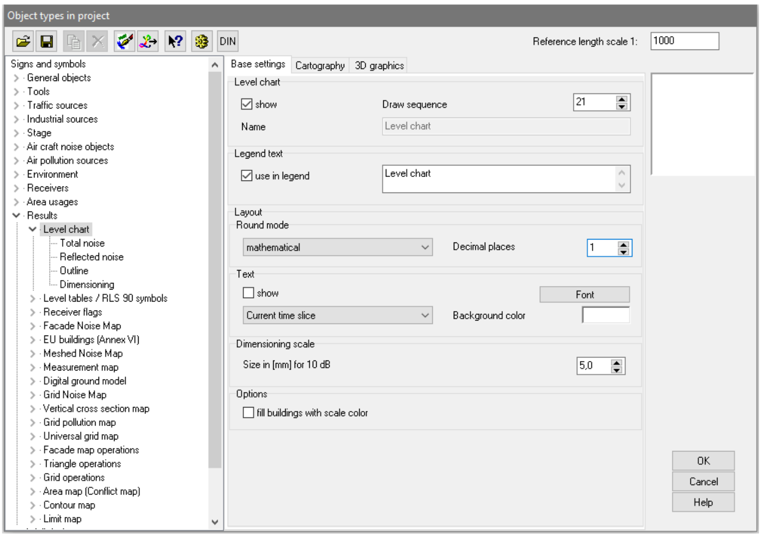
Level charts can be presented as a ray diagram or as a circumference line.



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 a outline.

10

Object type level chart



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.

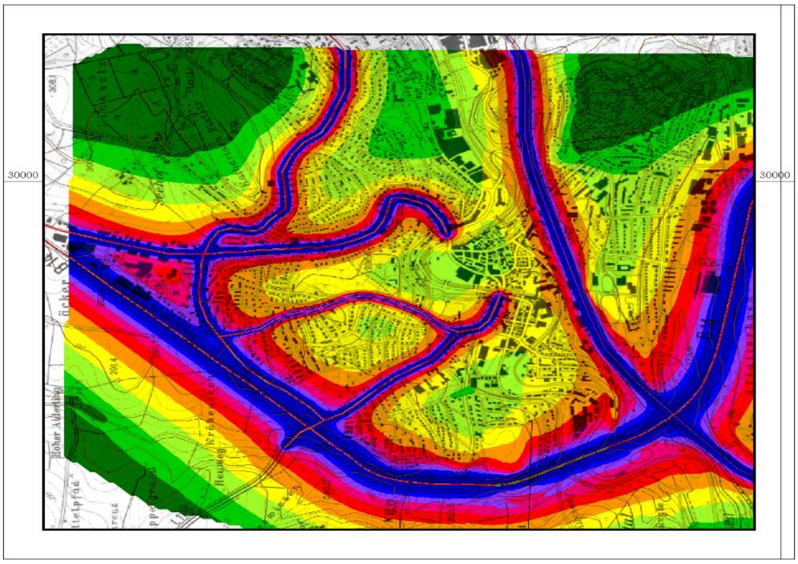
The size of the level charts is defined by the parameter **SIZE IN [MM] FOR 10 DB**.

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 in the Geo-Database are shown. 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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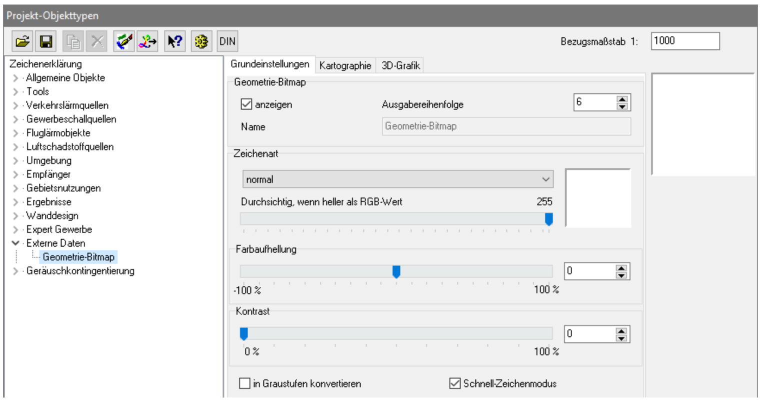
Object type geometry bitmap

The output options for geometry *bitmaps* are in the object type file in the *External Data,* Geometry *Bitmap* branch.



You can choose between the character types **NORMAL** and **ADDITIVE.**

With **NORMAL**, a bitmap is output in its entirety - objects that were already drawn due to their output sequence are painted over by the bitmap. If you output geometry bitmaps together with areal results, using this draw mode you can have them included in the bitmap in the object type Grid map or Meshed noise map, see "Draw Grid Maps and Meshed Noise Maps in geometry bitmap" (page 436).

With **ADDITIVE**, the colors of existing objects are mixed with those of the bitmap. This can lead to not desired color combinations, even with grayscale bitmaps. Therefore, **ADDITIVE** is only suitable for black and white bitmaps or when bitmaps are rotated, see "Rotated bitmaps" (page 459). A black bitmap pixel overlaps, a white pixel leaves the existing pixel.

Rotated bitmaps

Windows can only manage rectangular bitmaps aligned to the x-axis. Depending on the rotation angle, a correspondingly larger target bitmap is created, into which the rotated original bitmap is included. The empty areas at the sides are filled with white. If now several geo bitmaps lying next to each other are rotated, these corners cover the bitmaps already output before in the normal mode. In such cases, **ADDITIVE** must be used.

Contrast, Lighten, Grayscale

If the result colors are falsified too much during output together with areal result data, you can also make the geometry bitmap **BRIGHTER** (good for aerial photos) or increase the **CONTRAST** (recommended for symbolic maps).

Additionally, you can also have the geometry bitmap output in **GRAY COLORS** here.

Fast drawing mode

In the object types, you can set a “fast drawing mode” (default) 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.

Save sections 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 | SAVE GEOMETRY BITMAPS** 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.

File operations

10

Some of the calculation results can be used for calculation operations on a file basis, e.g. to generate a difference map or to add a value. Depending on the basic data, 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

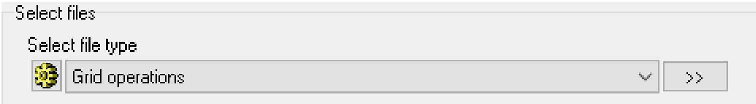
Select from the following options:

- 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

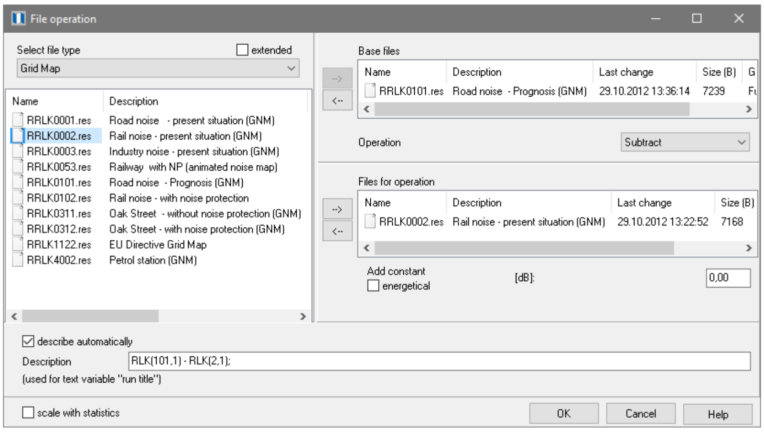
In addition, you can add a constant or a base noise level to a map.

Procedure for the file operations

In the file selection, select the file type according to the basic data and open the file operations with the double arrow.



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.

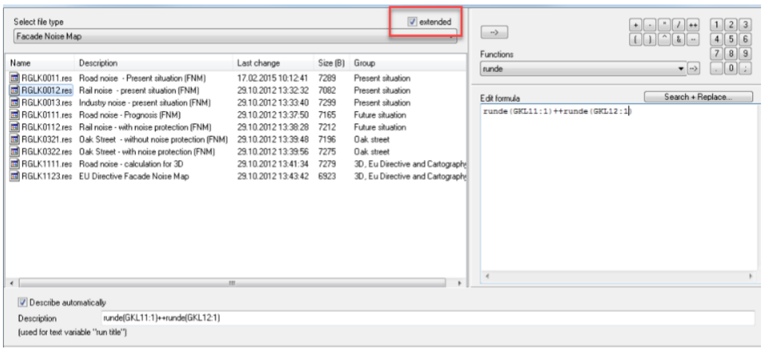


Internally, SoundPLAN generates a formula similar to the ones used in the SoundPLAN spreadsheet. The formula is stored with the drawing and will re-execute loading the data. By default, the **DESCRIPTION** field displays the created formula. Clear **DESCRIBE AUTOMATICALLY** if you want to enter descriptive text instead of the formula. The description field can be output as a text variable "Calculation run title” in the map.

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 slice, for example, right click on the base file and the operations file.

File operations can also be calculated in the calculation kernel as a calculation run, for example to save several time slices in one file operation or to reduce the loading times in the graphics for larger calculations. See "File operations as calculation run " (page 267).

Extended formula entry



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, see “Calculating using formulas” (page 326)

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 **&**.

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
- 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 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

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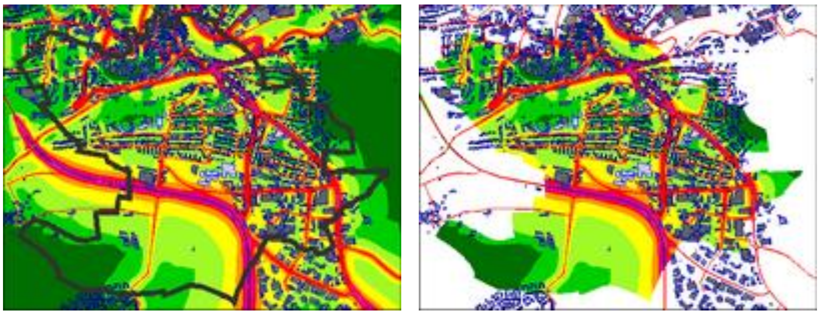
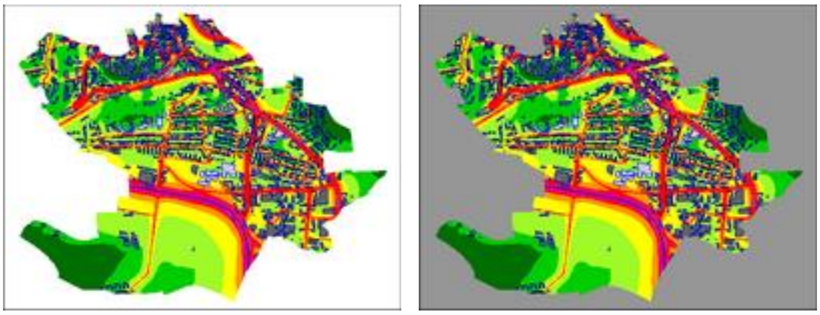
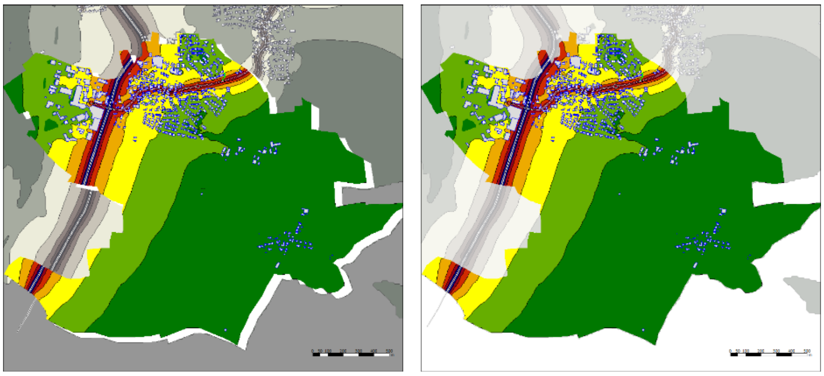
The calculation area has been amended with a new Cartography attribute to highlight the calculation area.



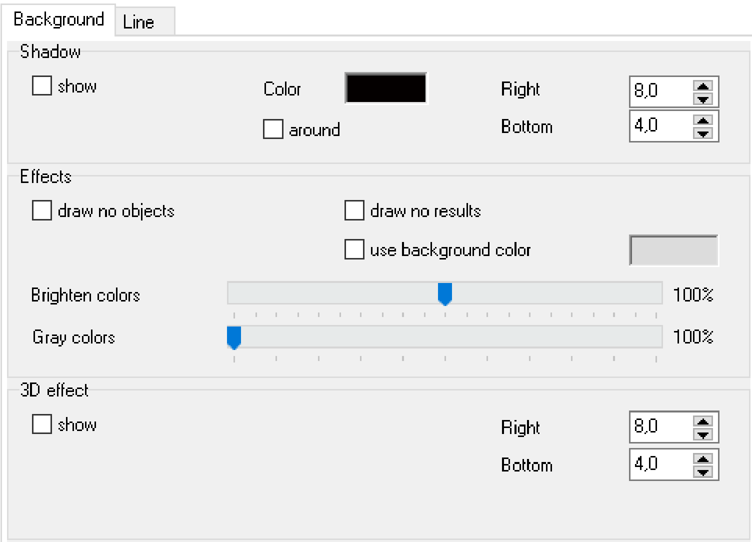
Left picture: no effect (with area border), right picture: do not display results



Left picture: Do not display objects, right picture: additionally with background color



Left picture: Results outside the calculation area with brightened gray values, 3D effect and background color, right picture without background color



You have multiple options of highlighting the calculation area:

- 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.

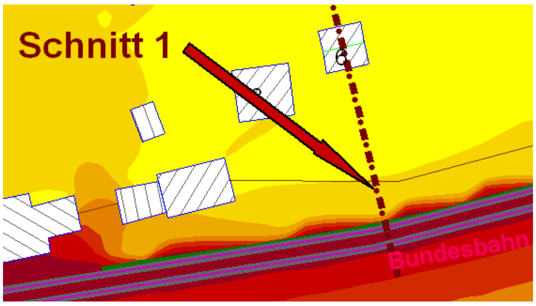
Just experiment what option you like best!

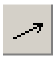
When the area outside the calculation area / area is not to be displayed, the area within the section rectangle between the calculation area and the frame is filled with white or another background color.

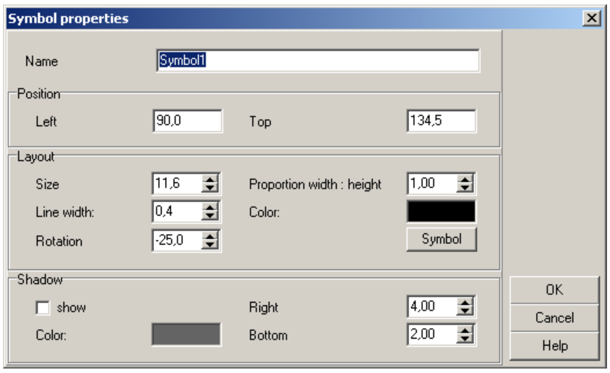
When masking with color intensity settings or converting into gray scales, first the entire plan is plotted. After this a windows function defines the entire „clipping area“. For screen and bitmap output this procedure is working well but most printer drivers cannot cope with this procedure. Additionally, print files and PDF files are becoming so big that it is advisable to first generate a bitmap when working with masking.

Highlighting with symbols

Use the element "Symbol" to 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 "Connection lines" (page396)!




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.

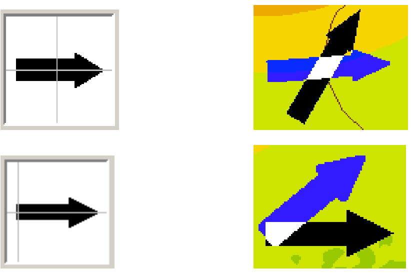


Move symbol, rotate and zoom

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:



SoundPLAN Symbols

Administration of symbols

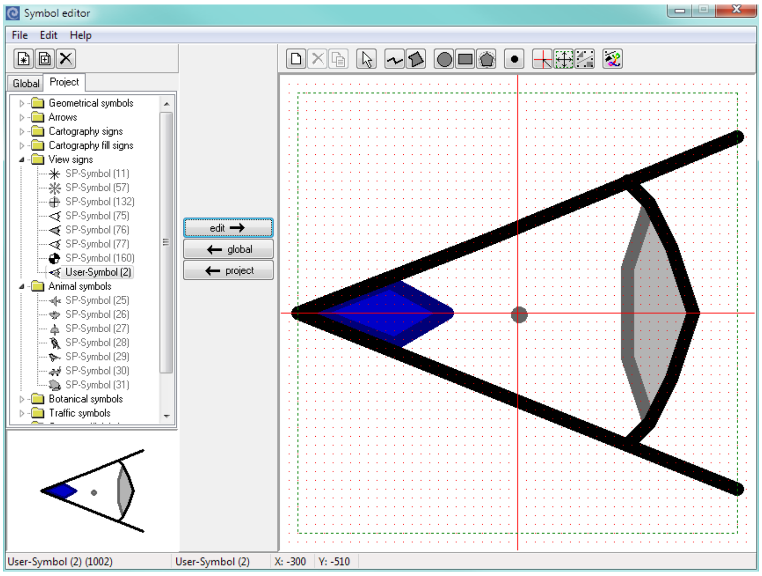
SoundPLAN is delivered with a small symbol library named „Symbols.sym“. The file is installed in the system folder and will remain there for future extension of the symbol library.

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.

The symbol editor

Open the symbol editor from the **OBJECT TYPES** via **EXTRA | SYMBOL EDITOR**.



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.

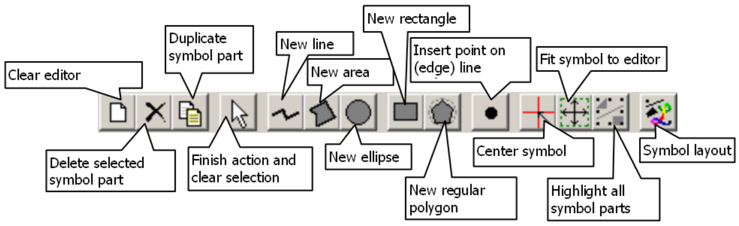
To the right of the symbol tree is the symbol editor. Between the symbol tree and the symbol editor you see three buttons. The upmost button moves the symbol from the symbol tree to the symbol editor. The two lower buttons move the symbol in the symbol editor to the currently active location of the symbol 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.

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.



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.

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.

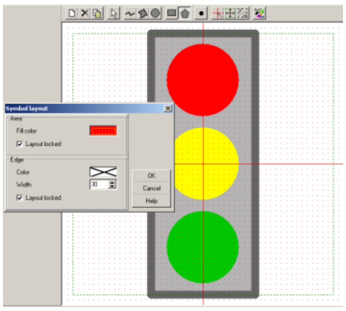
With the move mode active, symbol parts can be rotated around the center if you keep the ***Ctrl***-key pressed or enlarged / downsized if you keep the ***Shift***-key pressed.

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.



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:

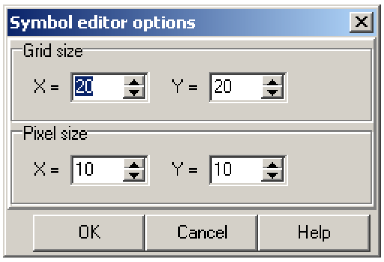
The symbol consists of a rectangle with 3 circles of different colors. The circles are assigned the colors red, yellow and green. The frame is disabled. Both are marked with the setting „Layout fix“. For the rectangle, the default settings were left intact, i. e. the border is dark gray and the fill 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.

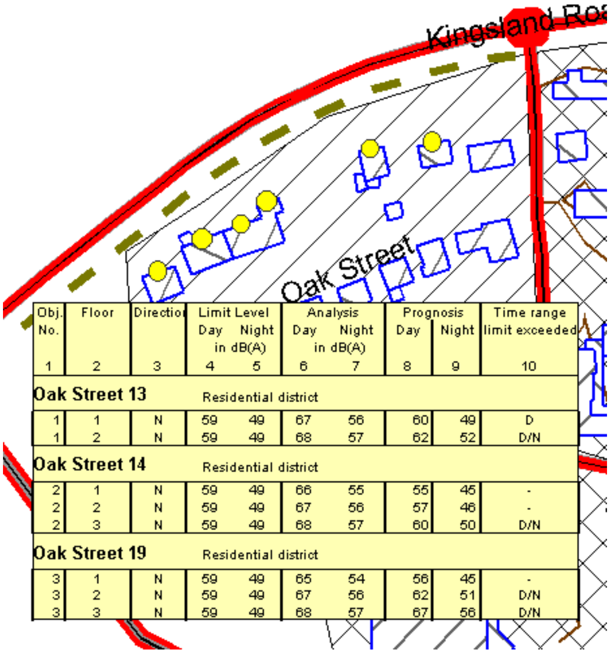
For a point type object type consisting only of a symbol, the (0/0) coordinate is located at the exact location of the world coordinate assigned to the object in the GeoDatabase.

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.



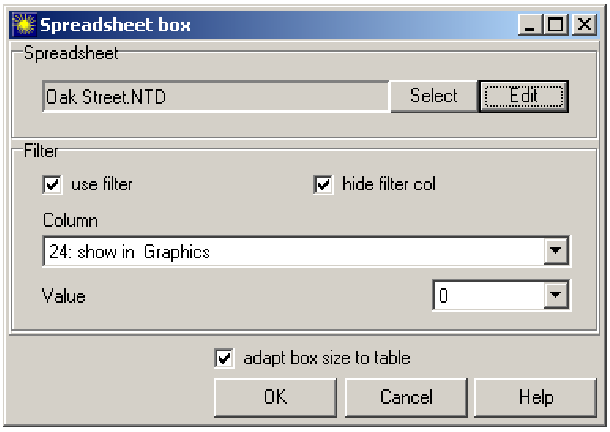
Spreadsheets in the graphics

Spreadsheets and parts of spreadsheets can be presented in a table box.



Obj. No.	Floor	Directio	Limit Level Day	Night in dB(A)	Analysis Day	Night in dB(A)	Prognosis Day	Night	Time range limit exceeded
1	2	3	4	5	6	7	8	9	10
Oak Street 13			Residential district						
1	1	N	59	49	67	56	60	49	D
1	2	N	59	49	68	57	62	52	D/N
Oak Street 14			Residential district						
2	1	N	59	49	66	55	55	45	-
2	2	N	59	49	67	56	57	46	-
2	3	N	59	49	68	57	60	50	D/N
Oak Street 19			Residential district						
3	1	N	59	49	65	54	56	45	-
3	2	N	59	49	67	56	62	51	D/N
3	3	N	59	49	68	57	67	56	D/N


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).



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.

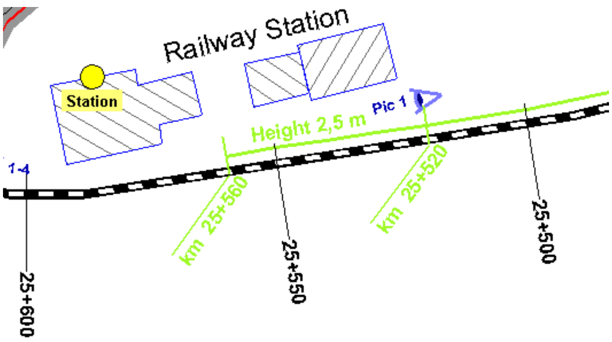
10

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 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.

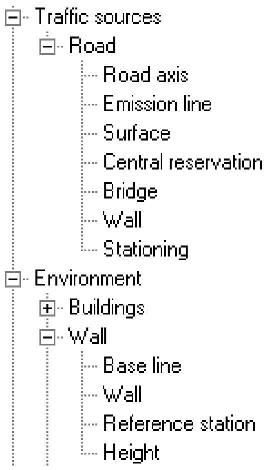
Display properties as text



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:

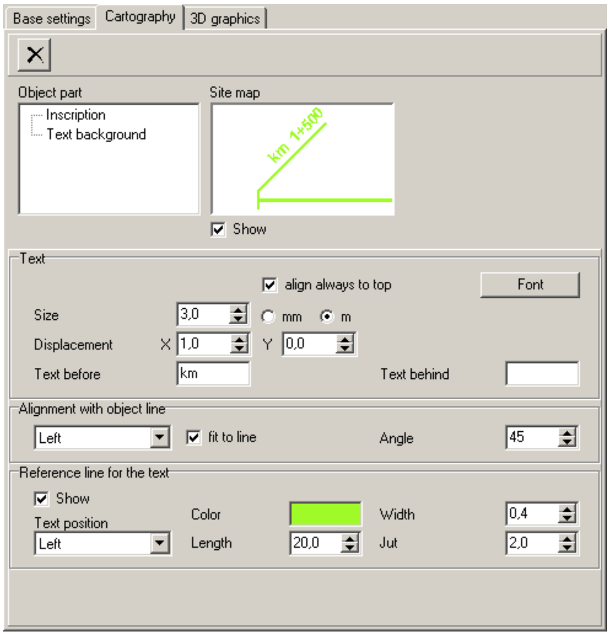
- Receiver names and numbers
- Number and name of point, line and area sources as well as parking lots and wind turbines
- Number and name of sources of an industrial building
- Number and name of receivers in an industrial building
- Road and railway kilometer marks if the road or railway line is defined 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
- 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.



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.



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.

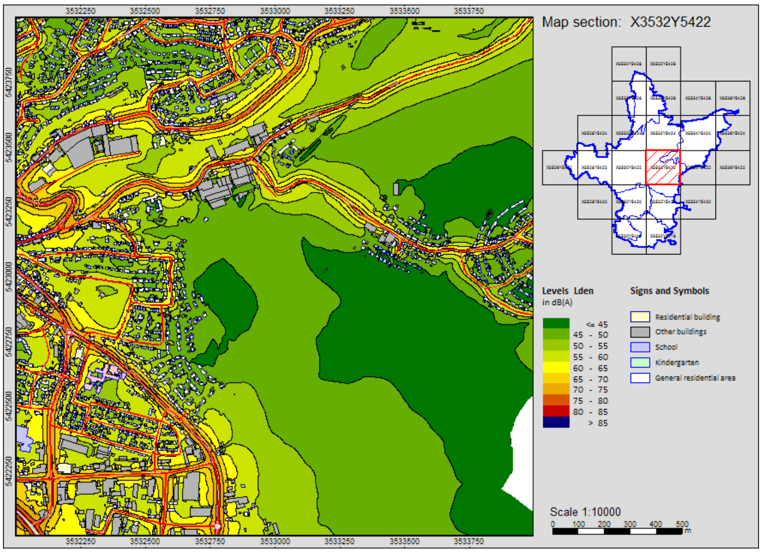
Hint: Movements of texts cannot be transferred to other situations even if they contain the same geo-files (and thus the same texts).

10

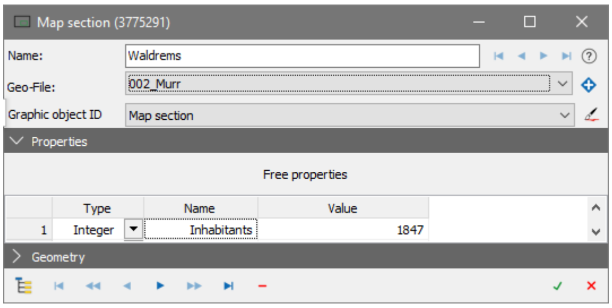
Map sections, overview map and sheet tools

Generate map sections

Map sections are very helpful if you want to present multiple sheets with the same content but varying sections (viewports).



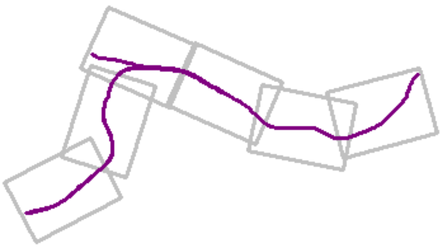
You can generate the map sections manually from the Geo-Database or automated directly from the Graphics. Map sections are always rectangles. In the Graphics you can process the map viewport in Edit Map. For licenses without the Cartography module the map section is saved as a general area and the sheet name as a geometry text. When the Cartography module is present the section is saved as a object type map section and the sheet name as property “name”.



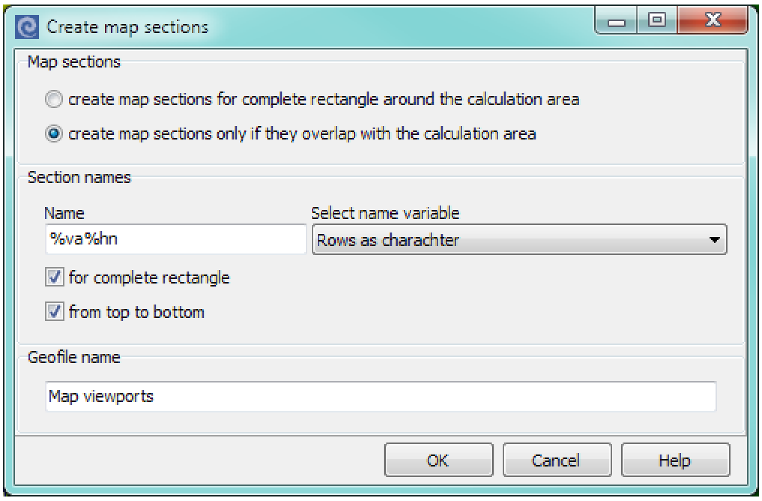
To generate the map sections in the Graphics, you need a “template sheet” with a plan which has the desired size and scale.

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-File.



[Module Tools NMP] 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.



You can decide to generate map sections covering a rectangle around the calculation area 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 x 210 mm.

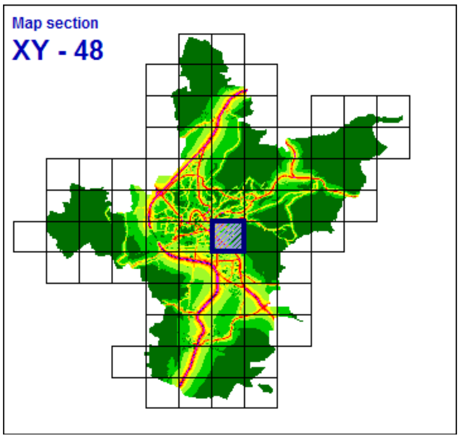
You can format the section name for example to insert an additional identifier or a separator between the variables for example to display the default section name X3530Y5422 as X3530/Y5422.

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.

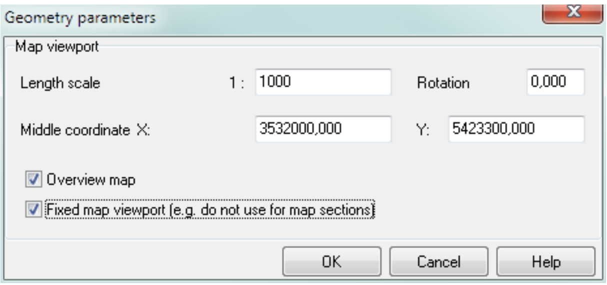
10

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.**



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.

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 Attribute 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.

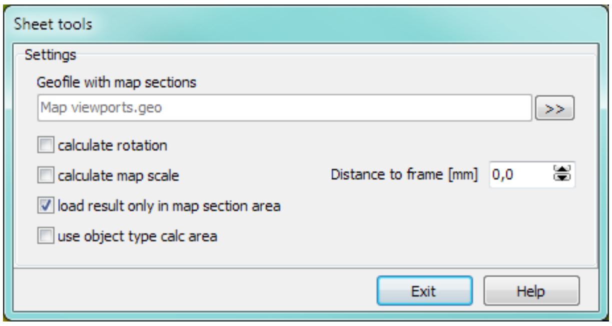
The map section or the area names are used as the text variable „ Plan name“, and for the sheet and the export file name.

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



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.

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.

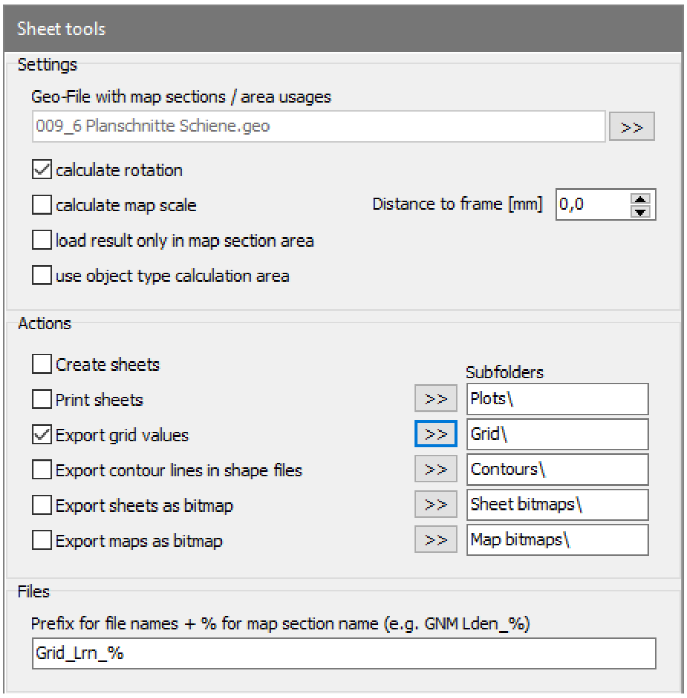
LOAD RESULTS ONLY IN THE MAP SECTION AREA: is only sensible for areas as otherwise the data are loaded for the section anyway.

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 AS**.

Select the desired action; it is also possible to run them parallel to save time.



The **SETTINGS** have been already explained in the chapter for the definition of the map sections.

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 (for details on settings see "Contour line and grid value export" (page 439).

EXPORT SHEETS AS BITMAPS exports the whole sheet as bmp, jpg, tif or png. Resolution and compression defaults are queried.

EXPORT PLANS AS BITMAPS exports only the main map with frame. If you need only the plans, set the frame width to 0 in the Plan Properties, *Frames* panel.

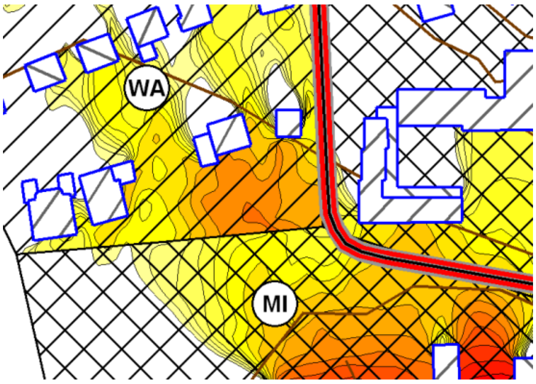
Important for running the sheet tools is the file name: Enter a file name that must contain a % character, e.g. Raster_%_Lden. The % character will be replaced by the respective map section name.

Conflict map / Summed-up conflict map

Conflict map

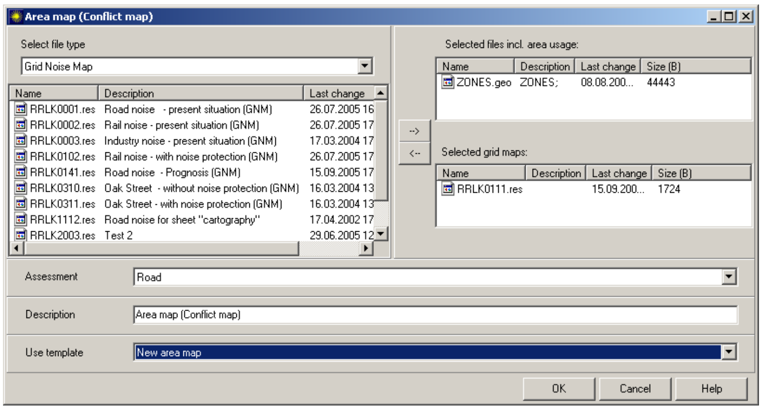
Conflict maps show limit violations for each of the area usages of one noise type. The limit violations sharply change at the area usage boundaries.

The basis of the graphical representation is an automatically created Spreadsheet of the file type area table.



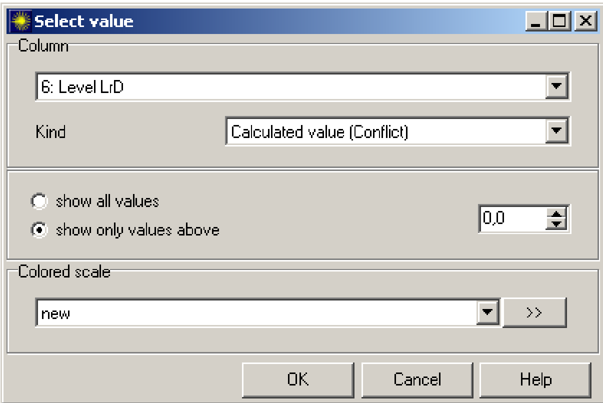
How to generate conflict maps

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 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 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.



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 sum conflict map

Create a normal conflict map in the Graphics. Use the right mouse button (conflict grid map) to switch from the Graphics to the area table.

Column description of the area table:

- Area name: Input in the GeoDB
- Area type: Assignment in the GeoDB
- Area size in m²: is calculated automatically
- Population: Input in GeoDB
- Limit values: from the assessment standard assigned in the calculation run
- Result grid column: the average noise level day minus the limit level in the last column (formula GV0-x5;).

How is this formula interpreted?

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).

Use **FILE | ADD RESULTS** to select the next grid map that is relevant for the sum conflict. You will get a dialog that reads the grid map into a new column by default (you could of course overwrite an existing one). If the calculation is based on a different assessment, you can also insert a new limit column for this grid map. In this case, select the assessment standard and set "in column" to **NEW**.

Now you have 2 new columns: X7 (a value column containing the limit value) and X8 (a grid column with an associated grid map) where only 0 appears. Go to the table settings. Select column 8 in the upper window (column 8 in the table). Enter the required formula at the bottom under Formula: GV0-X7; This now also describes a conflict map again.


Create another grid column for the sum conflict via **TABLE | INSERT GRID COLUMN** or via the corresponding icon button.

In the table settings, go to column 9 and enter the formula for the summed-up conflict. This can be different depending on the standard or regulation. The following example adds up the individual conflicts energetically:

GV6 ++ GV8;

Close the table settings. You will be asked if you want to "Recalculate all". Confirm with yes (column 6 will be recalculated unnecessarily - if you have many areas and/or a dense calculated grid map, it is recommended to answer no and to calculate the necessary columns individually via the right mouse button in the column header | **CALCULATE**).

In the area table, the average value of all grid points is displayed, which means that even if the average value is < 0, some of the grid points may have conflicts.

Note: *This formula for summed-up conflict adds all grid points. I.e. there might be grid points that do not have a single conflicts but a summed-up conflict.*

If only grid points with a single conflict should be taken into account, us CV (conflict value) 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.

Printing

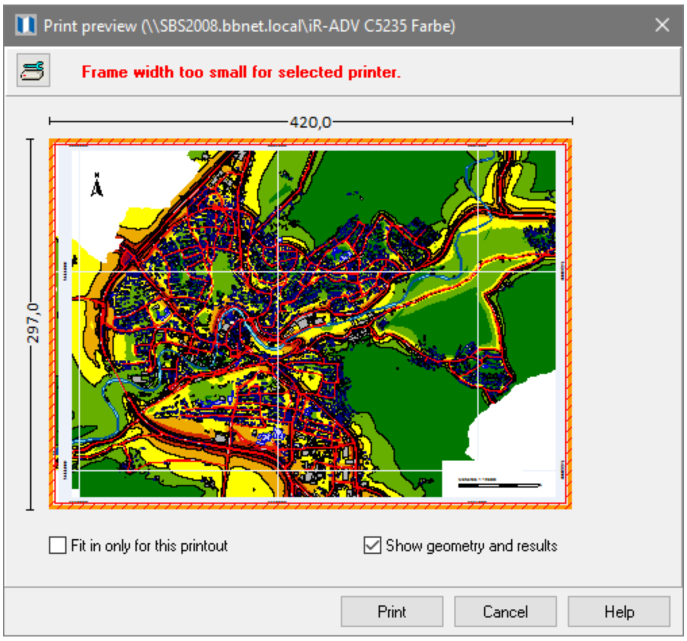
For printing and plotting your sheets, SoundPLAN uses the infra-structure Windows supplies.

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 **ELEMENT | SHEET PROPERTIES**, tab index card *Edge*. If it does not fit, you will get a message.

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".

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**.

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.

You can activate the checkbox **FIT ONLY FOR THIS 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**.

Save graphics file or copy to clipboard

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.)

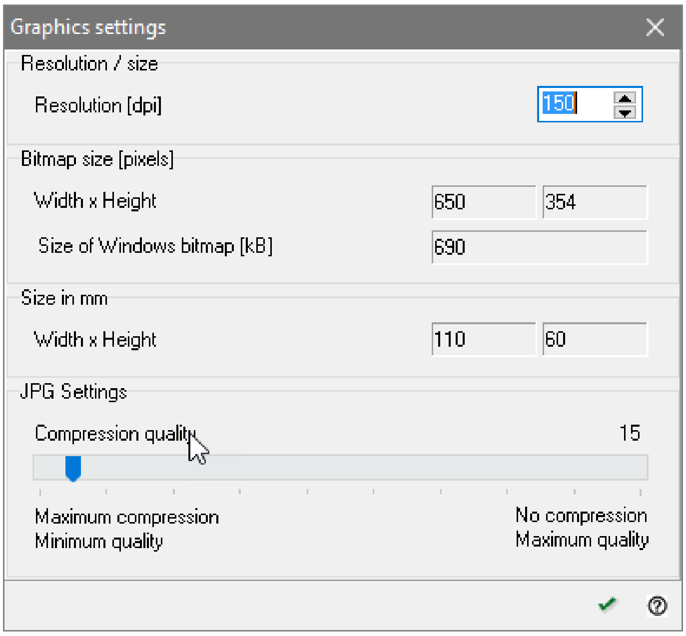
Invoke **FILE | SAVE AS GRAPHICS FILE**. If an element (not the entire sheet) is active, select if you want to export only the active element or the entire sheet.

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.

For saving graphics (also holds for diagrams from the Result Table and Expert System for Industrial Noise) 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**.



If graphics is stored to JPG, you can select the magnitude of the file compression With the switch **COMPRESSION QUALITY**, The higher the compression, the smaller the file and the bigger the quality loss of the picture.

10

3D Graphics

3D Graphics - general handling

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 (with Cartography) additional 3D properties for points, lines and walls.

Load the data as usual or open an existing sheet and call **EDIT MAP CONTENT** (right mouse button or double click on the map). Select **VIEW | 3D MODEL** (***F10)***. Depending on the graphics card and the amount of data, it may take a while until the 3D model is displayed.

Basic principles

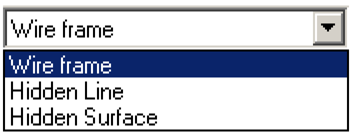
The 3D Graphics works with the 3D standard OpenGL 4.1. As soon as you call the 3D Graphics, the objects are converted for OpenGL.

OpenGL can only draw to the screen, but not to the printer. Therefore, when you exit the 3D Graphics, a bitmap of the selected section of the screen is drawn. Bitmap is a generic term for "pixel graphics". The scene can be saved in *.bmp, *.jpg, *.png and *.tif formats. The bitmap is stored in the sheet, not as a separate file. Depending on the graphics format, this can make the sheet very large. In the "normal" graphics interface, the bitmap is output in the sheet. With ***Ctrl+R*** you update the scene bitmap if data has changed. If you close the file selection or the map object types with OK, the scene bitmap is updated automatically.

The speed of processing in 3D Graphics is very dependent on the graphics card of the computer. When buying a new computer, pay attention to the graphics chip used.

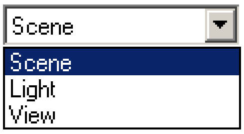
Display options, views and movements

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).

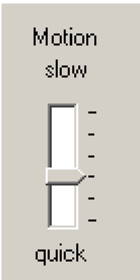
In menu accessible by right clicking, there is the menu topic **OVERVIEW**, with which you can recall the view of the last saved scene (in case you got lost in 3D space).

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.

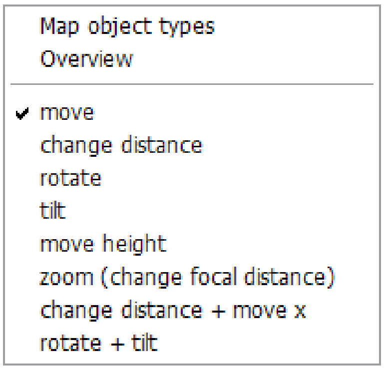
The step size of the movement is controlled using the slider to the right of the frame.

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 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.



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.

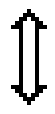
The cursor changes appearance depending on the movement type. The most common movements are available via mouse and arrow keys. A right click on the canvas opens a menu with all available movements.




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

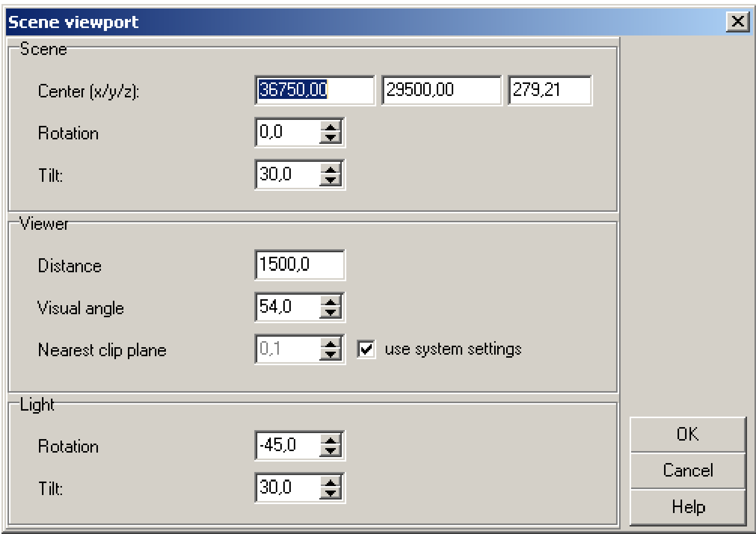

Left mouse button + Alt or shift + arrow keys:
Move height

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 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**.

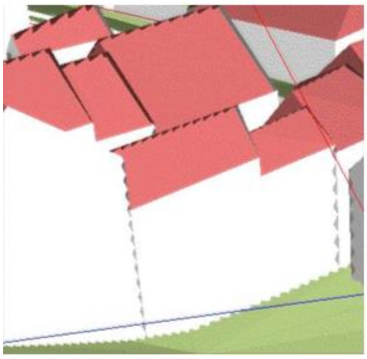
Use **GEOMETRY VIEWPORT | GEOMETRY PARAMETER** to open a dialog that depicts all view parameters of the scene.



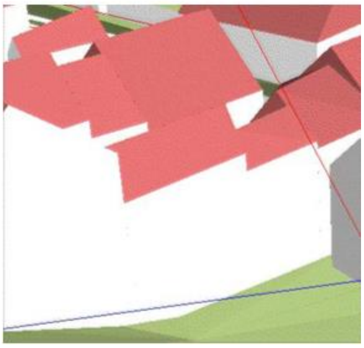
The **NEAREST CLIPPING PLANE** is defined in the system settings of the SoundPLAN Manager (options | settings, under program | system). As different viewports might correct display problems, it is also possible to override the system settings locally by hand.

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.

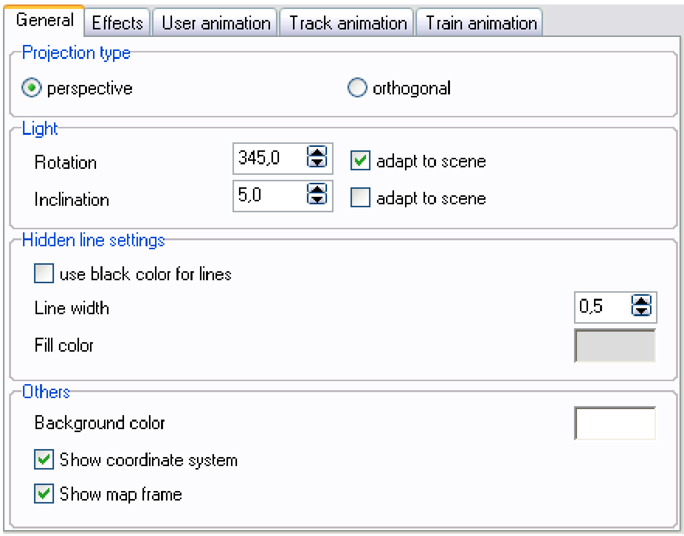


Example: Clipping plane 0.1 m



Example: Clipping plane 5 m

3D-settings

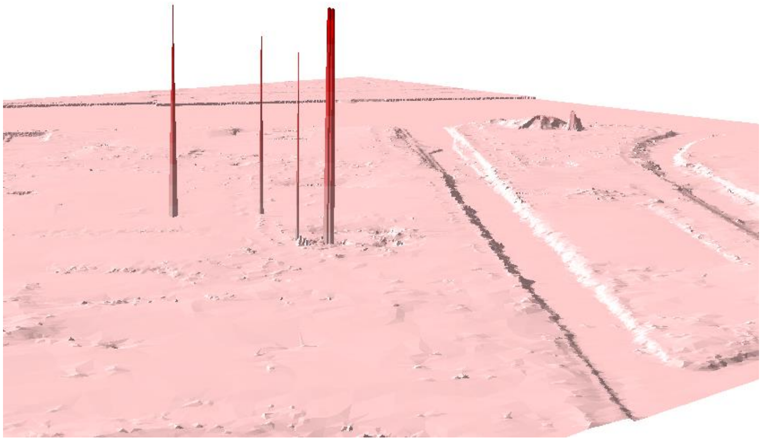


Additional settings are found under **PARAMETER | 3D-SETTINGS**:

- 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 "Effects" on page 485.

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.

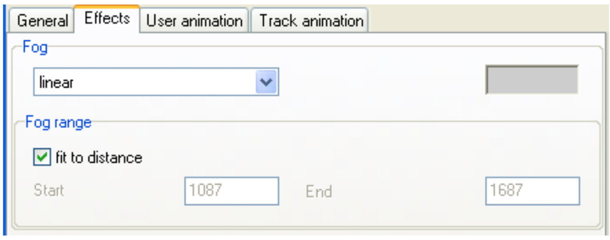
The following data types are displayed:

- 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

Effects

With the **fog effect** you can now simulate distances from the viewer.

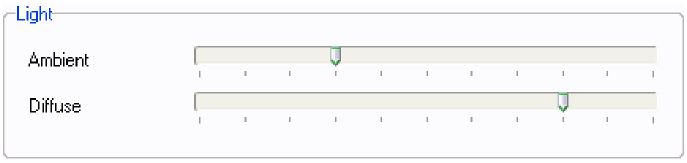
Open **PARAMETER | 3D-SETTINGS**, (the 3D model must already be loaded via **VIEW | 3D MODEL**).



Select from the pick list the fog type of choice „linear“, „exponential“ or „steep-exponential“ 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



AMBIENT-LIGHT is light where the source is not recognizable. It stems from multiple re-flections on walls and other surfaces.

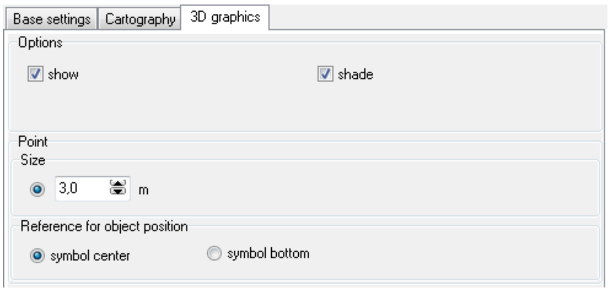
"DIFFUSE"-LIGHT allows the detection of the light source. The angle to the light source determines how bright an object is.

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

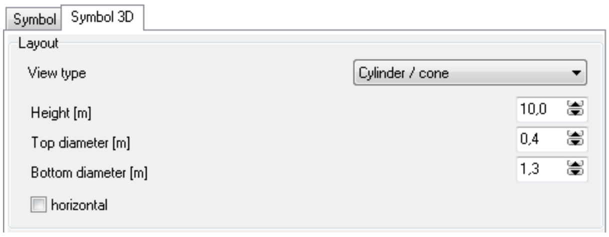
For the geometry and result object types, you may configure the appearance of the 3D-objects independent of the top view graphics settings.

Point object types

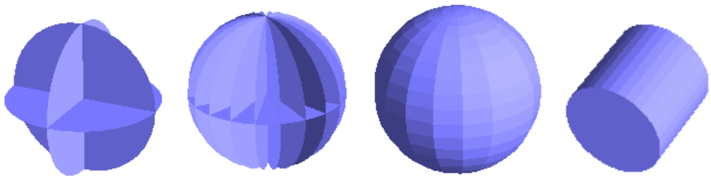


Point objects in 3D-graphics are presented in the x, y and z plane. For object positions on the terrain, you can choose between the bottom and the middle of the symbol.

Cartography includes additional options and possibilities. Under the Cartography tab, switch to the 3D-symbols.



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.



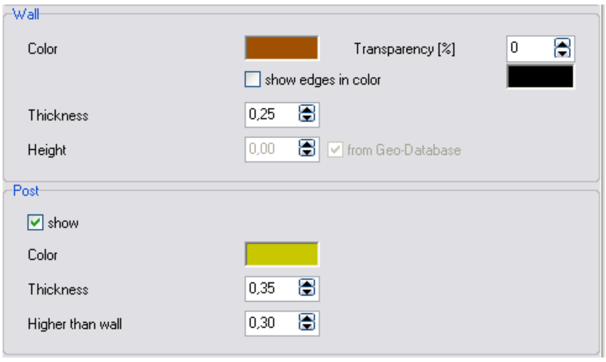
From left to right: 2 xz planes, 10 xz planes, rotation symmetric body with 18 steps of rotation, cylinder.

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 attribute "constant wall element" is evaluated.

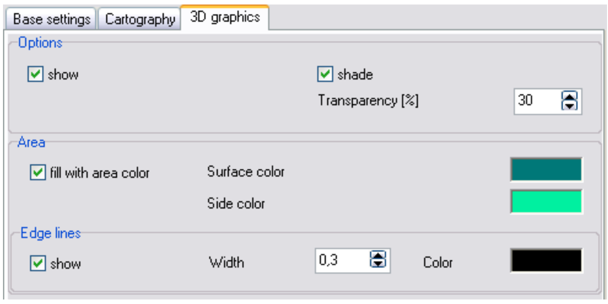
With Cartography, a 3D-wall is inserted to simulate the appearance of the noise control wall. (The 3D wall can be inserted in all line type objects, not only in the noise protection wall.)



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.

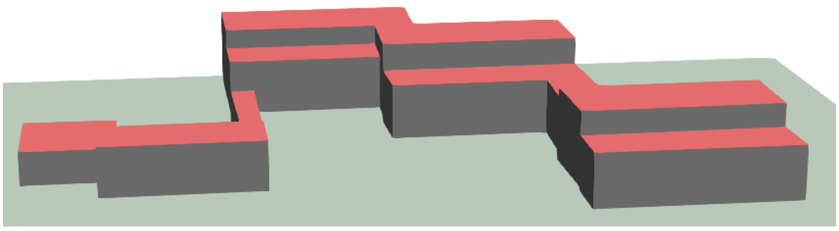
Area object types



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*.

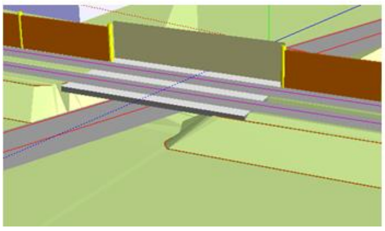
For areas in the 3D-graphics, it is possible to assign different color schemes than in the top view. The border line of the area can be drawn with the set line width and color, which is especially interesting if you assign a transparency.

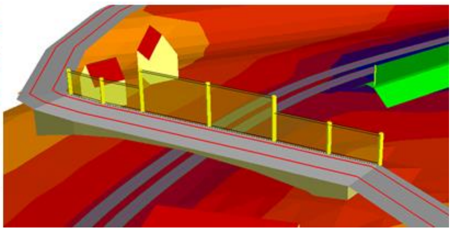
All objects with vertical components (buildings, industrial buildings, bridges, mitigation areas) can have different colors for the top surface and the sides.



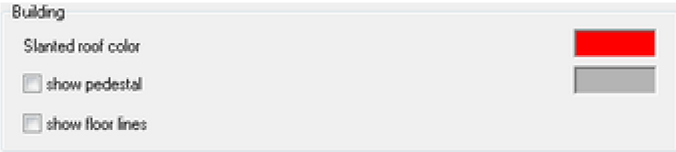
Bridge thickness is taken over from the settings in the Geo-Database. The bridge edges are defined via the noise control wall built into the bridge object.

10

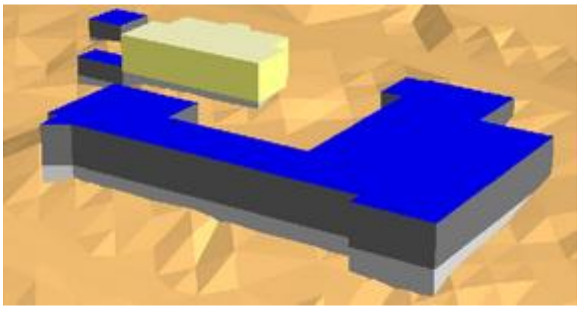




For buildings, you can additionally define the color for gable roofs, see "Roofs" (page 493).



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.



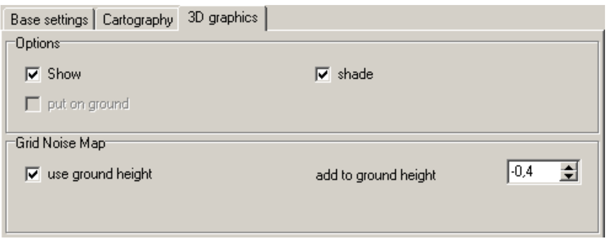
Digital Ground Model (3D)

The Digital Ground Model can be loaded without or with (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. See also "DGM with continuous color flow and elevation lines" (page 437).

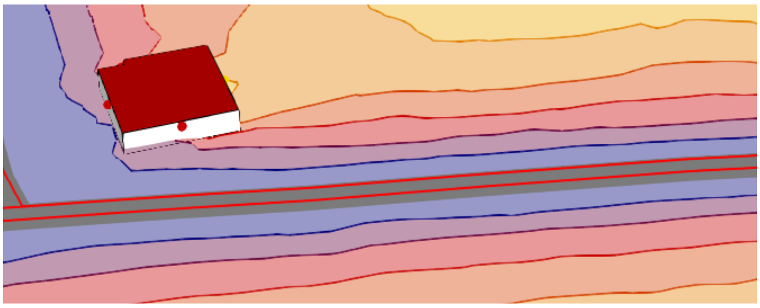
Grid Map (3D)

10

When Grid Maps are drawn in 3D, the settings in the main object type of the Grid 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.



In the 3D tab you can specify a transparency. This gives special effects when the contour lines of the intervals are output in scale color in the basic settings box.



Some changes will not be visible until you use the brush to re-render the scene.

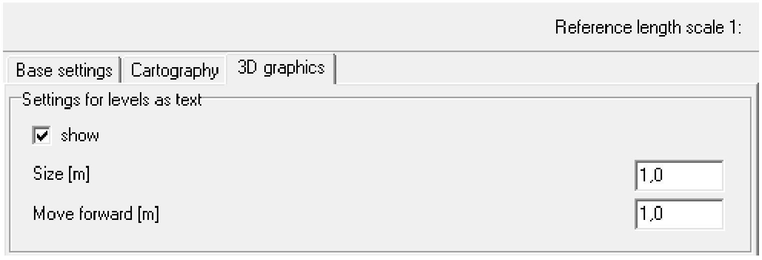
Façade Noise Map (3D)

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 "Object type Facade Noise Map" (page 443).

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 3D point object types. See “Point object types” (page 487).

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.



In connection with the settings for „half-transparent“ for the building the labels deliver a very informative presentation.

Cross Sectional Noise Map (3D)

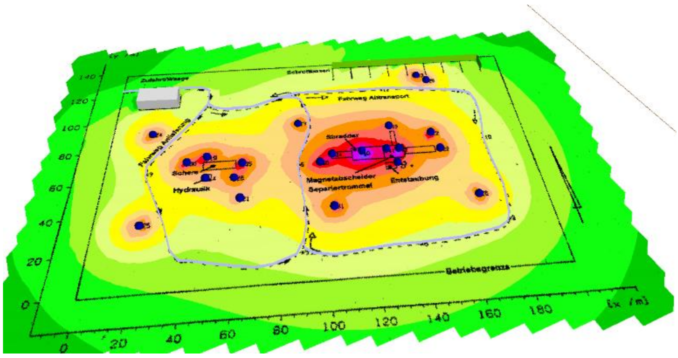
Cross sectional noise maps are very well suited to present the functionality of a noise map.

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:

- 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 size so that, for example, a bitmap of the size 1025 x 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 (paint-brush 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.

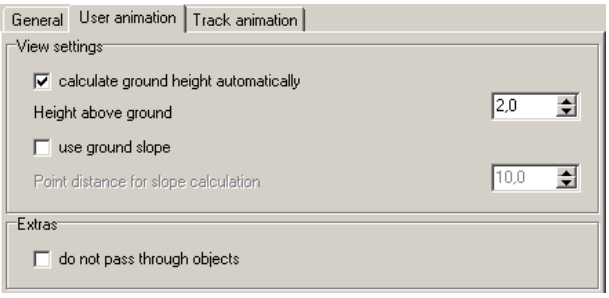
Mouse movements back and forward with the left mouse button pressed move you backward and forward. With mouse movements left and right you rotate left and right.

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).

View settings

For the view settings, you can find an extra configuration sheet under **PARAMETER | 3D-SETTINGS**:



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.**

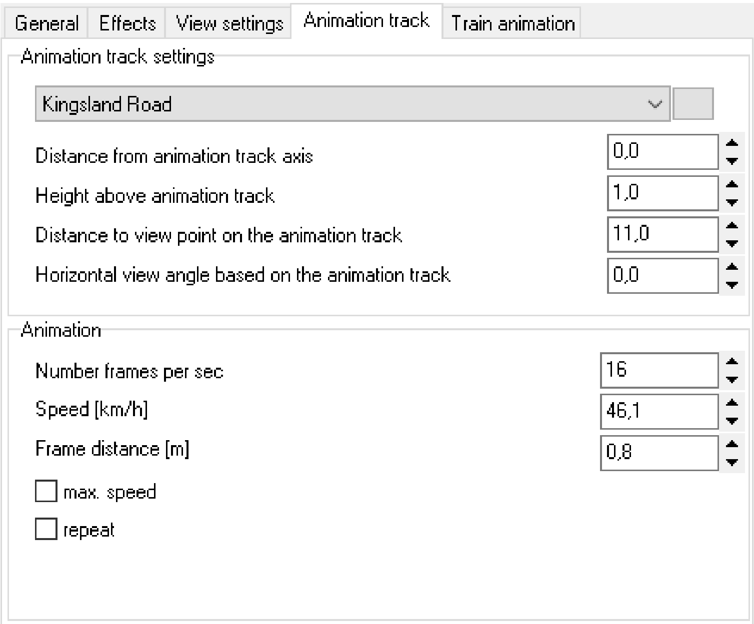
Roofs

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 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.

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 an animation track (see "Camera track / animation track" (page 215)), or any road or railway.



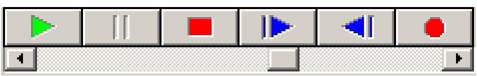
The parameters at the top of the form define the position of the „driver." The **DISTANCE FROM TRACK AXIS** is the vertical offset (if set to 0 the driver drives in the middle of the road) and uses positive values to move to the right and negative values to move to the left. (Drivers in the UK use negative values, the rest of Europe and the US use positive values).

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.

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 "Smooth elevations" (page 124) or "Interpolation: Segments with constant distance" (page 115) 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. The animation can be stored as an AVI file, see "Create AVI file" (page 496).

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:

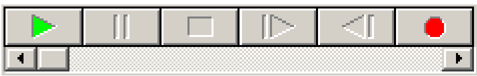
- In the railway properties (emission calculation railway) provisions for the maximum noise level must be made; trains must be selected that constitute the maximum noise level.
- In the calculations, the calculation run for the maximum noise level must have an assessment that enables the maximum noise 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.

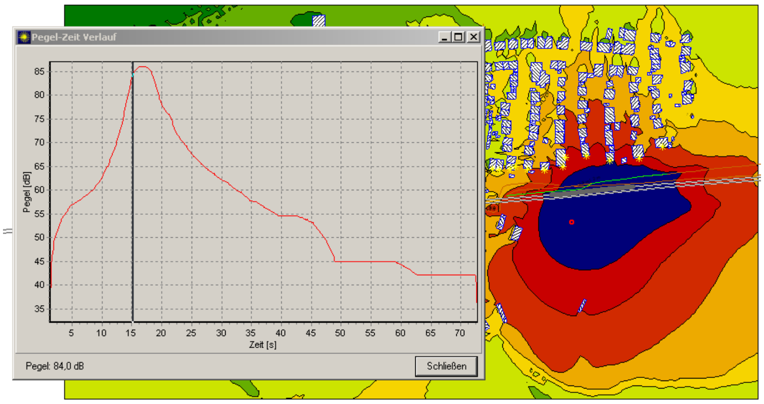


With the check box **CENTERED** the geometry moves with the train pass-by. Start the on-line animation with the green arrow. While the animation is in progress, the stop and pause buttons are active. After the animation is run, you can move the slider to visualize a particular time of the animated noise 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, "Create AVI file" (page 496).

When the level time charts are loaded, a left click on the map will open the chart for the area where you are clicking.



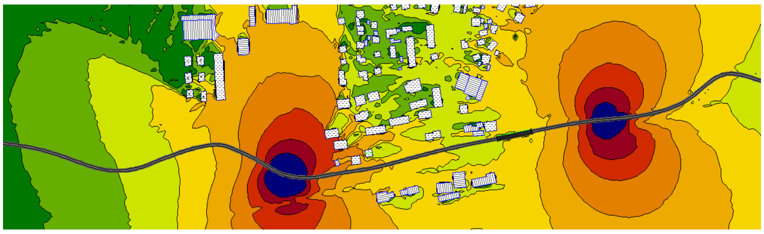
Grid operations with animations

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.

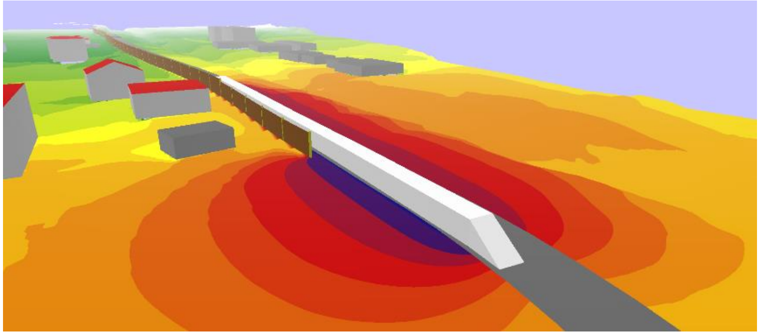
If one of the animations should begin later, enter this in the extended formula entry with the parameter:

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.

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

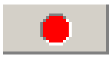
In order to present the train-animation in 3D, the data must be loaded while the Edit-Map facility is operating in 2-D. After loading the data, switch to the 3-D mode. Please make sure that the object types for the grid noise map has the switch **USE GROUND ELEVATIONS** set in the tab 3D of the object settings.

In the settings for 3D there is a new tab for the train animation, select one of the 4 different way of presentation:

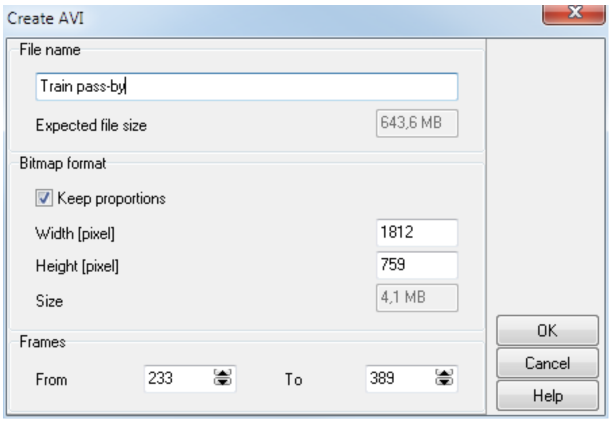
- Keep the current view
- Move with the train and look at the noise map from a position on the train in a defined angle.
- Move with the train and look towards the center of the of the animation world
- Look from the center of the animation towards the train.

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.

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.



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. If necessary, change the bitmap size here to reduce the file size. Depending on the operating system, the size limit for AVI files is 2 or 4 GB. This limit can be reached very quickly, depending on the amount of data.

There are various converters on the Internet to save the animation as mp4 video, for example.

11 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:

- Statistical evaluations (including statistical information for projects according to the EU Environmental Noise Directive)
- Tiling system - Divide the study area into tiles of the same size
- Additional options for large elevation models
- Statistical evaluations (including statistical information for projects according to the EU Environmental Noise Directive)
- Annoyance analyses
- Total noise assessment according to VDI 3722-2

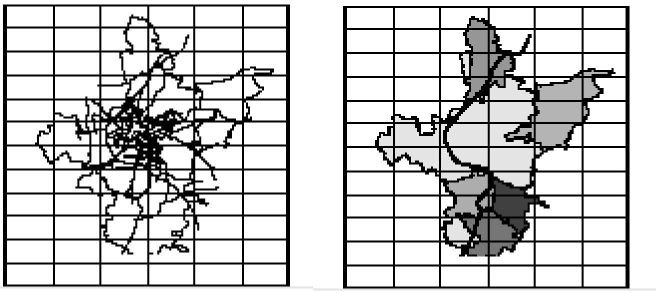
Tile projects

The tile manager

Prepare tile project: Create background graphic

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 not suitable.

Examples:



Left: small-scale information, right: few large-scale information in different gray shades

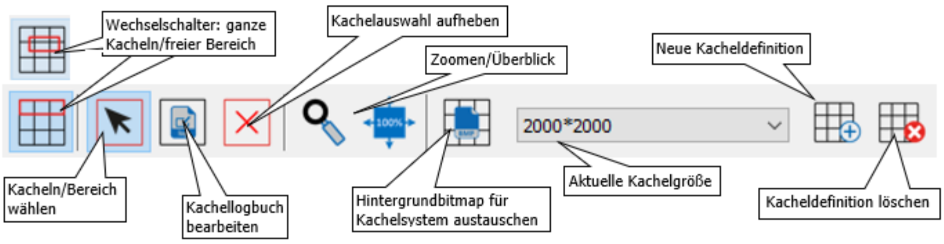
***Note**: Please note that the background graphic is opened every time you load data or use the navigator. Since this can lead to increased response times depending on the file size, the background graphic is converted to grayscale for the Tile Manager.*

Load the data into the Graphics and adjust the object types accordingly. Call Edit map content and save the map data via **EDIT | CREATE GEOREFERENCED BITMAP** in one of the available graphic formats.

Setting up the tiling system

Call the Geo-Database and open **TILE SYSTEM** in the **OPTIONS** in the *Current Project* branch.

Overview of the icons in the tile 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.

Once you have set the tile size, select the background bitmap. The referencing files of georeferenced bitmaps are displayed. The tiles are superimposed on the bitmap and the tiling system is completely defined. The background bitmap for the tiling project can be exchanged in the course of the project.

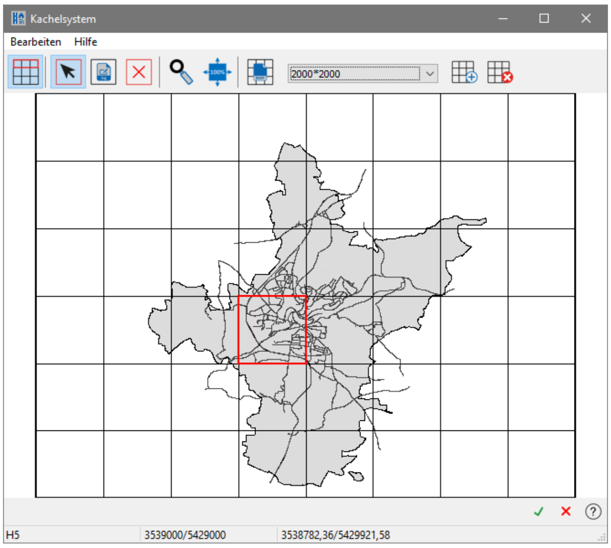
Working with tiled projects

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 ”Select tile“. In the calculation core it is only possible to select complete tiles.

Select complete tiles

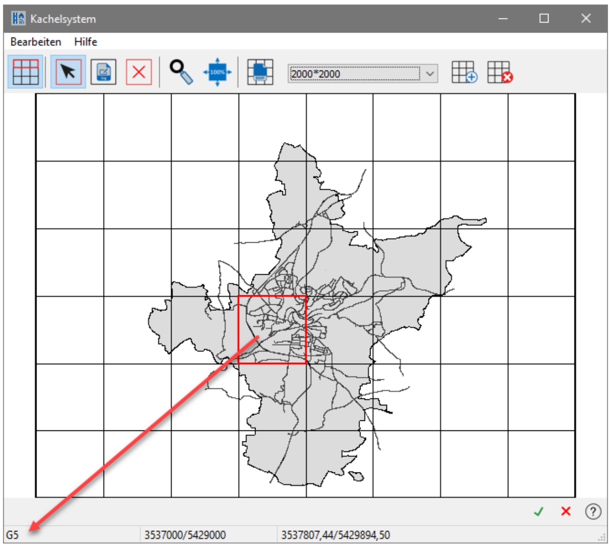
Select free area

The selection area is displayed with a red border.



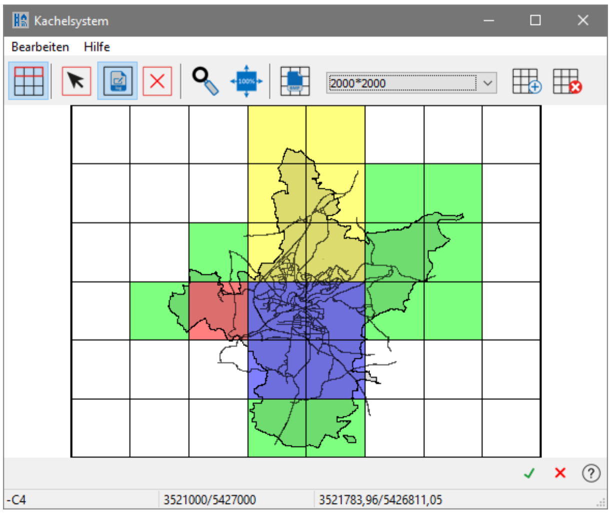
 Click on the button “Remove selected area” to deselect the area selected in red. If you open the Situation without any area selected, all data will be loaded!

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, …)).



Document the project status

For each tile you can document the status of the project:



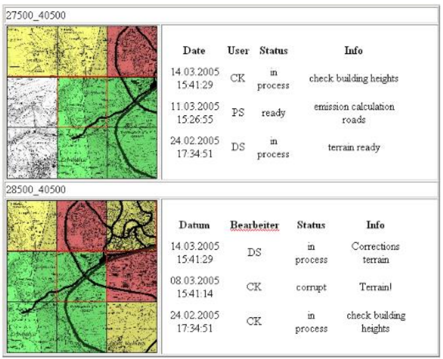
 Press the button “Edit Tile Log” in the Tile Manager. In this mode you can enter the status for the activated tiles. Aside from the status you can also enter the name of the operator and write comments pertaining the status of the project or what needs to be done or where problems were found with the 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.

Tiles Log File: Status Quo



27500_40500

Date	User	Status	Info
14.03.2005 15:41:29	CK	in process	check building heights
11.03.2005 15:26:55	PS	ready	emission calculation roads
24.02.2005 17:34:51	DS	in process	terrain ready

28500_40500

Datum	Bearbeiter	Status	Info
14.03.2005 15:41:29	DS	in process	Corrections terrain
08.03.2005 15:41:14	CK	corrupt	Terrain!
24.02.2005 17:34:51	CK	in process	check building heights

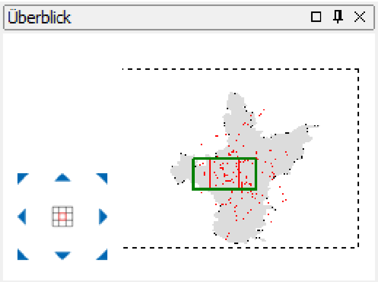
11

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.

Tile navigator

In the Geo-Database (docking window Overview)) and in the Graphics (**VIEW | NAVIGATOR**) the tile navigator is opened, where you can easily change the area for which the data are loaded.

Next to the navigator buttons, which allow you to change the area in all directions, an overview window with the selected area is displayed.



If you use the Navigator arrows to move to an area that requires data from Geo-Files that have not yet been loaded, they will be reloaded immediately, which can sometimes take a moment.

The “Tile navigator” icon in the center of the arrows opens the full tile manager to choose a different area or to enter the project status for the tiles.to the Tile Manager to select another area or set an editing status.

Tile 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 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.

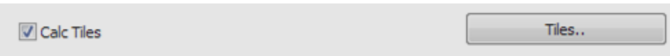
Calculate tile projects

Tiling calculations always require a calculation area within which the results for raster triangle and Facade Noise Maps are generated. The results of the individual tiles are kept in a results subfolder in the same way as for non-tiled calculations. When you load a result into the Spreadsheet or Graphics, select the result file as usual. Only the tiles for the selected range will be loaded.

For each project, you can create a tile system for the calculations of any size. Depending on the computer performance and available memory, larger tiles can significantly speed up the calculation. Try out what is the best configuration for your computing environment, your projects, and the standards you use. We recommend sufficient RAM and the 64 bit version.

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 non-tiled environment, thus the speed advantage remains even if there is only a single tile.

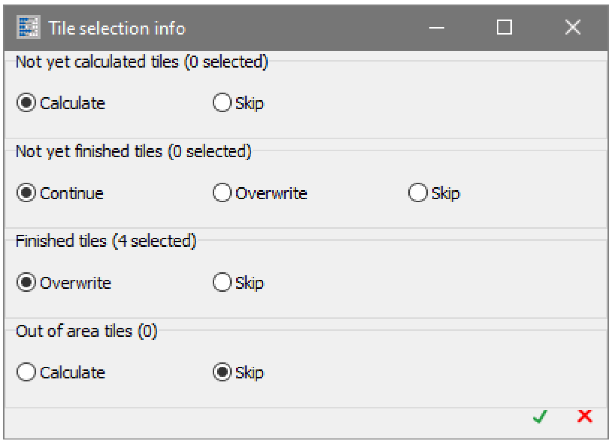


11

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.

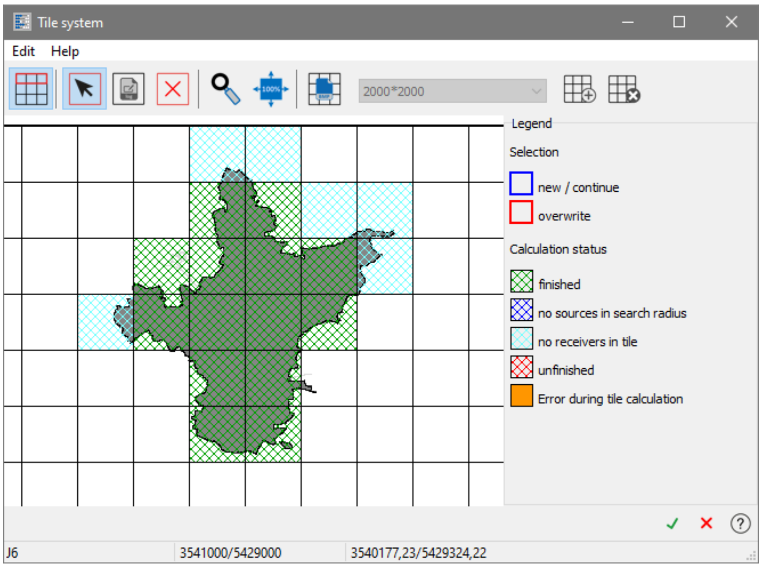
Select all tiles with ***Ctrl+A*** or pull open a frame around the desired tiles (selection of not continuous tiles with additionally pressed ***Ctrl-key***).

A dialog opens that shows the status of the selected tiles.



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.

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. Because the calculation stops at the end of a tile the overview window closes automatically after a certain time.

Tile projects in the Spreadsheet

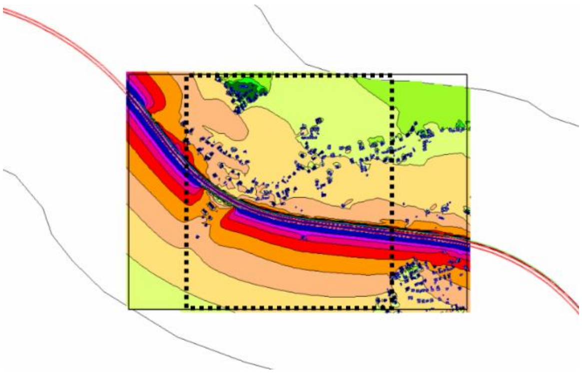
In the Spreadsheet, you have to activate the checkbox **LOAD DATA ONLY IN SELECTED AREA** in **SETTINGS / FILTER**. Then you can select the area in the tile manager.

Tile projects in 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.

Note: *For tiling projects, the checkbox* ***LOAD DATA ONLY IN MAP AREA*** *is always active. However, you can also use this checkbox for non-tile projects. After loading the data, select a geometry viewport in "Edit map", go back to the file selection manager and activate the checkbox. This can reduce screen build times for larger projects.*

Additional options for large elevation models

If you need to filter elevation points for large areas, the amount of remaining elevation points may be too big to open the elevation points as Geo-Files in the Geo-Database. For this reason, there is a separate import interface in the SoundPLAN Manager for preparing these elevation data under **EXECUTE | ELEVATION FILTER FOR LARGE DATA SETS**. This elevation data import works independently of the Geo-Database as a separate program, so that you can continue to work in the Geo-Database while filtering. The data is filtered as described in "Filter and import elevation points" (page 80).

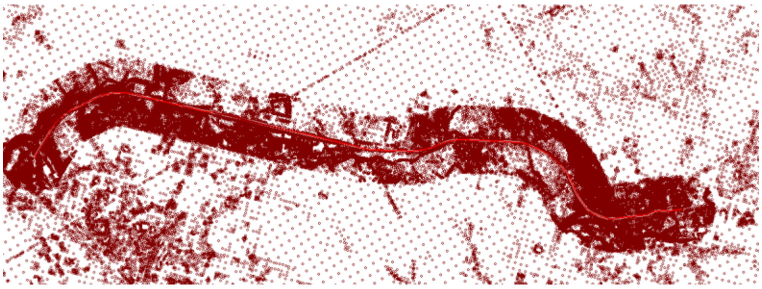
However, the further processing of the data differs. There are also additional options for reducing the amount of data, such as coarser filtering outside sensitive areas.

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.

Filter points in outlying areas with increased tolerance

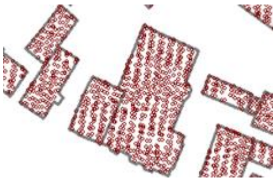
Often the area of a community consists of areas with buildings and outlying areas with fields, forests and meadows. As in the non-built up areas the accuracy is not quite as important as between buildings, a bigger tolerance can be chosen here.

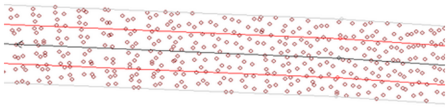


As soon as you select this task, a dialog opens to select the Geo-File. Select the Geo-File with the area(s) and/or lines (e.g. roads / railways) outside of which the coarser filter value shall be used. The line corridor width is only valid for line type objects. Determine the **FACTOR FOR COARSER FILTER 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.

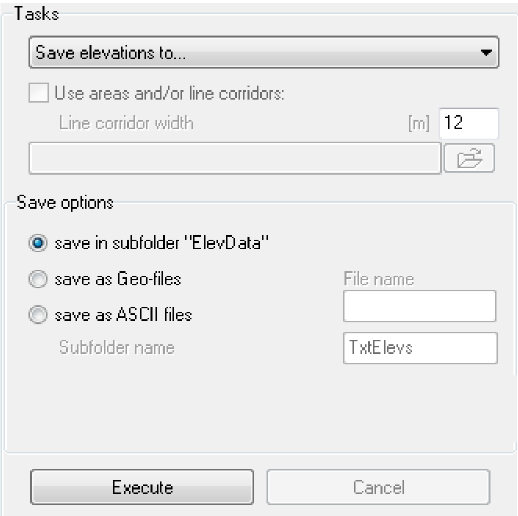




The amount of data of these elevations is often not too big, so that you could store them with the task **SAVE ELEVATIONS TO** directly to a Geo-File.

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.

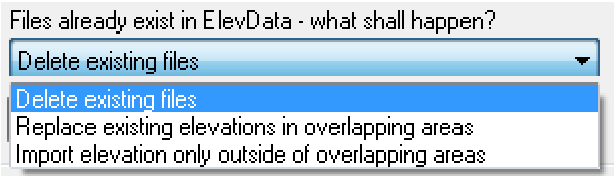


In addition, you can save the data as Geo-Files which are not automatically loaded to the Geo-Database.

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.



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.

Statistical evaluations

Noise mapping projects and action plans according to the EU Environmental Noise Directive require information on the affected inhabitants and dwellings, on the number of special buildings (schools, hospitals) and on the area sizes in different level classes. In addition, the harmful effects caused by environmental noise (standard EU 2020/367) can be reported.

Within the scope of action planning, different measures can be evaluated to compare their effectiveness. However, the statistics are also very well suited for making statistical statements on the number of affected inhabitants of different variants when investigating variants for a new planning.

The statistical evaluation was originally implemented for the requirements according to the Environmental Noise Directive and designed according to the different implementations into national law of the EU states.

The inhabitant **statistics** evaluate façade levels calculated via a Facade Noise Map to assign inhabitants, dwellings, and special buildings to level ranges.

EU Directive on Environmental Noise
Statistics on Affected Inhabitants

Name	Intervals	Number of affected Inhabitants Lden	Ln
All communities	50 - 55	4700	2400
	55 - 60	2800	1000
	60 - 65	1300	200
	65 - 70	300	0
	70 - 75	100	-
	> 75	0	-
Community Arbenrath	50 - 55	600	200
	55 - 60	300	100
	60 - 65	200	0
	65 - 70	0	0

In **area statistics**, the ambient noise is evaluated from the calculation of a grid or meshed noise map to determine the area exposed to noise.

The area size of the individual noise level intervals is determined by scanning the contour map in one-meter steps and accounting the level found in the middle of each grid cell to the interval it falls in. The areas within buildings can be filled with the lowest surrounding level or not taken into account.

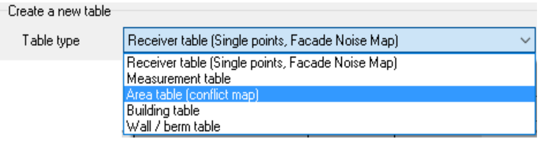
You decide which information you want to display in the statistics when you load the calculation results.

EU Directive on Environmental Noise
Statistics based on the Result of the Grid Map Calculation

Name	Threshold	EU Flächenstatistik für Lden Size [km²]	Number of Dwellings	Nunber of Schools	Number of Hospitals	Number of Kinder gartens
Sum over all communities	> 55	5,60	5400	6	3	6
	> 65	2,53	1300	2	1	-
	> 75	0,66	100	-	-	-
Community Wiesenach	> 55	2,51	2300	2	1	2
	> 65	1,28	600	-	-	-
	> 75	0,32	0	-	-	-
Community Geisdorf	> 55	2,02	2000	2	2	1
	> 65	0,69	400	2	1	-
	> 75	0,19	0	-	-	-

Create statistics

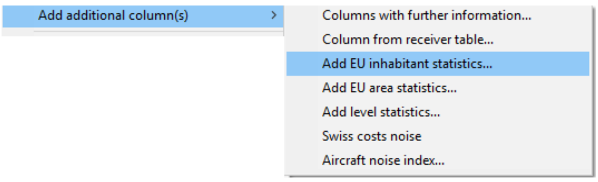
Call the Spreadsheet, select the **TABLE TYPE** "Surface Table (Conflict Map)" in the File manager and click **NEW**.



Subsequently, a dialog opens for the selection of the Geo-File or the Situation in which the area data are contained. These can be area usages or calculation areas. If the data contains more than one area usage (for example city districts or municipalities), area sizes, inhabitants, dwellings and special buildings are assigned area-related. In addition, the statistics is summed up for all areas.

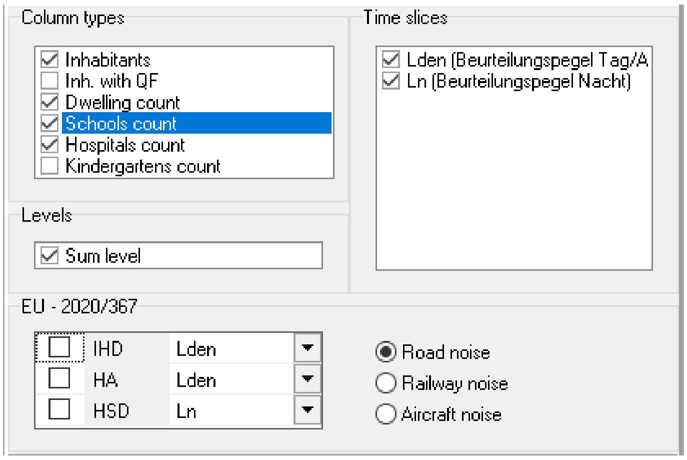
Click OK to generate the area table.

Select the desired EU statistics via **FILE | ADD ADDITIONAL COLUMNS.**



After you have selected the result file, a dialog appears in which you can define how the statistics are to be calculated (see "Statistics settings" (page 507)).

Then select which information and for which time slices should be displayed in the statistics. If the sources have been assigned to source groups, you can also perform the evaluation for individual groups. How to report the health effects caused by environmental noise according to Directive EU 2020/367 can be found in the section "Directive EU 2020/367" (page 510).



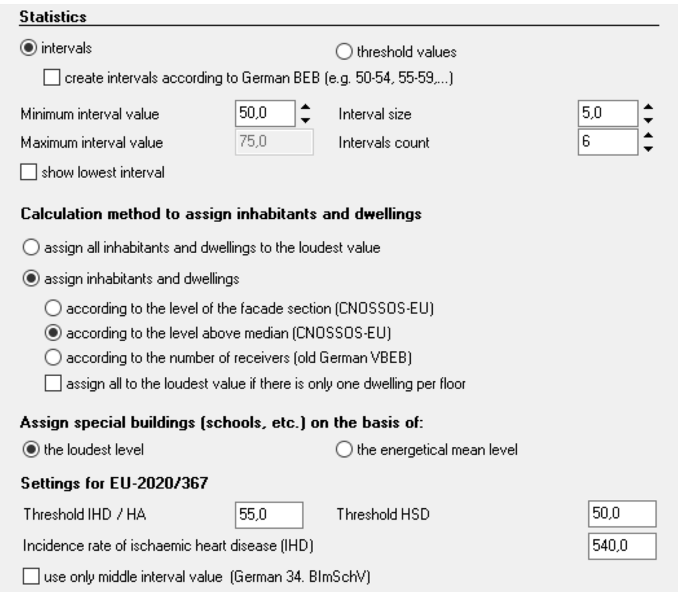
An area table can contain several statistics, for example, to compare changes in affected inhabitants or areas for calculations with different measures in the context of action planning, see "Variant comparisons" (page 511).

When calculating the statistics, the information on the buildings is taken from the current status of the geometry data specified in the calculation run. This means that the result of the statistics changes if you rename or delete Situations or Geo-Files or change their contents.

As a result, changes to the information used for the statistics, such as the identification as special buildings or changed population figures are considered in the statistics without recalculation of the noise maps.

Statistics settings

Due to diverging requirements to the statistics, some clarifications need to be made:



All settings selected here can be changed via **OPTIONS -> SETTINGS / FILTER**. If the statistics must be recalculated due to a change, you will be prompted to trigger it.

Level ranges

The statistics can be evaluated in intervals or via a threshold value. In the case of an interval analysis, the results (inhabitants, area, dwellings, ...) within a level range are

11

summed up, for example all inhabitants who are in a level range between 55 and 60 dB(A). When looking at a threshold value, the result > 60 dB(A) also includes all inhabitants > 70 dB(A).

According to German BEB the values in the individual level intervals should be rounded for the inhabitant statistics. The checkbox ark the interval limits accordingly:

The interval from 50 - 54 contains the values >=49.5 - < 54.5; the interval from 55 - 59 correspondingly contains the values >= 54.5 - < 59.5.

Calculation method for allocation of inhabitants and dwellings

ASSIGN ALL INHABITANTS AND DWELLINGS TO THE LOUDEST LEVEL assigns all inhabitants and dwellings of a building to the interval of the loudest level of the building for statistics.

If inhabitants and dwellings are distributed among the facade levels, there are three approaches:

Originally, according to CNOSSOS-EU, the inhabitants should be distributed according to the **LEVEL OF THE FAÇADE SECTION** represented by a receiver. In the updated version of 2021, this procedure is to be used only if it is known that the dwellings have only one noise-exposed façade. As soon as dwellings have more than one noise-exposed facade, **ABOVE MEDIAN** is to be used, i.e. all inhabitants are assigned to the receivers of the louder half of the calculated levels at the building.

ACCORDING TO THE NUMBER OF RECEIVERS corresponds to the procedure of VBEB old (Germany). The inhabitants and dwellings are equally distributed on all facade points.

In addition, all inhabitants and dwellings for buildings in which there is only one dwelling per floor can be assigned to the loudest level at the building. For the statistics to take this into account, **ONLY ONE DWELLING PER FLOOR** must be active in the building properties in the *Additional* card.

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.

Assignment of hospitals, schools and kindergartens

Depending on the requirements, special buildings are either summed up in the interval of the **LOUDEST LEVEL** or in the interval of the **ENERGETICAL MEAN VALUE**.

Enter the usage (school, hospital, kindergarten) in the Geo-Database as building type in the Property Explorer. (Numerical values, for the use of the building type in formulas: -1 unknown, -2 school, -3 hospital, -4 kindergarten).

Special buildings are treated as normal buildings, which means that if inhabitants are assigned (for example for the caretaker family) the inhabitants are accounted in the normal way.

11

Building complexes

Schools and hospitals that consist of several individual buildings can be combined into a building complex. As soon as the same text is entered for several buildings in the field **LAND PARCEL NO.** in the building properties (Geo-Database), these buildings are treated as one building complex during the evaluation, for example as one school.

Based on the assignment of the building complexes via the "loudest level" or the "energetic mean value", the loudest level is searched for or the energetical mean value is calculated for the entire building complex and assigned to the level range based on this level.

Assessment of a quiet facade (inhabitant statistics)

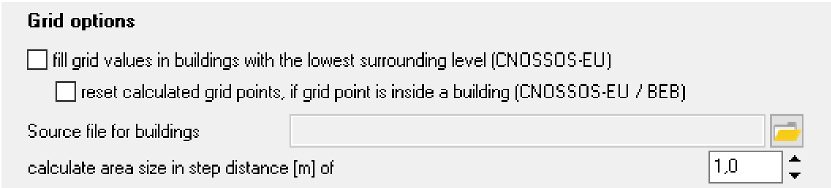
The relevant receivers for the assessment of the quiet facade can be located on the facade or 2 meters in front of it. The additional receivers 2 meters in front of the façade are calculated when you request **ADDITIONAL RECEIVERS 2 METERS IN FRONT OF THE FA-**

CADE 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 in the column “quiet façade”.

With the checkbox **USE QUIET FACADE MAXIMUM LEVEL** the entered maximum level is additionally checked. Only if facade level falls below the maximum level, a quiet facade is accounted. For the assignment of the maximum level to the results for Lden always the first time slice from the assessment library is used, for Ld Le and Ln the second one. If, as in Austria a quiet facade shall only be recorded if the level is 5 dB below a specified threshold value, “threshold value – 5” must be entered as maximum level.

Grid options for area statistics



CNOSSOS-EU states:

"*Grid points that are located inside buildings shall be assigned a noise level result by assigning the quietest nearby noise receiver points outside building.*"

It can happen that grid cells which are completely inside a building have got a value by interpolation. However, these interpolated grid points are not considered "calculated" according to CNOSSOS-EU and can be reset with the first checkmark and then filled with the lowest nearby level.

Points whose grid center is inside the building but where part of the grid cell is outside the building are calculated in SoundPLAN using a substitute point that is inside the grid cell but outside the building.

This procedure must not be used according to CNOSSOS-EU. All grid points whose center lies within the building must be filled with the lowest surrounding level. You can achieve this with the second checkmark.

According to CNOSSOS-EU, the "surrounding lowest level" is the lowest level of all grid points surrounding the building (not the lowest surrounding level of each individual grid cell). This procedure is now generally applied in SoundPLAN.

If none of the two checkmarks is set, the procedure is the same as before and the building area is not included in the statistics. The accuracy of this procedure is determined by the "Step size" value. This is preset with 1 m.

SoundPLAN calculates any point (x/y) in a grid, first determining the grid cell in which the point is located (grid cell 0). From this grid cell the 6 surrounding triangles are considered, which are formed as sketched:

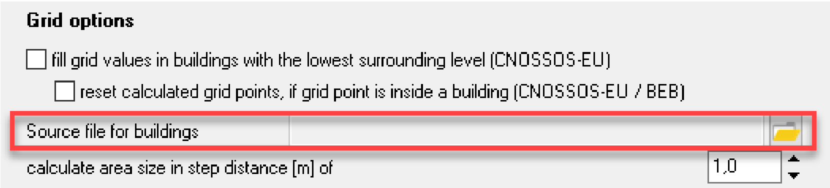
```
      1 ----- 2 grid row Gr0
   / | / |
3 ----- 0 ----- 4 grid row Gr1
| / | /
5 ----- 6 grid row Gr2
```

For example, if the point (x/y) is located to the right below the center of the grid, the value is calculated from the triangle 6-0-4.

For an area, the min / max rectangle is formed, and a 1 m grid is superimposed within this rectangle. If a 1 m² grid point is located in the area but not in any building, the grid point is interpolated and the one square meter is added up in the corresponding level area.

Special feature for aircraft noise

In the case of aircraft noise, the affected inhabitants are to be determined from the grid map and assigned to the loudest level surrounding the building. Since no buildings are involved in an aircraft noise calculation, a Situation or Geo-File containing the buildings can be assigned in the grid options to determine the inhabitants.



For the assignment of the inhabitants, dwellings and special buildings, only "assign to loudest level" is active, as the basis is a grid noise map.

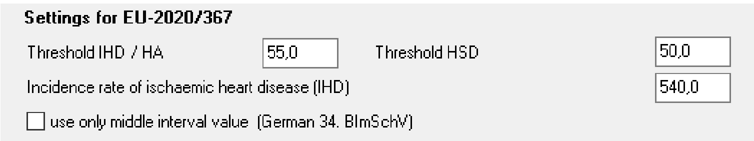
Directive EU 2020/367

Annex III of Directive (EU) 2020/367 is based on the World Health Organization (WHO) guidelines on environmental noise, which present dose-response relations for the relationship between harmful effects and environmental noise.

For the evaluations, ischemic heart disease (IHD), high annoyance (HA), and high sleep disturbance (HSD) are considered.

Settings for EU 2020/367

Select the settings for EU 2020/367 in the statistics settings. For IHD and HA the Lden is evaluated, for HSD the Lnight. Since only the population in the assessed intervals is to be considered, there are threshold values for IHD, HA and HSD. These are preset with the lowest intervals.



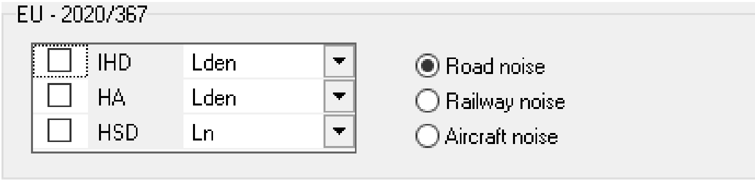
To calculate the IHD, you need to know the incidence rate in your country / study area and adjust it in the statistics settings. The default setting is the value of the current incidence rate in Germany of 540 per 100,000 inhabitants published in the German "BAnz AT 20.12.2021 B5".

The checkbox **USE MIDDLE INTERVAL VALUE** considers as defined in the German regulation the mean value of each contour band.

LDEN: 57 dB(A), 62 dB(A), 67 dB(A), 72 dB(A) 77 dB(A)

LNight: 52 dB(A), 57 dB(A), 62 dB(A), 67 dB(A) 72 dB(A) and optionally 47 dB(A

Select the values you want to calculate in the next dialog. According to the standards, IHD can only be quantified for road traffic noise and is therefore deactivated for the other types of noise; the other two values are evaluated for road traffic noise, railway traffic noise and aircraft noise. If you used time slices with the names Lden and Ln in the calculation, they are automatically assigned to IHD, HA and HSD accordingly. If the time slices have other names, select the corresponding time slice.



The resulting columns contain single-number values, that is, the same value for all intervals.

Name	Size [km²]	Interval	EU inhabitant statistics						
			Inhabitants		Dwelling count		IHD	HA	HSD
			Lden	Ln	Lden	Ln	Lden	Lden	Ln
Sample City	39,38	50 - 55	8528	5326	4061	2536	6	3183	587
		55 - 60	8273	2727	3940	1299			
		60 - 65	5481	1040	2610	495			
		65 - 70	2860	126	1362	60			
		70 - 75	1257	2	599	1			
		> 75	178	-	85	-			

If you have selected a Geo-File with several area usages as the calculation base, IHD, HA and HSD are presented for the individual areas. HA and HSD are summed up for the total area, IHD may not be summed up and is calculated separately for the total area. Thus, IHD total is not equal to the sum of IHD in the individual areas.

In the same way, IHD, HA and HSD are presented separately for each group if you have calculated with groups and have checked the group levels in the selection dialog.

You can also calculate the values manually in a receiver table, see Technical Information 22-02-TI_N-EN.pdf.

Notes: Depending on which calculation method you choose for the assignment of inhabitants and dwellings (level of the facade section, level above median, ...), the calculated values will change. A comparison with the result of the receiver table is only possible if you use the same calculation method there.

Likewise, you will get different results for the inhabitant statistics and the area statistics, because facade levels generated from the grid noise map do not necessarily correspond to the calculated FNM levels (e.g. levels from the grid cells interpolated, grid center of a grid cell in a building filled with the lowest surrounding level).

Variant comparisons

You can import several variants of inhabitant or area statistics into an area table and thus create variant comparisons based on the affected inhabitants or areas.

		Statistics		Staistics		Difference		Sum affected occupants				Improvement	
Name	Intervals	Var. 1		Var. 2		Var1-Var2		Var. 1		Var. 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						
	60 - 65	696	303	467	245	-229	-59						
	65 - 70	476	76	430	126	-46	50						
	70 - 75	193	-	233	-	39	-						
	> 75	-	-	21	-	21	-						

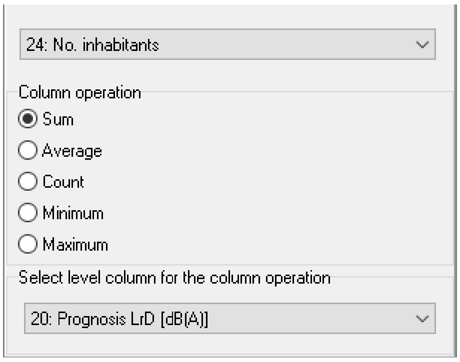
To link different statistics together, select the column type **TABLE | ADD COLUMN | INTERVALS**. To compare the effectiveness of different measures, it is not necessarily advisable to compare the individual intervals, since there are partial shifts between the intervals. For this reason, you can also determine the total number of people affected by a variant. In a value column, enter the formula SUMX*statisticsscolumn* (no blanks permitted).

Level statistics

In an area table, the content of a column from an immission sort table can be read in as level statistics via intervals or thresholds in order to evaluate values from an immission sort table. Call up an immission sort table via **FILE | ADDITIONAL COLUMNS | ADD LEVEL STATISTICS** and select which column is to be evaluated. In addition, you must

11

specify a **LEVEL COLUMN** from which the necessary information for the assignment to the level ranges is retrieved.



Then select how and in which level ranges the level statistics should be calculated. See "Statistics settings", page 507.

You can insert multiple level statistics in sequence in the area table, for example to show the influences of the different noise types for a total noise assessment.

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

Affected area analysis

The calculation basis for an annoyance analysis is a Facade Noise Map.

Additional necessary information

The calculation basis for an annoyance analysis is a Facade Noise Map.

Supplementary Necessary Information

For an annoyance analysis, add additional information to the building properties (e.g. number of inhabitants, 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 inhabitants per building, but you can also use the number of inhabitants 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

Create a new receiver table and load the results file. Call **FILE | ADD ADDITIONAL COLUMNS | COLUMNS WITH FURTHER INFORMATION,** choose the information that shall be added, then select a situation that includes the buildings.

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 m² floor area, create a value column and enter the formula "x25/40;" to obtain the number of inhabitants 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 inhabitants per building"
ELSE 0;

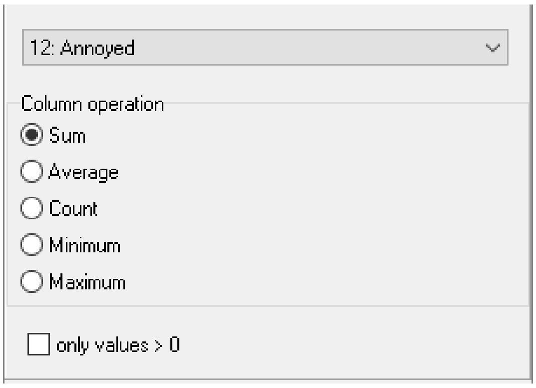
to calculate the number of inhabitants per building.

Use **TABLE | TABLE STATISTICS** to show the affected people for the whole area.

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 inhabitants 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:



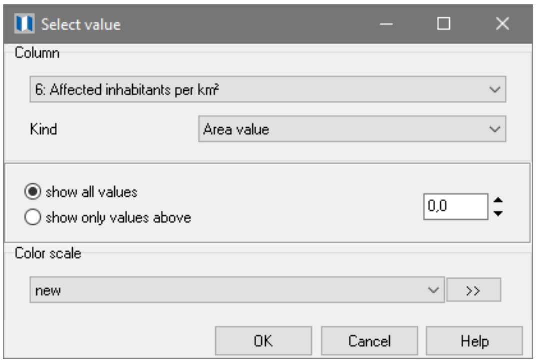
Select if only values > 0 should be loaded.

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 km²).

Create another value column and enter the appropriate formula:

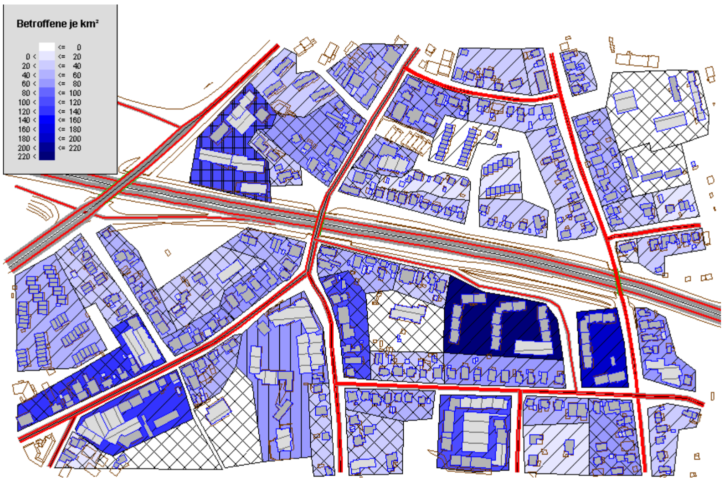
Column “affected people" / Column “size of the building block in m²" * 1000000;

Call the Graphics, load the situation and select the file type **AREA MAP (CONFLICT MAP)** in the file selection manager.



Select the column you want displayed. Additional selections are possible.

The result "affected people per km²" might appear as:

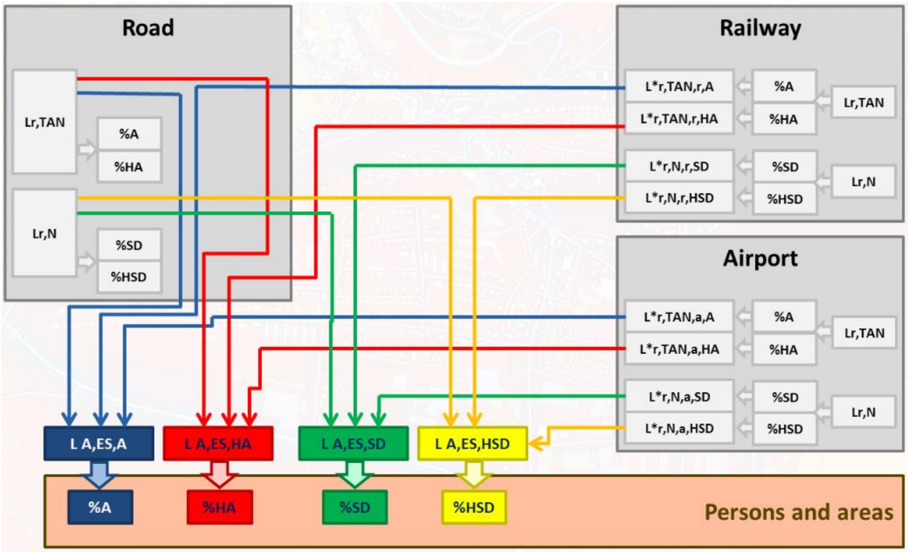


Total noise assessment according to VDI 3722-2

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", see also "Hotspot calculation" (page 269).

General procedure:

- 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, see also "Level statistics" (page 511).
- Definition of a noise indicator for the graphical presentation (hotspots) and to facilitate a ranking.



Flowchart

Formulas for the implementation of VDI 3722-2

For the implementation of the VDI 3722-2 file operations and the SoundPLAN Spread-sheet 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 (total), MOD=modified (see "Modified formulas" (page 516)), TOTMOD=total modified.

(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 Calculation core or Graphics (result of Grid noise map 601, time slice1 (Lden /Lr,TAN)). The renormalized substitution level results from a grid operation. The result is therefore indicated in the formula with RGOP.

% 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,x3)	VDI3722_HA_totmod(x1,x2, x3)	VDI3722_SD_totmod(x1,x 2,x3)	VDI3722_HSD_totmod(x1,x2, x3)

Backward calculation the renormalized 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,x3)	VDI3722_ES_HAmod (x1,x2,x3)	VDI3722_ES_SDmod (x1,x2,x3)	VDI3722_ES_HSDmod (x1,x2,x3)

For formulas adding up the total noise and for the calculation of the effect related sub-stitution 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.

Modified formulas

We recommend 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 ≤ L,r,TN ≤ 75 dB and for aircraft noise in the zone 37 dB ≤ L,r,TN ≤ 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 ≤ L,r,N ≤ 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 via file operations in the Calculation core

Go to the Calculation Kernel and select as **CALCULATION TYPE** Tools - grid operations or FNM operations. Enter the desired time slices.

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

To enter and later edit the formulas click on the edit symbol and activate the check box **EXTENDED**.

%Highly annoyed road (formula for row 1)

Formel editieren — Suchen + Ersetzen...

```
VDI3722_HAstreet(RKL101:1);
```

%Highly annoyed with modified formulas (formula for line 4)

Formel editieren — Suchen + Ersetzen...

```
VDI3722_HAtotmod(RKL101:1, RKL201:1, RKL301:3);
```

Hotspots via noise indicators

For the presentation of the noise indicators you need a Spreadsheet (receiver table), calculate the total 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.

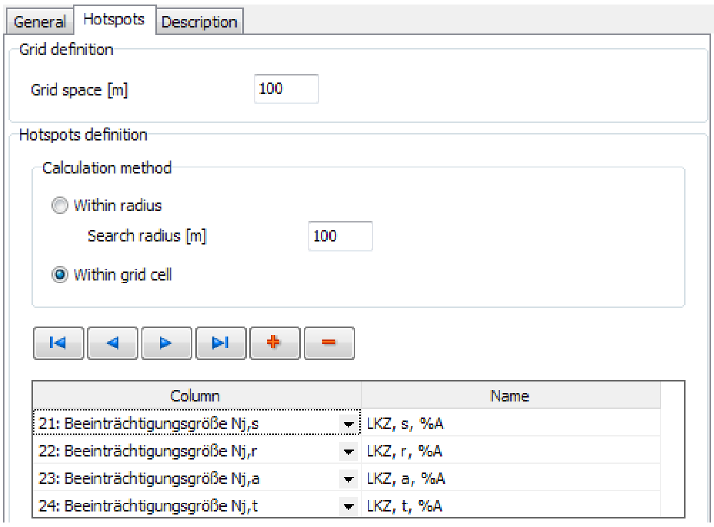
Generate a **Spreadsheet** (receiver table) and load the results of the Facade Noise Map. Calculate the annoyance and load additional columns with the number of inhabitants per facade and floor or the number of inhabitants per receiver. With the formula "Annoyance x number of inhabitants " you can calculate the annoyance factor Nj.

	Straße	Schiene	Flug	Annoyance				Renormierter Ersatzpegel		Efektb. Sub.Pegel	Beeinträchtigungsgröße			
Nr.	LTAN,s	LTAN,r	LTAN,a	%HA,s	%HA,r	%HA,a	%HA,t	L*r,TAN,r	L*r,TAN,a	LA,ES	Nj,s	Nj,r	Nj,a	Nj,t
	[dB(A)]	[dB(A)]	[dB(A)]	[%]				[dB(A)]	[dB(A)]	[dB(A)]				
Anzahl Einwohner: 35.179,31														
Beeinträchtigungsgröße	Nj,s: 2.263,2	Nj,r: 250,1		Nj,a: 507,7		Nj,t: 2.655,0								
Anzahl Einwohner: 5,45														
Beeinträchtigungsgröße	Nj,s: 0,3	Nj,r: -		Nj,a: 0,2		Nj,t: 0,4								
4	53,7	34,7	47,5	5,6	0,0	2,8	6,2	-	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	6,0	-	48,1	54,3	-	-	-	-
9	53,9	38,7	47,6	5,7	0,0	2,9	6,4	-	48,2	55,0	-	-	-	-
10	54,7	37,6	47,6	6,2	0,0	2,9	6,8	-	48,2	55,6	-	-	-	-
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

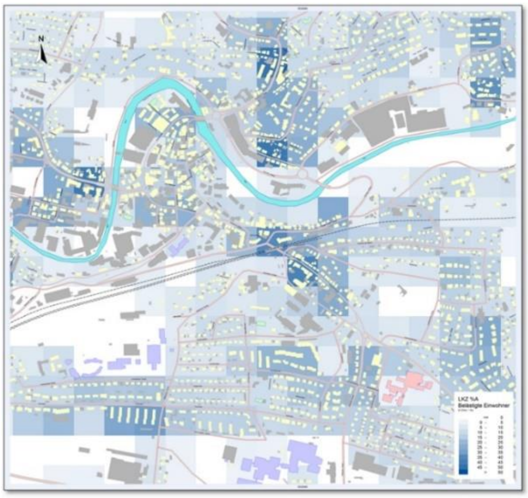
Go to the **Calculation core** and select the **CALCULATION TYPE** "Tools - Hotspots". In the tab "*General*" click on the double arrow next to **DATA** and enter the Situation with the buildings and inhabitants, a calculation area and the Spreadsheet. For the presentation in 3D you also need a DGM.

Select the columns of the Spreadsheet that shall be used to calculate the Hotspots.



For this type of hotspot calculation, it is important to use the calculation method **WITHIN GRID CELL**, which corresponds to a summation per grid cell.

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.



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 with 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 receivers 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 “GeoTools/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 attribute 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.

12 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 Industry

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 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 highlight-

ing the source marked in the source list (active source) in the top right-hand window.

- o Day histogram of the noise level at the receiver
  Day histogram of the sources
  Day histogram of source contributions to the receiver
- o Sound pressure spectrum at the receiver
  Spectrum of the source
  Spectrum of the source contribution
- o 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)
- o List of noise control measures
- o Ranking of the noise control measures
  Noise control cost/performance diagram

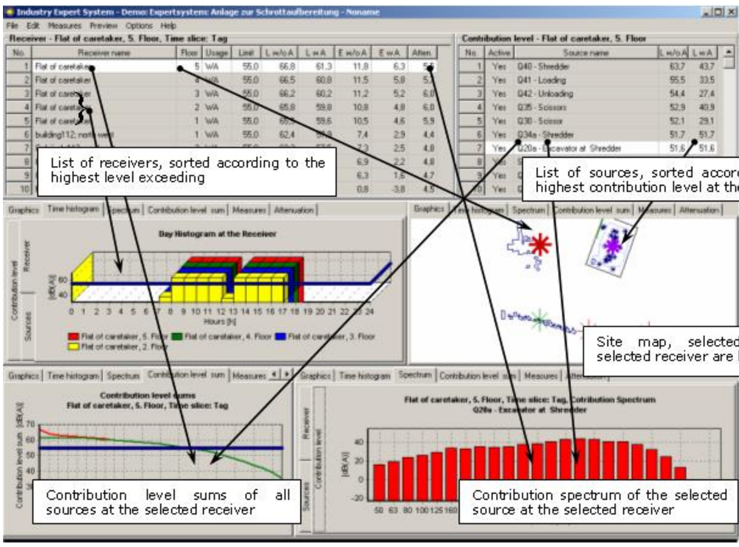
- The layout of the diagrams (diagram type, colors, title of the axis) can be customized via **OPTIONS** | **DIAGRAM SETTINGS** or via a right click on the diagram.
- To generate a noise control concept, noise control options are assigned to the sources in the noise control measures list: left click 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 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 **OP-**

TIONS | 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 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.

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 with their contribution at the receiver highlighted in the receiver list. You can search for a source in this list with ***Ctrl+F***.

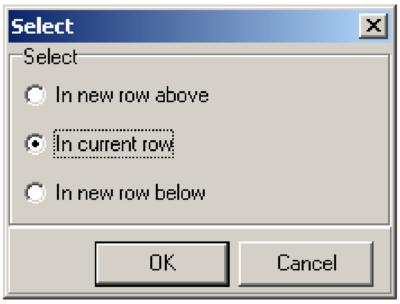
If groups have been assigned to the sources, it is possible not only to assign attenuations to individual sources but also to the group itself. Switch the display in the source contribution list in **PREVIEW** (or via right clicking):

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) right click on the window and then | **ADD DETAIL WINDOW.** In the following dialog select where the new window shall be inserted.

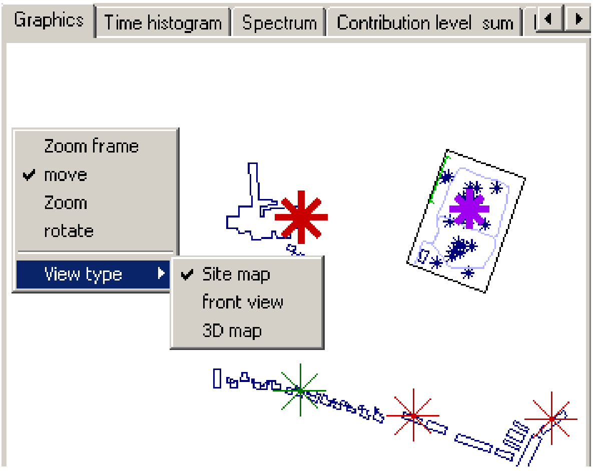


When no longer needed close the additional windows again by right clicking and selecting | **REMOVE DETAIL WINDOW**.

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

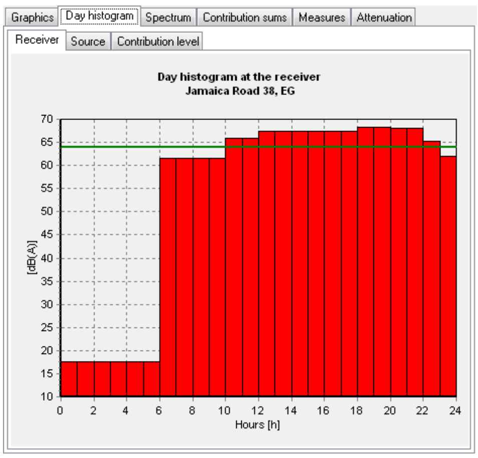
You can display the geometry data in a top view as a frontal projection or as a 3D projection. To switch between the display modes right click on the graphics picture and in the select the **VIEW TYPE**. If the view type is “front view” or “3D map” there is an additional choice to define the **DRAW TYPE** 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

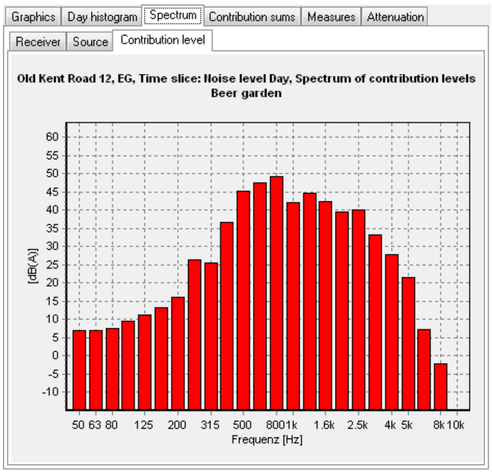
In the diagram type for the day histogram there are 3 tabs on the left side of the diagram allowing the display to switch between the day histogram at the receiver (receiver) or to view the day histogram of the sound power (source) or the contributions at the receiver.



Spectrum

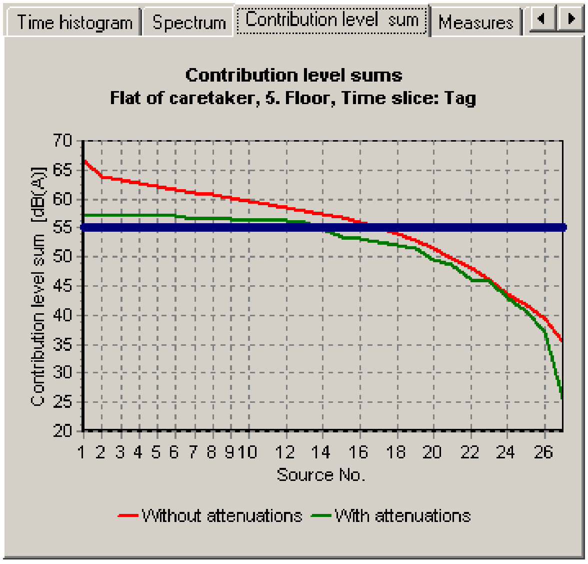
With the 3 tabs on the left side of the spectrum diagram you can select the view to represent the spectral information at the receiver caused by all sources (receiver) or the sound power spectrum of the highlighted source (source) or the contribution of the highlighted sources at the receiver.

12



Contribution Level Sum

For a quick overview of potential noise control measures the diagram with the progressive addition of the sources is very helpful.



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.

12

Measures and mitigation

See "Preparation of a noise control concept" (page 526).

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.

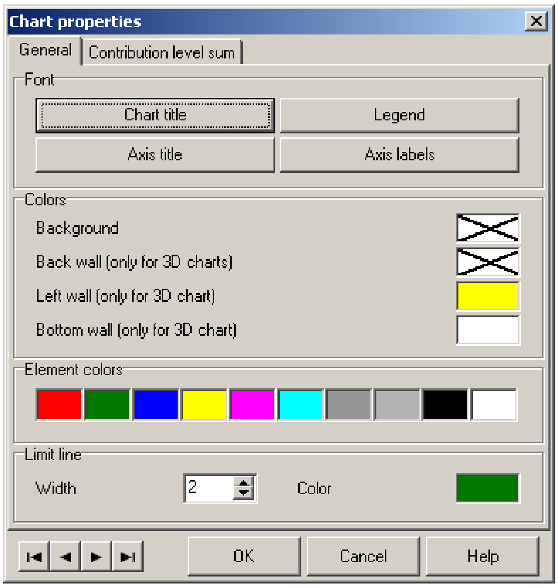


Diagram properties with general settings

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.

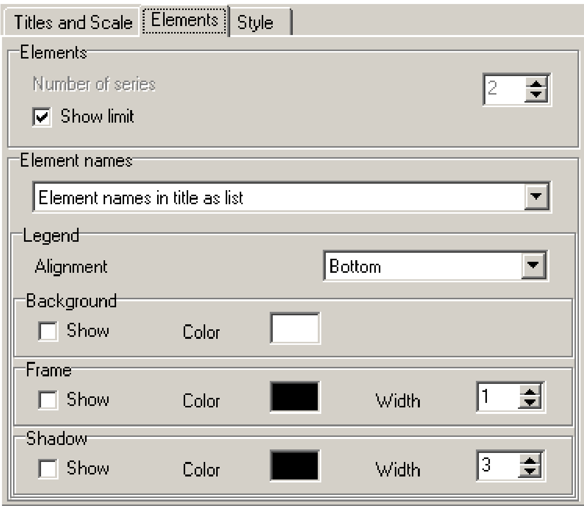


Diagram properties for individual diagrams

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

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. Furthermore, the **DATA POINTS** can be switched on/off (not available for bar diagrams).

You can copy the individual diagrams via right mouse button | **COPY DIAGRAM TO CLIPBOARD** into other applications, for example a Word document.

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.

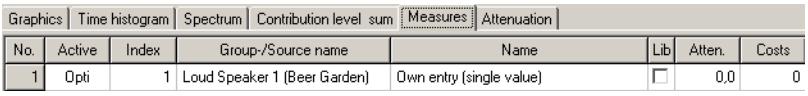
Optionally you can set the program in **OPTIONS | DO OPTIMIZATION WITHOUT COSTS** to only evaluate the noise control potential without taking the cost into account.

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.

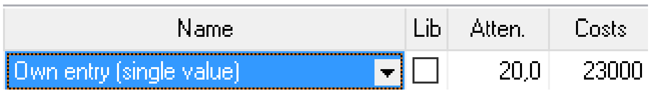
Assign noise mitigations

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"**.



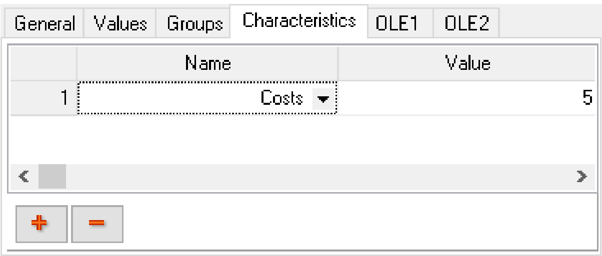
Add a measure for a single source or group

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.



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:



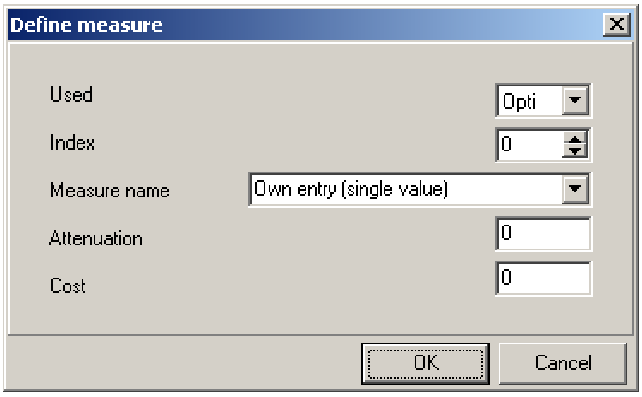
Entry of the cost in the attenuation library

Pick the measure in the Expert system in the window measure from the lib list.

12

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.



Predefine measures assigned to multiple sources

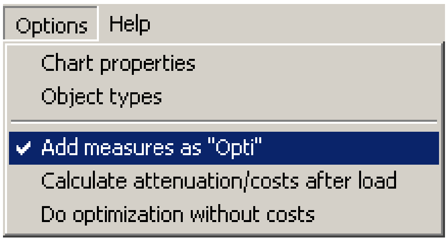
Enter the dialog if you want to have the same measures for multiple sources or skip this phase by clicking on the **OK** button. If you skip the definitions here you still can assign the measure manually or select the library elements.

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.



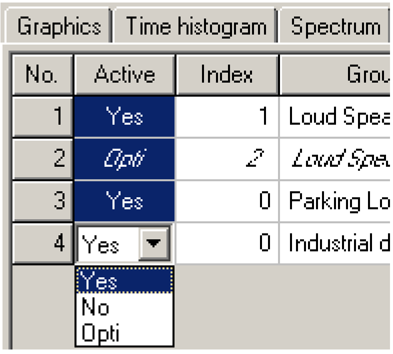
In this case the measures and costs are not accounted for immediately but only in the process of the optimization. The difference due to noise control measures is accounted for in the noise level at the receiver and at the contribution table. If there are measures that have been determined to be undertaken in any case, it may be beneficial to switch the status from „**OPTI**“ to „**YES**“.

12

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“.



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.

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.

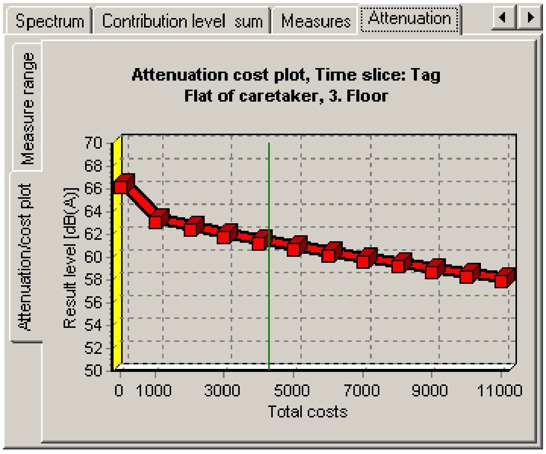
Meaning of „Index“: For a source only measures having the same index can be used simultaneously, measures with different index numbers are mutually exclusive. Exception: Index 0 can be combined with and other index.

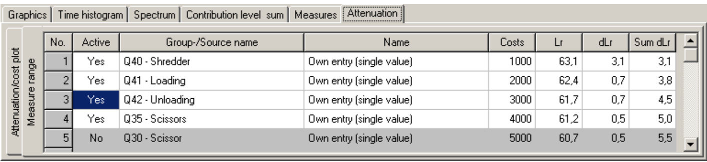
Alternative measures: If you have multiple different fan types to choose from you ultimately want to have only one selected, so the measures are mutually exclusive. Fan a can have the index 1, fan B the index 2... If the optimization finds fan B to have the best ratio of cost to performance all other 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).





No.	Active	Group-/Source name	Name	Costs	Lr	dLr	Sum dLr
1	Yes	Q40 - Shredder	Own entry (single value)	1000	63,1	3,1	3,1
2	Yes	Q41 - Loading	Own entry (single value)	2000	62,4	0,7	3,8
3	Yes	Q42 - Unloading	Own entry (single value)	3000	61,7	0,7	4,5
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.

No.	Active	Index	Group-/Source name	
1	Opti	1	Loud Speaker 1 (Beer Garden)	Own entry
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.

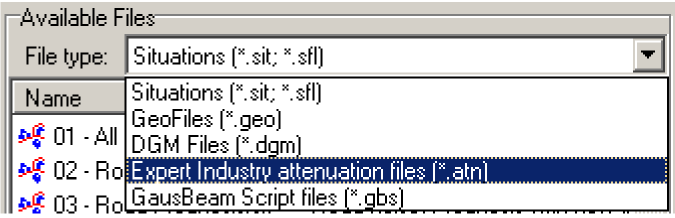
By right clicking on one of the detail windows you also can select the option **COPY USED MEASURES TO CLIPBOARD** to move your data into other programs and format the printout there

Hint: Only measures containing the „yes" status are printed and moved to the clip-board, 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.



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.

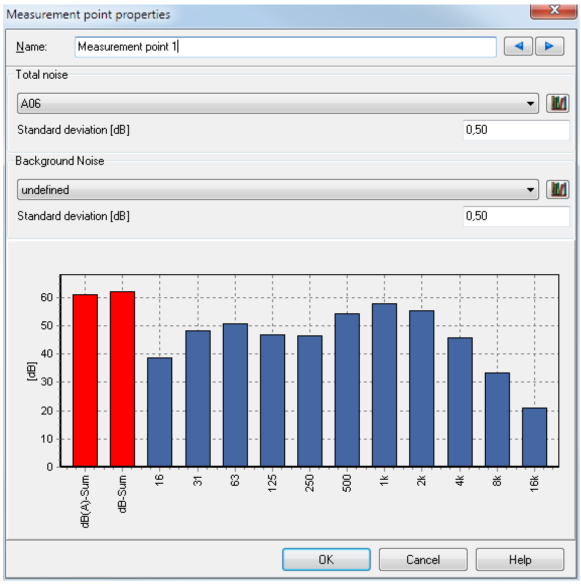
Caution: A new calculation run will overwrite the results in the result files, so if the noise control concept shall be accounted for it must be added to the calculation as a *.atn file!

Calculate sound power from measured data

First import the spectrum measured at a measurement point into the emission library with **file | Import**.

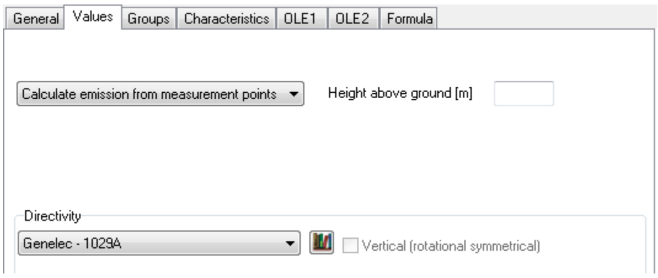
Digitize or import the location (x,y) and height (z) of the measurement points. There is no upper restriction of the measurement points, but as a minimum, you need at least as many measurement points as you have "unknown" sources that you want to evaluate. Select the object type **measurement point** from the Geo-Databases tool tab.

12



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**.



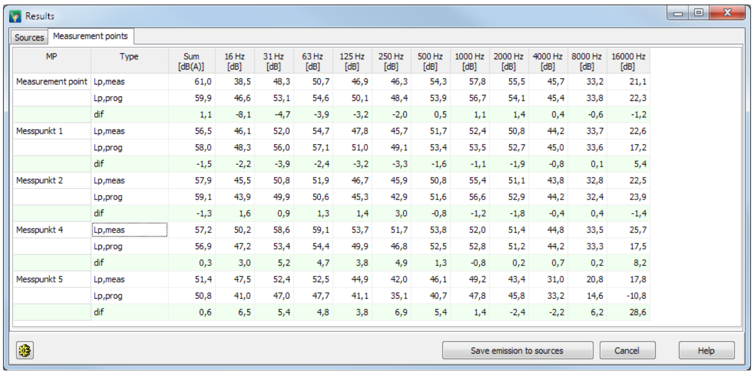
The fact that the sound power is calculated from measurement points is made visual with the symbol measurement point in the Graphics. The day history does not apply to these sources.

If multiple sources entered in the Geo-Database refer to the same library element that has the attribute „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.

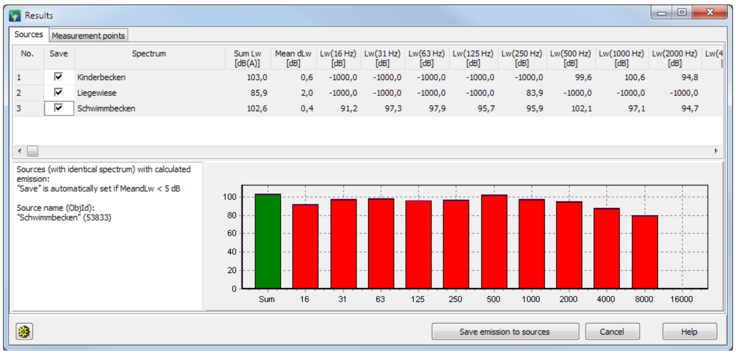
Start the calculation of the sound power spectra with **Tools | Calculate source emissions from measurement points**. After the calculation a dialog opens with a full documentation of the results.

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	Type	Sum [dB(A)]	16 Hz [dB]	31 Hz [dB]	63 Hz [dB]	125 Hz [dB]	250 Hz [dB]	500 Hz [dB]	1000 Hz [dB]	2000 Hz [dB]	4000 Hz [dB]	8000 Hz [dB]	16000 Hz [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.



No.	Save	Spectrum	Sum Lw [dB(A)]	Mean dLw [dB]	Lw(16 Hz) [dB]	Lw(31 Hz) [dB]	Lw(63 Hz) [dB]	Lw(125 Hz) [dB]	Lw(250 Hz) [dB]	Lw(500 Hz) [dB]	Lw(1000 Hz) [dB]	Lw(2000 Hz) [dB]	Lw(4
1	☑	Kinderbecken	103,0	0,6	-1000,0	-1000,0	-1000,0	-1000,0	-1000,0	99,6	100,6	94,8	
2	☑	Liegewiese	85,9	2,0	-1000,0	-1000,0	-1000,0	-1000,0	83,9	-1000,0	-1000,0	-1000,0	
3	☑	Schwimmbecken	102,6	0,4	91,2	97,3	97,9	95,7	95,9	102,1	97,1	94,7	

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.

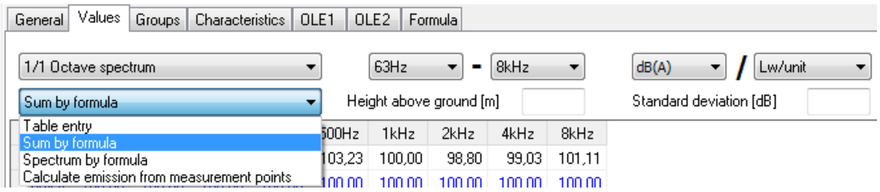
The formulas are entered in the emission library, the technical parameters are defined and set to default values. These values can be overwritten in the entry of the sources in the Geo-Database so that a general formula becomes specific to this case only with the entry of the source attributes.

12

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,m²).

As a next step, select from the lower selection list **SUM BY FORMULA** or **SPECTRUM BY FORMULA**.



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

Variables have

- A **NAME** how they appear in the formula

- A **UNIT** (except for local variables)
- A **TYPE**:
  - Float: real numbers with a decimal
  - 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“)
  - 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

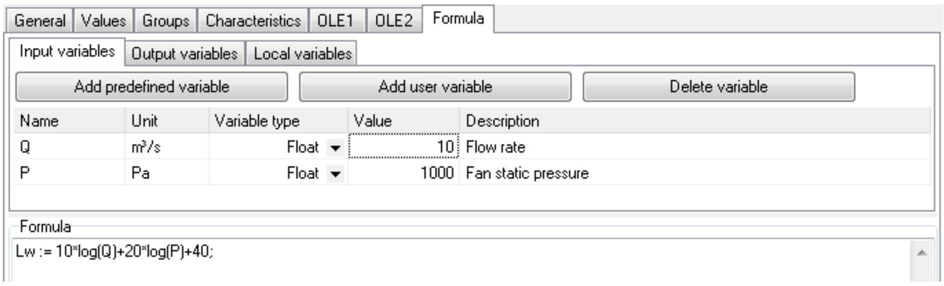
The sound power of a fan depends on the flow rate Q [m³/s] and the pressure difference P [Pa]:

Lw = 10*log(Q) + 20*log(P) + 40

Entry in the emission library

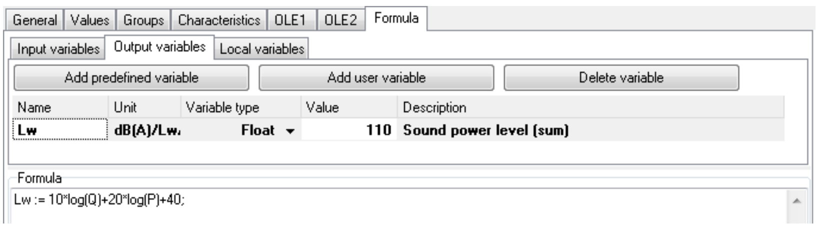
Request a new library element in the emission library and give it the name "Fan". Under the tab *value* set the boundary parameters. Select the data entry type **SUM BY FORMULA**.

Open the tab *Formula*.



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, 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 O*utput variable*; the pre-define output variable Lw is automatically set.



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 "Creating formulas - commands and keywords" (page 327)

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.

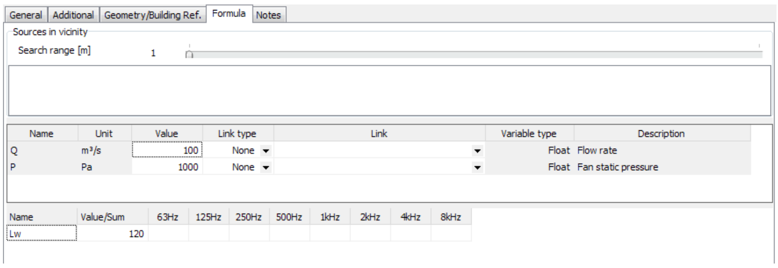
From the formulas and parameters we see:

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 attributes will open a new tab with the label *Formula*.



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.

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.

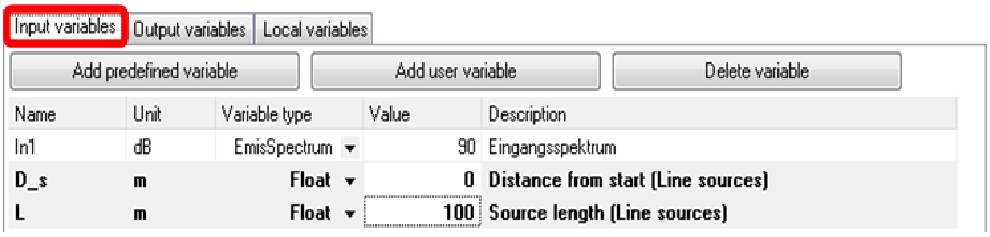
Source entry example 2

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:



Own input variables:

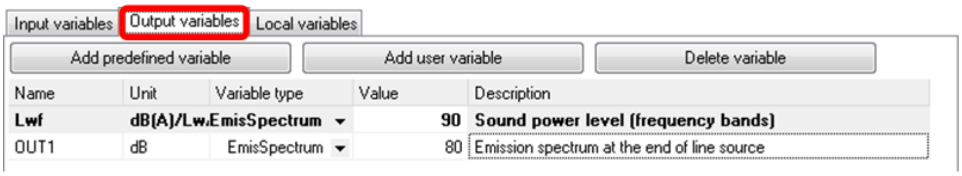
Name = IN1; Unit = dB; Type = Emisspectrum; Default value = 90; Description = Input spectrum

Predefined variables Input variables:

Name = D_s; default value = 0

12

Name = L; default value = 100

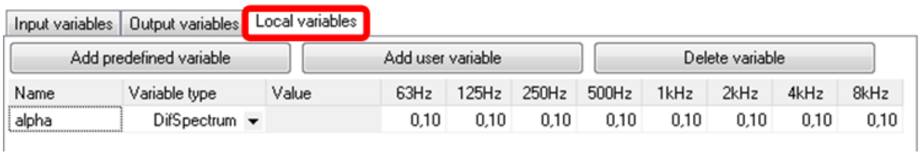


Predefined output variables:

Lwf: spectral emission level;

Own output variables:

Name = OUT1; Unit = dB; Type = Emisspectrum; Description = Emission spectrum at the end of the line source



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.

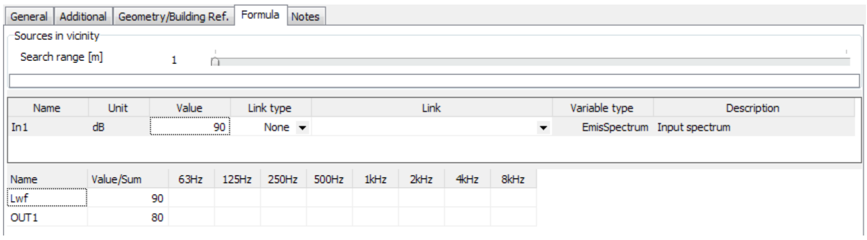
With the default values we get for OUT1:

OUT1 = IN1 - alpha * L = 90 – 0.1 * 100 = 80

The formulas are evaluated for each frequency. The shown value 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".



In the tab *Formula* the variable IN1 is entered for both sources from the library definition.

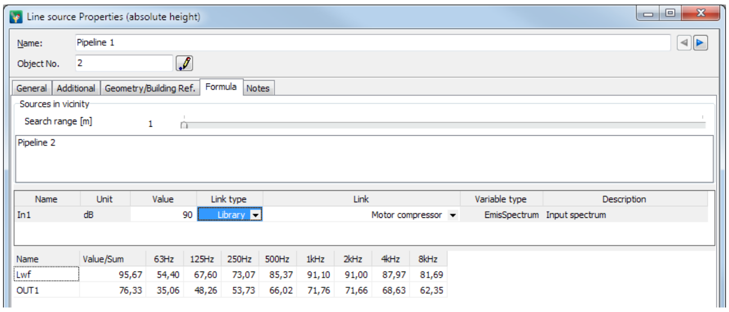
In the footer you will see an error message as the program expects a link:

Error in calculation of formula "Spectrum affords link, variable: In1"!

This link first has to be defined.

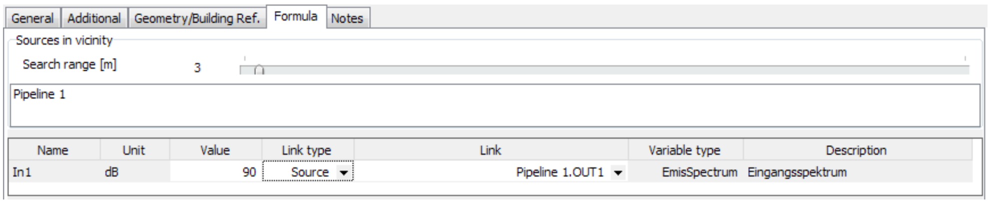
For the source "pipe 1" the input variable IN1 is set as a link to the emission spectrum of the library. For this the column link type must be set to „Library “. Now you can select any emission spectrum that was not defined as a spectrum by formula.

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.



As soon as the link is established the entry in the column "value" is ignored.

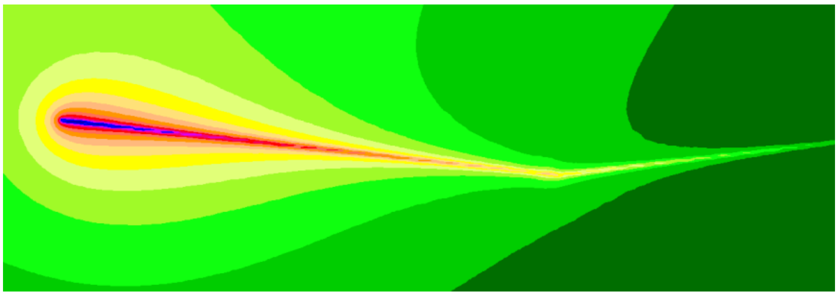
For "pipe 2" the variable for IN1 is set to the emission spectrum OUT1 from the last source. To do so the column link type is set to „source". Now you can choose from all output variables of the correct type for all sources that are presented in the window **SOURCES IN THE VICINITY**. If the source you 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.



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.

Result in a grid noise calculation:



12

13 Noise at Workplace

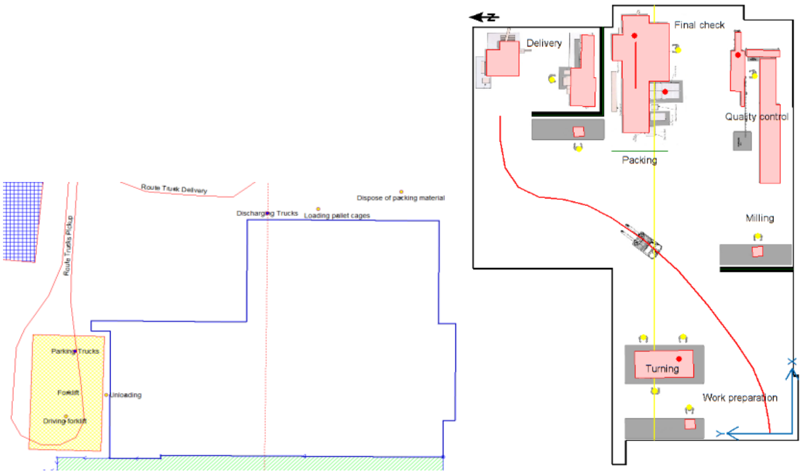
General

Noise at Workplace is a powerful tool for calculating and documenting the noise exposure to which workers at the various workplaces are exposed over the work period. The graphical representation of the situation helps in assigning the workplaces to the workers. One worker can be assigned several workstations, which can be either indoor or outdoor. The duration of the work at each workstation is determined 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 Workplace are developed, convert this module into a separate module with its own price. But this will not happen within one program version.

Pre-calculation

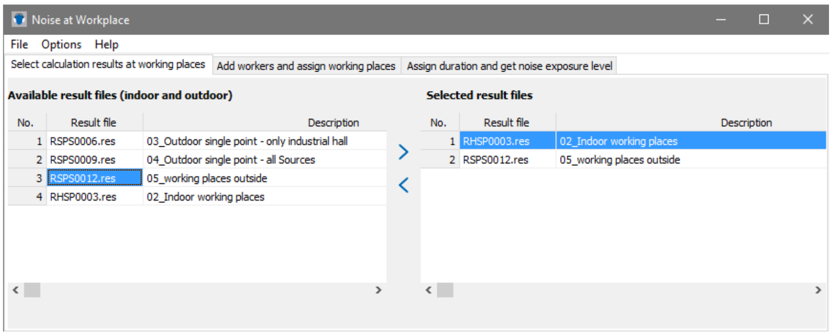
To prepare the assessment of the noise exposure for workers, the sound pressure level for all workplaces must be calculated. Each workplace is represented by a receiver.



For workplaces outside please calculate the single receivers for environmental noise outside, for workplaces in a factory building an Indoor Single Point calculation is required.

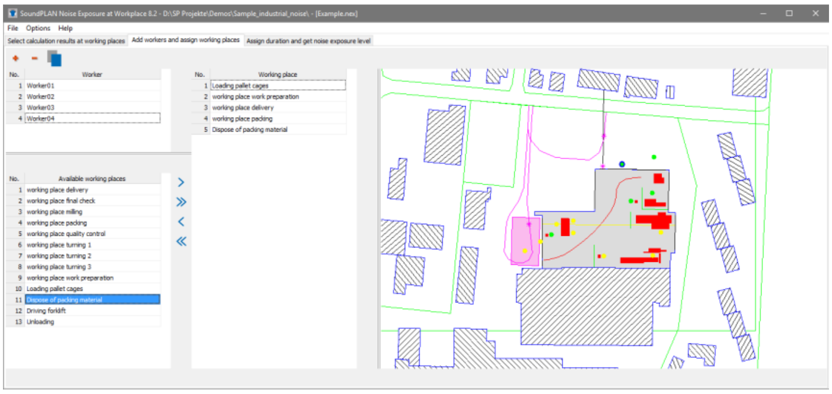
Assessment of the noise exposure

After the pre-calculation for the workplace, start Noise at Workplace from the SoundPLAN Manager **EXECUTE | NOISE AT WORKPLACE**.



In the tab *selected calculation results at working places* 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 working places*.

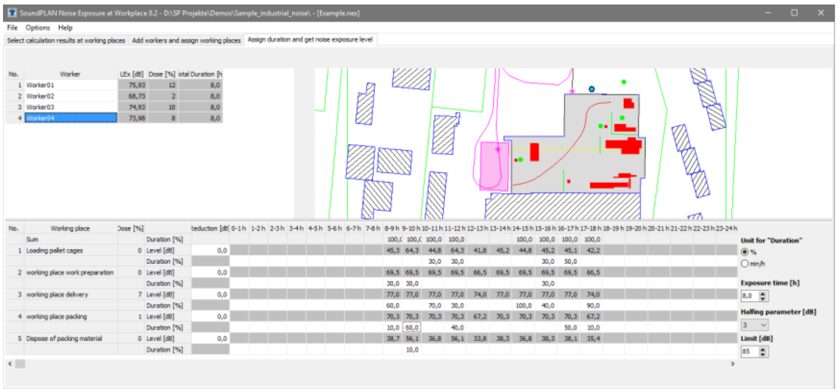


The top left offers a red + to add additional workers. With a click „worker01" is highlighted in blue, you can now assign a new name to this worker.

In the lower list the workplaces (activity, job) from the assigned calculation results are listed. Assign the activities over the course of the working day to the workers at the various workplaces. 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 workplaces assigned to the worker in green, workplaces not assigned to the highlighted worker are presented in yellow. With a double click on a workplace you can also assign this workplace to the active worker.

The assessment of the noise dosage is done under the tab *assign duration and get noise exposure levels*.



The table on the bottom contains a list of all workplaces assigned to individual workers along with the sound pressure levels found at these workplaces. For each worker, the proportional work time is listed for each workplace for each hour.

13

Set the **DURATION** to min/h or %. Additionally, assign a noise reduction for example to accommodate workplaces 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 workplaces 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.

14 Noise allotment

Introduction

Based on DIN 45691 and ÖAL 41, this module offers the possibility 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:
  - 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.

Working on a noise allotment in SoundPLAN

Only one noise allotment can be saved for each pre-calculation, so that all parts belonging to one scenario (pre calculation, noise allotment and grid noise map) can be clearly identified via a unique result number. If you want to calculate variants, copy the pre-calculation calculation run in the calculation core, calculate it and perform the contingency with this copy.

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.

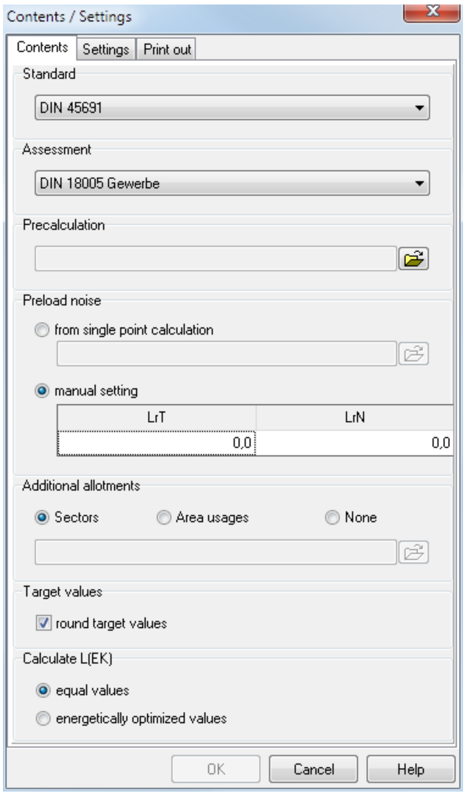
After the definitions open the **Calculation core** and carry out a pre-calculation.

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**.



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.

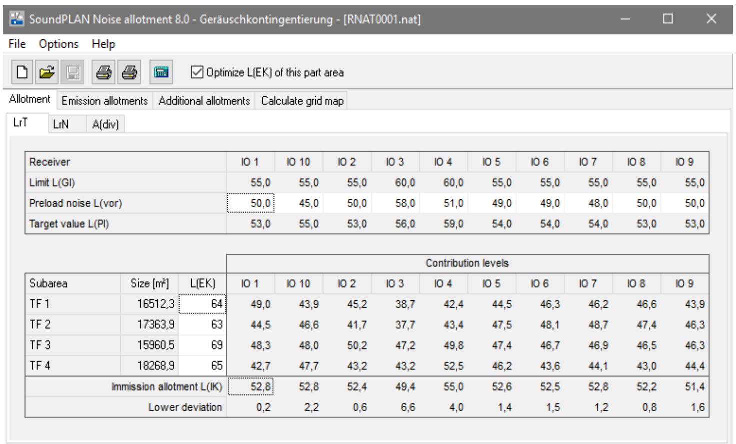
The additional contingents are assigned to the areas instead of the sectors. If multiple receivers are located in an area, the program will use the lowest additional contingent.

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



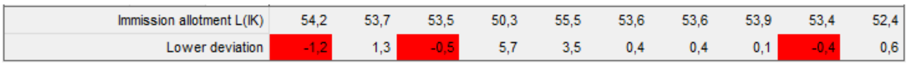
Receiver	IO 1	IO 10	IO 2	IO 3	IO 4	IO 5	IO 6	IO 7	IO 8	IO 9
Limit L(GI)	55,0	55,0	55,0	60,0	60,0	55,0	55,0	55,0	55,0	55,0
Preload noise L(vor)	50,0	45,0	50,0	58,0	51,0	49,0	49,0	48,0	50,0	50,0
Target value L(PI)	53,0	55,0	53,0	56,0	59,0	54,0	54,0	54,0	53,0	53,0

			Contribution levels									
Subarea	Size [m²]	L(EK)	IO 1	IO 10	IO 2	IO 3	IO 4	IO 5	IO 6	IO 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 allotment 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.



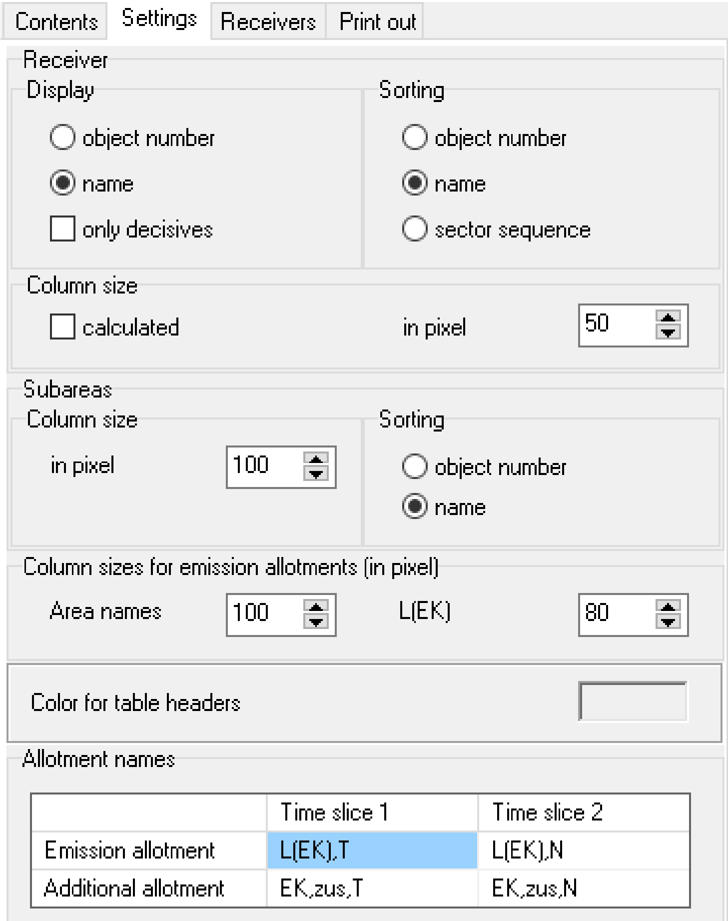
Immission allotment L(IK)	54,2	53,7	53,5	50,3	55,5	53,6	53,6	53,9	53,4	52,4
Lower deviation	-1,2	1,3	-0,5	5,7	3,5	0,4	0,4	0,1	-0,4	0,6

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.

Settings



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**.

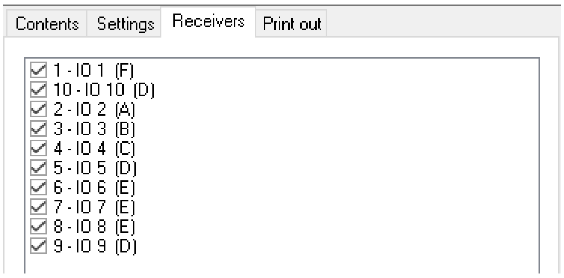
To make the tables fit the screen or printout if many receivers or many part areas are present, you can specify the **COLUMN SIZES** in pixel for receivers. part areas, and emission allotment. In addition, you have the option to let the software automatically determine the column width for the receiver 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

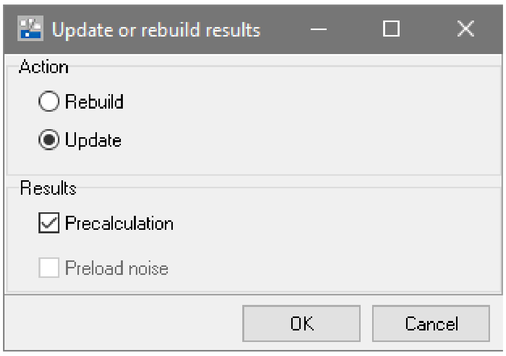
Individual receivers can be excluded, if there are too many receivers in the allotment table.



Open **OPTIONS -> SETTINGS** and click on the tab index card *Receivers*.

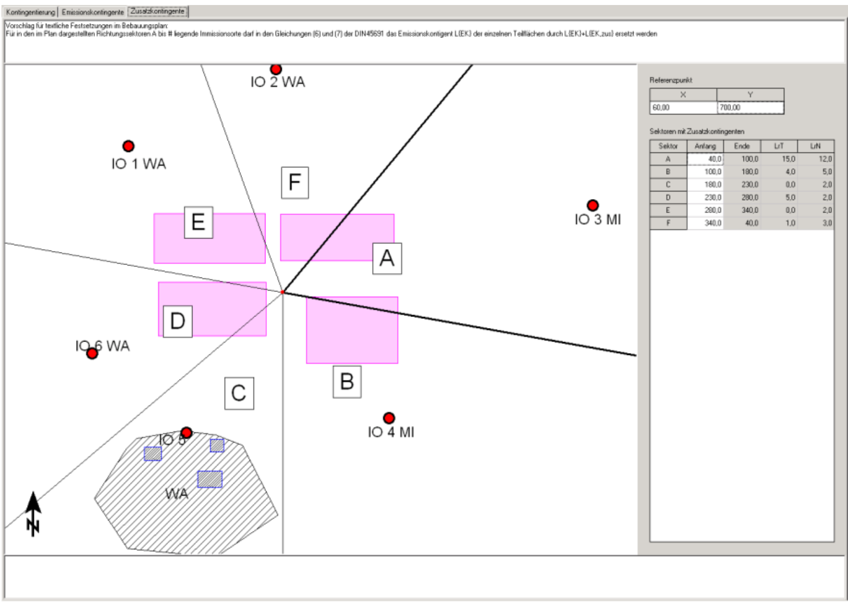
Update results

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***.



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 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).

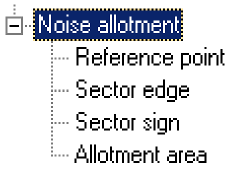
Additional information you could have entered in the Geo-Database (buildings, areas) is shown in the graphical representation in the tab "additional contingents".

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.



Calculation of Grid Noise Maps

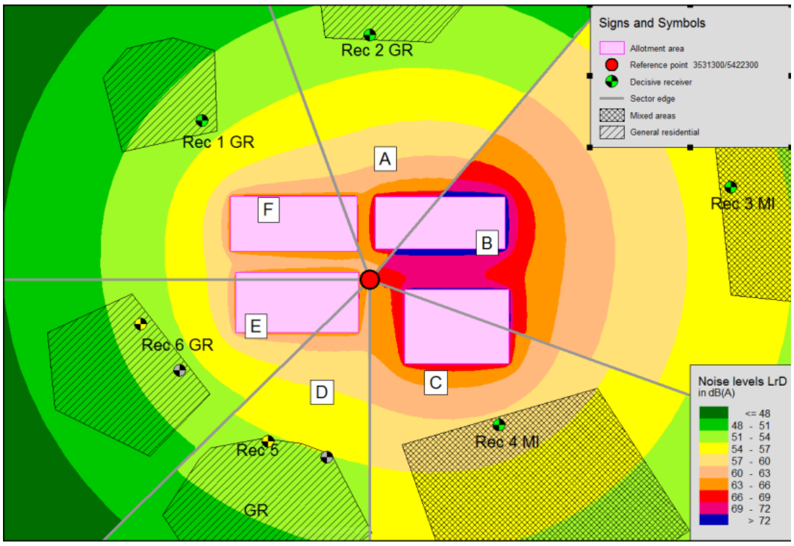
Once the Noise Allotment is finished you can calculate a Grid Noise Map using the allotment results. In order to simplify the handling, the grid noise map is saved under the same number as the pre-calculation and the allotment.

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.

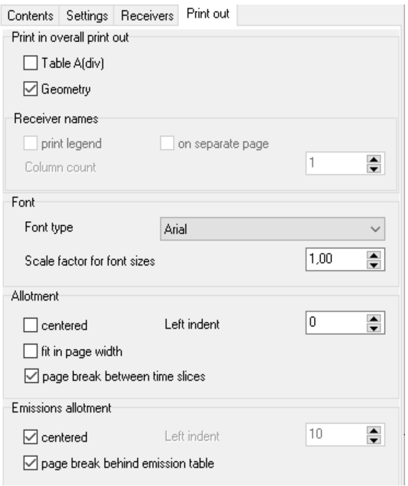


Further processing of the results

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”:



The table A(div) and the geometry can optionally be printed.

The receivers must all fit next to each other on the page for printing. Use the options to optimize the column widths, to specify object number instead of receiver name and to scale the font sizes. If the receiver names are displayed via the object number, a legend with the receiver names assigned in the Geo-Database can also be printed.

For the allotment table and the emission allotments, you can specify how to display the tables. If the subareas do not all fit on one page, a page break is automatically inserted. If there are only a few partial areas, it may be sensible to omit the page break between the time slices. If there are only a few subareas, emission allotments and additional allotments can be printed on one page.

Additionally, you can access the tables directly via **FILE | COPY TO CLIPBOARD.**

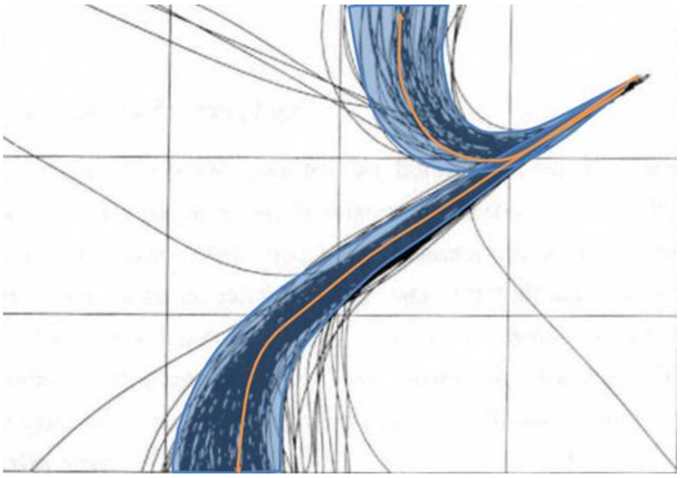
15

15 Aircraft noise

General

The emission data for aircraft noise calculations can be available as user-defined flight tracks (backbones) and as imported radar tracks. Flight tracks are usually created in coordination with the airport and reflect the actual flight operations in an abstract form. They can be used to analyze existing situations, but also to forecast a future situation. The use of radar tracks is only possible for past situations, but it offers considerable advantages, as there is only a minimum of modeling effort.

For aircraft noise calculations a DGM is necessary in most cases as a basis, and a project coordinate system should generally be defined.



Radar tracks and backbones

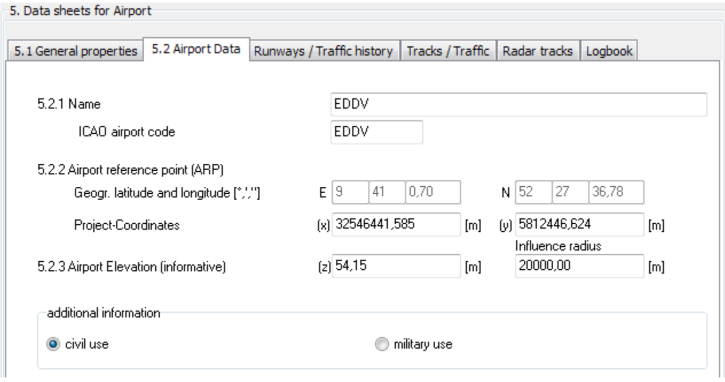
The calculation of aircraft noise based on flight tracks is available for all calculation standards that SoundPLAN has implemented. The direct simulation with recorded radar tracks is only offered for the standards AzB 2008, ECAC Doc 29, 3rd edition, 4th edition and CNOSSOS-EU.

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.

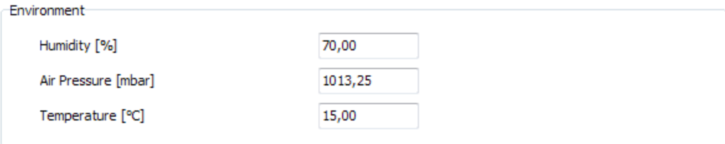
The airport elevation for calculations in accordance with the AzB 2008 and the DIN 45684-2012 only have informative character and will not be used in the calculation as runways for take-off and landings are automatically placed on top of the DGM.

15

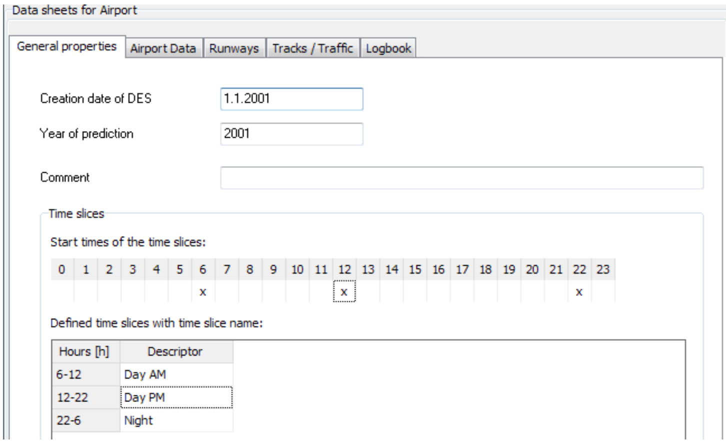


The airport usage for civil / military is only available for the AzB 2008, for other standards this is irrelevant.

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.



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.

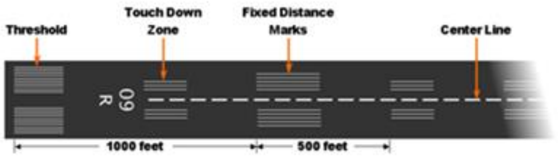


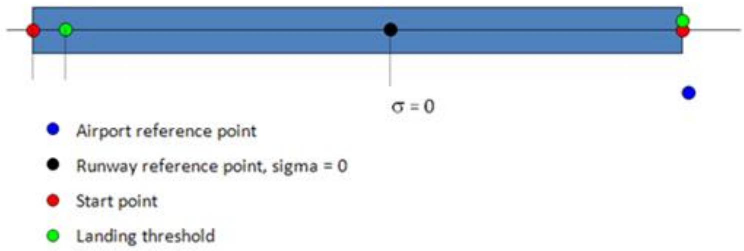
You can define up to 24 time slices, i.e. one time slice for every hour of the day. An **X** for the respective hour for **START TIME OF THE TIME SLICE** marks the beginning of the time slice. The time slices are listed in the table below. Enter the respective **DESCRIPTOR**.

! 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.

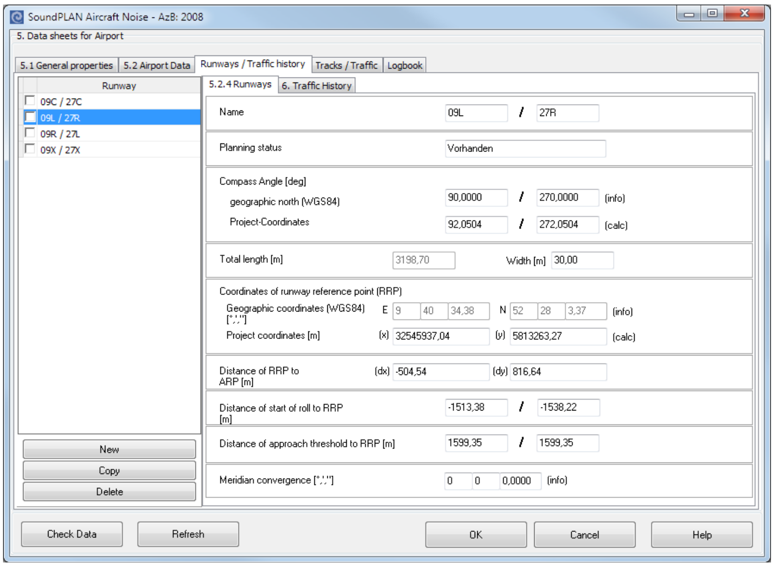
15

Runway for starts and landings

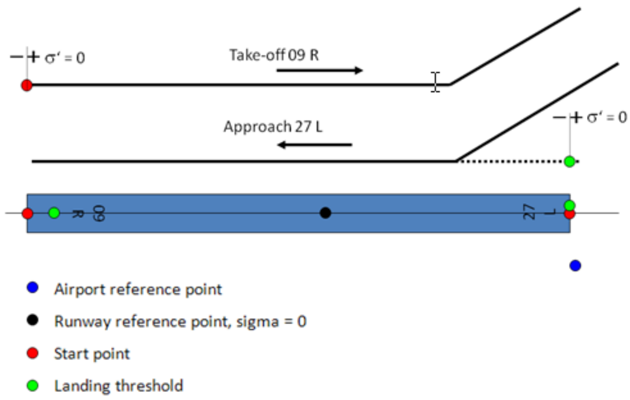




Runways for take-off and landings can be either digitized graphically with the runway reference point or via the aircraft noise definition screen with the tab *runways/ traffic history*.



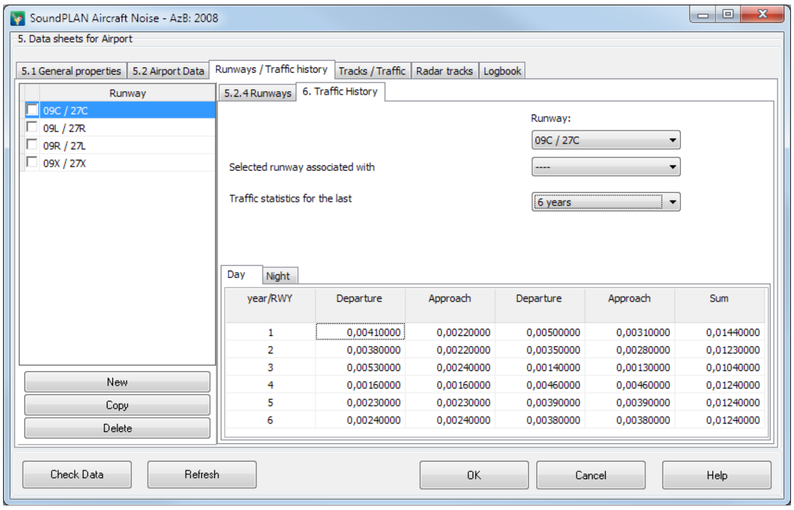
Additional runways can be generated via the list on the left, can be copied or deleted. In SoundPLAN each runway is associated with two directions of departure and approach, therefore with 4 different operational configurations In the presented example there is start and approach for the directions 09 (to the east = 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.



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 σ. 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 with 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*.

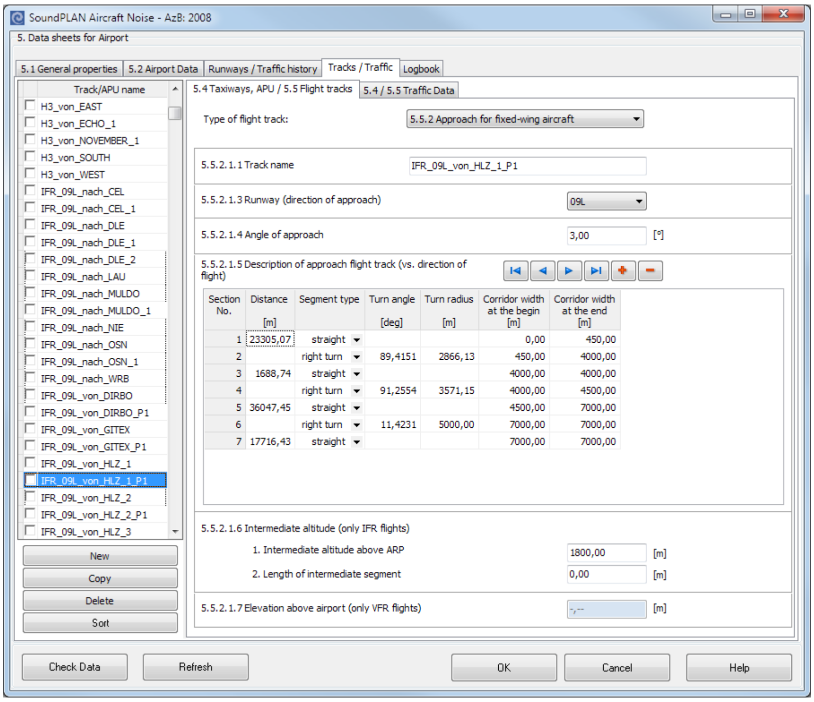


Flight tracks and APU

The flight tracks are defined in tabular form. Depending on the standard various track types are available.

Track type	DIN 45684	AzB 2008	ECAC 3rd Ed.	ECAC 4th Ed.	CNOSSOS
Taxiing from a parking position to the starting point	√	√			
Taxiing from the runway after landing to the parking position	√	√			
APU-usage before starting		√			
APU-usage after landing		√			
Departure of fixed wing aircraft	√	√			
Approach of fixed wing aircraft	√	√	√	√	√
Pattern flight for fixed wing aircraft	√	√	√	√	√
Departure of helicopters	√	√		√	√
Approach of helicopters	√	√			
Pattern flight for helicopters	√	√			
Departure with elevation profile	√	√			
Approach with elevation profile	√	√			
Pattern flight with elevation profile	√	√			
Helicopter departure with elevation profile	√	√			
Helicopter approach with elevation profile	√	√			
Helicopter pattern flight with elevation profile	√	√			

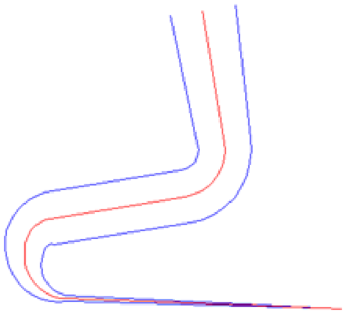
For the calculation of aircraft noise from recorded radar tracks only approach and departure can be regarded. Pattern flight and APU usage cannot be derived from the radar data and thus cannot be simulated with imported data.



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 with 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:

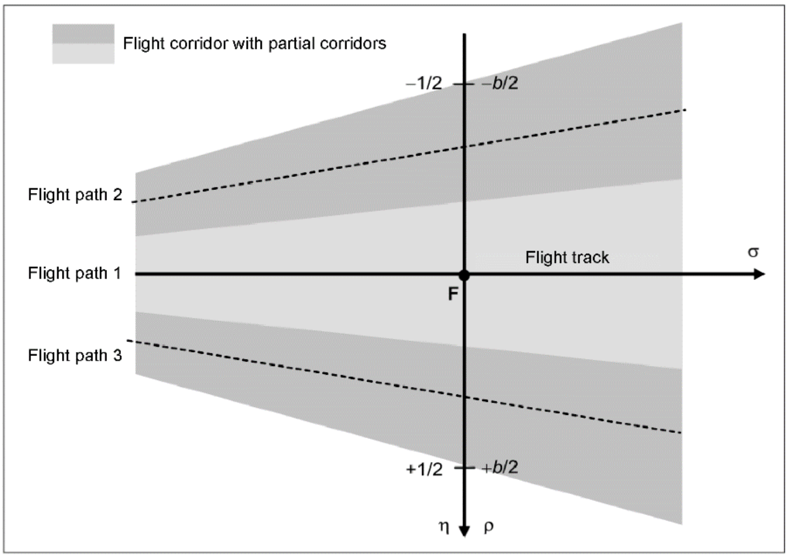


Left landing direction 09, right landing direction 27

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

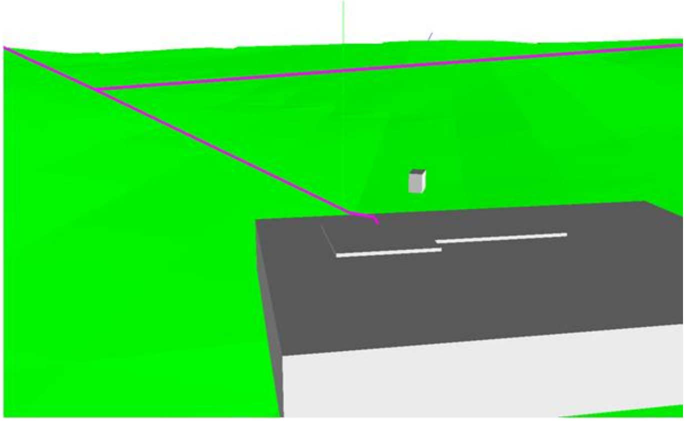
» If you change the display of the flight track to print the tracks „with properties“, the corridor edges are presented in the Geo-Database.

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.

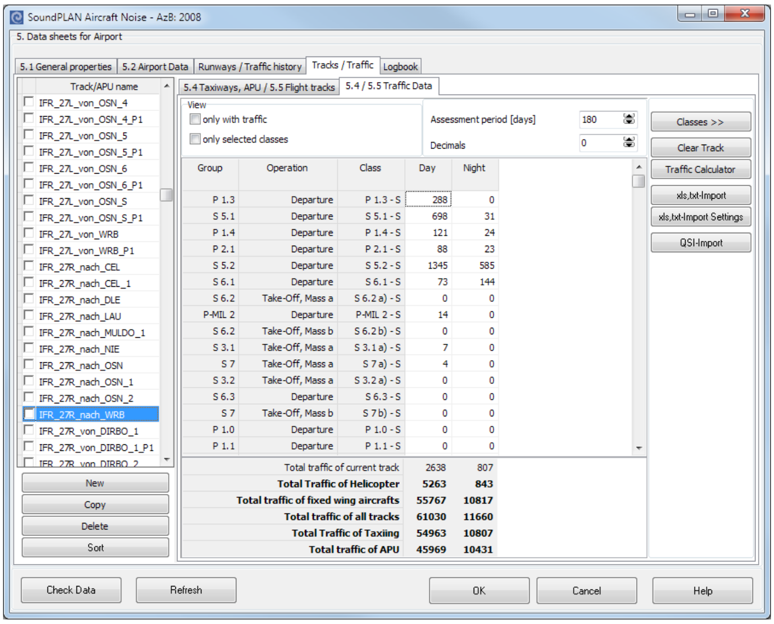
Like always the start point and the threshold/touch down point and also the emission lines are automatically set on top of the DGM.

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 take-off or landing track.



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 see page 2) 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 “QSI Import / Export” (page 561).

15

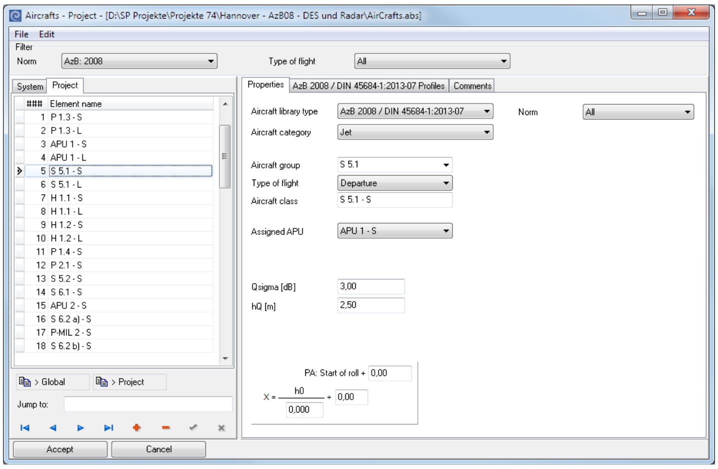
In case aircraft classes you need are missing or need to be amended, use the direct access via the button **CLASSES** in the library.

Aircraft class library

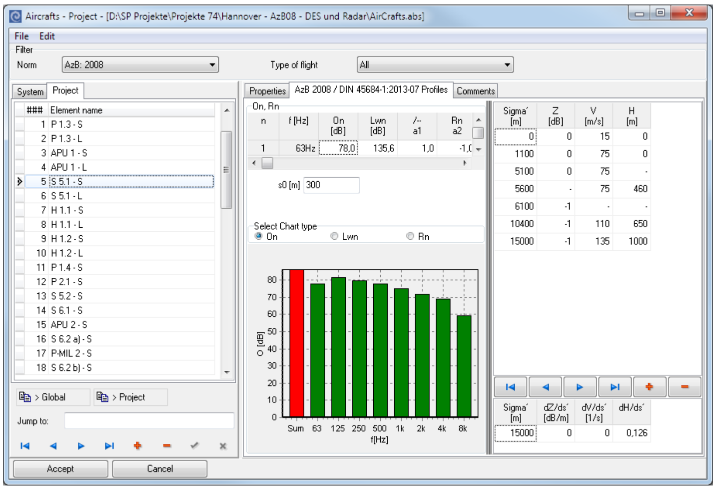
In the system library all aircraft classes are present that are needed (and documented) in the standards implemented in SoundPLAN. The project and the global library can be amended at will.

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 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.



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 σ‘ (σ‘=0 at the starting point and the threshold).



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).

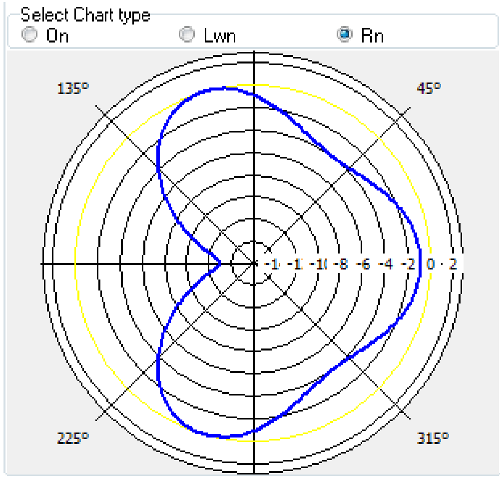


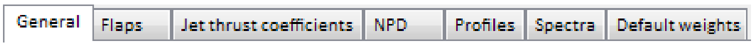
Diagram directivity of an aircraft class in accordance to AzB 2008

Aircraft classes ECAC

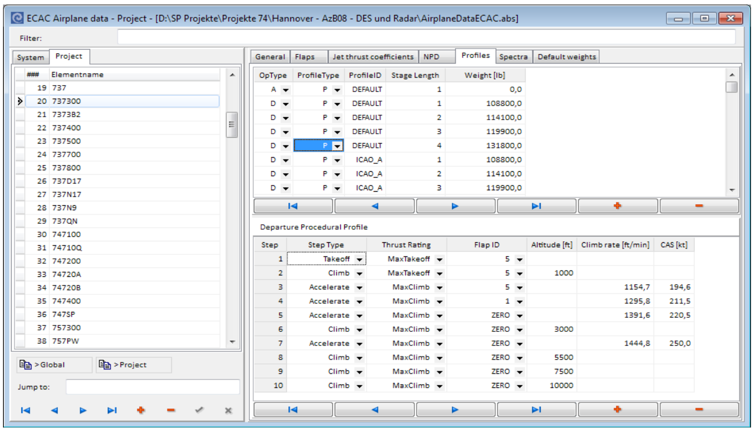
For ECAC Doc 29, 3rd edition the aircraft classes as supplied by Eurocontrol are available in the library under **AIRCRAFT CLASSES -> AIRPLANE DATA (ECAC)**. Via the import interface it is also possible to import the data from INM (US Department of Transport software) directly into this library.

Open the aircraft data via **AIRCRAFT CLASSES -> AIRPLANE DATA (ECAC)**.

The entry for an aircraft consists of the following entries:



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).



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.

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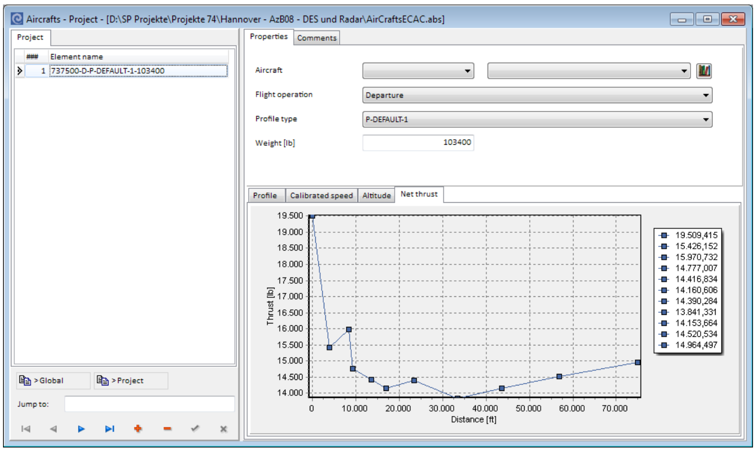


Only the aircraft classes (with profile) assembled here are available to the calculation model.

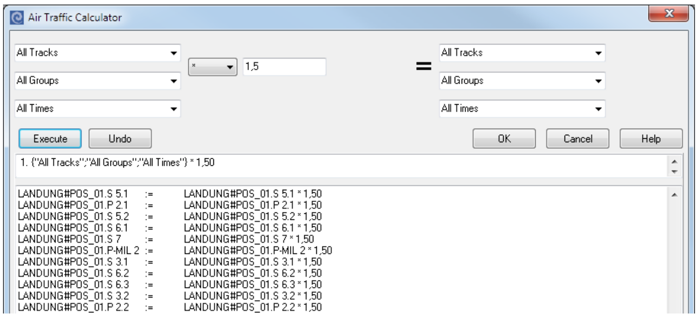
Import of the aircraft class databases (ECAC and INM)

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).

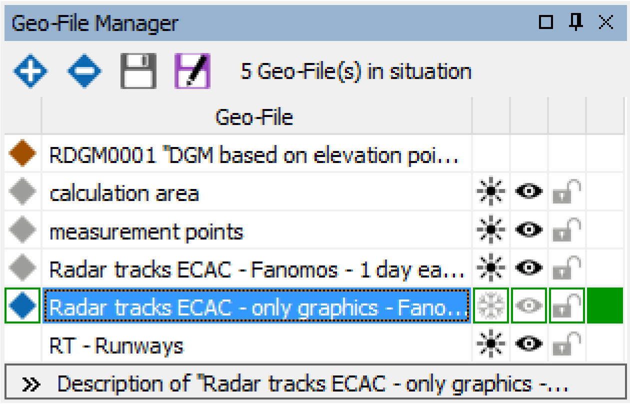
Flight track computer

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“.

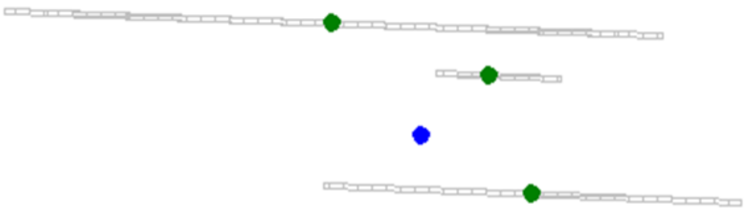


Work in the Geo-Database

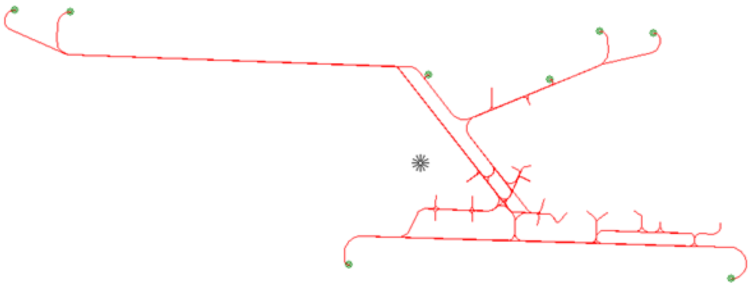
It is sensible to use the capabilities of the Geo-Database with its Geo-Files for structuring the model. The following minimum structure is a typical example for structuring a calculation in accordance with the AzB 2008 for a big airport (also see the example project on the program DVD):



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.



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.

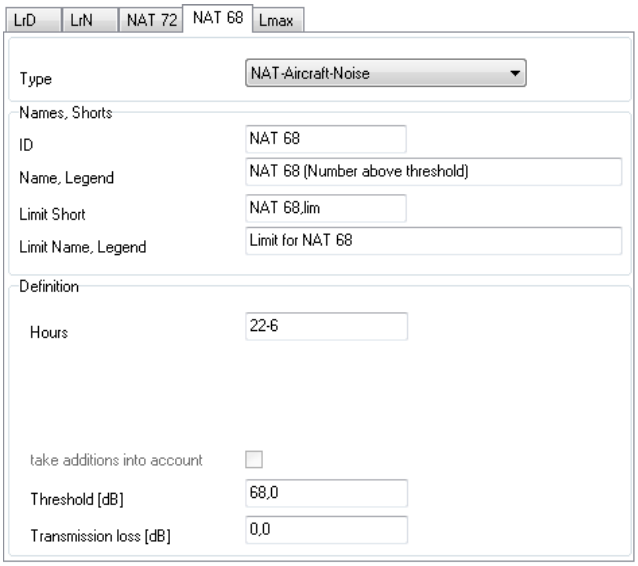
It is sensible to generate a DGM and assign it to a situation before you import as all data are referenced to this DGM.

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

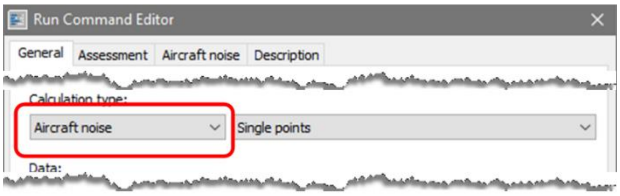
First define/select the noise descriptors you need in the **assessment library**. For aircraft noise it is common to use:

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 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 aircraft noise	The awakening reaction in accordance to a German DLR study for a selected time slice (ZfL (2005) Nr. 4 - Juli, Markus Basner, Ullrich Isermann, Alexander Samel)



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.

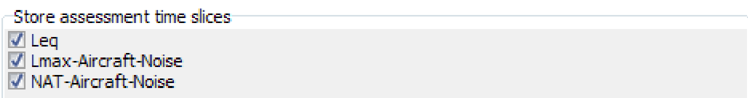
In the **calculation core** under the tab *general* in the left pick list select the category **AIRCRAFT NOISE** and in the right pick list select the **CALCULATION TYPE**.



For aircraft noise you can calculate single receivers, Façade Noise Maps, Grid Noise Maps and Cross-sectional Noise Maps.

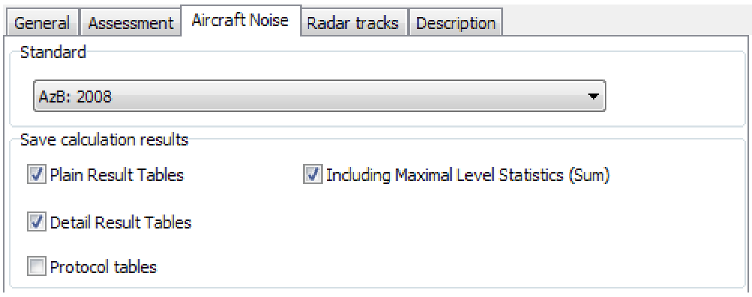
Enter the situation(s) and the Geo-Files for the calculation and assign a DGM.

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.



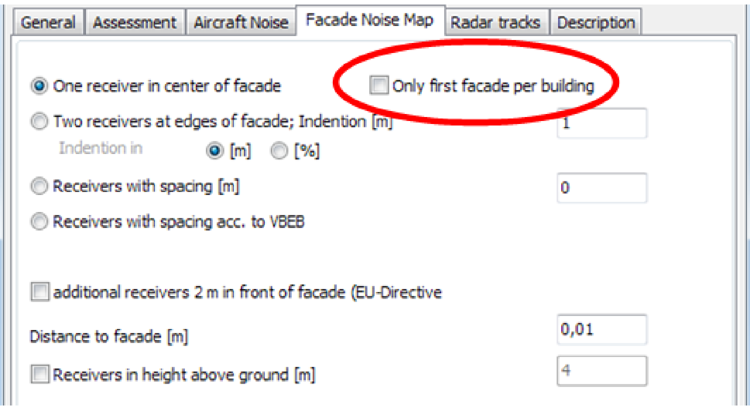
In the tab Aircraft Noise select the standard for which the aircraft noise is to be calculated. (the default is set in the SoundPLAN Manager under the standards section).

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.



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.

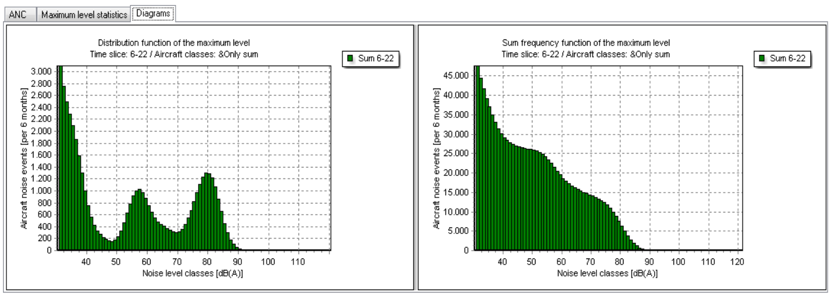


For the calculation with radar tracks additional parameters need to be defined under the tab *radar tracks*, see “Additional settings in the calculation core” (page 573).

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:

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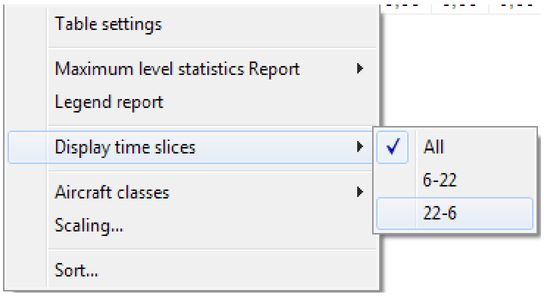
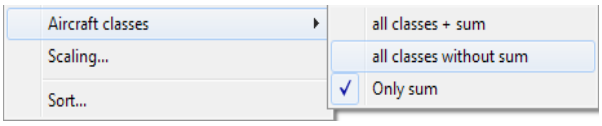
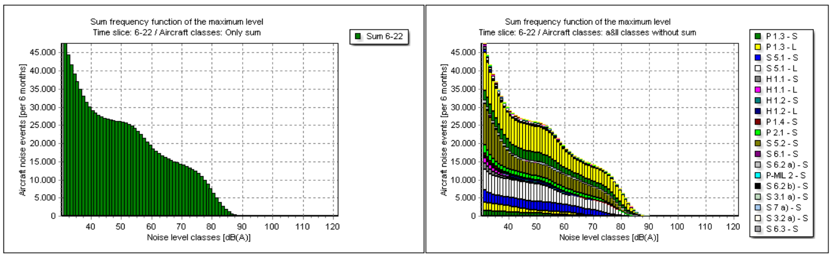
The selection of individual time slices or all time slices:



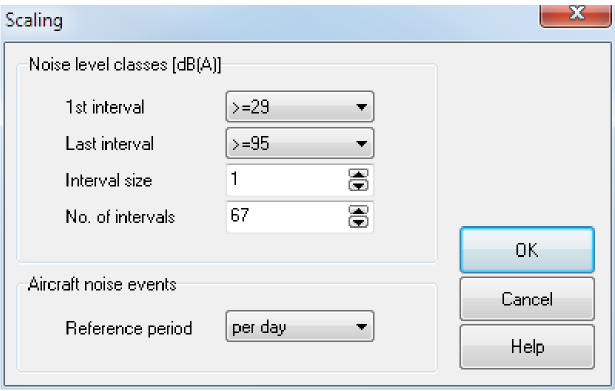
The choice to present the max level statistics for all aircraft classes or only to display the sum of the classes:





Left max level statistics –only the sum, right side statistics but differentiated for each aircraft class

The definition of the scaling:

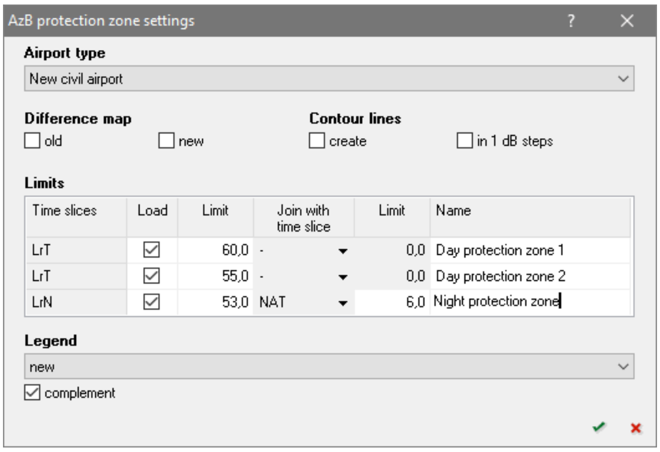


With this scaling the interval borders and interval sizes can be set. The smallest interval step is 1 dB. Most commonly 1 dB and 5 dB steps are used. The time reference is usually set to present the results per day.

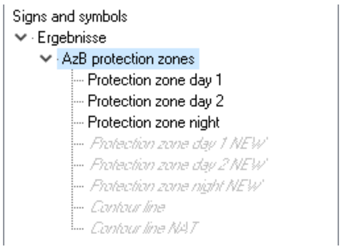
Presentation of the aircraft noise protection zones in the Graphics

The aircraft noise protection zones in accordance with AzB:2008 can be generated automatically. In the file selection select the data type **AZB PROTECTION ZONES** and assign the calculated Grid Noise Map to the map.

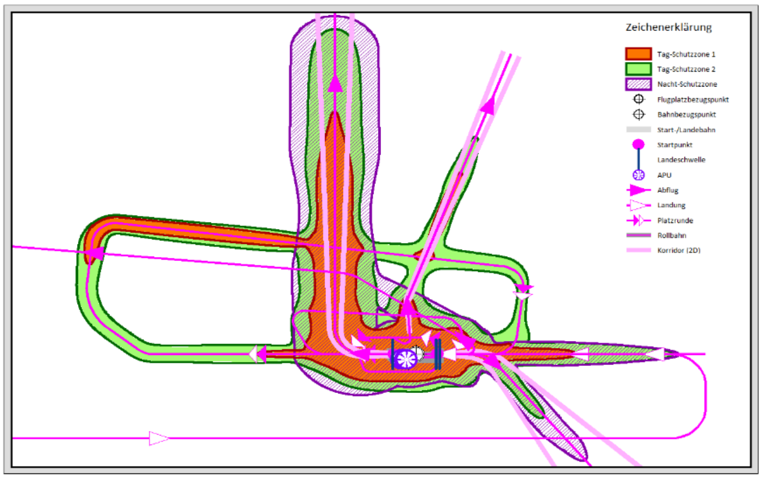
In the settings for the AzB protection zones, select the type of airport and the time slices and noise limits.



Depending on the **AIRPORT TYPE** (old / new civil airport and old / new military airport) the corresponding limit values are entered for the protection zones. Depending on the map type (protection zones, structural sound insulation), select the time slices to be displayed according to AzB. The type of representation (contour areas, 1-dB contour lines), the descriptions and the colors, fill colors, hatch lines or line widths are preset to conform to AzB. Switch on the desired objects in the map object types in the object type AzB protection zones.



For the verification of existing protection zones, the difference must be formed from OLD/NEW. First load the result for OLD and check the desired time ranges. Second, load the result for NEW with the same time ranges. Since the representation of the iso-lines or areas is different for OLD and NEW, the program must know whether the result is OLD or NEW. Therefore, tick **OLD** or **NEW** for the difference maps.



For the correct display in according to the AzB:2008, it needs to observe that the line positions in the main object type **AzB protection zones** is set to **DRAW THE LINE OUTSIDE AREA EDGE**.

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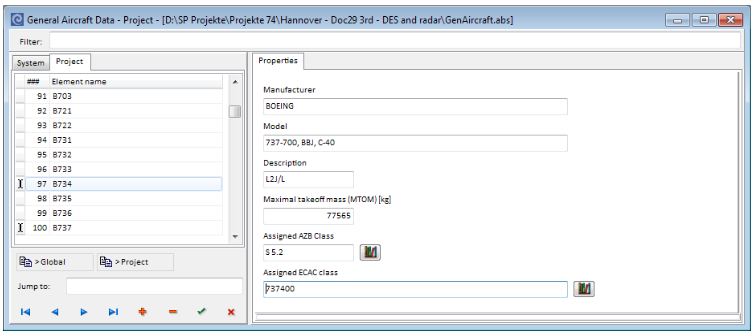
Work with radar tracks

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_{eq}, NAT, L_{max} 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)**.

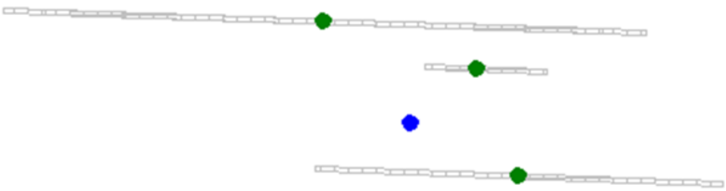


Exemplary presentation of the definitions fora Boeing 737-400.

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.

Preparation of the import

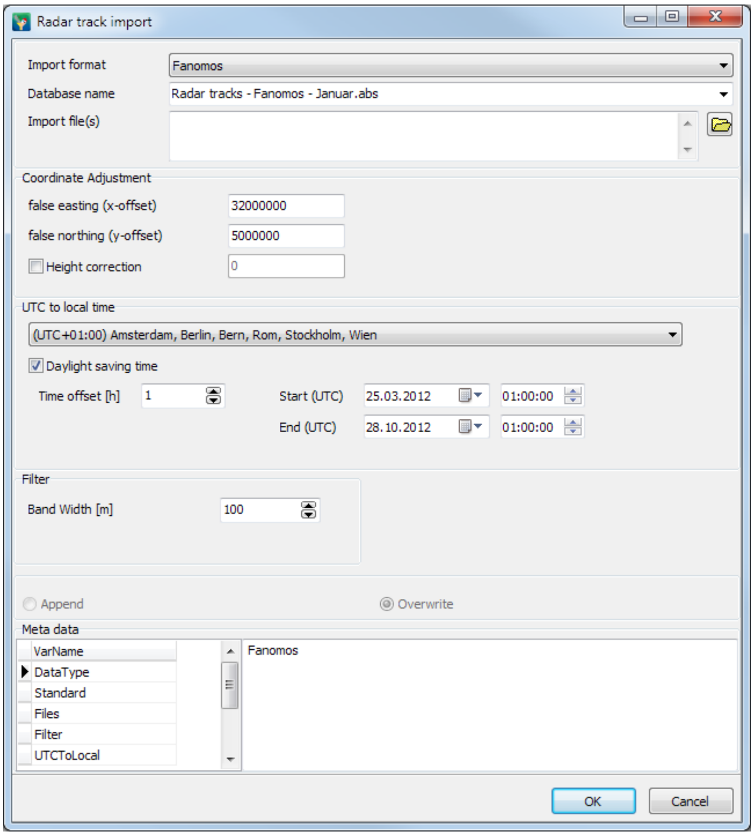
Before we can import radar tracks, we must have the airport defined with its runways and need to have made a DGM and assigned it to the Situation. In this way aircraft noise is not different from any other noise types.



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.



Via **IMPORT TYP** select the data format of the 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.

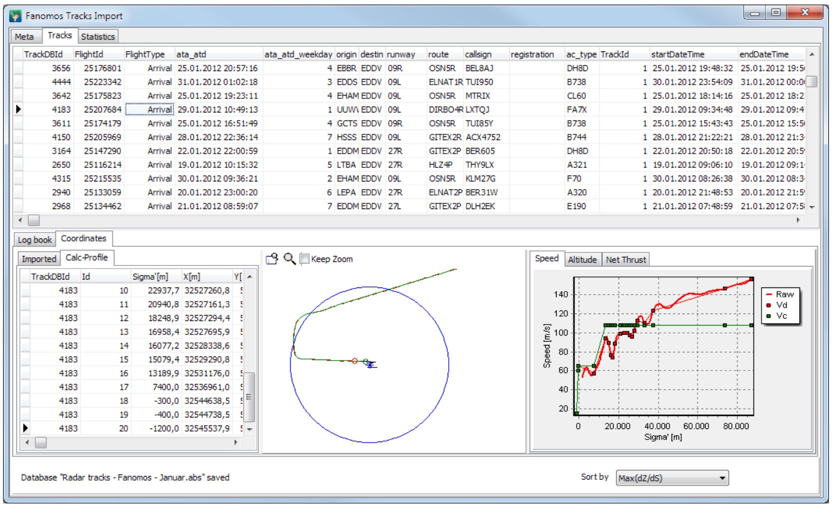
When importing Fanomos-data, it is possible to have an **ELEVATION CORRECTION** (to adjust a difference between the ground and the position of the radar data receiver).

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.

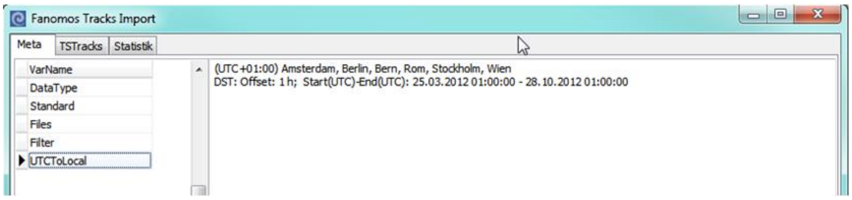
If you choose an already existing database for the import, you can either **AMEND** the data and thus expand the database step by step (for example by importing month by month   or you can opt to **OVERWRITE** the already existing database.

Data check after the import

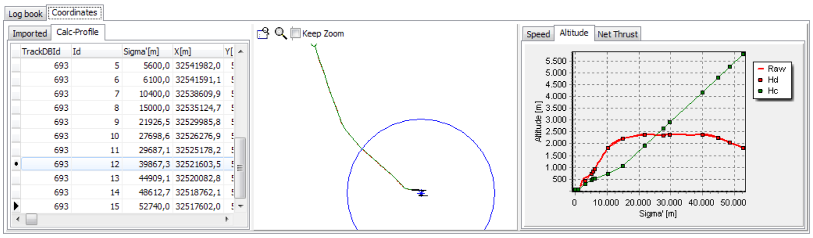
After all tracks are imported, there is very efficient way to get an overview or detailed information of all data.



Under the tab *Meta* you find the general information for the import settings.



Via the tab *tracks* you can obtain an overview of all imported tracks.

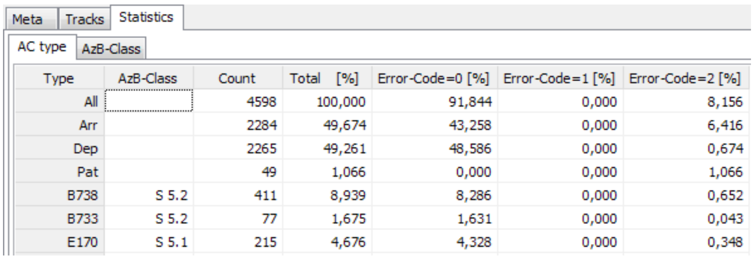


In the top section of the window all imported flight tracks are shown. Amongst others you can find the information of the “aircraft call sign”, time, assigned runway for take-off and landing, track type, „aircraft type“ and the aircraft class representing this particular aircraft for the standard selected (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.

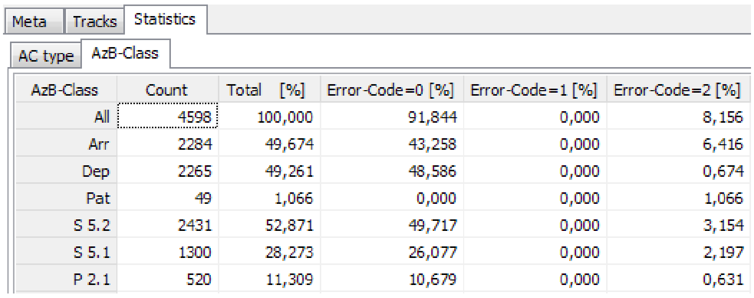
In the tab *Logbook* all problems and errors found in the imported track data are documented.

In the tab *coordinates* all imported coordinates used in the calculation are presented. Additionally a small graphical display will provide an overview of the 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.



Type	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
B738	S 5.2	411	8,939	8,286	0,000	0,652
B733	S 5.2	77	1,675	1,631	0,000	0,043
E170	S 5.1	215	4,676	4,328	0,000	0,348



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	0,631

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:

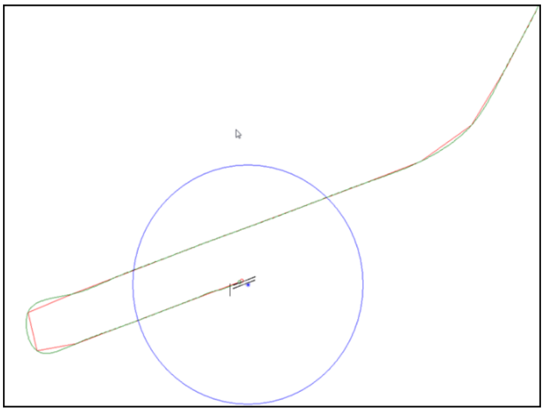
- Geometry was found to contain severe errors, for example if the track contains only a single coordinate or the flight time represented by the track exceeds one hour.
- The track is a pattern flight or is another track type not processed by ECAC (for example Taxiing for ECAC)
- The speed as calculated from the time stamps of the recorded coordinates would yield a speed that is out of the possible range
- 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.

Info: 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

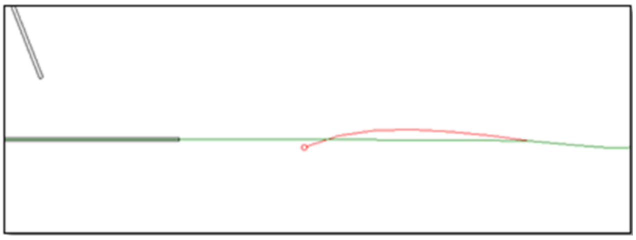
Radar track data can vary in their quality and accuracy, depending largely on the type of radar track storage format. It is therefore important that the program is adjusting some of the data with several geometrical tools:

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.

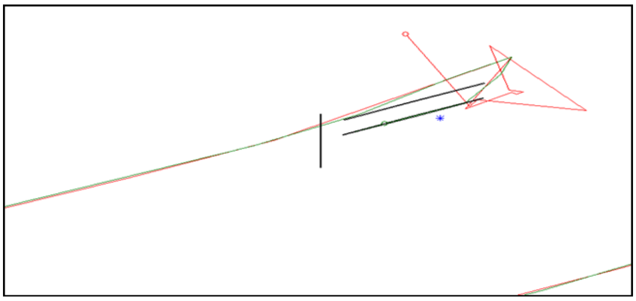


Original Stanly-data (red line) and the line approximated by SoundPLAN (green line).

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 interpolated for the last part of takeoff or landing. The new track coordinates are inserted in the area between σ`=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 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.



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.



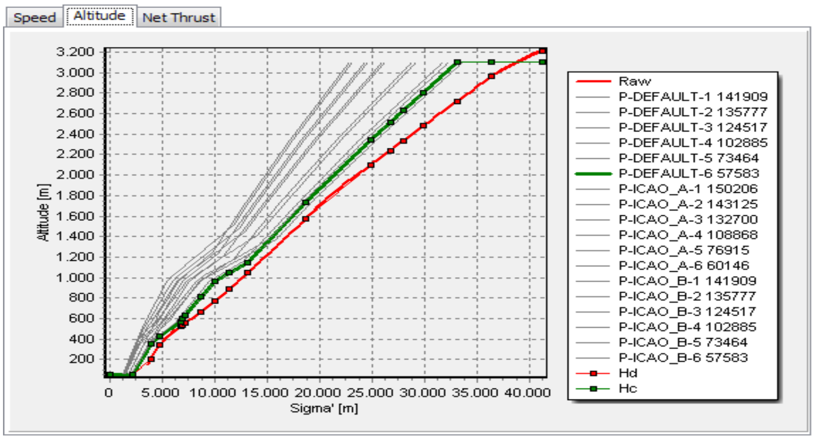
Sometimes a radar echo is creating unrealistic tracks when the aircraft is close to the grounds or on the ground. These unrealistic tracks are corrected by SoundPLAN (green).

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 of 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 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 σ'=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.

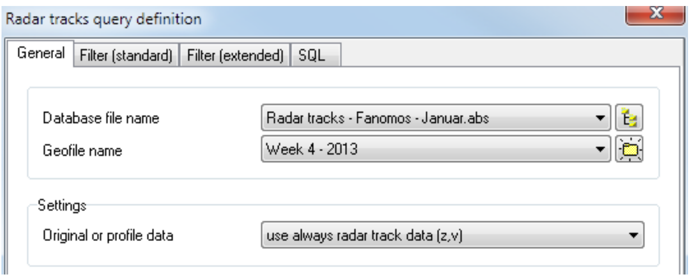


Selection of the best fitting procedural profile in the SoundPLAN import. The red line indicates the original radar profile, the green line represents the best fit with one of the ECAC profiles. The gray profiles are other profiles available according to ECAC Doc 29 3rd edition.

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 GEOFILES FROM DATABASE**.

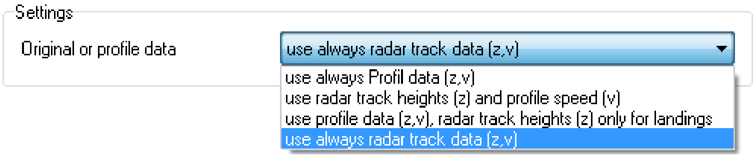
In the tab *general* select the database that contain the radar data to be imported into the Geofile.



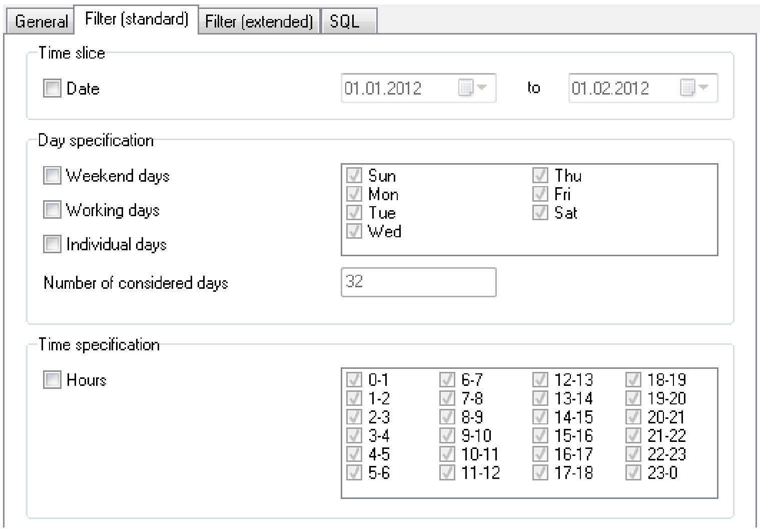
Additionally you can specify the elevation or speed (radar data or classes). By default (be careful if you alter this) z and v are taken from the radar tracks and are not taken from the aircraft class definition.

15

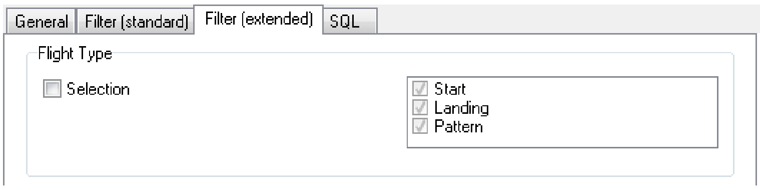
Additional selection possibilities:



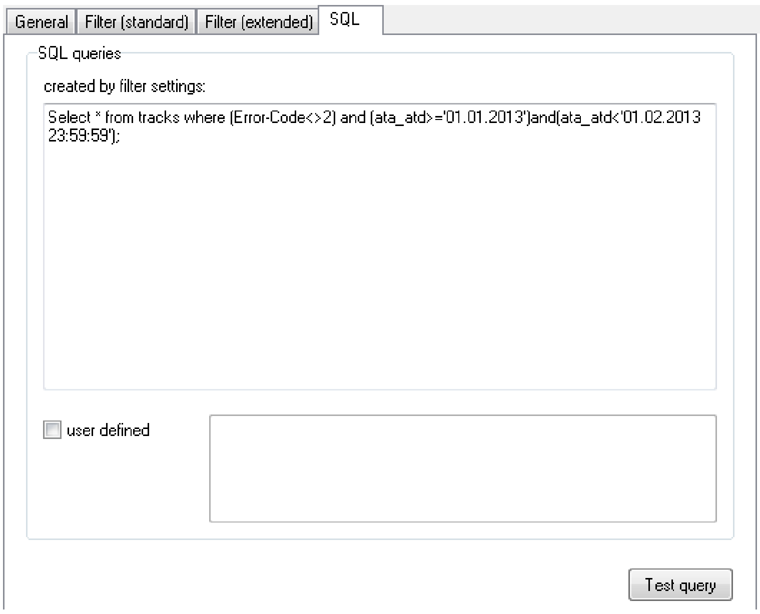
In the tab *Filter (standard)* you can set the standard filter of time frame, the selection of special days and hours. For information purposes the number of days used is also displayed.



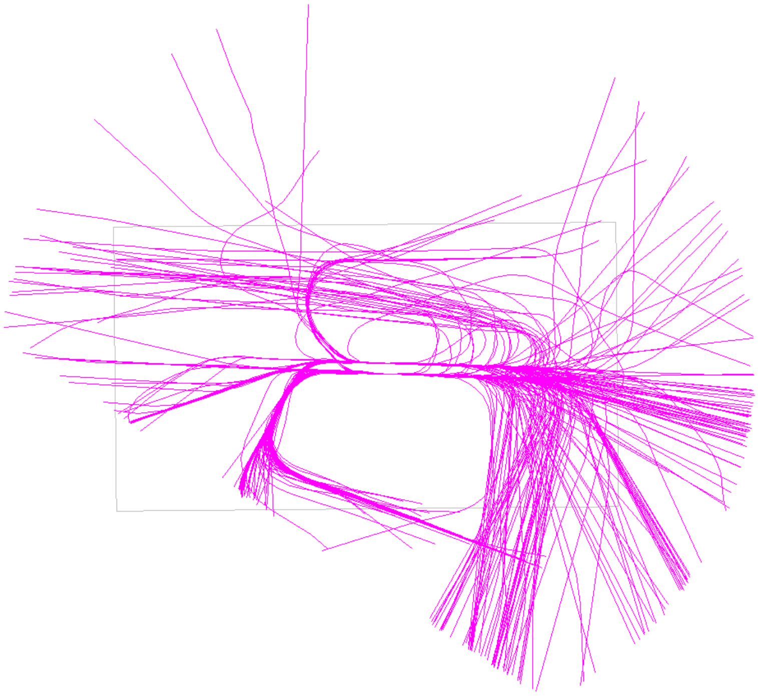
In the tab *Filter (extended)* additional filters can be applied to select the flight operations.



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.



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.

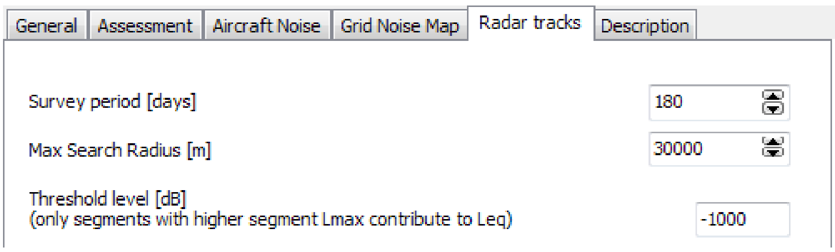


Display of a radar track Geo-File in the Geo-Database

A Geo-File generated with an SQL-query can be re-generated later on with different filter settings.

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.



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.

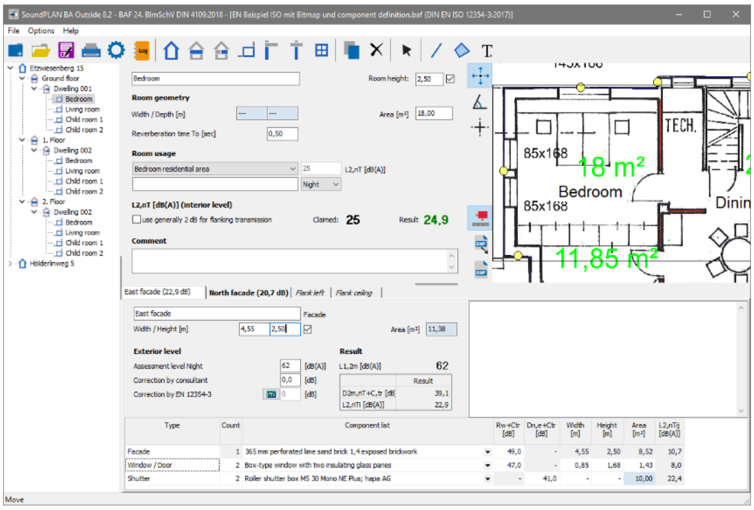
To accelerate the calculation, it is possible to define a maximum **SEARCH RADIUS** in meter. Depending of the number and geographical distribution of the radar tracks sometimes it is possible to reduce the influence radius of the aircraft in the calculation.

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.

16 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 with the EN ISO 12354-3:2017 and other standards.



EN ISO 12354-3:2017 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 room assessment is selected when you create a room book. You can change it under **OPTIONS -> SETTINGS** by clicking on the library icon.

The correction summand L2,nT is understood as the maximum permissible interior level in order to enable the guidelines to be implemented on more than one outside 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.

General overview

BA-Outside module is the program of choice for small and big projects alike hereby the SoundPLAN module 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 hierarchical structure makes it easy to transfer data from the higher level to the next level. Subsequent, general changes can thus be easily transferred to the rooms without having to change each value individually.
- 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.

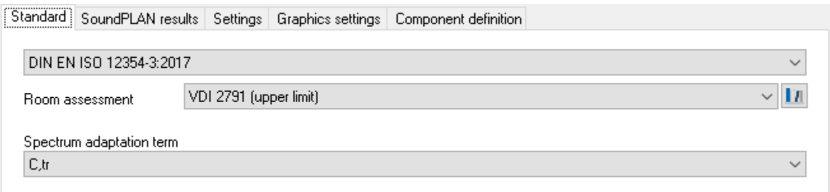
Generation of a new room book

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.

Standard

First select the standard you want to use for the calculation.



EN ISO 12354-3:2017 additionally requires a room assessment library. Click on the library symbol to select it. The system library contains two room assessment elements from the German VDI 2719. To select one of these elements, go to the system library and copy the element to the project library. You create your own room rating elements directly in the project library.

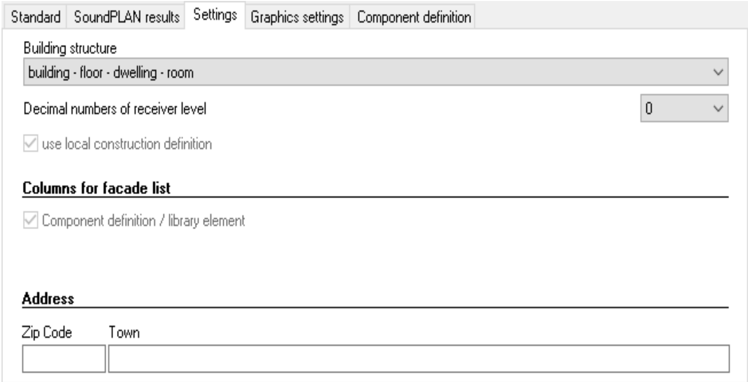
Select the default spectrum adaption term Ct or Ctr.

SoundPLAN results

Go to the next tab index card. Here you select, if desired a SoundPLAN result, see “Using SoundPLAN calculation results” (page 577).

If you don’t want to use SoundPLAN results, a room book with one building is generated.

Settings



With the **BUILDING STRUCTURE** 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, see “Building structure” (page 580).

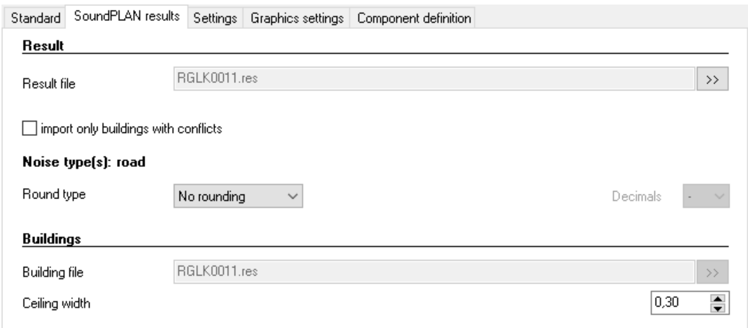
For the **FAÇADE LIST**, the column with the elements entered in the component definition is inserted by default. It can be deactivated later with a right click on the header of the façade list or with the short cut ***Strg+L***.

The component definition should already be generated when you start working on a new room book, see “Component definition” (page 583).

You can define defaults for the **ZIP-CODE** and the **TOWN** of the buildings, so that together with the street name and house number properties the address is already completely available after the import.

Click on the green tick to start a new room book. The buildings will be presented in tree structure in accordance with the selection of the building structure. On the right side the data of the selected sub element are displayed.

Using SoundPLAN calculation results



In order to generate a clear building structure, 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**).

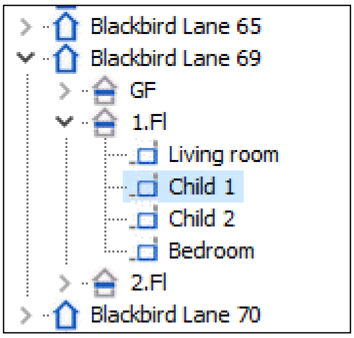
Select the result file with the double arrow to use an existing calculation result – receivers are imported along with the road name and house number. The usage and the assessment levels are assigned to the receivers. If the floor was selected for building structure, the number of floors present in the building properties the correct number of floors will be present in BA-Outside.

With the **ROUNDING TYPE** the noise levels are rounded at import time in accordance with 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.



If the results change in the course of the project work, you can use **FILE -> UPDATE SOUNDPLAN RESULTS** to exchange the assigned levels in the facades from the calculation result or the immission location table.

You receive a message about the number of updated facade levels. If not all facades can be updated, these facades are entered in the logbook. Double-click on the entry in the logbook to call them up directly.

So that the building and facade structure is retained for different variants that refer to the same room geometry, the result can be exchanged using the double arrow.

Add graphics and symbols

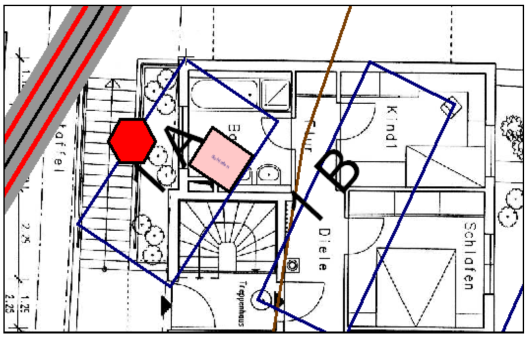
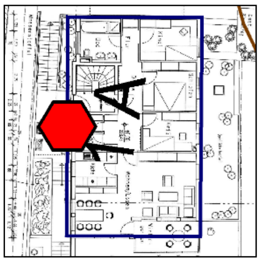
Each element a graphic or pdf file can be assigned to document the project. You can take for example a picture of the outside or the building and assign it to the building, you may want to assign a drawing of the floor plan to a floor or a dwelling or a construction drawing to show the construction of the roof to the top floor. These graphics can be incorporated in the printout.

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 geometry.

Load the graphics by clicking on the symbol **BITMAP** symbol and load the graphics/pdf file. The pdf file is first converted to a bitmap. If the graphics file is not located in the project, the program will copy it there.

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.

Inserted graphics can be placed easily for multiple rooms (for example for multiple floors with the same floor plan). With the symbol **COPY BITMAP**, you can for example transfer the graphics viewport of a dwelling to a room.

In the selection mode (arrow symbol) the graphics can be transferred with Drag&Drop to another element in the tree, for example to another room. Simply drag the graphics with the left mouse button pressed to the desired element in the tree.

In order to prevent accidental zooming, the mouse wheel in the selection mode is deactivated.

To remove a bitmap from a layer, click on the **BITMAP** symbol and press the Delete key (the graphics itself will not be deleted).

Add drawing objects

If you work with SoundPLAN results or a bitmap is assigned you can add simple drawing objects for example to highlight a specific room. The following drawing objects are to your disposal:

- **Line** – enter successive the points of the polyline, finish with a double click
- **Area**– pull open with or click on successive points, finish with a double click
- **Text** – click on the position and enter the text in the edit field

You can activate the drawing objects with the left mouse button (several equal objects with the ***Ctrl key*** pressed or by pulling open a frame around the objects) to add points on the line edge or move individual points. On the pink diamond you can move the entire object, rotate it (hold down the ***Ctrl key***) or enlarge / reduce it (hold down the ***Shift key***).

Use the uppermost icon on the left side of the graphics window to move (hold down the left mouse button), zoom (turn mouse wheel or ***Shift*** + left mouse button or rotate (***Ctrl*** + left mouse button) the SoundPLAN geometry data. For your own drawing objects, you can define a fixed angle step size (**OPTIONS -> SETTINGS**, Tab *Graphics settings*) and optionally display a crosshair at the cursor.

Object types

The drawing objects and if used the SoundPLAN geometry data and results are formatted with **OPTIONS -> OBJECT TYPES**.

To display drawing objects with different attributes, duplicate the general objects lines, areas and texts and customize their layout.

Use the right mouse button to assign the layout to the activated object -> **CHANGE LAYOUT TYPE**.

Structure the room book

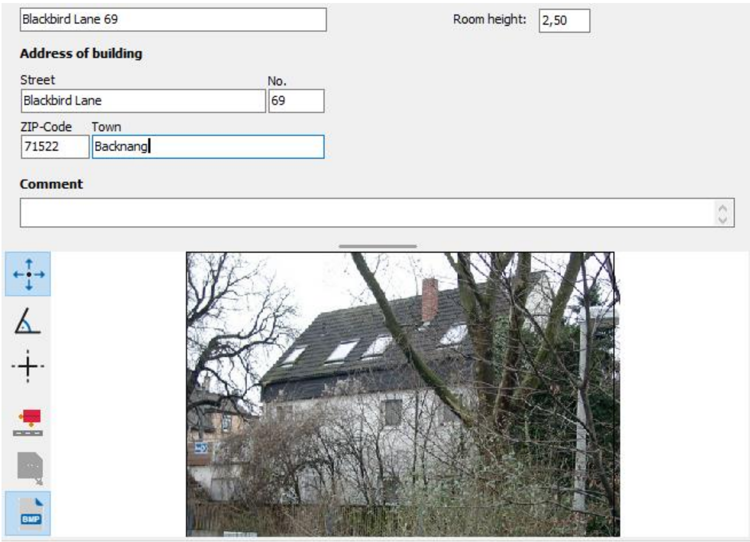
Duplicate and move elements

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 re-use. 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.

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.



Building structure

You can define a building structure in the settings when you create a new room book.

- Only buildings
- Building - dwelling (= apartment or flat)
- Buildings - dwelling - room
- Buildings - floor - dwelling - room

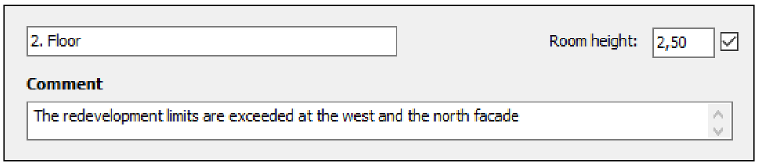
If the structure with floors is selected, using SoundPLAN results will automatically create the number of floors from the receivers.

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”.

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.

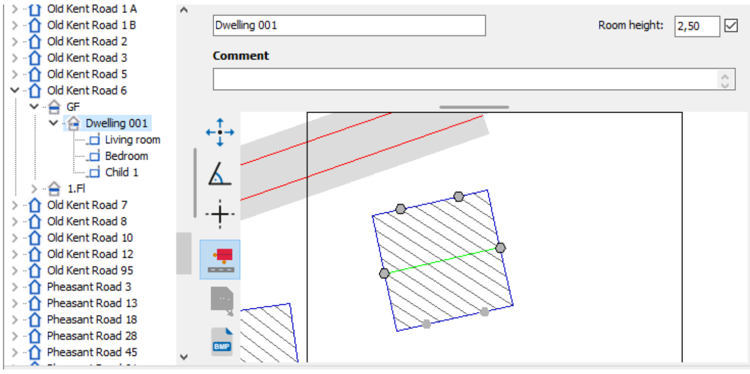
Floor

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. If the check mark behind the room height is active, the room height is taken from the building.



Dwelling

Dwellings can be generated directly below the building or as part of the floor. A dwelling can contain multiple rooms and floors.



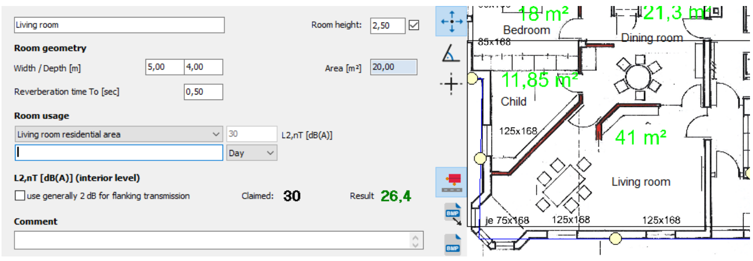
If the check mark behind the room height is active, the room height is taken from the superior element.

Façade calculation

After the rough structure has been specified or the receivers of the investigated area have been read in, the rooms and facades to be considered are created.

Room

The room itself is the core of interest for BA-Outside.



The **ROOM HEIGHT** is set as a pre-set value when you create a new façade. If the check box behind the room height is checked, the room height is taken from the superior element. Changing the room height at a later time will only change the height of the facade element if the check box behind the façade height is set.

The room usage is important for the evaluation of the required interior level and comes for EN ISO 12354-3:2017 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 **OPTIONS -> 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! The room usage is also used to select whether the day or night level is assigned when working with SoundPLAN results.

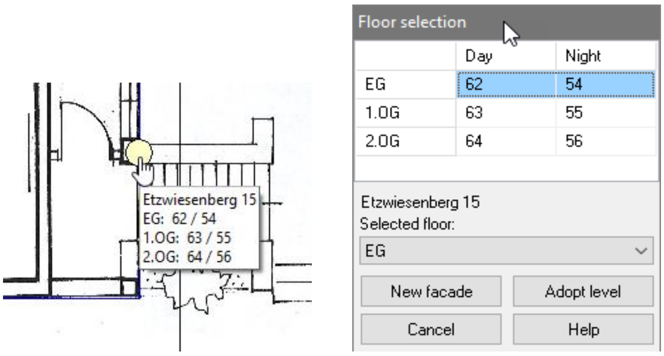
The reverberation time is standardized in the ISO to 0,5 s but can be customized if necessary.

The result of the facade calculations with an indication of whether the permissible values are complied with is displayed in the room.

Façade(s)

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.

If you work directly with SoundPLAN results, click on the respective receiver to insert a facade and take over the noise level.

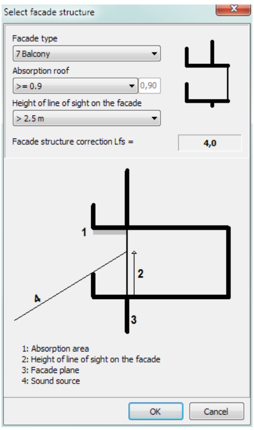


Select the floor and click on **NEW FACADE** to generate a new facade. Taking levels from other facades can only be done if the receiver already contains a façade. This procedure has the advantage that outdoor calculations can update the values while maintaining the object tree of building components (all levels are updated via **FILE -> UPDATE SOUNDPLAN RESULTS**).

If the assessment level is printed on gray background, the value came from a SoundPLAN calculation. With a right click the reference to the calculation.

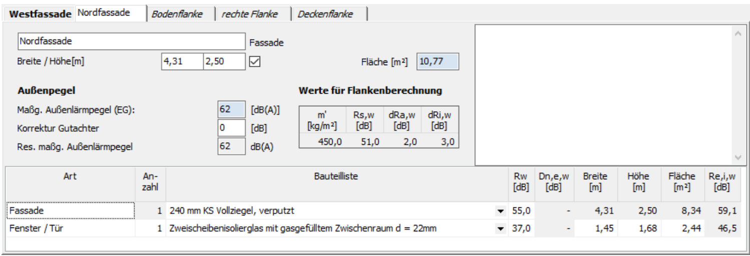
Below the facade description the dimensions of the facade are entered. With a double click on the gray field **AREA** the size of the facade can be entered directly. The labels for **WIDTH** and **HEIGHT** assume the standard case of vertical walls. By directly entering the area it is possible to accommodate the bigger sizes of slanting roofs and to add the area for a flat roof. However, an outside level adapted to the location should be used for this case.

The outdoor level used for the calculation according to EN ISO 12354-3:2017 uses the assessment level day/night as the base level. This can be adjusted with a **CORRECTION CONSULTANT** and/or a facade correction of the EN 12354-3.



The resulting total noise level is presented as the result L1,2m.

Façade list and components



In the facade list, the room components (wall, windows, doors, shutter boxes, fans, ...) intended for the room are entered or optimized. The area is specified by width x height or directly as area. You can print the used components as a facade component list, see “Print room book“ (page 585).

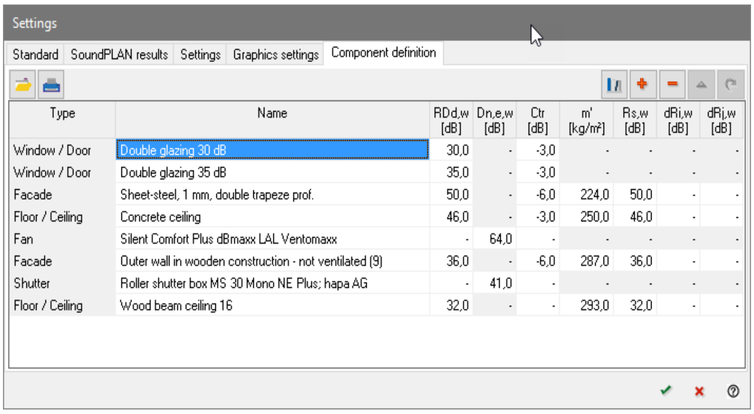
If necessary, here you also insert inner walls (flanking elements) for the flanking transmission, see “Flanking transmission ISO 12354-3:2017” (page 585).

When creating a new facade, the components wall and window/door are automatically inserted. Additional components can be added via the symbol **COMPONENT** or ***Ctrl***+’+’ obsolete components can be deleted with the symbol **DELETE** or ***Ctrl***+’-’.

The first line always hosts the main element, the wall. The area is calculated from the total façade area minus all other inserted façade components. The area of a component is not subtracted from the main element if the component is defined with the normalized level difference Dn,e,w, for example fans or shutters.

Component definition

When you create a new room book for EN ISO 12354-3:2017, you get into the tab index card *component list*.



The component list in the **SETTINGS** dialog is initially empty. Create the required components when you create the room book or later using the gearwheel. The component list is filled by either defining free components via the red "Plus" button or transferring components from the transmission library via the library button. If no suitable component is available in the system library, you can also create your own components in the project library or the global library, which you can then transfer to the component definition.

Components from the component definition can be assigned to several different rooms, allowing central changes to individual components.

You can use the **OPEN** button to transfer a component definition from another room book to the current room book, for example, if the same components are used for another order.

Excursus: Creating an element in the transmission library for use in BA Outside:

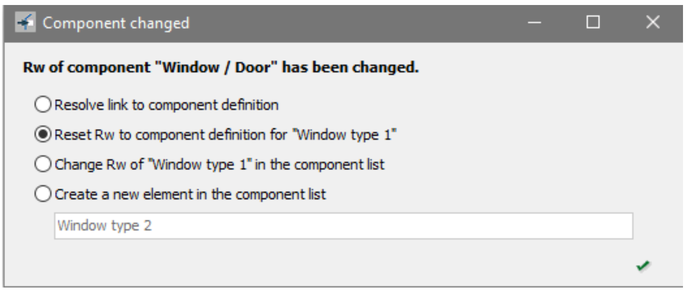
In the transmission library, the tab "Characteristic values" is particularly important in addition to the input of the evaluated sound insulation value Rw or the evaluated standard sound level difference Dn,e,w. Each element to be used in BA Outside must be assigned an element type (façade / wall inside / window, etc.). For solid components, the area-related mass and, if applicable, the improvement of the sound insulation coefficient for facing shells must also be specified.

Press the "Accept" button to transfer all marked elements of the transmission library to the component list. If you want to edit an entry again, use the blue arrow to return to the library entry.

Components entered directly in the component list without library reference can be recognized by the grayed-out library symbol.

Via the **PRINT** button the component list can be printed out or copied to the clipboard.

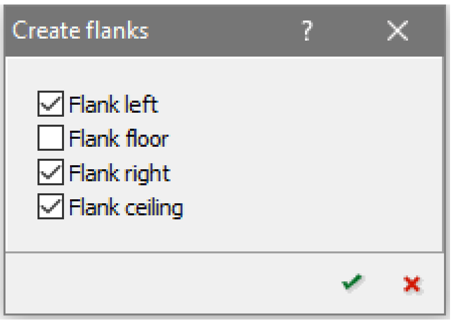
If the characteristic value of a component is changed during facade processing by scrolling with the mouse wheel or direct input, a query is made as to how the changed characteristic value is to be handled.



Flanking transmission ISO 12354-3:2017

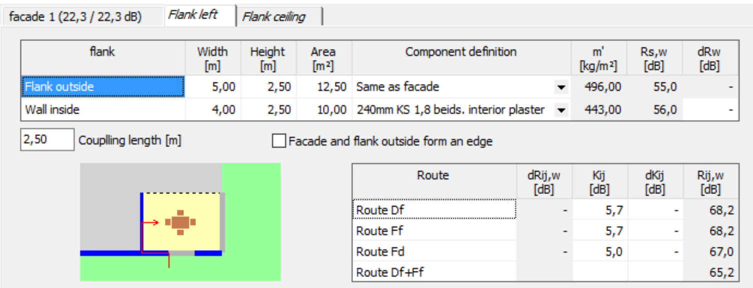
ISO 12354-3:2017 allows a generalized reduction of the sound reduction index of 2 dB for flanking transmission. For some noise and component situations, it may be necessary to take a detailed flanking transmission into account.

Once you have defined all the components, you can create the flanks using the "wall inside" symbol. The flanks to be considered always refer to the loudest façade; the title of which is written in **bold.** In principle 4 flanks are available for selection (left flank, floor flank, right flank, ceiling flank), whereby the direction designations refer to the direction of view from the outside to the loudest facade.



By deactivating the checkmarks, individual flanks can be switched off. This can be relevant, for example, if a flank is already an external facade or if a flank can be neglected.

A separate flank tab index card is created for each flank next to the facade tab index cards. The headings of the flank tab index cards are in *italics*.



On the left and right flank, the plan view and on the ceiling and floor flank, it is the side view explains the position of the considered components and the individual flank paths.

The component definition, the geometry, the area-related mass m' of the flank components, the sound insulation dimensions of the solid flank components Rs,w as well as the improvement of the flank sound insulation dimensions due to room-side attachment constructions dRw are listed here.

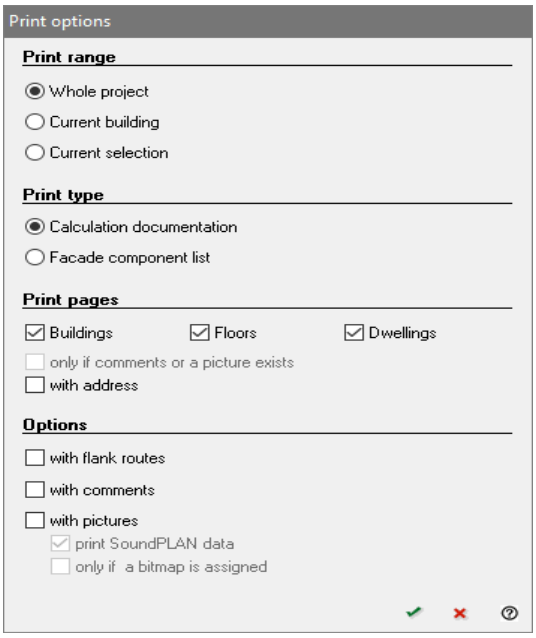
In the comment field on the right there is enough space for the documentation of expert adjustments.

If facade and flank outside form a corner, the check mark **FACADE AND FLANK OUTSIDE FORM A CORNER** must be activated under the component list of the flank. This results in a different calculation of the joints.

The **COUPLING LENGTH** is determined by default from the room geometry but can be adjusted if necessary.

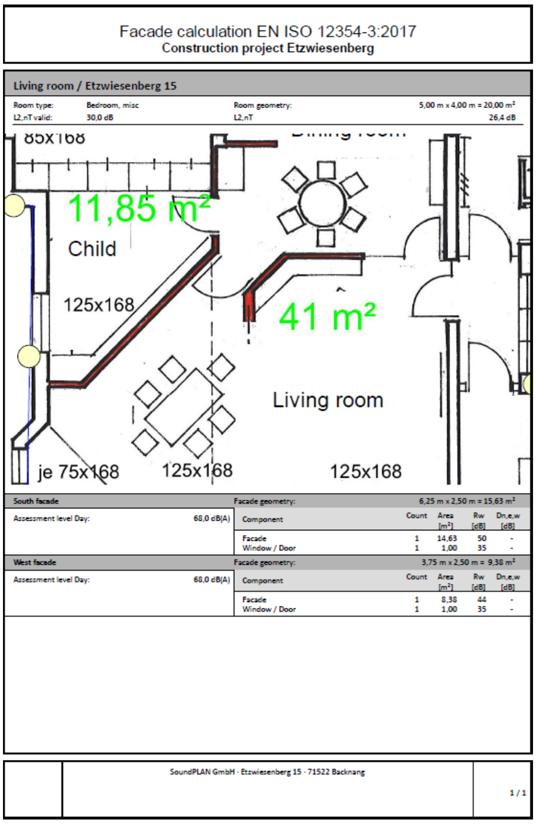
Print room book

Via **FILE -> PRINT** the results of the interior level calculations are printed. Define how much in depth you want your printed documentation.



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 building, 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.


Facade calculation EN ISO 12354-3:2017
Construction project Etzwiesenberg

Living room / Etzwiesenberg 15

Room type:	Bedroom, misc	Room geometry:	5,00 m x 4,00 m = 20,00 m²
L2,nT valid:	30,0 dB	L2,nT	26,4 dB

South facade — Facade geometry: 6,25 m x 2,50 m = 15,63 m²

Assessment level Day: 68,0 dB(A)

Component	Count	Area [m²]	Rw [dB]	Dn,e,w [dB]
Facade	1	14,63	50	-
Window / Door	1	1,00	35	-

West facade — Facade geometry: 3,75 m x 2,50 m = 9,38 m²

Assessment level Day: 68,0 dB(A)

Component	Count	Area [m²]	Rw [dB]	Dn,e,w [dB]
Facade	1	8,38	44	-
Window / Door	1	1,00	35	-

SoundPLAN GmbH · Etzwiesenberg 15 · 71522 Backnang

1 / 1

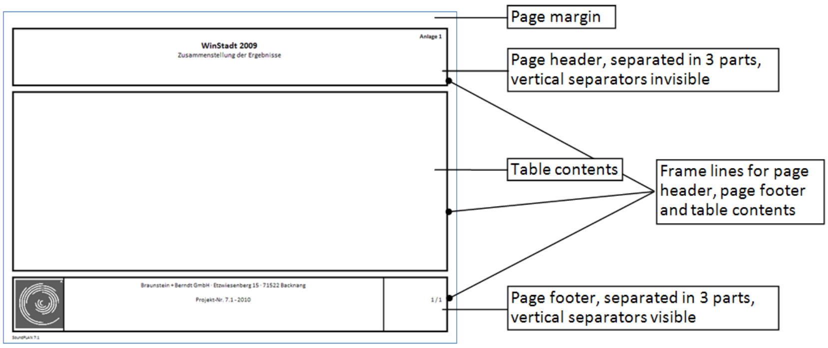
The printout is fixed in its formatting, headers and footers can be defined in the page layout **FILE -> PAGE LAYOUT**.

Page Layout

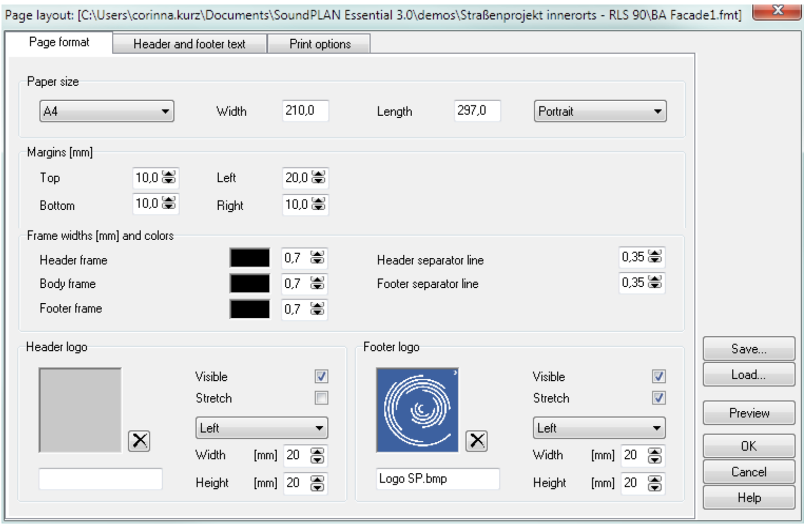
The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

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

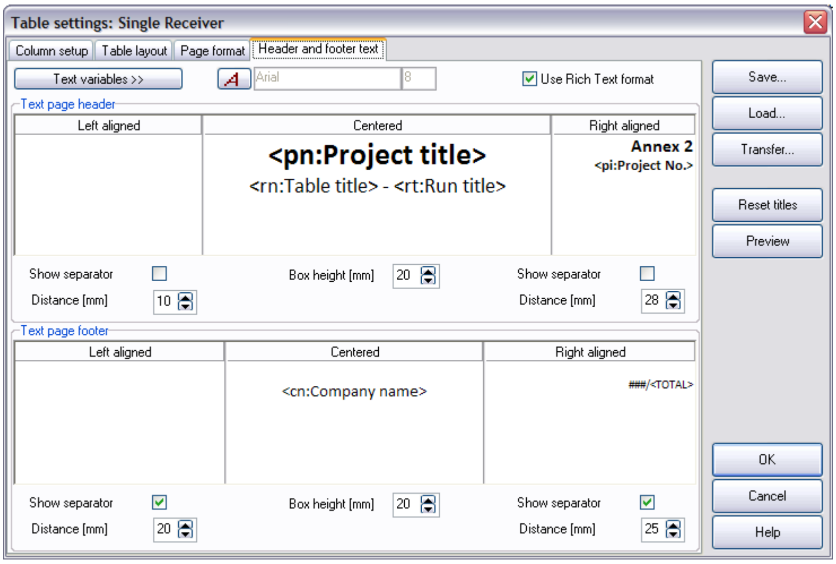


Define the print sheet size and the margins. The line widths and the colors of the frames and the separator lines can be defined for each section separately.

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.

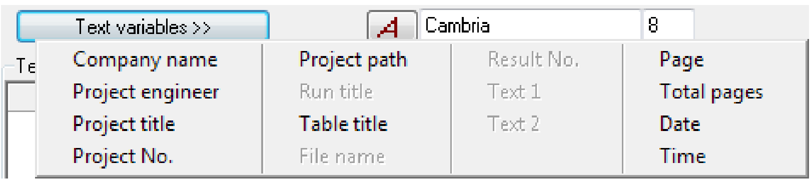
A graphics can be inserted in the header as well as the footer, for example your company logo or the logo of the customer. Click on the gray field to select the graphics file. Define the position (left, middle, right partition) the height and the width of the graphics. When you check the logo justification 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.



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:



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.

Appendix

A

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	
project.sp	Project settings
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	
WMSlist.wml	WMS servers in the project
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
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
RWNFxxxx.res	Façade noise map wall design precaluclaton
RDESxxxx.dat	Data of the wall design precalculation

A

RHOTxxxx.res	Hallout calculation
RHRKxxxx.res	Indoor grid map
RHSPxxxx.res	Indoor single point calculation
RSAKxxxx.res	Indoor noise propagation curve
RSLHxxxx.res	Indoor cross section map
RANSxxxx.res	Aircraft noise single points
RANFxxxx.res	Aircraft noise facade noise map
RANGxxxx.res	Aircraft noise grid noise map
RANIxxxx.res	Aircraft noise contour lines
RRHSxxxx.res	Hotspots
RRILxxxx.res	Grid import of external grid maps
RNATxxxx.res	Noise allotment
RNATxxxx.nat	Result of a noise allotment
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
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
GeoDBObjExt_.abs	Settings for the display of the object properties for attribute explorer, object info and shape export
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 Spreadsheet as well as noise allotment, emission documentation road / railway, long straight road, BA 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
WMSlist.wml	Globally predefined WMS servers

File Names of the Libraries

General

AbsoX.abs	Absorption library
Addresses.abs	Address database for BA-Outside
AssessX.abs	Assessment library
AttenX.abs	Attenuation library
BAIAssess.abs	Assessment for ISO 12354-3
EmisX.abs	Emission library
RiwiX.abs	2D directivity library
Time.abs	Time histogram library
Traffic.abs	Road time histogram library
TransX.abs	Transmission library

A

Standard dependent

CnossosRailBridgeConstant.abs	CNOSSOS Railway bridge constants
CnossosRailImpactNoise.abs	CNOSSOS Railway impact noise
CnossosRailRoughness.abs	CNOSSOS Rail roughness
CnossosRailStructureTransfer.abs	CNOSSOS Rail structure transfer
CnossosRailTrackTransfer.abs	CNOSSOS Rail track transfer
CnossosRailVehicles.abs	CNOSSOS Rail vehicles
CnossosRoadSurf.abs	CNOSSOS road surfaces
CnossosVehicles.abs	CNOSSOS road vehicles

N2ktraf.abs	Road time 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
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 2012
Tssncf.abs	Train table NFS 31-133
Tsvbusch.abs	Train table VBUSch
Ttrapid.abs	Train table Transrapid
VehCatFRA2005.abs	Waggon categories FRA 2005
VehCatS03_2012.abs	Waggon categories Schall 03 2012
Wind.abs	Wind statistics for ISO 9613 (Germany)

Aircraft Noise

AirCrafts.abs	Aircraft classes forAzB 75, ÖAL, VBUF, DIN 45684, AzB 2008
AircraftsECAC.abs	Aircraft classes for ECAC 3rd, ECAC 4th & CNOSSOS
AirplaneDataECAC.abs	Aircraft data for ECAC 3rd, ECAC 4th & CNOSSOS – „contains" / „uses":
AppProfile.abs	Profiles approach (procedural)
DepProfile.abs	Profiles departure (procedural)
ECACDefWeights.abs	predefined aircraft weights
FixedPntProfile.abs	Profiles approach and departure (fixed point)
Flaps.abs	Predefined flaps settings
JetThrust.abs	Thrust settings for jet aircrafts
NPD.abs	"noise-power-distance"- data
PropThrust.abs	Thrust settings for propeller aircrafts

SpectralClasses.abs	Predefined spectrum classes
GenAircraft.abs	Assignment aircraft type / flight class (radar data)

Implemented standards

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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 cases of the standard manufacturers are used. If there are no official test cases, SoundPLAN GmbH or a SoundPLAN distributor creates test cases to check the correct implementation of the standard. With each update, all official and own test cases 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.

Road

ASJ-RTN Model 2018 · BUB:2021/2018· CNOSSOS-EU Road:2021/2015· CoRTN:1988 · CoRTN [AU-NSW]:2013 · DIN 18005 Strasse:1987 · EMPA StL 86 · EMPA StL 86+ · EMPA StL 97 · FHWA:1978 · HJ2.Road:2009 · Hungarian Road · NMPB 96 · NMPB 2008 · Nord2000 Road · ODM 218.2.013:2011 · ÖAL 28:2021/2019 (RVS 4.02.11:2021/2019) ·RLS-90 · RLS-19 · RTN: 1996 · Russian Road · RVS 3.02 · RVS 4.02 · sonRoad18 · sonRoad18:2021 · Standaardrekenmethode2:2012 · Statens planverk Report no.48: 1980 · TNM 2.5 · TNM 3.0 · VBUS:2006 · VRSS:1975

Railway

BUB:2021/2018 · CNOSSOS-EU Rail:2021/2015 · CoRN:1995 · DIN 18005 Schiene:1987 · FTA:2018 / FRA-HSGT: 2005 · GOST R 54933:2912 · HS2 Phase 2b · Israeli Rail:2006 · Japan Narrow Gauge Railways:2008 · Kilde Report 67/130 · NFS 31-133 Rail:2007 · NMT:1996 · Nord2000 Rail · ÖAL 28:2021/2019 (RVE 4.01.02:2021/2019) · ONR 305011:2004 · ONR 305011:2009 · RMR:2002 (EU Interim) · Russian Rail · Schall 03:1990 · Schall 03:2012 · SEMIBEL · Transrapid · VBUSch:2006

Industry

ASJ CN-Model:2007 · BS 5228-1:2009 · BUB: 2021/2018 · CNOSSOS-EU Industry:2021/2015 · Concawe (International Standard of the Oil Industry) · DIN 18005:1987 · DIN 45691 · General Prediction Method:2019 · General Prediction Method:1982 · HJ 2.4: 2009 · HMRI-II.8: 1999 · Industry Noise Model – based on TNM 1998 · ISO 9613-1:1996 · ISO 9613-2:1996 · Japan Industry Model:2003 · NF S 31-133: 2011 · Nord2000 · ÖAL 28: 2021/2019 · ÖAL 28 · ÖNORM ISO 9613-2:2008 · Schall 03:2012 (RuLII3hf) · TA Lärm simple method · VBUI · VDI 2714/2720:1988

Parking lot

RLS-90 · RLS-19 · Bavarian Parking lot study

Wind turbines

IoA GPG Wind Turbine Noise · ISO 9613-2 interim:2015-05.1 · BEK nr 1284 af 15/12/2011 · BEK nr 135 af 07/02/2019

Aircraft noise

AzB 2008 · AzB 1975 · AzB 1975 DIN 45643 · AzB 1975 Hungary · AzB 1975 ÖAL 24 · BUF:2021 / 2018 · CNOSSOS-EU AirNoise:2021 / 2015 · CNOSSOS-AT: 2021 / 2019 · DIN 45684-1: 2013-07 · DIN 45689:2020 · ECAC 2nd, 3rd and 4th Edition · ÖAL 24:2004 · SANC · VBUF

Interior calculations

VDI 3760 - Sound particle diffraction SPD (Sound particle model with diffraction)

Noise allotment

DIN 45691 - ÖAL 41

Assessment regulations

SoundPLAN provides common country-specific assessment regulations; however, you as the user can add further ones yourself at any time. The limit values for the various usages, the Leq or Lmax time slices, the hours over which the assessment level is to be averaged and any additions in certain hours are taken into account.

Index

3

A

B

C

I

D

E

F

G

H

O

P

Q

R

S

T

U

V

W

Z