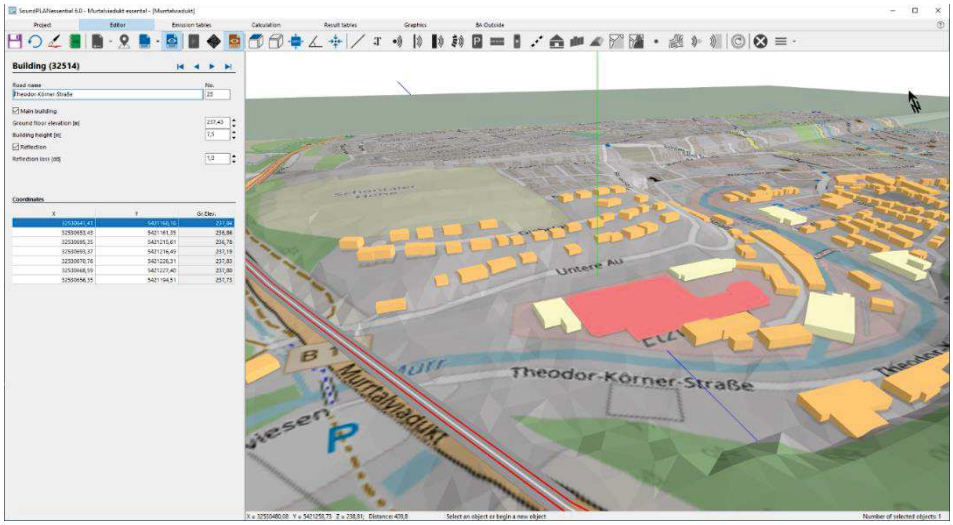
Manual

SoundPLANessential 6.0



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SoundPLANessential 6.0 – 2024

Contents

SoundPLANessential

SoundPLANessential is designed to carry out sound calculations for standard cases with the proven SoundPLAN calculation kernel with minimal training time.

All project work steps are clearly arranged in individual cards, from the project definition to the editor for data input the tabular emission and result documentation, the calculation, to the graphical map display.

The BA Facade module is also available in SoundPLANessential for calculating the required sound insulation of facades.

SoundPLANessential is designed to be easy to understand and intuitive to use. With the help of the clear program structure, you will quickly find your way around. You will also find detailed instructions on the following pages, which will guide you through the program step by step.

First time installation and initialization

The latest SoundPLANessential version can be installed in parallel with previous SoundPLANessential versions, so you do not need to uninstall previous versions.

Please log in as administrator to install. SoundPLANessential is protected with a HASP key and is licensed via a license file. Before installation, insert the HASP key into a USB port, copy the license file you received as an e-mail attachment to your computer and double-click on the installation file. Follow the instructions of the installation program.

At the end of the installation, you will be asked to select the directory in which you saved the license file (BABExxxx.007). Always use the license file that you have received for your current main version number, the license files are valid for one main version number!

Select which program languages and which language versions of the help file and manual shall be installed.

When SoundPLANessential is opened for the first time, demo projects for various noise types are extracted to the directory "..Documents\SoundPLANessentialxx\Demos". Call up one of the demo projects offered (SoundPLANessential always works in an open project). The next time you open it, the last project you worked on is automatically active.

Installation of updates

Program updates for SoundPLANessential are regularly available on the Internet. You will find the corresponding icon button in the **PROJECT** tab. If the installed version is older than the current version, **DOWNLOAD** is automatically checked. Click **DOWNLOAD** at the bottom and then, when the file has been downloaded, click **INSTALL**. SoundPLANessential closes for the installation and then opens again.

Check from time to time whether a new update is available so that you are always up to date.

Project

Quick start in SoundPLANessential

- Create a new project in the **PROJECT** tab.
- Set the project type (calculation of a single variant or calculation without / with noise protection), noise type and time slices / limits.
- Switch to the **EDITOR** tab. You can prepare the geometry data on the basis of a georeferenced bitmap or import it from DXF, ESRI Shapefile, ASCII or OSM.

  Activate the objects in the toolbar. Line and area type objects are finished with a double-click. You can generate right-angled north oriented objects by pulling a frame with the left mouse button.
  For projects that require terrain it is advisable to produce the digital ground model (DGM) entering elevation lines and spot heights in a first step (click on the **CALCULATE DGM** button). All additional objects entered or imported in the future will be placed on the DGM.
  Define the properties of the objects: Building heights, receiver names, the emissions of roads and railways, or the sound power level for industrial sources as a sum level or via a frequency spectrum. When wall heights or traffic data change, enter the new values at the relevant coordinate.
  Pressing the right mouse button activates a popup menu with additional functions such as duplicate objects or insert coordinates.
- The emission of the sources is documented separately for each noise type in the **EMISSION TABLES** tab.
- To calculate, switch to the **CALCULATION** tab and select the desired calculation types (single points, limit lines or grid noise map).
- The **RESULT TABLES** tab contains the assessment levels with the documentation of limit violations and, depending on the project type the differences between two scenarios, the contribution levels at the receivers, the spectra at the receivers for frequency dependent calculations as well as the mean propagation table for industrial sources. For the printout, you can define frame widths and fonts for all tables and customize the header and footer texts.
- The maps of the individual calculations are generated in the **GRAPHICS** tab. You can select the different maps in the list on the left. The single point results are displayed as small tables together with the limit lines for all time slices in one map. Grid noise maps are generated separately for each time slice and provided with a colour scale.

  To zoom, rotate and move the view on your map, click the hand button (**CHANGE MAP VIEWPORT**). Turn the map by holding down the ***Ctrl*** key and using the mouse. After the operation is completed, click on the hand symbol in the top frame to deactivate the change mode.

Click in the description block at the top right to enter the title and a description on the left-hand side. By clicking on the legend and on the scale, you can also adjust the layout here. A bitmap with the company logo can be inserted in the lower empty area in the description block.

Project settings

A SoundPLANessential project consists of several files, which are stored jointly in one project folder. When you create a new task, you create a folder not a file. Each folder that is recognized as a SoundPLANessential project is displayed as a dark blue folder symbol.

Select a new project in the **PROJECT** tab. Enter the name of the project folder. As a default the project title is automatically taken from the name of the project folder but can be changed. Use the fields project number, project engineer and customer to add information for the project. The description field may host e.g. the telephone numbers of the customer or other project notes.

When the program is started, it automatically loads the project last used.

If you want to open another project, select **OPEN PROJECT.**

Pressing the right mouse button activates a popup menu with additional functions such as copy, delete or pack.

If you click on the small arrow next to the **OPEN PROJECT** button, you will be offered a quick selection of the most recently opened projects.

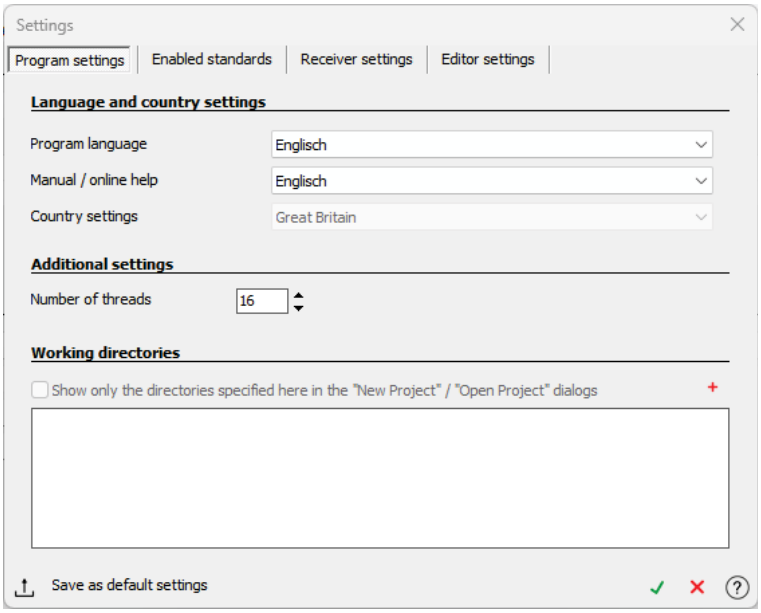
A project folder can be compressed using the **PACK PROJECT** button. If a program error occurs due to geometric peculiarities, you can send the project directly from here to the support via **PACK & SEND**.

If you want to use the same geometry data for different planning variants, store the project with **SAVE AS** under a new name.

Open the **MANUAL**, the **QA-DOCUMENTS**, the **HELP** or the **PROGRAM INFORMATIONS**.

Various program setting options are available via the cogwheel symbol button.

Program settings

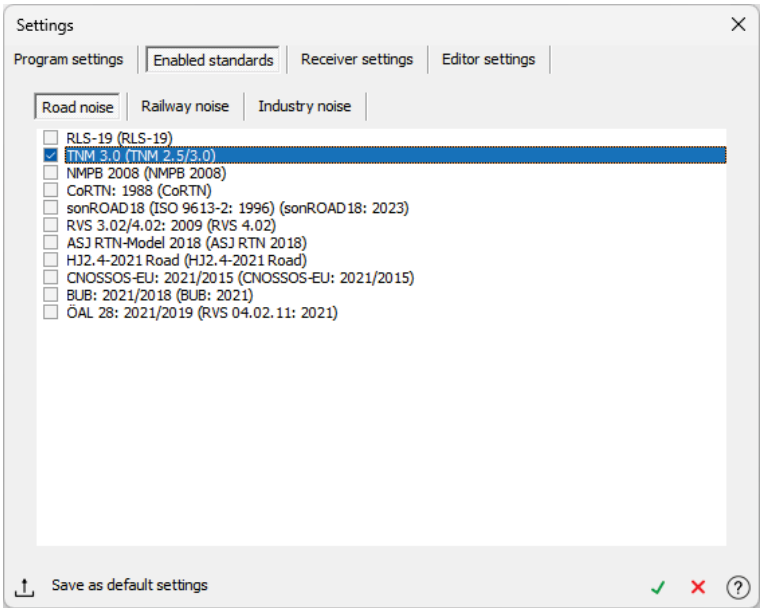


Program language, language of help file and manual and the country settings for the standards and time slices are set to defaults according to the language of the operation system. You can change these settings if needed.

The number of threads controls how many threads of a multi-core computer are used for the calculation. As default SoundPLANessential uses all available cores.

In the **WORKING DIRECTORIES** area, you can define specific directories to be used for opening and creating a project. Add new directories with the red **PLUS**.

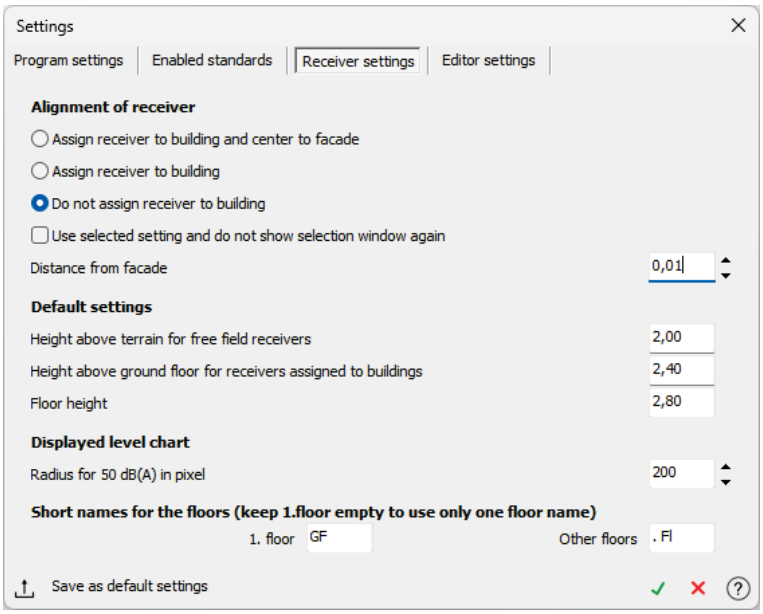
Enabled standards



The guidelines used are preset based on the country setting. You can activate additional road, rail and commercial noise guidelines or deactivate unnecessary ones. The implemented standards are listed in the annex, see Implemented standards. As soon as emission definitions or results are present, the settings for

the noise type can only be changed, if you delete them using the buttons **DELETE EMISSION DEFINITION** or **DELETE RESULT FILES**.

Receiver settings



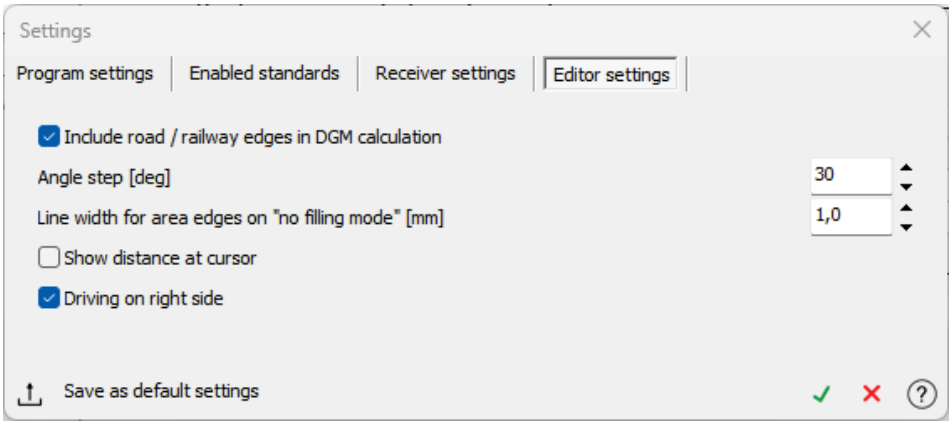
You can preset how receivers should be handled when entering them in the editor (**ALIGNMENT OF RECEIVER**). If a building has been named with a street name and house number, assigned receivers are named accordingly. The distance from the facade depends on the used standard and can also be preset in the settings.

The **DEFAULT SETTINGS** for receivers refer to the calculation height for single point calculations. Default values are preset both for receivers assigned to buildings and for free field receivers, which you can change if necessary. The floor height is evaluated when assigning receivers to buildings with several floors. The calculation height of the first calculation point is determined using the **HEIGHT ABOVE GROUND FLOOR**, otherwise the reference height is the entered base height. Any number of receivers are calculated one above the other using the **NUMBER OF FLOORS**, the calculation height of which is determined by the **FLOOR HEIGHT**.

For a single point calculation, a **LEVEL CHART** is presented depicting the magnitude of the noise received from each angular segment. Adjust the radius if necessary.

Define **SHORT NAMES FOR THE FLOORS**.

Editor settings



Here you can specify whether road and rail edges are to be taken into account in the DGM calculation. The elevation points and elevation lines within road strips and rails are then not taken into account for the meshing. This means that the emission lines in moving terrain are not buried by the terrain. If rails are included in the terrain model, the DGM parameters specified in the calculation settings are used.

The set **ANGLE STEP** and multiples thereof are used when objects are entered in the editor using the angle mode.

Select whether or not there is **RIGHT-HAND TRAFFIC**.

Select **SAVE AS DEFAULT SETTINGS** if you want the settings and parameters immediately available for new projects.

Projects from previous program versions

Since data structures can change between two versions, projects created with an older version must be converted. Converted projects can no longer be opened with the older version.

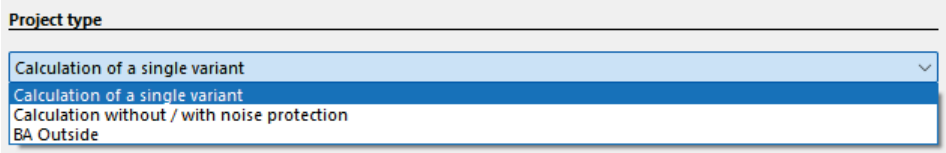
Projects prepared with an older version are marked with a gray project folder. When you click on the project folder, you will be asked if you want to convert the project. Specify how you want to convert. Depending on the setting, the project is first packed or copied and then converted.

Select project type

SoundPLANessential has two project options:

- Calculation of a single variant,
- Calculation of 2 variants without and with noise protection,
- [Additional module] The BA Outside module can be used to calculate the required sound reduction index R'_w of external building components. The calculation is carried out according to EN 12354-3:2017 (only single values, no frequency-based calculation). Calculation results of a single variant or without/with noise protection can be used. Only select the BA Outside project type if you do not want to carry out your own sound propagation calculations but want to enter the relevant external noise levels manually. The other cards are then hidden.

Select the project type from the selection list:



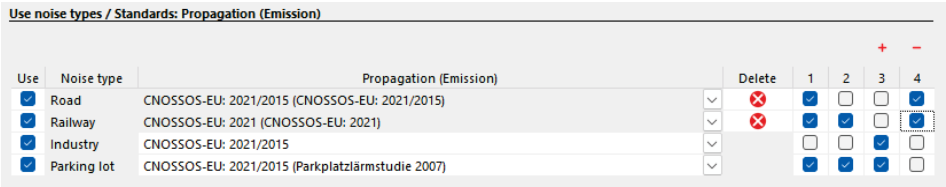
The calculation of a single variant represents the standard case. When calculating two variants (without and with noise protection), a situation without noise protection structures is compared with an additional variant with a wall or embankment. The difference is then also shown in the results tables and maps are created for both variants in the graphic output.

Noise type combinations

A project may contain several different noise sources (road, railway, industrial sources, parking lot), so that you can calculate and superimpose different noise types using the same geometrical data. The combinations and calculation standards are set to defaults according to the selected country settings.

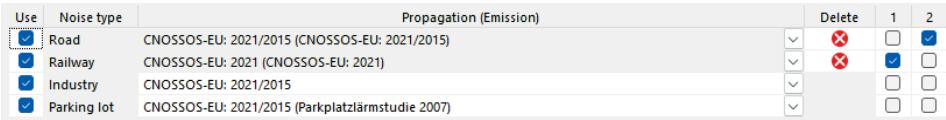
Select the noise type(s) you want to calculate in this project from the view list:

To do this, check or uncheck the appropriate boxes in the table. The corresponding propagation standard can be selected for each noise type (pull-down menu). With the red **PLUS** you can create noise type combinations. As soon as data for the respective noise types has been entered in the editor, the selection is locked to prevent accidental changes later on. A changeover is then only possible if the emission for roads, railways or parking lots is first deleted.



Example: In a project, the noise immissions of a road and a nearby railway are to be analyzed. The noise levels are to be calculated and documented for the two emitters individually as well as combined for road and rail.

First select the two noise types “Road” and “Railway” by ticking the boxes. Then use the red **PLUS** to create your noise type combinations:



Other combinations or additional emitters in the combination used do not interfere. The tables and graph sheets contain the results for road, railway and the sum level.

*Tip: If you want to calculate different planning variants for the same geometric data, use the **SAVE PROJECT AS** function (**PROJECT** tab).*

Limit values and standard dependent settings

Select whether you require the day/night (i.e. 2 time slices) or L_{den}, L_d, L_e, L_n (i.e. 3 time slices) for entering the emissions and the calculation. Then enter the start of the day and night time slice (or day, evening and night time slices) and enter the corresponding **LIMIT VALUES**. When calculating with three time slices, the noise index L_{den} is increased in the evening period (5 dB) and in the night period (10 dB).

The project limit values are used for the first receiver entered and are also used to draw the limit line in the graphics display. A checkmark in the column labeled **USE** determines, whether the time slice is displayed in the tables and in the graphics. This is useful if you calculate for example according to L_{den} and only want to show the noise indices L_{den} and L_{night} but not the intermediate products L_{day} and $L_{evening}$.

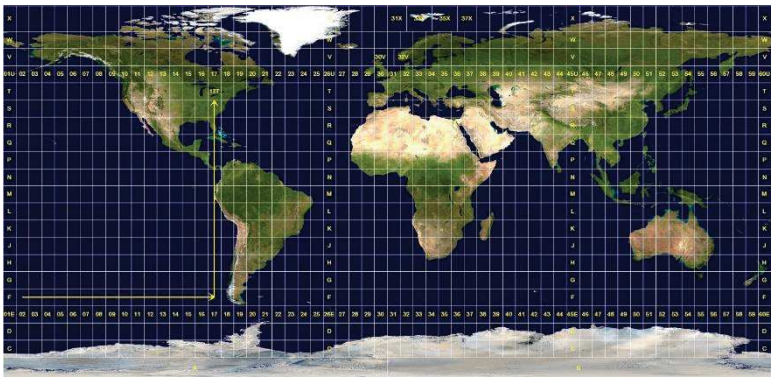
Standard depending settings: For calculations according to ISO 9613-2 enter the factor $\mathbf{C_0}$ (for each of the time slices) for the calculation of the meteorological correction C_{met}.

For calculation according to the French standards NMPB Routes 2008 and NFS 31-133 and according to CNOSSOS-EU the percentage of favorable propagation conditions is needed, enter the value in the column **FAV.**

Coordinate settings

If you want to use background images from Google Maps or OpenStreetMap in your project, you need a global coordinate system as a basis. Set UTM northern / southern hemisphere and enter the UTM zone.

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



Overview of the UTM zones

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

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

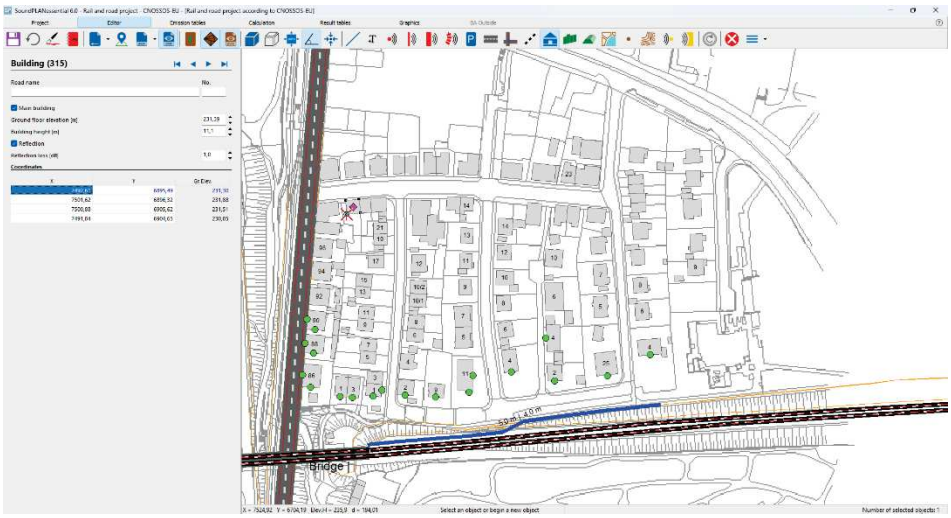
The website https://coordinats-converter.com offers a very helpful converter in different coordinate systems. For example, specify a location in your study area. The coordinates are displayed in different coordinate systems. This will allow you to quickly find out in which coordinate system the data is available.

Editor (Data entry)

Enter the noise relevant data and geometry for your project and start the calculation (single receivers, noise contour lines and grid noise maps) in the tab index card **EDITOR**. You can prepare the geometry data on the basis of a georeferenced bitmap (also directly from the connection to Google Maps /OSM) or by importing from different formats.

The elevation supply works with a digital ground model (DGM) and places the objects on top of the triangulated surface.

SoundPLANessential works with global cartesian coordinate systems or a user defined local coordinate system. The base unit is **METER**. Import data that use cm, inch or feet need to be converted. For the DXF import you can enter a conversion factor.



The symbol bar on top of the graphical entry field contains symbols for entering the geometry, controls for zooming and editing, and symbols for selecting the background graphics.

In the block on the left side of the graphical entry field, the properties and coordinates of the currently active object are listed. In case an object (i.e. elevation lines) does not contain properties, only the coordinate list is displayed.

Digitizing on screen with background graphics

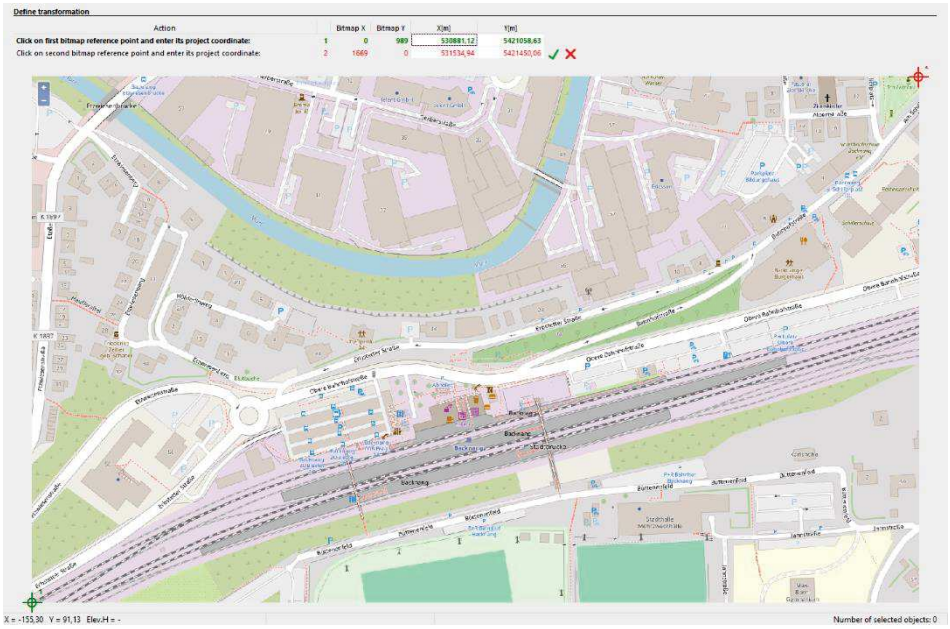
Digitizing on top of digital background graphics is the most common mode of data entry unless the data are already present in a usable form in digital format. You can use any number of background bitmap graphics in any of the formats BMP, JPG, PNG or TIF.

Background bitmaps must be used to establish the geo reference between the pixel formatted bitmap and the world or local coordinate system. If the bitmap already came with its geo-reference transformation, SoundPLANessential will detect it and read the geo-reference file as soon as the file is opened.

Open **SELECT BITMAP** and select the graphic file. The initialization window opens. Here you can georeference the graphic using control points (if no referencing file is included). The procedure for georeferencing differs depending on whether geometry data has already been entered in the editor or not.

Georeferencing if no geometry data is yet available in the editor:

After you have selected your graphics file as described above, it will be displayed in the editor. At the top you can see the table for the coordinate transformation.



1. Click on the upper, green line of the transformation table and then set the green control point by left-clicking on a position in your bitmap where you know the project coordinates. Then enter the x and y coordinates in the table (world coordinates or local coordinates).

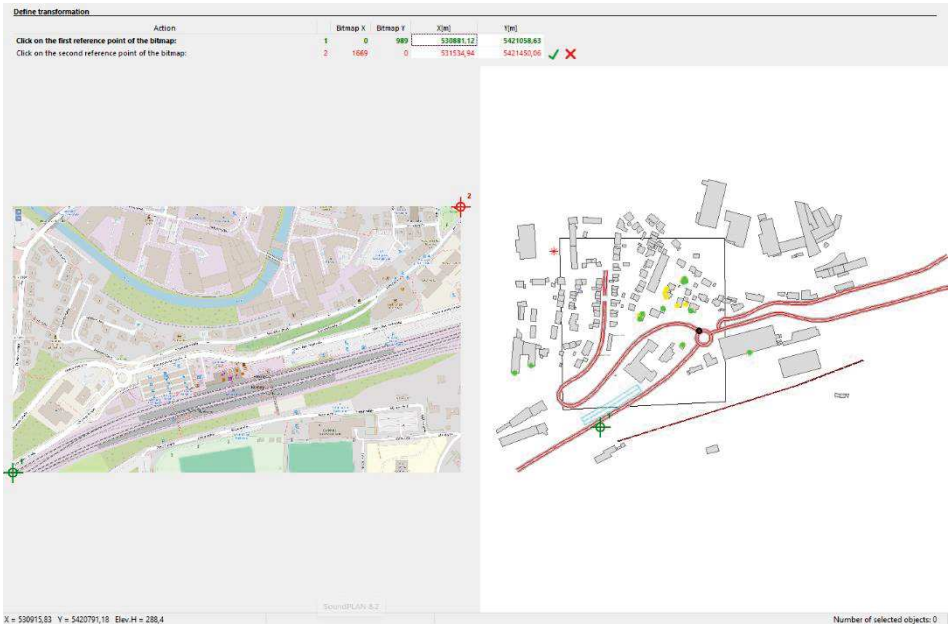
2. Click on the bottom red line of the transformation table and set the red control point to a suitable position in the bitmap. Also enter the corresponding project coordinates for this point in the table.

The reference points should be as far apart as possible and should enclose the investigation area as much as possible.

Confirm the transformation with the green tick next to the transformation table.

Georeferencing if geometry data is already available in the editor:

After you have selected your graphics file as described, the initialization window is displayed. You will see your bitmap on the left and your geometry data on the right. At the top you will see the table for the coordinate transformation.

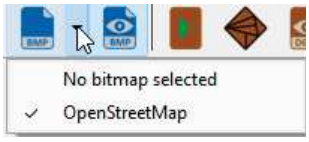


1. Click on the top green line of the transformation table to activate the green control points. First set one green control point by left-clicking on a suitable position in your bitmap and then click on the corresponding position in your geometry data. The position of the two green control points must correspond.

2. Click on the bottom red line of the transformation table and also set the red control point to a suitable position in the bitmap. Then click again on the corresponding position in your geometry data.

The reference points should be as far apart as possible and should enclose the investigation area as much as possible.

Confirm the transformation with the green tick next to the transformation table.



In the editor, you can switch between several bitmaps using the pull-down menu to the right of the **SELECT BITMAP** icon button.

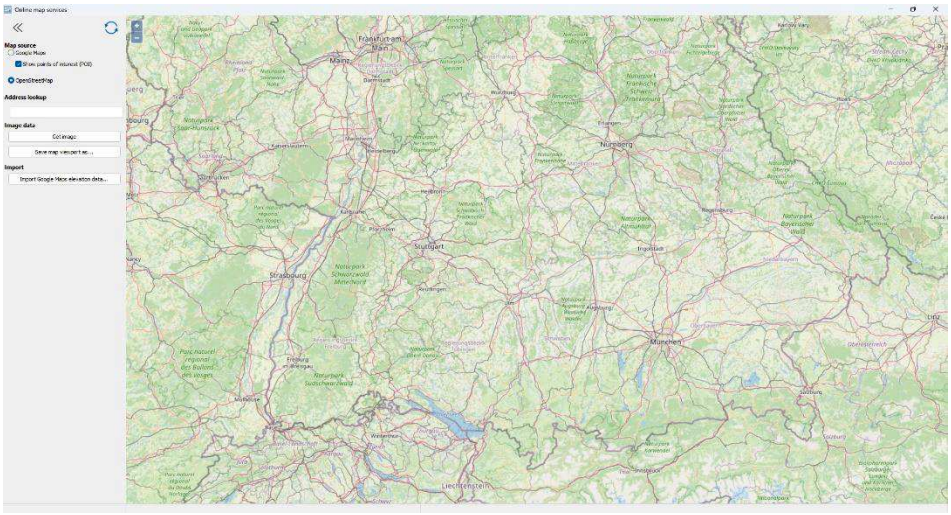
 If required, the selected bitmap can be switched on and off.

Google Maps / OSM bitmaps and Google Maps elevations

When using Google Maps, please observe their usage and licensing conditions. SoundPLAN supplies the tools but is not responsible for the licensing conditions. This is entirely the responsibility of the Google Maps user. As Google licensing may vary between countries, SoundPLAN can't even assist.

In the project settings select either UTM northern or southern hemisphere and the zone, see Coordinate settings.

 Switch to the **EDITOR** and click on the icon at the top to open Google Maps / OSM.



Zoom to the investigation area or enter the town name in the address lookup. With **GET IMAGE** the bitmap is stored in the editor. If geometry data in UTM coordinates are already available in the project, the online map services open automatically in the data area.

Elevations from Google Maps

Google Maps elevations are based on free SRTM elevation data. These have a resolution of approx. 90 m. This means that every 90 meters is a measured elevation point, between which a spline interpolation is performed. Changing topography cannot be reproduced with these elevations. For smaller, relatively flat areas, these elevations offer an alternative.

In the Online Map Services window, click **IMPORT GOOGLE MAPS ELEVATION DATA**; the elevations of the selected area will be imported and meshed directly into a digital ground model.

The height filter dialog opens during the import. You can find more information on the height filter dialog in the chapter Import of elevation points.

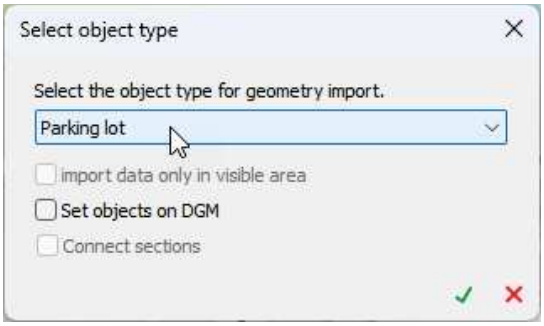
Geometry Import

The model geometry can be imported in the formats of **DXF**, **ESRI SHAPE FILE**, **ASCII** or **OSM XML**. The objects must be organized in individual files or layers (DXF).

Properties in Shape files, OSM XML or ASCII files will not be taken into account.

Select the object type for which you want to import geometry.

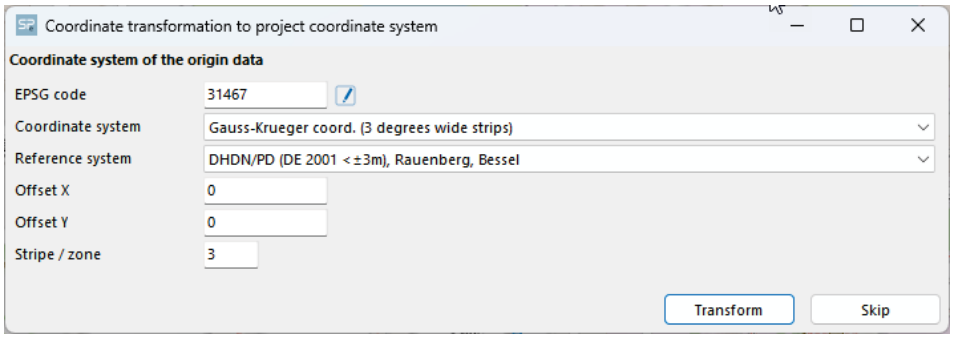
If required, you can set default properties before the import by activating the corresponding object type and assigning properties that are to be transferred to all imported objects during the import.



Select the object type for which you want to import the geometry. Use the **IMPORT DATA ONLY IN VISIBLE AREA** checkbox to restrict the import to the area selected in the editor. If the objects do not have a defined base height or this is not to be used, you can use the **SET OBJECTS ON DGM** checkbox to use the average terrain height in the model as the base height of the objects directly during import. **CONNECT SECTIONS** can be used for line objects (i.e. roads) that consist of several sections.

Select the import file. A window for a coordinate transformation then opens. A coordinate system is often defined in the import data. To ensure that the data is available in the project coordinate system after the import, a transformation may need to be carried out during the import. To do this, specify the original

coordinate system and, if necessary, the stripe / zone, either via the associated EPSG code or by selecting the coordinate and reference system. If you do not want to carry out a transformation, select **SKIP**.



Import of DXF-data

SoundPLANessential can import relevant objects from the AutoCAD 2002 DXF format specification. As **DXF FILES** contain different layer, an additional window is supplied to select the appropriate layers for import. The layer list is displayed 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 scroll through the layer list to view the content of the individual layers. Use the ***Shift*** key or the ***control*** key to mark multiple layers of the same object type for import. The assignment to the different layers is then lost.

By holding down the left mouse button, you can draw an area in the preview image within which the data is to be used. Click on the **DELETE AREA** icon to import the entire coordinate range.

When importing a DXF-file you can enter a conversion factor if the drawing was for example set in millimeter or feet.

Import of OSM XML data

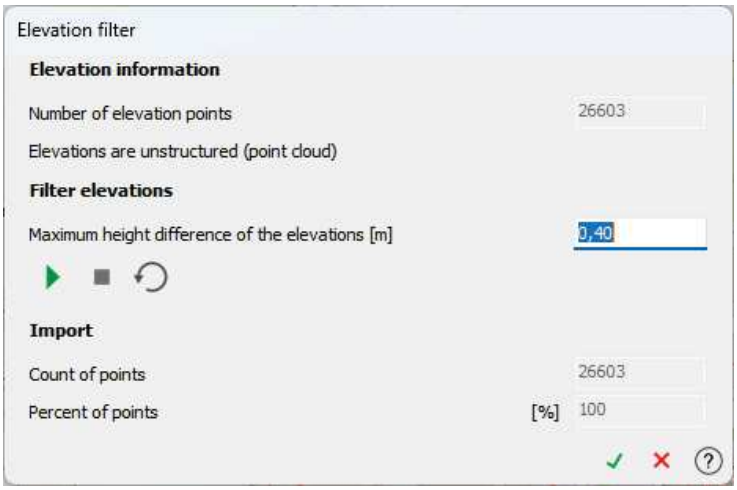
For the import of **OSM XML DATA** first go to the website www.openstreetmap.net or another page from which you can save OSM XML and select the section from which you want to import geometry data.

Be careful not to select a section that is too large, as the computing time and the processing time are greatly increased by unnecessary amounts of data!

During the import, **building facades** are filtered within a band width of 1 cm, in order not to get unnecessary facade parts.

Filter elevation points prior to import

If you have elevation spot heights to be imported as ASCII or DXF data, they often are present as either a grid or a cloud with very small spacing (for example 1x1 [m] grid with little variance in elevations). The amount of elevation information far exceeds the need to correctly model the terrain. As the number of elevation coordinates has a big influence on the size of the DGM and also on the calculations, it becomes advantageous to filter the elevation information and thus minimize the number them.



In the dialog that opens after selecting the import file, the number of elevation points and the structure (grid or cloud) is presented as the file information. Enter the maximum deviation between the elevation data given in the import file and the elevation model that will be used after filtering the data. With the pre-set max deviation of 40 cm a tolerance of ± 0.40 m is guaranteed between the raw data and the model to be created. Click on the green checkmark to start the filtering and import. In the filter result you get the information how many elevation coordinates will remain and how many percent of the original data will remain.

If you are not satisfied with the filter result, you can undo the filtering and then filter again with a different maximum height difference.

In contrast to grid data, point clouds can also be imported without filtering if required, although this is not usually recommended. If you want to import the points 1:1 without filtering, click directly on the **green checkmark** in the height filter dialog.

Digital Ground Model

A Digital Ground Model (DGM) is the basis for creating a 3D noise model. If you haven't calculated a DGM, SoundPLANessential automatically generates a DGM from outside positioned spot heights with a height of 0 m and uses it for the calculation.

The DGM is generated from elevation lines and spot heights, optionally road and railway edges can be evaluated for the DGM, see Editor settings. If you use this option, emission lines in changing terrain can no longer be spilled from the terrain. If railways are evaluated, the DGM parameters set in the calculation settings are used.

Enter the DGM relevant data and then invoke the calculation of the DGM via the symbol button **CALCULATE**.

The **SHOW DGM** symbol button can be used to show and hide the DGM triangles in the editor.

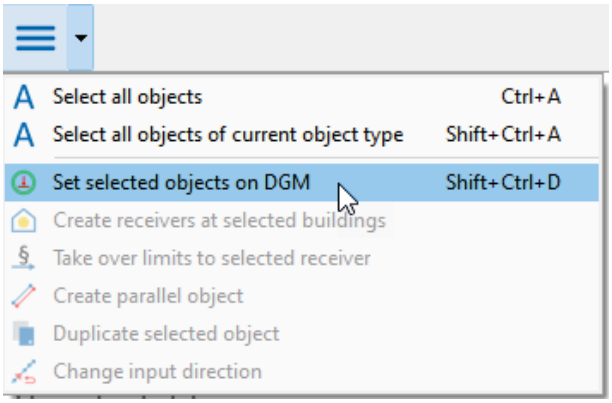
The **USE DGM** symbol button activates and deactivates the digital terrain model.

If the DGM is active, all objects that are entered are automatically set to the DGM. For import data, this is offered as an option. When moving objects, the

height is automatically adjusted. Deactivate the DGM temporarily if you want to retain the height of the original object, for example for a wall parallel to a road or rail.

You can also place the objects on the DTM manually. To do this, select the relevant objects and select the corresponding command from the TOOLS icon button in the pull-down menu. The mean ground level is always used for buildings.

The terrain elevation can be assigned manually via **TOOLS -> SET SELECTED OBJECTS ON DGM.**



Check the model data in the 3D-plan view.

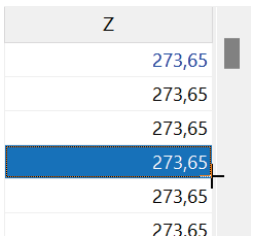
Coordinate list

The coordinate list shows the x and y coordinates and depending on the object type the base height or the relative height. The terrain elevation of the objects is only displayed for information purposes but cannot be edited as it is either 0 or it is derived directly from the digital terrain model. For objects that consist of several coordinates (e.g. buildings, roads etc.), a coordinate list is created for each object with a list of the object coordinates. Coordinates at which the object properties change (e.g. noise barrier height) are highlighted in blue.

Point objects consist of only one coordinate. A single coordinate list is therefore created for each object type, in which all point objects are listed.

In the coordinate list you can:

- correct x and y coordinates
- enter the z coordinate for several points. (Keep the **Shift**-key pressed, highlight the points with the arrow keys and enter the value or use the fill handle like in Excel program.)



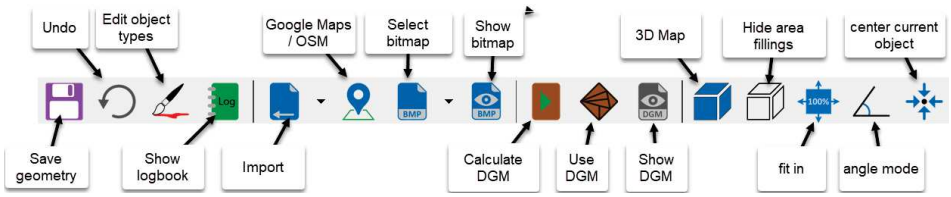
- insert coordinates with the right mouse button **-> INSERT POINTS**. The point is inserted in the middle of the two coordinates, the elevation between both points is interpolated. (This is for example useful to divide a wall in smaller regular sections.)
- Delete coordinates (***Del*** key)

- Delete changes in the property definition within roads, railways, walls and berms (right mouse button -> **DELETE PROPERTIES**).

If a line contains only a single coordinate after deleting, then the entire object is deleted. This is the same for areas having only 2 coordinates.

Edit objects and object properties

The following symbol bar depicts the entry and edit functions in SoundPLAN-essential:



Enter objects clicking on the points describing the object with the left mouse button. North oriented, rectangular objects can be entered by pulling open a frame with the left mouse button. You can also enter coordinates with the keyboard in the coordinate list or correct them afterwards. To enter, the desired object must be active. Select it by left-clicking on the object icon. The field is then highlighted in blue. The individual objects will be explained in detail later.

End the data entry for the line and area objects by double clicking or use the symbol button **FINISH OBJECT** (F2). For buildings entered with the right-angle mode, you can close the building with a double click at the third coordinate; the fourth coordinate will be set by the program and the building will be closed.

The area can be enlarged and reduced (**zoomed**) using the scroll wheel of the mouse. Holding down the mouse wheel **moves** the geometry section. Also press the ***Ctrl*** key to **rotate** the data.

The **crosshair cursor** is visible when entering objects. If the crosshair cursor is close to another object …

… it will change its appearance into the **selection cursor** to select the object and display its coordinates and properties on the right side.

...snap circle cursor when the ***Alt*** key is pressed. When entering new objects, points and lines of existing objects can be snapped. If the cursor comes close to an existing point or line, you can activate the snap circle cursor by pressing the ***Alt*** key. If a point is created by snapping another point, it then has both its x and y coordinates as well as its z coordinate. However, when snapping lines, only the x and y coordinates are adopted, the terrain height is used for the z coordinate.

Notes:

- If objects are overlapping (e.g. buildings and assigned immersion locations) and the wrong object is found, click on the object type you are looking for in the toolbar. The active object type is always searched for first.
- You can use the navigation bar above the properties to scroll through the individual objects of an object type and check properties or coordinates.

- If you have accidentally entered a new object although you actually wanted to activate an existing object, the coordinates are deleted again with ***Esc*** or ***Ctrl + z*** as long as the object has not yet been completed.

With **ANGLE MODE**, the object coordinates are entered from the 2nd coordinate in the angular increment set in the **PROJECT SETTINGS** or multiples thereof. The default setting is an angular increment of 15 °. Hold down the ***Ctrl*** key to temporarily deactivate the angle mode, for example to model a bay window on a building or to precisely align the first edge of a surface.

The **OVERVIEW** symbol button zooms in on all objects entered. Also use the **OVERVIEW** symbol button if there is a large bitmap in the background and you have only entered data in a specific area. SoundPLANessential zooms in on the input area. If you want to enter more data outside the displayed area, use the mouse wheel to enlarge the area.

If the **CENTER CURRENT OBJECT** icon button is activated, the geometry moves and the active object is displayed in the centre of the screen.

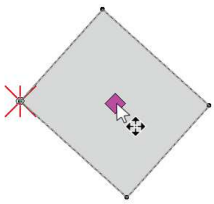
Selection of multiple objects

With the pressed ***Ctrl*** key and a **left** click on the object, multiple objects are marked. As an alternative you can pull a frame with a pressed **right** mouse button around the objects – all objects that have at least one coordinate within the frame are marked. Marked objects can be deleted jointly (popup menu right mouse button or ***Ctrl+Del***), they can be moved (by moving the pink diamond with the left mouse button) or rotated (***Ctrl***+ left mouse button on pink diamond).

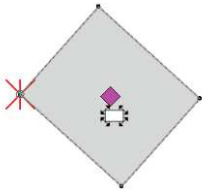
Keep the ***Shift*** key pressed and pull open a frame with the **right** mouse button to only select the objects of the current object type. With pressed ***Shift*** and ***Ctrl*** key additional objects of this object type can be selected (pull open a frame or left mouse click).

If multiple objects of the same type are marked, it is also possible to jointly modify the objects properties. This however is not possible for objects that have the ability to change properties within the object (road, railway, wall or berm).

Modify and delete objects

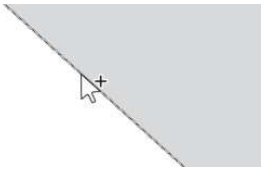


Move object(s): The pink diamond appears as soon as at least one object is activated. Move the cursor to the diamond, the shape changes to the move cursor. Selected objects are moved with the left mouse button pressed.



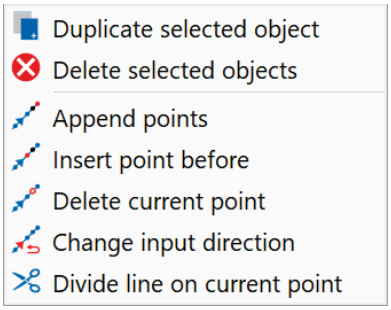
Rotate object(s): The pink diamond appears as soon as at least one object is activated. Keep the ***Ctrl-key*** pressed and move the cursor to the diamond, the shape changes to the rotation cursor. Selected objects are rotated with Ctrl +left mouse button pressed.

When objects are moved or rotated and **USE DGM** is activated, they are automatically re-referenced to the DGM. If the DGM is deactivated, the object elevation (z-coordinate) is not updated to conform to the new position.



You can insert points in a selected object by holding down the ***Shift*** key and moving the cursor to the corresponding position. The cursor changes to an arrow with a small **+**. Click to insert the new point. You can remove existing points in the same way. Hold down the ***Shift*** key and the cursor changes to an arrow with a small **-**. Click to remove the point.

The objects can be further edited with a right mouse click:



DUPLICATE SELECTED OBJECT: Duplicated objects are positioned at a slight offset to help with placing it. The duplicated object is activated and can be moved with the left mouse button pressed.

DELETE SELECTED OBJECTS: Selected objects can alternatively be deleted with ***Del***.

APPEND POINTS is only active for line type objects so additional coordinates can be digitized at the end of the object.

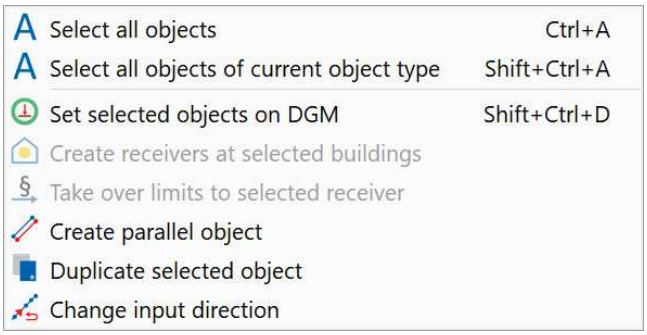
INSERT POINTS BEFORE: Right-click on the point in front of which another point is to be inserted. The inserted point is centered between the current and the previous one, the height is taken from the DGM.

Individual coordinates are deleted via right mouse button -> **DELETE CURRENT POINT**. To do this more quickly, hold down the ***Shift*** key, move the cursor to the point and, after it has changed to an arrow with a small **-**, click on the point.

CHANGE INPUT DIRECTION: Changes the input direction of an object. The object properties are retained and do not change.

DIVIDE LINE AT CURRENT POINT: Splits line objects into two individual objects. The new object receives the properties that are valid at the point at which the object was split. Lines can only be split if both partial lines have at least 2 coordinate points after splitting.

In the toolbar you will find a selection menu with various **TOOLS** for easier data entry. Depending on the situation, individual commands are grayed out and are then not available.



SELECT ALL OBJECTS can be used as an alternative to ***Ctrl+A***.

SELECT ALL OBJECTS OF THE CURRENT OBJECT TYPE marks only the objects of the active object type (e.g. only buildings).

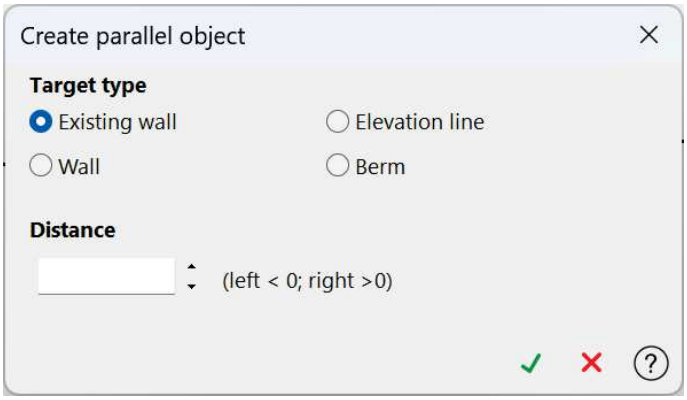
SET SELECTED OBJECTS TO DGM evaluates the terrain heights at the coordinate points of the marked objects and sets them as new z-coordinates. For buildings, the average ground level is used as the first floor level.

CREATE RECEIVERS AT SELECTED BUILDINGS: One receiver is automatically set in the middle of each facade that is longer than 1 m on the selected buildings. The z-coordinate of the receiver results from the project settings. If there are limit values in the **PROJECT** tab in the **ASSESSMENT** area, these are automatically entered when the receivers are created. The name of the receiver is generated with a consecutive number from the building name and the number of storeys is calculated from the building height.

If several buildings are selected, the receivers are only generated for main buildings. This check is not necessary if only a single building is active, so that receivers can be generated specifically for an auxiliary building.

TAKE OVER LIMITS TO SELECTED RECEIVERS transfers the limit values entered in the project settings for all selected receivers.

CREATE PARALLEL OBJECT: The creation of parallel line objects is used for walls or embankments running parallel to a road or rail, a second track or road axis running parallel or elevation lines running parallel to a track or road axis. Select the source object and call up **CREATE PARALLEL OBJECT**. Select the target line type (wall, berm, elevation line or keep object type) and the distance from the source object. A positive value creates a new line in the input direction to the right of the original line, a shift to the left in the input direction is entered as a negative value.



If parallel road or rail axes are created, the properties are transferred to the new object.

If a DGM has been calculated and **USE DGM** is switched on, the object and terrain height of the parallel object are adapted to the DGM. If you want to retain the height of the gradient for a wall parallel to the road axis, switch **USE DGM** off.

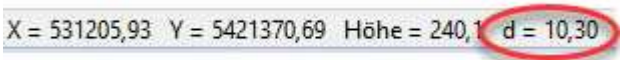
DUPLICATE SELECTED OBJECT: Right-click on the object you want to duplicate. Duplicated objects are placed slightly offset. The duplicated object is highlighted and can be moved to the pink diamond by holding down the left mouse button.

Display types: Site map, 3D map and wireframe

Site map

The geometry data of the calculation model is entered in the site map.

During input, the distance between the last digitized coordinate and the next coordinate is displayed in [m] in the status bar. When drawing a rectangle, the size is indicated with dx and dy.



In the **PROJECT** tab, you can set that the distance to the previous input point is also displayed at the cursor. **SETTINGS | EDITOR SETTINGS | SHOW DISTANCE AT CURSOR.**

Tip: The further you zoom into the data, the more precisely you can define the distance.

You can use the mouse wheel to move freely around the map:

- Move the mouse with the mouse wheel pressed down to move the geometry.
- Turn the mouse wheel: zoom in and out.

In the site plan, the display of the **AREA FILLINGS** can be switched on and off for all objects together, for example to be able to see the graphic better when digitizing from a background bitmap.

In the **PROJECT** tab, under **SETTINGS | EDITOR SETTINGS**, you can specify the line width that should be drawn if the area fillings are not displayed.

3D map and wireframe

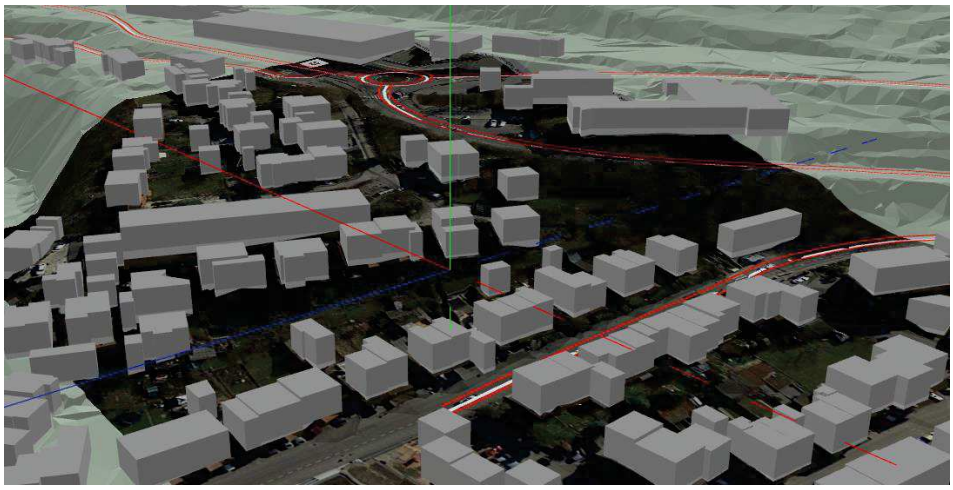
The 3D map can be used to check the data. You can also switch between the site plan and 3D map by pressing **F10**.

The object properties of a selected object can also be edited in the 3D map.

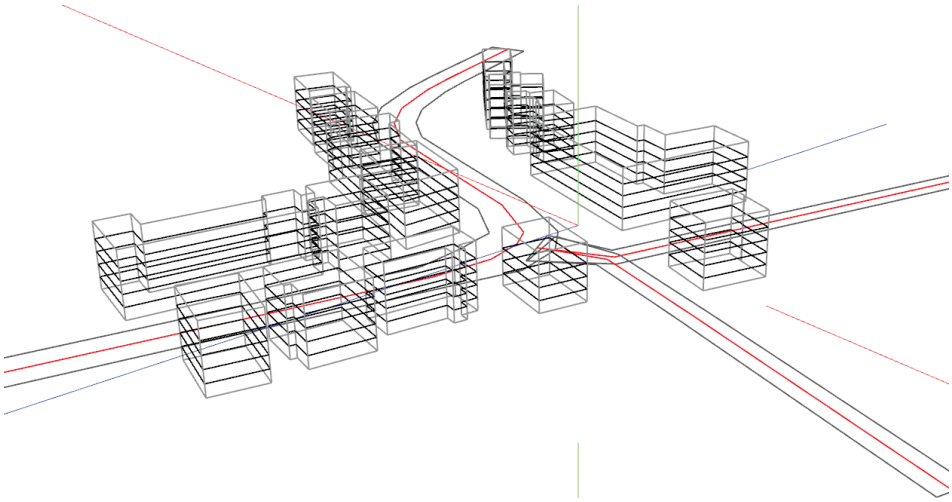
Navigation in the 3D map works as usual by holding down the mouse wheel (move) or by turning the mouse wheel (zoom). In addition, the environment model can be tilted and rotated by pressing ***Ctrl*** + holding down the mouse wheel.

If a geometry **BITMAP** is stored in the editor, this can also be displayed in the 3D map. The same applies to the **DGM**.

Note: The colours of the DGM triangles and the objects in the 3D map can be set in the object types.

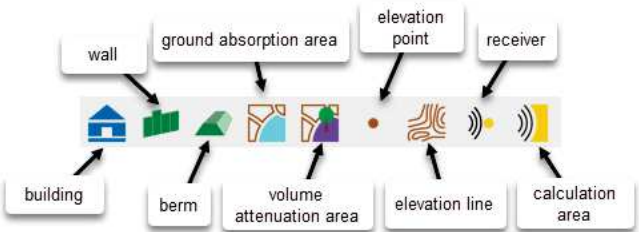


If you **HIDE AREA FILLINGS** in the activated 3D map, you will receive a wireframe model.



Navigation and moving in the wireframe model is analogous to the 3D map.

Objects for all noise types

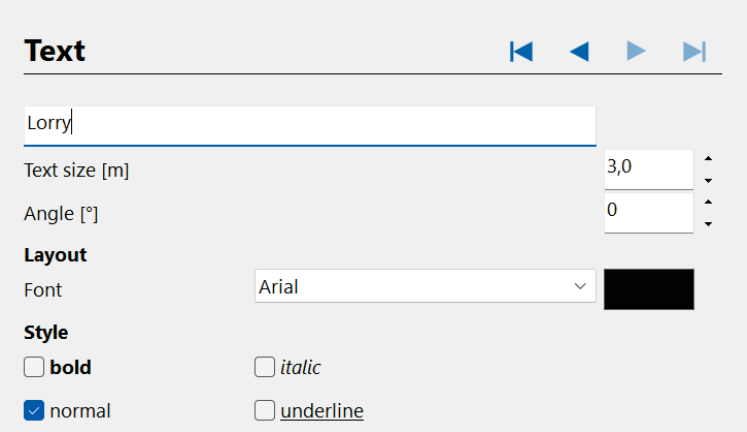


Click on the symbol button for the desired object and enter the coordinates.

Hint: *Take advantage of the fact that the object properties are always taken from the object last entered and enter similar or identical objects one after the other. This speeds up generating the model.*

Text

Texts are used to write descriptions or annotations for the graphical output (e.g. source name, house number). The texts are linked to the entry coordinate.



Enter the text, the text size and if needed an angle and the parameters for the layout and the style of the text.

General line

General lines have no properties. You can for example import all lines from a DXF file to the object type "general line" and digitize the needed objects similar to digitizing them from a background bitmap.

You can also use the DXF lines instead of a bitmap as a background graphic in the graphic output.

Activate the snap mode with the ***Alt*** key to digitize the individual objects.

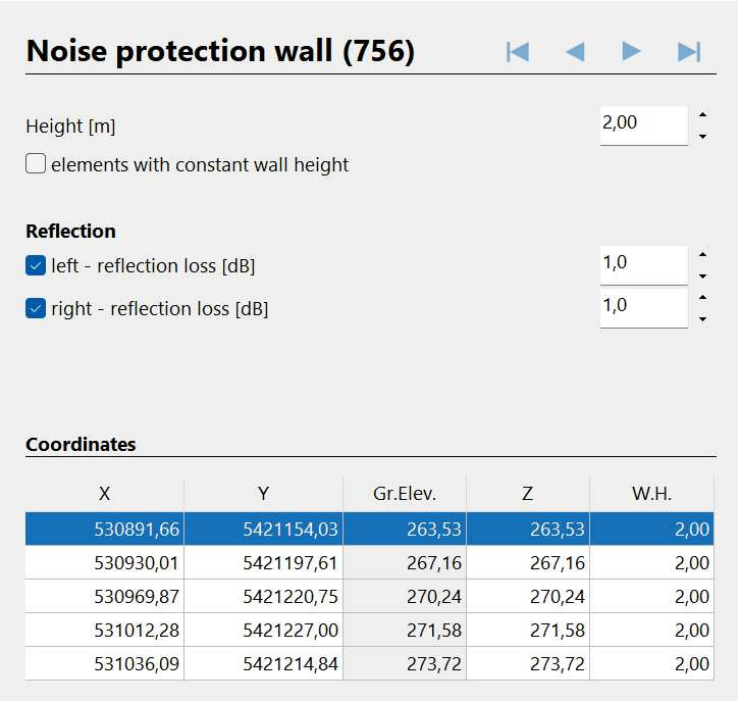
When you have finished digitizing and the lines are rather annoying, you can switch them off in the **OBJECT TYPES** by ticking the **SHOW IN EDITOR** box.

Elevation point, Elevation line

Elevation points and elevation lines supply the digital terrain model (DGM) with elevations. The mean height above ground (ground attenuation) and sound diffraction are calculated using the DGM. Elevation points and elevation lines are generally no longer required as graphical objects after the DGM has been calculated and tend to get in the way. They can therefore be shown or hidden using the symbol button.

Noise protection wall

A noise protection wall is defined by its base line (height Z), the wall height (W.H.) and the reflection loss (depending on the material of the wall).



The screening edge results from the wall height above the base line. Walls with a wall height of 0.0 meters are already considered for screening (screening edge = base line).

The reflection loss to the right and left is set in data entry direction. According to RLS-90, for example, the following reflection losses are to be assumed:

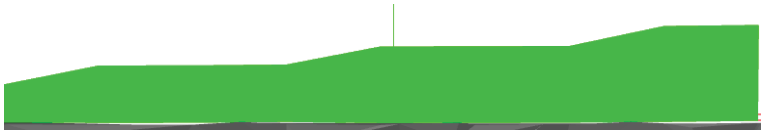
Wall type	Reflection loss
Acoustically hard surfaces (concrete, glass)	1 dB
Absorbent noise protection walls	4,0 dB
Highly absorbent noise protection walls	8-11 dB

If you do not want the wall to be calculated as a reflective object, uncheck the reflection marks for the left and the right side.

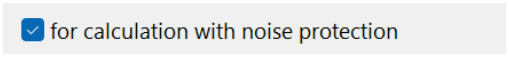
The height of the wall can change in the course of the wall. The coordinates in the coordinate list where the properties change are marked in blue. In the editorgraphics, those coordinates are marked with small double circles.

Click on the mark for **CONSTANT WALL ELEMENT** if you want to set a height jump at a certain coordinate.

Otherwise, different heights are interpolated:

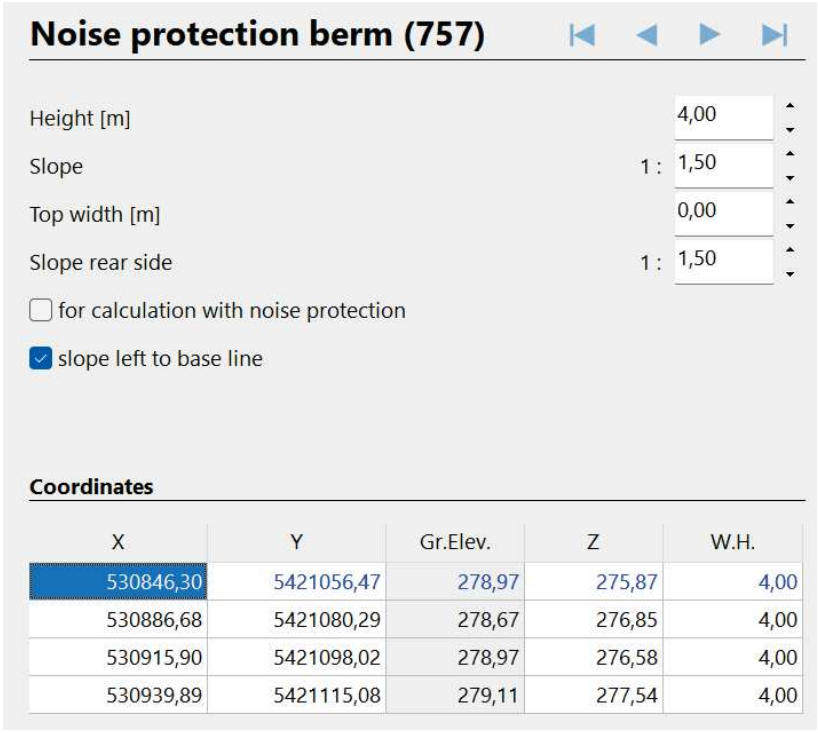


For the project type „Calculation without / with noise control“ you can also specify if the wall is a planned wall that is to be disregarded in the status quo calculation.

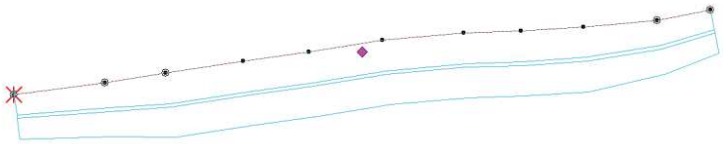


Noise protection berm

Like the noise protection wall, the berm is also defined by the base line (= base of the berm) and the height. In addition, the position of the bending edges depends on the height, inclination and crown width.



The properties can change over the course of the berm and can therefore be defined accordingly at each coordinate. The calculated diffraction edges are automatically adjusted.



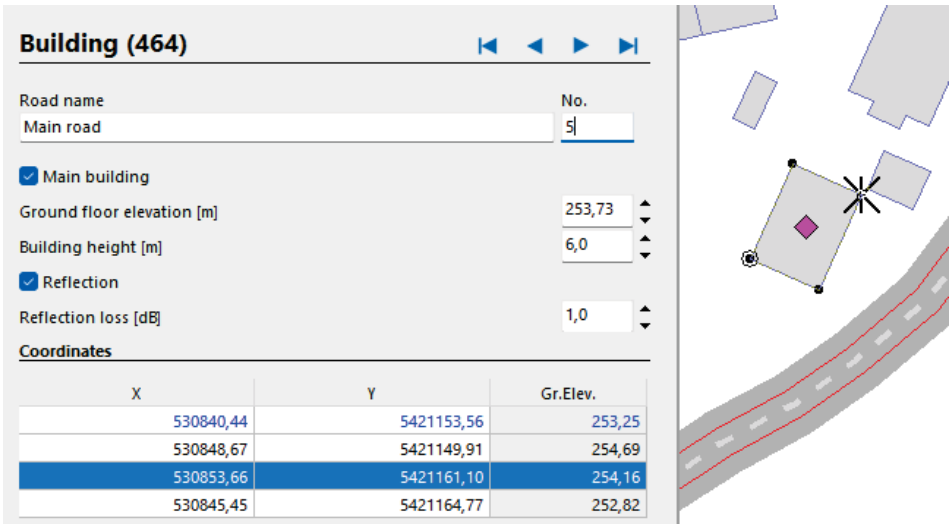
Entered baseline and calculated berm lines

In the coordinate list, coordinates where properties change are displayed in blue. In the editor graphic, these coordinates are marked with a double circle. For the “Calculation without / with noise protection” project type, you can also select whether a planned wall is involved.

Buildings

A building is described by the ground floor elevation (height of the first floor above sea level), the building height above ground level and the reflection loss. If you do not want the building to reflect, deactivate the **REFLECTION** checkbox.

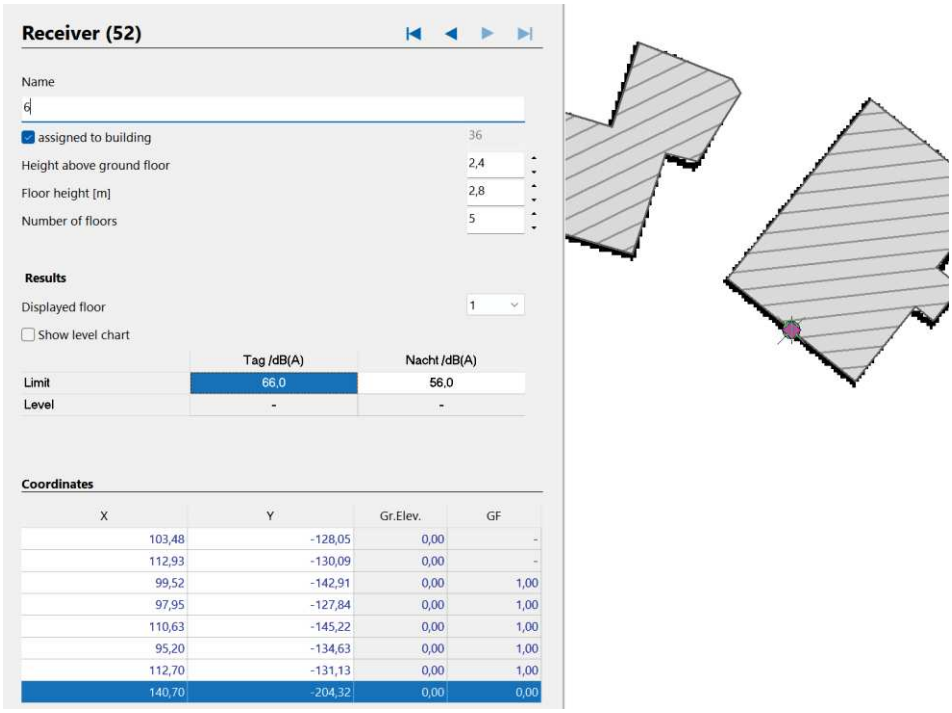
Receivers and point sound sources can be assigned to buildings.



By default, buildings are calculated at right angles (angle mode (F11)). To optimize the input, it is recommended to start the input with the longest side of the building. The angle mode can also be switched on or off while entering a building by holding down the ***Alt*** key, pressing ***F11*** or using the symbol button.

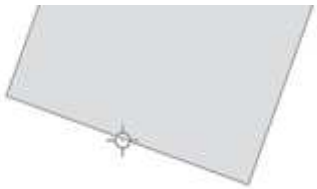
Receiver

Receivers are entered to predict the noise level at a specific location, e.g. building, property border or measurement location. The receivers can be located in the free field or attached to buildings. For receivers attached to buildings, the last reflection on its own building is suppressed.

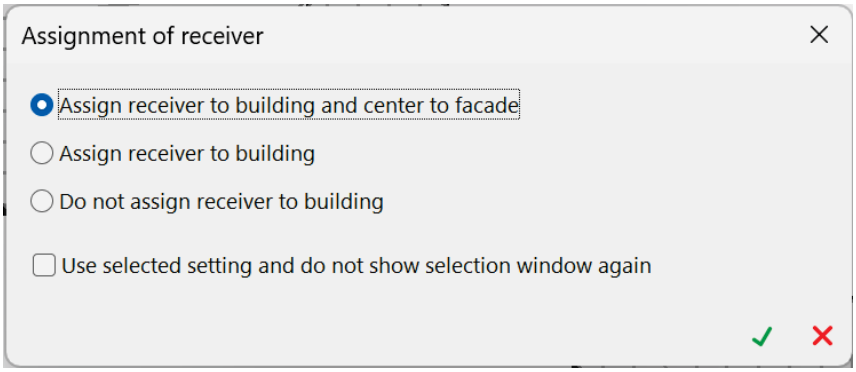


The height of the lowest calculation point for receivers attached to a building is entered in **HEIGHT ABOVE GROUND FLOOR**; for free field receivers in **HEIGHT ABOVE GROUND**. A receiver (both free field and attached to a building) can have several floors, i.e. the noise levels are calculated in different heights, depending on the **NUMBER OF FLOORS.** The spacing between the calculation points of a receiver is defined in **FLOOR HEIGHT**.

If a receiver is to be set at a building, the cursor can be changed to a small snap circle by pressing the ***Alt*** or ***Ctrl*** key.



You can decide where to locate the receiver within the capture radius.



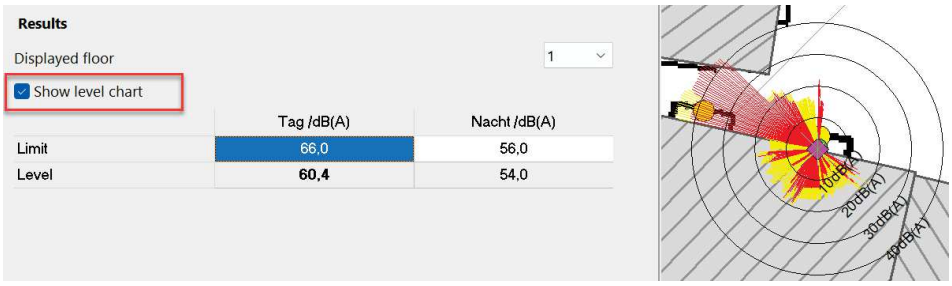
If a building was named, this name will be transferred to an assigned receiver, otherwise the name of the previously entered receiver plus a consecutive number is used as default name.

Default settings for the receivers and the description of the floors can be changed via **SETTINGS | EDITOR SETTINGS**.

If a receiver is placed at a common facade of two buildings, the receiver will be assigned to the higher building.

Receivers can also be automatically assigned to buildings. To do this, select **TOOLS | CREATE RECEIVERS AT SELECTED BUILDINGS** from the pull-down menu.

After the calculation, the noise level for the selected floor is presented. For the project type „Calculation without / with noise control“ both levels are presented. If **SHOW LEVEL CHART** is checked, a level chart is also presented in the editor. Direct sound components are shown in yellow, reflected components in red.



"Use rest hours" is a special checkbox for calculations according to the German TA Lärm.

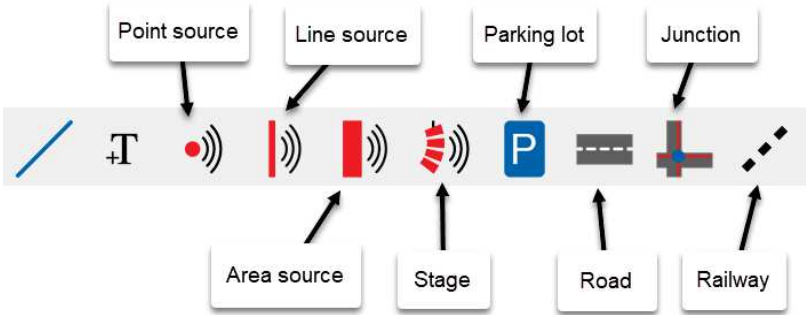
Calculation area

The calculation area defines an area in which the noise levels for a receiver grid are calculated (calculation of limit contour lines and grid noise maps). If no calculation area is present, the area is set by the min/max coordinates of all objects.

This may lead to longer calculation times because the area may be bigger than needed.

Objects for the different noise types

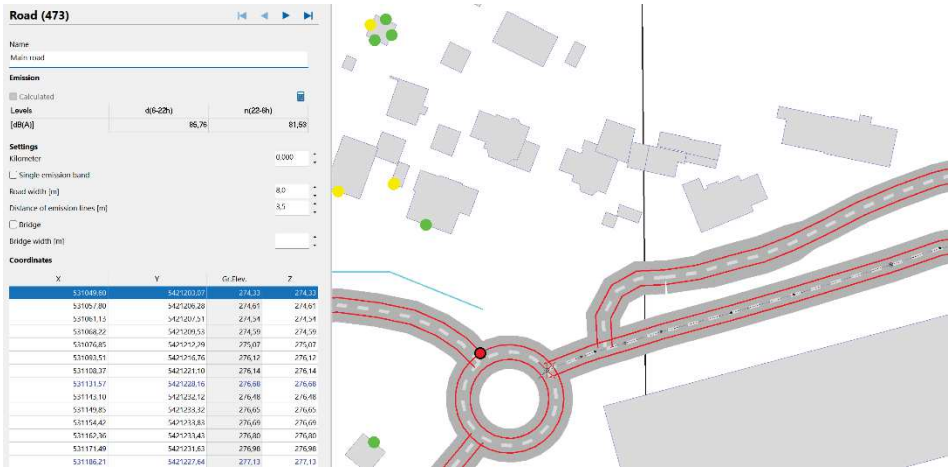
Depending on the noise type, there are different or additional objects at your disposal to create the acoustical model.



Road noise

Enter the road and define the emission. The reference elevation is the top of the roadway. The software automatically sets the elevation of the emission band according to the definition in the selected standard.

The road properties can change in the course of the road (width or emission level). The coordinates in the coordinate list where the properties change are marked in blue. In the editor-graphics, those coordinates are marked with small double circles.



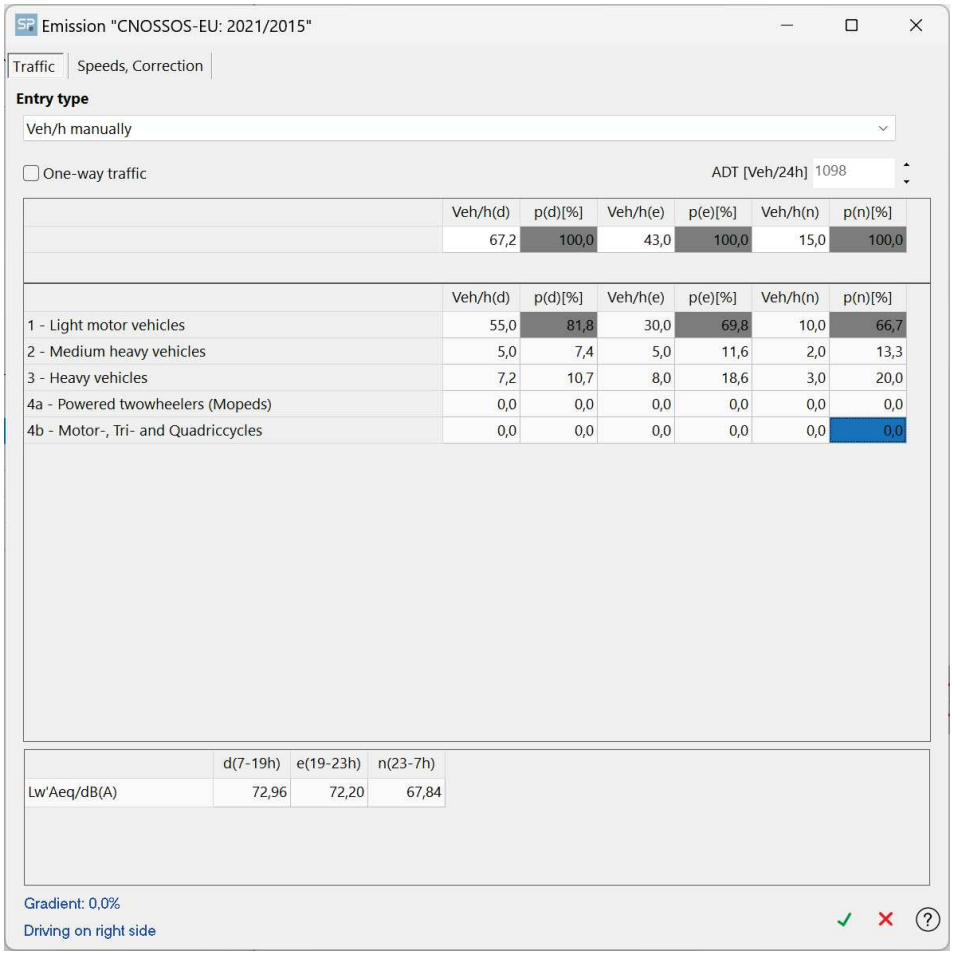
Enter the road width (for the graphical display and hard ground definition) and the distance of the emission bands so the program can distribute the emission between the 2 emission bands. Click on **SINGLE EMISSION BAND** at the first coordinate if the entire emission is to be placed on a single source line (i.e. for one-way streets).

The **KILOMETER** marker is available to document the change in emissions related to the kilometer/mile post. The kilometer marker can only be assigned to the first coordinate of the road.

Bridge situations can also be taken into account in the propagation calculation, see Bridges for roads and railways.

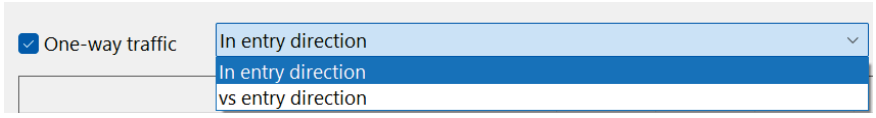
Emission calculation road

Click on the symbol button "calculator" to compute the emissions from the parameters of traffic volume, road surface and speed. Some standards allow entering already known emission levels directly in the road properties.



Depending on the standard the data for the composition of the traffic can be provided as an average daily traffic (ADT) and the percentages for each of the time slices (input type "percentages manually on ADT") or as traffic data per hour (input type "Veh/h manually").

The **ONE-WAY TRAFFIC** input field is relevant for guidelines that differentiate between different surcharges for inclines and declines. Select the direction of travel for one-way streets.



Traffic data

Veh/h direct entry:

Vehicles/h: hourly traffic volume for each time slice and each vehicle type or the percentages of each vehicle type referring to the total traffic volume.

Percentages manually on ADT:

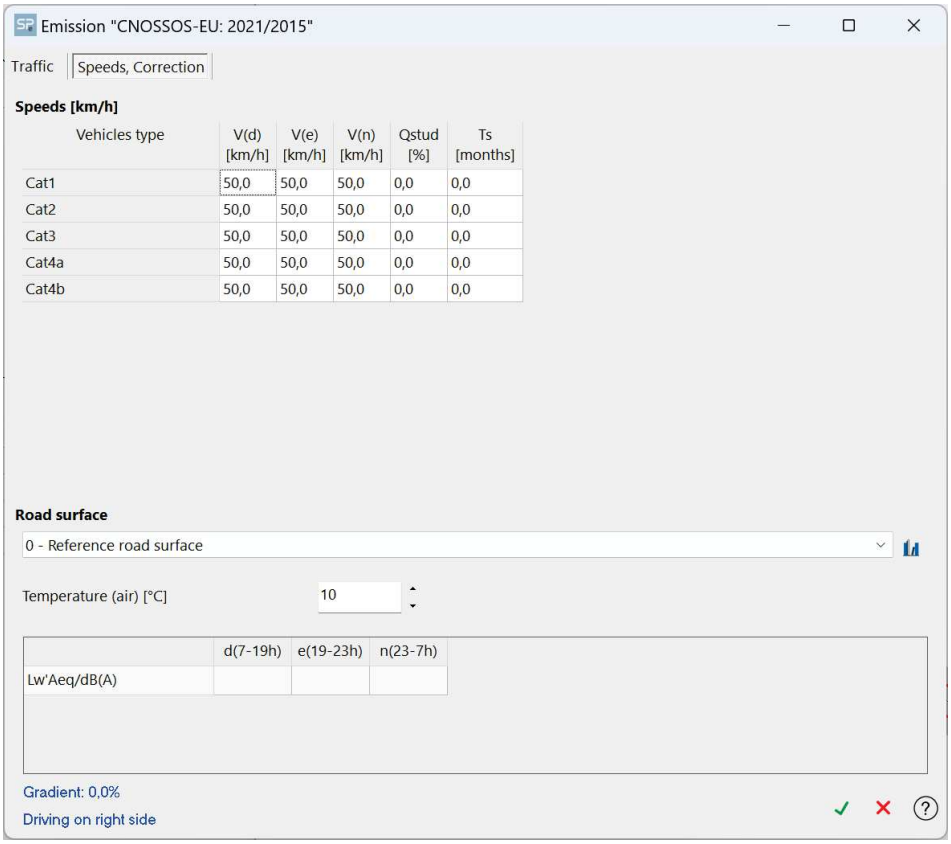
These entry fields must be filled in to calculate the emission level:

- ADT [vehicles/24h]: average daily traffic
- k: Factors to calculate the hourly traffic volume from the ADT: k*ADT=vehicles/h for the given time slice
- p[%]: Percentages of heavy vehicles referring to the total traffic volume in the given time slice.

For Germany default settings for the factors k and the percentage of heavy vehicles come from the road types of the RLS-19. Additional road types are derived from traffic censuses.

Speeds and road surface addition

Enter other components of the emission level in the tab **SPEEDS, CORRECTION** which are different depending on the used standard.



Enter the **SPEED** for the different vehicle types and time slices in [km/h].

In most standards, this is the permissible speed (e.g. RLS-19, RVS 4.02, NMPB), but can also be the average speed (CoRTN) or the actual speed (e.g. ASJ).

The **TRAFFIC FLOW** is taken into account differently in various standards, mostly via the driving states “decelerated, accelerated, steady”. The TNM specifies the type of measure (stop sign or traffic light) and the percentage of vehicles affected by it. The RLS-19 and CNOSSOS-based guidelines set corresponding signal points at signalized junctions or traffic circles, see Junction RLS-19, BUB, RVS, CNOSSOS.

The **ADDITIONS FOR THE ROAD SURFACE** are different for each standard, too. Additions that are dependent on speed are automatically tallied. You can also define a road surface with a corresponding addition not listed with the **SELECTION OWN SETTINGS**. The NMPB additionally takes the age of the road surface into account.

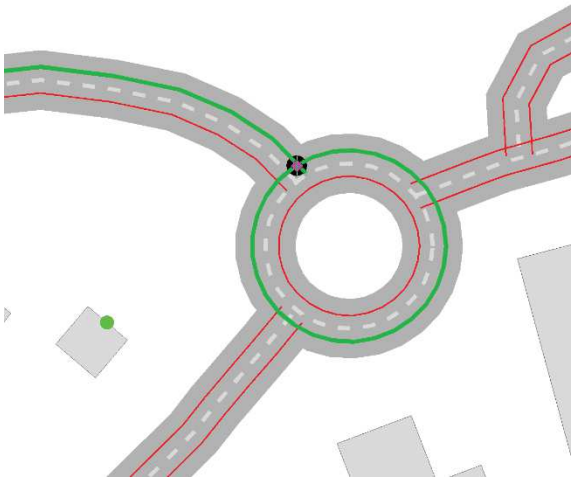
In the RLS-19 **MULTIPLE REFLECTIONS** in street canyons are accounted for by means of an addition to the emission noise level (D_{refl}). The propagation calculation then must be limited to the second reflection. Enter the mean height of the walls on the lower side of the street canyon (h_{Bldg}[m]), the distance between the left and the right side and a reflection factor to accommodate for the hardness of the walls (absorbent for absorbing walls and reflecting for walls with little absorption). Alternatively, D_{refl} can also be entered manually as an **OWN INPUT**. Multiple reflections may only be applied if the angle of the opposing buildings / reflective retaining walls and noise barriers is < 5° to the road axis. The distance between the reflective surfaces up to which a multiple reflection allowance is applied is limited to 100 m.

The **INCLINE** itself is normally calculated from the geometry. The incline addition (D_{LN}) is evaluated automatically at calculation time. It depends on the standard from which percentage on an addition for the incline is evaluated. Some standards distinguish between the uphill and downhill direction for the incline addition (e.g. RLS-19, CoRTN). For your information the incline in [%] is displayed on the lower left-hand side in blue writing.

Junction RLS-19, BUB, RVS, CNOSSOS

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. The junction objects must be entered at each intersection of intersecting or merging emission lines.

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 surcharge K_{KT}.

Change the values for searching the emission lines **WITHIN A RADIUS / WITHIN A VERTICAL TOLERANCE**, to influence the automatically found emission lines, for example if

- the junction is not exactly at the intersection of the emission lines,
- the emission lines do not intersect,
- the height 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.

Parking lots

Parking lots are regarded as uniformly radiating area sources. Enter the border line at the height of the asphalt surface. Parking lots can also be defined as following the terrain, see section Line and area sources following the terrain. The emission height is automatically set 0.5 m higher. During the calculation, parking lots are divided into triangles.

The parking lot according to RLS-19 is only used for public parking lots. All other parking lots are calculated according to the Bavarian parking lot study.

Parking lot - RLS-19

Enter the corner points of the parking lot and define the traffic volume. The reference elevation is the elevation of the parking lot. The emission default is 50 cm above the parking lot surface.

The traffic volume of the parking lot is entered with the number of moves per parking bay (in and out are each considered a single move), the hour (for the time slices day and night) and the number of parking bays.

Via the **PARKING LOT TYPE ADDITION** different emissions for different parking lot types are accounted for:

Car parking lot	0 dB
Motorcycle parking lot	5 dB
Truck and bus parking lot	10 dB

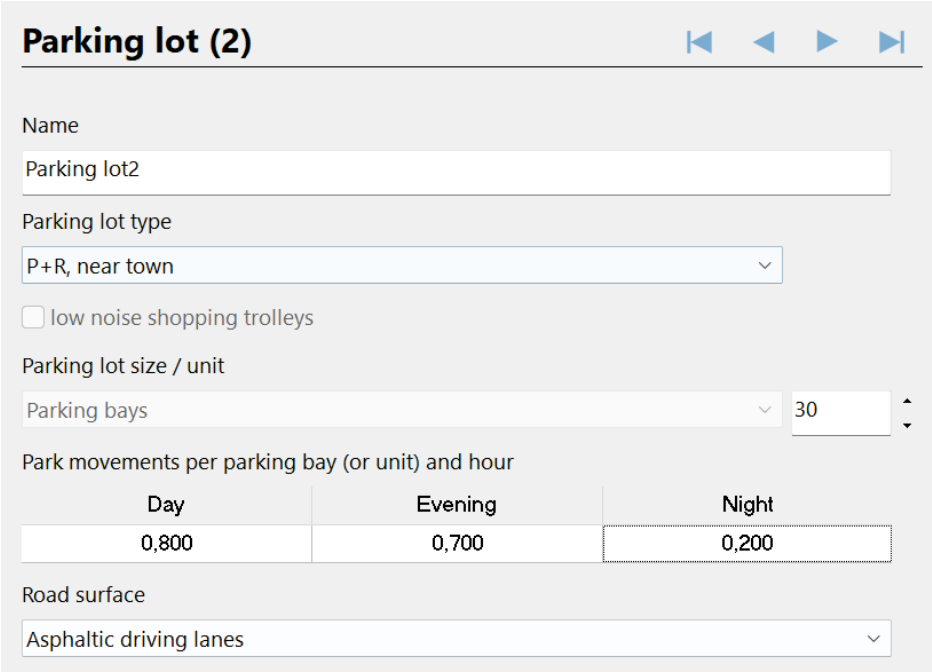
The emission level of a parking lot is automatically increased by the values set in the parking lot type. Additionally, "own values" allows the entry of custom declared corrections.

The result is the area-related sound power level L_w'' of the entire parking lot. The emission calculation of the car park is documented in the **EMISSION TABLES** tab.

Parking lot - 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 emissions depend on the types of vehicles, the number of parking movements, the behavior of the parking users and other noise on the parking lot (e.g. rattling of the shopping trolleys/carts).



Parking lot type and parking lot size

The study paper distinguishes between different parking lot types, taking into account the different uses and vehicles; details can be found in the study paper.

Parking lots at shopping centers, restaurants and hotels are defined with the reference units "net sales area", "net restaurant area" or "number of beds". The number of parking bays is calculated according to a formula from the parking lot study. If you have a more accurate knowledge about the parking moves, you can change to the reference unit "number of parking bays". For shopping centers, the usage of low noise shopping trolleys/carts can be taken into account.

The traffic volume of the parking lot is entered with the number of moves.

Into a parking bay and out of a parking bay = 2 parking moves!

The values for the number of parking moves for each time slice is the number of parking moves per reference unit (most often per parking bay), averaged for the hour.

Example:

Time slice day: 92 moves on the overall parking lot / 65 bays / 16 hour = 0.088 moves

Time slice night: 26 moves on the overall parking lot / 65 bays / 8 hours = 0.05 moves Sum 0-24 o'clock: 118 moves, i.e. 59 vehicles come and go.

Reference level

The parking lot emission table documents the reference level (Lw,ref) from the parking lot study.

$$L_{w,\,ref} = L_{w0} + K_{PA} + K_I + K_D + K_{StrO} + 10\ \log(B)\ [dB(A)]$$

With the following parameters:

L_{w0} = Basic sound power, sound power level of one motion /h on P+R areas = 63 dB(A)

K_{PA} = Surcharge parking lot type

K_I = Surcharge for impulse character

K_D = Surcharge for the traffic passaging and searching for parking bays in the driving lanes

$$K_D = 2{,}5 * \lg (f * B - 9)$$

f = Parking bays per unit of the reference value

B = Reference value

K_{StrO} = Surcharge for the road surface

Road surface

The selection of the road surface (surface of the lanes not of the parking bays) determines the addition K_{StrO}.

Separate method (driving lanes separately modeled)

With the lane addition K_D, the traffic within the parking lot is calculated using the number of parking bays and moves as long as you use the normal case "integrated method".

The emission calculation of the separated method (special case) doesn't include the traffic on the parking lot. Therefore, it must be modeled separately as a line source or a road using the emission calculation of the (now outdated) RLS-90. This method should only be used for very big parking lots or if the total parking lot is separated into several parts.

Addition for K_I (impulse addition - German regulatory assessment)

An impulse addition is evaluated, if the checkbox **USE KI FOR PARKING LOT** is checked in **CALCULATION** tab. The addition depends on the parking lot type and if the lanes within the parking lot are included.

Railway noise

Enter the railway axis and define the emissions. The reference elevation is the railhead (the upper part of a railway rail, on which the traffic wheels run). The emission heights are calculated automatically based on the standards.

The properties of railways (train numbers and types, corrections) can vary along the train line. The coordinates in the coordinate list where the properties change are marked in blue. In the editor graphics, those coordinates are marked with small double circles when the railway line is activated.

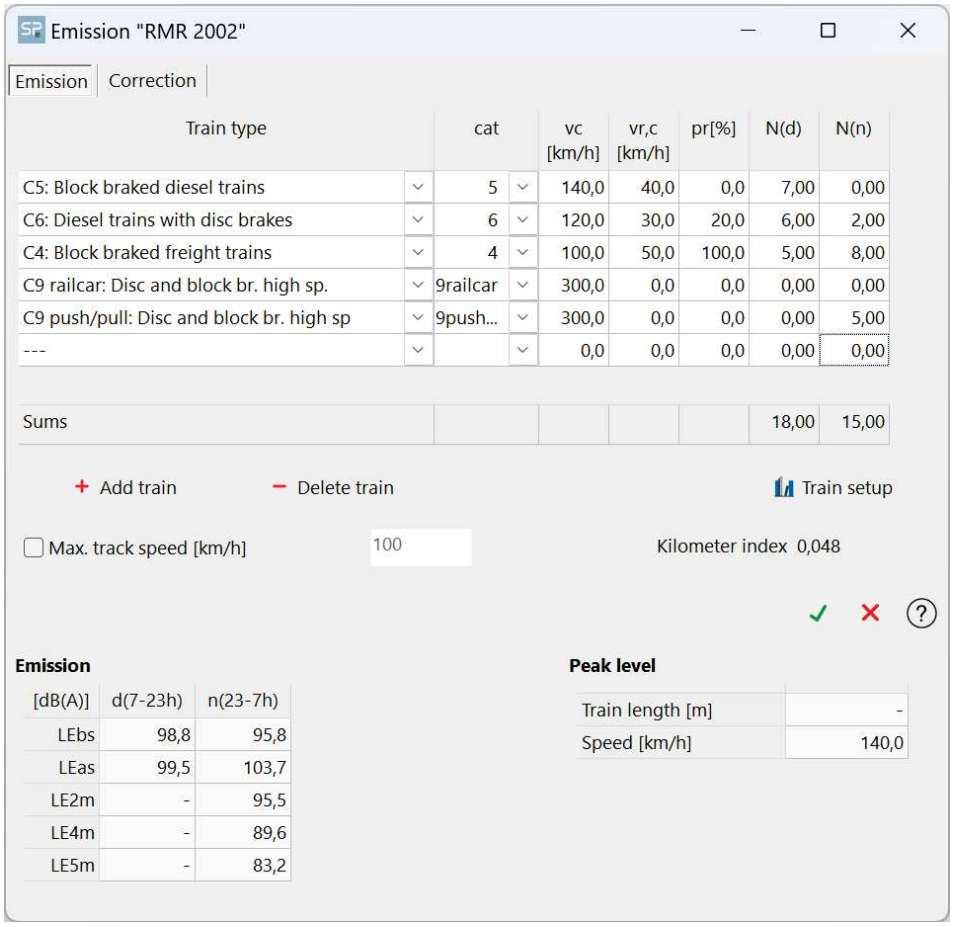
Bridge situations can also be taken into account in the propagation calculation, see Bridges for roads and railways.

Emission calculation railway

Click on the calculator to calculate the emissions from the trains or locomotives/wagons in operation and route-related surcharges. An already known emission level can be entered directly into the fields in the emission mask.

Emission calculation for RMR 2002

Click on the symbol button "calculator" to calculate the emission from the trains or engines and wagons and track specific corrections.



Select a train category, suitable for the train type from the selection list and enter the mean speed non-braking trains vc [km/h]. Please look at the RMR for further information on the train categories.

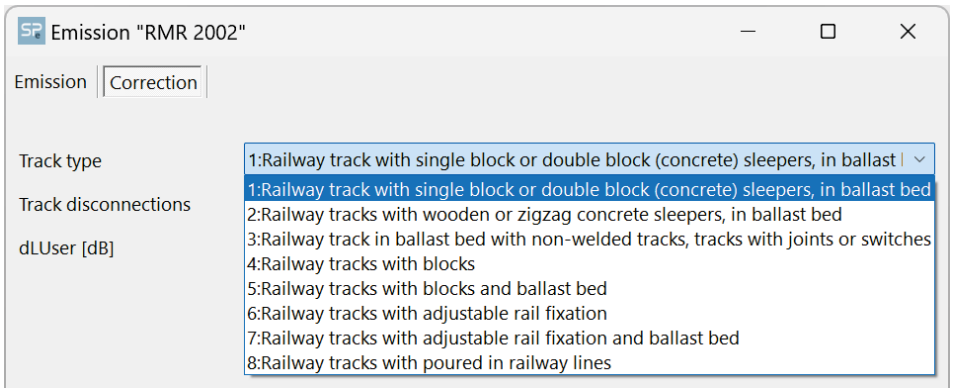
Enter the percentage of braking trains in train stations (pr [%]) and the mean speed of the braking trains vr,c[km/h]. To finish the emission entries, enter the number of train units N, i.e. carriages or engines for the time slices day, evening and night.

The emission table shows the emission level (mean sound power per meter) for all frequencies, emission heights and time slices. The RMR distinguishes between five emission heights above rail head: 0 m (bs), 0.5m (as), 2m, 4m, 5m.

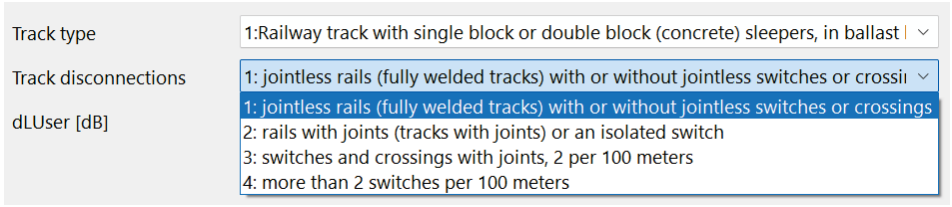
Depending on the train category, the emission is not defined for all emission heights.

Track data

Definitions for the track type (bed, sleepers)



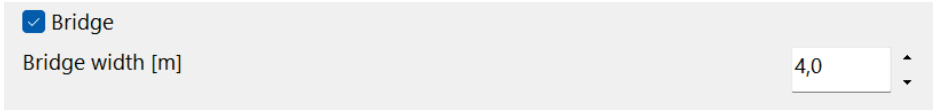
And track disconnections (switches, crossings) are necessary.



Bridges for roads and railways

For roads and railways, bridge situations can be taken into account in the propagation calculation.

In the property block for roads and railways, click on the **BRIDGE** checkbox at the corresponding coordinate.



The bridge width is preset to road width + 1 m or 4 m for railways. Turn off the check mark at the last bridge coordinate. The bridge is visualized in the editor with a dark band. The bridge edges have a shielding effect. Depending on the standard for rail bridges, the bridge addition must be entered in addition to the bridge checkbox in the emission definition (**CORRECTION** tab).

Recalculate the DGM. Roads and railways within the bridge areas are not included in the DGM; the elevation points are meshed at the bottom of the valley. Then select the road / railway with bridge and place the objects on the DGM. The heights within the beginning and the end of the bridge are interpolated. It is best to check the bridge situation using the 3D plan.

Industry noise (point, line and area sources) and stages

Calculation standard ISO 9613-2

General method:

- Noise sources must be entered with the sound power in octave or third octave bands.
- A ground absorption area must be defined (otherwise the program will assume soft ground).

Alternative method:

- No ground absorption area is needed.
- Calculation for a single mean frequency (for example 500 Hz) or with a spectrum.
- The **ALTERNATIVE GROUND EFFECT (FOR ISO 9613-2)** must be checked in the **CALCULATION** tab.
- Sources entered with a single value sum level are automatically calculated according to the alternative calculation method. The program dispatches a warning message if the alternative method of calculation is used.

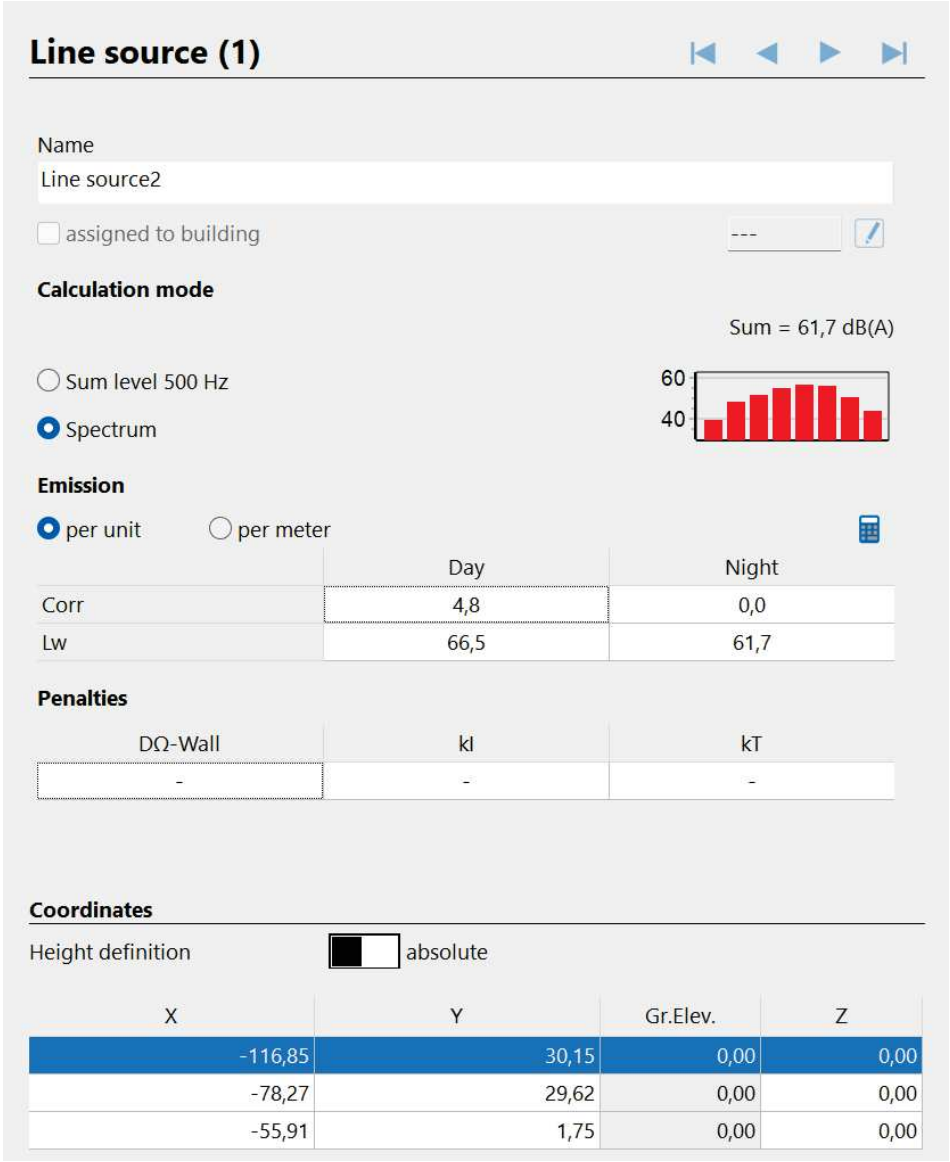
Properties of the sources

The sources of industry noise represent point, line and area type emitters. The sources are described with coordinates x, y, and a relative height above the terrain. The ground effect depends on the height of the source above the terrain.

Area sources may have any orientation in space. The only requirement is that they form a single plane. However, small deviations from the plane are adjusted by the triangulation process. If sources do not form a plane, you must subdivide the area sources. Define a horizontal, vertical or angled surface.

The sound power can be entered as a **single value A-weighted sum level** (mean frequency 500 Hz) or as a **spectrum**. If you enter a spectrum, the program will treat this as a **reference spectrum**. The sound power of the source needs to be entered

into the table for the individual time slices. You can use the spectra from the SoundPLAN library, see Frequency spectrum from the emission library.

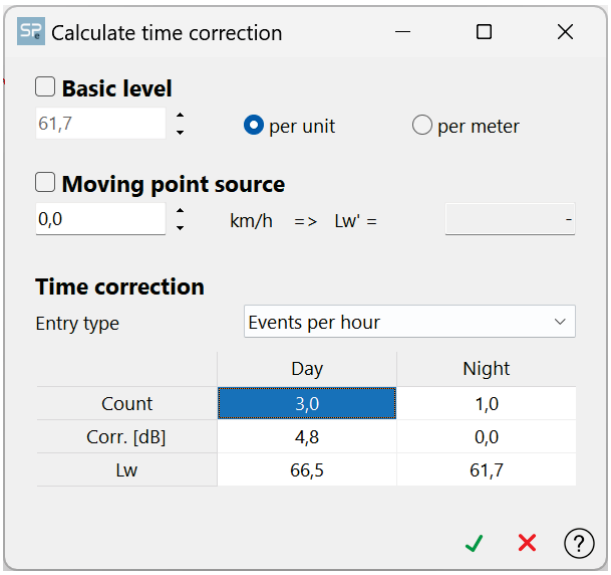


For line and area sources, the sound power can be defined per **METER** or **UNIT**. If the **UNIT** setting is used, the emission is set as the total sound power. This results in an even distribution of the sound power over the entire line/area of the source.

If the level entry per **METER** is used, the emission level is defined as the sound power level per dB/m (line source) or dB/m² (area source). The longer the line source or bigger the area source, the bigger the magnitude of the total sound power. The total sound power level of the source is the defined emission level plus 10 · log(size of the source).

Time correction calculator for industrial noise sources

Sound sources rarely run at 100% per time slice. To calculate the time correction, click on the calculator symbol in the emission definition for the industrial sources.



Activate the selection of the basic level and enter the base sound power level; if a spectrum was previously selected, the base level is taken from the spectrum.

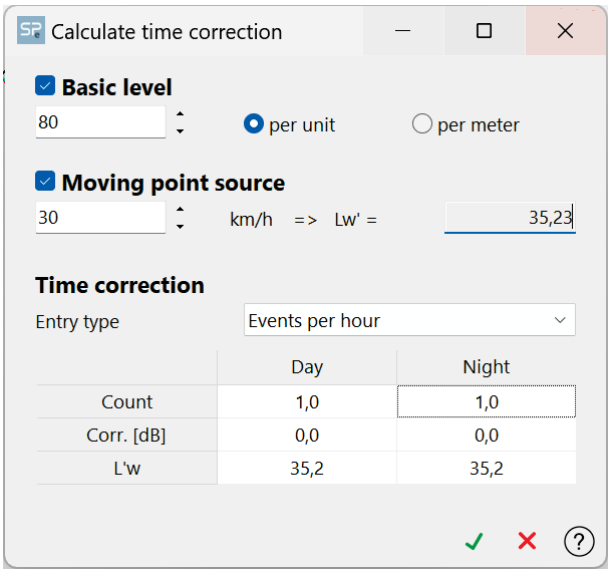
From the selection list, select the **ENTRY TYPE** you want to use to calculate the time correction:

- Events per hour
- Events per time slice
- Minutes per hour
- Minutes per time slice
- Hours per time slice

Enter the number of events (**COUNT**) for the individual time slices.

For assessments that take into account the loudest night hour (e.g. TA Lärm), the night period is interpreted as the loudest night hour. This means that the number you enter is not distributed over the night period.

For line sources, tick **MOVING POINT SOURCE** to calculate the length-related sound power level L_w' per meter at a certain speed from the sound power level of a vehicle.



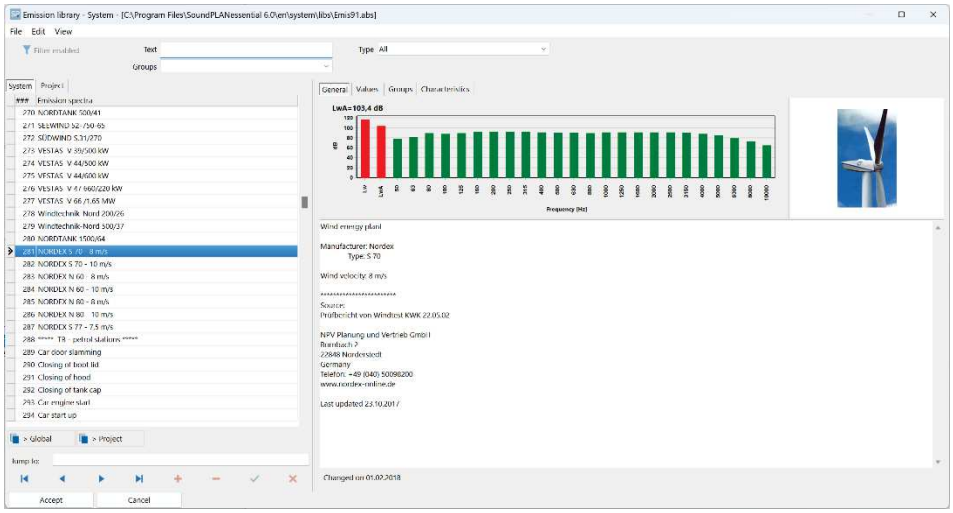
Enter the basic level per unit and the speed of the vehicle.

Correction factors

Enter the correction factor **DΩ WALL** for sources attached to walls and if necessary, the additions for impulse and tonality. The value for the influence of the ground effect (DΩ ground, Agr) is automatically accounted in accordance with the standards for industrial noise.

For sources attached to walls (quarter sphere) an addition of 3 dB is given. The reflections are suppressed on the wall where the source is located. For point sources assigned to buildings, the DΩ wall is set to 3 dB. The restriction of transmission into an eighth sphere can be simulated by assigning a DΩ wall of 6 dB if the source is located directly in the corner. SoundPLANessential assigns sources in the eighth sphere, not exactly located in the corner to the wall where they are located (DΩ wall = 3 dB, the reflection of the assigned wall is suppressed). The higher sound radiation of the eighth sphere results from the contribution level of the reflected sound at the other wall.

Frequency spectrum from the emission library



When you select the option **SPEKTRUM** from the noise source objects, you open a library with over 1000 sound source spectra in third octaves and octaves. These spectra were compiled from various sources (handbooks, literature…).

You cannot modify the spectra in the **SYSTEM LIBRARY**! Own spectra must be hosted in the **PROJECT LIBRARY** or in your own **GLOBAL LIBRARY**.

The library is split into two sections: on the left side you can find the emissions spectra, on the right-hand side details are listed for various details.

The tab **GENERAL** delivers an overview of the spectrum with the information where the data came from and optionally a picture. In the tab **VALUES** the values in octaves or third octaves can be found along with facilities to toggle between different dB weightings and the possibility to convert a sound pressure level to a sound power level.

You can find the right emission spectrum by using the group definition or by using a text as a filter to narrow down the number of spectra presented.

Copy a spectrum from the system library via the button **>PROJECT** to the project library to use it in this project.

For a new spectrum, select whether the values are available as **OCTAVE** or **THIRD OCTAVE SPECTRUM** or as **CENTER FREQUENCY** and determine the lower and upper boundary of the frequency range respectively the center frequency. Enter the values in the table or use copy & paste if values are available e.g. in an Excel sheet.

Check your data to see if it is linear or weighted with an A…D filter, and select the dB-weighting accordingly.

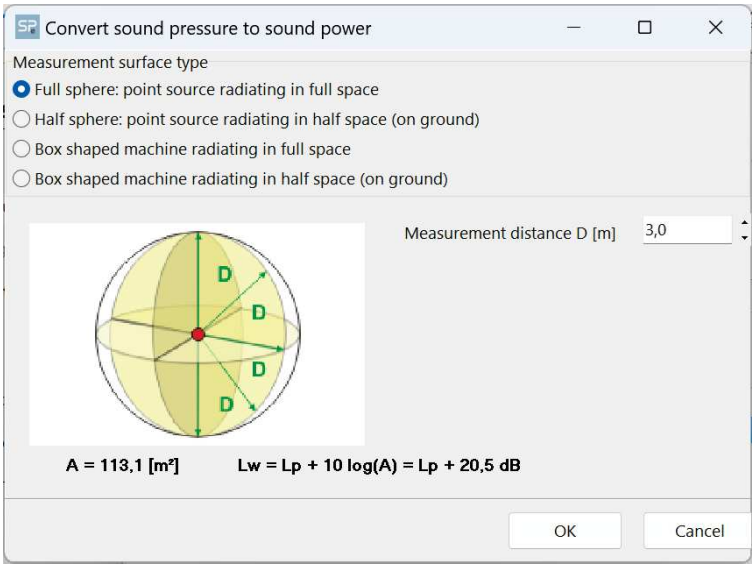
Above the emission spectrum with the selected frequency filter the spectrum is shown with a linear filter. The user defined spectrum and the selected filter are displayed in blue. You can modify values in the filtered or the linear spectrum. Either way, the values of the other spectrum are immediately calculated to reflect the modification.

If your data is available in [dB] but you want to keep it in the library as an A weighted spectrum, enter the data as a linear spectrum and change the weighting to [dB(A)] after the data is typed in. SoundPLAN will ask you whether you want to convert the spectrum. Click "yes" to convert the spectrum. "No" only changes the display, the linear spectrum remains unchanged.

Select whether the spectrum is a total sound power level (Lw/unit) or a length-/ area-related sound power level (Lw/m,m²).

The frequency spectra in the library are often measured sound pressure levels (Lp/level). For the propagation calculation, sound power levels are needed. Therefore, you can convert sound pressure spectra into sound power spectra. It is important that you know the measurement distance.

Open **EDIT -> CONVERT SOUND PRESSURE TO SOUND POWER** (or click right mouse button while the cursor is on the spectrum).

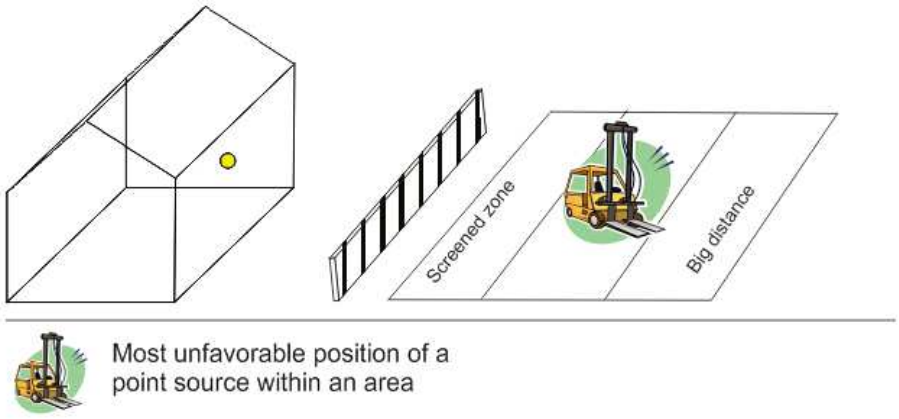


Select the surface type that was the basis of your measurement of the sound pressure level. Enter the distance D in meters at which the measurement was taken and enter the width, length and height in meters for machines the equivalent size of a box. By clicking the **OK** button, the sound pressure spectrum is converted into a sound power spectrum and the reference is set to per Lw/unit.

Maximum level Lmax

SoundPLANessential can 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.

The program will use the same emission spectrum as for the Leq calculation. For point sources, the Lmax depends only on which source produces the highest noise level within the time slice. For line and area sources you can also calculate a spatial maximum level if the checkmark **LMAX LOCATED IN ONE POINT** is activated.

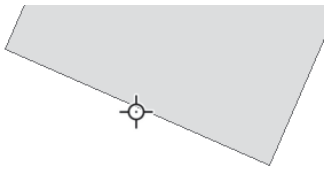


As shown in the sketch above, the maximum noise level of an area source is caused by moving the entire sound power to the spot on the line/area that produces the highest noise levels. SoundPLANessential determines the worst possible position and the corresponding maximum level.

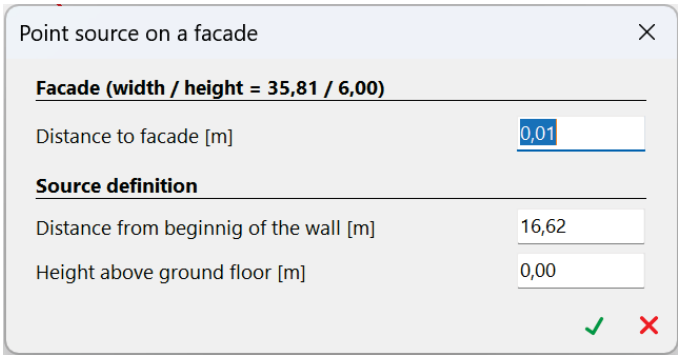
Assignment of noise sources to buildings

Point, line and area sources can be attached to buildings (for example fans, pipes and window openings).

Press down the ***Strg*** or ***Alt*** key and set the first coordinate of the source in the vicinity of the building as soon as the cursor changes into the capture cursor.



A dialog opens where you can set the position of the source relative to the facade. The entries have different provisions depending if the source is a point, line or area source.

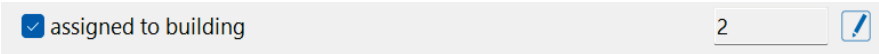


For your information, the width and height of the facade is presented. Enter the distance of the source to the facade. With **DISTANCE FROM BEGINNING OF THE WALL** and the **HEIGHT ABOVE THE GROUND FLOOR** enter the location of the first coordinate for the line or area source or the point source. The correction k-wall is automatically set to 3 dB(A) and the first reflection on the „own“ facade is suppressed.

For line source in addition you can select if the line source is horizontal or vertical and how long the source line is, for area source enter the width and height.

For area sources it is also possible to select the **TOTAL FACADE** if the total facade is radiating.

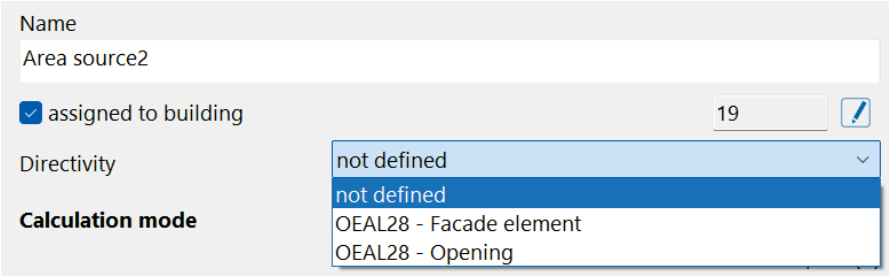
To later view the source definition or modify it, click on the field with the building ID.



The automatic assignment is only covering the standard cases for line and area sources. More complex sources – for example line sources at any angle or area sources that are not rectangular, need to be defined via the coordinate list. After defining the coordinates activate the checkbox **ASSIGNED TO BUILDING** and enter the **DISTANCE TO FACADE.**

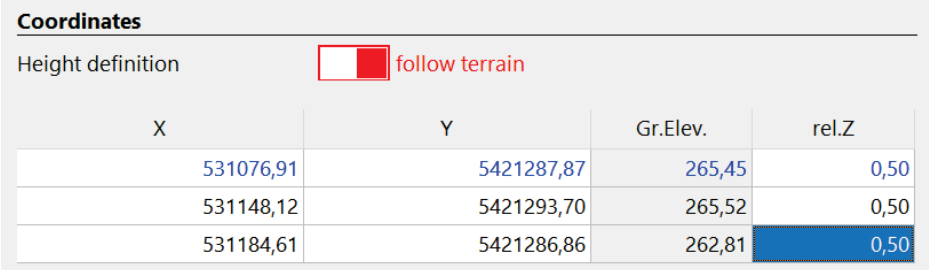
Directivity according to ÖNORM ISO 9613-2:2008

If an area source is assigned to a building and the standard ÖNORM ISO 9613-2:2008 is selected for commercial noise, a **DIRECTIVITY** can be selected for the area source.



Line and area sources following the terrain

For line and area sound sources as well as for parking lots, the height definition can be absolute or following the terrain. This ensures that the emission of each segment or partial area of the sources generated by the decomposition during the calculation is always at the specified relative height above the DGM, even in changing topography.



To change the height definition, switch the slider from **ABSOLUTE** to **FOLLOW TERRAIN**.

The relative height above ground is the same for all coordinates. If the relative height at one coordinate is changed, it also changes for all other coordinates.

d&b audiotechnik stages

The environmental noise at a festival created by one or multiple stages can be calculated 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.

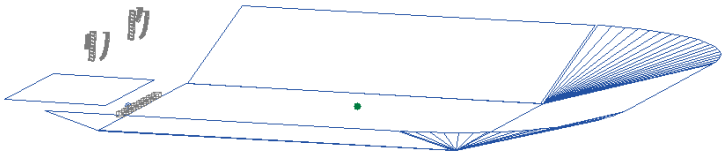
A stage is a combination of the position of the noise sources, the properties of the loudspeaker array and the area for the spectators. The data are defined in the ArrayCalc file.

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 concert attendees.

You can download the software for free from the website of d&b audiotechnik under

http://www.dbaudio.com/en/support/downloads/category/detail/software/simulation.html

In SoundPLANessential the entire stage from the ArrayCalc file is defined as a point object.



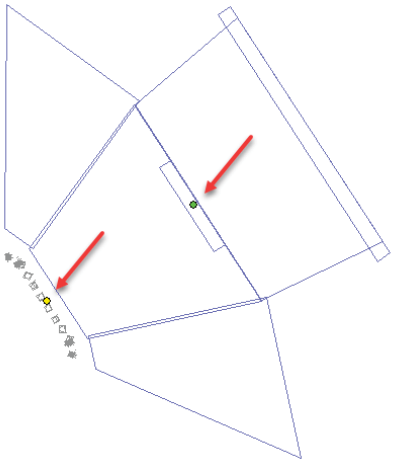
Select the symbol **STAGE** from the object bar and with the mouse place the stage on the screen. The entry point is the zero point of the stage. Open the ArrayCalc file. Depending on the complexity of the stage this may take some time. With the ArrayCalc symbol you can open ArrayCalc to if needed change the stage in ArrayCalc or adjust the **NOIZCALC REFERENCE POINT** (see below).

Customize the **DIRECTION** of the venue.

Via the library symbol select a frequency spectrum. As the spectra often are relative spectra with the sound power of LAeq =0 dB, use the field for **LEVEL CORRECTION** to set the level selected at the sound mixing booth. A non-

normalized spectrum that was measured with a sound level meter can also be set to the level defined at the sound mixing booth.

Calibrate the stage



In the picture above, you see the venue with the loudspeakers and additionally a yellow and a green dot. The yellow dot represents the position that you see in SoundPLANessential, 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 SoundPLANessential to be able to calculate the stage. You can customize the NoizCalc reference point in ArrayCalc in the **3D PLOT**. SoundPLANessential 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 (i.e. in 1.7 meters above ground) at the sound mixing booth. The calibration point must be at least 0.1 meters above the ground. The calibration is done in a pre-calculation.

Ground absorption areas

Ground effect areas describe the acoustic ground properties (absorbing - reflecting). They are important for the acoustic model because they influence the sound propagation particularly near the source and the receiver.

Nearly all standards evaluate different ground properties of acoustically hard or soft ground for the propagation calculation; most of them use the ground factor. TNM (USA), ASJ (Japan) and Nord2000 describe the ground effect by the "effective flow resistivity", Nord2000 additionally uses the parameter "roughness class".

Below is a list of the settings of the different standards, with the default values used when no ground absorption area has been entered, highlighted in gray. So, you only need to enter ground absorption areas where the ground properties deviate from the default values.

The ground factor G is accordingly defined:

G = 0: 100 % hard ground. Asphalt, concrete, pavement, water, rough scattering area, industry site.

G = 1: 100 % soft ground. All with possible or present growth (agricultural, forest, grass, garden).

G = p/100: Partially soft and hard ground. Percentage p of soft to total ground.

The effective flow resistivity has the following selection possibilities:

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 Nord2000:

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 Nord2000 calculations, the input of the ground factor is not relevant.

Volume attenuation areas

The first row of buildings should always be simulated with buildings so the reflective properties from the other side can be simulated properly. Areas behind the first row can be simulated either by entering the buildings or by volume attenuation areas. Stacking different areas with different heights is also a possibility.

The attenuation D is evaluated according to the formula:

$$D = f \times S_G$$

S_G	Distance the noise travels within the v. attenuation area [m]
f	Mitigation factor [dB/m]

The distance S_G used for the calculation is measured along an arc of 5 km radius stretched between source and receiver. If there are solid objects like buildings and screens between the source and the receiver, the parts between the top of the screens/buildings are also simulated with an arc.

If a search beam passes through multiple volume attenuation areas, the total attenuation by multiple volume attenuation areas is calculated as:

$$D_G = \sum_{i=1}^{n} f_i \times S_{Gi}$$

D_G Total attenuation

$f_i \times S_{Gi}$ Attenuation area i

Select the area type from the area type industrial site, forest or building attenuation. The effective height is the height of the buildings or forest. The ISO 9613 uses an attenuation spectrum depending on the area type.

According to Nord2000 the attenuation A is calculated using the path length through the volume attenuation area d [m]:

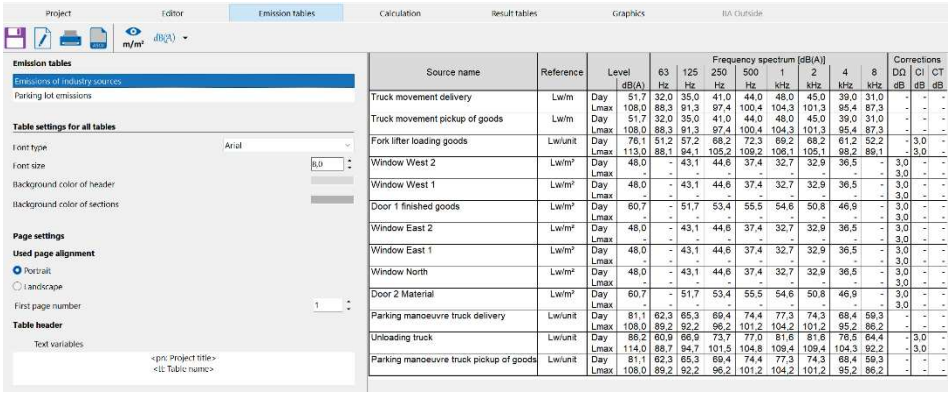
A = d · a(f)

a(f) is calculated from the mean tree density, mean stem radius, factor k_p and mean absorption coefficient.

Emission tables

The emission of the sources is documented in pre-formatted tables in the **EMISSION TABLES** tab.

The emission of the sources involved is listed in a separate table for each noise type. The tables included in the project are listed on the left.



Source name	Reference	Level		63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	Corrections DΩ dB	CI dB	CT dB
			dB(A)											
Truck movement delivery	Lw/m	Day	51,7	32,0	35,0	41,0	44,0	48,0	45,0	39,0	31,0	-	-	-
		Lmax	108,0	88,3	91,3	97,4	100,4	104,3	101,3	95,4	87,3	-	-	-
Truck movement pickup of goods	Lw/m	Day	51,7	32,0	35,0	41,0	44,0	48,0	45,0	39,0	31,0	-	-	-
		Lmax	108,0	88,3	91,3	97,4	100,4	104,3	101,3	95,4	87,3	-	-	-
Fork lifter loading goods	Lw/unit	Day	76,1	51,2	57,2	68,2	72,3	69,2	68,2	61,2	52,2	-	3,0	-
		Lmax	113,0	88,1	94,1	105,2	109,2	106,1	105,1	98,2	89,1	-	3,0	-
Window West 2	Lw/m²	Day	48,0	-	-	43,1	44,6	37,4	32,7	32,9	36,5	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Window West 1	Lw/m²	Day	48,0	-	-	43,1	44,6	37,4	32,7	32,9	36,5	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Door 1 finished goods	Lw/m²	Day	60,7	-	-	51,7	53,4	55,5	54,6	50,8	46,9	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Window East 2	Lw/m²	Day	48,0	-	-	43,1	44,6	37,4	32,7	32,9	36,5	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Window East 1	Lw/m²	Day	48,0	-	-	43,1	44,6	37,4	32,7	32,9	36,5	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Window North	Lw/m²	Day	48,0	-	-	43,1	44,6	37,4	32,7	32,9	36,5	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Door 2 Material	Lw/m²	Day	60,7	-	-	51,7	53,4	55,5	54,6	50,8	46,9	-	3,0	-
		Lmax	-	-	-	-	-	-	-	-	-	-	3,0	-
Parking manoeuvre truck delivery	Lw/unit	Day	81,1	62,3	65,3	69,4	74,4	77,3	74,3	68,4	59,3	-	-	-
		Lmax	108,0	89,2	92,2	96,2	101,2	104,2	101,2	95,2	86,2	-	-	-
Unloading truck	Lw/unit	Day	86,2	60,9	66,9	73,7	77,0	81,6	81,8	76,5	64,4	-	3,0	-
		Lmax	114,0	88,7	94,7	101,5	104,8	109,4	109,4	104,3	92,2	-	3,0	-
Parking manoeuvre truck pickup of goods	Lw/unit	Day	81,1	62,3	65,3	69,4	74,4	77,3	74,3	68,4	59,3	-	-	-
		Lmax	108,0	89,2	92,2	96,2	101,2	104,2	101,2	95,2	86,2	-	-	-

For point, line and area sources, the emission spectrum can be converted to other dB-weighting.

In addition, a column with the source size can be activated.


PRINT out the tables if required.

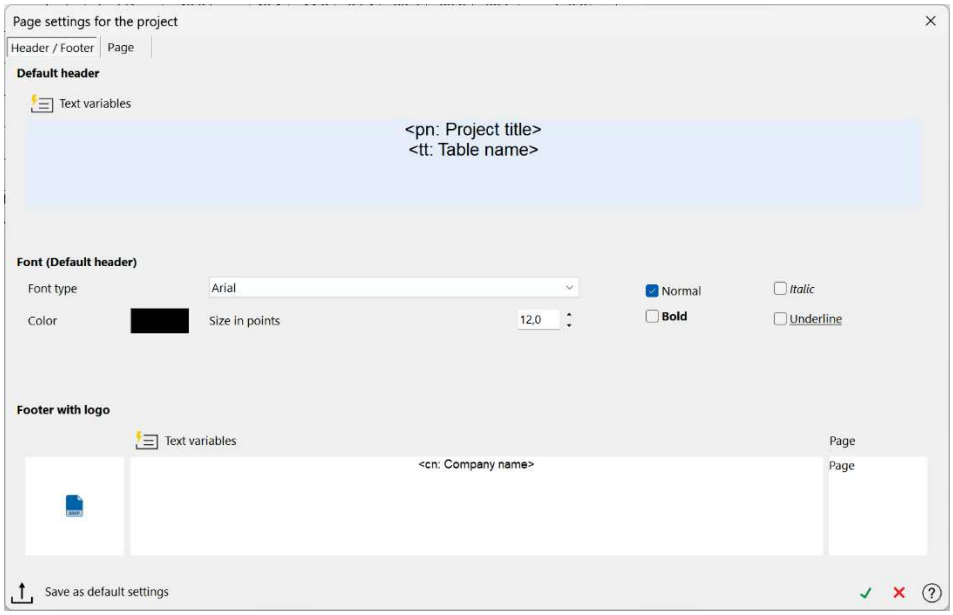
Page settings

On the left-hand side, you can define the **FONT TYPE** and **SIZE** as well as the **BACKGROUND COLORS** of the **HEADER** and the **SECTIONS**. The settings apply to all tables in the project.

You can also set the **PAGE SETTINGS** for the current table, i.e. whether the table should be output in portrait or landscape format. You can also enter the **FIRST PAGE NUMBER** and the **TABLE HEADER (TITLE)** for the current table here.

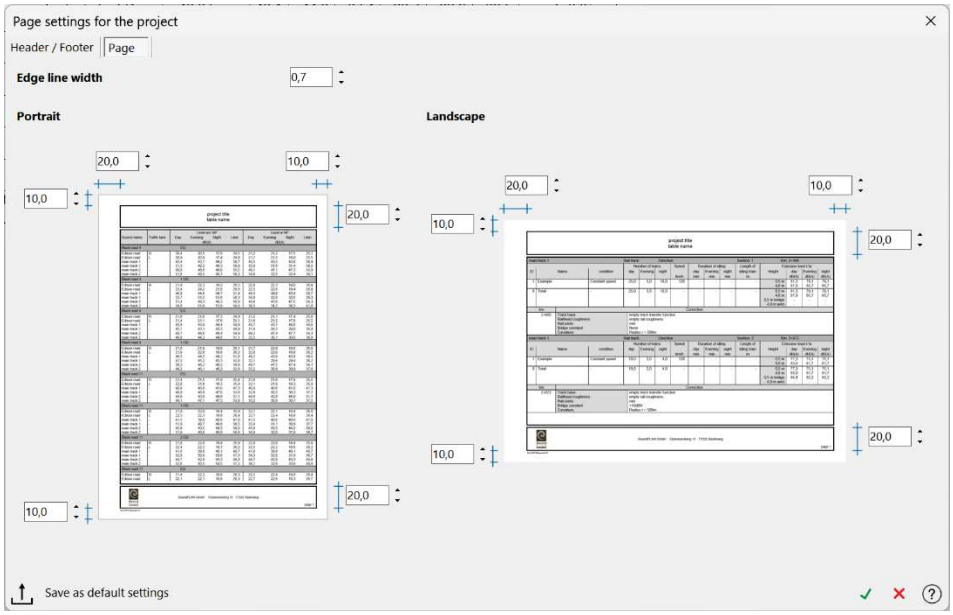
Open **PAGE LAYOUT** to define default settings for all tables in the project.

In the **HEADER/FOOTER** tab, you can enter a standard title that will be displayed in the header if there is no individual title. You can use the text variables **PROJECT TITLE, PROJECT NUMBER, TABLE NAME, NOISE TYPE(S) AND COMPANY NAME** or enter your own texts.



A text can be entered in the footer and a logo can be integrated. Load the corresponding image file by double-clicking in the logo area. On the right-hand side, you can enter a text for automatic page numbering. The logo, the fonts for the header and footer and for the page number apply to all tables in the project.

Define the position and width of the edge lines in the **PAGE** tab.



You can save your page settings globally so that you can use them as default settings for future projects.

Export tables

You can export the emission and result tables to ASCII files. Click the symbol button **EXPORT**, select where to store the data and enter the file name. It is also possible to use the **CLIPBOARD** (***Strg + C***) to paste the result data to another program e.g. Excel, Word, ….

Calculation

SoundPLANessential calculates single points, limit lines and grid noise maps.

Open the **CALCULATION** tab and select what you want to calculate (the DGM calculation is always activated).

Calculations

Run	with n.p.	Calculation type	Distance/m	Height/m
☑		Digital Ground Model	-	-
☑	☑	Single points	-	-
☐	☐	Limit lines	5,00	6,00
☐	☐	Grid noise map	5,00	2,00

☐ Include road / railway edges in DGM calculation

Calculation types are active only when data are present. If no single receivers are defined, for example, this calculation type is not available.

For the project type without / with noise control, select the variant you want to calculate.

Limit lines and grid noise maps are calculated in a specified **HEIGHT ABOVE GROUND**. For the grid noise map you can select the **GRID DISTANCE**, limit lines are always calculated in a 5 m grid.

The fields in which you select whether a calculation should be carried out can have different **COLORS**:

GRAY: the calculation type is not available because no suitable data is available.

WHITE: No calculation has been carried out yet.

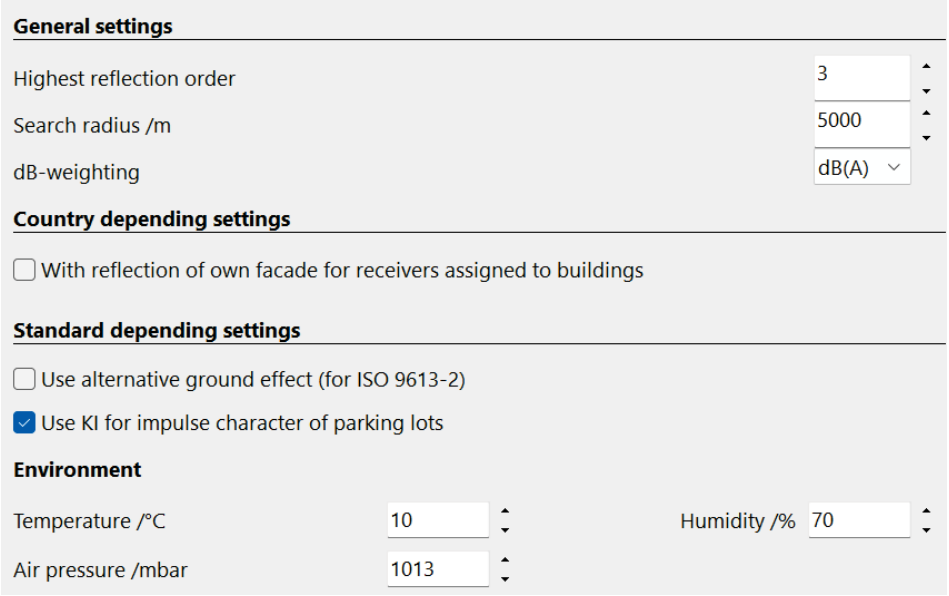
GREEN: A calculation has been performed successfully.

YELLOW: The data was changed after the calculation, so the results may no longer be up-to-date.

RED: The calculation could not be performed successfully due to an error or it was canceled by the user.

Calculation settings

The calculation settings are preset differently for the countries. Check the standard and country depending settings.



General settings

The **HIGHEST REFLECTION ORDER** specifies the maximum number of reflections to be taken into account. See also **STANDARDS DEPENDING SETTINGS** (below).

The **SEARCH RADIUS** specifies the radius around the receiver in which sources and reflectors are to be searched for.

The **DB WEIGHTING** can be switched between dB(A), dB(B), dB(C), dB(D) or dB(Z) (linear). During the calculation, sources with a frequency spectrum that do not correspond to the dB weighting set here are converted to this. Sources that have been assigned a center frequency in the geodatabase cannot be converted. This means that the weighting filter in the editor must match the one in the calculation settings for these sources, otherwise the calculation will be aborted.

Country depending settings

In some countries, the **REFLECTION OF THE OWN FACADE** should also be calculated for receivers that are assigned to a building.

Standard depending settings

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.

The **CORRECTION KI** is used in Germany for parking lots according to the Bavarian parking lot study.

The check box **REST HOURS** is used in Germany for calculations according to TA Lärm.

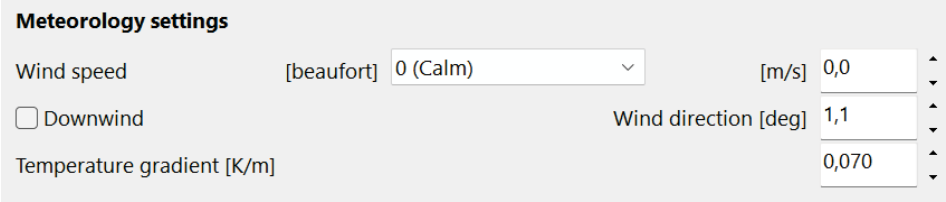
CREATE GROUND EFFECT AREAS FROM ROAD SURFACES automatically generates hard ground areas according to road width. Activate this check box for all standards that use this option (e.g. NMPB 2008).

Environmental settings

HUMIDITY, AIR PRESSURE, TEMPERATURE: The environment parameters are important to calculate the air absorption. Furthermore, is the sound speed a function of temperature, influencing the wave length and therefore the screening calculation.

SIDE DIFFRACTION is automatically calculated if a standard defines algorithms for side diffraction.

For Nord2000 there are additional meteorology parameters:



The Beaufort scale classifies wind speeds from 0 (calm) to 12 (hurricane). Typically, events are evacuated at wind classes higher than 4 or 5.

The **DOWNWIND** option enables a hypothetical and non-physical worst-case scenario, which is quite commonly used for calculations of environmental noise such as traffic noise and industry noise: The calculation includes downwind in every direction form the source to the receiver (like a vortex)! For open-air events this is not very fitting due to the short duration of the event. Different specific scenarios should be considered, e.g. two different wind directions or no wind.

The temperature gradient defines the vertical temperature change. It affects distant receivers.

Calculation types

DIGITAL GROUND MODEL (DGM)

See Digital Ground Model.

For each calculation, the digital ground model is first recalculated. This usually only takes a few seconds and ensures that the terrain model is up to date.

Single points

The calculation type **SINGLE POINTS** calculates the assessment levels for all receivers and floors and saves the results for each receiver. During the calculation, a level chart is presented depicting the magnitude of the noise received from each angular segment. Via the checkbox at the receiver, the level chart can appear later on, so you can check the geometry and noise intake.

The level chart enables you to graphically check the single receiver calculation. The rays in the diagram depict the noise coming to the receiver from a certain direction (red rays show reflected noise). The length depicts the magnitude. The total noise level can be derived by adding the contributions of all depicted rays.

The results of single point calculations are located in the **RECEIVER TABLE** and can be presented in the site map in the **GRAPHICS** display as a little table for each receiver.

Limit lines

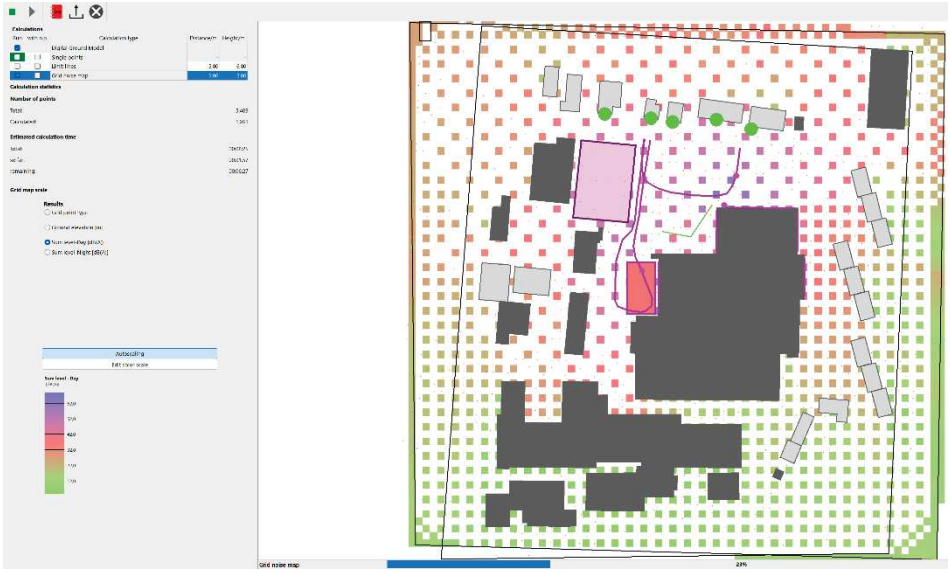
The **LIMIT LINES** calculation type is based on a grid calculation and outputs the isolines of the limit values for all time ranges. You enter the limit values in the project settings. Reflection from nearby buildings is suppressed so that the limit lines match the single point calculation. The limit lines are displayed in the site plan in the graphic output together with the single point results and formatted via the **OBJECT TYPES**.

Grid noise map

The calculation type **GRID NOISE MAP** is used to calculate the areal level distribution in the open areas. Specify the grid spacing and the calculation height above ground in the **CALCULATION SETTINGS**. The grid noise maps are displayed in separate maps in the graphic using a user-defined color scale.

Limit lines and grid noise maps are calculated within a calculation area or, if you have not entered a calculation area, for the entire geometry area.

During the calculation of limit lines and grid noise maps, the progress of the calculation is displayed graphically on a color scale. You can also see the percentage progress of the calculation using a progress bar below the graphic. The results can be displayed either for the grid point type (e.g. calculated, not calculated), for the ground level or for the sum level in the different time slices.



A **STATISTICS** shows how long the calculation will take.

Stop calculation: Click on the button **STOP CALCULATION** to stop a running calculation, if necessary.

Calculation messages

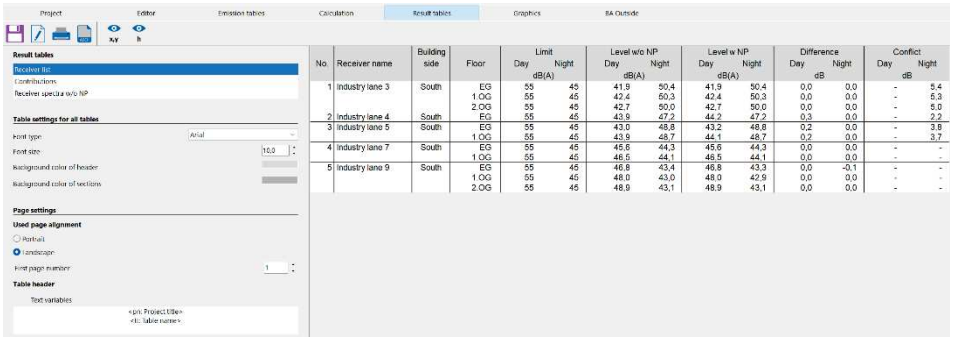
During the calculation, the editor dispatches messages in the lower portion of the screen. Errors and warning messages are presented in red. Double clicking on a message will open and activate the object in question so an error in the definition of the object or the geometry can be fixed easily.

You can hide or display the calculation messages using the **LOGBOOK** symbol button.

Result tables

The **RESULTS TABLES** contain the results of the single point calculations. All the results tables are listed on the left-hand side. You can select them by clicking on the corresponding list. In the **RECEIVER LIST**, the rating levels are displayed for each receiver and limit value exceedances are shown in the “Conflict” columns. For calculations with noise protection, you can also see the difference between the two variants.

In the **RECEIVER LIST** you can add columns for the x and y coordinates as well as a column for the height of the receivers above ground.



No.	Receiver name	Building side	Floor	Limit Day	Limit Night	Level w/o NP Day	Level w/o NP Night	Level w NP Day	Level w NP Night	Difference Day	Difference Night	Conflict Day	Conflict Night
				dB(A)		dB(A)		dB(A)		dB		dB	
1	Industry lane 3	South	EG	55	45	41,9	50,4	41,9	50,4	0,0	0,0	-	5,4
			1.OG	55	45	42,4	50,3	42,4	50,3	0,0	0,0	-	5,3
			2.OG	55	45	42,7	50,0	42,7	50,0	0,0	0,0	-	5,0
2	Industry lane 4	South	EG	55	45	43,9	47,2	44,2	47,2	0,3	0,0	-	2,2
3	Industry lane 5	South	EG	55	45	43,0	48,8	43,2	48,8	0,2	0,0	-	3,8
			1.OG	55	45	43,9	48,7	44,1	48,7	0,2	0,0	-	3,7
4	Industry lane 7	South	EG	55	45	45,8	44,3	45,6	44,3	0,0	0,0	-	-
			1.OG	55	45	46,5	44,1	46,5	44,1	0,0	0,0	-	-
5	Industry lane 9	South	EG	55	45	46,8	43,4	46,8	43,3	0,0	-0,1	-	-
			1.OG	55	45	48,0	43,0	48,0	42,9	0,0	0,0	-	-
			2.OG	55	45	48,9	43,1	48,9	43,1	0,0	0,0	-	-

The **CONTRIBUTIONS** table the partial rating levels of the sources at the receivers are shown. For spectral calculations, the spectra are documented in the **RECEIVER SPECTRA** table. In addition, a **MEAN PROPAGATION** table is output for commercial projects (see below).

As soon as source emissions or results change, the tables are updated when they are called up again. If you change the geometry or add emission locations without performing the calculation, you will be notified that the results are no longer up-to-date. In this case, you must perform the calculation again to obtain up-to-date results.

The page settings for result tables are the same as for emission tables and apply to all tables (emission and result tables) in the project.

Mean propagation table for industrial projects

For industry noise calculations the mean propagation table documents the various influences on the propagation path (air absorption, Cmet, ground effect, ...) for each receiver point. The propagation parameters are interdependent and cannot be considered separately.

Quellname	Quelltyp	Zeit bereich	Lw	Lw	KI	KT	DΩ	S	Adiv	Agr	Abar	Aatm	Amisc	ADI	dLrefl	Ls	Cmet	dLother/dB	dLw	ZR	Lr
			dB(A)	dB(A)	dB	dB	dB	m	dB	dB	dB	dB	dB	dB	dB	dB(A)	dB		dB	dB	dB(A)
Aufpunkt 1a , EG																					
Abluft 1	Punkt	Leq,tag	70,3	70,3	0,0	0,0	0,0	109,50	-51,8	0,8	-0,5	-1,0	0,0	0,0	0,0	17,7	0,0	10,1	9,7	1,9	29,4
		Leq,nacht	70,3	70,3	0,0	0,0	0,0	109,50	-51,8	0,8	-0,5	-1,0	0,0	0,0	0,0	17,7	0,0	8,7	9,7	0,0	27,4
		Lmax,nacht	80,0	80,0	0,0	0,0	0,0	109,50	-51,8	0,8	-0,5	-1,0	0,0	0,0	0,0	27,4	0,0	0,0	0,0	0,0	27,4
Abluft 2	Punkt	Leq,tag	70,3	70,3	0,0	0,0	0,0	93,94	-50,4	0,6	-0,7	-0,9	0,0	0,0	0,0	18,9	0,0	10,1	9,7	1,9	30,5
		Leq,nacht	70,3	70,3	0,0	0,0	0,0	93,94	-50,4	0,6	-0,7	-0,9	0,0	0,0	0,0	18,9	0,0	8,7	9,7	0,0	28,6
		Lmax,nacht	80,0	80,0	0,0	0,0	0,0	93,94	-50,4	0,6	-0,7	-0,9	0,0	0,0	0,0	28,6	0,0	0,0	0,0	0,0	28,6
Abluft 3	Punkt	Leq,tag	70,3	70,3	0,0	0,0	0,0	75,93	-48,6	0,4	-3,0	-0,8	0,0	0,0	0,0	18,3	0,0	10,1	9,7	1,9	29,9
		Leq,nacht	70,3	70,3	0,0	0,0	0,0	75,93	-48,6	0,4	-3,0	-0,8	0,0	0,0	0,0	18,3	0,0	8,7	9,7	0,0	28,0
		Lmax,nacht	80,0	80,0	0,0	0,0	0,0	75,93	-48,6	0,4	-3,0	-0,8	0,0	0,0	0,0	28,0	0,0	0,0	0,0	0,0	28,0
Abluft 4	Punkt	Leq,tag	70,3	70,3	0,0	0,0	0,0	61,08	-46,7	0,2	-3,3	-0,7	0,0	0,0	0,0	19,8	0,0	10,1	9,7	1,9	31,4
		Leq,nacht	70,3	70,3	0,0	0,0	0,0	61,08	-46,7	0,2	-3,3	-0,7	0,0	0,0	0,0	19,8	0,0	8,7	9,7	0,0	29,5
		Lmax,nacht	80,0	80,0	0,0	0,0	0,0	61,08	-46,7	0,2	-3,3	-0,7	0,0	0,0	0,0	29,5	0,0	0,0	0,0	0,0	29,5
An-und Abfahrt Lkw	Parkplatz	Leq,tag	49,1	80,0	0,0	0,0	0,0	65,84	-47,4	1,5	0,0	-0,5	0,0	0,0	1,6	35,2	0,0	0,5	-0,6	2,7	37,3
		Leq,nacht	49,1	80,0	0,0	0,0	0,0	65,84	-47,4	1,5	0,0	-0,5	0,0	0,0	1,6	35,2	0,0	2,0	3,0	0,0	38,2
		Lmax,nacht	110,0	110,0	0,0	0,0	0,0	47,02	-44,4	0,5	0,0	-0,4	0,0	0,0	1,6	67,2	0,0	0,0	0,0	0,0	67,2
Gabelstapler	Fläche	Leq,tag	-33,5	0,0	2,5	0,0	0,0	62,20	-46,9	1,5	0,0	-0,4	0,0	0,0	2,0	-43,7	0,0	99,2	95,1	3,2	57,1
		Leq,nacht	-33,5	0,0	2,5	0,0	0,0	62,20	-46,9	1,5	0,0	-0,4	0,0	0,0	2,0	-43,7	0,0	99,5	98,0	0,0	56,8

The sound pressure at the receiver from a source is the sum over the contributions from any reflected paths from source to receiver and the direct sound.

$$p_{tot} = p_{Dir} + p_{Refl}$$

Area and line sources will be dissected in a number of sub-sources due to geometry etc. Each sub-source contributes with its sub-sound power and the corresponding propagation losses (m1..mn) to the sound pressure at the receiver. Therefore, the direct sound is the sum over all sub sources i and frequencies f:

$$p_{Dir} = \sum_{i} \quad \sum_{f} dPw(i,f) \cdot m_1(i,f) \cdot m_2(i,f) \cdot\cdot m_n(i,f)$$

where

dPw(i,f): Sub sound power of sub source I at frequency f

$m_1(i,f) \cdot m_2(i,f) \cdot\cdot m_n(i,f,)$: Propagation losses 1..n in the propagation path e.g. due to geometrical spreading, screening, ground effect, air absorption, etc.

During the calculation the following intermediate values are calculated:

$$P_{w0} = \sum_{i,f} dP_w(i,f)$$

$$P_{w1} = \sum_{i,f} dP_w(i,f) \cdot m_1(i,f)$$

$$P_{w2} = \sum_{i,f} dP_w(i,f) \cdot m_1(i,f) \cdot m_2(i,f)$$

..

$$P_{wn} = \sum_{i,f} dP_w(i,f) \cdot m_1(i,f) \cdot m_2(i,f) \cdot\cdot m_n(i,f)$$

The sound pressure at the receiver can therefore be expressed as:

$$p_{tot} = \overline{P_w} \cdot \overline{M_1} \cdot\cdot \overline{M_n} + p_{\mathrm{Re}\,fl}$$

mit

$$\overline{P_w} = P_{w0}$$

$$\overline{M_1} = P_{w1} / P_{w0}$$

$$\overline{M_2} = P_{w2} / P_{w1}$$

..

$$\overline{M_n} = P_{wn} / P_{wn-1}$$

The M_i depend therefore on each other and cannot be viewed independently.

In SoundPLAN$_{\text{essential}}$ holds:

$10\lg(\overline{P_w}) = \overline{L_w}$: mean sound power
$10\lg(\overline{M_1}) = \overline{A_{div}}$: mean geometrical propagation loss
$10\lg(\overline{M_2}) = \overline{k0}$: mean k0 (ISO 9613 - 2 alternative e)
$10\lg(\overline{M_3}) = \overline{A_{gnd}}$: mean ground effect
$10\lg(\overline{M_4}) = \overline{A_{scn}}$: mean screening effect
$10\lg(\overline{M_5}) = \overline{A_{air}}$: mean air absorption
$10\lg(\overline{M_6}) = \overline{A_{mti}}$: mean mitigation loss
$10\lg(\overline{M_7}) = \overline{A_{met}}$: mean wind effect

By means of a reverse function the mean acoustical distance is calculated from the mean geometrical propagation loss.

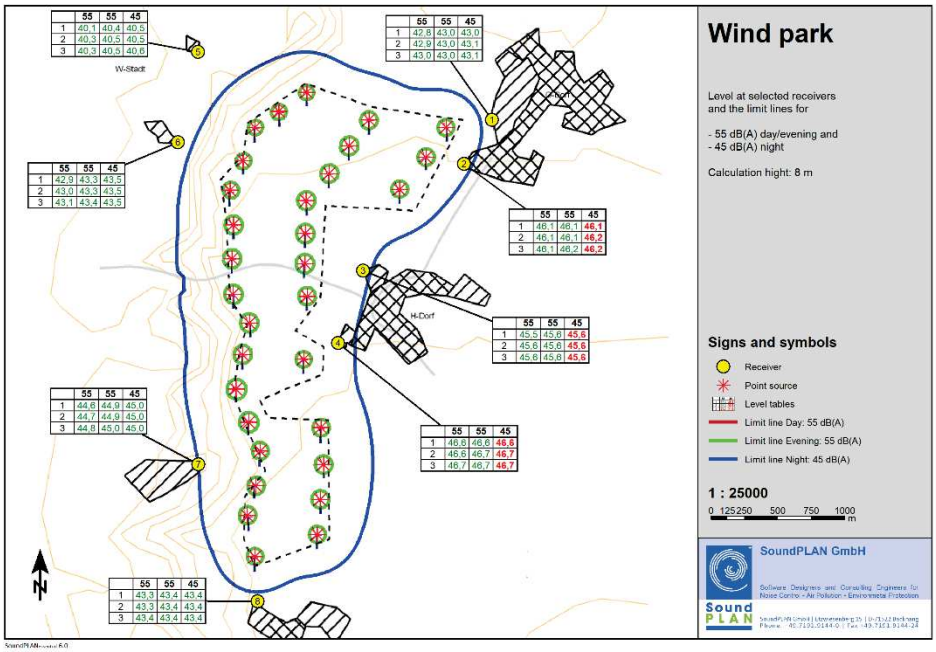
Graphics

The calculation results are presented under the tab **GRAPHICS** together with the model geometry in preformatted maps.

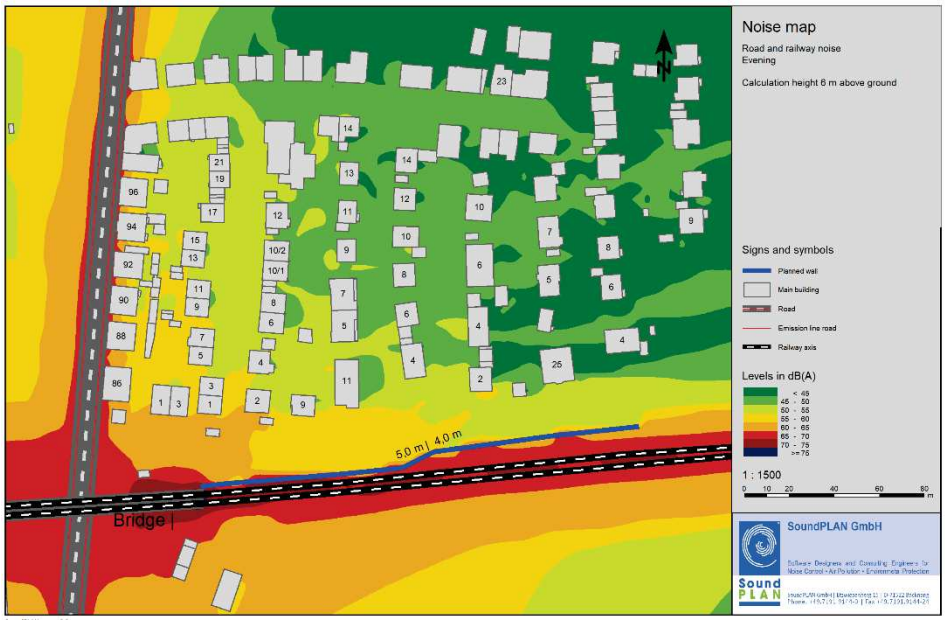
The single receiver map not only shows the results from single point calculations but also presents the noise limit lines for the calculated time slices (if calculated). If the geometry was entered on top of scanned bitmaps, the bitmap also is presented on the graphics sheet.

All objects and results can be formatted individually and selected/deselected in the graphics plot.

Example of a single receiver map:



Example of a grid noise map:



The description block contains the headers with an additional description, legend, scale bar and a company logo. For grid noise maps, the color scale is added in the description.

All formatting (font, company logo, length scale …) is valid for all maps in the project. Only the content of the description text is set individually for each map.

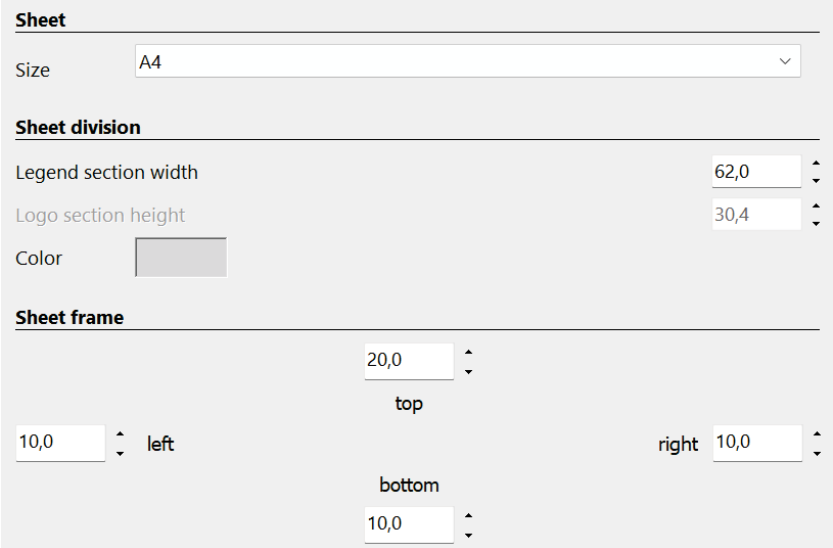
The element sequencing in the description block is fixed and cannot be altered.

The top right hosts the map header and an additional descriptive text, followed by the legend and the color scale for grid noise maps. The bottom of the description block includes a scale bar and the company logo.

Set sheet size and border size

Before you determine the viewport of your map, select the **SHEET SIZE** and **FRAME WIDTH** so the program knows the active drawing area and can determine the scale.

Click on the white frame of the sheet to define the settings.

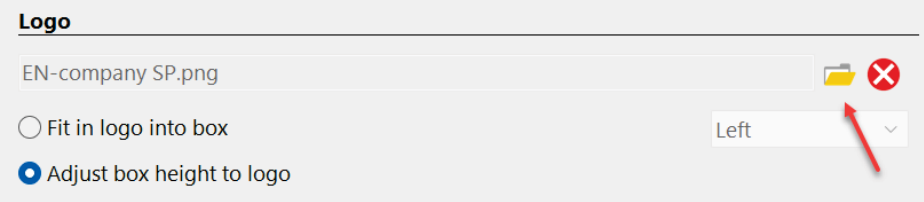


Please note the maximum print size of your printer when setting the margin widths.

You can also change the background color of the description block in the sheet setting.

Load company logo

Click on the lower area of the description block or the white sheet margin. Open the folder containing the image file with the logo. If the logo is not contained in the project, you can decide whether the file should be copied, moved or whether a link to the file should be created. To keep loading times to a minimum, it is advisable to keep the company logo as a BMP file.



Tip: As only one graphic box and no further text is possible for the company logo and company address, you would have to combine them in a graphics program if you want to display them together.

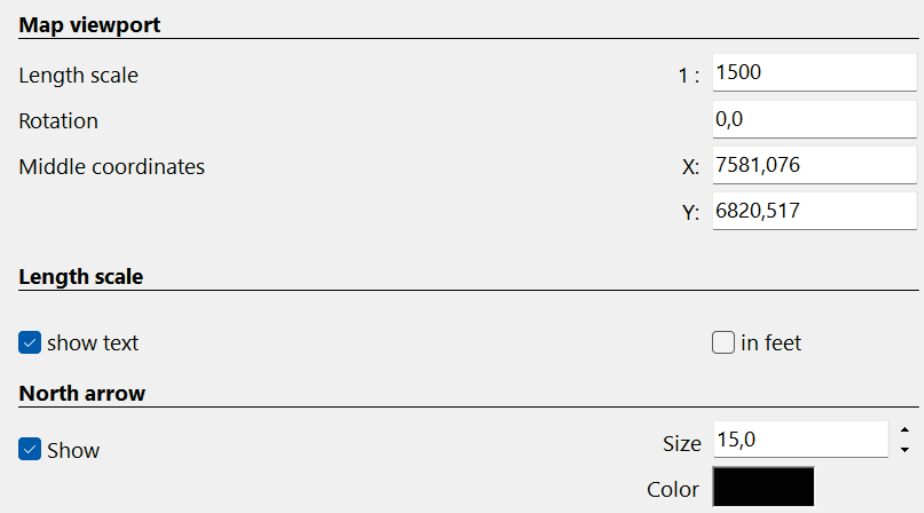
When using a company logo, you can choose whether the logo should be fitted into the box (according to the height of the logo area selected above) or whether the box height should be adjusted to the height of the logo - the height of the logo area (above) is then grayed out and can no longer be adjusted manually.

Set viewport and scale

As default the map will be scaled to present the entire project area.

Define the desired map section by activating Change map section and then roughly adjusting the geometry with the left mouse button and the mouse wheel. Hold down the ***Ctrl*** key to rotate the geometry.

Then click on the scale bar in the description block to enter the **SCALE**, **ROTATION** or **MIDDLE COORDINATES** numerically and to format the north arrow.



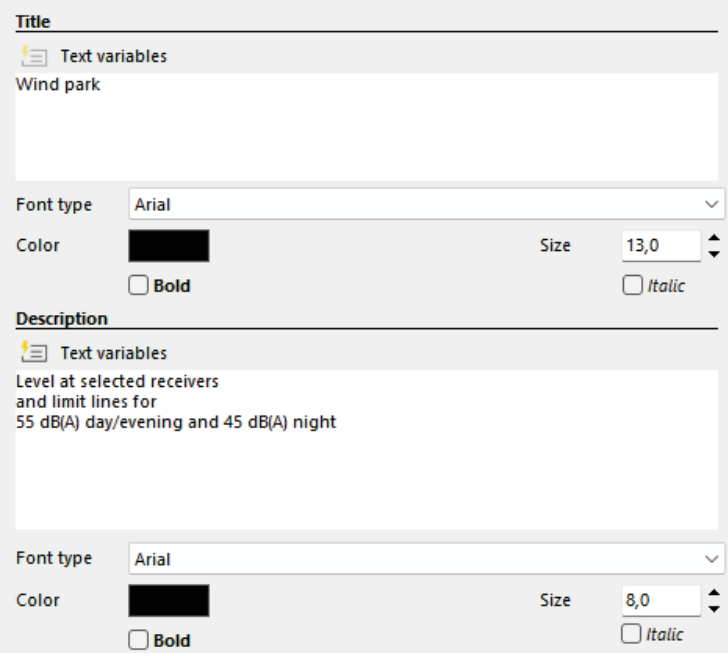
The **MAP LENGTH SCALE** is automatically adjusted when zooming. When rotating the map, the north arrow and the background graphics are also rotated. The length scale can be displayed in meters or feet.

Ratio: 1:1000 = 1 meter represents 1000 meters (no mixture of units)

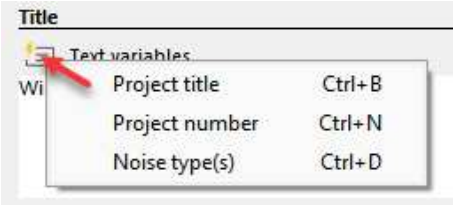
The **NORTH ARROW** can be moved to a new position pressing the left mouse button while moving the arrow to its new position.

Title and description

The descriptive texts of the maps are administered separately for each of the maps contained in the project. Click on the top right section of the description block to insert the title and description.



In addition to free texts, you can also use text variables. The **TEXT VARIABLES** are activated by clicking in one of the text fields.



The font is saved separately for the title and description text and applies to all cards in the project.

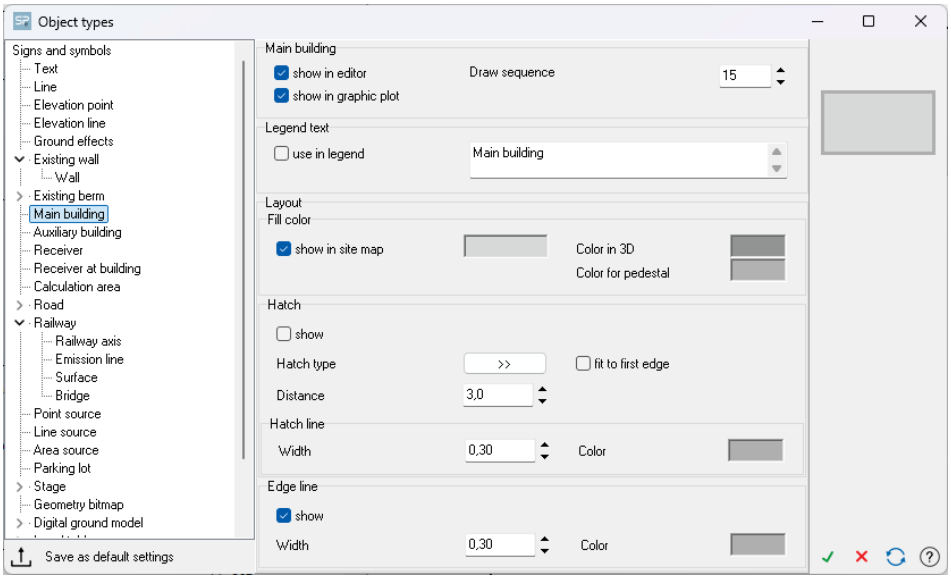
You can transfer the texts to other cards using Copy & Paste.

You can copy the sheet title, the sheet description or the color scale of the current sheet to other marked sheets using the **COPY SHEET SETTINGS** icon button. Use the ***Ctrl*** key to mark.

Edit legend, format objects

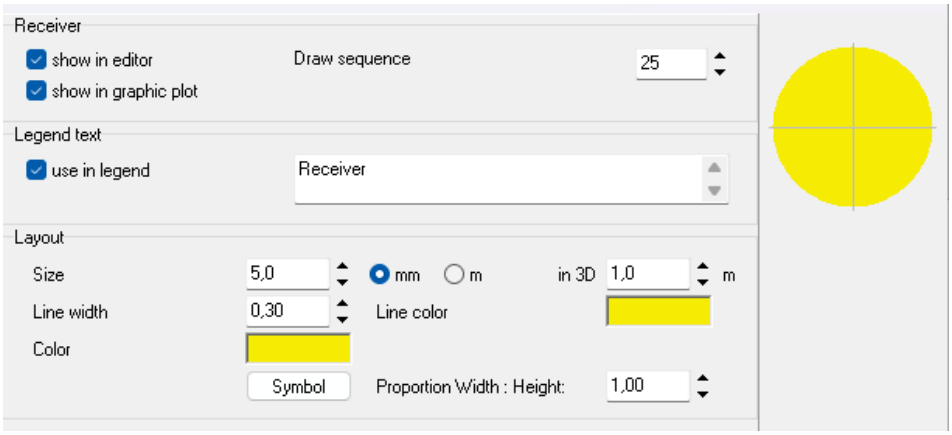
The layout for all drawable data is controlled via the object type file: Geometry object types (i.e. buildings and roads), result object types (level tables, grid noise maps and limit lines), as well as geometry bitmaps. A set of default definitions for all object types is delivered with the program. You may customize these as you like.

Open **OBJECT TYPES** or click on the **LEGEND** (or use ***Ctrl + O***) and select the object type you want to customize.



For each object type, select if this particular object type shall be visible on the editor and in the graphics display. You can alter the object name that appears in the legend in the section **LEGEND TEXT**. The higher the **DRAW SEQUENCE**, the later the object is drawn (and may hide objects of a lower sequence number).

Point object types



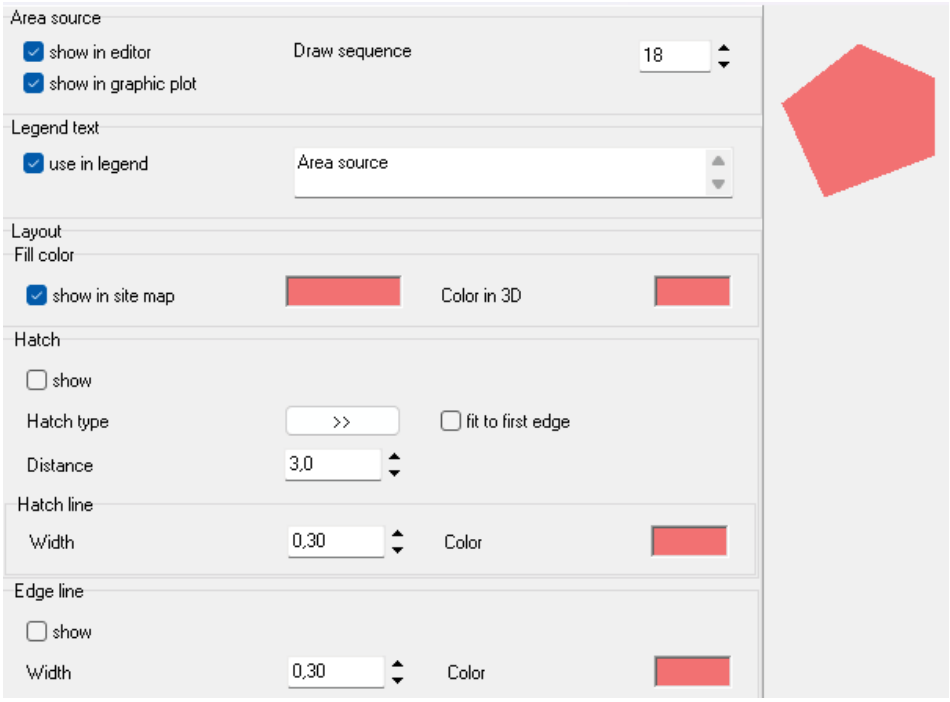
Define the size in [mm] (plan size) or in [m] (world coordinates). If selecting millimeters, the object will be drawn regardless of the scale of the drawing. If "meters" is selected, the size of the sign depends on the scale. The sign will be as large as the selected number of meters in the world coordinate scale. For the symbol size, an imaginary rectangle is drawn around the symbol. The longest side will determine the symbol size.

Click on the **SYMBOL** button to select a different symbol than the one proposed. Also select the symbol line width and border lines.

Line object types

Enter line width and line color.

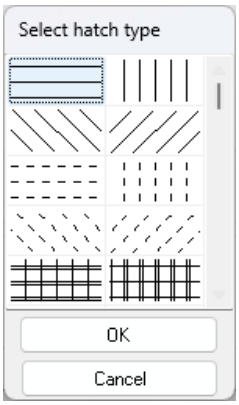
Area object types



For area object types, define the fill color, border and hatch pattern.

Hatch pattern

With the double arrow, select the hatch pattern and confirm it with OK.



If **FIT TO FIRST LINE** is marked, the hatch pattern will be parallel to a line through the first 2 coordinates of the object.

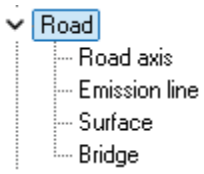
Geometry texts

The text layout is set in the editor. All settings (color, font type) in the graphics are taken from the definitions made in the editor. In the object types, you can adjust the sizes of all texts using the parameter **SIZE AS FACTOR** of the sizes selected in the editor.

Composite object types

Some of the object types consist of multiple sub-types (for example, roads, railways and noise protection walls). The layout of the sub-object types is defined

independently of each other. Select which of these sub-objects shall be drawn in the editor, map and legend.



Single point maps

The single point map depicts all results of the single point calculation for all available time slices and floors in small tables. In addition to the single receiver tables, it is also possible to display the limit lines for all time slices (if the limit lines have been calculated).

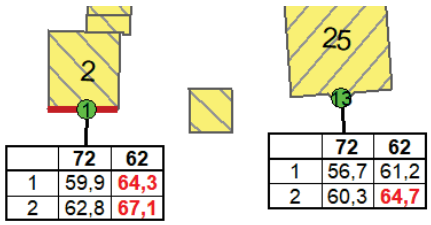
The level tables can be moved if the **MOVE LEVEL TABLES** icon button is active. Press the left mouse button and move the table to the new position. When the noise limit is exceeded on a receiver attached to a building, the facade where the receiver is located is marked with a red bar.

Edit the settings of the level tables

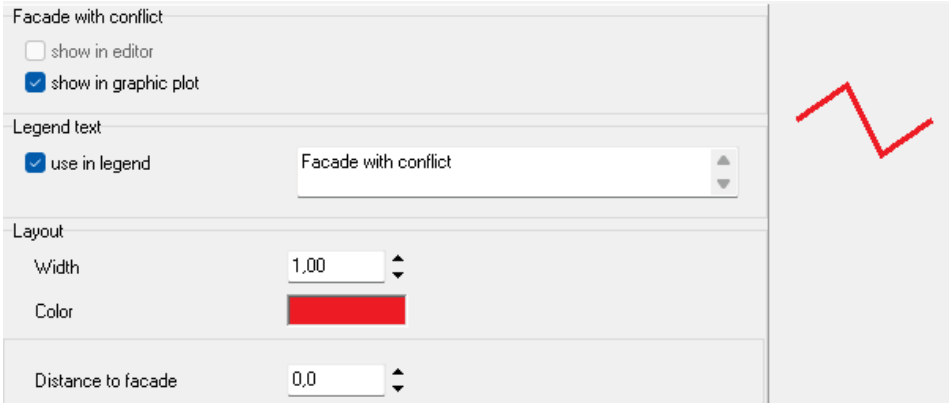
Open the **OBJECT TYPES** or click on the **LEGEND** and select the object type for level tables.

The level tables can be presented for all calculated receivers or only for those where the noise limit is exceeded.

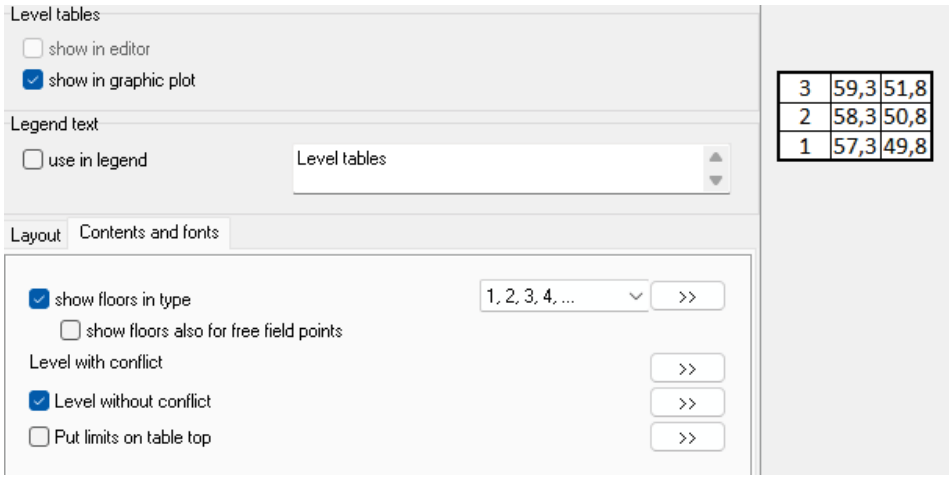
By default, the point number of a receiver is displayed in the reference point.



In the first sub-object type, format the **FASSADE WITH CONFLICT**.



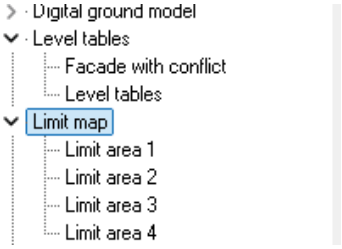
The sub-object type **LEVEL TABLE** is structured in the tabs for **LAYOUT** and **CONTENT + FONTS**.



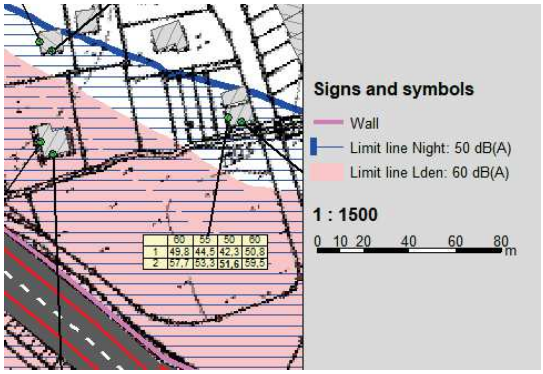
The line thickness and color of the seperating lines as well as the placement of the floors are defined in the **LAYOUT** tab. In the **CONTENT AND TYPES** tab, you can use the checkboxes to control what is to be output. The level values that exceed the limit value are always displayed. Use the double arrow to move to the font layout.

Edit limit lines

For each time slice you assigned a noise limit value in the project settings and activated it for display, the limit lines are presented on the single point maps. The appearance of the limit lines is edited in the **OBJECT TYPES.**



The contour line is displayed in the border color. You can also fill the areas with a solid color or select a hatch pattern if multiple contour lines overlap. The latter is helpful, for example, if several limit lines overlap.

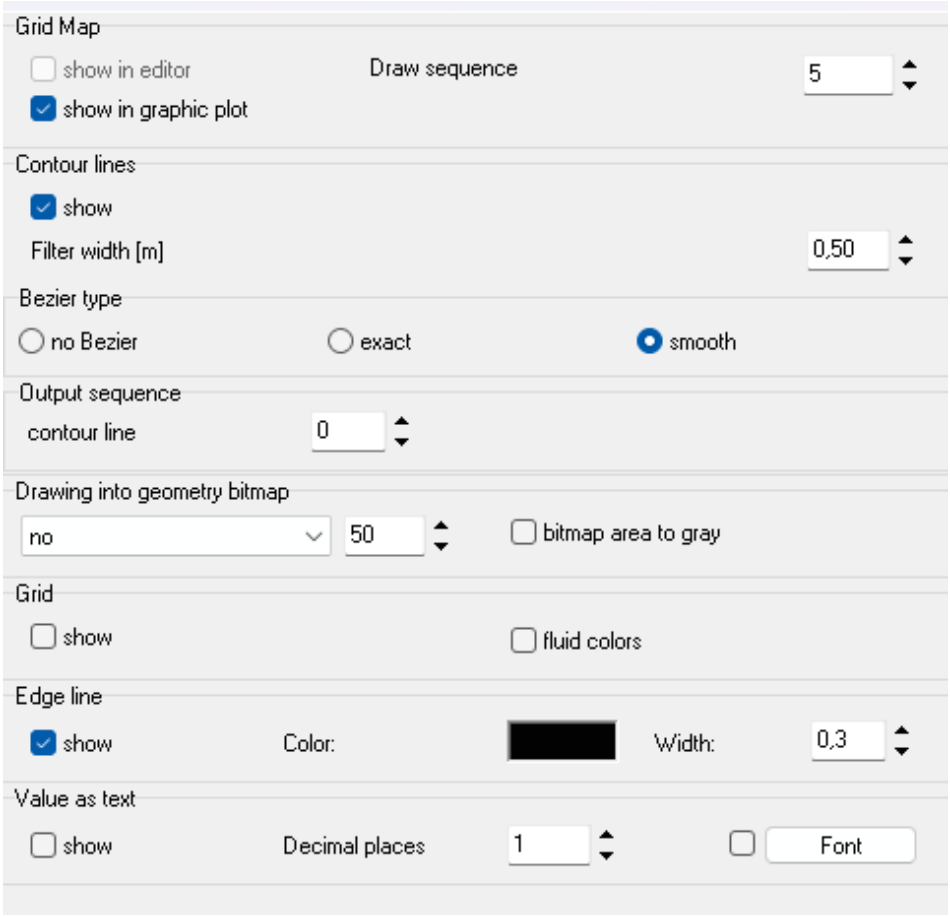


Grid noise map

The Grid Noise Map presents noise contour areas or the grid values filled with a user controlled color scale. The appearance of the noise map can be edited (contour lines and color scale).

Edit the appearance of contour lines

Call **OBJECT TYPES** and select the object type **GRID NOISE MAP**.



The **SHOW CONTOUR LINES** checkbox should always be ticked unless you want to output the grid. If the check mark is deactivated, no isolines and isosurfaces are output for the main interval either.

The **FILTER WIDTH** [m] defines a bandwidth within which support points are to be deleted. This leads to a smoothing of the isolines.

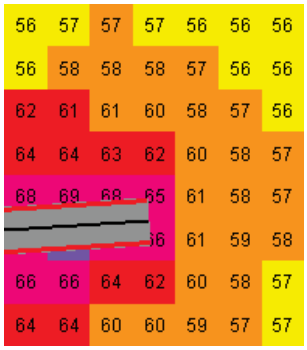
The **BEZIER TYPE** sets the form accuracy of the contour lines. With exact Bezier curves, the contour lines will move through the calculated interception points. The smooth Bezier option means the interception points are only used to pull the curve in its direction but will not force the curve to go through it.

The exact Bezier curve moves through the calculated points of the contour lines. However, when the lines have strong and changing curvature, this option will make the line less accurate.

The **EDGE LINE** displays the calculation area border. This option provides how this line will be presented. Please specify the color and line width.

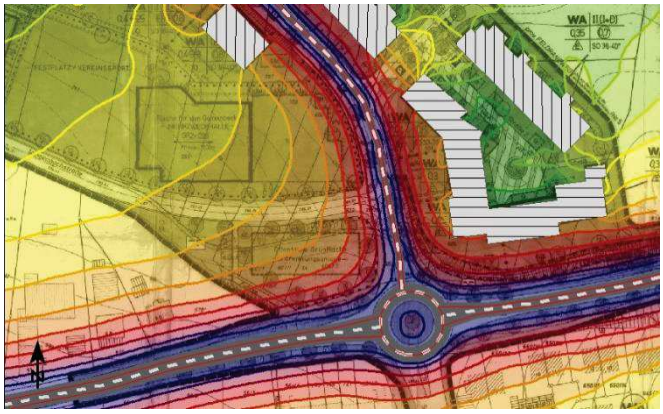
If you want to present the raw grid, activate the checkmark **DISPLAY GRID** and deactivate **DISPLAY CONTOURS.** You can also have the program interpolate the colors of the scale to more closely represent the colors of the grid cells by requesting a **FLUID SCALE.**

The option **VALUES AS TEXT** will display the predicted noise level as a text. The text is centered in each grid cell.



Drawing into geometry bitmap

If a geometry bitmap is in the background of the editor, the display of the grid map can be included in the geometry bitmap either transparent or shaded provided that the geometry bitmap is larger than the calculation area.



The contour lines are drawn on top of the bitmap in the selected color or in scale color.

Go to the object types (mouse click on the legend), select **TRANSPARENT** or **SHADE** in the settings for the grid noise map and enter the percentage for shaded or transparent.

You can additionally select whether the colors of the bitmap should be taken into account or only the gray values (check box **BITMAP AREA TO GRAY**).

TRANSPARENT is suitable for fully colored darker geometry bitmaps (aerial photos). **SHADED** is suitable for digital base maps in which only lines and bright colors (e.g. light gray for built-up areas or light green for forests) are included. If the result colors are too falsified, you can change the settings in the object type

geometry bitmap for the options **BRIGHTEN** (useful for aerial photos) or **CONTRAST** (useful for base maps).

Hint: In the background the geometry bitmap is automatically set to "normal" in the object type settings and the output sequence of the contour lines is set to higher than the output sequence of the grid noise map.

Layout of the contour lines

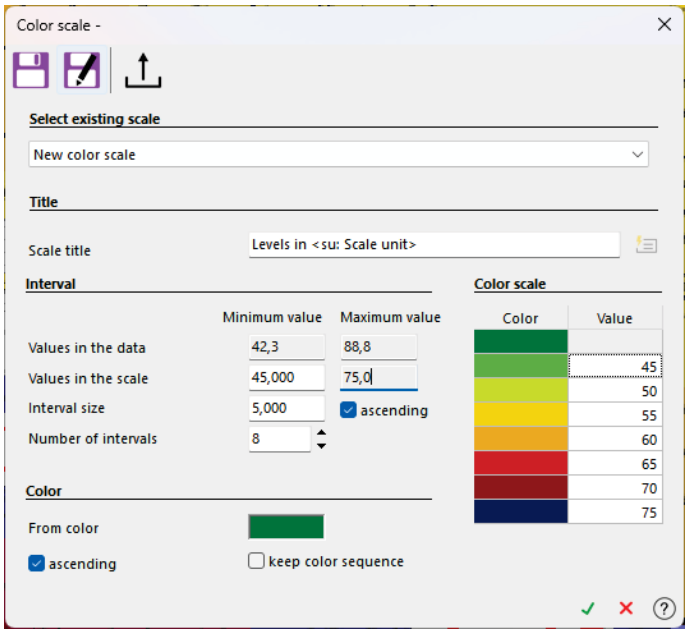
You change the layout of the isolines in the **MAIN INTERVAL** sub-object. The **FILL CONTOUR AREAS** button fills the areas between the contour lines in the scale colors. You can also specify here whether the contour lines themselves should be displayed as a line, in which color and with which pen width.

As a further display type, you have the option of deactivating **FILL IN ISOLINES** and displaying the isolines in **SCALE COLOR** instead.

Edit the colored scale

When the grid noise map is loaded, the program determines the minimum and maximum values of the grid noise map levels and suggests a sensible scale covering the value range of the map. The color sequences are chosen from the color palette.

Click on the color scale in the description block to make changes.



Enter the value of the smallest interval, the magnitude of the intervals (in dB(A)) and the number of intervals. **ASCENDING** defines if the lowest noise levels are on the top or the bottom of the scale.

For the **COLOR SELECTION**, a color palette is used. A line in the palette has 16 color fields so you can manage your scales and store the color sequences properly. SoundPLANessential is delivered with a default color scale. You can define your own scale color progressions any time**,** see Color palette.

The scale uses the colors starting from the field marked **FROM COLOR**. **ASCENDING** defines if the colors start from the marked field to the left or right (with „ascending“ deactivated).

If less than 16 intervals are used, SoundPLANessential selects a color sequence from the following 16 colors. Select **KEEP COLOR SEQUENCE** to disable the automatic assignment of colors.

Manually modify scale intervals of the color scale

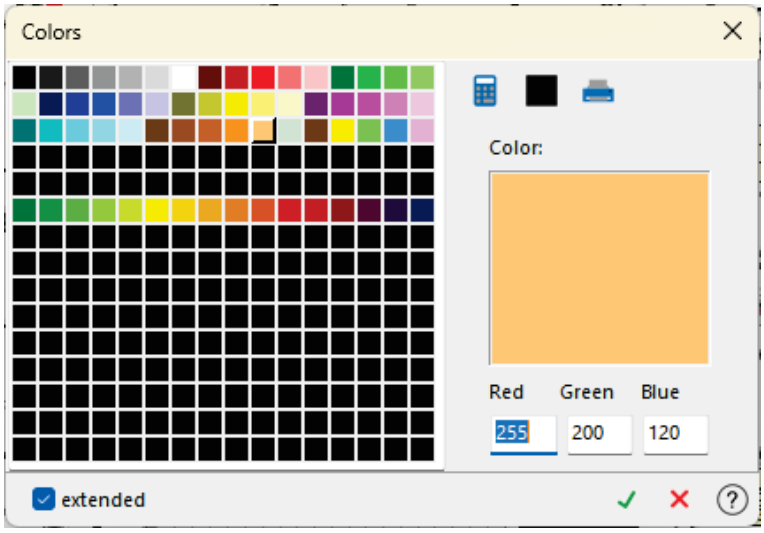
The interval size of the color scale is still pre-set according to the noise values found in the grid noise map, however it is possible to manually customize the scale. Click on the color scale and in this dialog on the individual colors next to the values to change them. Select a different color from the color palette in the color field. You can change the upper interval limit in the color value column. The intervals do not have to be linear.

Color palette

The color palette is used to control the color of the objects and elements and the scale colors. 16 consecutive colors are used for the scale colors.

As soon as you click anywhere in the program in a color field, the color palette opens. The colors are arranged in a matrix and are defined in RGB values. To display the RGB components, set the expanded checkbox.

RGB = Red-Green-Blue-components for each color range from 0 to 255.



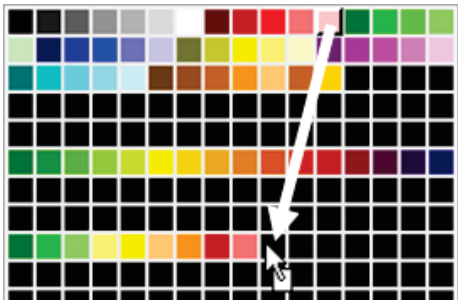
Define colors / compile scale colors

Click on **EXTENDED**. Enter the numerical value for the RGB components and move the new color with Drag&Drop to the desired position on the left. You can also

click on an existing color, modify it and move the new color with Drag&Drop to the desired position on the left.

Rotating the mouse wheel in the **COLOR** field will proportionally vary all RGB components while rotating the mouse wheel in one of the components will only vary the individual component.

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. To fill the gap with interpolated colors, click on the pocket calculator icon.

Hint: 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.

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 color values

The color palette can be output to the printer using the **PRINT** button. The colors are specified together with the RGB values. Depending on the screen resolution and printer, the colors can vary greatly between the screen and plotter. It is therefore advisable to print out the colors once in order to obtain a meaningful scale.

Export and print graphics sheets

Click on the button **PRINT** to print the map on the printer or to save it in a pdf file. If the margin of the sheet is cut, the selected margin width of the sheet is too small for the maximum print size of your printer. In this case correct the sheet frame.

Press ***Ctrl+C*** or the **COPY TO CLIPBOARD** button to copy the current graphic sheet to the clipboard. ***Shift+Ctrl+C*** copies only the plan without the legend block.

The graphic sheets can be saved in different graphic formats using ***Shift+Ctrl+S*** or the **SAVE GRAPHIC** symbol button. The map displayed on the screen is always processed.

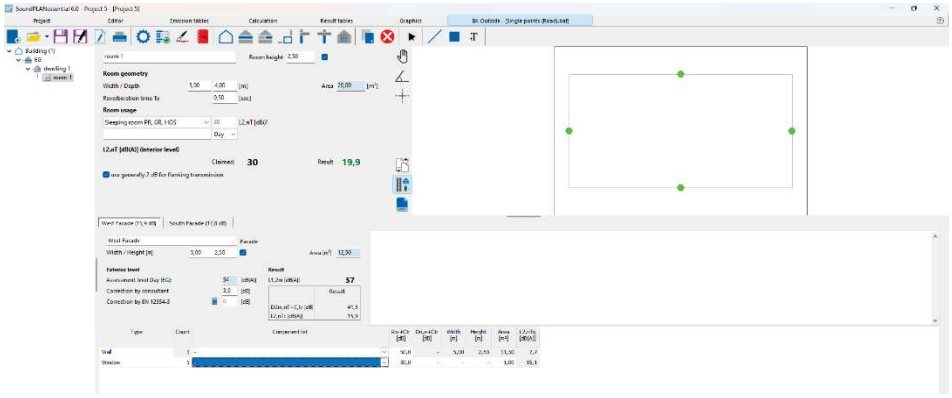
You can save the grid values of the loaded map in various formats (ASCII, DXF, ESRI Shapefile, ESRI ASCIIGRID, SoundPLAN binary grid or GeoRIFF) using ***Ctrl+E*** or the **EXPORT GRID** icon.

You can save the isolines of the loaded map in ASCII, DXF, CARD/1 and ESRI Shapefile format by pressing ***Shift+Ctrl+D*** or by clicking the **EXPORT CONTOURS** icon.

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 (German) standards. This description only covers the calculation according to EN ISO 12354-3:2017.



The sound reduction index of the used windows, windows or shuttters comes from a project specific component definition or from the extensive transmission library.

From the outside level EN ISO 12354-3:2017 calculates the required sound reduction index of the facade components on the basis of different room types defined in the room assessment library. Depending on the use of the room, the day or night assessment level is decisive. The room assessment is selected from the room assessment library when you create a room book.

The permissible interior level $L_{2,nT}$ is the energetic sum of the partial levels $L_{2,nTi}$ of all facades. The partial level $L_{2,nTi}$ of a facade is obtained by the energetic summation of all partial levels $L_{2,nTij}$ of the components of this facade.

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$_{essential}$-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 single point calculation are later on assigned to each facade of the building.
- A room can be exposed to the outside via one or multiple facades. For the room the inside noise level that is calculated is presented in red color as soon as the noise limit has been exceeded.
- The elements making up the facade are made up of the size in square meters and the valued sound reduction index R'_w. Inserted facade

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.

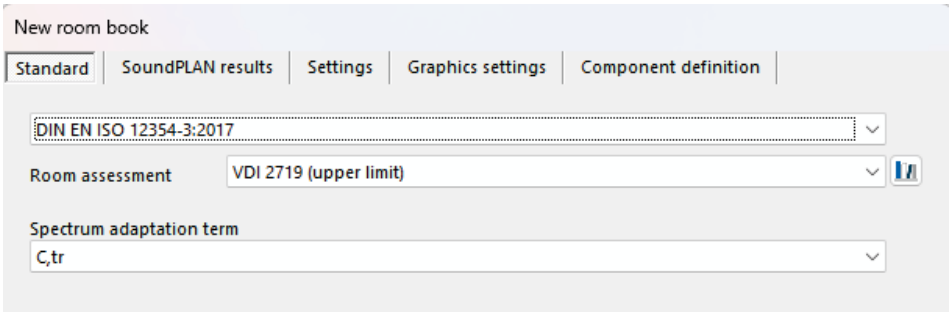
- The hierarchical structure makes it easy to transfer data from the higher level to the next level. Subsequent, general changes can thus be easily transferred to the rooms without having to change each value individually.
- The sound reduction index is set manually or is taken from the SoundPLAN transmission library or via a facade 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 had been changed during the BA-Outside process.

Generation of a new room book

Start BA Outside and create a new room book using the **NEW** button. When you open BA Outside for the first time in the project, a new room book is created automatically.

Standard selection

First select the standard you want to use for the calculation.



EN ISO 12354-3:2017 requires a room assessment from the room assessment library. Click on the **LIBRARY** symbol to open 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 assessment elements directly in the project library.

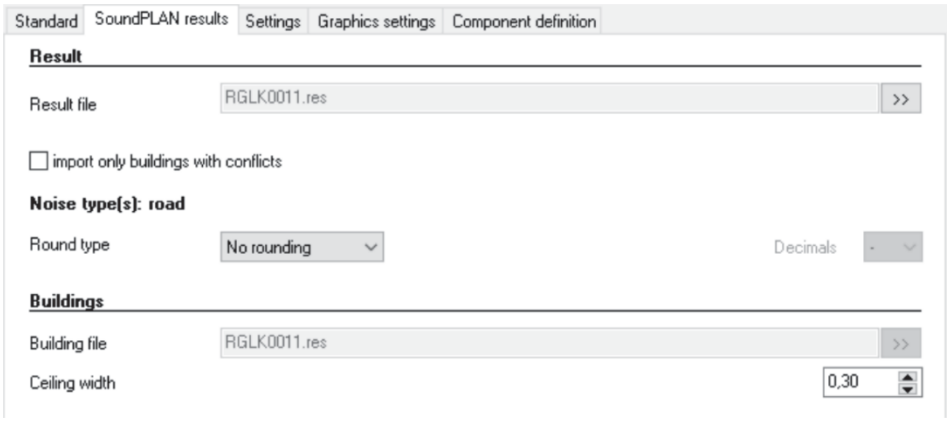
You can change the room assessment later und **SETTINGS -> STANDARD** by clicking on the **LIBRARY** icon.

Select the default spectrum adaption term C or Ctr.

Then use the blue navigation arrow to switch to the next tab.

Working with SoundPLAN results

If a calculation result is available, the result file is used automatically. If variants with and without noise protection have been calculated, select the desired file using the double arrow. How to use it is described below.



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**).

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.

You can show or hide the SoundPLAN geometry and the facade levels in the graphics window.

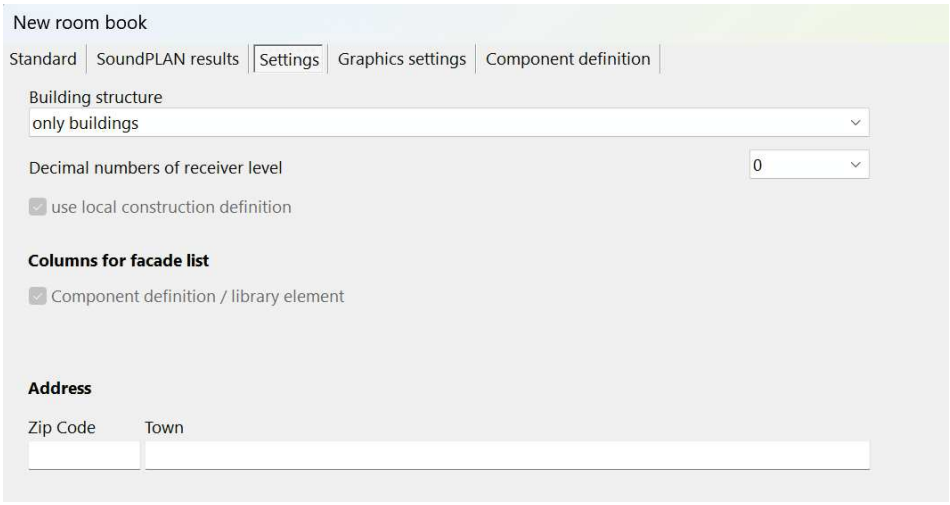
If the results change in the course of the project work, you can use **UPDATE SOUNDPLAN RESULTS** to exchange the assigned levels in the facades from the calculation result.

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.

To retain the building and facade structure for different variants that refer to the same room geometry, the BA outside project can be saved (under a different name) and the result can be exchanged using the double arrow.

Each hierarchy level (building / floor / apartment / room) can be assigned a graphic (graphic file or pdf file) so that you can better document a project. This can be an external image of the building, which is assigned to the building for information purposes, the floor plan of an apartment or the roof structure on the top floor. The graphics can be included in the printout.

Settings for the room book structure



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.

Specify the **NUMBER OF DECIMALS** for the levels used.

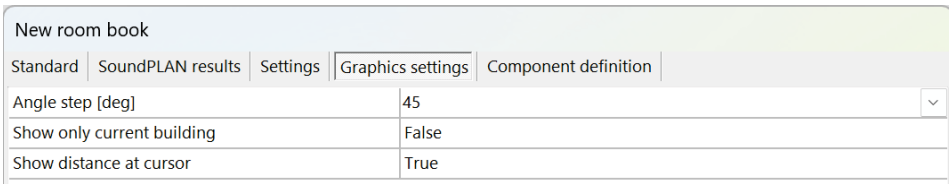
For the **FACADE LIST**, the column with the elements entered in the component definition is inserted by default. It can be deactivated later with a right click on the header of the facade list or with the short cut ***Strg+L***.

The component definition (see component definition) should already be generated when you start working on a new room book. If a local component definition is used, the column with the names entered in the component definition is added to the facade list by default.

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.

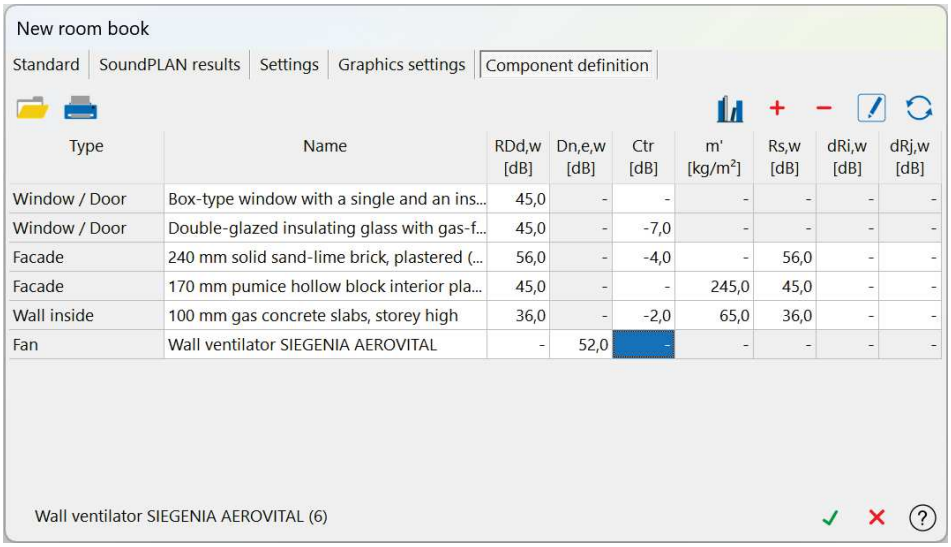
Graphics settings



The graphics settings refer to the geometry display in BA Outside.

Component definition

When you create a new room book for EN ISO 12354-3:2017, you get into the tab index card **COMPONENT DEFINITION**.



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 definition 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 R_w or the evaluated standard sound level difference $D_{n,e,w}$. Each element to be used in BA-Outside must be assigned an **element type** (facade / 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 pencil button 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.

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.

Fit in 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 **BITMAP** symbol. 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 left mouse button pressed onto the appropriate corner in the bitmap. Then click and hold the second corner of the building and move it to the correct position on the graphic. As soon as you release the mouse button the cursor will again change into a hand. To repeat the process, activate the **BITMAP** symbol again.

Embedded graphics can be easily placed for several rooms (e.g. in overlapping floors). To transfer the section from the apartment to the room, for example, select the room and click on the **COPY BITMAP** icon.

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***).

The drawing objects (and if applicable the SoundPLAN geometry data) and results are formatted via the **OBJECT TYPES**.

Using the hand symbol on the left-hand side of the graphics window, you can move the SoundPLAN geometry data (hold down the left mouse button), zoom (turn the mouse wheel or ***Shift*** + left mouse button or rotate (***Ctrl*** + left mouse button). For your own drawing objects, you can specify a rotation increment (**SETTINGS** -> **GRAPHIC SETTINGS** tab) and optionally display a crosshair at the cursor.

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 reuse. All elements in the hierarchy below this base element are also duplicated. When you duplicate dwelling 1 to become dwelling 1 and 2, all rooms and facades 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.

Facade 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 facade. 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 facade 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 $L_{2,nT}$. The room assessment library is selected when defining a new room book. It is possible to change it under **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.

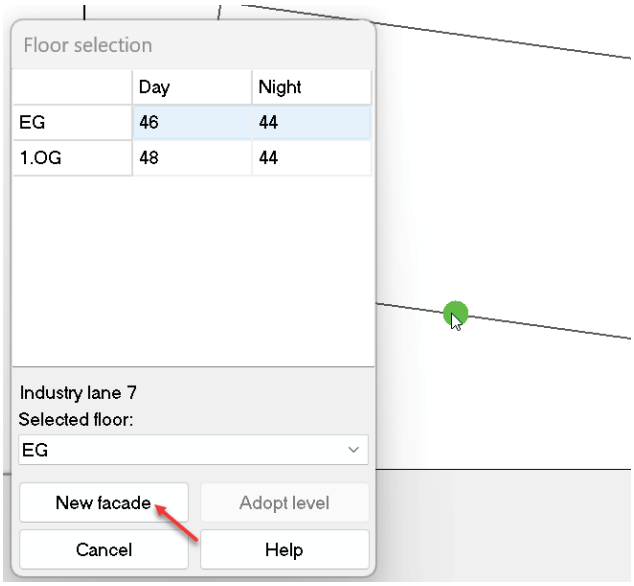
The reverberation time is standardized in the ISO to 0,5 s but can be customized if necessary.

The result of the facade calculations with an indication of whether the permissible values are complied with is displayed in the room.

Facade(s)

You can assign several facades to each room. The label on the tab is taken from the field **FACADE**. Behind the name in brackets you can see the partial noise level associated with this facade. Each facade can be assigned a comment.

If you work directly with SoundPLAN results, click on the respective receiver to insert a facade or take over the noise level to an existing facade.

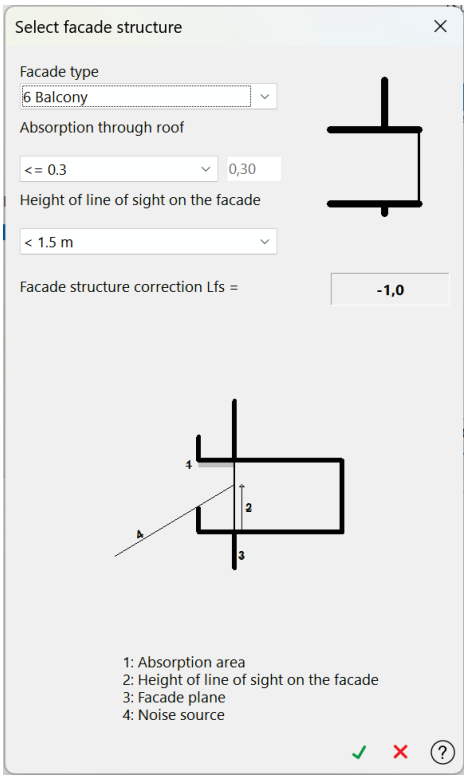


Select the floor and click on **NEW FACADE** to generate a new facade. Taking levels from other facades can only be done if the receiver already contains a facade. This procedure has the advantage that outdoor calculations can update the values while maintaining the object tree of building components (all levels are updated via **UPDATE SOUNDPLAN RESULTS**). The reference to the result can be deleted by right-clicking in the **LEVEL** field (**DELETE REFERENCE TO SOUND PLAN RESULT**).

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.

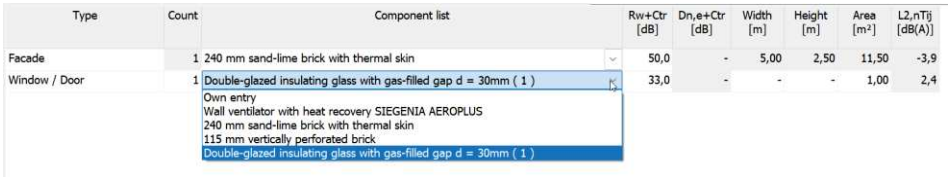
Facade list and components

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**.**

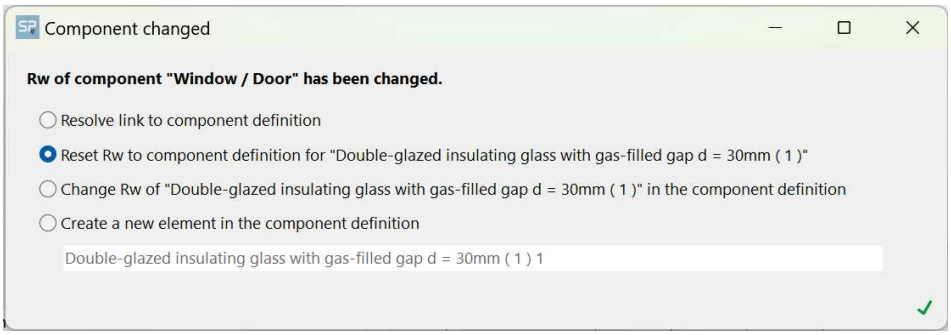
If necessary, here you also insert inner walls (flanking elements) for the flanking transmission, see Flanking transmission EN ISO 12354-3:2017**.**

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 facade area minus all other inserted facade components. The area of a component is not subtracted from the main element if the component is defined with the normalized level difference $D_{n,e,w}$, for example fans or shutters.



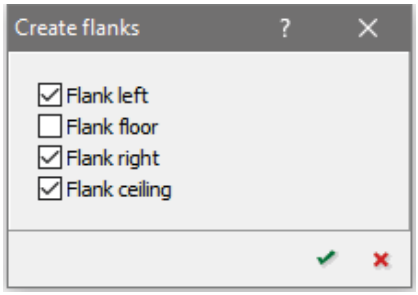
If the characteristic value of a component is changed during facade processing by scrolling with the mouse wheel or direct input, a query is made as to how the changed characteristic value is to be handled.



Flanking transmission EN ISO 12354-3:2017

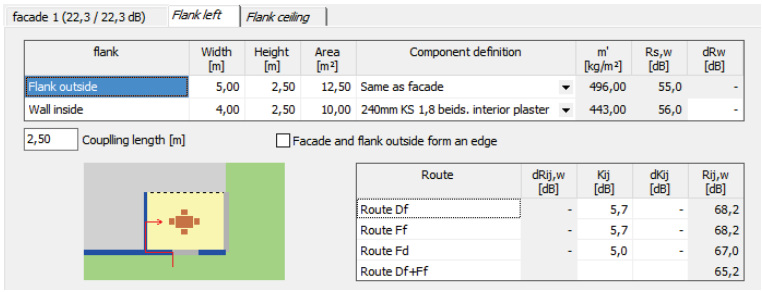
EN ISO 12354-3:2017 allows a generalized reduction of the sound reduction index of 2 dB for flanking transmission. For some noise and component situations, it may be necessary to take a detailed flanking transmission into account.

Once you have defined all the facades and components, you can create the flanks using the **WALL INSIDE** symbol. The flanks to be considered always refer to the loudest facade; 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 $R_{s,w}$ as well as the improvement of the flank sound insulation dimensions due to room-side attachment constructions dR_w are listed here.

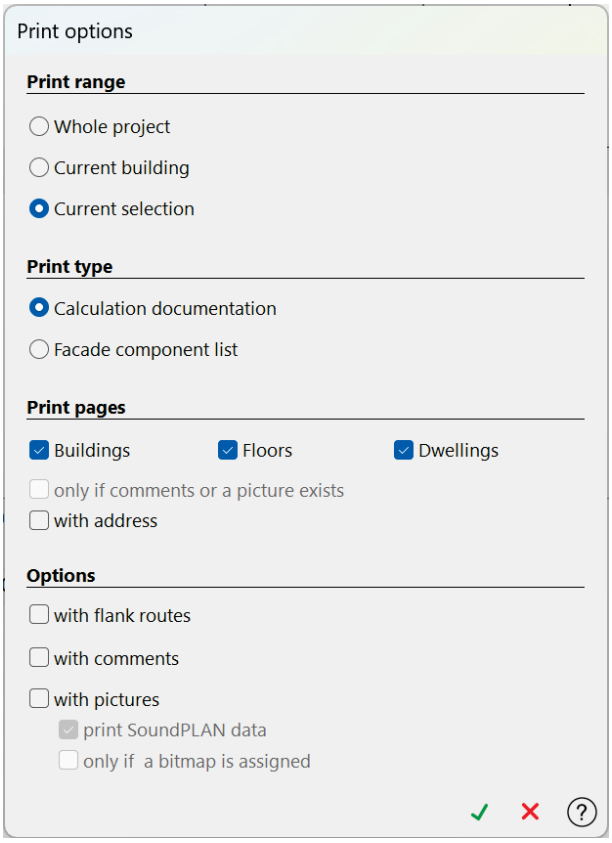
In the comment field on the right there is enough space for the documentation of expert adjustments.

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

The scope of the printed documentation differs depending on the standard used and the level of detail.



The selected printout either can print the data for all objects in the room book (**WHOLE PROJECT**), the **CURRENT BUILDING** or the **CURRENT SELECTION** a selected element. Aside from this the building, floor and dwelling pages can be suppressed.

You can select between two fix formatted printouts:

- The detailed calculation documentation
- The facade components used in this project (**FACADE COMPONENT LIST**)

With additional options you can define if the flank routes, the pictures that were created within BA Outside, assigned bitmaps and comments are printed.

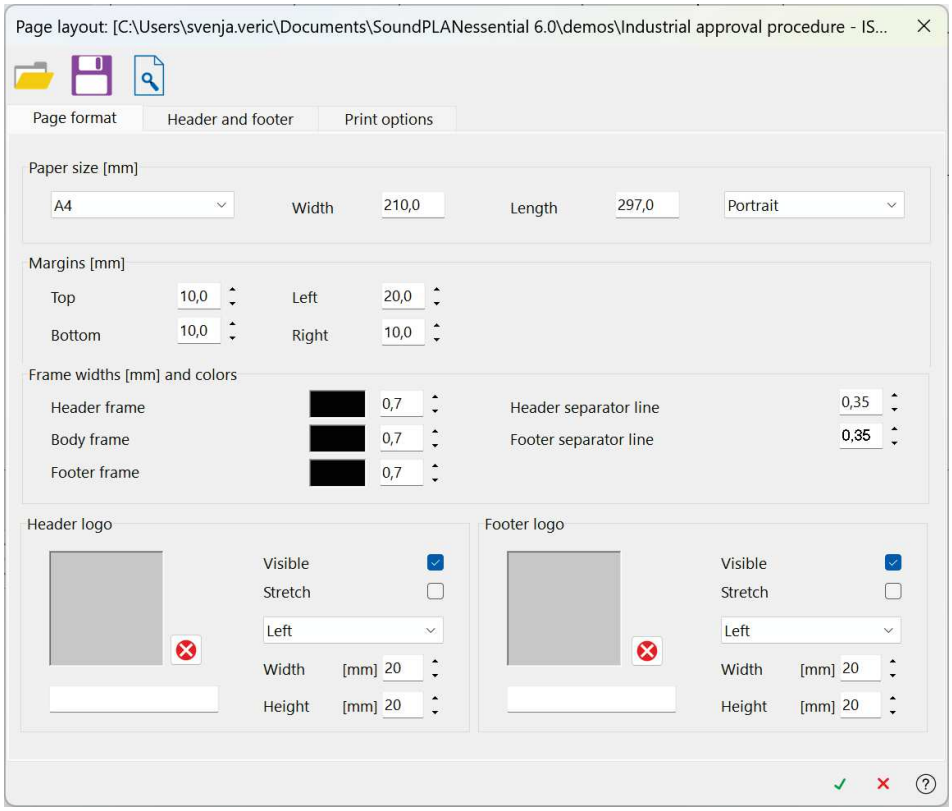
The printout is fixed in its formatting. Headers and footers can be defined in the page layout.

Page Layout

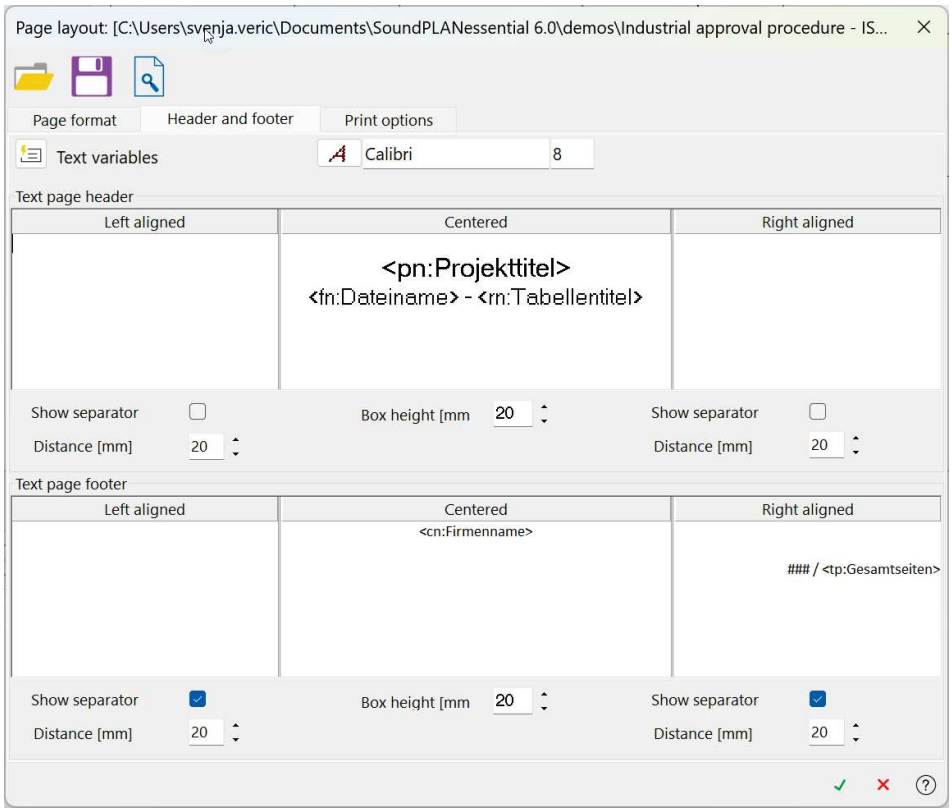
The page layout in SoundPLAN not only includes the paper size and the frames, but also the contents and layout of the headers and footers so that all enclosures of an investigation report look the same.

The print layout can be saved globally and is then available for other projects. Use text variables (e.g. project title or project number) in the headers and footers to automatically adjust the texts.

Specify the page size and print margins in the **PAGE FORMAT** tab. The page header and page footer are each divided into three areas: Left, center, right. Texts or logos in the left area are left-aligned, centered in the middle area and right-aligned in the right area.



A graphic, for example your company logo or the client's logo, can be inserted in the page header and page footer. Click on the gray field to select a graphic file. The position left, center, right) places the logo in the corresponding area of the header and footer. The aspect ratio of the graphic is retained and adjusted to the height of the area.



The height and content of the page frames are formatted in the **HEADER AND FOOTER** tab. Texts can be entered as **TEXT VARIABLES**, which are updated from information in the project, or as your own texts.

Page header and page footer are output on all pages. To format the texts, select the text or text variable and click on the **FONT TYPE** field. Specify the width of the right and left sections and the height of the page frames. Vertical **SEPARATION LINES** can be drawn at the edges of the sections.

The **PRINT OPTIONS** tab is used to specify the page number with which the printout should begin. You can also set the font type and size and the colors for column headers and heading lines here.

Click on **PREVIEW** to check the page layout.

Annex

Implemented standards

Road

RLS-19 · TNM 3.0 · NMPB 2008 · CoRTN:1988 · sonROAD18 · CoRTN:1988 · RVS 3.02/4.02: 2009 · CoRTN:1988 · ASJ-RTN Model 2018 · HJ2.4-2021 Road · CNOSSOS-EU: 2021/2015 · BUB: 2021/2018 · ÖAL 28: 2021/2019

Railway

Schall 03:2012 · FTA 2018 / FRA-HSGT: 2005 · RMR 2002 (EU Interim) · CoRN:1995 · NF S 31-133 Rail:2007 · SEMIBEL · Japan Narrow Gauge Railways:2008 · Israeli Rail:2006 · CNOSSOS-EU:2021 · BUB: 2021 · ÖAL 28: 2021

Industry

ISO 9613-2: 1996 · ISO 9613-2: 2024-01[1] · ÖNORM ISO 9613-2:2008 · BS 5228-1:2009 · ASJ CN-Model:2007 · HJ 2.4: 2021 · Nord2000 · CNOSSOS-EU: 2021/2018 · BUB: 2021/2018 · ÖAL 28: 2021/2019

Parking lot

RLS-19 · Bavarian Parking Lot Study

Files in SoundPLAN$_{essential}$ projects

The geometry data are stored in different files in the project folder with the following names:

GeoRoad.geo	Roads
GeoRail.geo	Railways
GeoIndu.geo	Industrial sources
GeoPLot.geo	Parking lots
GeoObjs.geo	All other geometry objects for projects with one variant
GeoWand.geo	Noise protection wall for projects with the variant

The results are stored under the following numbers:

1 DGM
11 Single point calculation (one variant)
12 Limit contour lines (one variant)
13 Grid noise map calculation (one variant)
21 Single point calculation (two variants)
22 Limit lines (two variants)
23 Grid noise map calculation (two variants)

When different noise types are combined in one project, the numbers for each calculation are incremented by 100.

[11] Restriction: Reflections on round objects are not calculated in SoundPLAN$_{essential}$.

Convert projects to SoundPLANnoise

Projects edited in SoundPLANessential can be transferred to SoundPLAN$_{noise}$, for example to continue them with SoundPLANnoise and forward them to another office using SoundPLAN$_{noise}$.

The graphic sheets are not generated automatically, save them in the **GRAPHICS** tab index card via **GRAPHICS -> SAVE SHEETS AS SOUNDPLAN NOISE SHEETS** before you convert the project**.**

Select the SoundPLAN$_{essential}$ project in SoundPLAN$_{noise}$ via **PROJECT -> OPEN**.

Situations are automatically created during conversion.

- DGM.sit contains the elevation data and, if applicable, roads and railways.
- Objects.sit contains all objects for calculation and display.
- All objects.sit contains all objects entered in SoundPLANessential.
- Objects with Wall.sit additionally contains the planned walls for a calculation without and with a noise barrier.

The corresponding assessment is automatically created; in addition, the SoundPLAN$_{essential}$ calculations are converted into run file lines.

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