Information on IMMI Update 2: Version IMMI 2021-2 [516]

Date: 27. April 2022

New features

Design tools when creating and editing elements

Design tools in the form of helping lines and dimensioning can now be displayed when designing and editing elements:

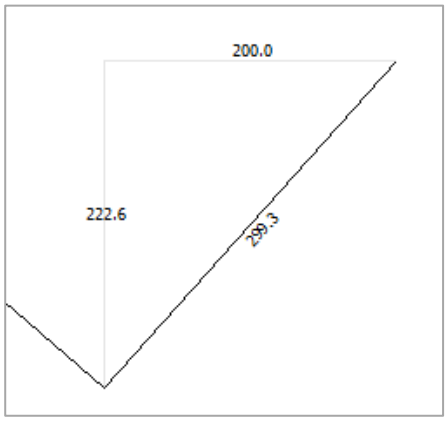


Image: Horizontal and vertical helping lines (gray) incl. parameters.

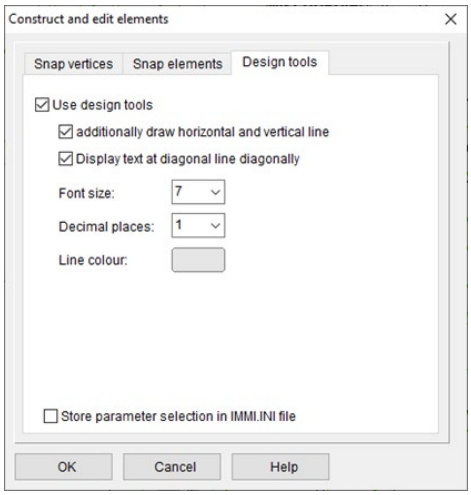
The "Construct and edit elements" dialog box can be used to switch the display of the helping lines and parameters on and off and to customize them with a few additional parameters.

Element design and element snap

The dialog boxes with the

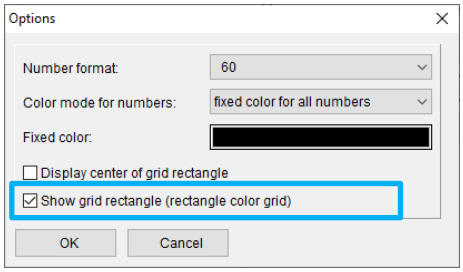
- settings for designing elements
- snap elements
- design aids

have been combined into one dialog box with three tabs. The dialog box for the settings of the design aids can also be found here



Display of the color grid

If a color grid is displayed in the **rectangular color grid mode** (without interpolation), a black frame can now be drawn around the grid boxes.

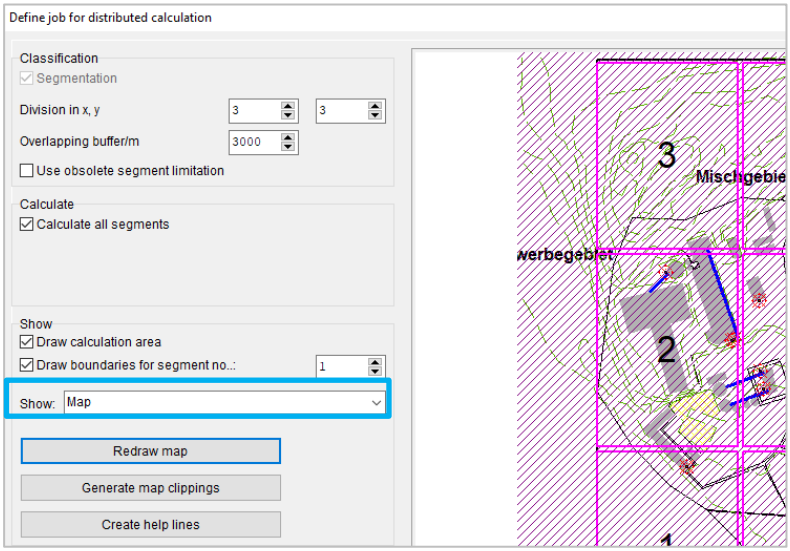


Distributed calculation

The dialog box in which the "distributed calculation" can be defined has been slightly redesigned to make it easier to use. In addition, the option has been created to select whether the

- entire site plan or only
- the grid to be calculated should be displayed.

Displaying the grid is useful when it covers only a small part of the grid.



Reflection proportions in the long list

The proportions of the total immission level can be divided into

- direct sound
- first-order reflections
- reflections of higher order
  -

These proportions can now be displayed in two different ways. Possible display formats:

- individually
- cumulated

Individually:

List - Part 2		Point calculation			Separation of partial reflection		
Noise prediction		Rating following: TA Laerm (1998)					
Industrie		Setting: Beispiel					
		Night (22h-6h)					
		Direct	1st order	> 1st orde	Total	Delta 2...	
		/dB	/dB	/dB	/dB	/dB	
IPkt001	RP1	45,8	45,8	37,6	49,1	0,3	
IPkt002	RP2	46,9	46,7	38,7	50,1	0,3	
IPkt003	RP3	48,0	48,3	40,2	51,5	0,3	
IPkt004	RP4	48,4	48,4	37,9	51,6	0,2	

Meaning in this context:

- Direct: Level that is generated only by direct sound without any reflection.
- Order: Level which is generated only by the 1st order reflection, without direct sound and without reflections of a higher order.
- >1st Order: Level generated only by higher order reflections. Without direct sound and without 1st order reflections.
- Total: The total immission level
- Delta2: The level increase resulting from the addition of the higher order reflections.

Cumulated:

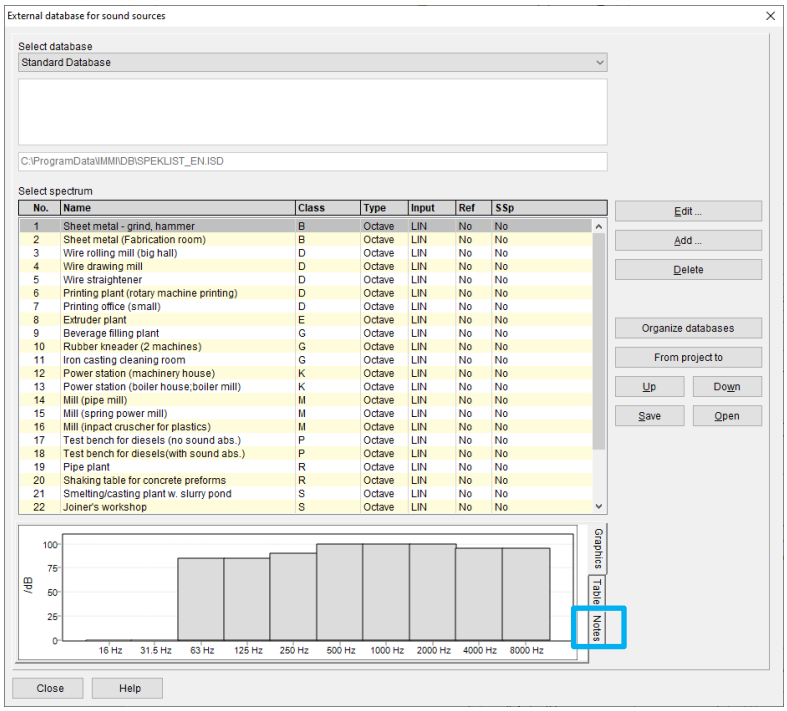
List - Part 2		Point calculation				Separation of partial reflection	
Noise prediction		Rating following: TA Laerm (1998)					
Industrie		Setting: Beispiel					
		Night (22h-6h)					
		Lrefl 0	Lrefl 0+1	Lr,A	delta 1	delta 2	
		/dB	/dB	/dB	/dB	/dB	
IPkt001	RP1	45,8	48,8	49,1	3,0	0,3	
IPkt002	RP2	46,9	49,8	50,1	2,9	0,3	
IPkt003	RP3	48,0	51,2	51,5	3,1	0,3	
IPkt004	RP4	48,4	51,4	51,6	3,0	0,2	

Meaning in this context:

- Lrefl0: Level resulting from direct sound only.
- Lrefl 0 +1: Level resulting from direct sound plus 1st order reflection components.
- Lr,A: The total immission level, added up from direct sound, 1st order reflection components and higher order reflection components.
- delta 1: Level increase resulting from the addition of only the first-order reflections.
- delta 2: Level increase resulting from adding only the higher order reflections.

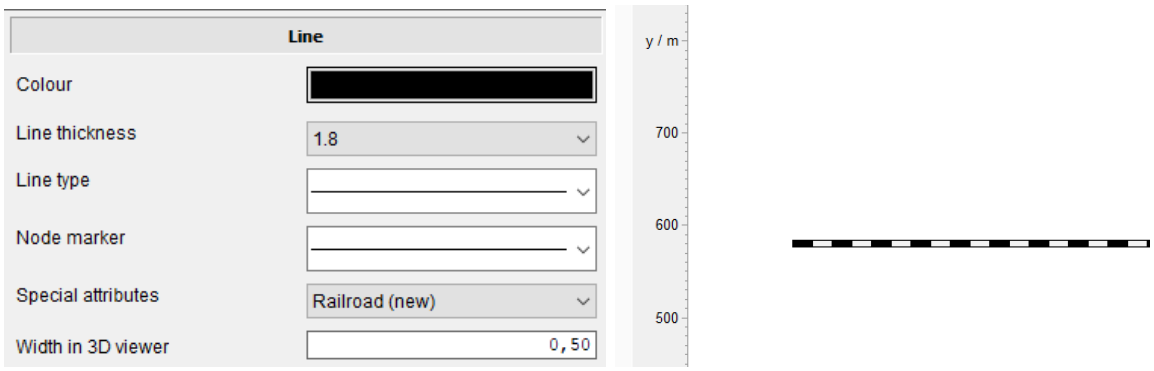
Notes in the spectra display

In the spectra lists dialog boxes, the notes on a spectrum can now be easily displayed in addition to the table and graph:



Display of rail elements in the site plan

A new display format for rail elements can be selected.



The element is drawn alternately with the line color and with the fill color. The total width is set by the line width.

New parameter for the search for colors with the color legends

The dialog box for the color legend was visually enhanced, some options were placed directly above each other for clarity.

A new mode for selecting color levels was introduced. (The new mode is needed because of [2])

Values directly used

The color for the level value is determined directly from the level.
The color legend has the level steps

A:60 <= P < 65
B:65 <= P < 70
C:70 <= P < 75

The value 65.2 dB falls into level band B

Round values beforehand

Some color legends use only rounded integer levels. As for example in [2].

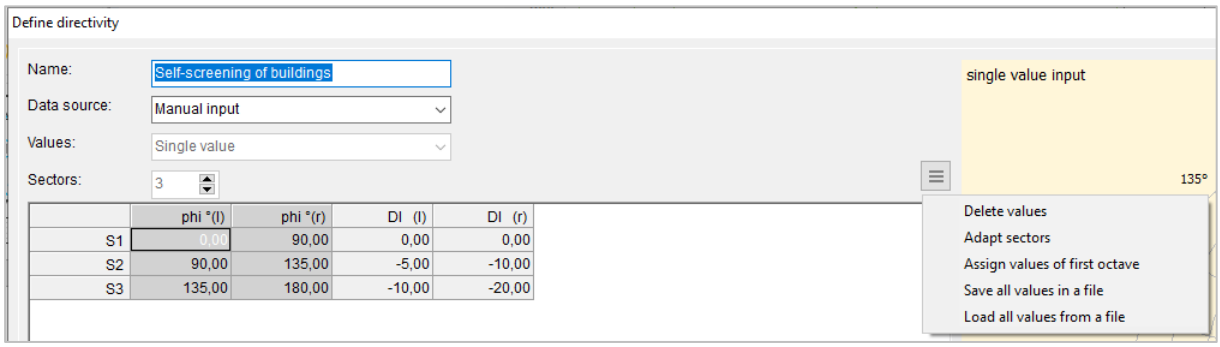
The color legend has the level steps

A:60 <= P <= 65
B:66 <= P <= 70
C:71 <= P <= 75

The value 65.2 dB is rounded to 65 dB and now falls into level band A

Directivity

Some helping functions have been added to the directivity dialog box. These are available via a local menu as well as via a menu button.



- Delete values: Deletes all directivity entries. The sector distribution and the number of sectors are retained.
- Adjust sectors: The fields phi(l) and phi(r) are filled automatically. Thereby the semicircle (180°) is evenly distributed to the set number of sectors.
- Adopt values of the first octave for all octaves: Fills all octaves with the directivity values of the first octave.
- Save all values to a file: Writes all directivity values to a text file. The file format is analogous to the display on the screen. The first line contains all values of the first sector, the second line all values of the second sector, and so on.
- Load all values from a file: Values that are in a text file in the above format are loaded into the directivity definition. The column separator must be a semicolon. The decimal separator may be a dot or a comma. To create such a file, the easiest way is to export an existing directivity (even if it contains only zeros) then fill it with the correct values and finally import it again.

Façade level – location parameters

When defining location parameters for façade levels, the "Minimum distance to nearest building" parameter is now accessible. Façade points are not generated if another façade is too close to a building. This critical distance can now be set.

Note: In the parameter set location of IP according to CNOSSOS, this distance was 1m. However, the regulation itself does not provide for a minimum distance here. Therefore, the value has been changed from 1m to 0m. However, since this parameter is now accessible, the user can use their own value.

Element library CNOSSOS-EU

General information about the CNOSSOS-EU library

With the publication of the directive:

COMMISSION DELEGATED DIRECTIVE (EU) 2021/1226
of December 21, 2020
amending Annex II to Directive 2002/49/EC of the European Parliament and of the Council with regard to common methods for noise assessment for the purpose of adapting to scientific and technical progress

the additions, extensions, and amendments described therein were also implemented in IMMI. In addition to some changes in the rules and regulations, the underlying tables have also been supplemented and changed in some places. As a result, data sets that were created and calculated with versions prior to the present Update 02 may now deliver different calculation results than in the earlier versions.

Important note: Compatibility with the results of the previous version(s) is not given.

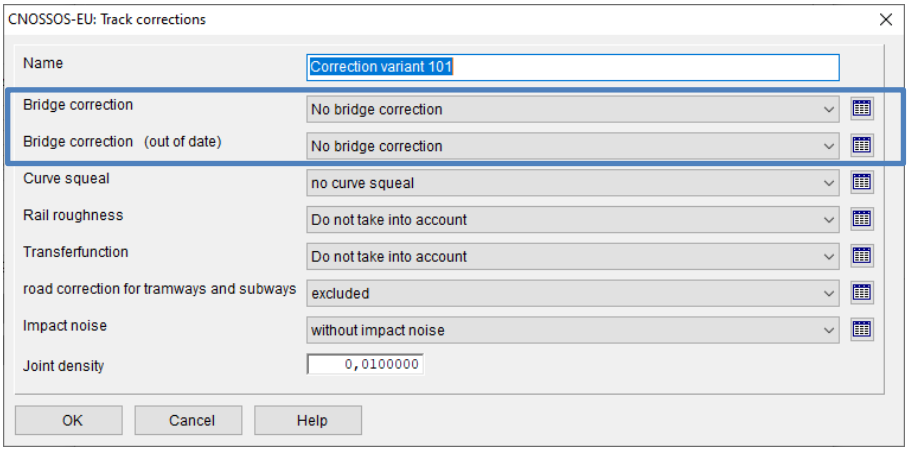
New features/changes to CNOSSOS-EU (original)

- Road surface and calculation parameters: The parameters for the road surfaces as well as the calculation parameters AR, BR, AP, BP, CR, and CP are now again part of the program for the default values and no longer outsourced to external files.

  These calculation parameters can be viewed in a dialog box.

Note: The calculation parameters can also be changed there. But this should be done only in absolutely exceptional cases and for research purposes!

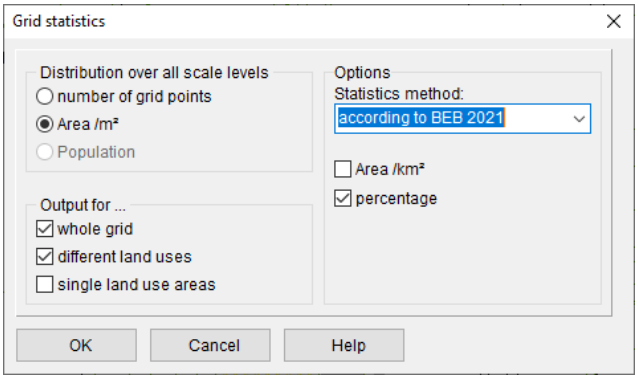
- New rail vehicles for Belgium: Some Belgian rail vehicles and their CNOSSOS parameters have been introduced.
- The table of rail vehicles now shows from which regulation or country the respective rail vehicle originates.
- Block function CNOSSOS road: When assigning the driving direction of a CNOSSOS road via the block functions, the entry "One-way against node direction" was missing. This selection has now been retrofitted.
- Switch K0: In the elements point, line, and area source according to CNOSSOS, the switch K0 was erroneously displayed, although this parameter is not evaluated according to regulations. The switch K0 is now no longer displayed.
- CNOSSOS-EU bridge correction: In [1] the bridge correction for CNOSSOS rail lines is completely redefined. However, since a suitable bridge transfer function is often not known, the desire arose to be able to continue to use the old bridge correction. Therefore, it is now possible to select either a bridge correction according to the new or the old procedure. Since the corrections are mutually exclusive, they also cancel each other out in the dialog box.



- Rail line surcharge for free rail line (default): This surcharge is the default rail line surcharge for CNOSSOS rail elements and is assigned to each geometry section of a CNOSSOS rail element. This entry can now be edited. This makes it easy to change the default rail line section without having to define and assign a new surcharge.
- Display of emission for rail elements: The display of the emission of a rail element is composed of the emission of the individual vehicles as well as surcharges caused by the track on which these vehicles move. Until now, the dialog box displayed the emission with a so-called "zero surcharge". This meant that all surcharges were set to zero. The disadvantage of this approach was that the speed of the train was not included at all in the emission displayed in the dialog box, which often led to inquiries. Now, for the rail line surcharge, the one assigned to the first pair of nodes in the geometry of the rail line is selected. This surcharge is now used to display the emission in the dialog box. The surcharge used for displaying the emission is shown in the dialog box. This change has no effect on the calculation.
- In the dialog box of the vehicle composition, the A-sum level of all trains of a route is now additionally displayed.

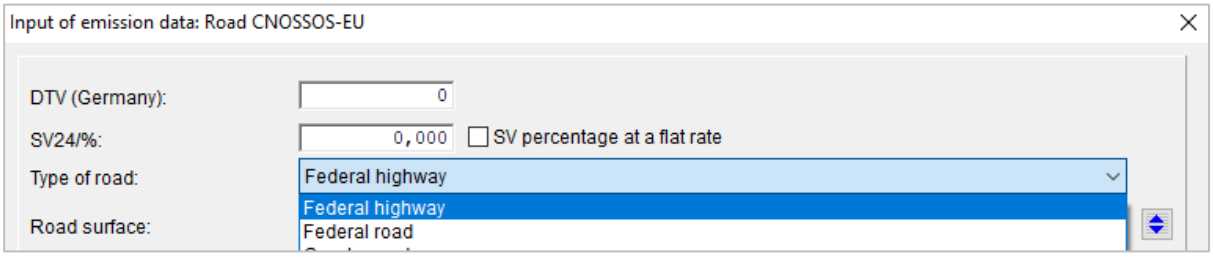
New features/changes to CNOSSOS-EU (Germany) – BUB, BEB, BUF

- CNOSSOS-EU Rail: Bridge surcharges BUB: The bridge surcharges according to [3] table B-10 have been added.
- Grid statistics according to BEB: For the evaluation according to [2], paragraph 5, the new, additional method according to BEB 2021 was introduced for the grid statistics



- New databases BUB-D: Changes and extensions of the databases from [3] have been incorporated.

- **Calculation of vehicle numbers from the DTV:** according to the LAI notes [4], the vehicle numbers for passenger cars as well as medium and heavy trucks are now calculated from the heavy traffic share for 24 h (SV24). In addition to the DTV, the SV24 and the road type can now be entered. The vehicle numbers are then calculated according to [4], tables 5, 6, and 7.



- If the SV24 is not explicitly known, a flat rate can be applied to heavy traffic in accordance with [4] Table 8. To do so, select **SV percentage at a flat rate** and select the desired road type.
- The list of DTV conversions now contains the new values from [4]. This list **cannot** be edited or extended in the current version.
- **Extension of the import/export of ArcGIS shape files:** The parameters "SV24/%" and "SV percentage at a flat rate" have been included in the import/export of ArcGIS shape files via the variables "SV24" and "SV24PAUSCHAL".
- New color legend BEB 2021: The legend DIN 45682 BUB/BEB was introduced, see above section **New parameter for the search for colors with the color legends**.

New features/changes to CNOSSOS-EU (Austria) – RVS 04.02.11, RVE 04.01.02, ÖAL 28

- **Input JDTV:** "Roads with predominantly interregional traffic", here the night value of the heavy load share is now correctly 20 % and no longer 35 %.

New macro: Generating high voltage power lines

In order to model noise ("crackling") from corona discharges on high voltage power lines, an helping lines generation tool is now provided. With this tool, the power lines can be modeled as line sound sources. The course of the catenary lines is thereby automatically generated.

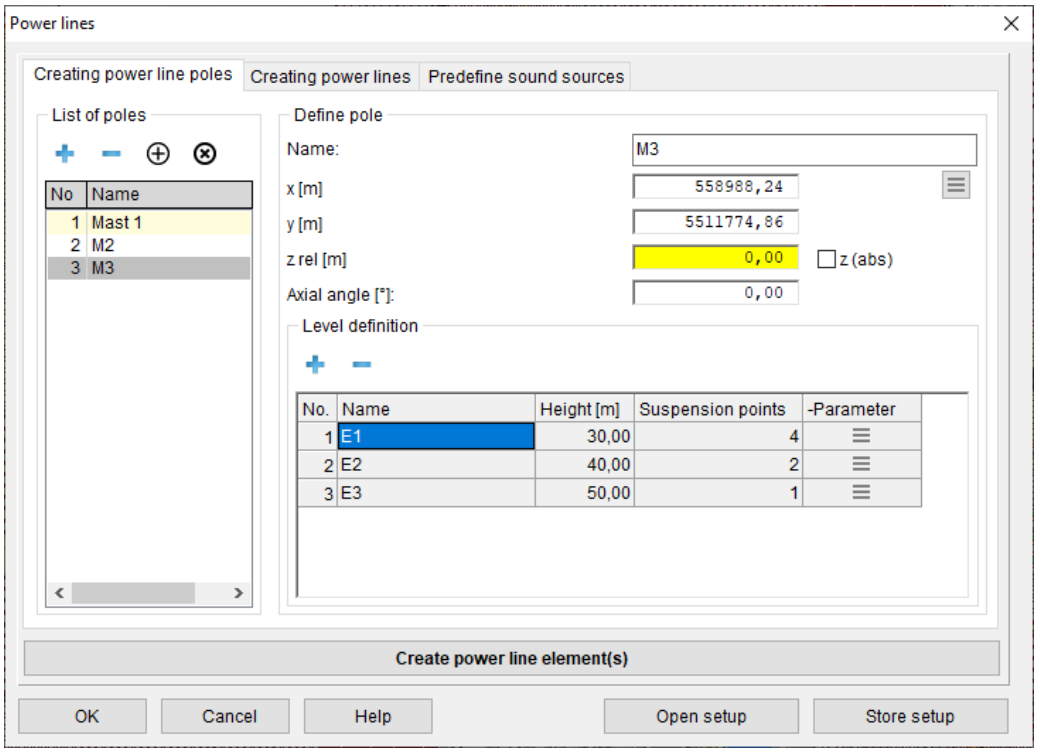
Access the dialog box "Power lines" via the menu Extras| Generate high voltage power lines. Using this dialog box, electric poles can be generated and the desired high-voltage power lines between the individual poles can be generated and specified. The line sound sources are therefore directly recorded in the site plan and directly available for calculations.

Procedure:

1) Creating power line poles
2) Creating power lines
3) Describing sound sources
4) Create power line element(s)

Tab: Creating power line poles

The tab Generating poles is used to specify the individual electric poles for the high-voltage power lines. The pole list is to the left.

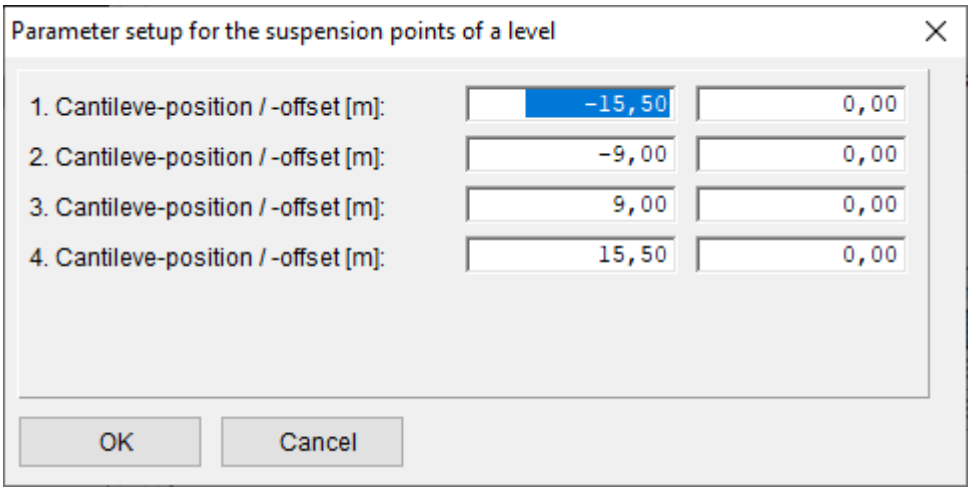


- The Add pole and Remove last pole buttons can be used to expand or reduce the pole list. Add further specifications to individual poles under the section "Define pole" on the right side.
- Add Remove: The "Add pole" and "Remove current pole" buttons can be used to add a pole to the list or remove a pole from the list.
- A name is assigned to each individual pole via the Name input field.

- Use the input fields **x [m], y [m] and z rel [m]** and the button z (abs), to specify the location of the poles with a coordinate.

Note: The x and y coordinates of a pole can be copied from the map using the popup menu (right mouse button) in the site plan and the "Copy coordinates to clipboard" function. In the map, move the mouse to the desired location and press the right mouse button.

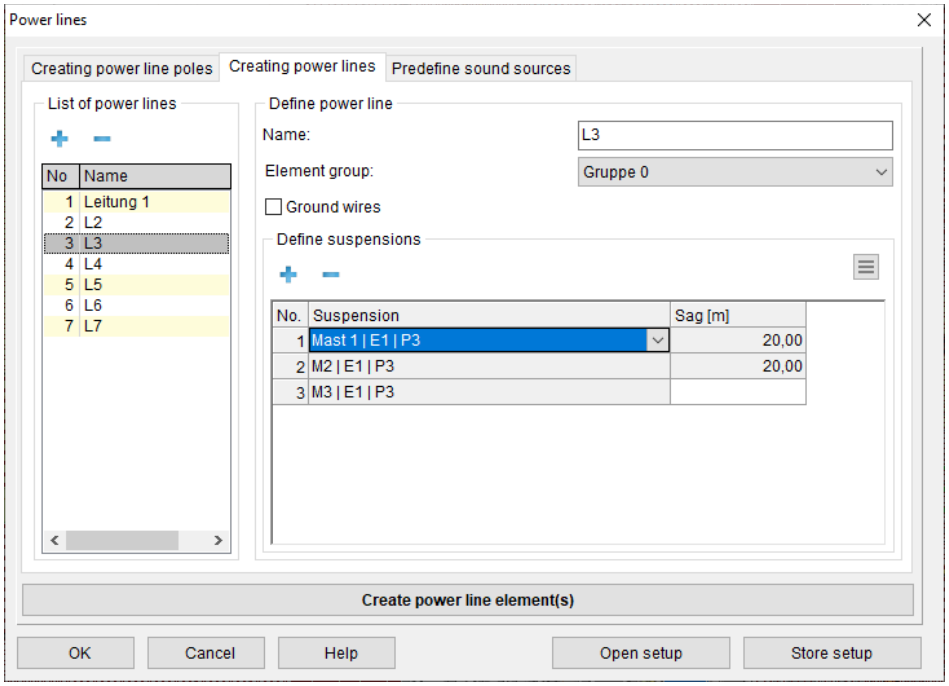
- **Transfer values**: Use the "Other functions" button to apply the following input help functions: Apply levels from predecessor: Here the complete specification of the levels of the predecessor pole is applied to the selected pole. Paste coordinates from clipboard: If the map function "Copy coordinates" to clipboard has been executed, these coordinates can be transferred to the selected pole with this button.
- The **Axial angle** input field can be used to enter a correction angle counter clockwise. The basic alignment of the poles is automatic, i.e. the current pole is aligned with the next pole and the last pole is aligned with the pole before last. This basic alignment can then be corrected/adjusted via the axis angle.
- The individual levels of the cross arms of the current pole are specified via the **Level definition** input area.
- **Button: Plus Minus**: With the buttons **Add level** and **Remove last level** the level list can be extended or reduced again. Each level is specified with the name, the height, the number of suspension points, and the suspension point contact point and offset. The **Name** column can be used to specify a name for each level. The **Height [m]** column can be used to assign a height in meters to each level. The "Suspension points" column is used to specify the number of suspension points for each level. A maximum of 6 suspension points can be assigned per level. The "Suspension parameters" column provides another dialog box "Parameter setup for the suspension points of a level".



In the **Parameter setup for the suspension points of a level** dialog box, the cantilever position and offset in meters must be entered for each suspension point of each level. The distance in meters from the center of the pole to the cantilever position is defined via the input field "Cantilever position". Negative values are used for the cantilever position on the left arm (looking from the current pole in the direction of the next pole) and positive values for the cantilever position on the right arm. The input field **Cantilever position / offset (m)** defines the distance in meters from the level to the actual cantilever position with the suspended power line. If the offset is populated with the value zero, the suspension point is defined directly at level height.

Tab: Creating power lines

The tab Creating power lines is used to define the individual high-voltage power lines between the poles. Note: When specifying power lines, in order to be able to add suspensions, poles must be created first (tab: Creating power line poles)!

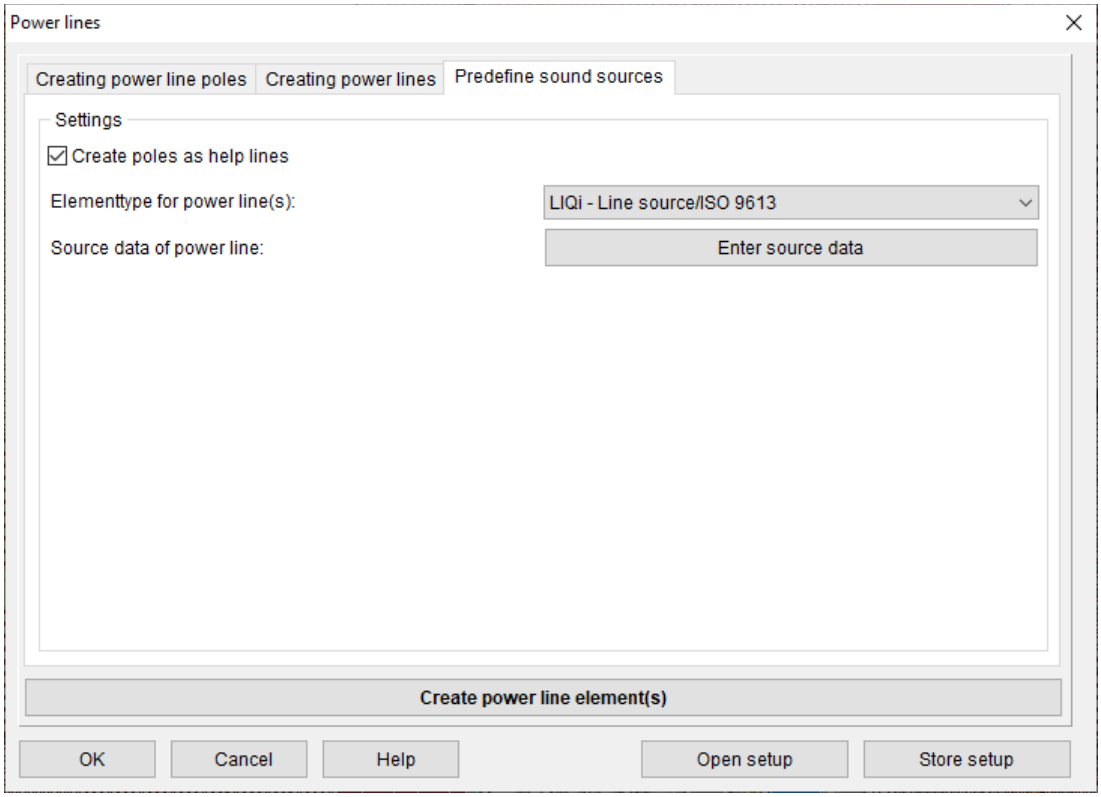


The "List of power lines" is displayed on the left side. Each individual power line can be routed over several poles, just as the real power lines are routed from pole to pole.

- Buttons Plus Minus: Use the Add power line and Remove last power line buttons to expand or reduce the power line list. Further specifications to individual power lines can be added under the section "Define power lines" on the right-hand side of the tab. On the right side of the tab, under "Define power lines", each individual power line and its physical course is defined.
- A name is assigned to each individual line via the Name input field. This name is then also assigned to the IMMI element when the element is being created.
- The drop-down menu Element group is used to assign an element group to each individual power line. The button Power line centerline can be used to designate a line as a centerline, the so-called ground wire. Such a centerline is generated as a helping line. Only one power line can be defined as a centerline at a time!
- The "Define suspensions" section is used to specify the physical course of the power lines over the individual poles. Button: Plus Minus: The suspension list can be expanded or reduced again using the Add suspension and Remove last suspension buttons.
- Button: Transfer values: To access the Automatically preset suspensions via first entry input help function, use the popup menu button. This allows for the pre-setting of the values in the "Suspension column" with the first entry, which are then automatically applied to the following entries. This avoids the time-consuming one-by-one specification of suspensions.
- The column Suspension is selected via a drop-down menu, which lists the pole, the level and the suspension point. Pole name, level, and suspension point are listed with the separator "|" in between (e.g.: "Pole 1 | Level 1 | P1").
- The column Sag [m] defines the sag between the current suspension point and the next one. For this reason, the last suspension point does not have a Sag input field. On the left side the line list is displayed. Each individual line can be routed over several poles, just as the real lines are routed from pole to pole.

Tab: Predefine sound sources

This tab provides additional parameters for creating power line elements.



- The **Create poles as help lines** check box can be used to create the poles that are used to define the power lines as help lines. This makes it easier to visualize the course of the power line.
- The element type for the power line elements is selected via the **Element type of power line(s)** drop-down menu. The element type **LIQi – Line-SQ /ISO 9613** is suggested as the default value.
- Via the button **Enter source data** the source data of the power line(s) for the selected element type can be initiated. That is to say, e.g. the emission values can already be filled in when creating the elements.

Note: The source data are not saved with the configuration file of the dialog box and must therefore always be reset after reopening the dialog box.

Button Create power line element(s)

Via this button, every single power line from the power line list is generated as a sound source element and included in the project. The following points are processed:

- Each individual power line in the power line list is created as a separate element in the current project.
- If the function Create poles as help lines is active, each pole, which was selected with the specification of the suspensions, will be generated via help lines.
- A preset element type is created and source data is applied.
- The individual suspension points are determined geometrically via pole, axis angle, level, height, cantilever point and offset.
- The catenary line between two neighboring suspension points is determined via the sag and generated with 16 support points.

- Open and save setup: Using these buttons, all settings of the dialog box can be saved as a configuration settings file and reopened at a later time.

The "Generate high voltage lines" feature can be purchased as an add-on option to the existing IMMI version.

Element library sonROAD18

The element library sonROAD-18 refers to the regulation:

sonROAD18 – Calculation model for road noise, Empa no. 5214.010948, 2018-07-09

and further documents such as

- sonROAD18 – further development and additions, Empa no. 5214.019298. 5214.023513, 2020-11-30.
- Road noise calculation model sonROAD18 – Preparation of input data and dispersion calculation, FOEN, 2021 | Umwelt-Wissen Lärm
- Noise Abatement Ordinance (LSV), 814.41, as of July 1, 2021.

The following elements are available:

- SR18: road traffic according to sonROAD-18
- TUSR: Tunnel according to sonROAD-18

Test Items: The correct calculation according to this set of rules is validated by fulfilling the following test tasks:

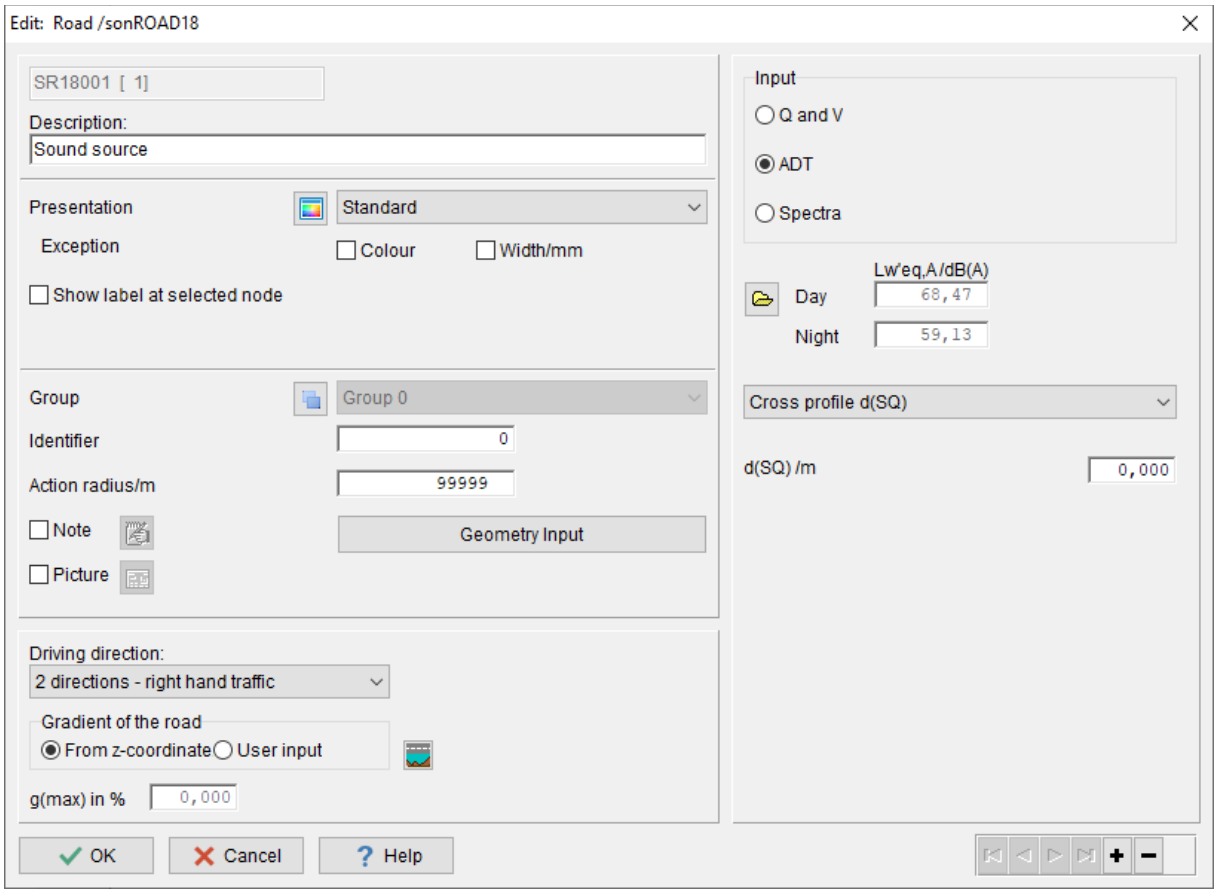
- Test items including dispersion calculation 1 to 6 from "sonROAD18 – Further development and supplements". Published on https://www.bafu.admin.ch/bafu/de/home/themen/laerm/fachinformationen/laermermittlung-und–beurteilung/ermittlungund-beurteilung-von-strassenverkehrslaerm/ermittlung-und-beurteilung-von-strassenverkehrslaerm–emissionen.html

The declaration of conformity can be found in the internal customer area of our website under "news".

Note: EMPA provides a web tool that can be used to perform emission calculations according to sonROAD.

Input dialog SR18 – Road noise according to sonROAD-18

In addition to the standard input fields the dialog box also provides specific fields:



- Input: The type of input is determined depending on the emission information available for the road to be modelled
  - Q and V: The input parameters are the number of vehicles per hour and the speed for the different vehicle classes.
  - ADT: The input parameter is the average daily traffic volume. The relevant hourly traffic volumes Q are determined according to the selected traffic volume distribution and the distribution key according to sonROAD-18 for the affected vehicle classes.
  - Spectra: Direct input of the length-related sound power level spectrum.
- Lw'eq,A in dB(A): For the applicable assessment areas or emission variants (e.g. "day", "night"), the length-related sound power level is displayed as a calculated value if the input type is Q and V, ADT, or spectra.

  The associated parameters are entered in a subordinate dialog box, which is opened by clicking the – button. If the values are the same for different periods, they can be copied with "Drag&Drop".
- Standard cross-profile – d(SQ) in m: The following settings can be selected in the cross-section combo box
- Cross-profile d(SQ): Here, d(SQ) /m can be set directly.

- Cross-section profile – extended: The position of the emission line, lane width, and, if necessary, the width of a center strip can be specified separately for the left and right sides. The emission proportions must add up to 1.0.

  D(SQ) /m left/right here is the distance of the emission band from the digitized road axis.

  The lane width is calculated without a center strip.

  So the left edge results as lane width (left) + center strip width (left), same for the right side.

  The width data are evaluated for representation in the map content.

- Gradient of the road: Depending on the road's gradient, the regulation provides surcharges to the emission level. Gradients are taken into account in sonROAD-18 with signs so that the direction of travel of all lanes is essential. When defining the gradient, there are two options to choose from:

  - From z-coordinates: The gradient of the road is automatically calculated from the z-coordinates of the element nodes for each section. The gradient for the steepest road section and the corresponding surcharge are displayed in two calculated fields, which are locked for input.
  - A possible problem should be pointed out here: When entering data for very short road sections, small discontinuities in the z-coordinates can lead to steep local gradients, which would act like additional point sources in the calculation. Since such modeling errors are difficult to detect, the slope is regularly checked in the formal review of the project data. The maximum calculated slope and the surcharge are displayed in the fields below g(max) in % and DStg in dB.
  - According to input: For special cases, the gradient for the entire road can be specified directly. The gradient calculated from the z-coordinates is then ignored.

  Note: The limitation of the gradient to a specified absolute value has the following background:

  The formula for calculating the gradient surcharge according to sonROAD-18 does not indicate an upper limit. This means that inaccuracies in the input of the z-coordinates of the road or the terrain model when using relative road coordinates can easily lead to unrealistically high gradient surcharges. This influences calculation results even if only a very short road section with relatively small differences in the z-coordinates is affected. The specification of a limit prevents such phantom gradients.

  Note: IMMI will notify you if the slope exceeds 15% (default). This value can be changed under Settings | Environment | Others.

Input dialog of ADT or Q and v

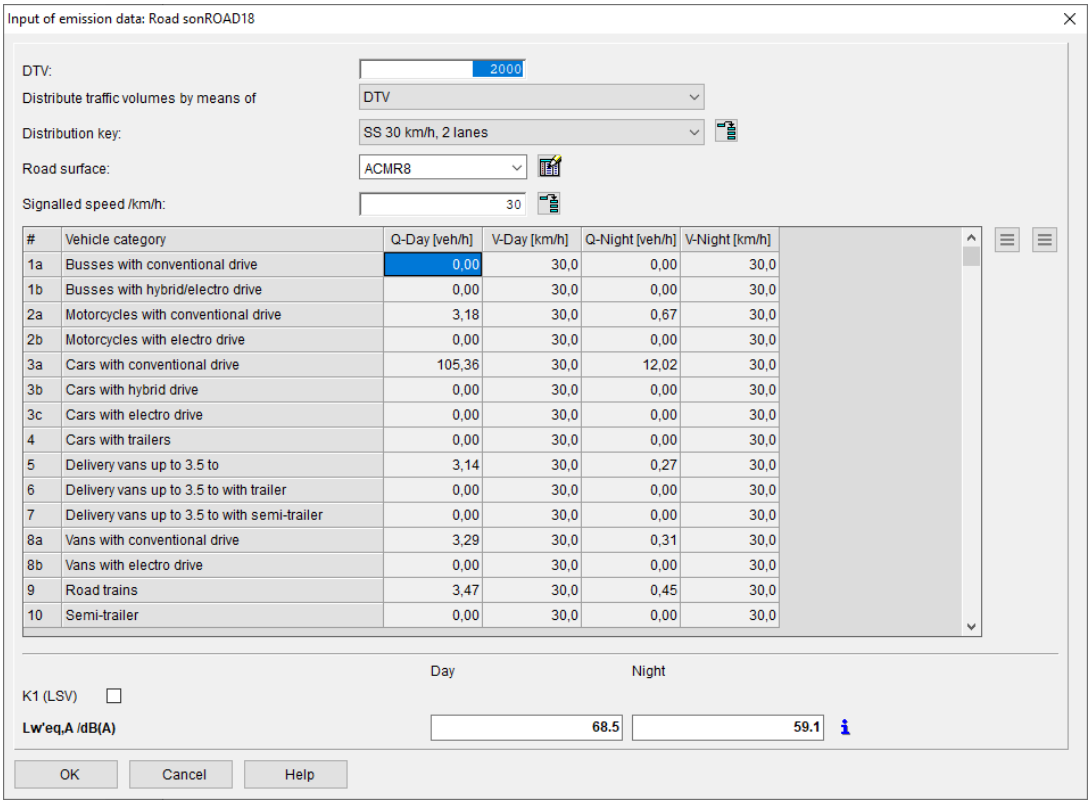
In sonROAD-18 you have 34 vehicle categories:

1a – Busses with conventional drive

1b – Busses with hybrid/electro drive

2a – Motorcycles with conventional drive

…



- ADT in vehicles/day: Average daily traffic density per day (=24h). After the input field is exited, the Q columns are also reassigned. The settings for "Distribute traffic volumes using:" and "Distribution key:" are also taken into account.
- Distribute traffic volumes based on: Selection of the distribution type. Depending on the selection "DTV" or "N1 and N2", the parameters Q of the individual vehicle classes are calculated. If the selection is changed, the Q columns will also be reassigned.
- Distribution key: Selection of the distribution key from the sonROAD18 list. Depending on the selection, the parameters Q of the individual vehicle classes are calculated. If the selection is changed, the Q columns are also reassigned. With the help of the button - Transfer speed based on distribution key, an automatic occupation (according to sonROAD18) of the speed columns for day and night and the different vehicle classes can be carried out.*
- Road surface: Selection of the road surface from a list. Depending on the selection, this is used for the emission.
- Signalized speed /km/h: Using the signalized speed, an automatic filling (according to sonROAD18) of the speed columns for day and night and the different vehicle classes can be carried out with the help of the button - Transfer speed based on signalized speed.
- Q-day/-night in Fz/h: Columns with the determined vehicles per hour for the assessment periods and the vehicle classes. **
- V-day/-night in km/h: Columns with the determined maximum permissible speeds for the assessment periods and the vehicle classes.
- K1 (LSV): This button can be used to include the level correction K1 for motor vehicle noise according to the Noise Abatement Ordinance (LSV). The determined level corrections are also shown individually for each assessment period.
- Lw' in dB(A): Length-related sound power level

* For explanation:
When entering DTV and distribute traffic volumes using: DTV, the Q-values are distributed using Table 4.2 of the EMPA report sonRoad18 - Further developments and additions.
When entering DTV and traffic volume distribution based on: N1 and N2, the Q-values are first divided into N1 and N2 according to the LSV (814.41, as of 1.7.2021), section 33 and then distributed to the individual vehicle classes according to table 4.3 of the EMPA report sonRoad18 - Further developments and additions. The distribution in N1 and N2 is based on Table 4.1 of the aforementioned report.

** For explanation: In comparison with the Webtool provided by EMPA, double the amount of vehicles is shown here, because IMMI distributes the emission to 2 emission lines before calculation.

The i-button can be used to output detailed lists of intermediate and overall results.

TUSR – Tunnel according to sonROAD-18

Detailed information on the tunnel can be found in the chapter TUNb – Tunnel in the IMMI-Online Help.

This new element library sonRoad18 is purchasable as an add-on to the existing IMMI version.

Optimizations

- Shape import: Until now, when importing shapes into an empty project, all project properties and user settings were reset to their default values before the import. In particular, lists to which user-defined entries were added were reset to their initial state. Now there is a query if the project should be completely reset or if all already executed settings should be kept.
- Program interface: The display mode "large colorful icons" for the icons of the toolbox and the main menu button bar is no longer supported. If a user still has this mode set, the program will automatically switch to the "cool style 2018" mode when it is started.

Error corrections

- Anzeige negativer Umweg: Die Anzeige „negativer Umweg bei Geländegitter" war nicht mehr Negative detour display: The "Negative detour for terrain grid" display was no longer accessible. The last setting made was evaluated correctly during the calculation, but could not be changed by the user. The switch can now be selected again.

- Reflections on house roof: In the case of reflections on the gable ends of house roofs, it could happen that the reflecting side – always the outward-facing gable end – was not correctly set. As a result, incorrect reflections were sometimes calculated on the house roof. This has now been corrected.
- Segmented grid calculation: If a grid was calculated in segments that were not defined over the entire site plan, the overhang around the area to be calculated was calculated too small at the left, right, upper and lower edges of the grid. This could cause discontinuities in the grid map. This problem is now fixed.
- Line sources in the long list: When displaying the results of line sources in the long list, they were not numbered correctly. The display of the results was correct, only the sequence number of the section was wrong. The display is now correct.
- Display of element name: If the name of an element was displayed parallel to a geometry section, in some cases the position of the name was not calculated correctly. The name was then not in the desired position. This has now been corrected.
- Library Nordic Road: The calculation of the distance dimension LAV when using LAFMax was not correct. Now the correct value is used.
- Lists: When saving an entry in a list and then loading it back into another project, it could happen that the assignment key that uniquely identifies an entry was assigned more than once. As a result, a unique assignment of the list entry was no longer possible. This can now no longer happen.

Literature references

[1] COMMISSION DELEGATED DIRECTIVE (EU) 2021/1226
of December 21, 2020
amending, for the purposes of its adaptation to scientific and technical progress, Annex II to Directive 2002/49/EC of the European Parliament and of the Council as regards common noise assessment methods

[2] Calculation method for determining the number of people affected by environmental noise (BEB)

[3] Database for the Calculation Method for Ambient Noise from Sources Close to the Ground (Roads, Railways, Industry and Commerce) (BUB-D)

BAnz AT 05.12.2021 B4

[4] LAI Notes on Noise Mapping, Third Update
In the version of January 27, 2022

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