IMMI

New Version – 2021

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What's New in IMMI 2021

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Preliminary Remark

The 2021 version of IMMI was created and tested with great care.

It meets the official test requirements according to RLS-90, RLS-19, Schall 03, RVS 04.02.11, ISO TR 17534-3 and -4, Directive (EU) 2015/996 (BUB, BUF and BEB), and other regulations.

Nevertheless, the following must be pointed out: Regulations such as those mentioned above are never so strictly formulated that there is no room for interpretation. The further development of a program such as IMMI cannot take place without the possibility of changing calculation results in certain situations and combinations of parameters within this scope.

We therefore recommend following the principle: One project - one program version. We cannot guarantee that exactly the same calculation results will be reproduced in a later recalculation of the project with a newer program version.

Therefore, archiving a project includes archiving the program version of IMMI with which the project was calculated.

1   What's New in IMMI in 2021

With the 2021 update, IMMI is releasing the first level-true auralisation algorithm for noise on the market. The basic idea is based on making sound immission predictions audible. On the one hand that means to make calculation results understandable to people outside the field, but on the other, to also allow IMMI users to explore their models via the sensory organ ear. Currently, the module supports road traffic noise as well as stationary industrial noise. The auralisation of road traffic noise is based on road location, traffic counts and velocities. Signal processing methods allow for the experience of stereo effects, Doppler effects and shielding in spatial and temporal context besides the usual distance dependent attenuation terms. With a simple calibration procedure the output is level-true over arbitrary loudspeakers, i.e. the audio signal, always calculated with a reference time of 1 min, the same average level results as for the calculation method selected in the prognosis calculation at the immission point. In order to provide a more realistic auditory impression, the audio signals can be supplemented by background noise, which is available in a database or can also be added from own measurements. In addition, insulation spectra of windows can be mapped in the auditory impression.

For us, the IMMI Team, the development of the auralisation tool was a valuable experience, because after more than 30 years of development work on sound propagation calculation software, we were able to listen to how our predictions sound for the first time. You will be surprised how different sets of rules sound for one and the same situation – for example, the good old ISO9613-2 proved to be an acoustically valid prediction calculation for us, in contrast to CNOSSOS-EU, which sometimes provides questionable artifacts, especially for special obstacle situations.

We hope you will enjoy this new development as much as we do!

1.1   Auralisation

Using methods of digital signal processing and the available information of a modern noise calculation program such as IMMI, noise can be made audible in the context of prognoses (auralisation). Thus this topic is made tangible even for people outside the field, making a tool available that enables urban planners, noise protection experts, noise polluters and people affected by noise to discuss with each other at eye level. Especially against the background of the constant densification in large cities, such an approach appears to be a helpful means for finding constructive solutions to problems in the planning phase.

An auralisation tool can provide answers to questions like the following:

- What does "6 dB louder" sound like?
- How does a specific noise reduction measure change the auditory impression?
- What is the acoustic effect of placing a traffic light in front of my front door?
- How does a special façade structure affect the "sound" on a street?
- Will I hear the cooling machine that is planned to be installed on the roof of my house if I live on a busy street?
- Will it really be quiet in my bedroom with the soundproof windows that are to be installed?

1.1.1   Description of Functions

Via the menu **Calculate | Auralisation** or the button in the quick start bar - - the dialog **Auralisation** is opened, via which this is made available.

The following requirements must be met to carry out an auralisation:

- The IMMI project with which the auralisation is to be performed must be opened.
- For the source type **road**, a line or road sound source (ISO 9613, RLS-19, RLS-90, CNOSSOS road or line sound source) must be available.
- For the source type **industry**, a point source (ISO 9613, CNOSSOS) must be present

1.1.2   Tab: Audio Generation

On the **Audio Generation** tab, the actual auralisation is parameterized and an auralisation audio wave is generated. The one-minute audio wave file generated, can be played directly or saved as a file.

Area: Auralisation: Source

Here the source for the auralisation is specified in more detail.

- **Source type** via the drop-down menu you can choose between **Road** and **Industry**. Depending on what is selected here, the following additional parameters are provided:

For source type **Road**:

- **Source type Road:** The desired road source from the present IMMI project is selected via the drop-down menu. Via the classic **Select element** dialog, the line or road source can be selected for auralisation.

- **Length in m**: Via the info field the street length of the selected road source is displayed in meters. This field is for display only and thus cannot be edited. Note: In order to get the best possible auralisation result, the road section in combination with the speed should be a temporal run of about one minute!

- **Number of vehicles in Kz/h | truck share in %:** The input fields are used to define the calculated vehicles per hour and the percentage of trucks.

- **v cars | trucks in km/h:** The maximum permissible speed for cars or trucks is specified in the input fields. If road elements are selected for which the number of vehicles in cars/h, the share of trucks in % and the speeds have already been defined, these parameters are transferred to the input fields directly after selection.

For source type **Industry:**

- **Source type Industry:** The source type industry in the present IMMI project is selected via the drop-down menu. The auralisation sound source point can be selected via the classic **Select element** dialog box.

- **Industry noise:** The drop-down menu can be used to select between **From internal database** and **From external wave file**. If the industrial noise is to be taken out of the internal database, the selection is made via the **File name** drop-down menu. Various industrial sounds are available here.

- If the industrial noise is to be taken from an external wave file, the entry is made via the **File name** drop-down menu. Any audio wave files can be selected here via the **Industrial Noise** drop-down menu.

Area: Auralisation: Receiver Point

Here the desired receiver point is selected and further specified.

- **Immission point:** The drop-down menu is used to select the desired immission point from the existing list from the present project.

- **Wave no. of channels:** The drop-down menu can be used to select between **mono** and **stereo**.

- **Use background noise:** Select to fade in noise. If activated, the drop-down menu can be used to choose between **From internal database** and **From external wave file**.

  - **File name**: If the background noise is to be taken from the internal database, select it from the *File name* drop-down menu. Various background noises are available here.

    If the background noise is to be taken from an external wave file, select it from the *File name* drop-down menu. Any audio wave file can be selected here via the *Use background noise* dialog.

  - **LAeq in dB**: The sound level for the selected background noise can be freely defined via the input field. Thus, the dominance (volume) of the background noise can be raised or lowered.

  - **Use insulation spectra**: If selected, an insulation spectrum from the external database of insulation spectra at the immission point can optionally be taken into account. If activated, an insulation spectrum can be selected via the drop-down menu. E.g. the auralisation behind a window in the room can be simulated via an insulation spectrum of a window. Or, for example, the differences of different window types can be "listened to".

Area: Auralisation: Calculation

Here the different calculation parameters are defined.

- **Calculation parameters**: Use the drop-down menu to select from the available calculation parameter sets.

- **Variant**: Use the drop-down menu to select from the available variant sets (e.g. without or with noise barrier).

- **Emissions variant:** Use the drop-down menu to select from the existing emission variants (e.g. day, evening and night).

  If a road element was selected as a source, for which the number of vehicles in cars/h, the truck percentage in % and the speeds were already defined, then the parameters are directly taken over after the selection of the emission variant.

The Calculate Auralisation Button

- **Calculate Auralisation:** Clicking this button starts the algorithm for generating the auralisation result in the form of an audio wave file.

  The calculation process is displayed via the progress bar. After the calculation process is completed, the **Audio start/stop function** and **Save audio wave as...** buttons are available for evaluating the result. The result can either be played directly or/and saved as a wave file.

  The following points are processed via the calculation process:

  - IMMI – point calculation between source and receiver point
  - Number of cars defined for source type *Road*
  - Calculation of the partial distance and frequency dependent insulation spectra for each motor vehicle
  - Distribute result data to "stereo" channels incl. Doppler effect
  - Scale wave data to calculated Leq value
  - Optionally mix background noise into the signal
  - Optionally calculate insulation spectrum as well
  - Optionally calculate Fade-In / Fade-Out

- **Open Setup / Save Setup:** Using the buttons, all dialog settings can be saved in the form of a setup file (*.ini) and reopened/applied for later editing.

1.1.3   Tab: Setup

Under the **Setup** tab, general parameters for the auralisation can be specified.
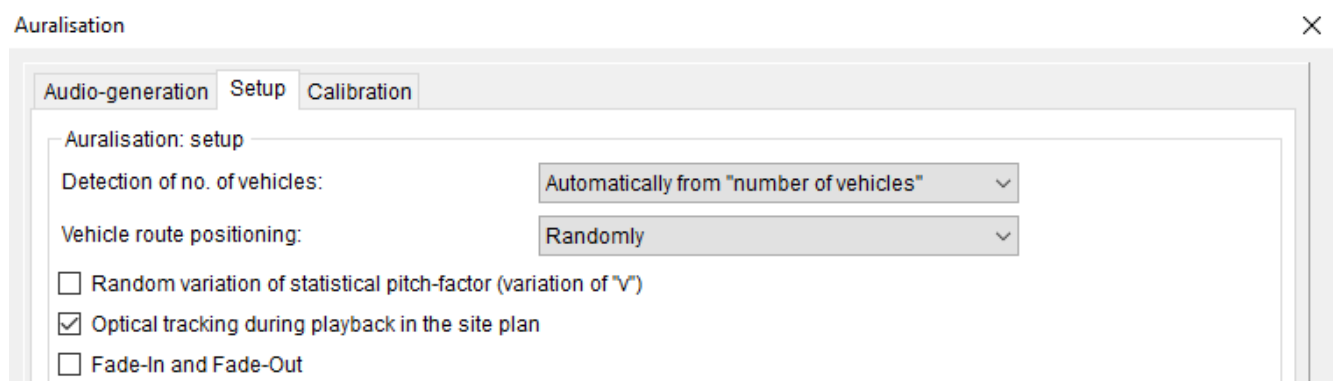
Area: Auralisation: Setup

- **Determination of the number of vehicles**: Use the drop-down menu to choose between **Automatically from "number of vehicles"** and **A car with the index**. In the case of a motor vehicle with the index, it can be specified in the drop-down menu. This defines which vehicle from the database is to pass on the selected road.

- **Vehicle route positioning:** The drop-down menu can be used to choose between **Random** and **Uniform**.

- **Random variation of statistical pitch factor (variation of "v")**: The button can be used to additionally randomly vary the motor vehicle speeds.

- **Optical tracking during playback in the site plan**: Via the button, an auxiliary line can be followed online during playback of the audio wave data to achieve a better mapping between listening and the position of the motor vehicle.

- **Fade-in and fade-out**: Use the button to further reduce the wave volume at the beginning and at the end of the wave data. The fade-in/out process is performed over two seconds at a time.

1.1.4   Tab: Calibration

Under the **Calibration** tab you can calibrate your audio system. When you have calibrated your audio system, the audio result signals will be output with the calculated Leq and your listening impression will be closer to reality.
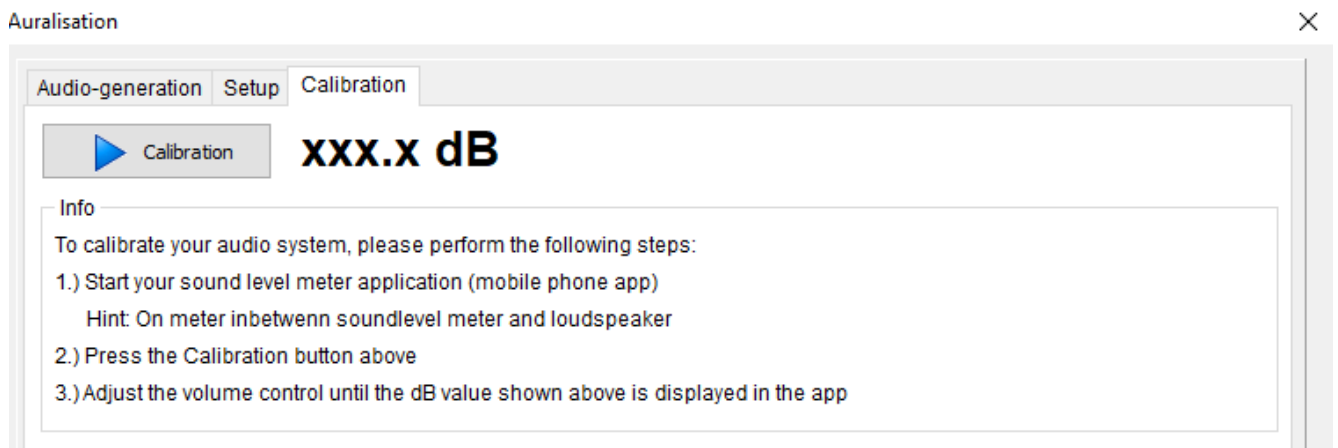
The following steps are necessary to calibrate the audio system:

1.) Start your sound level meter application (mobile app) or use a real sound level meter to determine the Leq value.
Note: Keep a one meter distance between sound level meter and loudspeaker or at the position where the listener is located during auralisation.
2.) Press the "Calibration" button and a noise signal should be heard.
3.) Change your audio system volume control until dB shown above is displayed in the app or on the sound level meter.

After that your audio system should be calibrated.

1.2 Automated generation of sound sources on the house as well as on the roof

For the construction of sound-emitting buildings (e.g. industrial halls), the **macro Erect building** of the element Help line for facilitated construction has been used or recommended so far. When executing the macro, area sound sources were generated in front of the house for all exterior walls and these could be described with sound power levels, insulation dimensions etc. as well as openings if necessary. With this procedure, no sound sources could be generated automatically for the roof or for a roof construction.

In IMMI 2021, this is now possible: directly from the house element, in addition to the automated creation of sound-radiating walls on the building, sound-radiating roof surfaces can now also be created automatically. In the input dialog of the house via the button **Edit sound sources** the input dialog starts to create sound radiating surfaces at the building and at the roof, either for all or single wall and roof surfaces.

With the new functionality **Edit sound sources** at the house, the creation of these outdoor sources was considerably simplified.

1.2.1 Sound Sources at the House – Definition


- **Edit sound source**: The button starts the dialog that can be used to define sources at the house.

Note: To be able to create sound sources at the house or at the roof, the upper edge of the house must be aligned horizontally – as it is already the case for the roof construction. Houses with absolute z-coordinates cannot be provided with roofs and sound sources.
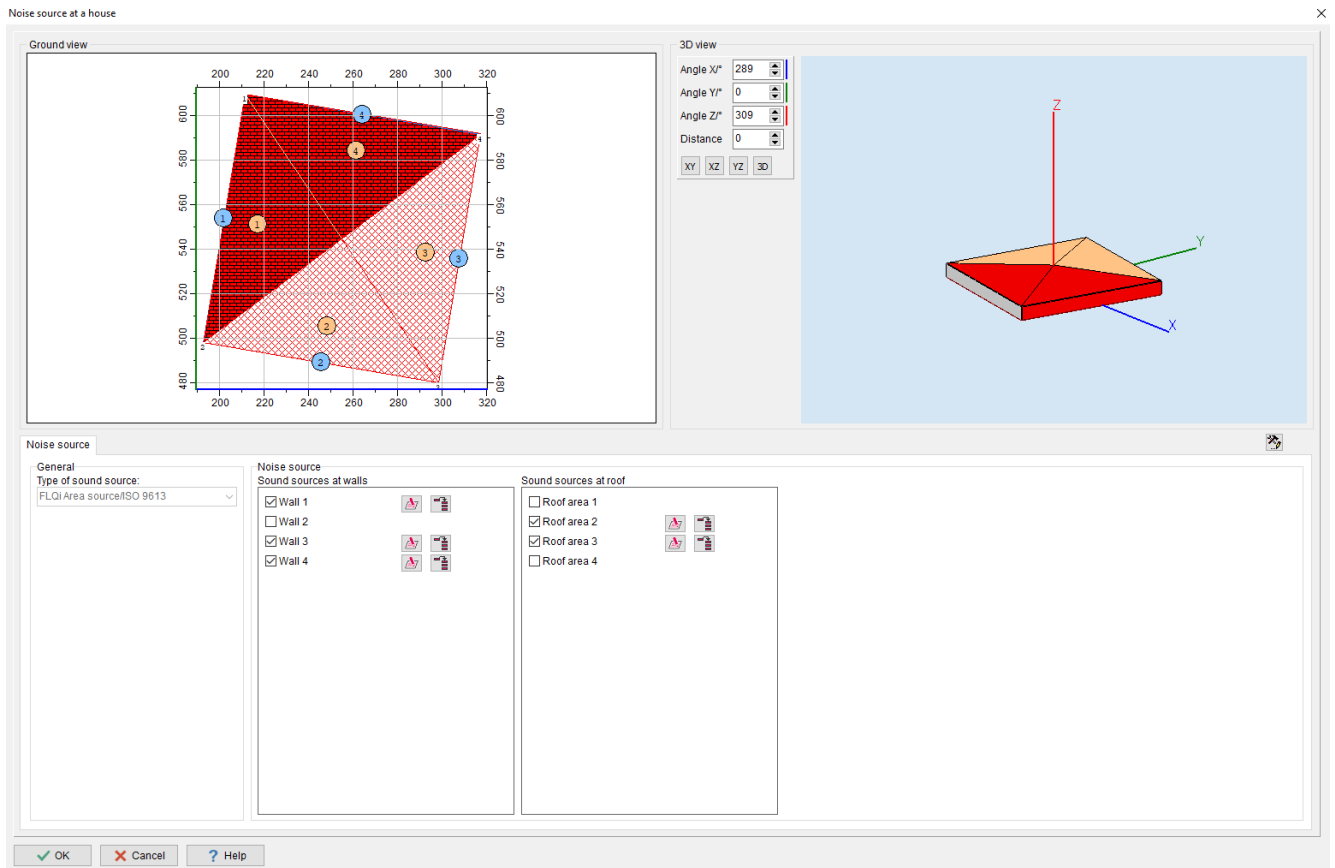
Sound sources are defined in multi-part dialog.

- **Type of sound source:** First define from which type the sound sources should be (ISO 9613, CNOSSOS-EU, …).

  - All sources at the house are of the same type. The source type can only be selected as long as no sound sources are defined yet.

- **Sound sources on walls:** Each wall of a house can be assigned a sound source.

  - Each source is basically a **vertical rectangle**.

  - The sources are located **0.1 m** in front of the building.

  - The upper edge is at the height of the eaves. (upper edge of the horizontally aligned house)

  - If the house is not horizontal (this is the case if the ground level at the nodes of the house is different), all sources are pulled down to the lowest ground position.
    In such cases, this then results in parts of the source being below the terrain.

  - The sources are placed on a parallel curve to the ground plan of the house.
    If all walls of the building are covered with sources, a **closed source front** in front of the house is created in this way.
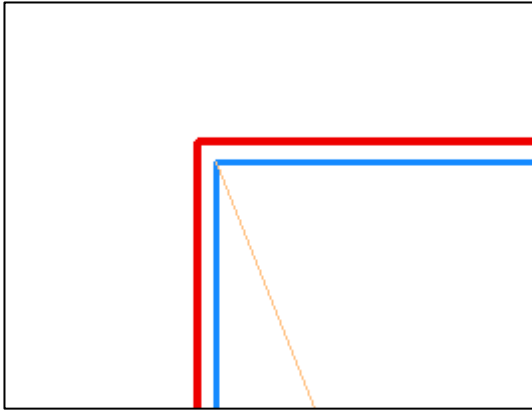
Sources (red in the picture) form a closed front at corners of the house.

- Sources on the house have the same **emission parameters** as normal sources.

- Sources at the house can have **openings**.

- The **element group** of the source at the house is initially the same as the group of the assigned house. The group can of course be changed by the user.

- The **geometry** of a house source can be viewed but not changed. If the geometry of the house or the underlying terrain is changed, the geometry of the surface always adjusts automatically.
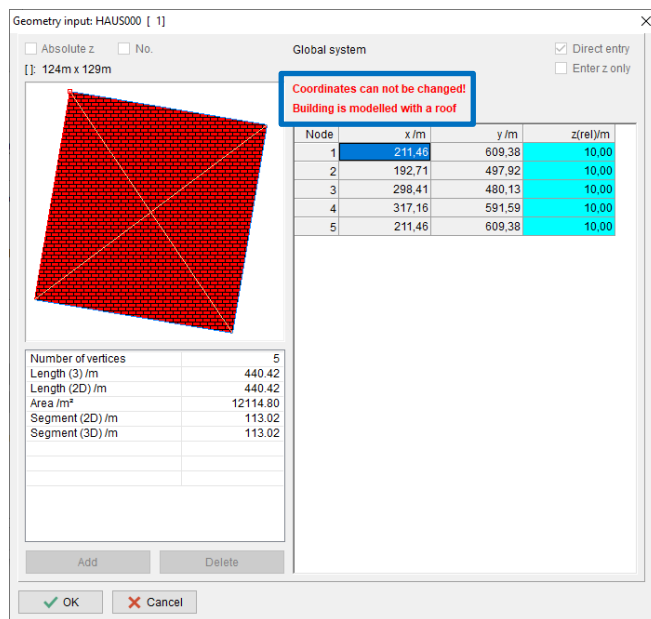
- To assign a sound source to a wall, only the desired wall must be marked.
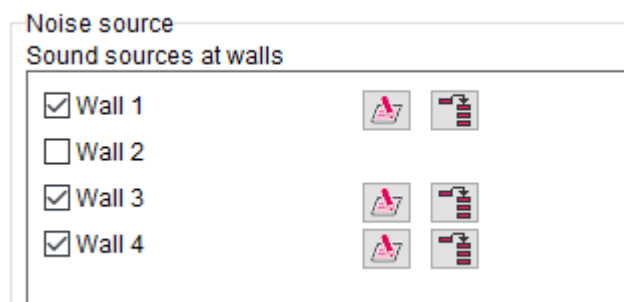
- To delete the source unmark it.

- This button opens the dialog box with which the parameters of the source can be edited. With the exception of the geometry (see above) all parameters are accessible.

- With this button the emission values of a source can be assigned to other sources.

Example: If you press this button to the right of **Wall 1**, you can assign the emission values to all other wall sources. **Wall 4** cannot be selected for assignment because no source has been activated for this wall.
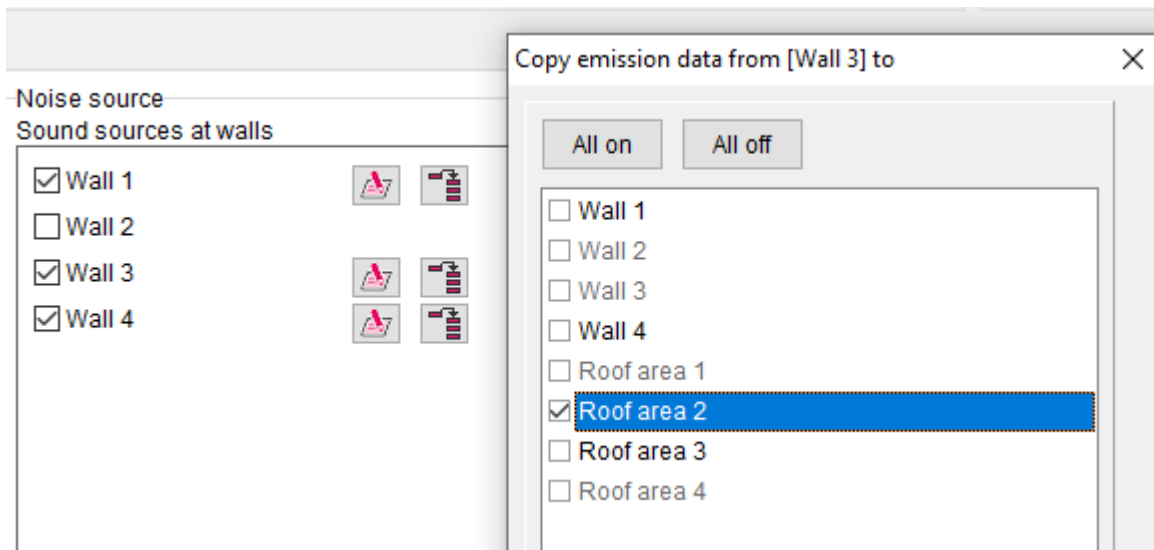

- **Sound sources on the roof:** The same rules apply to sound sources on the roof as to sources on house walls.

- **Diagram: Floor plan:** Here the house is drawn in plan in its natural position, as in the site plan, and dimensioned with the global coordinates.

  - Wall and roof sound sources are drawn with the colour of the selected source type.

  - Individual drawing colours of individual sources are also taken into account.

  - The numbers of walls are marked with numbers in blue circles.

  - Numbers of roof surfaces are marked with numbers in orange circles.

  - The graphical elements of the diagram can be controlled by **options**. (See below)

- **3D view:** Here the house is drawn in a 3D view.

  - The display height of the walls is based on the highest sound source. (The source height is the distance from the top of the house to the lowest ground point of a house node)

  - Walls without a sound source are drawn in grey.

  - Roof surfaces (if the house has a roof) are drawn orange.

  - Sound sources on walls or on the roof are drawn in the colour of the source type

  - Individual drawing colours of individual sources are also taken into account.

  - The house view can be rotated with the mouse and zoomed in or out with the mouse wheel.

- If the building is not level, sound sources can be partially below the terrain edge.
  The terrain edge is displayed as a brown line on the walls of the 3D view.
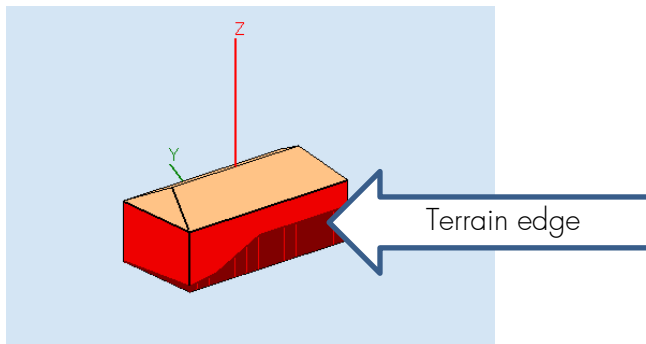
Note: In the dialog box for constructing openings in sound sources, the terrain edge is also displayed as a brown line for such sound sources.

Display Options

The button opens the dialog box for the graphic options of the floor plan diagram
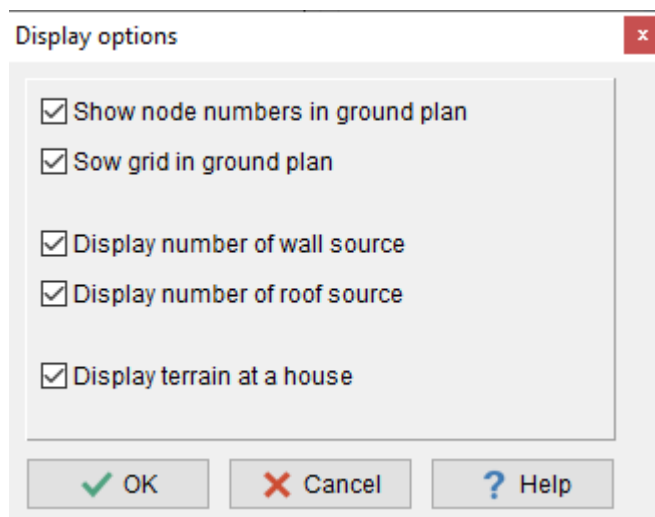
Selecting the respective option switches it on or off.

1.2.2   Sound Sources at the House – Calculation

For the calculation of sound sources assigned to a house, the same rules apply as for all other area sources of the same source type.

Only the geometry of the source cannot be changed by the user, it will be recalculated immediately before the calculation according to the house or roof geometry.

1.2.3   Sound Sources at the House – Editing the Site plan, Element list

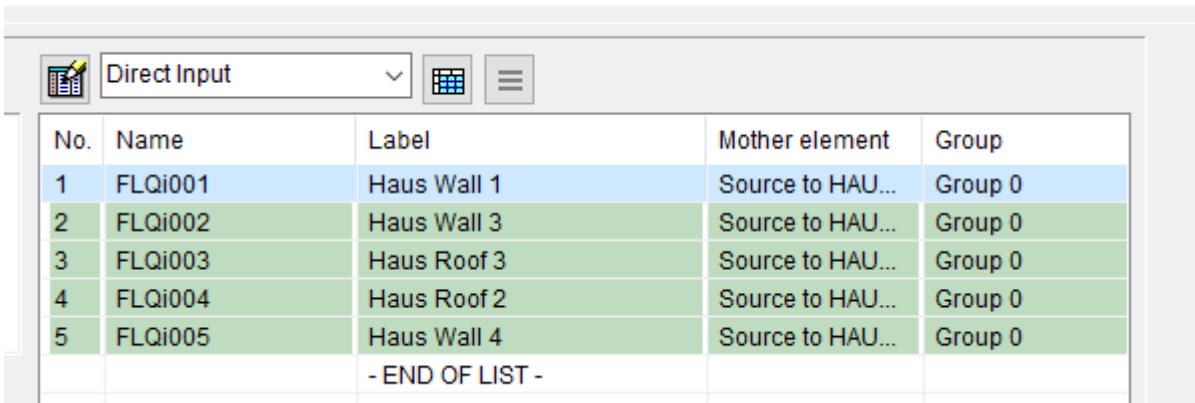| No.	Name	Label	Mother element	Group
1	FLQi001	Haus Wall 1	Source to HAU...	Group 0
2	FLQi002	Haus Wall 3	Source to HAU...	Group 0
3	FLQi003	Haus Roof 3	Source to HAU...	Group 0
4	FLQi004	Haus Roof 2	Source to HAU...	Group 0
5	FLQi005	Haus Wall 4	Source to HAU...	Group 0
		- END OF LIST -		

- In the list of elements, sound sources that are assigned to a house are displayed with a green background.

- The scope of the popup menu in the element list is limited as soon as one or more house sources are selected.
  In particular, functions that change the geometry and the element type are not accessible.

- However, sound sources on the house can be deleted in the element list.

- In the element editor of the site plan, the scope of the popup menu is also limited.
  Here, only the functions "Edit element" and "Delete element" are allowed.

1.2.4   Sound Sources at the House – Editing the House

If sound sources are assigned to a house, editing the geometry of the house is still possible in many cases, among others:

- Rotating the house

- Moving the house

- The macro for transforming nodes acts on the house and its sound sources.

- Individual nodes can be warped with the mouse.

What is not possible:

- Deleting individual nodes

- Reversing the node order

- Changing the element type

- The roof shape cannot be changed once sound sources have been assigned to the roof. In order to change the roof shape, all area sources must first be removed from the roof again.

1.3 Displaying Colour Grid and Coloured Background Image Simultaneously

With IMMI 2021 it is possible to display background images and calculated colour grids **simultaneously in colour**. This display is also the default setting.

The combination of background image and colour grid can be controlled via the **Set Plan Contents** dialog box ( ).

- **Grid and Bitmap:** The selection of how the grid should be displayed was revised and simplified. To get to the image/grid display options, press the button.
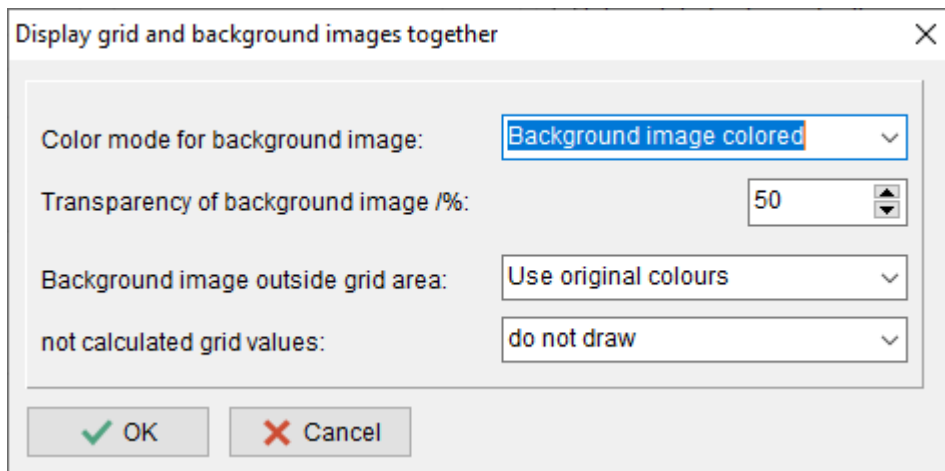
- Colour mode for the background image:
  - **Background image coloured**: Activates the new mode that displays the background image and the grid together in colour. (Default)
  - **Background image black/white:** Switches back to the old mode.
- **Background image transparency in %:** This parameter controls how strong the background image is displayed. Default is 50%. This way the colours of the grid and the background image are displayed equally strong. If you increase the transparency, the colours of the background image become paler and the colours of the grid become stronger. If you decrease the transparency, the opposite happens.
- **Background image outside the grid:** If the grid does not cover the entire background image, you can choose how to display the part of the image that does not coincide with the grid.
  - **Use original colour:** Regardless of the transparency setting, the background image outside the grid is displayed with full colour saturation. (Bottom right image)
  - **As inside the grid**: The background image is displayed brighter outside the grid according to the transparency settings. (Image below left)

- **Uncalculated grid values:** A grid in IMMI is basically a rectangular area. This is the case even if the grid is calculated within a usage area which itself is not rectangular. In such a case, the grid values that have not been calculated are displayed as white rectangular boxes.
  - **Fill in white**: The white boxes are drawn. The background image underneath is lightened according to the transparency settings.
  - **Do not draw:** No white boxes of the non-calculated grid values are drawn.

    Note: This option can only be used if the **Rectangle colour grid** display has been selected.

1.4   New Display Options for the Number Grid

New options have been introduced for displaying the number grid. You can access these options in the **Set Plan Contents** dialog box by clicking the **Number Grid** button.
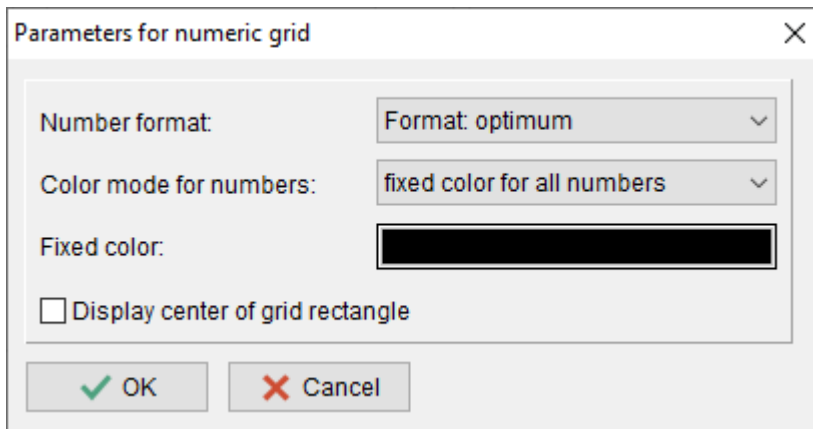
- ▪ **Number format:** Here you can select different formats how the level values should be displayed.
- ▪ Colour mode for numbers:
    - • **Fixed colour for all numbers:** All level values are drawn with the same colour. This colour can be selected with under **fixed colour**.
    - • **Colour according to level values**: The level value is written in the colour in which the colour grid is also drawn.

1.5   Extension IMMI PLUS: Number of Elevation Points Increased

The extension **IMMI Plus** can now process up to 6 million elevation points. Previously, only a maximum of 400,000 points could be processed.

1.6   Show Digital Terrain Model (.IDG) as Coloured Image

If the terrain model is an .IDG, it can be displayed in the form of relief shading. The disadvantage of this display is that it must be redrawn whenever the site plan is redrawn.

Now it is possible to save this terrain shading as a background image. This speeds up the redrawing considerably.

You access this function via the popup menu (right mouse button) of the site plan axis.

- Function: **Create terrain image (JPG) from IDG**

The new image is automatically entered as background image in the list of background images. The image is automatically georeferenced and therefore does not have to be manually fitted into the site plan.

Before the image is saved, the resolution can be reduced if necessary.

In general, an image size of 2000 to 3000 pixels is quite sufficient.

1.7 New Element Library for Pollutants: AUSTAL According to the New TA Luft

Probably this year, as a result of the amendment of the TA Luft, the calculation program AUSTAL2000 will be replaced by AUSTAL. Additional substance types have also been included here.

IMMI was completely adapted to AUSTAL. This was done by integrating the new element library **AUSTAL**, which can be found via the forecast type **pollutants** under selection of the forecast type **AUSTAL**.

In addition to the already existing subfolder **austal2000**, the new subfolder **AUSTAL** is now included in the IMMI program folder for the calculation of AUSTAL projects.

1.7.1 PLURIS Flue Gas Plume Model

The PLURIS plume model has been integrated as part of AUSTAL. The associated (obligatory and optional) parameters are defined in the input dialog of the sources:

1.7.2 Roughness Length According to CORINE Cadastre.

Together with AUSTAL the so-called CORINE-cadastre is provided by the Federal Environmental Agency, which describes the roughness length of the soil for the FRG. If the AUSTAL library is available, this roughness cadastre can be imported and displayed as a raster in georeferenced projects. This function can be found in the menu item **Extras | Show CORINE Cadastre.**

This function takes over the data of the CORINE cadastre for the workspace, converts it into an IMMI grid and saves it automatically in the project folder. The project name is used as the grid name, supplemented by the characters "_CORINE".
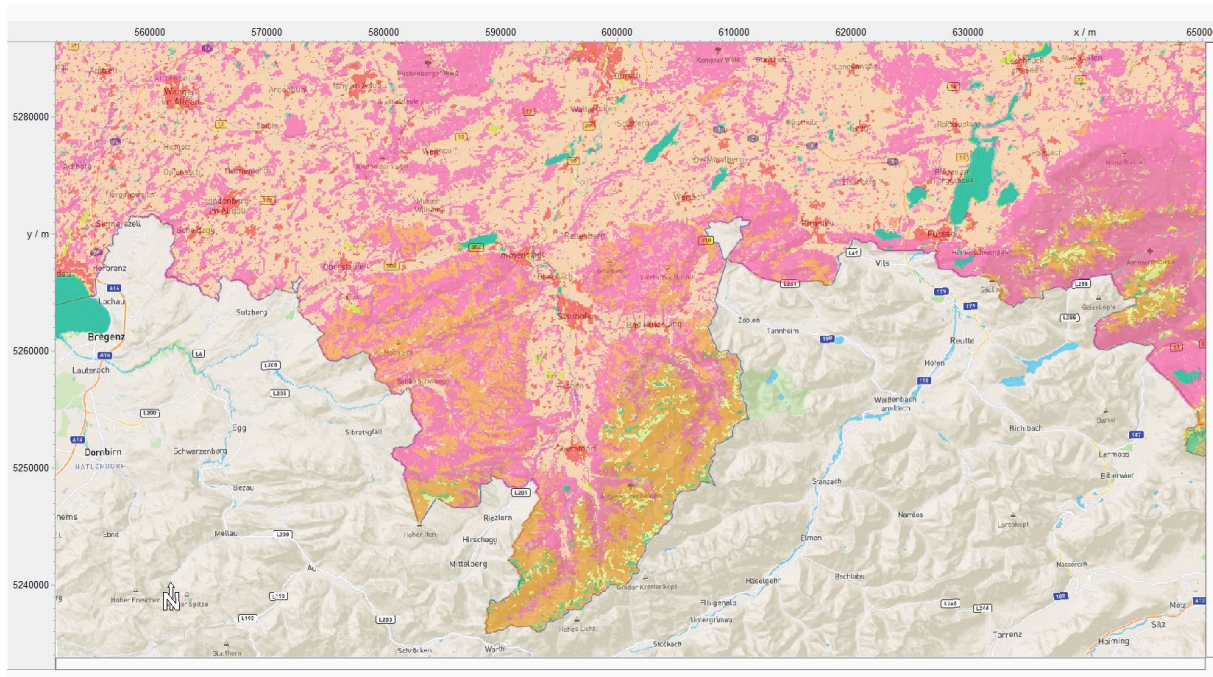
Note 1: This function is not available for Austria.

Note 2: If the **AUSTAL** library is available in your license, this function can also be used under AUSTAL2000.

1.7.3   Show Layer Height Grid Per Pollutant Type

In the computer control centre there is the import of all layer heights of a pollutant type:
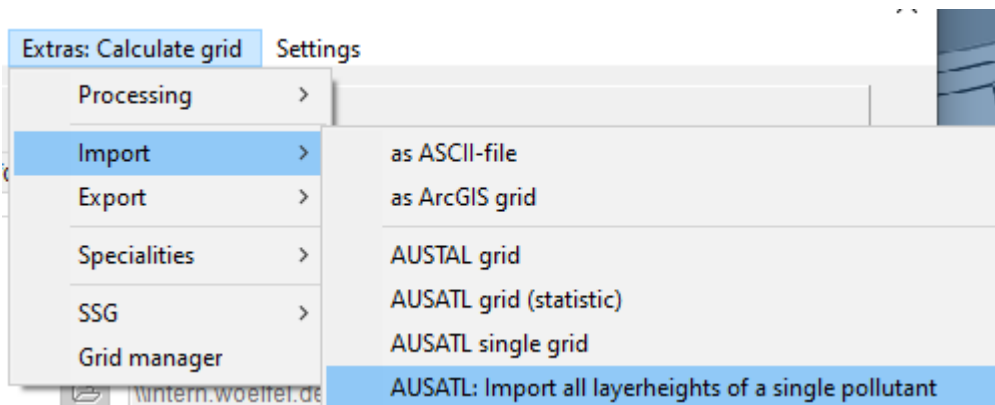
Now up to 100 layers are possible. In addition, the name of the layer height is displayed correctly even if the layer heights had been defined user-defined.

1.7.4   List of Input Data (Variable Emissions)

If the element library is available, the list of input data for variable emitters has been extended. Thus, daily variation, weekly variation and annual variation are now documented:

| Punkt-Quelle /Poll (1)																															Variante 0
Zeitabhängige Emissionen																															

so2	Jahresgang			Anzahl Emissionsstunden (1999): 8760																											
Datum	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Januar	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Februar	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+			
März	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
April	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Mai	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Juni	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Juli	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
August	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
September	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Oktober	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
November	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Dezember	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

Wochengang						
Montag	Dienstag	Mittwoch	Donnerstag	Freitag	Samstag	Sonntag
+	+	+	+	+	+	+

Tagesgang																								
	0-1h	1-2h	2-3h	3-4h	4-5h	5-6h	6-7h	7-8h	8-9h	9-10h	10-11h	11-12h	12-13h	13-14h	14-15h	15-16h	16-17h	17-18h	18-19h	19-20h	20-21h	21-22h	22-23h	23-24h
	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

	0-1h	1-2h	2-3h	3-4h	4-5h	5-6h	6-7h	7-8h	8-9h	9-10h	10-11h	11-12h
g/h	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03
	12-13h	13-14h	14-15h	15-16h	16-17h	17-18h	18-19h	19-20h	20-21h	21-22h	22-23h	23-24h
g/h	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03	1.000E+03

Note: If the AUSTAL library is available, this function is also available for AUSTAL2000.

1.7.5 Graphically Optimized Display of the Wind Rose

In the menu of calculation parameters a wind rose can be displayed graphically when selecting meteorological data or when reading in meteorological data. This display has been enhanced to provide a simple and quick overview of time series or annual statistics.

The dialog box has been extended with by 2 tabs. On the first tab **Data**, as before, the time series or annual statistics can be read in and displayed in the form of a table. On the second tab **Wind rose**, the time series or annual statistics are now displayed in the form of a wind rose **Distribution of wind direction and wind speed.**
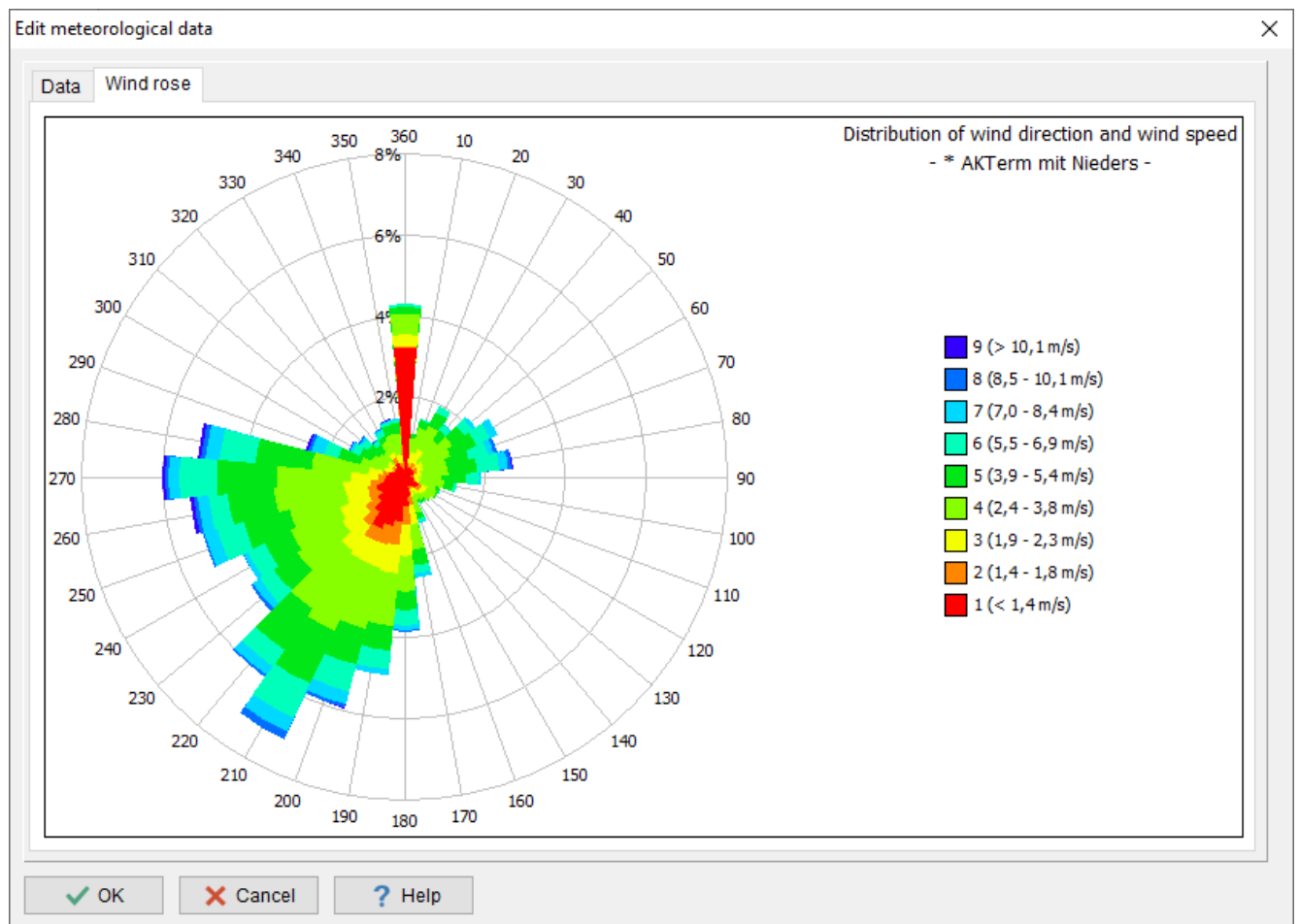
On the left side the actual wind rose is displayed and on the right side the colour legend for it. Thus one gets a fast overview of his present time series/yearly statistics. The wind directions are divided between 0 and 360° in 10° grids. The wind speeds are displayed in colour using the categories 1 to 9 for the respective wind direction.

With a mouse click on the wind rose it can be exported via **Copy wind rose to clipboard?** and inserted e.g. into a report.

1.8   Façade Level Calculation

IMMI now makes the calculation of the **adverse health effects of environmental noise** possible. The calculation is carried out according to **COMMISSION DIRECTIVE (EU) 2020/367 of March 4, 2020**, in Germany according to: 34th BImSchV and its amendments.

Quantities calculated are:

- IHD (ischaemic heart diseases) for road noise only
- HA (high annoyance) for road, rail and aircraft noise
- HSA (high sleep disturbance) for road, rail and aircraft noise

The calculation can be set in the options dialog for façade levels:

- **Noise type**: Defines for which noise types the quantities HA and HSA are calculated.

- **Level increments, upper and lower limits** define the ranges for which the quantities HA, HSA and IHD are to be calculated. IHD and HA are calculated with L_{DEN}, HSA with L_{Night}.

- **Calculate L_{DEN} (or L_{Night}) according to**: Defines how to calculate the range average used in the formula.

EU 2020/367:	$L_{Den}=(L_{oben}+L_{unten})/2$
Example:	$L_{Den}=(60+65)/2=62.5$

34. BimSchV	$L_{Den}=(L_{oben}+L_{unten})/2$, truncated
Example:	$L_{Den}=(60+65)/2$, truncated= 62

The tabular output of the results is done by the button **Statistics health**.
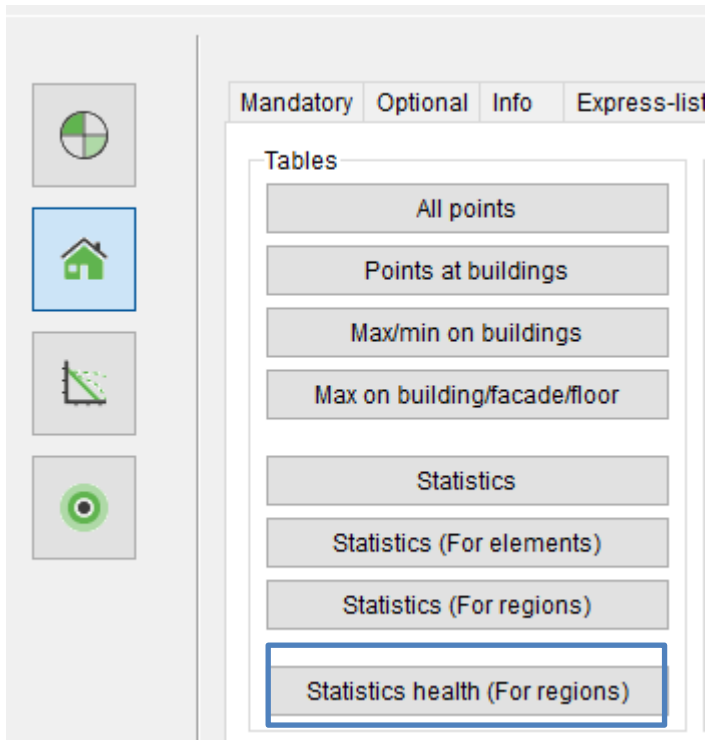
For each selected area (usually usage areas) all parameters are calculated and listed according to the selected level ranges.

Example of such a result list:

Evaluate only for ...	NuGe001 Allg. Wohng. WA
Level range LDEN	**Inhabitants**
55 .. 60 dB	138
60 .. 65 dB	3
65 .. 70 dB	0
70 .. 75 dB	0
Total	141
Level range LNight	**Inhabitants**
45 .. 50 dB	44
50 .. 55 dB	0
55 .. 60 dB	0
60 .. 65 dB	0
65 .. 70 dB	0
Total	44

1.9   New IMMI Netrun Service

For **distributed** IMMI calculations with **multiple computers**, the IMMI Netrun Service is required. This is software that runs on the client machines that normally have an IMMI Calculator license installed. The IMMI Netrun Service is required to start the Calculator clients and to stop and close them after the calculation is finished or if the user cancels the calculation.

The IMMI version and the IMMI Netrun Service version must match, otherwise correct communication is not possible.

As of IMMI 2020/Update 01 – and therefore also for the current version 2021, the IMMI Netrun version 4.20 has to be used.

If you want to perform distributed IMMI calculations, please check if the latest IMMI Netrun is installed and started.

To do this, proceed as follows:

- Check the correct file version of ImmiNetrun.exe
- First check if a Netrun Service is started and if it is the correct version
- If an old version is started, stop it
- Start the correct version of the Netrun Service

The steps necessary for this are described in detail below.

Note: These steps are **not** to be performed before each calculation. Once the correct Netrun version is running, there is nothing more to do.

Checking the Netrun version – file version

Use the file info to check if you have the correct Netrun version available. If the IMMI Update 2021 is installed correctly, the correct version is already in the installation directory.

You can get this info by right-clicking on the file **Imminetrun.exe** in the file explorer in the Immi installation directory and then selecting "Properties/Details":
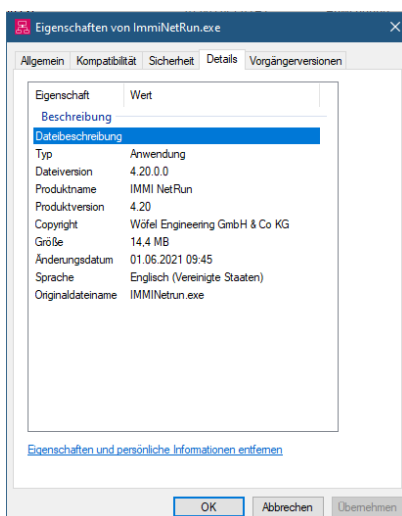
The correct version is the **product version 4.20**

This new version is in the installation directory as of delivery IMMI 2021.

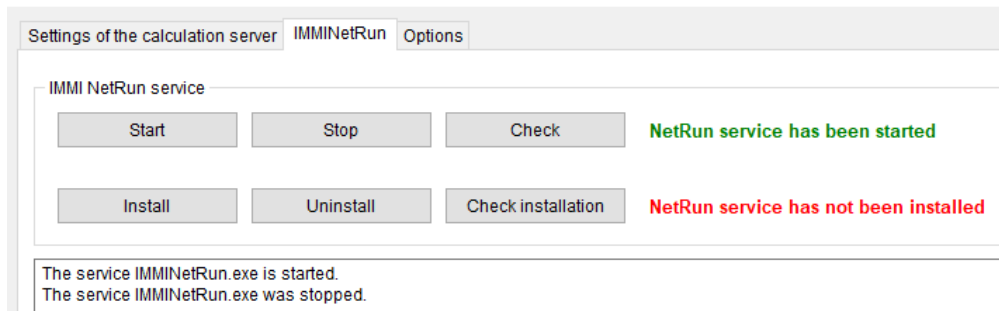## Checking the Netrun version – service already started

- Open with the triangle symbol of the taskbar the window, which shows the installed services.

- If you find the icon , the Netrun Service is started

- Now with the right mouse button click the Netrun icon
- Select the menu item "Open ImmiNetRun"
- The interface of the service appears.
- Select the menu item "? / Info"
- The version box appears
- The current valid and to IMMI 2020 suitable version is the *Version 4.20, 26.08.2020*
- Select "Options/Close" to close the interface again without ending the service!

If the current service is running, there is nothing more to do.

Checking the Netrun version - Service not started

- In the window of installed services (see: #)

- If you do not find the icon [icon], the service has **not** started yet
- Start IMMI or IMMI Calculator
- Select "Settings/Automatic Cluster Calculation (ACR)"
- Select the "ImmiNetRun" tab and press the **Start** button.

- The service is now started

- Continue with **Check Netrun version – service already started** to check the version

Exit the Netrun Service

If the correct version of the service is not running, open the service interface as described above and select "Option/Exit".

Alternatively you can exit the service via the task manager:
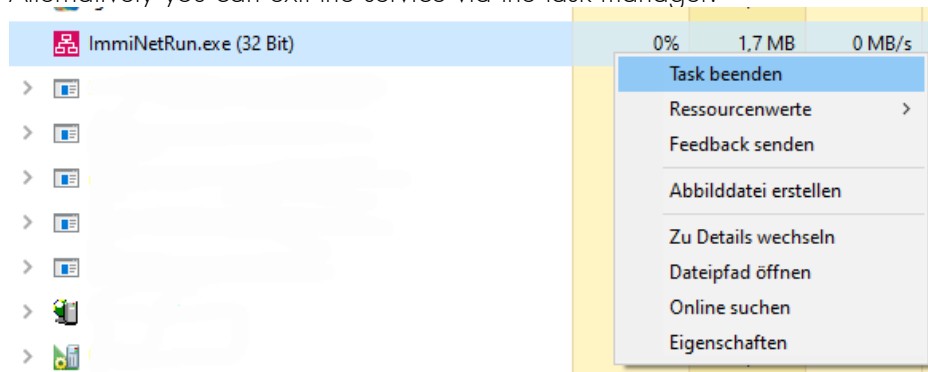
Installing the Netrun service with correct version

- Starting with the delivery IMMI 2021 the correct version will be delivered.
  Nevertheless, after installing an IMMI update, it is useful to check whether the new version of the Netrun Service is actually running.

Starting the new Netrun Service version

If the correct version is installed, start the service as described in **Checking the Netrun Version - Service Not Started.**
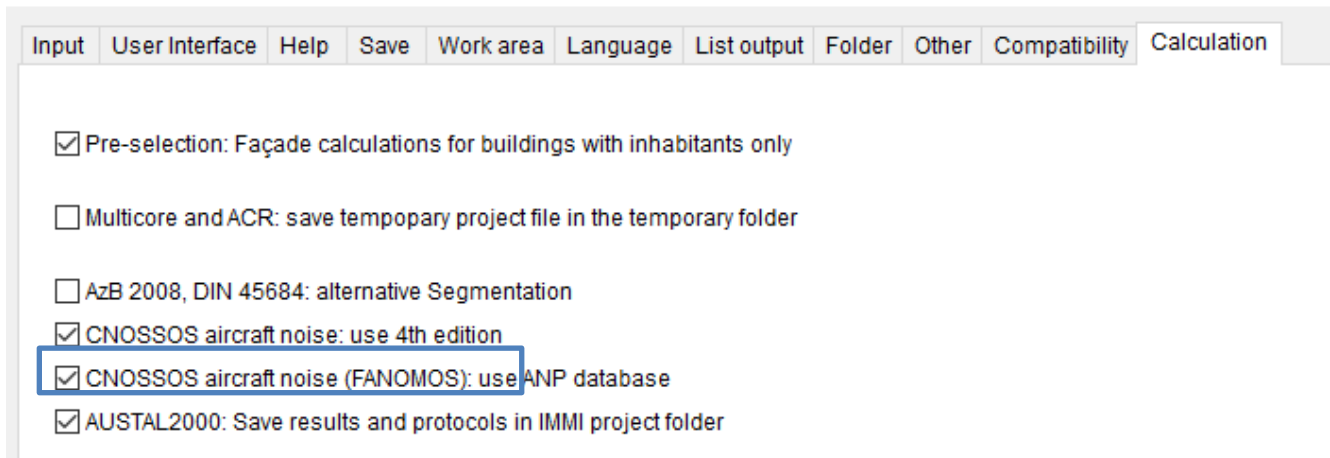
1.10   Aircraft Noise

1.10.1   CNOSSOS-EU Aircraft Noise (BUF (Guideline in Germany))

The German Federal Environmental Agency is planning a new version of the BUF for 2021, which is now based on ECAC.CEAC Doc. 29 4th Edition. The main changes associated with this new set of rules are as follows:

- Height of sound sources on runway 2 m (previously 0 m).

- New formulas for the calculation of "Start-of-Roll" (SOR).

- By assuming a temperature of 10°C (previously 15°C), the impedance changes.

- The air absorption coefficients and thus all NPD tables have to be recalculated. In addition to the changed temperature, a different humidity (70% instead of 80%) is assumed for this purpose. Furthermore, instead of the AIR 1845 set of rules, the SAE 5534 set of rules is used to convert the third-octave spectra. From the newly obtained third-octave spectra, adapted NPD tables are generated, which are the basis for the dispersion calculation.

- A new set of aircraft classes is also planned by the German Federal Environmental Agency. These are not yet available when IMMI 2021 is published. However, we will add them as soon as we receive them from the UBA.

In the future, BUF calculations will be performed exclusively with these modifications. However, we will continue to allow calculations using the previous method, as the new set of rules is not yet in force. We also want to allow existing IMMI projects to be calculated as before for comparison purposes. For this purpose you will find in the dialog **Settings | Environment | Calculation** the switch **"CNOSSOS Aircraft Noise: Use 4th Edition.**

Test airfield

For the new set of rules, the existing test airfield has been adapted and recalculated. The guideline for the implementation in a program is to keep a precision of ±0.5 dB. Recommended is a maximum level deviation of ±0.1 dB. The IMMI results are well within the sharper tolerance range.

1.10.2   Aircraft Noise: FANOMOS

We have significantly revised and extended the FANOMOS module for importing and evaluating radar tracks.

AzB 2008: Segmentation of flight history data:

For the segmentation of flight history data, the altitudes from the radar tracks were used so far. The velocities were taken from the respective data sheets.

If a predefined file format is used (we will be happy to document this on request), the segmentation for generating line sources can be handled more flexibly. These variants are available for selection:

- Elevations from radar data, velocities from data sheets (as before)

- Heights and velocities from radar data

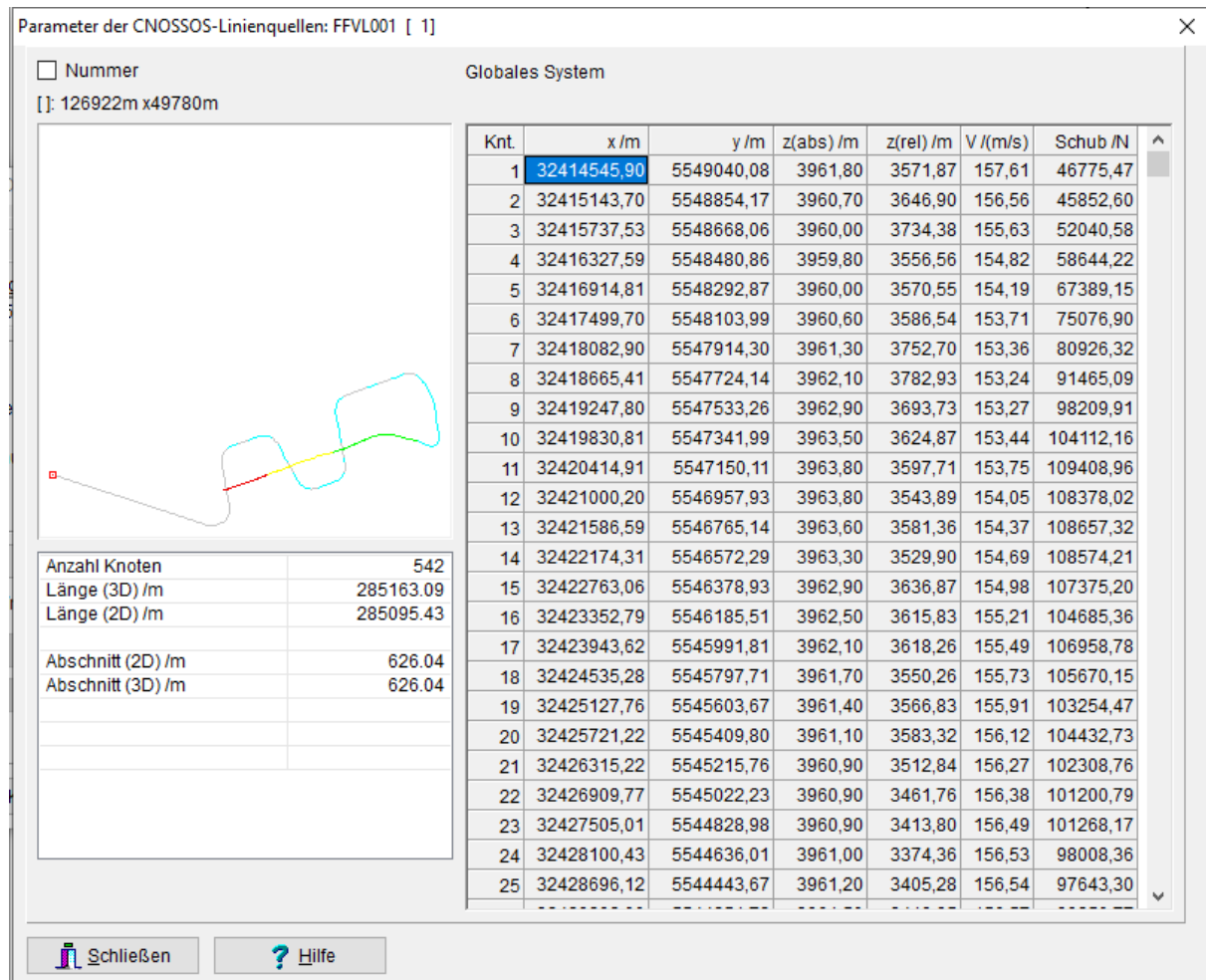- Heights and velocities from data sheets

The algorithm for segmenting the flight history data has been revised. As a result, the generated segments are even closer to the AzB 2008. In addition, robustness with respect to unusual (erroneous) tracks has been increased.

BUF: Segmentation of flight history data:

Segmentation of flight history data was previously only possible within the AzB 2008 rule set. Under certain conditions, this is now also possible within the BUF set of rules. The prerequisites are:

- The velocities must be included in the flight progress data

- The thrust values must be included in the flight history data

- The IMMI database data sheets were taken directly from the ANP database. (IMMI provides these entries)

For such transferred flight history data, an extended geometry display is available in the element dialog box:

Knt.	x /m	y /m	z(abs) /m	z(rel) /m	V /(m/s)	Schub /N
1	32414545,90	5549040,08	3961,80	3571,87	157,61	46775,47
2	32415143,70	5548854,17	3960,70	3646,90	156,56	45852,60
3	32415737,53	5548668,06	3960,00	3734,38	155,63	52040,58
4	32416327,59	5548480,86	3959,80	3556,56	154,82	58644,22
5	32416914,81	5548292,87	3960,00	3570,55	154,19	67389,15
6	32417499,70	5548103,99	3960,60	3586,54	153,71	75076,90
7	32418082,90	5547914,30	3961,30	3752,70	153,36	80926,32
8	32418665,41	5547724,14	3962,10	3782,93	153,24	91465,09
9	32419247,80	5547533,26	3962,90	3693,73	153,27	98209,91
10	32419830,81	5547341,99	3963,50	3624,87	153,44	104112,16
11	32420414,91	5547150,11	3963,80	3597,71	153,75	109408,96
12	32421000,20	5546957,93	3963,80	3543,89	154,05	108378,02
13	32421586,59	5546765,14	3963,60	3581,36	154,37	108657,32
14	32422174,31	5546572,29	3963,30	3529,90	154,69	108574,21
15	32422763,06	5546378,93	3962,90	3636,87	154,98	107375,20
16	32423352,79	5546185,51	3962,50	3615,83	155,21	104685,36
17	32423943,62	5545991,81	3962,10	3618,26	155,49	106958,78
18	32424535,28	5545797,71	3961,70	3550,26	155,73	105670,15
19	32425127,76	5545603,67	3961,40	3566,83	155,91	103254,47
20	32425721,22	5545409,80	3961,10	3583,32	156,12	104432,73
21	32426315,22	5545215,76	3960,90	3512,84	156,27	102308,76
22	32426909,77	5545022,23	3960,90	3461,76	156,38	101200,79
23	32427505,01	5544828,98	3960,90	3413,80	156,49	101268,17
24	32428100,43	5544636,01	3961,00	3374,36	156,53	98008,36
25	32428696,12	5544443,67	3961,20	3405,28	156,54	97643,30

Parameter der CNOSSOS-Linienquellen: FFVL001 [1]

Nummer

Globales System

[ ]: 126922m x49780m

Anzahl Knoten	542
Länge (3D) /m	285163.09
Länge (2D) /m	285095.43
Abschnitt (2D) /m	626.04
Abschnitt (3D) /m	626.04

Schließen   Hilfe

Note 1: Since these radar tracks contain complete velocity and thrust history data, they themselves represent the complete flight profile. Therefore no fixed point profiles of the data sheets are needed here. Consequently, no fixed point profiles have been adopted for the database entries from the ANP database.

Note 2: In a next step, we will integrate the official database entries of the BUF for the segmentation of the flight history data, so that the previous radar track formats can be used here as for the AzB 2008. We already expect this to be realized in 2021.

Substitution tables

In the flight progress data, the ICAO code of the aircraft concerned is transferred for each flyby. Via so-called substitution tables, an aircraft class is assigned to this ICAO code in the IMMI database. This substitution table was previously hard-wired. To increase flexibility and to use different sets of rules, the substitution table has been moved to the folder "C:\Programdata\IMMI\DB". In doing so, we have already created the prerequisite to use different sets of rules, so that 3 substitution tables are already available (for use under AzB 2008, BUF as well as direct use of the ANP database):

Name	Date	Type	Size
BUF_Aircraft_Substitutions.csv	05.05.2021 09:27	Microsoft Excel-C...	3 KB
POLLMETZR.DAT	23.04.2021 09:25	DAT-Datei	10.027 KB
BUB_D_A4_C1.ISD	20.04.2021 16:17	ISD-Datei	2 KB
BUB_D_A4_C1_GB.ISD	20.04.2021 16:15	ISD-Datei	2 KB
Fluglärm-DB_2021-04-06.zip	15.04.2021 09:41	ZIP-komprimierte...	207 KB
__AzB_CNOSSOS_TerzKorr_ANP_GfL_2021-04-06.zip	06.04.2021 10:12	ZIP-komprimierte...	201 KB
__AzB_CNOSSOS_TerzKorr_2021-03-30.zip	30.03.2021 07:32	ZIP-komprimierte...	139 KB
__AzB_CNOSSOS_2021-03-24.zip	24.03.2021 08:52	ZIP-komprimierte...	144 KB
AzB_Aircraft_Substitutions.csv	19.02.2021 06:45	Microsoft Excel-C...	11 KB
ANP_Aircraft_Substitutions.csv	18.02.2021 09:54	Microsoft Excel-C...	12 KB

Note: In the future, these substitution tables will also be used for the QSI import of forecast projects (BUF, AzB 2008 as well as in the upcoming set of rules DIN 45689-1).

2   Optimizations in IMMI 2021

2.1   Setting of the Multiple Reflection Method

If multiple reflection is calculated in a project, all potential reflection paths must be found. There are basically two methods for this:

- Mirror source method

- Raytracing method

With the mirror source method all possible reflection paths are found, however the computing time increases very strongly with increasing number of reflectors. Therefore, IMMI automatically switches to the ray tracer when a certain reflection order and a certain number of reflectors are reached. However, it has been shown that the switching is not always optimal and sometimes the slower mirror method is used, although the ray tracer would be significantly faster with comparable accuracy.

Therefore, the user can now set whether…

- To continue with automatic switching

- Or always use the mirror source method

- Or always use the ray tracer method

… for reflections greater than 2nd order.

This setting can be made in the calculation parameters:

Note: For the RLS 19 calculation, the reference setting was set to "Ray tracer".

2.2   Settings for the Calculation of the Obstacle Effect for Terrain Grids

If the terrain model is available as an .IDG raster, the obstacle effect of the terrain is also taken into account here. Since there are no explicit diffraction edges for a terrain raster (neither contour lines nor triangulation edges), the terrain profile under the sound beam has been scanned with an automatic so far. The terrain was scanned with a maximum of 750 profile points.

Now the user can override this automatic and define himself in which increment the terrain grid under the sound beam should be scanned.

For this purpose, the **Optimize profile section in digital terrain** button can be activated.

<u>Note:</u> This option is only available if an IMMI model contains an .IDG or external terrain.

- **Step size in profile /m:** This value specifies the step size along the sound beam at which the terrain under the sound beam is scanned. With a step size of 10m, for example, the height of the terrain is determined every 10m starting from the source and thus a terrain profile is determined, which together with the houses and walls results in the obstacle effect.

    If the step size is chosen smaller than the grid width, the grid width is used as step size.

    If the distance between IP and source and the selected step size results in more than the maximum possible number of terrain profile points, the step size is automatically increased so that the maximum number of profile points is not exceeded. Currently this limit is 1000 profile points

- **Boundary area /m:** For the area in the immediate vicinity of the source and the receiver point, the step size can be reduced in order to scan the terrain there more precisely. This range can be entered here.

- **Step size in the boundary area:** The step size with which the selected boundary area is to be scanned is specified here. Again, the step size in the boundary area must not be smaller than the grid width.

- **Info button:** The info button allows the user to display information about the terrain grid used in the project.

- **Print colour grid and background image as PDF:** Printing a colour grid together with a colour background image on PDF printers (PDF output) often resulted in the grid and background combination image not being displayed or not being displayed correctly.

    With the new possibility displaying the grid and background image together in colour, this problem no longer exists on PDF printers. All PDF printers we tested can now print grid and background combination images.

2.3   Optimizations of the Element Library CNOSSOS-EU

2.3.1   Accelerated Calculation with CNOSSOS-EU
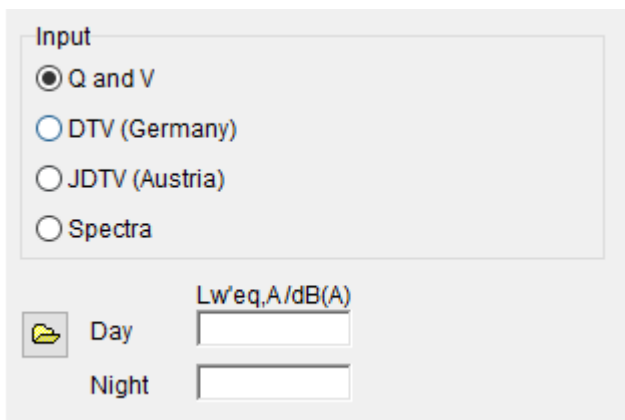
When calculating the dispersion according to CNOSSOS-EU, it is necessary to calculate the mean baseline between two points. The procedure given in CNOSSOS-EU requires an ordered profile for the calculation. Since such profiles are usually not ordered at first, the profile must be ordered before each calculation of the compensation plane, which is time-consuming. Therefore, IMMI provides a much faster algorithm for computing the compensation plane, which is minimally different from the original method, but faster. (In fact, the IMMI method actually provides minimally better compensation than the original.)

This fast calculation of the compensation plane can be found on the CNOSSOS-EU library page. There you have the option: **Quick calculation of the compensation plane.**

Note: For the calculation of the test task, this switch must not be activated, since deviations of approx. 0.1 dB may occur.

2.3.2   Extension of the CNOSSOS-EU Road: Input DTV and JDTV

The input of the emission data of the CNOSSOS-EU Road (BUB) has been extended. Now it is possible to calculate the traffic volume Q from the **DTV (Germany)** or the **JDTV (Austria)**:

DTV for Germany (BUB)

You can enter

- DTV and the

- Type of road

The breakdown into the individual traffic volumes is done according to **LAI Notes on Noise Mapping, Second Update, August 24, 2020.**
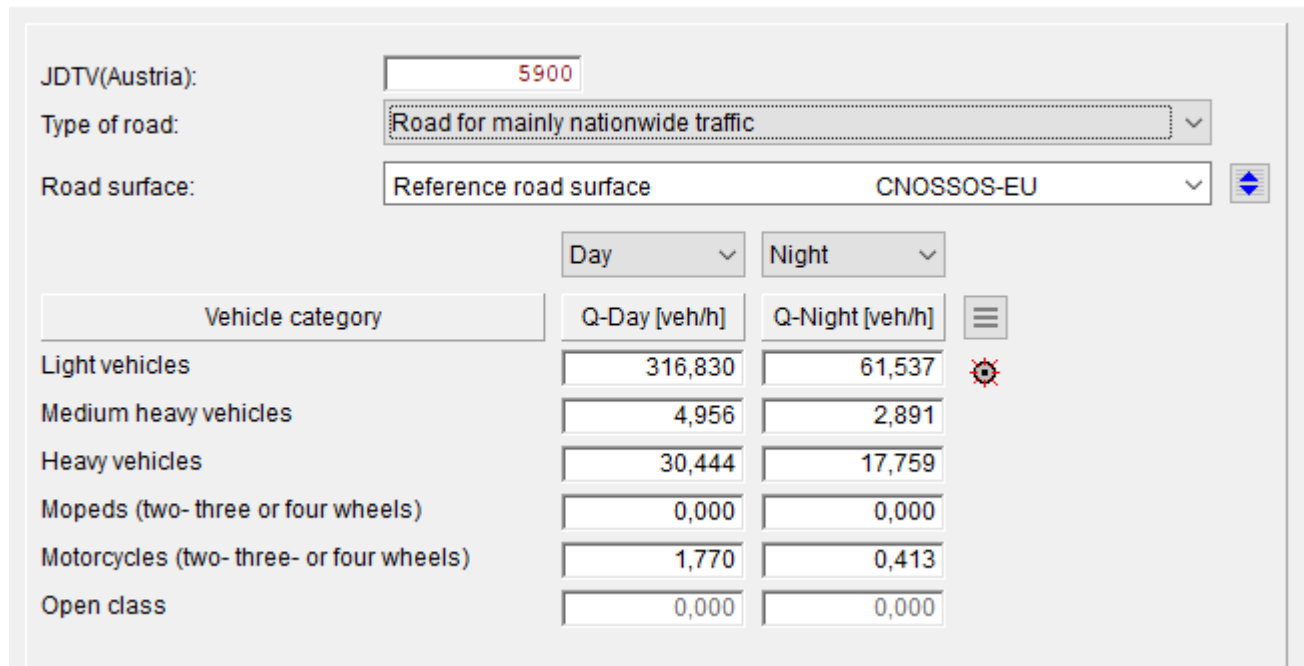
In extension of these conversions, own conversions and distributions can be defined in IMMI. This definition is done on the library page **CNOSSOS-EU** (Menu: Calculation | Calculation parameters | Parameters for element libraries) with the switch **DTV Conversions (Germany)**. Further parameter sets for conversion factors can be defined here. In addition, the conversion coefficients of the LAI notes can also be viewed there.

Here you can create new conversions from DTV to the traffic volumes of cars, light and heavy trucks. These newly generated conversions can then be selected in the CNOSSOS Road dialog box under **Type of road**.

JDTV for Austria (RVS 04.02.11)

Input of emission data: Road CNOSSOS-EU   ✕

JDTV(Austria):	5900
Type of road:	Road for mainly nationwide traffic
Road surface:	Reference road surface CNOSSOS-EU

		Day ⌄	Night ⌄
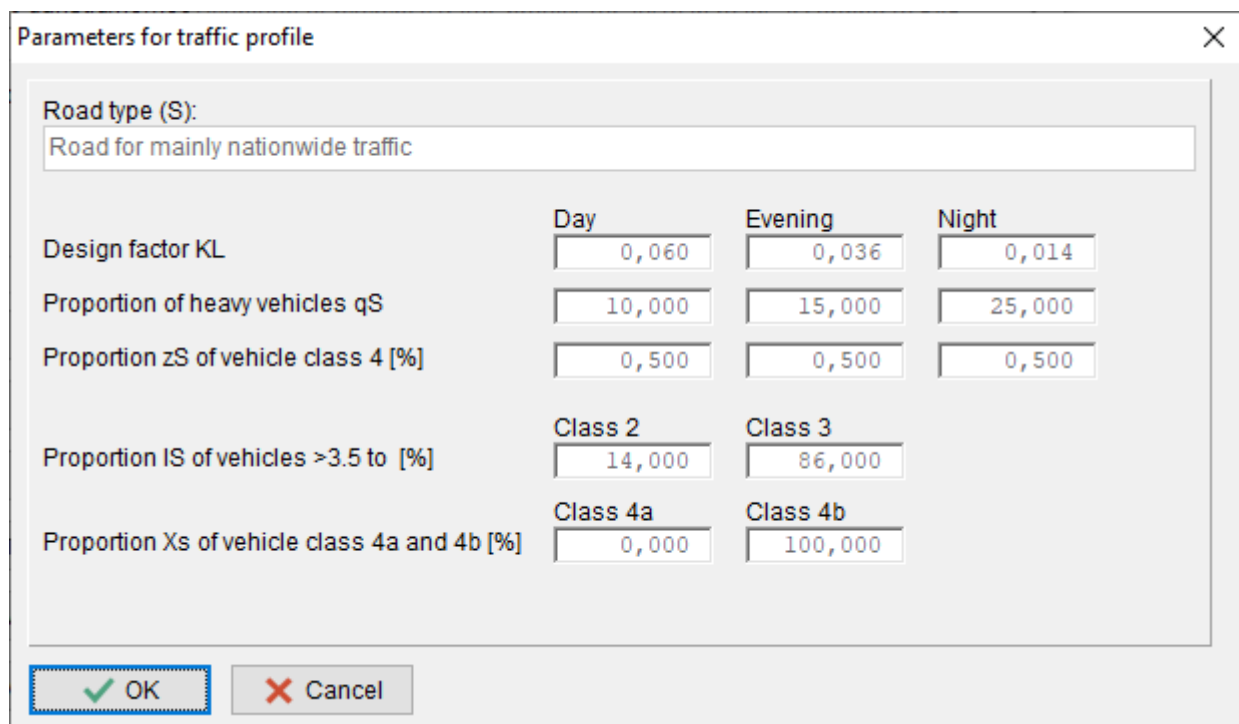
Vehicle category	Q-Day [veh/h]	Q-Night [veh/h]	☰
Light vehicles	316,830	61,537	☼
Medium heavy vehicles	4,956	2,891	
Heavy vehicles	30,444	17,759	
Mopeds (two- three or four wheels)	0,000	0,000	
Motorcycles (two- three- or four wheels)	1,770	0,413	
Open class	0,000	0,000	

You can enter

- DTV and the
- Type of road

The division into the individual traffic volumes is done according to: **Calculation of noise emissions and noise protection, RVS 04.02.11, February 1, 2019.**

Own conversion factors can also be defined for the conversion JDTV according to traffic volumes. This is done on the library page **CNOSSOS-EU** (Menu: Calculation | Calculation parameters | Parameters for element libraries) with the switch **JDTV conversions (Austria)**.

Parameters for traffic profile   ✕

Road type (S):
Road for mainly nationwide traffic

	Day	Evening	Night
Design factor KL	0,060	0,036	0,014
Proportion of heavy vehicles qS	10,000	15,000	25,000
Proportion zS of vehicle class 4 [%]	0,500	0,500	0,500

	Class 2	Class 3
Proportion IS of vehicles >3.5 to [%]	14,000	86,000

	Class 4a	Class 4b
Proportion Xs of vehicle class 4a and 4b [%]	0,000	100,000

✔ OK   ✕ Cancel

Parameters for user-defined conversions from JDTV to traffic volumes for cars, light and heavy trucks. These user-defined conversions can be selected in the input dialog of the CNOSSOS road at JDTV under **Road type**.

2.3.3 Conversion of RLS-19 Roads to CNOSSOS-EU Roads (BUB) (Guidelines in Germany)

Road elements according to RLS-19 can be converted to CNOSSOS Road (BUB).

Hereby:

- The road surfaces and the
- Traffic figures are converted

There is a list of parameter sets for the conversion. The default setting is the conversion of the traffic figures according to **LAI Notes on Noise Mapping, August 24, 2020, Table 2.**

The user can define his own conversions:

The conversion is performed as follows:

Number CNOSSOS-light motor vehicles	=	Number RLS-19 car
Number CNOSSOS-medium heavy vehicles	=	Number (RLS-19 truck) * F
Number CNOSSOS-heavy vehicles	=	Number (RLS-19 truck1) *(1 - F) + truck2
Number CNOSSOS-scooters	=	Number (RLS-19 motorcycles) * G
Number CNOSSOS-motorcycles	=	Number (RLS-19 motorcycles) * (1 - G)

Parameters F and G can be entered (separately for day, night and evening).

The list of conversion parameters can be found under the library page CNOSSOS-EU via the button **Conversion (RLS-19 > CNOSSOS)**.

2.3.4   CNOSSOS-EU Import of Road Surface Coefficients

The list of CNOSSOS-EU road surfaces also allows user-defined road surfaces. If a larger number of such user-defined surfaces is to be added, this can be done by importing them from a text file.

The structure of the text file to be imported is very simple:

- Each line contains the data for one road surface

- The values within a line are separated with a semicolon

- Decimal separator can be point or comma

- The first entry of each line is the name of the road surface

- Followed by 8 values for alpha and 1 value for beta for vehicle class 1

- Followed by 8 values for alpha and 1 value for beta for vehicle class 2

- Followed by 8 values for alpha and 1 value for beta for vehicle class 3

Optionally, values for classes 4a and 4b can follow. If these values are not available, the corresponding entries of the classes 4a and 4b are filled with the value 0.

2.3.5   Representation of the CNOSSOS-EU Meteorology List

An overview is now integrated in the CNOSSOS meteorology list. If the values for an emission period (day, night, evening) are the same in all angular directions, this common value is displayed on the overview. If an emission period contains different values for different angles, "var" (=variable) is displayed in the column of this period.

2.3.6   CNOSSOS-EU Coefficients Outsourced

The coefficients used for the calculation of road and rail emissions were previously hardwired into the program and could not be changed. These coefficients are now swapped out to three text files. These files are included and are a permanent part of the IMMI delivery.

These files are:

- `CnossosRailRoadparams.txt`

- `CnossosRoadAlphaBeta.txt`

- `CnossosRoadParams.txt`

CAUTION:
The user can now change these coefficients! However, this should only be done if the user is exactly aware of the consequences. With change of these coefficients is no longer calculated according to the valid regulations!

This possibility was created mainly for research purposes.

The location and version of these files can be viewed in IMMI:

Right mouse button on the area containing the buttons with the lists shows the menu item **Parameter Info**, which then displays the desired info.
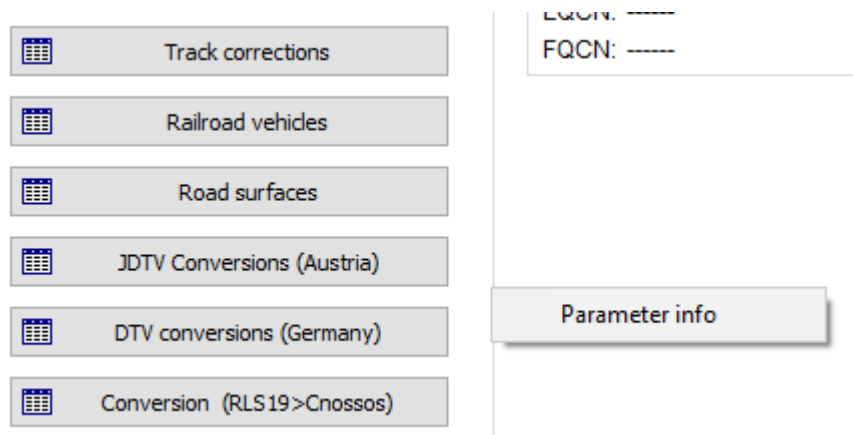
2.3.7   Ground Elements with G=0 under CNOSSOS-EU - Roads

There was already the possibility to place soil damping elements with G=0 automatically under CNOSSOS road elements. The geometrical arrangement of these elements has now been revised and improved.

Note: this does not change the position of the emission lines on which the point sources are located!

The generation of the ground elements depends on the selection dSQ:

- **Cross profile dSQ with dSQ=0**: No ground elements are generated here.
- **Cross profile extended**: For the position and size of the ground elements, the parameters **lane width** and **median strip** are evaluated.
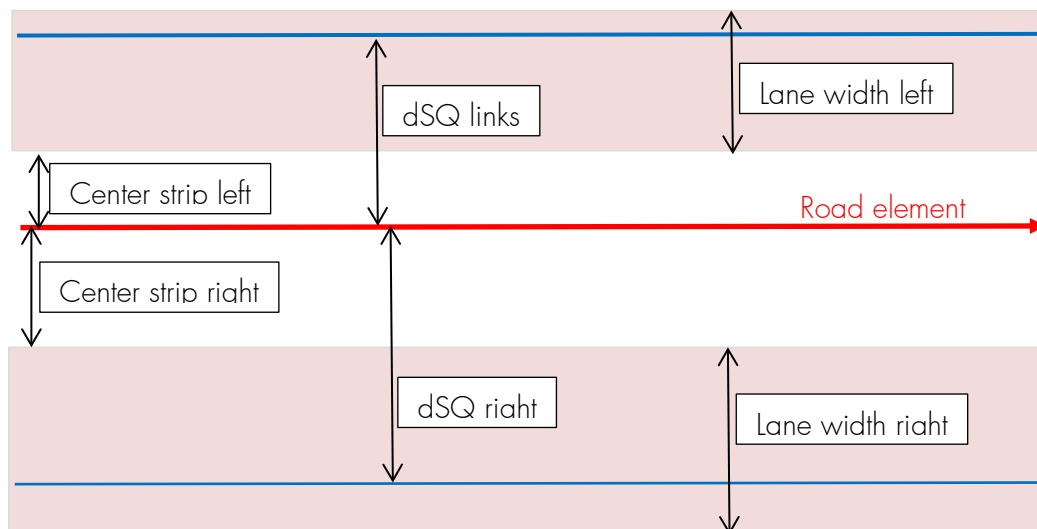
The red areas represent the automatically generated soil elements (with G=0).

Note that the position and size of the ground elements depend only on the values for the **centre strip** and **lane width**, but not on dSQ!

2.3.8   Further Emission Databases

Two small databases for emission spectra were added.

The following databases were added

- D Industrial Sources Germany, Annex 4, Table C-1 with 5 spectra
- CNOSSOS-EU Annex H, Table H1 with 3 spectra

2.3.9   Amendments for rail traffic

Aerodynamic Limit Speed Adjustable

According to CNOSSOS-EU, the aerodynamic effect on railway vehicles does not start until 200km/h. Below this speed, no surcharge is levied due to aerodynamic effects.

This limit speed can now be entered freely for **user-defined railway vehicles**.

In the above example, the aerodynamic effect does not start until 225 km/h.

Create New Vehicle from Template

If a new rail vehicle is to be created, an existing vehicle can be loaded as a template as an input aid. The parameters of the template vehicle are taken over, the vehicle name is preceded by two asterisks to distinguish it.

2.4   More Optimizations in IMMI 2021

- **Font size for number grids:** The size of the digits used to display the values of the number grid was calculated automatically. The correct digit size was not always determined. Often the characters were too small and did not fill the available space optimally. This has now been improved. The character size should now always optimally fit the available box size.

- **House with roof**: Houses with roofs can now be moved and rotated.

- **Short list options:** The short list settings are now saved. This applies in particular to the colours to be used when displaying guideline value overruns.

- **Block functions for wind turbine generators (WTG):** Block functions for

  - Uncertainties ON/OFF

  - Sigma values have been added.

- **Display of element legend:** Up to now, the additional character attributes are also displayed for an element class, even if there is no element of this class in the selected variant that uses this additional character attribute.

- **Documentation of collections:** In the collections dialog there is a new button Documentation. This can be used to list the elements in all collections.

- **Conversion RLS-90 to RLS-19:** When converting a RLS-90 road to RLS-19 road, the L,m,E values of the RLS-90 road are now converted to Lw' of the RLS-19 road. This conversion was not done before.

- **Overgrowth attenuation in profile section**: In the "Profile Section" dialog, cut vegetation elements are now displayed in green and can thus be distinguished from obstacles and houses (red).

- **Display of the progress bar when the calculation is aborted:** If a running calculation is aborted, the question appears whether the calculation should really be aborted. Until this question is answered, the colour of the progress bar changes to yellow. If the calculation is aborted, the colour of the bar changes to red. If Multicore or ACR was active for the calculation, the clients are terminated, which can take a few seconds. Now in the calculation window this process is also displayed, the bar remains on red until all clean-up is completed.

- **Assessment: 16th BImSchV**: The 16th BImSchV was subjected to some changes in 2021. In IMMI, a new hard-wired assessment regulation is available for this purpose (**16th BImSchV (2021)**).

- **Import of SRTM elevation points:** IMMI already supports the import of SRTM elevation grids from files previously downloaded from the NASA-Server (https://earthexplorer.usgs.gov/). In doing so, the import area is automatically adapted to the workspace of the <u>georeferenced</u> IMMI project. User interaction was not required for this. The imported elevation model was previously stored as a digital terrain model (.idg). However, many users prefer elevation models defined by elevation points and contour lines. The SRTM elevation model was only usable here via a detour. Therefore, in addition to the above import, we have implemented an SRTM import of elevation points. The import is called up under **File | Import | Import SRTM altitude points**.

- **Aircraft Noise (AzB 2008, DIN 45684):** The long list has been revised. The unused frequency bands 16 Hz and 32 Hz were also hidden.

- **Aircraft Noise (BUF):** The labelling period was set to 12 months.

- **Aircraft Noise (all libraries):**

  - The dialog for the description of aircraft classes has been revised.

  - The check of wrong class assignments of flight routes stopped after finding the 1st error. Now a complete list of all incorrect entries is output.

  - When exporting flight numbers to the clipboard, duplicate or multiple entries of aircraft classes are automatically merged. Such double entries may occur when AzB projects are converted to BUF projects, because there are BUF classes (e.g. "S 3.1 - S") for which there are 2 corresponding AzB classes described (e.g. "S 3.1 a) - S" or "S 3.1 b) - S").

- **QSI Import Aircraft Noise (all libraries):** There is a specified labelling time for each set of rules. In the metadata of QSI projects, however, the marking time can be overridden (parameter "obsvperiod"). This value is now taken over by IMMI.

- **RLS-19 Roads:**

  - The speeds of all vehicle categories previously had to be entered individually. If the switch v! is deactivated, the speeds entered for passenger cars apply to all vehicle categories.

  - In the RLS-19, correction values for road surface layers are partly described only for certain speed ranges. Outside these speed ranges, these correction values are not described. However, since this situation may occur, we have decided to apply the correction values for these speeds as well. In the input dialog there is a button for this purpose, via which a corresponding info field is displayed.

  - On customer request, we now allow peak levels to be entered.
    Background: The state of Schleswig-Holstein requires the calculation of peak levels.

  - The maximum gradient surcharge of each vehicle category is now displayed in the input dialog:

Straße /RLS-19 (1)							Variante 0
SR19002	Bezeichnung	RLS-19 2		Wirkradius /m			99999,00
	Gruppe	Gruppe 0		Steigung % (direkt)			12,00
	Darstellung	SR19		Fahrtrichtung			2 Richt. /Rechtsverkehr
	Knotenzahl	6		Abst. Fahrb.mitte/Straßenmitte /m			0,00
	Länge /m	2568,06		DTV in Kfz/Tag			10000,00
	Länge /m (2D)	2557,38		Verkehr			Bundesautobahn und Kraftfahrstraßen
	Fläche /m²	---		d/m(Emissionslinie)			0,00
	Emiss.-Variante	Zeitraum	M PKW /Kfz/h	p1 /%	p2 /%	p Motor	
Tag		Tag	555,00	3,00	11,00	0,00	
			DSD PKW /dB	DSD LKW (1) /dB	DSD LKW (2) /dB	DSD Motorrad /dB	
			0,00	0,00	0,00	0,00	
			DLN PKW /dB	DLN LKW (1) /dB	DLN LKW (2) /dB	DLN Motorrad /dB	
			1,20	5,00	6,00	6,00	
			v PKW /Kfz/h	v LKW (1) /Kfz/h	v LKW (2) /Kfz/h	v Motorrad /Kfz/h	
		Tag	50,00	50,00	50,00	50,00	87,14
	Emiss.-Variante	Zeitraum	M PKW /Kfz/h	p1 /%	p2 /%	p Motor	
Nacht		Nacht	140,00	10,00	25,00	0,00	
			DSD PKW /dB	DSD LKW (1) /dB	DSD LKW (2) /dB	DSD Motorrad /dB	
			0,00	0,00	0,00	0,00	
			DLN PKW /dB	DLN LKW (1) /dB	DLN LKW (2) /dB	DLN Motorrad /dB	
			1,20	5,00	6,00	6,00	
			v PKW /Kfz/h	v LKW (1) /Kfz/h	v LKW (2) /Kfz/h	v Motorrad /Kfz/h	
		Nacht	50,00	50,00	50,00	50,00	84,05
	Straßenoberfläche	Nicht geriffelter Gußasphalt					

Steigungen und Steigungszuschläge für Straßen										
Element	Bezeichnung		Abschnitt	s /m	ds /m	Steigung /%	Steigung /%	Zuschlag/dB	Zuschlag/dB	Zuschlag/dB	Hinweis
				m	m	aus Koord.	für Rechng.	Tag	Nacht		
SR19002	RLS-19 2		1	0,00	393,50	12,64	12,00	3,82	4,62		*1) Max.
			2	393,50	430,56	12,57	12,00	3,82	4,62		
			3	824,06	408,41	-8,48	12,00	3,82	4,62		
			4	1232,48	440,02	-10,24	12,00	3,82	4,62		
			5	1672,50	884,89	-2,97	12,00	3,82	4,62		

*1): Die für die Berechnung relevante Steigung wurde direkt eingegeben.

- **Designing circles:** The design function for creating circles previously created regular closed polygons with 16 edges. The number of edges has been increased to 64 for better display of auxiliary line circles.
- **Meteorology import (ISO 9613):** Meteorological time series can now be imported for evaluation of meteorological influences (previously only annual statistics)
- **Designing openings:** If an area source is partially below the terrain, the course of the terrain along the sound source is now displayed in the dialog for constructing openings.

   Such situations can arise, for example, when constructing area sources at houses.
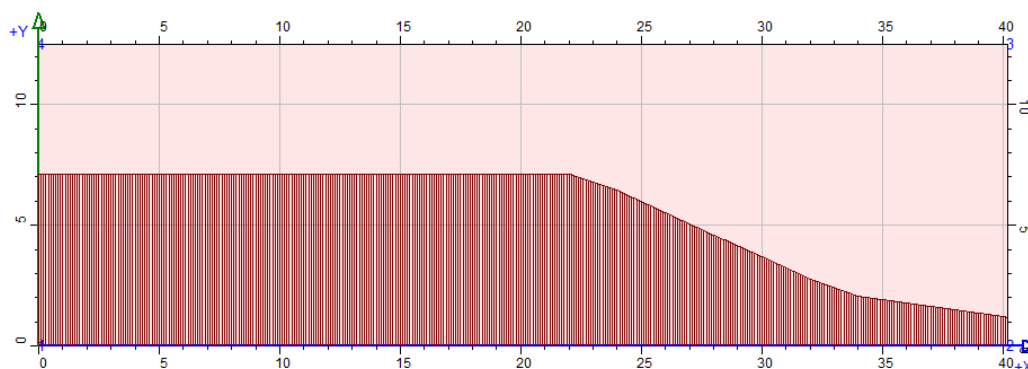
   Representation of the course of the terrain (brown) along a sound source.

- **Print colour raster and background image as PDF:** The joint output of a colour raster together with a coloured background image on PDF printers (PDF output) often resulted in the combination of raster and background image not being displayed or being displayed incorrectly.

   With the new possibility to display raster and background image together in colour, this problem no longer exists on PDF printers. All PDF printers tested by us can now print raster and background image.

3   Corrections in IMMI 2021

The problems and errors listed below have been corrected and should not occur in the current version 2021:

- *Search and replace element names* truncated the name of the searched and replace element names to 20 characters. Now the new name entered by the user is completely taken over

- With self-defined assessments, crashes could occur in the 3D Viewer.

- If a project contained a very fine elevation model (grid or contour lines) and at the same time the search for reflectors was not spatially limited, program crashes could occur

- When importing octave spectra from the clipboard, the 8000Hz octave was not imported.

- When using frequency-independent sound sources, errors could occur when displaying the Compact Long List.

- If the CNOSSOS meteorology 50% day, 50% night 50% evening was selected, 51%m 52% and 53% were incorrectly used. Now the correct percentages are used.

- In the list of RLS-19 traffic volumes, the p1 and p2 values for day were incorrectly displayed under "p1Night" and "p2Night". This has now been corrected.

- The macro for calculating the flat for multiple reflections for roads did not work for the roads according to RLS-19.

   Reach the macro via the menu Project/Elements, mark a street with the mouse and then right mouse button **DRefl for multiple reflection street RLS/19**. The macro now also works for the road type RLS-19.

   In addition, the dialog of the macro has been slightly revised to make it easier to use.

- **RLS-19 Road surcharge**: The DSD surcharge for cars and trucks was not collected correctly if the speed was exactly 130 km/h for cars or 80 km/h for trucks.

- In the dialog External databases for sound sources, no

   o   CNOSSOS sources nor

   o   WTG sources

   could be transferred from the project to the external database. This is now possible.

- Element measuring point: If no selection was made in the dialog at "Selection of a source" and the dialog was terminated with "Cancel", a program crash occurred.

- Empty lines with non-existent second and higher order reflection components were displayed in the long list. These lines have now been removed.

- BUB-D: The surcharge for curve squeal of streetcars (+4dB) can now be selected for track surcharges.

- In the Report Manager, the submenu entries of the "Design" menu were lost.
   These entries are now visible again.

- If an element group was deleted, the user-selected replacement element group was not always used. Now the correct element group is used.

- The conversion of a tunnel element RLS 90 into a tunnel element RLS 19 resulted in the project not being able to be loaded after saving.
   The tunnel elements can now be converted without errors.

- When the dispersion calculation of the parking lot noise study should be executed according to CNOSSOS-EU, but the library is not available, a crash occurred.
   Now an error message is displayed and the calculation cannot be executed.

- In the case of traffic lights according to RLS 19, it was previously not correctly taken into account whether the traffic light was effective or not during a certain period (day, night, evening/quiet). The traffic light surcharge was always levied regardless of the **Effective** switch. This has now been corrected.

- **DIN 4109 Decisive external noise level**: When using variants, the names of the immission levels were not always displayed correctly.
  In addition to the correct element name, the element short key (e.g. IPkt0001 etc.) is now also displayed in the results table.

- **Pollutants (AUSTAL2000):**
  - For time-dependent meteorologies in connection with wet deposition, there were problems with the generation of the AUSTAL-compatible file "time series.dmna". This has now been corrected.

  - The definition of the grid boundaries resulted in a grid that was too small in both dimensions by one cell each. This has now been corrected.

  - The presence of terrain in the calculation of linear grids could lead to an error. This has now been corrected.

  - For time-dependent emissions, the last days of a year could not be hidden, because the week selection only went up to the 52nd week. This has now been corrected.

- **Assessment dialog (diurnal cycle):** For the assignment of each hour of the day to the associated assessment period, 2 times could be assigned for each time zone of an assessment period. With certain editing steps, it could happen that the fields were partially no longer displayed. This has now been corrected.

- **Photovoltaic calculations:** The list headings or titles have been corrected.

- **Block function peak level:** When using the block function to set peak levels, these levels were not immediately transferred to all assessment periods. This transfer occurred only after saving and then loading the project. This has now been corrected.

3.1   Corrections Since IMMI 2020

- **Openings in area sound sources**: The z-coordinate for openings was calculated incorrectly in some cases. If terrain was present and the area sources were defined with relative coordinates, the openings were set too high both for the calculation and in the 3D view.

- **Compressed Long List**: For sound sources with A-sum levels, parts of the compressed long list were not output correctly.

- **Compressed Long List/18.BImSchV**: For non-frequency-dependent sound sources, the list was not output completely.

- **RLS-19**: List of traffic volumes: Here, the values p1 and p2 for the night period were displayed incorrectly. Instead of the correct night values, the day values were also displayed for the night. The calculation was correct.

- **RLS-19**: Road surfaces: The road surface extra charge for cars, light weight and high weight trucks were calculated incorrectly if the maximum speed was set for the vehicle speed. (e.g. 130 km/h for cars). In such cases, the surcharge received the wrong value 0.

- **Spectra Import:** When importing spectra from the clipboard (e.g. Spectra Database Emission and similar) the last octave or third was not imported. It is fixed now.

- **Library SRMII:** If the number of moves with constant velocity Qc was zero, then a roughness penalty for these (non-existent) moves was still collected and added to LE. It is corrected.

- **Terrain profile for mirror sources:** Extremely long reflection paths in combination with the terrain could cause program crashes. This no longer happens at this point.

- **Search and replace element names:** The Find and Replace function had truncated texts, especially the element name, to always 20 characters. That no longer happens.

- **Pollutants (AUSTAL2000):** For time-dependent meteorologies in connection with wet deposition, there were problems with the generation of the AUSTAL-compatible file "time series.dmna". It has now been corrected.

- **Assessment dialog (diurnal cycle):** For the assignment of each hour of the day to the associated assessment period, 2 times could be assigned for each time zone of an assessment period. With certain editing steps, it could happen that the fields were partially no longer displayed. It has now been corrected.

- Job list: If the Job list was activated in the halftone calculation and a new halftone calculation is added, then there was a crash when selecting a calculation variant in this new halftone calculation. This problem is now solved.

- Colour scale and isolines: In the Colour Scale dialog, the Isolines dialog can be opened. In the 2020 version, this dialog erroneously contained no controls. The dialog now works again.

- Library NORDIC: During calculations of the Library NORDIC, elements of type "auxiliary point" were created. This is no longer happening.

- If the IMMI program is started by double-clicking on a project file, a subsequent multicore calculation no longer worked. Now multicore calculations are possible again in such cases.

- ACR in network distributed computing: Depending on the IP address of the computer starting the calculation, the calculation clients could crash. This is now fixed.

- It is important that a new Netrun service must also be used. The new Netrun Service is included in the delivery. Version 4.2 from 26.08.2020

- Linear elements with very acute angles were sometimes incorrectly displayed in the 3D viewer. In some cases, the line could no longer be recognized as such.

- The display is now correct.

- CNOSSOS Road: In the block functions of the road according to CNOSSOS, the properties "concatenation" and the associated tolerances can now also be set.

- Input dialog for frequency dependent sources:
  o In this dialog, a button for calling up the local menu has been added.
  o The input can now be copied between the individual emission variants.

- Element legend: Possible crashes when deleting additional lines no longer occur.

- Display element name: For line elements, the node can be specified from which the element name is to be written to the element. When the last node was specified here, a crash occurred. This does not happen anymore.

- The import of time series is now also possible for ISO 9613.

- Display of the direction of travel for roads:
  - For some road elements, the direction of travel was not displayed even though this option was turned on. This has been corrected.
  - For road elements where the direction of travel cannot be entered explicitly, there was no direction of travel display until now. For such roads, an arrow is now displayed in both directions of travel.

- Indoor Module: When switching from *raytracer calculation only* over to *hybrid calculation* in the 2020 version, the reflection and spatial body elements lost the ability to act as a sound screen at low reflection orders.

  - Reflection elements can now have the following property: "no obstacle", "normal obstacle", or "floating screen". The effect is the same as for the outdoor calculation.

  - Room body: The shielding effect of a room body behaves like a room wall element when the room body is on the ground. (property zLower Edge=0) or like a floating obstacle if the space body is not on the ground. (Property zLower edge>0)

- Element library CNOSSOS-EU: When calculating the surcharge for traffic lights or traffic circles, the calculation was possibly incorrect when more than one traffic light was assigned to the respective street. This error has been corrected.

- In the list of element inputs, the table contents can be copied to the clipboard in the right list. Previously, only a limited number of elements could be copied since the available buffer for the clipboard was limited. This buffer has been significantly increased, so that even with a very large number of elements, all data shown in the table can be exported.

- RLS-19: When saving data sets for older projects, crashes could occur if the project contained an RLS-19 road. The problems were dependent on the selected road surface. This problem is now resolved.

- Shape import. After import of CNOSSOS Roads, the emission of the sources was not calculated immediately. Therefore a calculation could not be started immediately after the import. Now the emission is calculated immediately after the import and a calculation is immediately possible.

- House roof: The function "Force right angle" did not always work. This is corrected.

- Export raster-isolines as DXF: This function caused a crash if the project did not contain any auxiliary lines. This problem is also fixed now.

Please feel free to contact us if you have any questions:

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