

IMMI Tutorial Noise

IMMI 2017

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# 1 Introduction to the program and practical exercises

This section provides an introduction to the practical application of IMMI by means of examples.

- A first example: point sound source with attenuation
- A road as emission source of traffic noise: design with scanned-in maps
- Calculation of industrial noise
- Creating a conflict map

After having completed these exercises, you will not be an IMMI expert yet, but you will be familiar with using the program for a great number of noise forecast tasks.

## 1.1 Point sound source with attenuation

The following simple example will show you step by step how to edit an immission calculation with INMI.

Naturally, there are alternative editing steps. That is why you should "search" the program for additional possibilities after you have become familiar with the procedure described here. Reading the explanations on the menu system will be particularly helpful.

## 1.1.1. Starting the program

In the first step, INMI is started and a new project is created.

- Double-click on the IMMI program icon to start IMMI.
- This will open the starting dialog. Click on the Create new Project button and then on OK to edit an "empty" project.
   Starting dialogue

🗎 Load test example	Use OK to create a new project and start the dialogue
📙 Open existing project	riojed   riopenies
Create new project	
Start directly	
♦ View tutorial	
🖞 Hints	
Do not show this dialogue	
OK Help	

## 1.1.2. Preparatory steps

In the beginning, only make the settings below. This first example is particularly intended to facilitate working with INWI. For that reason, element libraries are not yet used at this point.

- Verify that Topic is set to Noise (Outdoor propagation).
- In the Emission variant field, set the number of emission variants to 1 so that only one rating period will be taken into account. Use the arrow buttons next to the input field.

Set project properties	×
Specification Work area	
Set specification	Project description
Project template	
Topic	
Noise (Outdoor propagation)	
O Noise (in working rooms)	
O Aircraft noise	
O Pollutants	
Type of prediction	
Noise (national methods)	
Select rating method	
No rating ~	
Emission variant Duration/h	
1 Cay 16	Safety
	Password: Not provided
Select element libraries	
OK Cancel Help	

Figure 1: Setting the properties of the project

 Select the Work area tab and apply the work area limits which are preset there:

x/ m	0 to	1000
y/ m	0 to	1000
z/ m	0 to	100

Terrain height in the corners:

```
z1 bis z4 0 m
```

• Click on the OK button to confirm these values. This will open the map which is the central editing window in IMWI.

## 1.1.3. Entering a point source and a noise barrier

In the following steps, the geometry of a source and the screening wall is designed on the monitor by means of the mouse.

Select ISO 9613-2 from the tool box to the left.

- Select the **Point source** (<sup>1</sup> Point source/ ISO).
- Click on ?? Draw elements in the Design tool box.

Note: Choose the function - Draw elements to create new elements. The

function **C** - **Edit elements** is chosen for editing existing elements or for opening the element dialog.

- Left-click on the desired position (x = 500 m, y = 500 m) on the map.
- Since the either Open element dialog instantly button is activated, the appropriate input mask will open directly after you have generated the point sound source.

) ಶ 🔚 🏫 💩 🧰 🐚 🛤 📣			Noise (rational methods)
	0 100 200 300 Add: Rank source r10 36	400 500 600 700 800 ×	x/m 1000
	Eccont 11 Cescont 11 C	Lewinput         O Expanded           Image: Spanned in edition         Lar in edition           Image: Spanned in edition         125, 60           Image: Spanned in edition         0.00	
	Action radiustities (C)		
er har han an a	Coordinate system Coordinate s		
	OK Cancel Help	(a)	

Figure 2: Digitizing a point sound source

- Enter the following data in the input dialog:
  - The point sound source is a Circular saw.
  - Emission value for the period Day: Lw = 120 dB(A).
  - z-coordinate z rel/m = 1 m
- Confirm your entries with OK.
- Move to the Standard element library.
- Click on the **Wall element** button to select the wall element type.

11

- Left-click approx. at x = 400 m, y = 450 m to set the first node.
- Set the second node approx. at x = 600 m, y = 450 m.
- Right-click to complete your entry of the element geometry.
- This will open an input dialog.
- Click on Geometry input and, in the z(rel/m) column, enter z = 5.0 m as the height for the first node and z = 7.0 m for the second node (inclined wall).
- Exit the input dialog by clicking on **OK** twice.

📄 ỡ 🖬 🎲 🕸 🧰 📑	🗖 🔊	1	目	🕈 🏠	50	۵	5			20			E
	Adap (Variant 0)		H	0 1	00 2	00 300	400	500	600	700	800	x/m	100
Design v			900										
	WANDOO1	[ 1]				Constant	el. height /m						
	WAND	. mit in	Tendard			Refecto	n						
Standard · ·	Exception:		]Colour	Width/mm	Geometry i Abso []: 145n	nput: WANDOO1 ( lufe z 🗌 No. h x 0.00m	η	Global s	ystem			Direct entry	
	Group Identifier   Note   Picture	8 ( 3 (	irinip 0	0 Geometry Input				Node 1 2	1 403 2 541	m. 99	y /m 451.37 451.37	2014(Jim 5.00 7.00	
	ок	Cancel	Help										

Figure 3: Entering the screening wall

## 1.1.4. Calculating a reception point grid

In the next step, an area-type reception point grid is calculated.

- Select the <Calculate | Definition | Calculation area> menu item.
- Click on Edit... to define the grid dimensions.
- Ensure that the step sizes in both x- and y-direction is 20 m. Leave the grid field setting as it is, i.e. Work area.

• Enter 2 m under z/m (relative).

#### Define grid

Name 20x20m, 2m high	
dx/m 20.00 nx 51.	from to Dimensions x/m 0.00 1000.00 1000.0
dy/m   20.00 ny   51. n 2601.	y/m 0.00 1000.00 1000.00 z/m relative v 2.00
Range     Work area ONuGe + []     Rectangle OVertical grid     L and use only	Use map clipping Align grid on fixed point
	Copy from
	Mark wraparound

Figure 4: Defining a grid

- Click on OK and then on Close to complete your entry.
- Save the project with <File | Save Project As ... >. Enter a name.

Note: The filename extension of IMMI project files is .IPR.

 $\times$ 

• Start calculation of the grid by selecting the <Calculate | Calculate grid>

ne calcula list	tion and Calcu	l execute it Ilation mode Calculation	Extras: Calculate grid Settings	
	[		Job list	
•		Job State Project file Result file	<ul> <li>Calculate grid</li> <li>not calculated</li> <li>Not saved</li> <li>C:\Users\dr\Documents\Example.IPR</li> <li>C:\Users\dr\AppData\Local\T \Erg674.IRD</li> </ul>	
0		Setting S Variant S Calculation area	Image: Copy from "Reference Setting"       ~         Image: Variant 0       ~         Image: 20x20m, 2m high       ~	
		Multicore calculation	n 📰 uster calculation 🕎 ion 🗐	
Ħ		Mandatory Optional Inf	ifo	
		Calculate	🗎 🛠 🖇 🛛 🖥 🖥	

Figure 5: Calculation control center - Start the grid calculation

- Use the default settings of the calculation dialogue.
- Click on **Calculate** to start calculation.
- The reception point grid calculated is displayed.
- Select the **<Calculation** | **Save>** menu item in this dialog. Enter a name and save the grid.

## Note: The filename extension of IMMI grid files is .IRD.

• Click Close to leave the dialogue.



• To use the possibilities of an additional graphical evaluation, click on the

Define map content button (1997) and select Map: Grid and Layers: Day.

- Select Grid of squares from Presentation in the same dialog.
- Click on **OK** to view the grid.

 $\times$ 

Мар Layers Presentation ○ Map Day Grid of squares O Single p. calc. Height Interpolated grid Façade levels No colored arid Grid Isolines Display grid points Hotspot analysis Numeric grid Variant (calculated) Variant 0 OK Cancel Help

Also try the other presentation options.

Figure 6: Changing the grid presentation

• To change the colour scale, select the select scale or scale or select the select the



Figure 7: Changing the display of calculation results

• Try the other functions and change the grid presentation.

#### You have now successfully completed your first self-created project. Congratulations!

Note: You can open the Simple.IPR example by selecting the <File | Open Project ...> menu item and then moving to the Examples\Noise\Tutorial subfolder in the INWI installation directory.

Define map content

## 1.2 Traffic noise – Design with scanned-in maps

A major tool for editing projects in IMMI is designing them on the screen on the basis of scanned-in maps. This is illustrated by the following example of a traffic noise project.

## 1.1.5. Fitting the background image

In the first step, a background image is downloaded and fitted. This image will form the basis of the entire project which is established as follows.

- Select <File | New Project> to open the Set project properties ... dialog.
- On the Specification tab, select No Rating from the Select rating method field.
- Move to the Work area tab and define the work area in x- und y-direction by selecting -500 1250 m for the x- and y-values.
- Click OK to close the input dialog.
- To open the background image, select the <Map | Install | Open background image> menu item.
- Click on Add single image to open a new background image.
- Click on Search and select UETTING.BMP from the IMMI installation directory (...\Examples\Noise\Tutorial).

There are four functions to support you in fitting the background image selected:

- 1. With reference points: Enter the number of reference points.
- 2. With image parameters: Define the dimensions of the image (height and width) and specify the image origin.
- 3. With scanner parameters: Enter scale and resolution.

Note: Pictures with georeferencing will be fitted automaticlly.

ge file:	Search
Program Files (x86)\IMMI 2016\Examples\Noise\Tuto	rial\Uetting.bmp
t Colours Options Info	Scheme preview Grid preview
Fit	(722*622)
with reference points	
with image parameters	
with scanner parameters	- June of the second
	- Will ( - warman - ) - D
	TT - I - Olio

Figure 8: Fitting a background image

- Click on the with reference points button.
- The image will be displayed in the preview window. The zooming buttons allow you to zoom into and out of the image.
- Click on the left-hand cross on the Würzburger Straße to set the first reference point. Enter the following coordinates in the dialog for the first reference point:

x = 0, y = 0

- Click **OK** to exit the dialog.
- Click on the right-hand cross and enter the following coordinates for the second reference points:

x = 905, y = 310



Figure 9: Entering reference point coordinates

- Confirm your entries with OK.
- Exit the dialog with OK.
- The fitting result will be displayed. Click on Close to exit the display.
   Result of fitting ×

```
        Number of reference points: 2

        Point:1 ( 0.00: 0.00) / ( 24.00: 221.00)

        Point:2 ( 905.00: 310.00) / ( 707.00: 454.00)

        Image angle: -360 Degree

        Scale
        1.33 Meter per pixel

        Maximum fitting error : 0.00 m
```

Figure 10: Displaying the fitting result

• Close all dialogues.

## 1.1.6. Editing the project - Modeling a road and a building element

In the next step, a road and several buildings are designed on the basis of the fitted background image.

- Choose the **Design** mode from the tool box to the left and select **XP S 31-133** as the element library.
- Initially, design the road axis along the "Würzburger Straße".

Since we start from the fact that the actual assessment area is limited to the background image, the roads should extend a little beyond the image.

Initially, you should digitize the roads only roughly. You can later fine-adjust the course of the road axis by means of the following useful functions: Move, Turn, Move node and Insert node.



Figure 11: Designing the road axis on the map

- Right-click to complete your design. This will automatically open the input dialog.
- Enter Würzburg Street as the element name.
- To enter traffic data, select ADT (average daily traffic load) from the Input field and click on the button for opening the input dialog (2).

• Enter 10,000 in the ADT in vehicles/day input field. The rating periods and emission variants are automatically calculated for Day and Night.

dit: Road /XP S 31-133			×
R96_001 [ 2] Description:		Input ○ Q ● ADT ○ L	eq
Würzburg Street			Leg / dB(A)
Presentation free Standard Ausnahme: Farbe		Day Night	64.72 54.74
EL-Text	Input emission data: Road	I/XP S 31-133	;
Group 🖇 🚮 Group 0	ADT in vehicles/day	10000	
Identifier	Road surface	Asphalt	~
Action radius/m		Day	Night
Note 🖉	Traffic flow	Continuous flow ~	Continuous flow ~
Picture	Q cars in vehic./h	576.00	106.70
	Q trucks in vehic./h	64.00	3.30
Driving direct. /gradient:	v cars in km/h	50.	50.
2 directions / driving on the right	v trucks in km/h	50.	50.
g(max) in % - calculated using z	E cars in dB(A)	32.7	32.7
	E trucks in dB(A)	44.7	44.7
	Leq cars in dB(A)	60.3	53.0
OK Cancel Help	Leq trucks in dB(A)	62.8	49.9
	Leq in dB(A)	64.7	54.7
	OK Cancel	Help	

Figure 12: Input dialog for a road according to XP S 31-133

- From the Road type list box, select **District road** and **Asphalt** as road surface layer.
- Select continuous flow as traffic flow.
- Ensure that the speeds for both passenger cars and trucks is 50 km/h.
- The following emission levels are calculated:

Leq = 64,7 dB(A) Day Leq = 54,7 dB(A) Night

Now try to change the editable values to better understand the influence of the various parameters. As you will see, the new Leq emission levels will be updated immediately, based on the values edited.

- Click OK to quit.
- Enter 2m for the Distance carriageway centreline to road centreline
- Complete your entry with OK.
- Save the project with <File | Save Project as>.

Note: The filename extension of IMMI project files is .IPR.

In the next step, a building obstructing the free propagation of sound will be entered.

 Using the lens S -Select new clipping – zoom into the centre of the map to show the big rectangular house directly at the Road in the clipping.



Figure 13: Zooming into the map clipping to be edited, using the lens

**Note:** You can move the map clipping with using the arrow keys on the keyboard or by pressing the mouse wheel [Edit mode].

• Ensure that you have selected ? - Draw elements in the Design mode.

- Select the 🕨 Building element from the Standard element library.
- Re-digitize the building on the background image. Right-click to close the building automatically.

Since the Open element dialog instantly button (<sup>1</sup>) is activated by default, the appropriate dialog for entering the building parameters is opened automatically.

Edit: Building		>
HAUS001 [ 1]	Constant rel. height /m	10.00
Description:	Building use	
Family Müller	Non residential V	
Presentation 🖬 Standard 🗸		
Exception: Colour Width/mm 0.1 ~		
EIText		
Group 🖬 Group 0 🗸		
Identifier 0		
Oceometry Input	Reflection Wall type	~
Picture		
Ignore area for grid calculation	External wall smooth wall (-1 dB)	~
OK Cancel Help		-

Figure 14: Input dialog for defining a building

- Enter an element name.
- Enter 10 m as constant relative building height.
- Activate **Reflection** and select **smooth wall** as **Wall type** with an absorption loss of 1 dB.

• Complete your entry with OK. The map should now show the following building presentation:



Figure 15: Designed building on the map

## 1.1.7. Changing display attributes

You can, of course, select the type of element presentation as desired.

- Draw three to four additional buildings and set the appropriate individual parameters.
- To change the presentation, select the <Settings | Display attributes | Additional attributes> menu item.

Note: Select Standard to change the default setting.

- This opens the selection list of the various element types. Click on Add to define a new attribute.
- Enter an attribute name in the field **Description**.
- In the Area field: Click on Hatches to select Filled.
- Click on the Colour-Button to select a **Colour**.

In the Line filed: Click on the Colour-Button and select the same colour. •

5	ymbol			Text
Picture 👝 o Show representation in 3D viewer Diameter in 3D viewer /m	_ (5*6) Yes Cube	~ ~ 2.00	Font Horizontal alignment Vertical alignment Text spacing	Select font Centred normal Transparent
Colour	Line		Font size for zoom	Do not change
Line thickness	0.2	~		
Line type		_ ~		
Node marker		_ ~		
Special attributes	None	~		
	Area			Preview
Colour				
Hatches	Filled	~		AsDbV:77
Fill mode	Not transparent	~		Aaburyez

Figure 16: Defining additional attributes

- Exit the dialog with OK and Close the dialog.
- Be sure that you are in mode 🖉 Edit elements. •



- Select a building by left-clicking on the edge of the element. •
- Double-click on the edge of the element. This opens the input dialog of the element where you select the Edit element menu item.
- Select the new defined attribute from the **Presentation** list box.



• Exit the dialog with OK.

Figure 17: Building with different colour attributes

• Do the same with the other buildings.

## 1.1.8. Defining receiver points

In the next step, the essential receiver points are entered. These are the points to be subsequently subjected to single-point calculation.

This can be achieved in two ways:

1) Use the mouse and design as you desire: This requires that you activate the

Receiver point button () in the Standard element library and left-click to position the point on the map in the Design mode.

2) Use the Generate reception points macro: A certain number of receiver points are automatically generated at a building. This has the advantage that, in addition to selecting the exact position (e.g. distance of 0.5 m from the wall of

the building), time can be saved while several different reception point heights are generated (e.g. modelling the various floors).

We use the macro in our example.



Select the **Contract Select** the **Design** mode.

- Left-click on the building on the map to select it. The footer will show the element type and name. The display of the building changes (nodes are shown clearly).
- Right-click to open the pop-up menu.
- Click on the Macros option and select Generate receiver points.



Figure 18: Generating reception points automatically

• Enter the parameters specified in the figure below.

Generate receiver points	×
Align on elements HAUS001 Family Müller	Position relative to element inside outside both sides
✓ Use group	Distance from element ds /m
Group 0 $\lor$	Multiple points per section
Limiting val.[dB(A)]  Day  Night  z-coordinates	
⊖ absolute	All sections
Mode:       Same floor height ∨         Number of floors       3         Ground-floor z0 /m       3.00         Floor height dz /m       2.50	<ul> <li>Document orientation (put north indicator)</li> </ul>
OK Cancel Help	

Figure 19: Input dialog for generating reception points

- The system will now generate receiver points on each building wall always centrally between the bordering nodes. These receiver points are located at a distance of 0.5 m from the wall both on the ground floor and on the second and third floors.
- Complete your entry with OK.

• A list showing the generated reception points appears.

Following receiver points were generated: (38)

777.000						0.000	
IPRC001	Family Mu	iller 1	Gr West   X=	441.94 Y=	190.68 Z=	3.00R	^
IPkt002	Family Mü	iller 1	UF1West   x=	441.94 y=	190.68 z=	5.50R	
IPkt003	Family Mü	iller 1	UF2West   x=	441.94 y=	190.68 z=	8.00R	
IPkt004	Family Mü	iller 2	GF North   x=	470.36 y=	207.74 z=	3.00R	
IPkt005	Family Mü	iller 2	UF1North   x=	470.36 y=	207.74 z=	5.50R	
IPkt006	Family Mü	iller 2	UF2North   x=	470.36 y=	207.74 z=	8.00R	
IPkt007	Family Mü	iller 3	GF North   x=	474.11 y=	217.52 z=	3.00R	
IPkt008	Family Mü	iller 3	UF1North   x=	474.11 y=	217.52 z=	5.50R	
IPkt009	Family Mü	iller 3	UF2North   x=	474.11 y=	217.52 z=	8.00R	
IPkt010	Family Mü	iller 4	GF North   x=	478.61 y=	221.61 z=	3.00R	
IPkt011	Family Mü	iller 4	UF1North   x=	478.61 y=	221.61 z=	5.50R	
IPkt012	Family Mü	iller 4	UF2North   x=	478.61 y=	221.61 z=	8.00R	
IPkt013	Family Mü	iller 5	GF North   x=	481.74 y=	226.37 z=	3.00R	
IPkt014	Family Mü	iller 5	UF1North   x=	481.74 y=	226.37 z=	5.50R	
IPkt015	Family Mü	iller 5	UF2North   x=	481.74 y=	226.37 z=	8.00R	
T k±016	Fami Mü	Ich F	GF N/E	81 79=	9. 7 I=	3. IR	
. 50	ar y M	ilei i/	=X / L1U	/. * *	1/0.04 4-	.5 K	
IPkt '	· iv · i	ller 17	UF25/E   x=	487.90 v=	170.04 z=	8.00	
IPkt052	Family Mü	iller 18	GF S/E   x=	487.39 v=	161.21 z=	3.00R	
IPkt053	Family Mü	iller 18	UF1S/E x=	487.39 v=	161.21 z=	5.50R	
IPkt054	Familv Mü	iller 18	UF2S/E x=	487.39 v=	161.21 z=	8.00R	
IPkt055	Family Mü	iller 19	GF South   x=	481.37 y=	149.23 z=	3.00R	

Close

Figure 20: List of generated reception points

- Click on **Close** to return to the map.
- Save the project with <File | Save Project As ... >.

You can now see the receiver points that have been generated on the various sidewalls. In the next step, the display of the map is switched to 3D mode where it is easier to examine the spatial arrangement.

• To start the 3D Viewer, select the <Map | Edit layer | Generate 3D view >

menu item or click on the Generate 3D-View (<sup>1</sup>) button.

Х

• Deactivate the Apply formal control checkbox.



Figure 21: 3D view of the generated reception points

For detailed information about the 3D Viewer, please refer to the online help or the 3D Viewer Manual.

• Press the ESC key and select Exit to return to the map.

## 1.1.9. Defining compass (Meteorology)

Do not forget the Compass: It is very important for calculations according to XP S 31-133!

- Choose the Design mode from the tool box to the left and select Compass from the standard library.
- Insert the NPFL on the map.

Note: Meteorology according XP S 31-133: Select the <Calculate | Calculation parameters | ... | Parameters for element libraries | XP S 31-133> menu item. This opens a dialog where you can choose or insert meteorology. The meteorology for France according XP S 31-133 appendix 1 is already included.

### 1.1.10. Single-Point calculation

In the following, you learn how to perform an immission calculation at certain reception points.

- To start single point calculation, either click the  $\bigcirc$  button in the header or proceed via the <Calculate | Calculate receiver points> menu.
- In the lower frame of the central dialogue deactivate All.
- Click the button **Selection** under **Receiver points** to select 3 points. Select 3 receiver points at different heights.
- Select the points by means of the arrow buttons.

-			Job	b list		
Ð	doL	P	Point c	calculation		
ô,	State		not cal	Iculated Not saved		
	Project file	۵	W:\wm	ns-daten\S001_IMMI\MMI_A \Road.IPR		
<u></u>	Result file	۵	C:\Use	ers\dr\AppData\Local\ \Erg5967.IRP		
•	Setting 🚯	ď	Copy f	from "Reference Setting" ~		
	Variant 🚯	M	Varian	t 0 ~		
	Receiver points		🗌 All S	Select Receiver points		
	Quantity of results		🗹 Sh	To be calculated Receiver points [3]		Available Receiver points (75)
	Multicore calculation  ACR - automated cluster  Distributed calculation	calcula	ation	IPH001 Family Müller 1 GF Vest IPH002 Family Müller 1 UF1West IPH003 Family Müller 1 UF2West	< «< >	IPH004 Factories point (13)     IPH005 Family Müller 2 UF1North     IPH005 Family Müller 2 UF1North     IPH007 Family Müller 3 UF2North     IPH007 Family Müller 3 UF1North     IPH009 Family Müller 3 UF1North     IPH009 Family Müller 4 GF North
Ð	Mandatory Optional Info	Expre	ss list		>> 44	IPkd011 Family Müller 4 UF1North IPkd012 Family Müller 4 UF2North IPkd013 Family Müller 5 GF North IPkd014 Family Müller 5 UF2North IPkd015 Family Müller 6 GF N/E IPkd016 Family Müller 6 GF N/E
			B	OK Cancel		

Figure 22: Dialog for calculating reception points

- Click OK to exit the selection.
- To start the calculation, click on **Calculate**. The calculation is completed within a few seconds. The result is shown in the Express list.
- Click on the **Results** tab.

• Under Short list, select Noise level and click Show and OK.

Short list		Point calcula	ation		
Noise pred	diction				
Variant 0		Setting: Cop	y from "Refe	rence Setting	1"
		Da	y	Nig	ht
		LV	L r,A	LV	L r,A
		/dB	/dB	/dB	/dB
IPkt001	Family Müller 1 GF West		39.7		29.7
IPkt002	Family Müller 1 UF1West		39.8		29.9
IPkt003	Family Müller 1 UF2West		40.8		30.9

Figure 23: Single-point calculation results - short list

- Study the results, and the numerous functions of lists.
- Click the 😈 button to quit the list.
- Click on another list (black written) and the Show button to see the results on the screen. Additionally, a legend is available, depending on the applicable calculation regulation. If you like you can view all created lists one after the other.
- Once you have finished quit all open dialogues.

#### 1.1.11. The concept for using variants

The established dataset consists of one calculation variant only, i. e. Variant O. That means that, presently, all generated elements are included in calculation. Below, however, we will extend the dataset such that we can generate and calculate selected variants.

To achieve this, enter a further element – a section of a road –in the map.

- Select the **Design** mode and activate the **Draw elements** function.
- Open the XPS S31-133 element library and select the Road element.



• Draw an additional road at the position shown in the figure below:

Figure 24: Adding a road

• Right-click to complete your entry. The input dialog will be opened automatically.

• Enter the parameters describing the street (traffic load, road type, name according to the figure below):

R96_003 [ 2]			oq ⊚ADT⊖Leq	
Linde Street				Leg (dB(A)
Presentation 🖬 [ Ausnahme: [ ] ElText	Standard ] Farbe 🗹 Width/n	~ nm 1.0 ~	Day Night Distance carriageway ce road centreline /m	entreline to
Group 🖇 🚮	Input emission data: Road	/XP S 31-133		
ldentifier Action radius/m	ADT in vehicles/day Road type	900	~	
Note 👔	Road surface	Asphalt	~ Night	
	Traffic flow	Continuous flow	<ul> <li>Continuous</li> </ul>	flow ~
Driving direct. /gradient:	Q cars in vehic./h	51.84	9.60	
2 directions / driving on	Q trucks in vehic./h	5.76	0.30	
g(max) in % - calculated	v cars in km/h	50.	50.	
	v trucks in km/h	50.	50.	
OK Cancel	E cars in dB(A)	32.7	32.7	
	E trucks in dB(A)	44.7	44.7	
	Leq cars in dB(A)	49.9	42.6	
	Leq trucks in dB(A)	52.3	39.4	
	Lonia (D(A))	54.2	44 3	

Figure 25: Input dialog for an additional road

In the following stage of the project, you will create several variants in order to become more familiar with the variants function. For a better understanding of variants and element groups, please read the following excerpt from the manual.

#### Using Variants:

The option of calculation variants allows editing of different variants within one and the same project. That means that, while a variant is calculated, specific elements are activated for or excluded from calculation.
### This requires two steps:

- The first step is to assign elements which are to be activated in one variant but deactivated in another to a special element group.
- The second step is to define calculation variants and to determine the element groups to be activated in the particular variant.

## Using Element Groups:

Element groups form the basis for the calculation of variants. Unless additional entries are made, there is always exactly one element group, i.e. Group 0.

Create the following variants:

- contributions of "Würzburg Street" and "Linde Street" on the 3 reception points,
- contribution of "Würzburg Street" only, and
- contribution of "Linde Street" only.

To achieve this, define these calculation variants in the program.

- Select the <Project | Element Groups + Variants> menu item.
- Activate the Variants tab.
- Click on Add...Würzburg Street to add the "Würzburg Street" variant.
- Enter Würzburg Street in the Label field.
- Complete your entry with OK.

• Proceed as described above to add the Linde Street variant.

No. NAME	Note key	Edit	
0 Variant 0 1 Würzburg Street	- 0 - 1	Add	
	Definition of Variants		
		Name Linde Stree	
	Active groups	Available groups	
		< Group o	
		<<	
iant "Variant 0"		>	
contains		>>	
roup o			
		Menu	
	□ Note		
lose Help			

Figure 26: Creating variants

The default setting of all elements, on being generated, is "Group O". The order of variants aims at assigning different group names to the various elements and to determine the groups to be active in the variants defined so that they are involved in calculation and also to determine the groups to be explicitly excluded so that they will not be included in calculation.

Our variants only differ in their noise causes, i.e. the roads. That is why a new group should be assigned to Würzburg Street and Linde Street. At first, however, new group names must be defined.

- Activate the Element groups tab.
- Click on Add... to enter a new group.
- Enter Würzburg Street.
- Confirm your entry with OK.

• Proceed as described above to define the Linde Street group.

Element groups + Variants				$\times$
Element groups Variants Matrix Compare				
No. NAME	Elements Note key	Edit	Delete elements	
1 Würzburg Street	0 1	Add	more	
		Delete	Up Down	
Element grou	ps [2]	×	Multiple choice	
Element g Linds Stre	oups e¢			~ ~
Element group "Würzburg Street" is active in Variant 0				
ОК	Cancel			
Change assignment by drag and drop				
Close Help				

Figure 27: Creating element groups

The new groups are now defined. The next step is to assign the groups to the variants defined. This is achieved in the Variants tab.

Variant O cannot be edited because, here, all groups are always active. That means that, in our example, Variant O always includes both roads in calculation.

- Activate the Variants tab.
- Select the Würzburg Street variant.
- Click on Edit.... This will open the dialog for the definition of variants.

• Using the arrow buttons in the middle of the dialog, move the "Group 0" and "Würzburg Street" element groups to the left to the Active groups window.

Definition of Variants	×
	Name Würzburg Street
Active groups [2]	Available groups [1]
Group 0 Würzburg Street	< <p>Contraction of the street</p>
	Menu
☐ Note	
OK Cancel Help	

Figure 28: Assigning element groups in variants

- Exit the dialog with OK.
- Now select the Linde Street variant from the list and click on Edit.
- Using the arrow buttons in the middle of the dialog, move the "Group 0" and "Linde Street" element groups to the left to the Active groups window.
- Exit the dialog with OK.
- Activate the Matrix tab to verify the assignment.

Ele	ilement groups + Variants												
E	lemen	t groups	Variants	Matrix	Compare								
	No.	Varian	t				0		1		2		
							Group	0	Würzburg	Street	Linde	Street	
	0	Varian	t 0								5	2	
	1 Würzburg Street												
	2	Linde	Street								5	2	

Figure 29: Matrix showing an overview of the variants including assigned element groups

• Click on Close to exit the dialog.

In the final step, the "Würzburg Street" and "Linde Street" elements must still be assigned to the new group. This is achieved on the elements level.

• Open the input dialog of the "Würzburg Street" element by double-clicking on the element.

Edit: Road /XP S 31-133	X
R96_001 [ 2] Description:	Input O Q @ ADT O Leq
Würzburg Street	Leg / dB(A)
Presentation 🖬 Standard 🗸	Day         64.72           Night         54.74
	Distance carriageway centreline to road centreline /m 2.000
Group 🖇 🌃 Würzburg Street 🗸	Section profile
Identifier 0 Action radius/m 99999	➢ No rating
Note      Geometry Input	
Driving direct. /gradient:	
2 directions / driving on the right 🗸 🗸	
g(max) in % - calculated using z	
OK Cancel Help	

Figure 30: Assigning the element group in the element

- Confirm your entry with OK.
- Proceed as described above for assigning the Linde Street element to the Linde Street element group.

The effects of the variants created can be simply seen from the map.

• Using the arrow button of the **Map tool box** (E), switch between variants and look at the changes in the map.

Map tool box				
$\langle \rangle \oplus$				?
Würzburg Street	$\sim$	۹	►	

Figure 31: Map tool box for switching between variants

Once all assignments have been made correctly, both roads will be displayed whenever you call Variant O. However, if you call the "Würzburg Street" or "Linde Street" variant, only the related road will be displayed.

If you wish, you can make another single-point calculation as described above. You can then also select variants after having selected the reception points.

It is obvious that the variants function is extremely flexible so that a great number of variants can be involved, such as typically with/without noise barrier, with/without by-pass, with/without industrial noise percentage and with/without individual emission sources.

### 1.1.12. Grid calculation

In this chapter you will learn how to calculate a grid.

- Before starting the calculation zoom to the area of the background image.
- Choose <Calculate | Definition | Calculation area> and click Edit... to change the predefined grid. The step size should be 2m x 2m, the height 1,6m.

Define grid				>
Name 2x2m, 1,6m				
Step size Points		from	to	Dimensions
dx /m 2.00 nx 3	300 <b>. x/m</b>	190.00	788.00	598.00
dy/m 2.00 ny 2	200 <b>. y/m</b>	20.00	418.00	398.00
n 600	000 z /m	relative $\sim$	1.60	
Range OWork area ONuGe + []			Use map clipping	g
Rectangle     Vertical grid	I	Ali	gn grid on fixed p	oint
			Copy from	
			Mark wraparoun	đ
OK Cancel Help				

- Click on Use map clipping to take over the area you zoomed.
- Close all dialogues.
- Choose <**Calculate | Calculate grid**> from the main menu or **o** to start the calculation.

•	Choose	the	variant	Würzburg	Street	for	calculati	on.
---	--------	-----	---------	----------	--------	-----	-----------	-----

	Job list
	Jub not
$\mathbf{\mathbf{D}}$	Job 💼 Calculate grid
	State not calculated Not saved
	Project file  W:\wms-daten\S001_IMMI\A \Road.IPR
	Result file C:\Users\dr\AppData\Loca\\\Erg5969.IRD
5	
•	Setting 🚯 🌃 Copy from "Reference Setting" 🗸 🗸
	Variant 🚯 🖬 Würzburg Street 🗸
	Calculation area 👔 2x2m, 1,6m 🗸
	ACR - automated cluster calculation
	Distributed calculation
_	
	Mandatory Optional Info
	12 III The state of the state o
	Calculate 🖄 💥 🕅 🐕

Figure 32: Start the calculation of the grid

- Click Calculate to start the grid calculation.
- After the calculation, select <**Calculation | Save**> in the CCC menu to save the grid.
- Close the dialogue and study the result showing in the map.

## 1.1.13. Further features

The section below treats some features of IMMI once again in more detail so that you will get to know further options provided by the program.

In many cases, you can right-click to open a pop-up menu providing many useful functions.

• Select a building and right-click. This opens the following pop-up menu:

Edit element	
Delete element	
Close element	
Copy element	
Terrain level profile (rolling off)	
Elements	>
Nodes	>
Change	>
Macros	>
Select	>
Collections	>
Special functions	>

• Activate and try the various functions.

## 1.1.14. Documentation

The last section provides information about important documentation tools.

## 1.2.1.1 Building a report page

Print layouts are the graphical basis of reports. A project can contain any number of layouts. These layouts are managed in a list.

A lot of layouts are already predefined in IMMI, e. g. format A4 to A0, portrait and landscape.

The following report is to be created on an already existing print layout. In the first step we will have a look on the print layout.

- Open the menu <Report | Print layouts>
- Choose the page layout A4-Hochformat and click on Edit...
- Have a look on the page layout with the several components. You will find further information in the IMMI online Help.

• Close the layout with OK.

In the next steps several components should be filled with content.

- Open the menu <Report | Report pages>
- Click on Add... to design a new page.
- Enter a name and choose the layout DIN A4 Querformat.
- Choose Switch layout an preserve as much content as possible.



- Double-click on the text field in upper left corner to fill in the component.
- Choose **Own text** and click on **Edit text**.
- Give the report page a headline (e. g. Noise prediction).
- Do the formatting as you like.
- Close the dialogue with **OK**.
- Do the same with the text field on the upper right side and type an address.

- <b>Y</b>	Y
Noise prediction	Î
Content and design [TextFeld]	Wölfel Engineering GmbH + Co. KG Max-Planck-Str. 15 97204 Hoechberg / Germany
🚺 Text editor	- 🗆 X
Denotation: Testbor	
☞■■ ¾ № ® ×№ ♀ A F X U E E E E H & -	
_ 0 + 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 + 11 + 12 + 13 + 14 + 15 + 10 + 17 + 18 + - Noise prediction 	19 - 20 - 21 - 22 - 23 - 24 - 25

- The component Plan/Raster is filled automatically.
- Double-click on the component field to open the input dialogue
- Click on **Design** to change the **Axis annotation** and the **scale bar**.

 $\times$ 

Content and desi	gn [Plan/Raster]
------------------	------------------

Axis a	nd scale	
Axis a class	nnotation: ical annotation ~ font of the axis	
Us	e user-defined scale	
Show bottor	scale bar n right v	
Dis	play scale "M 1:xxxxx"	
⊠ Sca ⊠ Sho ⊡ Dra	ale labelling transparent ow coordinate grid aw axis frame	
Map n	ame ow map name Font for map name	
⊡ Col	lour background for map name	

- Close the dialogue with OK and Close.
- The report page is completed and ready for printing.

# 1.2.1.2 Printing the Map

• Select the <Report | Print> menu item.

Printer:								
Name:	WMS-Allgemein PCL o	n printfix (redirected 2)					~	Properties
State: Type: Port: Comment:	im Leerlauf WMS-Allgemein PCL or TS001							
🗌 Integrate prin	nt-outs into one print job		scale factor for graphics file and clipboard: 1.00					
Show preview	w before printing					-		
Mark several	reports for printing							
Print to file								
						1		
Name		Layout	Paper format	Orientation	Page number	Copies		
Current screen	· · · · · · · · · · · · · · · · · · ·	DIM A4 Heabformat	DIN A4	Hochformat	-1-	1		
current screen	content (Portrait)	DINA4 - Auerformat	DINA	Querformat	- 1 -	1		
current screen	i content (Landscape)	DIN A4 - Querformat	DIN A4	Querformat	-1-	1		
_ current screen	i content (Politali) i content (Landscape)	DIN A4 - Querformat	DIN A4	Querformat	-1-	1		
current screer	i content (Portrait) i content (Landscape)	DIN A4 - Querformat	DIN A4	Querformat	-1-	1		
current screer	i content (Fordan)	DIN A4 - Querformat	DIN A4	Querformat	- 1-	1		
current screer	i content (Fordan)	DIN A4 - Querformat	DIN A4	Querformat	-1-	1		
current screer	i content (Landscape)	DIN A4 - Querformat	DIN A4	Querformat	-1-	1		
current screer	content (Landscape)	DINA4 - Querformat	DIN A4	Querformat	-1-	1		
current screer	content (Landscape)	Dirves Froundinina DIN A4 - Queformat	DIN A4	Querformat	-1-	1		
current screer	content (rotrait) content (Landscape)	DIVA4 - Queformat	DINA	Querformat	-1-	1		
current screer	content (Fordari) content (Landscape)	DIVA4 - Queformat	DINA	Querformat	-1-	1		
current screer	content (Landscape)	DINA4 - Queformat	DINA4	Querformat	-1-	1		

Figure 33: Printing the map

This opens a dialog where you can make settings for the printer and for the graphical representation.

- Select current screen content (Portrait) layout and click on Printing.
- Exit the dialog with Close.

### 1.2.1.3 List of Input Data

A documentation should also contain a list of all input data of the project as well as a list of variants, the dimensions of the work area, etc.

- Select the <Report | List of input data> menu item.
- Select the Sound sources only list and click on Show lists.

- Look at the list.
- Try the various functions.

Road /XP S 3	31-133 (2)							Variant 0	
R96_001	Label		Würzburg Street		Action radius/m			99999.00	
	Group		Würzburg Street		Emi. variant			Emission	
	Number of nodes	i i i i i i i i i i i i i i i i i i i	7				dB(A		
	Length/m Length/m (2D) Area /m³ Emiss. variant Traffic flow		1099.01 0 1099.01 1 1		Day		64.72 54.74 0.00 2 direct/driving on the righ 2.00		
					Night				
					Max gradient % (z-	coord.)			
					Driving direction				
				Dist.:centrel ADT in vehic		e - road /m			
						DT in vehic/day		10000.00	
					Road type Road surface		District road		
				Q car /vehic/h	Q HGV /vehic/h	v car /km/h	v HGV /km/h	Leq /dB(A)	
	Day	Continuous flow		576.00	64.00	50.00	50.00	64.72	
	Night	Continuous flow		106.70	3.30	50.00	50.00	54.74	
R96_003	Label		Linde Street		Action radius/m		99999.00		
	Group		Linde Street 8 797.54		Emi. variant		Emissi		
	Number of nodes	i de la companya de l						dB(A)	
	Length/ m				Day		54.27 44.28 0.00 2 direct/driving on the right 0.00		
	Length/ m (2D)		797.54	797.54 Night Max gradie					
	Area /m²					coord.)			
					Driving direction Dist.:centreline lane - road /m				
					ADT in vehic/day			900.00	
					Road type			District road	
					Road surface			Asphalt	
	Emiss. variant	Traffic flow		Q car /vehic/h	Q HGV /vehic/h	v car /km/h	v HGV /km/h	Leq /dB(A)	
	Day	Continuous flow		51.84	5.76	50.00	50.00	54.27	
	Night	Continuous flow		9.60	0.30	50.00	50.00	44.28	

Figure 34: List of input data

• Additional task: Create an individual list.

# 1.3 Getting started with the calculation of industrial noise

The present example relates to the planned erection of a storehouse for an existing industrial establishment. The property is located in a commercial area.

The construction licensing procedure requires that a technical sound expertise should be submitted, proving that the allowed noise impact values are complied with in the neighbourhood.



## 1.1.15. Local situation and noise impact protection requirements

The terrain of the newly planned storehouse is located to the west of the Rhine-Main-Danube Canal on plot no. 1642. The land development plan includes industrial establishments neighbouring to the south and west. Residential buildings in a general residential area are located to the west, outside the land development plan.

The following relevant receiver points (RP) in the neighbourhood of the planned facility form the basis of the assessment:

RP 1: Second-floor south-facing façade/GE (commercial area)/ 6 m above top ground surface

- RP 2: Second-floor north-facing façade/GE (commercial area)/6 m above top ground surface
- RP 3: First-floor west-facing façade/WA (residential area)/2 m above top ground surface
- RP 4: Second-floor east-facing façade/GE (commercial area)/6 m above top ground surface

The sound impact of the facility to be assessed is determined for the aforementioned relevant receiver points and documented in detail, including the noise impact percentage of all sound sources.

Pursuant to  $L_{den}$ , the following recommended noise impact values (RNIV) are applicable for the rating levels determined from the overall business of the interfering facility noise as a whole in general residential areas and/or commercial areas:

Rating period	RNIV /	′ dB(A)	Rating time	
	WA (residential Area)	GE (commercial )		
During the day 6:00 am to 6:00 pm			16 hours	
During the evening 6:00 pm to 10:00 pm	55	65		
During the night 10:00 pm to 6:00 am	40	50	8 hours	

The facility is reached and left on the service road in the commercial area. There, the traffic immediately mixes with the remaining traffic. From a technical point of view, it is therefore not necessary to examine this issue in detail.

# 1.1.16. Creating the 3D model

The first step includes starting IMMI and opening the prepared project.

- Start IMMI.
- Open the example project **Storehouse.IPR** from the example folder of the installation directory (C: \Program Files (x86)\IMMI ... \Examples \Noise \Tutorial).

- From the <Project | Properties> menu item, select the  $L_{\mbox{\tiny den}}$  rating method.

	r tojeci description
Project template	(D.
Topic	
Noise     In workrooms	
○ Aircraft noise	
○ Pollutants	
Type of prediction	
Noise (national methods)	~
Select rating method	
8	Defat.
	Salety Password: Not provided
Select element libraries	

Figure 35: Selecting the rating method

• Close the dialog box and have a look at the project.

The adjacent buildings and the receiver points (RPs 1-4) have already been plotted. Assign the guideline values to the receiver points based on your rating and pursuant to  $L_{den}$ .

- Double-click on the receiver point (IPkt) to open the input dialog box for a receiver point.
- From the Select land-use type button, select the land-use type according to its name. Enter the guideline values.

Edit: Receiver point		×
IPkt001 [ 4] Description: IO 01 - (GE) Presentation ☑ EIText	Standard v Standard v	Select land-use type Use: Commercial area Limiting val.[dB(A)] Day (12h) 65.00 Evening (4h) 65.00
Group Note Picture	Gruppe 0 🗸 🗸	Night (8h) 50.00 DEN 65.00
Coordinate system Absolute z x /m y /m z rel /m	Globales System ~ 4427208.60 5478999.52 6.00	
OK Cancel	Help	

Figure 36: Enter the limiting values for the receiver points

 Click the arrow keys in the right bottom corner to go to the next receiver point (IPkt). Repeat the above steps for all of the other receiver points. As regards IPkt003, select residential area as land-use type.

The sound impact of the facility to be assessed is to be determined for the aforementioned relevant receiver points and documented in detail including the noise impact percentages of all sound sources.

### 1.1.17. Sound radiation from the storehouse

Business hours of the storehouse are planned on workdays between 7:00 am and 5:00 pm. There will be no business on Sundays and holidays or at night.

# 1.3.1.1 Determining the indoor level and the sound insulation utilizing the databases

On the east-facing side, the planned storehouse will be made of reinforced concrete. Sandwich panels will be used on the remaining facades and on the roof. The business time in the storehouse will be 10 hours. The following emission values

are taken as a basis according to VDI 2571(Sound radiation from industrial buildings; German guideline).

f/Hz	63	125	250	500	1000	2000	4000	8000
Lw (dB(A))	85	85	90	100	100	100	95	95

This covers business in the storehouse.

The sound insulation of the outside components of the storehouse is based on the sound insulation indices of the existing IMMI database.

The sound radiation of the outside components is included in the calculations pursuant to DIN EN 12354-4.

Before entering the indoor levels and insulation spectra, some explanatory remarks have to be made on the internal and external databases of IMMI.

### External databases

Emission and insulation spectra that are frequently used in IMMI can be stored in an external database. The spectrum type can be separately defined for each spectrum, i.e., octave spectrum, third-octave spectrum, linear and A-weighted. This database does not depend on the project and is always available.

When a spectrum is selected from the spectrum database, the values are copied to the sound source. Whenever the spectrum is changed in the database at a later point, the corresponding spectra of the sound sources will not be automatically updated.

You do not have to enter the emission and insulation spectra separately for each sound source. Instead, you can just select the spectra desired.

### Internal databases

If you must expect that you will have to change the spectra while processing the project, e.g., in case of noise control measures, we recommend that you use the internal database. Whenever spectra are changed in the internal database, IMMI will automatically update the spectra of the associated sound sources.

This minimizes the time and effort required for noise control measures (e.g., when the indoor level of the storehouse or the insulation values of the walls are changed).

### 1.3.1.2 Inserting spectra in the internal database

The next step in the project involves creating the emission and insulation spectra for noise-radiating components. Manually enter spectra or import them from MS Excel to fill the internal database.

The following example shows how to enter values manually using the external databases.

The starting point is the emission spectrum for the storehouse.

- Open the internal databases in the <**Project | Internal databases Spectra | Emission spectra>** menu where you can define the octave spectrum for the indoor level of the storehouse. The empty emission spectrum list shows that there are no data yet.
- Click Insert from database to enter the first spectrum.
- Select the first spectrum Sheet metal grind, hammer and click OK.

• The spectrum is applied to the internal database. Click **Edit** to view the spectrum.



Figure 37: Display of the spectrum for the storehouse

• Click OK and Close to close the dialog boxes.

In the next step, enter the insulation spectra for the outside components, gates and windows.

- Open the internal databases for insulation spectra in the <**Project | Internal** databases Spectra | Sound Insulation>.
- The values for the reinforced concrete wall on the east-facing side of the building, the sandwich panels and the windows are already included in the database. Now, enter the value for the gates.
- Click on the end of the list and select Add.

 $\times$ 

 $\sim$ 

 $\sim$ 

efine sound insulation		
Name of component:		Class:
Gates	003	
		Spectrum type:
		Octaves

مام من بين الم الم م الم الم الم الم الم



0.0

63

17.0

Help

125

17.0

250

19.0

500

24.0

1000

31.0

2000

34.0

4000

35.0

8000

35.0

Figure 38: Entering the insulation spectrum for gates

• Click OK and Close to close the dialog boxes.

This completes your input of spectra.

16 31.5

Cancel

40 dB

0 dB

f/Hz

R'/dB

Note

οк

### 1.3.1.3 Erecting the new storehouse

In the next step, erect the storehouse with sound-radiating walls.

• Zoom in the background image in the area of the storehouse.

• The ground plan of the storehouse is already defined as a help line. Click on the help line (name: Storehouse) and press the Enter key to open the input dialog box.

Edit: Help line	×
HLIN001 [ 3] Description: Storehouse Presentation	Properties Simple line Line with arrows Dimensioning line
EIText	Parameters
Group Gruppe 0 🗸	
Oceometry Input	
Picture	
Erect building	
Erect indust. hall	
OK Cancel Help	< < ► + -

Figure 39: Start the function "Erect building" on basis of a help line

- Click the **Erect building** button in the help line input dialog box to generate the building with its sound-radiating and screening elements.
- Enter the parameters as shown in the following picture:

Erect noise emitting	y walls on footprint	:
Name	Storehouse	
z(abs)		
z(bottom)/ m		0.00
z(top)/ m		7.00
Define contou	ır line	
Close ground	l plan	
Generate area	a sound source "roof"	
Activate reflect	tions	
Element groups	Group 0	$\sim$
Collection		~
Sound source	FLQi Area source/ISO 9613	~
ОК Са	ancel Help	

Figure 40: Settings for erecting the storehouse

• Confirm your entry and the prompt whether elements are to be generated with OK and Yes.

As a result of this operation, 4 sound-radiating walls, a sound-radiating roof, a screening house element with activated reflections, and the "roof" reflection surface have been generated.

EFT 001		
ELTOOT	Storehouse/DACH	
LQ1005	Storehouse/WAND1	
LQ1006	Storehouse/WAND2	
LQi007	Storehouse/WAND3	
LQi008	Storehouse/WAND4	
LQ1009	Storehouse/DACH	

Figure 41: List of generated elements

- Click Close.
- The new elements are displayed in the Map. If not, actuate the brush ( $\swarrow$  ).

The erection of the storehouse is completed.

### 1.3.1.4 Designing windows and gates as openings

After having designed the storehouse, create windows and doors and allocate the emissions to the various sources.

- Select the <**Map | Design | Create openings**> ( ) menu where you can model the openings on sound-radiating walls.
- Tick the **Edit adjacent area sources** check box. As a result, IMMI automatically recognizes that the sound-radiating walls form a coherent area.
- Click Area source and select the first area source from the list. Click OK.
- Select Create opening to open the input dialog box.

This opens a dialog box comprising three panels. The left upper panel shows the ground plan, while the left lower panel presents a three-dimensional view where the perspective can be changed. Options are isometric, dimetric, and cavalier. All wall surfaces that belong together can be selected using the navigation bar at the bottom of this panel. The right-hand panel shows the active area sound source with

local coordinates, with the origin being positioned in the left lower corner of the partial area.



- Use the arrow keys to go to WALL 4 (WAND 4).
- Click New to generate the first openings belonging to the current area.
- Enter the following parameters:

Name:	Gate 1
Origin x/m:	5,2
Origin y/m:	0,01
Width /m:	4,5
Height/m:	4,5

- Click OK to confirm your entry.
- Make the same entries for gate 2.

Name	Gate 2
Origin x/m:	20,0
Origin y/m:	0,01
Width /m:	4,5
Height/m:	4,5

In the next step, insert a row of windows on the roof of the storehouse.

X

- Click the arrows on the left to go to the roof element. Click **Yes** to confirm the changed elements.
- Click New.
- Enter the parameters as shown in the following picture. Define openings

Name:		Opening is sound source
Row of windows		Enter source data
Origin x/m:	6.50	
Origin y/m:	5.00	Assign source data
Width /m:	2.00	
Height /m:	10.00	
Area /m²:	20.00	
Area /total /m²:	80.00	
Multiple openings		-
Nx:	4	
dx /m:	3.00	
Ny:	1	
dv /m:	0.10	

Figure 42: Creating a row of windows

• Confirm your entry with OK and Close all dialog boxes.

When calculating the noise impact, INMI automatically takes into account that the openings reduce the area content of the individual walls.

• View the project in detail in the 3D Viewer. Click the 🖤 button in the tool kit to the upper left to start the 3D Viewer.

### 1.3.1.5 Allocating emission data

In this step, the emission and insulation data are allocated to the sound-radiating walls. This can be done block by block for several elements.

• To specify the emission spectra, right-click to select all area sound sources (FLQi) of the ISO 9613 library (Mark all elements) in <Project | Elements | ISO>.

🚺 Elem	ent input															
All	STD	PLOT	BNPM	RLS	PLS	VDI	S03	S03a	028	5011	RVS	ISO	NA	SStr		
SEMI	NORD	NoRa	NoRo	XS31	NF31	CNOS	CRTN	CRN	TRap	SRM2	HI99	BS52	ABSW	HUNG		
Avia	Poll	INTR														
Area s	ource/ISO	9613	[]: 19.3	9m x 3.6	5m	<b>1</b>	Direct Inpu	ıt	~	m	Sort	Click on o	column h	eader		
EZQi						No.	Name	Label		4	Moth	er elemen	t Gro	up		
LTO1 FLO1	11		1			1	FLQi0	Storeh	ouse/WA	ND1			Gro	up O		
WEAL						2	FLQi0	Storeh	ouse/WA	ND2			Gro	up O		
						3	FLQi0	Storeh	ouse/WA	ND3			Gro	up O		
						4	FLQi0	Storeh	ouse/WA	ND4			Gro	up O		
						5	FLQi0	Storeh	ouse/DA	СН			Gro	up O		
						6	FLQi0	Gate 1			FLQi	004 /1	Gro	up O		
						7	FLQi0	Gate 2		Mask all	-	-		<u> </u>		
						8	FLQi0	Row of	wine 📃	IVIDIK DI	element	.5		_		
						9	FLQi0	Row of	of wine Mark element group							
						10	FLQi0	Row of	w of wine Inverse marks							
						11	FLQi0	Row of	Row of wind Put element into focus				_			
								- END	ID OF L Split elements [Multiple choice]				_			
										Copy [N	Aultiple o	hoice]				_

Figure 43: Selecting all area sound sources according to ISO 9613

- First, set the type of the sound source on indoor level.
- Click Edit block.
- Select **Type of sound source** from the data field. Then, select **Indoor level (Lp)** by clicking the button.
- Click Execute and All and OK.

Since all spectra are available as octave spectra, set the spectrum type to octave level (linear).

- Select Overall level or either octave or third-octave band level from the data field. Then, select Octave bands (linear) by clicking the 🕒 button.
- Click Execute and All.

In the next step, the indoor level spectrum is allocated to all sources.

- Select the **Reference spectrum (emission) (Day (12h))** function from the data field.
- Click 🖻 to open the internal emission spectra database.
- Select the Sheet metal grind, hammer spectrum.
- Click OK and Execute.
- Click All to confirm your entry for all sources.

• Close the dialog box.

Insulation spectra are allocated in the same manner.

- First, activate the insulation spectrum function for all sources.
- Mark all elements and select Edit block.
- Select the Is sound insulation defined for the sound source? function, tick the box (HAS...) and confirm your entry with Execute and All and OK.
- Close the dialog box.

Now, allocate the insulation spectra of the east-facing outside wall (Wand2) to the remaining outside walls and to the roof as well as to the gates and the row of windows.

- Double-click Storehouse/WAND2 to open the input dialog box.
- Click (at level input) to go to the dialog box where you can enter the insulation spectrum.
- Right-click in the Insulation field (grey area) and select Sound insulation from internal database.
- Select Reinforced concrete East-facing side wall and click OK.
- Close all dialog boxes to return to the elements list.
- Select the remaining 3 walls and the roof.
- Click Edit block and select Reference spectrum (sound insulation) (Day (12h)) from the data field.
- Click 🗁 to select the Sandwich panels insulation spectrum.
- Click OK and Execute.
- Allocate the insulation spectrum to windows and gates in the same manner.

In the last step, ambient conditions are allocated pursuant to EN 12354-4.

- Mark all sources.
- Click Edit block.
- Select the Select EN 12354-4: Select CDiffuse via space requirements from the data field.

- Click 🗁 to select re. small rooms in front of abs. walls (C=-3dB).
- Click OK and Execute.
- Click All to confirm your entry.

Close all dialog boxes. This moves you back to the map.

# 1.1.18. Non-commercial traffic

Non-commercial traffic involves the arrival of 7 staff members during day time and their departure in the evening. Additionally another 7 occupation cases (14 parking operations) are taken into account during day time for visitor's traffic and traffic at lunch time. 14 parking lots are considered.

Noise emissions are determined according to the integrated method of the Parkplatzlärmstudie (study on parking area noise), chapter 8.2.1.

- Insert a parking lot area at the plot boundary. Use the available help line for your design. Tip: Right-click, change function, edit element type, PLS.
- Double-click the new element to open the input dialog box.

 $\times$ 

• Enter the data as shown in the following picture: Edit: Park. noise study 03

PRKL001 [ 1]		Constant height /m
Description: Car park		Global setting
Presentation	Standard ~	PLS 2007   ISO 9613
EIText		Lw direct input
Group	Group 0 🗸 🗸	Normal case (integrated meth.) $\sim$
Identifier	0	P+R areas ~
Action radius/m	99999	Kpa /dB 0.0 Ki /dB 4.0
🗌 Note 🖉	Geometry Input	Select f = carports per unit of the reference value:
Picture	Openings	P+R area, employees parking area, $\qquad \qquad \lor$
Ignore area for grid ca	alculation	f 1.00
		Asphaltic layer ~
		B 14
		Lw /dB(A) N
		Day (12h) 71.18 0.125 🕞
		Night (8h) 0.000 🗁
		Evening (4h) 71.18 0.125 🔁
English parking area no	ise study:	Rating following:
http://www.bestellen.bay	ern.de/	Lden
OK Cancel	Help	

Figure 44: Defining the parking lot for staff members

- You have completed your entries. Regarding the parameter N the calculation is the following: During day time you have 21 movements for 14 parking lots in 12 hours. This means 21/14/12 = 0.125. During the evening you have 7 movements for 14 parking lots in 4 hours. This means 7/14/4 = 0.125.
- Close the dialog box with OK.

#### 1.1.19. Commercial traffic

The arrival and departure of 4 trucks is assumed per day. The calculation of the sound power is based on the study of the Hessian State Office for Environment and Geology (Book 3).

This study specifies the sound power level for 1 truck > 105 kW per hour on a 1- m route to be 63.0 dB (A), averaged over time.

Model the driveway using the available help line. To do this, select the Line source element of the **ISO 9613** element library and use **Design**.

- Trace the existing help line.
- Right-click to complete the modeling step and to open the input dialog box. Edit: Line source/ISO 9613

LIQi001 [ 1] Description:	Level input ● Direct ○ Expanded
Truck Road	Lw' in dB(A)
Presentation 🖬 Standard 🗸	🗁 Day (12h) 63.00
EI -Text	Night (8h)
	Evening (4h)
Group Gruppe 0 V	
Identifier 0	
Action radius/m 99999	Aircraft segment according to DIN 45684/AzB 2008
Note 🕅 Geometry Input	
Picture	High buildings/high noise sources
	Directivity
	E Rating following:
	Lden
	Diurnal cycle
OK Cancel Help	

Figure 45: Input data for truck driveway

- Enter 63 dB(A) in the direct level input panel.
- Click the folder icon ( $\stackrel{\frown}{\rightharpoonup}$ ) to open the rating according to  $L_{den}$ .
- Enter **4** in the **n-times** field and **1** in the **Impact time/h** field. The one-hour impact time value results from the level specification taken from the Study Book 3 because, there, the value relates to one hour.

×

Rating method Peak level in dB(/ Couple peak le	Lden (): 108.00 evels	ē			Corre For im For to For inf Specia	ction /dB ipulsivity (<= 6 nality (<= 6 dE formation con al correction	5 dB) 3) tent (<= 6 d	B) 0.0
Rating period	i	Duration /h	Emission variant	Lw' /dB(A)	n - times	Impact time /h	dLi /dB	Lw'r /dB(A)
1. Day (12h)		12.00	Day	~ 63.00	4.0	0 1.0000	0 -4.77	58.2 <mark>3</mark>
2. Evening (4	1)	4.00	Evening	$\sim$	1.0	4.0000	0 0.00	
3. Night (8h)		8.00	Night	$\sim$	1.0	0 8.0000	0.00	
ОК Са	incel H	elp						

Figure 46: Truck driveway rating

- Additionally enter the Peak level of 108 dB(A) (= decompression noise of the truck air brake system, Book 3).
- You have now completed your entry and can start calculation.
- Close all dialog boxes.
- The 3D Viewer provides a preview of the model (🔍)

### 1.1.20. Calculating the noise impact at individual receiver points

The rating levels to be expected for the day rating period are determined and documented based on the rating method to be used, including subordinated rules and regulations. To simplify matters, the topography of the terrain is supposed to be flat.

The results of the single point calculations at the relevant receiver points, including the noise impact percentages of the individual sound sources, can be viewed in

the respective lists. Open < <b>Calculate</b>	Calculate receiver points> (	🛡 ) and
start single point calculation.		

• Click **Calculate**. Close any messages that are displayed and start calculation with **Yes**.

		Day (	12h)
		LV	L r,A
		/dB	/dB
IPkt001	RP 1 - (commercial area)	65.0	59.3
IPkt002	RP 2 - (commercial area)	65.0	61.8
IPkt003	RP 3 - (residential area)	55.0	39.4
IPkt004	RP 4 - (commercial area)	65.0	63.7

• Have a look at the results. You should already be familiar with the results lists.

• You can also view the peak levels list to check any values that are too high.

The planned business on the property complies with the percentages of the allowed recommended noise impact values.

The quality of the results meets the standard of the detailed forecast of current standards. The rating levels specified are tailwind averaged levels LAT (DVV). The calculation approaches for the sound sources have been determined based on recognized studies and empirical values gained with comparable facilities and yield reliable values just like the currently known use specifications that are taken as a basis.

The requirements for the protection of the neighbourhood against harmful environmental impact by noise are therefore fulfilled.

# 1.1.21. Calculating the noise impact on areas

The area for which noise impact calculation is to be carried out must first be defined to allow making the grid calculation.

- Zoom in on the storehouse area.
- Go to the <**Calculate | Definition | Calculation areas**> menu to define the calculation area.

• Click Edit and define the grid as shown in the following picture.

Define grid				:
Name 2x2m, 6m				
Step size Points	x /m	from	to	Dimensions
dv/m 2.00 nv 137.	v/m	5478888.00	5479160.00	272.00
n 26441.	z/m	relative ~	6.00	,
Range O Work area O NuGe + II			Use map clippin	g
Rectangle     Vertical grid		Alig	gn grid on fixed p	oint
C Land-use only			Copy from	
			Mark wraparoun	d
OK Cancel Help				

Figure 47: Defining the calculation area

- Do not forget to click the Use map clipping button.
- Confirm your entry with OK and close all dialog boxes.

• Click on the obstitution in the header or go to the <**Calculate | Grid** calculation> menu to start grid calculation.

Define calculatio	on and execute it	
Job list	Calculation mode Calculation Extras: Calculate gr	id Settings
Job list	Job I	ist
	Job Calculat State not calcu Project file $$ C:\User Result file $\boxdot$ C:\User	te grid ulated Not saved s\dr\Documents\Lagerhalle2.IPR s\dr\AppData\Local\\ErgF804.IRD
0	Setting 1 Kopie vo Variant 1 Variante Calculation area 1 222m 6	n "Referenzeinstellung" ~ 0 ~
	Multicore calculation     ACR - automated cluster calculation     Distributed calculation	
Ħ	Mandatory Optional Info	■ ★ \$ 0 % §
Close	Help D	

Figure 48: Starting grid calculation

- Click Calculate. The grid is being calculated.
- After completed calculation, go to the <**Calculate | Save**> menu and save the grid as .IRD file.
- Close the dialog box. The calculated grid will be displayed.



• You have now completed your first industrial noise project.
## 1.4 Creating a conflict map

In your IMMI installation directory, you will find the exemplary data record Staedtep\_Lden.ipr under **<Examples | Noise | Tutorial>**. By way of this example, we will show you how to create conflict maps and difference grids.

To get an overview of the target values for the various utilization types, the representation of a Sensitivity map (Noise target values) is created in a first step.

- In the Toolbox on the left, select the **Thematic maps** mode.
- Click the <sup>45</sup> Sensitivity map button to show the target values. Select an evaluation period. The resulting screen should look like this:



Figure 49: Display of the target values for daytime

 Now, via <Calculate | Calculate grid | Calculate | Open>, load the grid Staedtep.IRD from the IMMI Examples file.

- Select the menu <Extras: Calculate grid | Processing | Evaluate>.
- Click on **Evaluate**. Under **Select operation**, select: **Conflict map**. It is possible to activate all time periods.

The grid that is shown now displays the comparison between the target values and the calculated noise levels.

But the representation could be made even more meaningful for reporting purposes. Accordingly, only exceedences of the target values should be shown. Non-exceedances, though desirable in the interest of noise protection, are not meaningful in the representation of conflicts.

- Quit the dialog for grid calculation.
- In the Toolbox on the left, click on the Solution to redefine the grid scaling.
- Under Scale, select Fixed-linear scale, as well as 0 as a Minimum and 1 dB(A) as Step size. Now, you see the new colour scale in the preview. In the preview, click on the first line ...< 0.0 dB(A) and assign the colour white (bottom right of the colour range chart). Now, the conflict map will be displayed in the desired manner. The conflicts are readily visible.</li>



Figure 50: Conflict map

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