IMMI

Newsletter Edition 2018 – Q1

Wölfel

IMMI – What's new?

Dear IMMI users,

Though the first few weeks of the New Year are already over, I hope you had a good start into the New Year… We wish you all the best for 2018!

Once more, you can look forward to an interesting seminar and event program that we put together for you and that you can find on our website immi.eu/en/training-events. We would be pleased to welcome you all again!

In this newsletter, we would like to take a second look at the subject of CNOSSOS-EU calculation methods and present a very interesting master thesis from the University of Antwerp, which deals with the comparison of the Belgian regulation for calculating road noise with the new calculation method being introduced. Lore Penders, a student at the chair of Professor Cedric Vuye, compared the calculation method SRMII with CNOSSOS-EU using simple test examples using the IMMI software.

On April 25, 2018, the 21st International Noise Awareness Day will take place with the theme „Noise is passé!" In the context of Noise Awareness Day, Wölfel would like to draw attention to this complex topic and inform other companies and local authorities about it. Based on current local projects, we will inform about noise action planning, about the fight against road and rail noise and show how the urban quality of life can be maintained even in densely populated urban areas. Details of the events planned for that day will be available on our website shortly.

I hope you enjoy reading this newsletter!

Your,

Denise Müller and the entire IMMI team

Comparison of the SRM II and the CNOSSOS-EU

Comparison of the calculation method SRM II and the coming European calculation method CNOSSOS-EU Road for the calculation of road noise

In this issue we would like to present an interesting master thesis from the University of Antwerp, which deals with the comparison of the SRM II calculation method used in Belgium for calculating road noise with the new CNOSSOS-EU regulation. We have printed the work in excerpts below. If you are interested in the complete thesis, please do not hesitate to contact the student or us.

The comparison between the 'Standard Calculation Method II' and the 'Common Noise Assessment Methods Europe'

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Introduction

This paper is trying to give an answer to the main research question 'What is the difference between the 'Standard Calculation Method II' and the 'Common Noise Assessment Methods Europe'?'. Different sub questions can be formulated.

- What is the theoretical difference between the two calculation methods?
  – Are there differences in the calculation?
  – Are there other starting coefficients?
  – Are there factors that are not taking into account?

- Are there differences in the used software program?
  – Is there a difference in input for both methods?
  – Are there differences in results with the same input for both methods?

First, an analysis of the differences between the two calculation methods was made. The calculation method of the SRM II is formulated in section 2, the calculation method of the CNOSSOS-EU in section 3. In section 4, there is a practical part, where different simulations were implemented in the software program 'IMMI' by 'Woelfel'.

Section 5 describes the results from the practical part. A summary of all the tested parameters is given. The paper is finalized in section 6 with some conclusions and general recommendations.

Standard Calculation Method II

The Standard Calculation Method II is currently used in Belgium. This calculation method is adopted from The Netherlands. First the road noise sources implemented in this calculation method are described followed by an overview of the calculation method.

Road noise sources

The SRM II divides all the vehicles in three categories and one non-official category. The description of all road vehicle categories is included in Table 1.

Table 1: Classification of road vehicles per category for the determination of noise production with the SRM II

Category	Description
Light vehicles	Passenger cars,Sport utility vehicles, delivery vans < 3,5 tons with only single tyre mounting on rear axl
Medium heavy vehicles	Trucks with twin tyre mounting on rear axle, busses and touring cars
Heavy vehicles	Trucks with three or more tyre mounting on rear axle
Powered two-wheelers	–

Common Noise Assessment Methods Europe

The Common Noise Assessment Methods Europe is a calculation method imposed for all the member states of Europe. This calculation method is based on the current French and Spanish calculation method. First the road noise sources implemented in this calculation method are described followed by an overview of the calculation method.

Road noise sources

The CNOSSOS-EU classifies road vehicles in five categories, see Table 2. The fifth category is an open category allowing the possibility to add sound emission factors in the near future for electric cars.

Table 2: Classification of road vehicles per category for the determination of sound production with the CNOSSOS-EU

Category	Description
Light vehicles	Passenger cars, delivery vans ≤ 3,5 tons, Sport utility vehicles, multifunctional vehicles like trailers and caravans
Medium heavy vehicles	Delivery vans > 3,5 tons, busses, campers etc. with two tyre mounting on rear axle
Heavy vehicles	Heavy commercial vehicles, touring cars, busses, with three or more tyre mounting on rear axle
Powered two-wheelers	A: Mopeds with two, three or four wheels B: Motorcycles with or without sidecar, tricycles and four-wheelers
Open category	This category will be defined according to future needs

For the above mentioned categories, an equivalent sound emission level per frequency depending on the traffic flow exists. With this sound emission level, a total sound emission level can be made.

Case study

A test case was made to obtain objective test results. This case has been kept very simple and easy in order to be able to assign small changes.

The case is built a road of 2,5 km long. This length is chosen to avoid that the surroundings at the end influence the results. An SMA-C road type is used with the correction factors from measured CPX-values.
The whole area around the road is reflective soil, with a relative height of 0 m.The effect of variations in the ground factor is examined.

From experience, the weather influence with the SRM II is limited. For the CNOSSOS-EU, the ratio homogeneous and favourable conditions has to be captured, the standard settings are used; 50 % favourable conditions and 50 % homogeneous conditions. Also the effect of variations in temperature and relative humidity is tested.

The traffic intensity is determined as follows:

- Category 1: 1600 vehicles per hour, 120 km/h
- Category 2: 100 vehicles per hour, 100 km/h
- Category 3: 300 vehicles per hour, 90 km/h
- Category 4: neglected

To investigate the emission factor, the traffic intensity and velocity are adapted. Immission points are used to compare the results of the two methods and are placed at a certain distance from the road.

The exact differences can be determined at these locations. Noise maps from the two methods are made and results can be compared visually.

Results

The results are given for the test case for both methods. All the differences in sound level between the SRM II and the CNOSSOS-EU for the tested parameters are included in Table 6.

SRM II

The sound levels from the immission points for the SRM II are shown in Table 3. Figure 1 visualises the emission of the road noise. The black points on the noise map are the immission points set out on a certain distance.

Table 3: Sound level in function of the distance from the road per height, SMA-C road type with SRM I

Distance	Height: 1,2 m	Height: 4 m	Height: 5 m	Height: 7,2 m
10 m	79,8 dB(A)	79,9 dB(A)	79,8 dB(A)	79,5 dB(A)
30 m	74,0 dB(A)	75,1 dB(A)	75,2 dB(A)	75,3 dB(A)
50 m	71,4 dB(A)	72,2 dB(A)	72,5 dB(A)	73,5 dB(A)
100 m	68,5 dB(A)	67,9 dB(A)	70,4 dB(A)	70,2 dB(A)
250 m	63,8 dB(A)	63,3 dB(A)	66,5 dB(A)	65,8 dB(A)

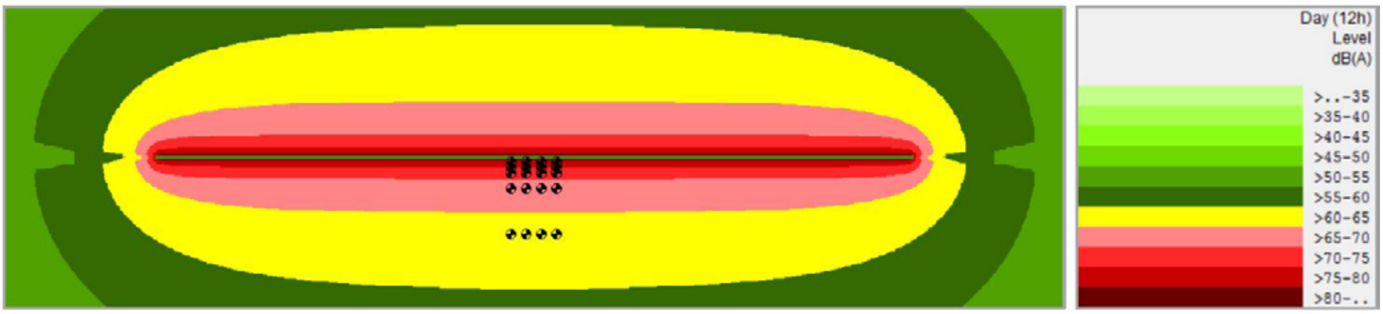


Figure 1: Noise map SMA-C road surface with SRM II

Results

CNOSSOS-EU

The sound levels from the immission points for the CNOSSOS-EU are given in Table 4. Figure 2 visualises the emission of the road noise. The black points on the noise map are the immission points set out on a certain distance

Table 4: Sound level in function of the distance from the road per height, SMA-C road type with CNOSSOS-EU

Distance	Height: 1,2 m	Height: 4 m	Height: 5 m	Height: 7,2 m
10 m	80,7 dB(A)	80,3 dB(A	80,1 dB(A)	79,7 dB(A)
30 m	76,5 dB(A)	75,9 dB(A)	75,9 dB(A)	75,7 dB(A)
50 m	74,5 dB(A)	73,7 dB(A)	73,6 dB(A)	73,5 dB(A)
100 m	72,7 dB(A)	70,7 dB(A)	70,4 dB(A)	70,2 dB(A)
250 m	68,0 dB(A)	66,9 dB(A)	66,5 dB(A)	65,8 dB(A)

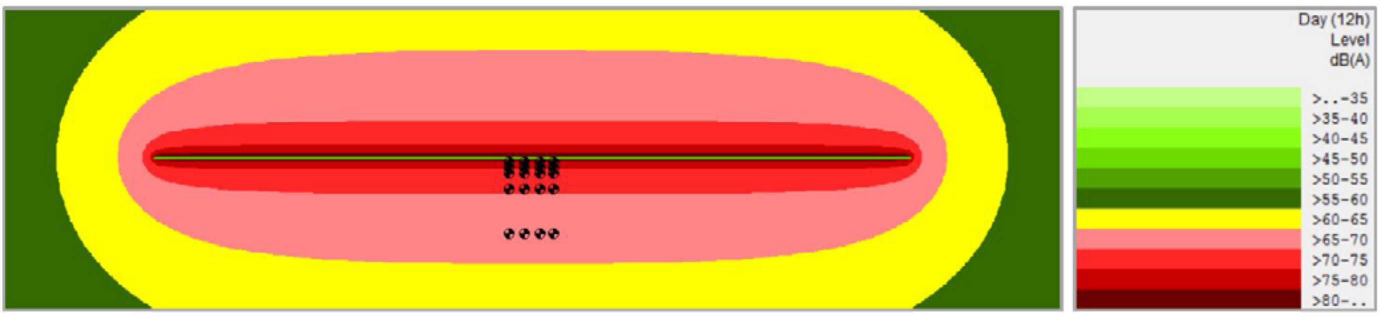


Figure 2: Noisemap SMA-C road surface with CNOSSOS-EU

Difference

To compare the two methods, the results of the CNOSSOS-EU are deducted from the results of the SRM II. The biggest difference is found at 250 m from the road and at 1,2 m height. The SRM II shows a result of 4,2 dB(A) less than the result of the CNOSSOS-EU. The differences are shown in Table 5.

.Table 5: Difference in sound level in function of the distance from the road per height, SMA-C road type with SRM II and CNOSSOS-EU

Distance	Height: 1,2 m	Height: 4 m	Height: 5 m	Height: 7,2 m
10 m	-0,9 dB(A)	-0,4 dB(A)	-0,3 dB(A)	-0,2 dB(A)
30 m	-2,5 dB(A)	-0,9 dB(A)	-0,7 dB(A)	-0,5 dB(A)
50 m	-3,1 dB(A)	-1,6 dB(A)	-1,1 dB(A)	-0,7 dB(A)
100 m	-4,1 dB(A)	-2,8 dB(A)	-2,4 dB(A)	-1,7 dB(A)
250 m	-4,2 dB(A)	-3,6 dB(A)	-3,4 dB(A)	-3,0 dB(A)

At short distance and low height, de differences are low. The differences increases at long distance. This can also be visually seen on the noise maps in Figure 1and Figure 2. At the whole area, the SRM II shows a smaller sound level than the CNOSSOS-EU.

Tested parameters

In Table 6 the differences in sound level per parameter are shown. The values of the CNOSSOS-EU are eliminated from these from the SRM II. In general, the CNOSSOS-EU gives a larger sound level than the SRM II. At certain points, the SRM II gives a larger sound level, these values are marked in bold. With the change of the soil parameter to an absorbing soil, the CNOSSOS-EU gives in general a smaller sound level than the SRM II.

The numbers in Table 6 are referring to the following parameters:

A. SMA-C road type
B. SMA-D road type
C. Chemically washed concrete road type
D. Road in accumulation
E. Road in excavation
F. Road with road bank, 45°
G. Road with road bank, 35°
H. Road with sound barrier at 3,75 m
I. Road with sound barrier at 5,36 m
J. Road with a building nearby
K. Road with an absorbing soil

When considering the different road types, the sound levels are approximately equal. Only the results of the SRM II are often lower than the results of the CNOSSOS-EU. The road types SMA-C, SMA-D and chemically washed concrete are tested, from lower sound level to louder: SMA-D < SMA-C < Chemically washed concrete.

Table 6: Difference in sound level [dB(A)] in function of the distance from the road per height with SRM II and CNOSSOS-EU

	Height at distance: 10 m				Height at distance: 30 m				Height at distance: 50 m				Height at distance: 100 m				Height at distance: 250 m			
	1,2 m	4 m	5 m	7,2 m	1,2 m	4 m	5 m	7,2 m	1,2 m	4 m	5 m	7,2 m	1,2 m	4 m	5 m	7,2 m	1,2 m	4 m	5 m	7,2 m
A	-0,9	-0,4	-0,3	-0,2	-2,5	-0,9	-0,7	-0,5	-3,1	-1,6	-1,1	-0,7	-4,1	-2,8	-2,4	-1,7	-4,2	-3,6	-3,4	-3,0
B	-0,8	-0,3	-0,2	-0,1	-2,4	-0,7	-0,6	-0,4	-3,0	-14	-1,0	-0,6	-4,0	-2,6	-2,3	-1,6	-4,1	-3,4	-3,2	-2,8
C	-1,7	-1,2	-1,1	-1,0	-3,3	-1,7	-1,5	-1,3	-3,9	-2,4	-2,0	-1,6	-5,0	-3,6	-3,3	-2,6	-5,1	-4,5	-4,3	-3,9
D	-2,0	**0,8**	-0,4	-0,3	**0,5**	**0,0**	-0,4	-0,4	-0,9	-1,2	-1,1	-0,5	-1,2	-2,2	-2,0	-1,6	-2,6	-2,4	-2,2	-2,2
E	**2,0**	-0,3	-0,3	-0,2	-3,8	-0,7	**0,8**	**3,0**	-4,2	-1,9	-1,4	-0,1	-4,1	-3,1	-2,7	-1,7	-2,6	-1,7	-1,5	-1,0
F	-3,1	-1,5	**0,3**	-0,1	-5,1	-2,8	-2,4	-1,0	-4,8	-3,3	-3,2	-2,1	-3,3	-3,5	-3,2	-3,0	0,1	-2,6	-2,4	-2,2
G	-6,2	-4,0	-3,3	-1,0	-5,1	-2,8	-2,5	-1,1	-4,8	-3,3	-3,2	-2,1	-3,4	-3,5	-3,2	-3,0	0,1	-2,6	-2,4	-2,2
H	-4,0	-1,6	-0,3	**2,6**	-4,3	-2,7	-2,3	-1,0	-4,0	-3,6	-2,9	-1,9	-3,2	-3,7	-3,4	-2,7	-2,8	-2,3	-2,1	-2,0
I	-4,0	-1,5	**0,5**	**1,5**	-4,6	-2,8	-2,0	-0,8	-4,9	-3,3	-2,6	-1,8	-3,9	-3,5	-3,2	-2,5	-2,9	-2,3	-2,2	-2,0
J	-0,9	-0,4	-0,3	-0,2	-2,4	-0,6	-0,4	-0,5	-3,1	-1,2	-1,2	-0,7	-4,3	-2,3	-1,9	-1,9	-4,4	-3,7	-3,5	-3,1
K	**1,0**	-0,4	-0,5	-0,6	**3,9**	-0,1	-0,4	-0,9	**3,6**	**0,5**	**0,0**	-0,5	**1,2**	**3,1**	**1,8**	**0,3**	-1,5	**1,6**	**1,9**	**2,2**

The emission term

To determine the differences for the emission term with both methods, the traffic intensity and the velocity is variable. The results are per vehicle category, so the influence is good to distinguish. With the halve of the traffic intensity, the emission declines with 3 dB(A). This isn't the case with the velocity; with halve of the velocity, the decline of the emission is different per vehicle category.

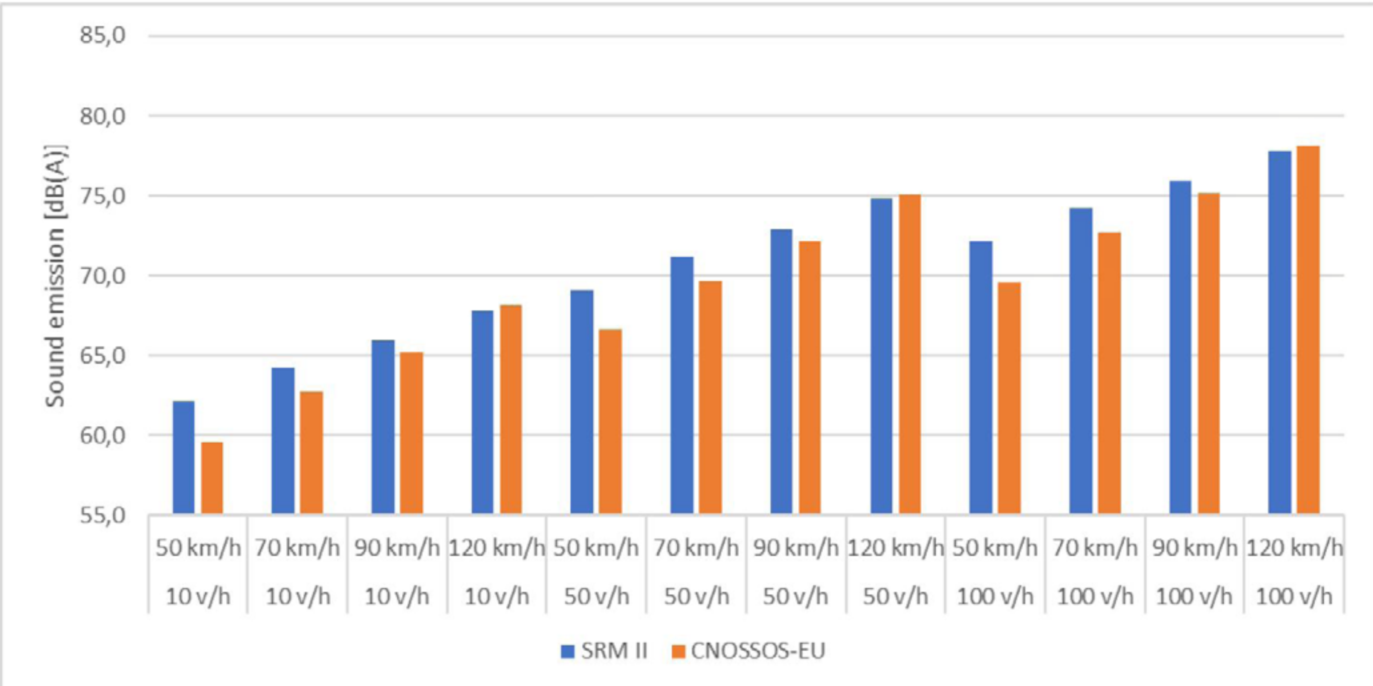


Figure 3: Sound emission level in function of a variable traffic intensity and velocity

Effect of differences with the soil

In general, a difference in soil has a larger effect on the sound level with the CNOSSOS-EU than with the SRM II. This can be seen in Figure 4 for the SRM II and in Figure 5 for the CNOSSOS-EU.

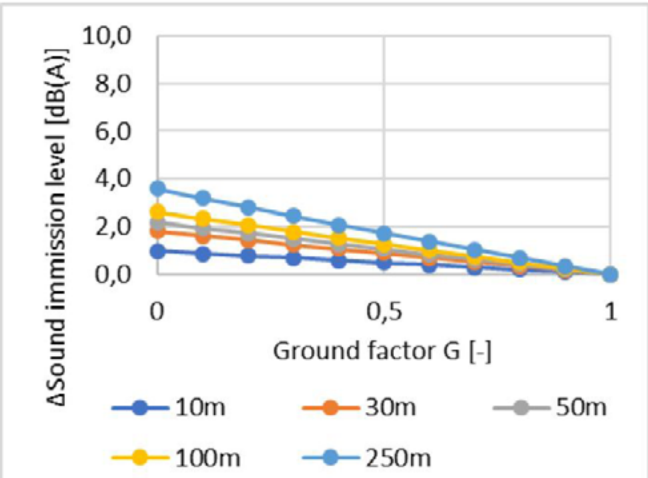


Figure 4: Relative sound immission level in function of the ground factor at a height of 7,2m with a variable distance to the source with the SRM II

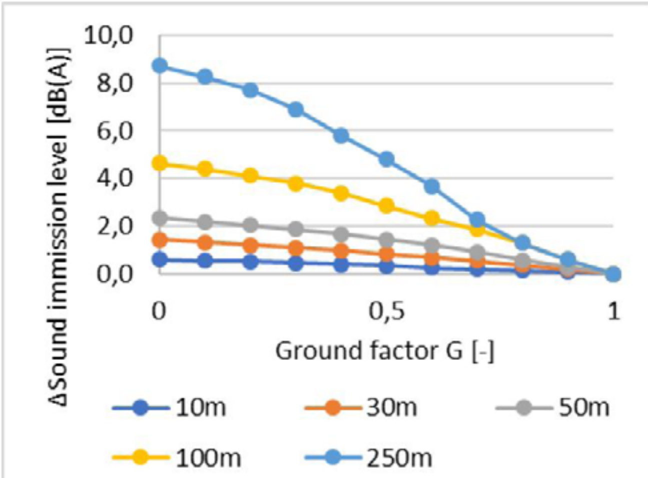


Figure 5: Relative sound immission level in function of the ground factor at a height of 7,2m with a variable distance to the source with the CNOSSOS-EU

The greater the distance, the influence of the soil increases. For the SRM II there is clearly a linear relationship. For the CNOSSOS-EU, the curve is not linear.

Effect of different meteorological conditions

For the SRM II the emission term and the immission sound level stays the same, whatever the meteorological conditions. For the CNOSSOS-EU, this is different. The emission term depends on the temperature. The relative humidity hasn't an influence on the emission term. The emission relative to the emission at 20°C is set out in Figure 6.

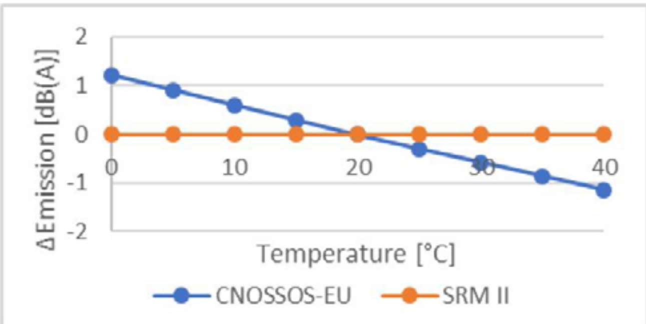


Figure 6: The relative emission in function of the temperature for the SRM II and the CNOSSOS-EU

The relative humidity surely has an influence on the immission term. The further away from the road, the higher the influence. The higher the temperature, the influence declines. The lower the relative humidity, the lower the sound levels.

For the CNOSSOS-EU, homogeneous and favourable conditions are determined. This means the percentage favourable conditions in a specific wind direction has to be known. This has the consequence that the sound levels can be different at different sides of the road if the percentage favourable conditions is variable in the wind directions.

Conclusion

Firstly, both calculation methods are compared and the main influencing parameters are analysed. Next, a simple test case is used to calculate the actual differences in calculated sound levels using both methods.

A first big difference is the extra vehicle category used in the CNOSSOS-EU. When you consider this category, the calculation will already start with a bigger sound emission.

A second difference is the way of calculating all the side factors. Both methods consider a lot elements, but in a different way. The SRM II uses a lot of values from researches. The CNOSSOS-EU always calculates the different parameters and corrects them with a factor. This factor is different for each vehicle category and each octave band.

The transition from a point sound source to a line sound source is vague. The software programmer can decide how to make this calculation. In both methods, this happens in another way, which is visible in the noise maps in Figure 1 and Figure 2 from the simulations.

The road in accumulation gives little differences between both methods. The biggest differences are visible at the highest distances, the CNOSSOS-EU generates higher sound levels than the SRM II. At the lower distances, the differences are divergent, sometimes the SRM II shows higher sound levels than the CNOSSOS-EU.

The road in excavation shows bigger differences for both methods at short distances. The differences become smaller at a longer distance. Also, at short distance, the differences are divergent, although, at long distance, the CNOSSOS-EU shows higher values than the SRM II.

The road with an increased road bank shows relative low differences at a short and long distance. The differences are the highest at an average distance from the road. The CNOSSOS-EU generates most of the times higher sound levels then the SRM II.

A road with a sound barrier shows that the sound levels of the CNOSSOS-EU are higher than those of the SRM II at low altitude and at a long distance from the road. At high altitude at a low distance, the SRM II generates higher sound levels than the CNOSSOS-EU.

With the comparison of a road bank and a sound barrier, the conclusion can be made that at a short distance the sound barrier is better and at a long distance, the road bank is better.

The sound levels from the CNOSSOS-EU are clearly higher than those from the SRM II due to the proximity of a building.

The difference between a reflective and an absorbing soil using the same method is pretty high. The reflective soil generates higher sound levels than the absorbing soil. The differences are higher with the CNOSSOS-EU than with the SRM II, although the range of differences is bigger with the CNOSSOS-EU. The comparison between the two methods shows higher sound levels with the SRM II at a long distance from the road. At a low distance from the road, the CNOSSOS-EU generates higher sound levels. Only at the lowest height, this doesn't count, it is the exact opposite.

In contrast to the SRM II, the noise emission level is higher than that of the CNOSSOS EU. When the velocity increases, the difference becomes smaller. Only with the light vehicles, the noise level of the SRM II is exceeded by the CNOSSOS-EU.

When varying the ground factor in the software IMMI, it is clearly visible that the CNOSSOS-EU takes more account of the soil than the SRM II.

The effect of the temperature on the emission sound level is huge with the CNOSSOS-EU. With the SRM II, this side factor is completely ignored. When looking at the immission level, it is also dependent on relative humidity with the CNOSSOS-EU. This in contrast to the SRM II, the immission level is not dependent on temperature or relative humidity. The meteo correction term for the SRM II is a general correction that applies to all situations, independent of the temperature or the relative humidity. For the CNOSSOS-EU, a percentage of favourable conditions must be entered in the software. This can result in more accurate results due to the wind direction dependence

Based on the simulations, a general conclusion can be made that the CNOSSOS-EU bigger sound levels generates than the SRM II due to the difference of making a line source from a point source or due to the difference in making the calculations of the side factors.

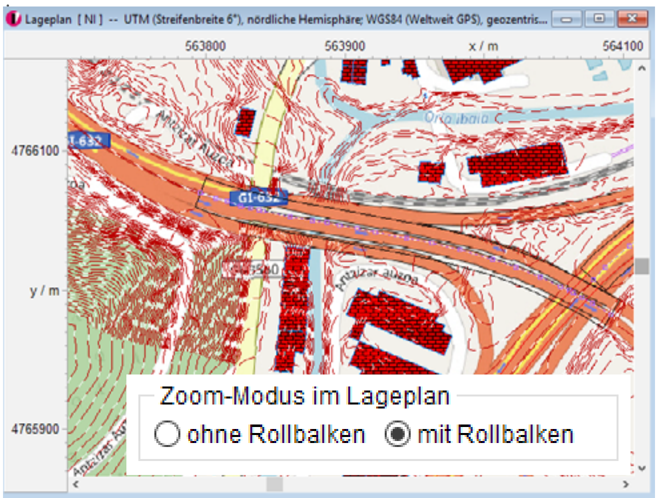
Acknowledgments

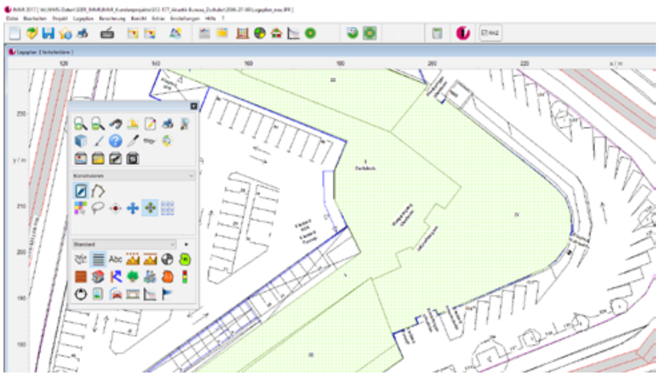
The authors would like to thank the Wölfel Group for providing a free version of their IMMI software.

Tipps and Tricks

Tip 1: Scroll bar for a better overview / zoom mode in the site plan

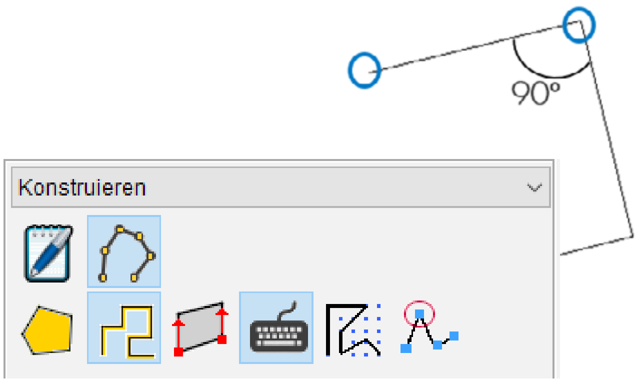
Using the scroll bars, you always have a full overview of your site plan. You can activate them in the menu <Settings | Environment | Work area>.





Tip 3: Designing elements with right angles

You can easily lay out elements, such as buildings, at right angles. Simply activate the function -right angles in the toolbox in the design mode.
After drawing the first line, the next line is added at a 90° angle.



Tip 2: Movable toolboxes

Switching to movable toolboxes gives you even more space for working on the site plan. You can find the function in the menu <Map | Toolbox: mobile vs. off>.

Here you will find special offers for our customers

Rental conditions for the IMMI software, limited time only

You can now rent the software! Depending on the equipment required, we will charge you the rental price according to your custom package.

As a rule: In the 1st month, the lease amounts to 15% of the package price. Thereafter, we charge a monthly lease of 7%. The term of the lease is at least one (1) month. If the package is continuously leased for three (3) months, 80% of the lease is deducted from the package price upon acquisition of the program.
All prices are in EUROS plus VAT. Delivery is ex works Höchberg/Germany, incl. packaging, excl. transport, insurance and all taxes (INCOTERMS 2000).

IMMI – Ready for the future?

CNOSSOS-EU Regulations for the calculation of road, rail and industrial noise

Strategic noise mapping for road, rail, industrial, and aircraft noise in Europe is being carried out in accordance with Directive 2002/49/EC since 2007. Since then, the noise maps are reviewed and revised every 5 years. In 2008, the European Commission (EC) launched the project "Common Noise Assessment Methods in Europe" ("CNOSSOS-EU") to define common calculation methods for noise assessment. These were published in 2012.

In 2015, Directive 2015/996 on the establishment of common noise assessment methods in accordance with Directive 2002/49/EC was published, stipulating that the new calculation methods be applied for strategic noise mapping in all member states from 31 December 2018. With IMMI you are ready for the future! Since version 2016, the calculation methods for road, rail and industrial noise are available.

For our customers with the maintenance contract

Special offer for the exchange of current European calculation methods (according to EU Directive 2002/49/EC) for the future European regulations (CNOSSOS-EU)*

- One element library (e. g. XP S 31-133)
  € 500.00
- Two element libraries
  (e. g. XP S 31-133 and ISO 9613-2)
  € 750.00
- Three element libraries
  (XP S 31-133, ISO 9613-2, SRM 2)
  € 1,000.00

Special offer for the purchase of future European regulations under Directive 2015/996 (CNOSSOS-EU)*

- One CNOSSOS-EU element library
  (e. g. CNOSSOS-EU Road)
  € 1,425.00
- Two CNOSSOS-EU element libraries
  (e. g. CNOSSOS-EU Road and Rail)
  € 2,100.00
- Three CNOSSOS-EU element libraries
  (CNOSSOS-EU Road, Rail and Industry)
  € 2,600.00

*25 % discount for customers with the maintenance contract already included; all prices are in EUROS plus VAT. The offer is valid until the end of 2018!

For further information,
please contact your local reseller:
www.woelfel.de/en/company/distributors

Performance – knowledge – experience – expertise

We are happy to announce our IMMI lectures for the next year. You can find an overview of all dates on our Website.

Our training program:

- Wölfel-Dialog Teilnahme am internationalen Tag gegen den Lärm, Höchberg, 25.04.2018
- Wölfel-Dialog IMMI 2018 – Neue Entwicklungen, neue Möglichkeiten, Höchberg, 03.05.2018
- Seminar IMMI – Grundlagen, Höchberg, 12.-13.06.2018
- Seminar IMMI – Gewerbe- und Industrielärm, Höchberg, 14.06.2018
- Seminar IMMI Grundlagen, Höchberg, 16.-17. 10.2018
- Seminar IMMI – Anwendung Luftschadstoffe, Höchberg, 18.10.2018
- Seminar IMMI – Basic (Englisch), Höchberg, 13.-14.11.2018

Events and exhibitions:

- DAGA, München, 19.-22.03.2018
- Euronoise, Kreta, 27.05-31.05. 2018
- Lärmkongress, Stuttgart, 07.-08.06.2018
- Internoise, Chicago, 26.-29.08.2018
- Euroregio und Tecniacustica, Cadiz, 24.-26.10. 2018

Wölfel group of companies

The Wölfel Group consists of three companies which have more than 80 employees who are engaged in challenging solutions in the field of vibrations and acoustics.

- Wölfel Engineering focuses on engineering solutions in our central spheres of competence, i.e., vibrations, structural mechanics and acoustics. Our service offer comprises professional opinions by a consulting engineer and turnkey supply of a system for the solution of vibration problems.
- Wölfel Monitoring Systems is the company for the development, production and sale of customized measuring and monitoring systems for oscillations, vibrations as well as sound and noise impact protection, including the associated services. In addition, Wölfel Monitoring Systems is a system house which provides technical support, training courses and application advisory service.
- Wölfel Wind Systems focuses on serial production and delivery as well as installation of SHM and CMS systems and systems reducing vibrations and structure-borne noise for both onshore and offshore wind turbines.

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