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SoundPLAN 7.3 release

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This Net Info outlines the most important news in SoundPLAN 7.3 related to the Nordic standards.

Volume Attenuation (also available in 7.2).

This object type is mainly used to model attenuation from forest. The properties of this object type have been totally revised. In older versions the attenuation was found by multiplying the length of the transmission path through the volume by a user defined but frequency independent attenuation factor. This approach was not in accordance with any Nordic standard. Now the user can select between several calculation methods depending on the used standard.

For projects done with RTN96 and NMT96 this is hardly relevant. RTN96 basically leaves it to the user to guess an attenuation within the range 3-6 dB(A), whereas NMT96 does not deal with attenuation from forest at all. If you in spite of that – and on your own responsibility – want to deviate from the standard and take a forest into account you can now define a frequency dependent factor which will be multiplied by the length of the transmission path through the forest, see Fig 1.

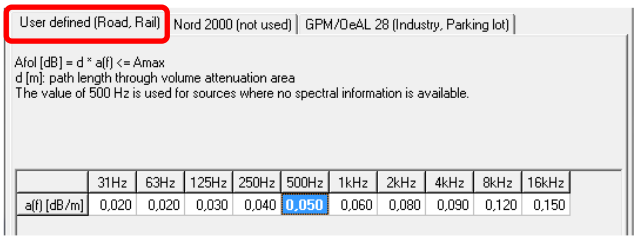

Fig 1 Input mask for volume attenuation properties, user defined.

General Prediction Method (GPM) defines a way to take vegetation into account. This you can now fulfill, see Fig 2.

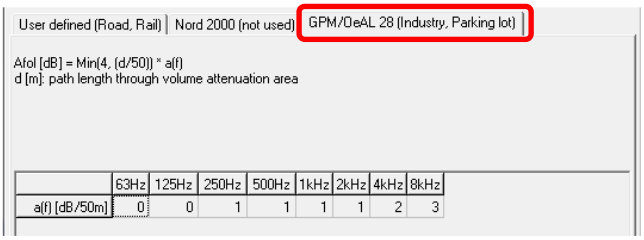

Fig 2 Input mask for volume attenuation properties according to GPM.

As for NORD2000 the program needs further input, see Fig 3 (Factor kp is a constant of proportionality which for forest is 1,25; the absorption coefficient for trees can in general be set to 0,1). So far we have no official guidelines as how to define tree density and stem size in specific projects so the new feature is not expected to be widely used, but at least SoundPLAN is ready whenever someone publishes such guidelines.

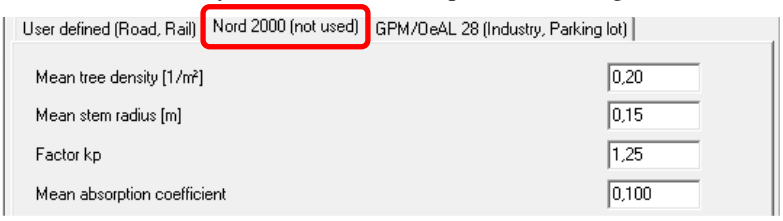

Fig 3 Input mask for volume attenuation properties according to NORD2000.

NMT96 double screening selectable (also available in 7.2).

The propagation model in NMT96 is almost identical to GPM. GPM allows two screens that fulfil certain conditions to produce double screening with up to a limit of 40 dB. So did the implementation of NMT96 in SoundPLAN since the first version. But recently a specific project gave rather absurd results in a case in which double screening occurred. This project made the programmers study the basic report on NMT96 an extra time. The report states (on page 18):

"The obstacle or part of the ground that gives the highest screening effect, is used in the case of multiple screens".

In other words: Double screening is not allowed in NMT96. This difference between NMT96 and GPM the programmers have not been aware of. This means in fact that no matter the dimensions and position of two screens intersecting the transmission path, the screening cannot exceed 20 dB according to NMT96.

This might cause NMT96 to return results which in some cases are very different from what can be measured. On one hand SoundPLAN must follow rules. On the other hand there might be jobs where you are not obliged to follow rules, but instead are more interested in reaching a level that comes close to what you would measure. For this reason we have introduced a switch so you can select between single or double screening in calculations with NMT96, see Fig 4.

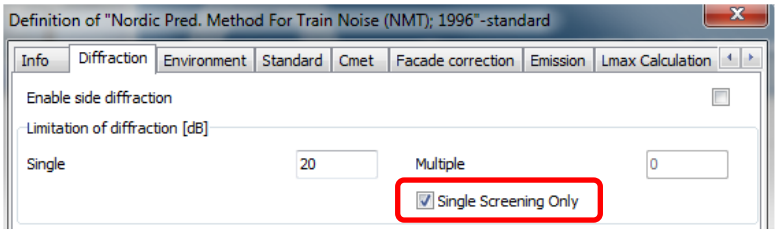

Fig 4 Enable/disable double screening

Default single screening is enabled, see Fig 4. This setting should be kept if you want to fulfill NMT96, e. g. in freshly generated projects. However, when updating existing projects with the new version, single screening is disabled! This solution was chosen in order not to risk huge deviations (in worst case up to 20 dB) compared to former results.

RTN96 reflection point on ground found by mirroring the source (also available in 7.2)

The ground effect according to RTN96 depends on the ground properties in the point of reflection. In the basic report on RTN96 it is not described explicit how to evaluate the point of reflection. For simplicity the implementation in SoundPLAN has always assumed that the point is located half way between source and receiver. In models with relatively big receiver height this led to unexpected shape of contour lines in areas behind (when seen from the source) hard areas surrounded by soft ground.

This issue has been discussed with the developers of RTN96 who did not approve our former approach, but instead have recommended using mirroring principles, see Fig 5. This is now introduced in version 7.2/7.3.

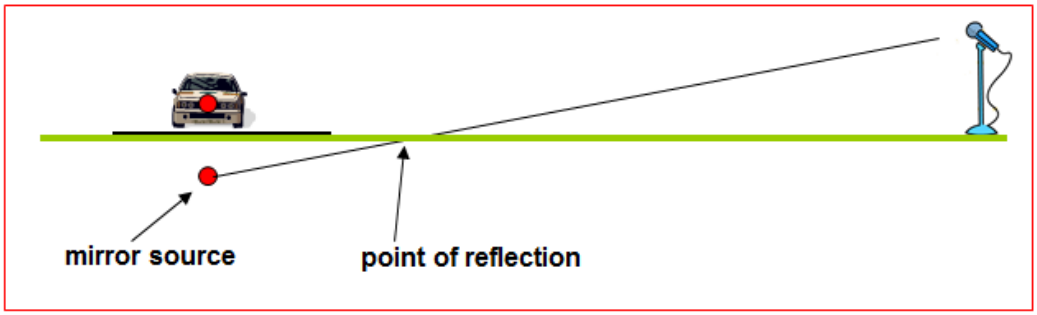

Fig 5 Evaluation of reflection point according to new approach

Like with the screening in NMT96 we leave it to the user to decide which method to use. In the settings of RTN96 you can select which reflection point to use, see Fig 6. If you tick for 'Use improved method…' the mirroring principle

illustrated in Fig 5 will be used. It is recommended keeping the tick mark in new projects, which is also the default setting (and the setting recommended by the developers of RTN96). If you don't want to risk new results in old projects you convert and run with the new version, you should however remove the tick mark which will make the program use the former reflection point. TAKE CARE: Converting old projects into the new 7.2/7.3-format will activate 'Use improved method….', so it is your job to remove the tick mark if you want to stay with the old reflection point.

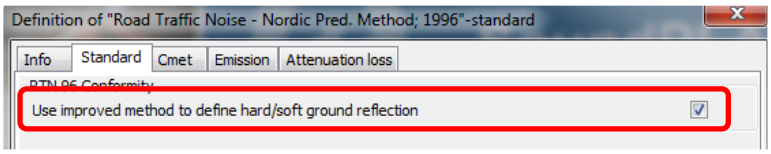

Fig 6 Enabling the new position of the reflection point in RTN96

Lmax rail according to NORD2000 now under unfavorable weather conditions (not available in 7.2)

Ever since the first implementation of Lmax rail according to NORD2000, SoundPLAN has calculated the level under 'average' weather conditions. When official test cases were published it became clear that something was wrong. It turned out to be the weather conditions that SoundPLAN assumed; the developers of NORD2000 informed us that Lmax was supposed to be calculated not as an Lmax value averaged over a meteorological standard year ('average max'), but under most unfavorable weather conditions ('max max', causing higher levels). This has been implemented in SoundPLAN 7.3 (without a possibility to select between 'average max' or 'max max'). At the same time the calculation procedure itself was changed so it now fully complies with the procedure described in NORD2000.

The new implementation will definitely return new results for Lmax rail. The increase depends on various parameters, among others the propagation distance, but will typically take values within the range 0 – 5 dB.

New Road Day Histograms for NORD2000 Road (not available in 7.2)

The Danish System lib now includes new road day histograms published by Danish Road Directory (Håndbog - Nord2000. Beregning af vejstøj i Danmark, Miljøstyrelsen og Vejdirektoratet, Rapport 434 – 2013, ISBN e-udgave : 9788770607421; ISBN Trykt udgave : 9788770607438, Vejdirektoratet 2013).

New Road Surface corrections for NORD2000 Road (not available in 7.2)

The Danish System lib now includes new road surface records published by Danish Road Directory (Håndbog - Nord2000. Beregning af vejstøj i Danmark, Miljøstyrelsen og Vejdirektoratet, Rapport 434 – 2013, ISBN e-udgave: 9788770607421; ISBN Trykt udgave : 9788770607438, Vejdirektoratet 2013).

New records in the train table for NMT96 and NORD2000 (partly available in 7.2)

The Danish System lib has been extended with records for some tramways and a couple of trains, Fig 7.

32	S-M28/29 Gothenburg Tramway
33	S-M31 Gothenburg Tramway
34	S-M32 Gothenburg Tramway
35	N-BM72
36	S-X40

Fig 7 New train records

New side screening in GPM (not available in 7.2)

GPM prescribes that in order to produce screening the horizontal dimension (perpendicular to the source-receiver line) of a barrier must be greater than the wavelength. This condition causes the screening to drop suddenly to 0 at a certain point when decreasing the width of the barrier. Such 'on/off'-conditions tends to cause strange looking contour lines, in this case near ends of barriers and corners of buildings. For this reason the producer of SoundPLAN chose to deviate from the standard when this was first implemented in the program many years ago. Instead a 'homemade' algorithm made sure the screening was gradually decreased with decreasing width of the barrier.

This deviation from the standard was not written down anywhere and none from the current team of programmers knew about it, including your distributor. At the same time no official test case challenged this specific condition in GPM. But a customer revealed the deviation by comparing results with SoundPLAN up against results with other software.

The condition in GPM would be fairly easy to implement, but replacing the gradual limitation of the screening by an 'on/off'-condition seemed to be a bad solution. Birger Plovsing, who developed crucial parts of NORD2000, proposed to introduce a gradual limitation of side diffraction in the same way as GPM already is doing it for the vertical screening (parameter C_h). The SoundPLAN producer has adopted the idea, so from now on the parameter Ch in GPM (4.5.8) has been replaced by $C_h \cdot C_{rl}$ where

$$C_{rl} = \frac{f_c}{340}\left|P_r P_l\right| \sin\left(\Theta_S\right)$$

We have performed tests with the new implementation. A medium size industry noise project was calculated with the original 'homemade' algorithm, a full implementation of (4.5.1) in GPM and finally with 'Birger Plovsing's factor'. More than 2000 results were studied (256 sources and 8 receivers) and the conclusion was that 98,6% of all results remained unchanged (within +/- 0,01 dB), if we switched from the 'homemade' algorithm to Birger Plovsing's factor whereas when switching to a 'clean' implementation of GPM the number of unchanged results were a bit lower, 97,9%. The biggest change we found for any source when switching from the 'homemade' algorithm to Birger Plovsing's factor was 0,8 dB. Receiver levels tend to go up a bit if they change at all.

For Danish users of SoundPLAN it might be of special interest to know that we have informed Referencelaboratoriet and Miljøstyrelsen about this change in our implementation of GPM. We expect a note on the homepage of Referencelaboratoriet will soon announce that calculations done with Birger Plovsing's factor are in accordance with Danish official guidelines.

Status for testing SpoundPLAN 7.3.

GPM:

All official test cases (including those in Report no. 32 from Danish Acoustical Laboratory + Miljøstyrelsens Referencelaboratorium Orientering 37 + Sammenlignende målinger #14 and 15) are fulfilled.

RTN96:

Official test cases in report AV1059/97 from DELTA Acoustics & Vibration fulfilled when it comes to the 'countryside' cases; for the 'town' cases however not all official results can be reached with the current version of SoundPLAN. Especially our results for Lmax in backyards, Rec 2-4, see Fig 8, deviate from the official results. The SoundPLAN team is working on this issue.

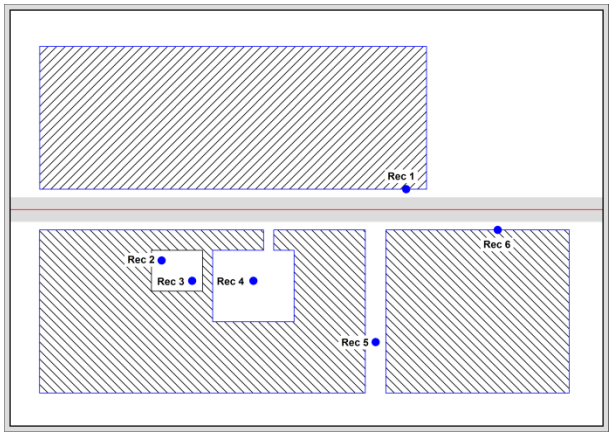

Fig 8 'Town' cases from AV1059/97

NMT96:

Official test cases do not exist. The Danish institute DELTA has worked out a report with test case, and the report was just about to be published when the Danish EPA approved NORD2000. For this reason the report was never published. But we have a draft of the report and we fulfil all cases.

NORD2000 Road:

We have been informed that NORD2000 is currently under revision and at least one error was found which might affect the official test results (published in Environmental Project No. 1335 2010 Miljøprojekt from the Danish EPA). As soon as the test cases have been updated and published (planned for spring 2014) we will check our implementation. Relative to the current official test cases we are outside the tolerance in these cases:

a. Straight road (case #103, 113, 121-124), number of differences 24, max deviation 2,4 dB
b. Curved road, number of differences 402, max deviation 23,5 dB
c. City street, number of differences 14, max deviation 1,7 dB

NORD2000 Rail:

Official test cases published in 'Test cases for railway noise NORD2000, Environmeltal Project No. 1391 2011'. All results obtained by our implementation.