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Moving point sources **SP Net info 99**

Uploaded: 26.11.2013
Latest revision: 27.01.2015

Moving point sources can be modelled in different ways. The most convenient way depends in the first place on the time history for the activity and secondly if the source is moving randomly around inside an area (like a wheel loader working in a gravel pit) or if the source continuously is following a fixed path from A to B (like a fork lifter constantly operating between two buildings or between a delivery truck and an unloading platform).

The general equation to work out the equivalent noise level during a reference period is:

$$L_{Aeq,T} = L_{WA} + \Delta L_{corr} + 10 \times log \frac{t}{T} \qquad (1)$$

where: L_{WA} = A-weighted unit sound power level [dB]

ΔL_{corr} = sum of propagation parameters (ground correction, screening, air absorption …) [dB]

t = active time during reference period [h]

T = reference period [h]

<u>Source moving inside area during specific time periods</u>

This situation basically is like modelling a stationary point source with known operating time. The only difference is that by using the area source object type the emission can be spread over the relevant area instead of radiated from a point.

Fig 1 shows and example. The emission is defined by the <u>unit sound power</u> level L_{WA} (e. g. 116,6 dB(A) for a caterpillar (record #20 in the Danish emission lib)), and the time history t is specified in min/h.

During calculation SoundPLAN spreads the emission evenly inside the area. If the source during the reference period operates more often in one part of the area than in another, you might have to divide the total area into minor areas with their own time histogram.

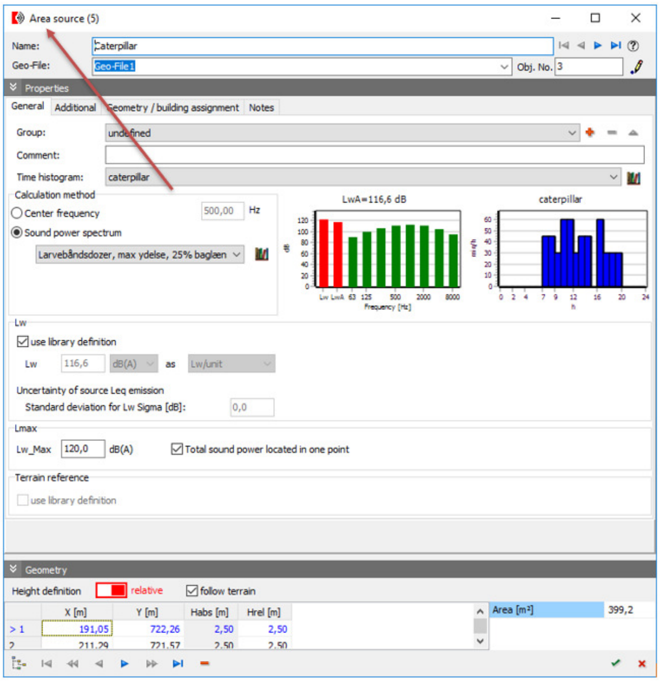

Fig 1 Area source modelling a point source moving randomly inside area

If you are asked to calculate L_{max} you must also tick for 'Total sound power in one point' (and insert a (guessed?) value for Lw_Max). (Hint: remember to tick for 'follow terrain').

Source moving along fixed path during specific time periods

In fact, this is a special variant of the situation above, just that the area 'shrinks' into a line. Use instead the line source object type and defined the emission by the unit sound power level L_{WA}. Time history as above.

In both situations SoundPLAN spreads the emission evenly inside the area/along the line and during the calculation the area/line is cut into subsegments according to the chosen dissection parameters in the settings for the standard, see Fig 2. To each subsegment the program internally assigns a time history that accounts for the segment's share of the total active time of the source.

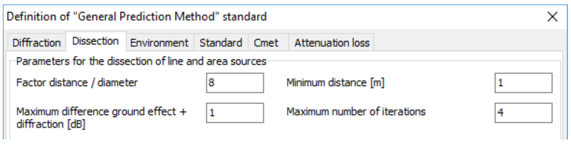

Fig 2 *Default dissection parameters in General Prediction Method*

Source performing a specific number of identical operations along fixed path

With known traveling speed, path length and number of operations/events, the active time t can easily be worked out by hand and inserted in a time record e. g. in unit min/h in the day histogram lib. This way formula (1) can be use also in this situation.

However, there is a much smarter way to model a point source that moves along a fixed path a given number of times. Formula (1) can be rearranged to:

$$L_{Aeq,T} = L_{WA} + \Delta L_{corr} + 10 \times log \frac{l \times N}{T \times v} \qquad (2)$$

where: l = path length [m]

N = number of operations/events [-]

v = speed [m/h]

The aim is to insert the number of events directly in a day histogram in unit E/h (events per hour); to obtain this the total number of events N is set equal to the number of events per hour n multiplied by the number of hours in the reference period T. Equation (2) becomes:

$$L_{Aeq,T} = L_{WA} + \Delta L_{corr} + 10 \times log \frac{l \times n \times T}{T \times v} \qquad (3)$$

where: n = number of events per hour.

$$\rightarrow \; L_{Aeq,T} = [(L_{WA} - 10 \times log(v)) + 10 \times log(l)] + 10 \times log(n) + \Delta L_{corr}$$

$$\rightarrow \; L_{Aeq,T} = [L'_{WA} + 10 \times log(l)] + 10 \times log(n) + \Delta L_{corr} \qquad (4)$$

where: $L'_{WA} = L_{WA} - 10 \times log\ v$ = A-weighted sound power level per m path length

L'_{WA} is easily worked out with the small pocket calculator in the property window of the line source object type (Fig 3). When a sound power level per m is inserted for a line source, SoundPLAN automatically works out the total sound power level by adding $10x\ log(l)$, which is exactly what is requested, see the bracket in equation (4).

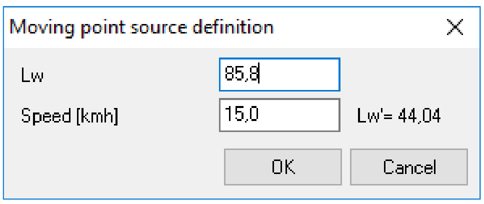

Fig 3 *Use the pocket calculator to work out the sound power level per meter line source*

Example: A fork lifter runs daily (from 7 am to 3 pm) 30 times per hour from A to B and back to A except during 30 min lunch break. Unit sound power level L_{WA} = 85,8 dB (like record #16 in the system lib), and driving speed 15 km/h, see Fig 3 and 4.

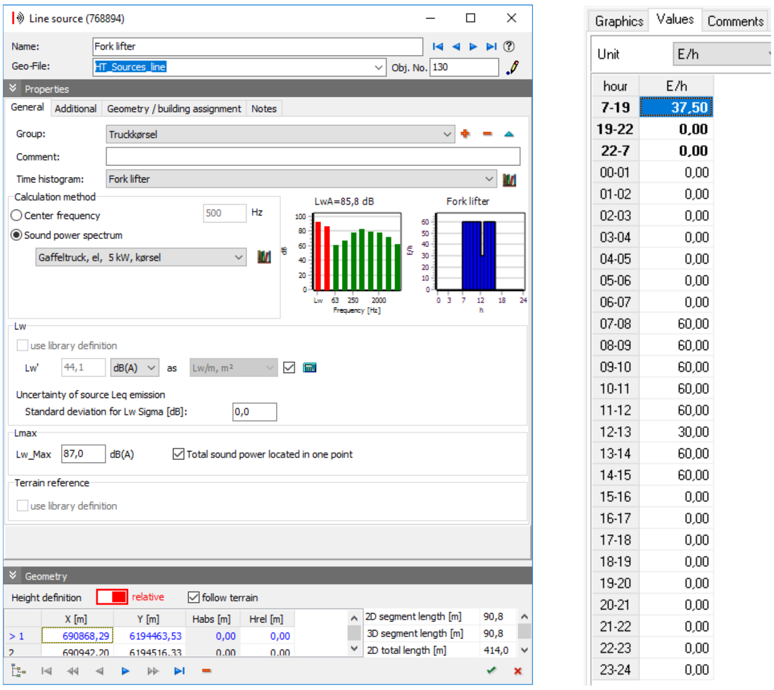

Fig 4 *Input according to the example above*

(Hint: remember to tick for 'follow terrain').

Please note it is assumed that the fork lifter goes from A to B and back from B to A exactly along the same path; only the path from A to B is digitized and thus the inserted number of events becomes 60 per hour. Naturally the path could have been created like A to B to A and the number would have been 30 per hour.

Hint for Danish users: When the noisiest 30 min during night is evaluated, it should be remembered that the SoundPLAN time history is based on 24 units (e. g. 24 1hour periods). The activity during the noisiest 30 min must therefore be doubled to end up with the correct activity per unit. If for example 2 events take place during the noisiest 30 min, you must insert 4 events for at least one of the night hours in the time history. Please observe that this hint can be used only if a single event does not exceed 30 min.