

A38 Derby Junctions

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8.77 Noise Assessment – The Averaging Time (T) and the Duration of Impact

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Noise Assessment - The Averaging Time (T) and the Duration of Impact

BS 5228-1:2009+A1:2014 (the Noise Standard) gives two methods for determining significance of noise effects for environmental impact assessment (EIA) purposes (i.e. at the Environmental Statement (ES) preparation stage) based on noise changes due to construction activities, namely: the ABC method and the 5 dB change method. The Noise Standard gives guidance on a range of other situations, for example the provision of noise insulation and temporary re-housing, and the impact of long term substantial earth moving.

Both methods (i.e. ABC and 5 dB change) require the noise levels from construction site activity to be compared with a threshold (i.e. the Significant Observed Adverse Effect Level (SOAEL)) which is determined from the existing ambient noise level for the averaging period, T . T is equal to the duration of the period (e.g. eight hours for night-time (23:00 to 07:00)). This averaging period (e.g. over the whole night) is appropriate to the level of detail available at ES stage on the nature and timing of the works.

The guidance in relation to noise insulation and temporary re-housing defines T for various time periods, which are shorter than those used in the ABC and 5 dB change methods. However, this guidance does not relate to the identification of significant effects at the ES stage, but instead relates to determining the need for noise insulation/ re-housing *after* Best Practicable Means (BPM) have been applied. Such an assessment, if carried out, would be done immediately prior to or during the construction works when more construction detail is available (though given the highly variable nature of construction activities, the detail to predict individual 1-hour construction noise levels is rarely available).

It is, therefore, not appropriate to apply the more granular T values from the noise insulation and temporary re-housing guidance to the identification of significant adverse effects at the ES stage.

However, to address the concern that using a longer averaging period could be 'more favourable' to Highways England and reduce the number of significant effects, examples based on the eight-hour night time period are provided below to illustrate the potential effect of the averaging period, T .

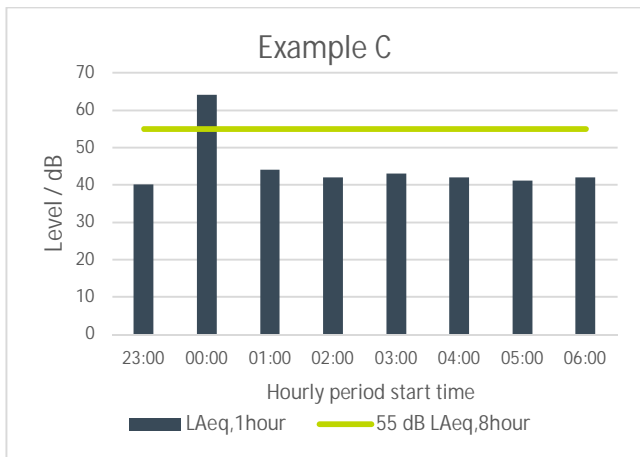
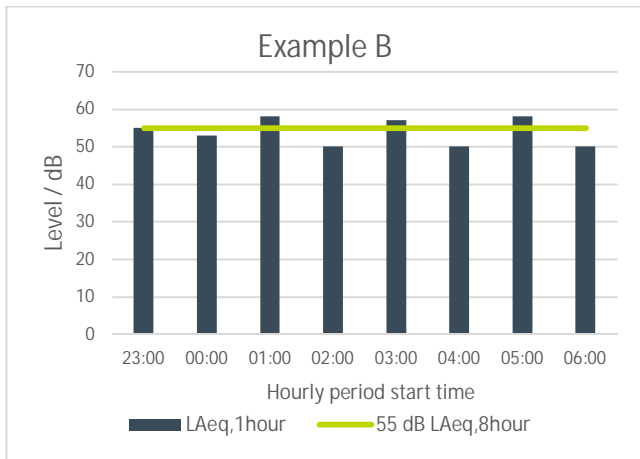
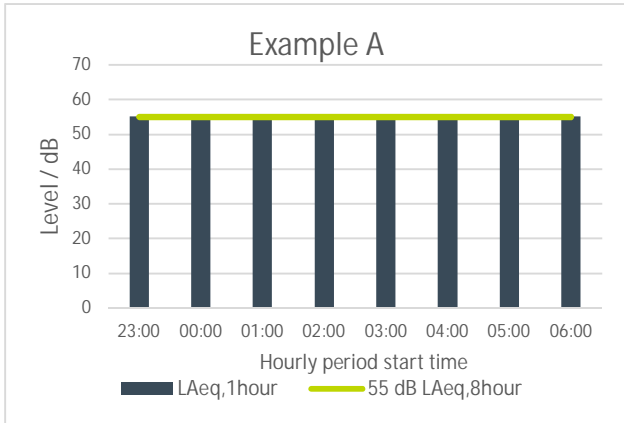
Both ambient and construction noise levels, by their nature, vary over time. Taking the eight-hour night-time as an example, due to the way in which noise levels in decibels are averaged over time, in order to achieve a given level (e.g. 55 dB $L_{Aeq,8hour}$), there is a limit to the amount by which the individual $L_{Aeq,1hour}$ can exceed this level. A construction noise level of 64 dB occurring for one hour (i.e. $L_{Aeq,1hour}$ 64 dB) which then stops (or is considerably reduced to e.g. the mid to low 40 dB range) for seven hours, would equate to 55 dB $L_{Aeq,8hours}$ (i.e. taking the average over the eight-hour period).

The examples below illustrate three hypothetical examples of individual hourly construction noise level data over an eight-hour night, each of which have a $L_{Aeq,8hour}$ of 55 dB.

- In Example A, the level in each hour is 55 dB $L_{Aeq,1hour}$, and the overall average is therefore also 55 dB $L_{Aeq,8hour}$.
- In Example B some hours are slightly above and slightly below 55 dB $L_{Aeq,1hour}$ with the overall average still being 55 dB $L_{Aeq,8hour}$.
- In Example C, one hour is considerably above 55 dB (64 dB), therefore, to maintain the overall $L_{Aeq,8hour}$ at 55 dB, the remaining hours must be considerably lower.

Thus, whilst Example C appears to 'allow' a single large exceedance, it is compensated for by seven hours of relative quiet, whereas Examples A and B consist of more continuous moderate

levels throughout. A person’s perception of Examples A and B are likely to be comparable, though not necessarily “more favourable” than Example C. Some people may prefer the situation illustrated in Example C, where the noisy activity takes place over a short period and then stops.



Exceedance of SOAEL, and Duration of Exceedance

Of the two methods based on the change in noise level presented in BS 5228 for determining significance of noise effects at the ES stage, the ABC Method is the most commonly applied, and is the method specified in the current version of DMRB (LA 111), issued in November 2019.

Using this method, for each period (night-time, evening/ weekend, daytime), a threshold for potentially significant effects (i.e. the SOAEL) is set in terms of $L_{Aeq,T}$ based on the existing ambient noise levels.

In simple terms, if the existing ambient levels are low (Category A), the daytime SOAEL is 65 dB $L_{Aeq,12hours}$. Therefore, if the daytime construction noise level averaged over 12 hours exceeds 65 dB $L_{Aeq,12hours}$ (the SOAEL) there is a potential significant effect. This allows for variation in noise levels throughout the day (as discussed above), as is expected given the nature of construction activities, with noisier periods of activity being balanced out by quieter periods.

However, the standard goes on to say that other factors, including the duration of the impact, should be considered, to determine if there is a significant effect.

As the ABC method itself gives no further guidance on duration, the options are therefore:

- i. Develop criteria from scratch; or
- ii. Apply appropriate guidance from within the standard itself.

As developing criteria from scratch would not be backed up by published guidance, it makes sense to first seek guidance from within the standard itself.

The only other two references to duration within the standard fall within the 5 dB change method, and the noise insulation and temporary rehousing guidance.

- The '5 dB change' method is comparable to the ABC method, as it relates to identification of significant adverse effects at ES stage. It suggests that an exceedance of up to one month would not normally be considered significant (unless works of a shorter duration are likely to result in a significant effect, but gives no further guidance on how this might be applied).
- The noise insulation and temporary rehousing guidance is less comparable as it does not relate to the identification of significant adverse effects, but the criteria are more stringent in that exceedances of 10 or more days of working in any 15 consecutive days (or 40 days in 6 consecutive months) would be considered significant.

Whilst the 5 dB change method may be more comparable (as it relates to the ES stage), in the interests of robustness the more stringent criteria from the temporary rehousing guidance have been adopted. If exceedances of a given threshold can occur for up to 9 days without the need for noise insulation or temporary re-housing, it follows that exceedances of a given threshold for up to 9 days could also occur without the effect being significant.

The duration criteria are therefore:

- Exceedances of the SOAEL for less than 10 days in any 15 consecutive days (or 40 days in any consecutive 6 month) would not normally be considered significant.
- Exceedances of the SOAEL for 10 or more days in any 15 consecutive days (or 40 days in any 6 month period) would normally be considered significant.

These criteria are adopted in the current version of DMRB (LA 111), issued in November 2019.

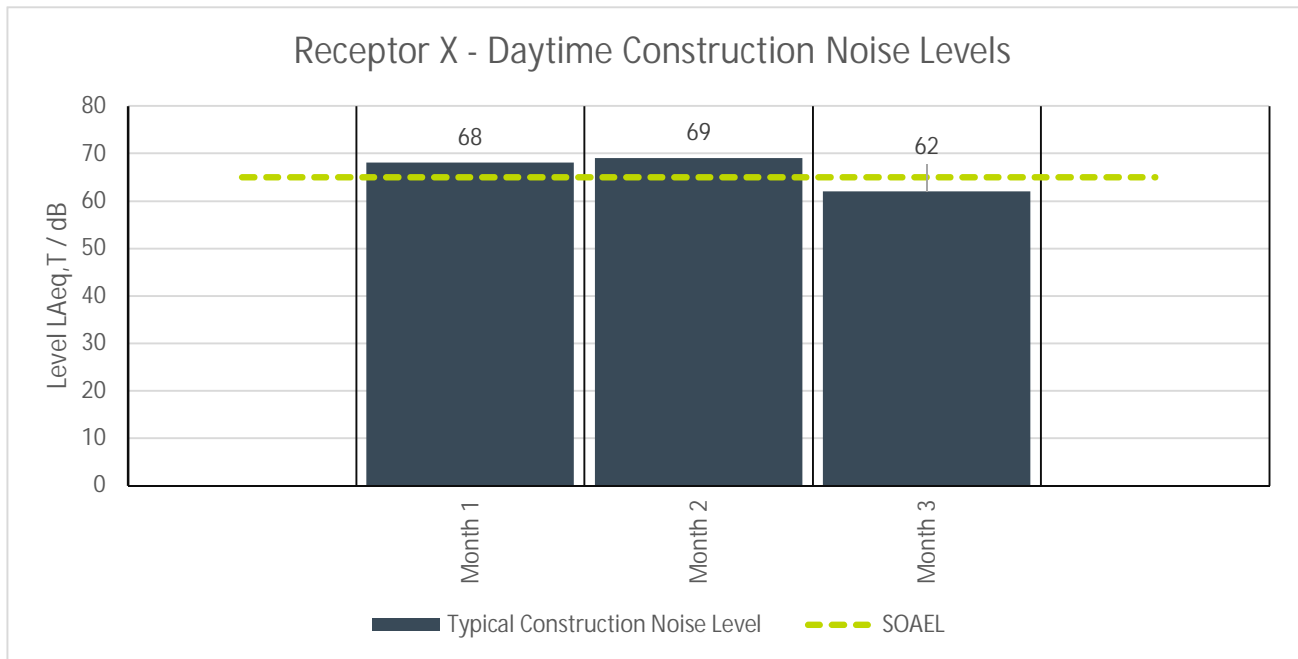
Together the SOAEL and duration criteria are not intended to be 'design criteria', as the overriding principle of BPM applies throughout the design and construction, they are intended to be used to assess the potential for significant adverse effects at the ES stage. Whether or not a significant adverse effect is predicted at the ES stage has no bearing on the requirement to adopt BPM.

The detail required to apply the duration criteria is not normally available at the ES stage. The Highways England contractor has provided details of the Scheme activities taking place within each month, however, precise details regarding durations and timings on individual days within each month, as required to apply the duration criteria, would not be expected to be available at this stage. Therefore, within the assessment, within each month all activities are assumed to take place simultaneously for the entire month, giving a 'typical worst case' construction noise level for that month. To be conservative, if this level exceeds the SOAEL, a significant adverse effect is identified in the ES, even if consideration of duration, which is not known at this stage, would have led to it being considered not significant.

A hypothetical example using a three-month period is illustrated below.

Example 1 – no detailed information on timings and durations:

- Activities in each month **known**
- Timings and durations **not known**
- All activities therefore assumed to take place simultaneously for the entire month (i.e. worst case)
- Any exceedance of SOAEL considered significant (i.e. duration criteria not applied)

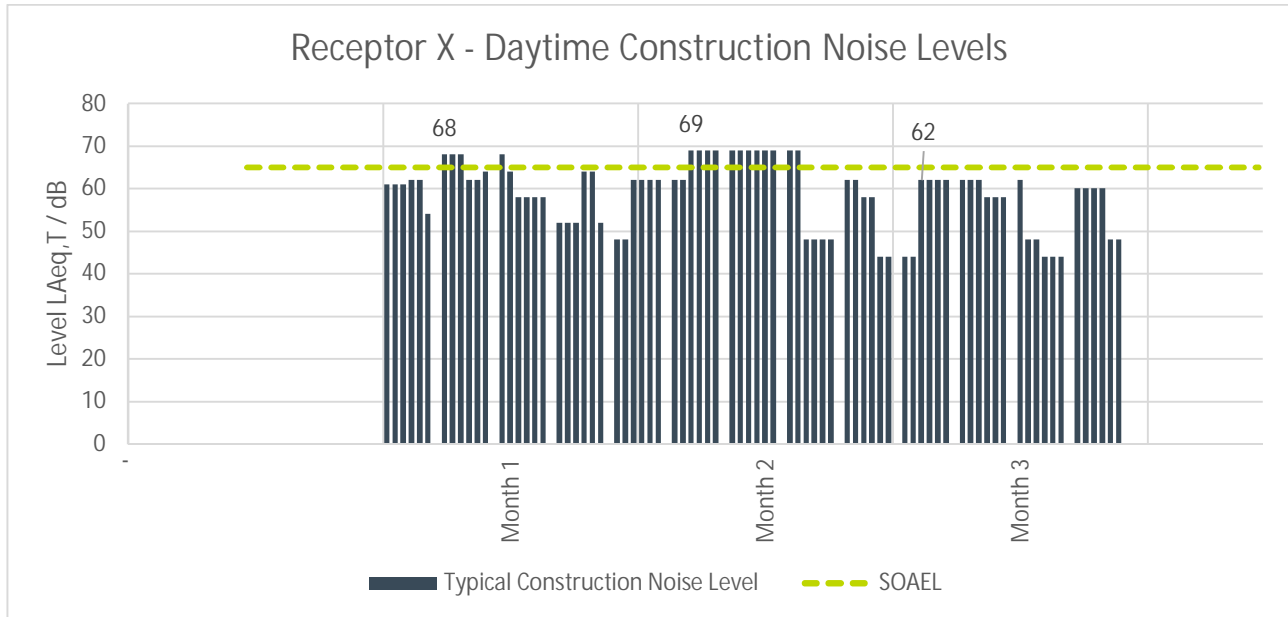


- *Month 1: SOAEL **exceeded**; duration of exceedance **not known**, to be conservative **a significant adverse effect is identified***
- *Month 2: SOAEL **exceeded**; duration of exceedance **not known**, to be conservative **a significant adverse effect is identified***
- *Month 3: SOAEL **not exceeded**; (and therefore there is no duration of exceedance) therefore **a significant adverse effect is NOT identified***

Conclusion: significant adverse effects identified in TWO MONTHS at Receptor X.

Example 2 – detailed information on timings and durations available:

- Activities in each month **known**
- Timings and durations within each month **known**
- Daily construction noise levels can be predicted
- Significant effect only identified if SOAEL exceeded AND duration criteria met



- Month 1: SOAEL **exceeded**; duration of exceedance **4 days in a 15 consecutive day period**, therefore **a significant adverse effect is NOT identified**
- Month 2: SOAEL **exceeded**; duration of exceedance **11 days in a 15 consecutive day period**, therefore **a significant adverse effect is identified**
- Month 3: SOAEL **not exceeded**; (and therefore there is no duration of exceedance) therefore **a significant adverse effect is NOT identified**

Conclusion: significant adverse effect identified in ONE MONTH at Receptor X

OVERALL CONCLUSION: More detailed assessment including consideration of duration of exceedance of the SOAEL would have led to fewer significant adverse effects being identified. Therefore, the approach in the ES is conservative and robust.

Noted that in this hypothetical example, the highest levels have been kept consistent between the two examples (68 in month 1, 69 in month 2, 62 in month 3), to help illustrate the effect of additionally considering duration of the exceedance of SOAEL.