



TRAIN INDUCED NOISE & VIBRATION

Trains can produce high levels of both noise and vibration which, if not treated correctly, can cause disturbance to a building's occupant. It is therefore important that for sites close to underground or over ground railways, early consideration is given to the effects of train noise and vibration.

Vibration

British Standard BS 6472: 2008 "Guide to Evaluation of Human Exposure to Vibration in Buildings" advises that intermittent vibration events should not be judged based on perception alone but using the corresponding vibration dose value (VDV) over a long period.

BS6472:2008 advises that "the VDV defines a relationship that yields a consistent assessment of continuous, intermittent, occasional and impulsive vibration and correlates well with subjective response" and also "the VDV is much more strongly influenced by vibration magnitude than by duration. A doubling or halving of the vibration magnitude is equivalent to an increase or decrease of exposure duration by a factor of sixteen."

The perception threshold for continuous whole-body vibration varies widely among individuals. Approximately half a typical population, when standing or seated, can perceive a vertical weighted peak acceleration of 0.015 m/s^2 . The weighting used is W_b . A quarter of the population would perceive a vibration of 0.010 m/s^2 peak, but the least sensitive quarter would only be able to detect a vibration of 0.020 m/s^2 peak or more. Perception thresholds are slightly higher for vibration duration of less than about 1 second.

Re-Radiated Noise

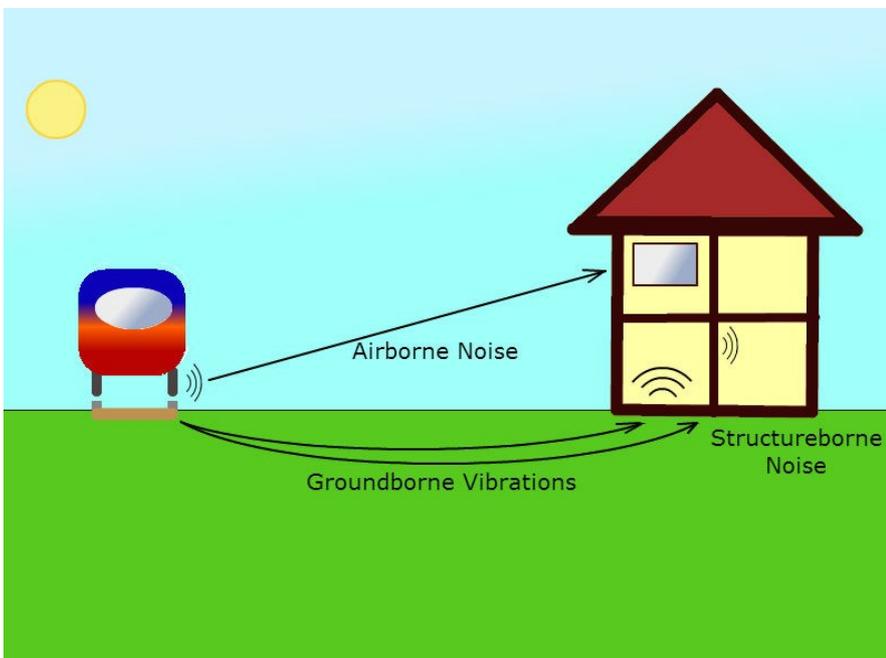
Currently no British Standards exist which recommend a method by which to assess intermittent ground-borne or structure-borne noise, such as that induced by trains.

Whilst there is no widely accepted method of evaluation of ground-borne noise, there is some consensus that for levels at and above $50 \text{ dBA } L_{\text{smax}}$ during daytime, there is likely to be significant adverse reaction. For residential situations the L_{smax} noise levels for which there is likely to be very little adverse comment can be taken as around 30 dBA during the daytime and around 25 dBA during night time.

Re-radiated noise is of greatest concern when it is the dominant noise, and also when the source cannot be seen, as in the case of trains in a tunnel. Criteria for re-radiated noise are therefore generally intended to apply to sources such as underground trains.

In the UK a criterion of $40 \text{ dBA } (L_{\text{smax}})$ is often considered unlikely to provoke adverse comment or complaint in a commercial environment. For residential premises we would advise in favour of a criterion of $35 \text{ dBA } (L_{\text{smax}})$. This equates to train movement being audible but not to an extent likely to cause significant adverse comments.

However, it is generally accepted however, that people are more tolerant of noise from sources which can also be seen. Furthermore, where sources are visible, airborne rail traffic noise intrusion through the façade in most cases masks the ground-borne noise which is re-radiated simultaneously.



Where commercial façades are likely to be exposed to relatively high levels of train airborne noise, it could be considered reasonable to apply the same criteria for both re-radiated and airborne noise. For airborne noise intrusion, higher noise levels are generally considered acceptable based upon the general consensus of research into this field.

Where bedroom façades are likely to be exposed to relatively high levels of train airborne noise, it could be considered reasonable to apply the same criteria for both re-radiated and airborne noise. For airborne noise intrusion, higher noise levels are generally considered acceptable, of around 45dBA L_{Amax} in the case of residential buildings - corresponding to a low probability of sleep disturbance according to the general consensus of research into this field.



Building Isolation

Where levels of vibration and/or re-radiated noise are calculated to exceed recommended criteria, consideration should be given to building isolation.

Vibration isolation of a building structure is a relatively complex, and therefore costly, process which fundamentally involves the introduction of resilient bearings between the substructure and superstructure.

The alternative method often used to isolate low frequency vibrations is to install an arrangement of steel springs. However, elastomeric

bearings for acoustic isolation of low frequency vibrations provide a more cost-effective and superior acoustic isolation over the long term compared with other alternatives, such as steel springs.

What Can I Do About It?

Hann Tucker Associates are able to advise our client to the potential threat to any existing or future buildings.

Typically our activities include:-

Measurement and prediction of noise and vibration levels associated with nearby trains.

Measurement and prediction of noise and vibration from associated work sites, including their impact on neighbouring properties.

Close liaison with other engineering disciplines who will measure and predict traffic flow implications and the likely levels of settlement for buildings.

Should you wish to establish the potential threat of noise and vibration from trains to your existing buildings or future developments, we would be pleased to discuss them with you and the specific ways in which we can help.



Hann Tucker Associates, the leading acoustic consultants in the UK, can give you the necessary advice to avoid potential problems at the design stage where costs are always at a minimum. While in many instances, it is possible to attenuate noise sources once a problem has occurred, this is always expensive and sometimes impossible. By using the specialist knowledge and expertise that Hann Tucker has gained through practical consulting since 1971, you can avoid these potential problems which may cause a delay to your programme, will certainly cost you money, can attract the unwanted attention of the media and generally distract you from your normal commercial activity.



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