Noise and Vibration: impact of trees and woodland

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Noise reduction

A number of methods can help reduce noise generated by the construction and operation of a high speed railway.[1] Noise can be reduced at source by use of special technologies (e.g. specially designed train wheels, track, pantograph etc), noise management plans can be used to ensure noise is generated in a controlled way (e.g. only between certain times), and noise can be reduced by installation of acoustic barriers.

This factsheet covers the latter. For more technical information on reduction of railway noise see reference[1].

Creating noise barriers between the source and the recipient is an option when noise levels cannot be reduced at source. However, this is not straightforward. High and low frequency sounds travel differently and soundwaves bend over and around objects and barriers. Noise can be amplified when reflected off hard surfaces but generally noise diminishes as distance from the source increases.

Definitions

Noise is defined as sound that is unwanted. Both the construction and the operation of HS2 will result in noise. Temporary noise will occur during the construction phase and trains will subsequently produce noise on a regular basis.

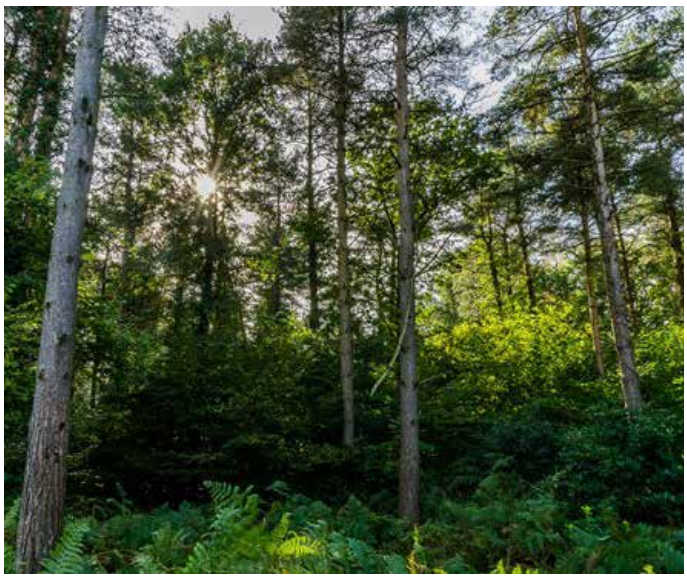
Vibration is felt through the body, rather than heard, or it can cause airborne vibration resulting in the rattling of windows or ornaments. It is harder to reduce vibration than noise and the cause of it is best dealt with at source. Like noise, vibration will occur in both the construction and the operation of HS2.

Barriers (man-made or natural) work by increasing the distance the noise has to travel from the source to the receiver and by creating an area the soundwaves fail to reach (an acoustic shadow).[2]

To be effective the barrier must be either close to the source or close to the receiver. Placement half way between the two is ineffective. Based on information currently available, HS2 Ltd is proposing to put noise reducing solutions close to the track.

Traditionally, man-made barriers (acoustic fencing) are used, typically made of concrete, metal or wood. Earthworks can also be used, either on their own or in combination with acoustic fencing.

While these are effective at reducing noise, many people do not like them for aesthetic reasons, particularly in rural environments. Some research indicates that these types of barriers act as canvases for graffiti and residents can feel that they encourage crime.[3]



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Natural barriers

Planted barriers can be more aesthetically pleasing than man-made barriers, but historically they have been considered less effective because they occupy larger areas of land, require maintenance while they establish, and are not as dense as man-made solutions. However, recent research indicates that in certain circumstances natural barriers can reduce noise effectively.

In general, for a natural noise barrier to be effective it must be very densely planted. This can be achieved by planting both shrubs and trees[4] so there is a dense barrier of vegetation from ground level to the top of the canopy.

Evergreen trees have been shown to be more effective than deciduous trees but they are not always a suitable choice for a particular environment (e.g. in areas where all other vegetation is deciduous). A barrier made of deciduous trees would need to be wider than one made of evergreens to compensate for leaf drop in the autumn, which makes the structure of the barrier more open for part of the year, enabling sound to travel further.

As the density, height and width of a planted barrier increases, the greater the scattering effect on soundwaves. This results in a greater reduction of noise. Therefore, the more substantial a planted barrier is the more effective it is likely to be.

As well as reducing noise, planted barriers can perform other functions. They may act as corridors joining fragmented habitats together or buffers protecting sensitive habitats, they can also improve the aesthetic appearance of an area and provide recreation opportunities. For more information on how buffers can be used in a multifunctional way see our other factsheets.

A combination of man-made and natural barriers to noise may result in an effective and aesthetically pleasing solution. Planting trees on top of an earth berm is particularly effective as it increases the height of the barrier. As with all buffers the design of a noise reducing barrier will have to be site specific to ensure its effectiveness.

Issues to consider

Noise and vibration can both be measured empirically. However, the effect that noise has on recipients cannot, because different people perceive noise in different ways. This makes the control and reduction of noise a complicated issue.

Various studies to quantify human response to noise show conflicting results. For example, some show that if the source is completely obscured from the recipient then the noise is perceived as louder than if the source is only partially screened. Other work demonstrates the exact opposite.

Furthermore, people's view on what makes an effective barrier to noise may conflict with their view on what makes an attractive barrier.

How much people like the activity that is creating the noise has also been shown to affect perception of noise. Therefore, two different barrier designs may reduce noise by exactly the same amount but one is perceived to be more effective because of how it looks.

Reduction of noise is complicated and more than one solution will have to be employed to achieve satisfactory results. Planted barriers can help to reduce noise levels, while at the same time providing other benefits such as increasing landscape connectivity and improving the aesthetic quality of an area.

References

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