Transport noise
Performance testing

NOISE BARRIER CASE STUDY 11

NZ TRANSPORT AGENCY
WAKA KOTAHI

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In-situ testing

The new European Standard EN 1793-6:2012[1] for in-situ testing of the acoustic performance of noise barriers is being investigated by the NZ Transport Agency. As part of this work, the Transport Agency commissioned the University of Canterbury to trial the new method and detail the practicality and effectiveness of the European Standard for use in New Zealand.

The acoustic performance of eight traffic noise barriers around the Auckland state highway network was assessed in October 2012 using the new in-situ test method. Testing was undertaken on a range of barrier types, with varying site conditions. The tests relate to sound transmitted through noise barriers and do not include the effects of sound travelling over the top of barriers. This case study summarises the key features of the in-situ test method, along with the results from testing undertaken in Auckland using the new method.

Test methods

The acoustic performance or sound insulation of noise barriers has traditionally been measured in a laboratory environment, similar to that used when testing building products such as walls, ceilings and roofs. This laboratory test method requires that the barrier be installed between two special acoustic rooms, although these have different sound fields from those encountered along an outdoor roadway. Laboratory barriers are generally constructed free from the defects often found on actual roadside noise barriers, which can have gaps caused by construction issues or ageing.

Alternatively, the in-situ test method described in EN 1793-6:2012 allows the sound insulation of a noise barrier to be assessed in its actual environment. This method gives a more realistic idea of the barrier's effectiveness. Sections of noise barrier can be tested immediately after construction to check the quality of workmanship and ensure that specifications have been met. Periodic testing of a barrier will reveal any loss in performance caused by ageing, and any complaints about the degradation of a barrier's performance can be quantified.

Eight noise barriers around the Auckland state highway network were tested in October 2012 using the new in-situ method. A selection of common noise barriers were tested of varying construction materials, including concrete, timber and acrylic.

For each noise barrier, a loudspeaker was placed on the road side of the barrier, with a grid of nine microphones then placed on the resident side. Several measurements were made with the loudspeaker and microphones centred on both the barrier panels and posts.

A special type of noise signal is played through the loudspeaker that allows any background noise to be filtered out from the sound recorded by the microphones. The recorded signals are then processed to provide information on the overall performance of the noise barrier. This data can also be used to look at the effects of specific gaps on noise barrier performance.

Greenhithe plywood noise barriers – typical test setup on the road side (left) and resident side (right) of the barrier

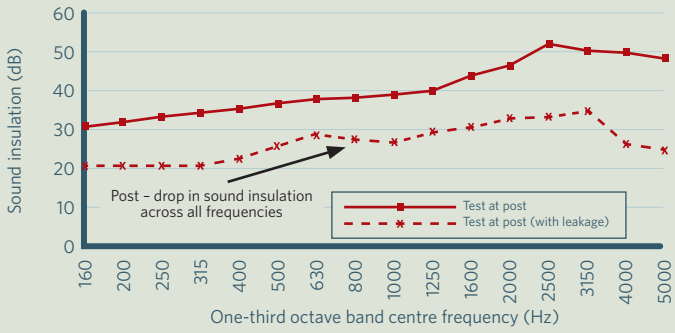
Advantages of in-situ testing

- Ability to perform measurements in the presence of background traffic noise.
- Compliance with specifications can be verified for new noise barrier installations.
- Periodic testing can quantify effects of ageing materials.
- Reduced costs compared with the laboratory test method.

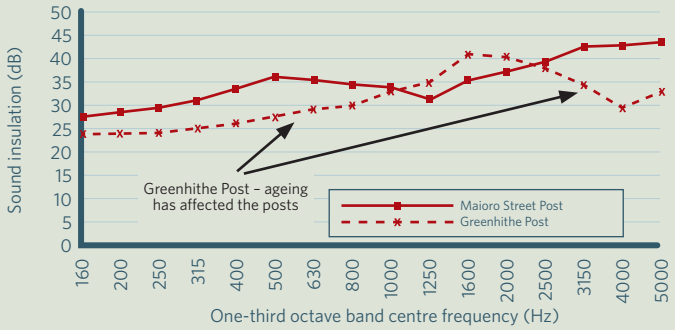
St Marys Bay acrylic noise barrier posts – the effects of small gaps can be investigated

1 EN 1793-6:2012 *Road traffic noise reducing devices – Test method for determining the acoustic performance – Part 6: Intrinsic characteristics – In situ values of airborne sound insulation under direct sound field conditions* (CEN, 2012).

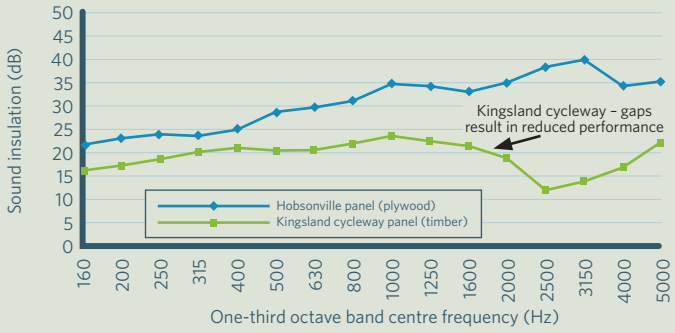
Effects of sound leakage of the acrylic barriers (St Marys Bay site)



Effects of ageing of the engineered timber noise barriers



Comparison between the plywood and timber plank noise barriers



Measurement results

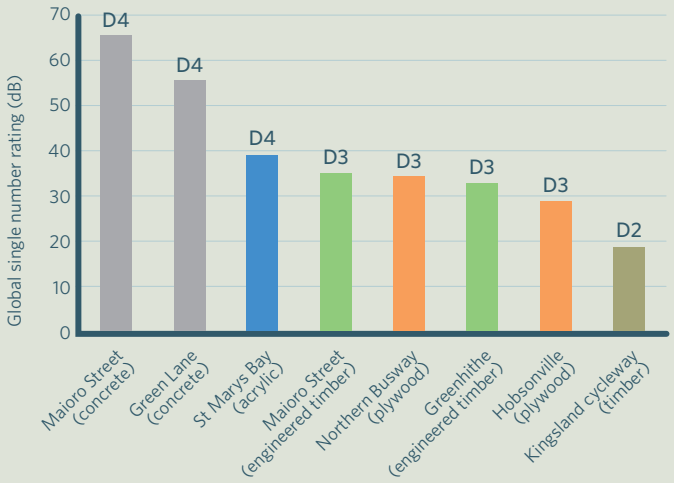
The in-situ testing programme provided data for the acoustic performance of eight noise barriers currently installed on the Auckland state highway network. These included noise barriers constructed of concrete, acrylic, engineered timber, plywood and timber planks.

As expected, the concrete barriers were the best performing due to their significant mass and lack of gaps. The acrylic barrier was the next best performing, although gaps around the base of some posts were found to significantly affect acoustic performance (although this has not affected compliance with designation conditions).

The engineered timber noise barriers performed well, though with a slight drop in sound insulation, due to sound leakage around the posts caused by age.

The timber plank noise barrier at Kingsland cycleway was found to have the worst performance. This was due to gaps between overlapping timber planks possibly caused by warping.

Global single number ratings and classification of each noise barrier



Lessons learnt

- The in-situ test method for noise barriers was found to be effective and more practical than the laboratory method. The in-situ method has the potential to allow the Transport Agency to verify that a new noise barrier meets Transport Agency specifications. Periodic testing is also possible.
- The small number of measurements performed during the initial testing programme (generally one panel and one post) meant that any variation in acoustic performance along the length of the noise barriers could not be investigated. In future a larger number of measurement positions should be used, possibly allowing a full day of testing at each site.
- The Auckland Motorway Alliance was closely involved during testing in order to minimise disturbance/extra costs. However, the amount of time that could be spent at some roadside locations was limited to 30 minutes due to safety requirements. There are opportunities to increase the efficiency of any future testing programme. For example, future testing of noise barriers could be scheduled to coincide with lane closures associated with routine maintenance activities to allow more time.
- Acoustic performance can be significantly affected by the presence of small gaps, for example those found in the vicinity of the posts on the St Marys Bay acrylic noise barrier and between the timber planks at the Kingsland cycleway noise barrier.

Contact details

Rob Hannaby
NZ Transport Agency, Environment and Urban Design Manager
09 928 8761 – rob.hannaby@nzta.govt.nz

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New Zealand Government