

# Transport noise

# Integrated noise/safety barriers



NZ TRANSPORT AGENCY  
WAKA KOTAHI

## NOISE BARRIER CASE STUDY 9

November 2012



The Newmarket Viaduct to Greenlane Auxiliary Lane project under construction. The workspace was tightly constrained between live motorway lanes and residential properties.

## Newmarket Viaduct to Greenlane Auxiliary Lane

The SH1 Newmarket Viaduct to Greenlane Auxiliary Lane Project (2011) in Auckland included the construction of a new southbound lane between Newmarket and Greenlane on the Southern Motorway, bringing the total to four lanes.

The project was completed in May 2011 and ties into the new four-lane southbound Newmarket Viaduct. The extra lane is expected to help manage traffic flows from the city and prevent a bottleneck beyond the new viaduct. Noise mitigation measures implemented for the new road layout include:

- Resurfacing using a low-noise road surface (open graded porous asphalt); and
- The installation of a combined retaining wall/safety barrier/noise wall along most of the alignment on the eastern side of the motorway between the new lane and adjacent residents.

This case study discusses issues associated with noise barriers adjacent to residents located in an existing high noise environment. Additionally safety issues associated with combination noise/safety barriers are reviewed.

## Acoustic requirements

Many residents affected by the project are in close proximity to the motorway, with some houses only half a metre to the project works and extra lane. These residents were already living in a high noise environment next to Auckland's busy southern motorway. The Outline Plan (OP) in 2008 included a noise assessment report, which described the existing environment for receivers near the project as within a 'high noise area' as defined by the 'Transit Guidelines' ( $>59 \text{ dB L}_{\text{Aeq}(24\text{h})}$ ) (these guidelines have now been replaced by NZS 6806 for new projects). Pre-existing noise levels were found to range from 61 dB to 81 dB. The Organisation for Economic Co-operation and Development (OECD)<sup>1</sup>



Some residents were less than half a metre away from the works and were already living in a high noise environment next to the Southern Motorway.

<sup>1</sup> Organisation for Economic Co-operation and Development. Ad Hoc Group on Noise Abatement Policies (1986) *Fighting noise: strengthening noise abatement policies*



considers noise levels above 75 dB unacceptable for human habitation and recommends they to be reduced to 70 dB, or preferably 65 dB, where practicable.

The project was contained within an existing NZ Transport Agency (NZTA) designation with no specific operational noise designation conditions. Although the provisions of the Transit Guidelines did not strictly apply, they were used as a basis for the OP noise assessment in order to satisfy the general duties regarding noise emissions under Section 16 of the Resource Management Act. In fact, the noise mitigation measures adopted for the project exceeded the requirements of the Transit Guidelines and included the installation of up to 3 metre high noise barriers as the best practicable option for noise mitigation. In comparison with the pre-existing levels, noise modelling showed the installation of the 3 metre high barriers to double the number of dwellings exposed to less than 66 dB and reduce the number of dwellings exposed to more than 70 dB by 40%.

The installation of the noise barriers was one of the early items to be undertaken in regards to the overall project programme. As such, residents gained immediate benefit from reduction of the high existing noise levels along with subsequent construction noise impacts.

Anecdotal reports from property owners differ on opinions of the final outcome of the barriers from a noise mitigation perspective. Although some residents have confirmed an improvement in noise levels, a few residents have reported that the motorway noise now seems to 'bounce' between the house and the high concrete retaining wall/noise barrier, creating an echo like sound.

While not statistically significant, there is some evidence that the noise barriers may have improved the sales appeal of the adjacent properties by improving the noise environment. Sales in Lillington Avenue (adjacent to the noise barriers) since the erection of the noise barriers (2011-2012) have seen price increases between rating and sales values in comparison with the previous year (2010-2011).

## Visual effects

Along with the noise mitigation benefits of the barriers, the visual appearance for residents was a consideration, especially due to their close proximity. A landscape report was undertaken in 2008 to develop conceptual design principles for the noise barriers with a particular focus on experience from the highway as well as the residential perspective on the other side of the barrier<sup>2</sup>. The final form decided for the noise barrier was a flat concrete wall, with geometric pattern contrasted with smooth concrete on the motorway side (the residential side was smooth concrete only). On the residential side a new basalt retaining wall was intergrated with the noise barrier to achieve a uniform look in terms of the consistency of the structures. Existing wooden fences were replaced with the new concrete noise barrier. Any damaged or demolished structures on adjacent properties were also reinstated and returned to their original (or better) condition.

Landscaping on the residents' side of the noise barrier was not included as part of the initial design. However, towards the end of the project a landscaping budget was provided to around 35 affected residents as a way to compensate some of the visual effects of the large structures. The landscape plans were done on a property-by-property basis and residents were able to make specific requests for their property landscape plans. The plans ranged from basic tree planting in front of the noise barriers to construction of separate frames adjacent to noise barriers for climbing plants. The residential landscaping works (covered as a provisional sum under the contract), were undertaken at the end of the project.



<sup>2</sup> <http://nzta.govt.nz/resources/urban-design/greenlane-landscape/docs/greenlane-noise-barrier-june-2008.pdf>

Landscape plans were tailored for each property, with residents consulted about the style of planting.





At Greenlane, camera coverage of the emergency shoulder is reduced and placement of signs was a challenge.

## Safety issues

Due to a lack of space between the motorway and the adjacent residential properties, noise barriers were designed to be integrated with the retaining wall and the safety barriers. However, in some cases combined safety/noise barriers may cause road safety hazards.

Safety inspections of these barriers have highlighted risks in regards to noise barriers which are above safety barriers. There is a potential issue with vehicle impacts to the ends of the noise barrier panels, particularly in situations where vehicles could ride over or climb concrete safety barriers prior to reaching the noise barrier, and then come into contact with end of a noise barrier panel. At Greenlane, a transition block was constructed to address this issue prior to opening the lane to traffic.

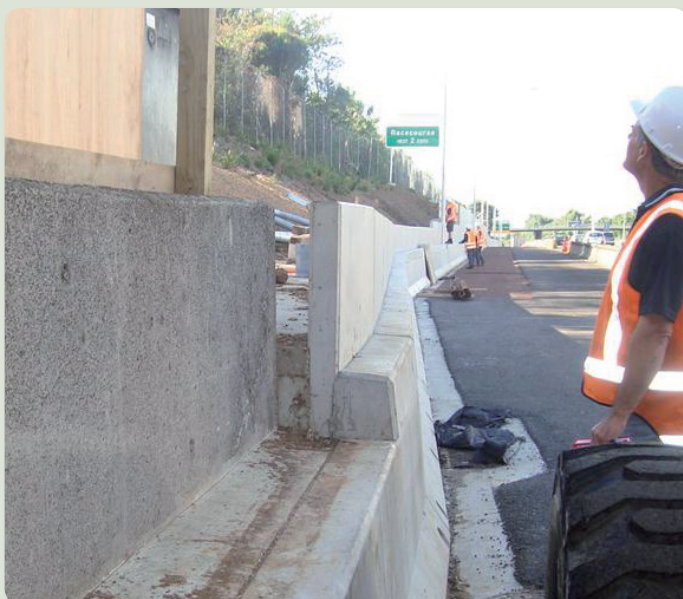
As discussed in Section 4.2 of the NZTA *State highway noise barrier design guide*, where space allows noise barriers should be set back from safety barriers. In general this should follow the advice as for bridge piers in Section 3.4.18 of the NZTA *Bridge Manual*. This can require a set back in the order of 1.1 metres from the face of TL4 concrete safety barrier. Where this cannot be achieved then the

noise barrier should be tapered into position, ideally in plan coming from behind the safety barrier at an angle of 1:15 or flatter but otherwise in long section with a gradual height increase in the order of 1:15.

Additionally, combined noise barriers can make it difficult and expensive to install new signs, gantries, signal poles, lighting columns, and cameras, and may also compromise their effectiveness. For example, at Greenlane the combined safety/noise barrier limits camera coverage of the southbound emergency shoulder and has also limited the locations where signs can be placed.



As seen in this photo sequence, vehicles can ride or climb concrete safety barriers during an impact.



(Before) A hazard was created when the ends of the Greenlane noise barrier panels were combined with concrete safety barriers. If vehicles were to come into contact with concrete safety barriers they may impact the noise barrier end panel.



(After) This hazard was rectified by the inclusion of transition panels on top of concrete safety barriers to create a smooth change from concrete safety barriers to combined safety/noise barriers.





The installation of noise barriers contributed to an improved living environment with regards to noise.

## Lessons learnt

- In situations where receivers are in high noise areas, consideration should be given to noise mitigation that may go beyond the designation requirements in order to achieve an acceptable living environment for adjacent residents. This matter is now addressed by application of the noise standard NZS 6806.
- Where practicable, project schedules should ensure that operational noise barriers are constructed works.
- Absorptive surfaces may need to be considered for high noise barriers in close proximity to houses.
- Visual treatment on the residents' side of noise barriers should form an integral part of the barrier design. This may involve individual landscaping, and should be planned at the start of the project.
- Ideally noise barriers should be setback from safety barriers to avoid vehicles impacting the ends of noise barrier panels. If this cannot be achieved then transition panels between concrete safety barriers and safety/noise barriers should be used.
- Consideration should be given to inter-relationships between noise barriers and traffic safety features.



Landscaping and retaining walls mitigated some of the visual impacts of the large barriers.

## Contact details

Rob Hannaby  
NZTA, Principal Environmental Specialist  
Telephone: 09 928 8761 - [rob.hannaby@nzta.govt.nz](mailto:rob.hannaby@nzta.govt.nz)