SPECIFICATION FOR NOISE MITIGATION

1. **SCOPE**

This specification covers the design, construction, documentation and post-construction review of state highway road–traffic noise mitigation. This specification applies to state highway asset improvement projects. This specification does not cover construction noise mitigation.

Noise mitigation is:

i. Structural mitigation (noise barriers and low-noise road surfaces), and

ii. Building-modification mitigation (acoustic treatment of buildings), as defined in *NZS 6806:2010 Acoustics – Road–traffic noise – New and altered roads* (NZS 6806). A noise barrier can be a noise wall, noise bund or a combination of both.

This specification provides overarching requirements, drawing on a number of other standards and guides. Implementation of this specification requires reference to those other documents. Key references include:

i. NZS 6806 for road–traffic noise criteria,

ii. NZ Transport Agency *Guide to state highway noise mapping* for road–traffic noise modelling techniques that shall be used to assess the performance of mitigation measures, and

iii. NZ Transport Agency *State highway noise barrier design guide, Guide to state highway road surface noise* and *State highway guide to acoustics treatment of buildings* for guidance on noise mitigation solutions and costs.

2. **GENERAL**

The Contractor shall assess noise mitigation requirements in accordance with the NZ Transport Agency *Guide to assessing road–traffic noise using NZS 6806 for state highway asset improvement projects*. Noise levels shall be assessed at Protected Premises and Facilities (PPFs) as defined in NZS 6806.

The Contractor shall design and construct all noise mitigation as required by:

i. Designation and resource consent conditions, and

ii. Property agreements,

as scheduled in the Contract documents.
2.1 **Suitably qualified professionals**

The Contractor shall engage suitably qualified professionals to conduct the work required by this specification. Acoustics work shall be conducted by a suitably qualified professional with:

i. A relevant tertiary degree or equivalent,

ii. At least eight years relevant experience in acoustics,

iii. Membership or preferably Chartered / Certified status with a relevant professional body that includes a requirement to provide evidence of continuing professional development,

iv. Experience as the acoustics lead for a fee value of at least $50,000 on at least one Transport Agency or major infrastructure project in the last five year period, and


Post-construction review of high performance road surfaces shall be conducted by a suitably qualified professional with:

i. A relevant tertiary degree or equivalent,

ii. At least eight years relevant experience in engineering road surfaces,

iii. Membership or preferably Chartered status with a relevant professional body that includes a requirement to provide evidence of continuing professional development, and

iv. Experience as the road surfaces engineering lead for a fee value of at least $50,000 on at least one Transport Agency or major infrastructure project in the last five year period.

3. **DESIGN**

Noise modelling shall be conducted in accordance with the relevant provisions of the NZ Transport Agency *Guide to state highway noise mapping*.

3.1 **Consent design**

If required, the Contractor shall request from the Principal an electronic copy of the input files for any noise models used in the consenting phase of the project.

3.2 **Tender design**

The following requirement applies where designation conditions make reference to ‘preferred/selected’ noise mitigation options developed in the consenting phase in accordance with NZS 6806.
The tender design for noise mitigation shall be based on the preferred/selected noise mitigation options. If the tender design for the road alignments, earthworks and structures varies significantly from the consent design, the Contractor shall undertake noise modelling and adjust the noise mitigation options as required to maintain compliance with the designation conditions. If only part of the tender design varies significantly, such as a reconfigured intersection, then only that part shall be modelled and corresponding noise mitigation adjusted.

For the purposes of this requirement, a significant variation between the consent design and the tender design can be considered the horizontal alignment of a traffic lane in the tender design moving 15% closer to a PPF or noise barrier compared to the consent design, or a change in the vertical alignment of a traffic lane in the tender design of 1 metre or more compared to the consent design.

3.3 Construction design
The Contractor shall undertake noise modelling for the construction design and document the modelling and noise mitigation in a Noise Mitigation Plan (see Section 7).

4. NOISE BARRIERS
The design of noise barriers shall adhere to the guidance contained in the NZ Transport Agency State highway noise barrier design guide, including:

i. Acoustic design,
ii. Urban design,
iii. Engineering issues,
iv. Safety issues,
v. Environmental issues,
vi. Maintenance issues, and

4.1 Statutory compliance
The Contractor shall ensure that necessary statutory approvals are obtained for noise barriers. Approvals obtained shall be appended to the Noise Mitigation Plan.

Noise barriers shall comply with the requirements of the Building Act 2004 (see Ministry of Business, Innovation and Employment Guidance on Barrier Design).

4.2 Acoustics
Noise walls (including posts and panels) shall be designed and constructed of materials that have a surface mass of at least 10 kg/m².

Noise walls that are more than 2 metres in height above the adjacent ground level, and are designed to provide mitigation to PPFs in a cluster, as defined in NZS 6806, shall have a sound insulation rating that achieves either:
i. Category B3 in EN 1793-2: 2012 *Road traffic noise reducing devices – Test method for determining the acoustic performance. Part 2: Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions*, or


The Transport Agency maintains a register of potential noise barrier suppliers, including details of the tested or estimated sound insulation ratings (see http://acoustics.nzta.govt.nz/noise-barrier-suppliers).

There shall be no gaps between noise walls and the ground, between adjoining panels or between panels and posts.

### 4.3 Durability

Noise barriers shall be designed and constructed to require minimal maintenance for at least the first 50 years after handover. Noise barriers (including noise wall posts and panels) shall have a design life of 50 years without replacement of any components, and shall meet the requirements of the NZ Building Code *Clause B2 – Durability*.

The design and construction of noise barriers shall ensure that:

i. Acoustic performance (noise attenuation) will not degrade, in accordance with designation conditions and clause 8.2.5 of NZS 6806,

ii. Panels can expand and contract without compromising acoustic performance, and

iii. The visual appearance will not degrade.

### 4.4 Graffiti

Noise walls shall be designed and constructed so as to avoid, remedy or mitigate the risk of graffiti.

The Contractor shall maintain all noise walls free of graffiti until handover. The Contractor shall address any graffiti problems within 48 hours of being notified of an issue. If it is not practical to remove the graffiti within 48 hours, the Contractor shall ensure it is obstructed from public view within 48 hours. Where noise walls have anti-graffiti coatings, graffiti shall be removed in accordance with the anti-graffiti coating manufacturer's instructions.

The front of noise walls facing the state highway and the rear of noise walls that are publicly accessible shall have an anti-graffiti coating applied in accordance with the following requirements:

i. Coatings shall be selected from the Auckland Motorways Alliance's list of approved products (see http://www.aucklandmotorways.com), unless otherwise approved by the Principal,

ii. Coatings shall have a design life of at least 10 years,
iii. Coatings shall be applied and maintained in accordance with the manufacturer's instructions to ensure validity of their warranties, and

iv. Coatings shall be applied to the entire length of noise walls and to a height of at least 2.7 metres above the adjacent ground level.

Drawings shall be included in the Noise Mitigation Plan showing the extent to which anti-graffiti coatings have been applied to noise walls.

4.5 Urban design

The design of noise barriers shall adhere to the guidance contained in the NZ Transport Agency *Bridging the gap: NZTA urban design guidelines.*

Noise barriers shall be based on, and their detailed design shall develop, the concepts and design principles contained in the relevant Urban and Landscape Design Framework or Environmental Design Framework, as scheduled in the Contract documents.

Noise barriers shall be integrated with the design of the overall corridor and complement the highway structures, landscaping and roadscape elements.

The front and rear faces of all noise barriers shall contribute positively to the visual amenity of both state highway users and users of adjacent land including; residents, pedestrians and cyclists.

To the extent practicable, there shall be minimal change in horizontal and vertical alignments of all noise barriers. To the extent practicable, acute angles and/or sharp changes in noise barrier direction shall be avoided. Where there is a step or sharp change in direction, noise wall panels shall be overlapped.

To the extent reasonable, and in accordance with requirements for developing the best practicable option in accordance with NZS 6806, all noise barriers should avoid blocking significant views of the surrounding area both towards and from the state highway.

Any artwork applied to the surface of noise walls shall be integral to the design of the noise walls.

4.6 Landscaping

All landscaping shall comply with the NZ Transport Agency *Guidelines for highway landscaping* and *P39 Standard specification for highway landscape treatments.*

Landscaping treatments shall adhere to the design principles contained in the relevant Urban and Landscape Design Framework or Environmental Design Framework, as scheduled in the Contract documents.

Planting shall be used to:

i. Soften and enhance the visual appearance of noise barriers and, where appropriate, minimise the potential for graffiti,

ii. Complement and/or screen noise barriers,
iii. Soften the appearance of noise barriers that are located behind crash barriers, and
iv. Highlight the colour of noise barriers that create a dark background.

Noise barriers shall be designed to incorporate access for maintenance of planting and landscaping.

Space shall be provided to allow planting incorporated in the noise barrier and/or landscape design to grow as intended without unreasonable restriction.

Routes for natural drainage flow paths shall be provided through noise barriers. Penetrations in noise barriers shall be designed with screening as required to maintain the acoustic performance.

4.7 Road safety

Unless approved otherwise by the Principal, noise walls shall be:

i. protected by roadside safety barriers and positioned outside the rollover clearance given in Austroads Guide to Road Design Part 6 section 6.3, if non-crashworthy, or

ii. integrated into roadside safety barriers if crashworthy (such as an extended height concrete barrier system).

Noise barriers shall be located clear of over-dimension traffic routes in accordance with the clearance envelope given in the NZ Transport Agency Bridge Manual Appendix A, section A3, figure A4, note 1. The effects of truck tracking on curves shall be considered where noise barriers are in the vicinity.

4.8 Electrical power line clearance

Noise barriers shall be located clear of overhead power lines in accordance with the requirements of the Electricity Act 1992 and regulations and codes of practice made under that Act, including the NZ Electrical Code of Practice for Electrical Safe Distances.

5. LOW-NOISE ROAD SURFACING

Low-noise road surfaces shall be used as required to comply with the designation conditions, and as specified in the Contract documents.

The design and construction of road surfacing shall adhere to the guidance in the NZ Transport Agency Guide to state highway road surface noise.

6. BUILDING-MODIFICATION

The Contractor shall ensure that necessary statutory approvals are obtained for building acoustic treatment. Approvals obtained shall be appended to the Noise Mitigation Plan.
The design and construction of building acoustic treatment shall adhere to the guidance in the NZ Transport Agency *State highway guide to acoustics treatment of buildings*.

7. **NOISE MITIGATION PLAN**

The Contractor shall prepare a Noise Mitigation Plan (NMP) to demonstrate compliance with this specification, using the template available on the NZ Transport Agency *Transport noise & vibration website* (see acoustics.nzta.govt.nz). The NMP shall include details of:

i. Noise criteria,

ii. Noise modelling,

iii. Noise barriers,

iv. Low-noise road surfaces,

v. Building-modification mitigation, and

vi. Post-construction review.

The Contractor shall submit a draft copy of the NMP to the Principal for approval before construction drawings are finalised and physical works begin.

If an Outline Plan is required, the NMP shall be submitted as part of the Outline Plan.

The NMP shall be updated and finalised to reflect the as-built noise mitigation. The final version of the NMP shall be submitted to the Principal within six months of the state highway opening. The Contractor shall upload the final version of the NMP to the NZ Transport Agency *Transport noise & vibration website*.

A GIS dataset of as-built noise barriers shall be appended to the NMP. The data shall include a polyline for each noise barrier, with the height of the line being the top edge of the barrier. The GIS dataset shall be supplied in ESRI shapefile format with NZ Transverse Mercator (NZTM) projection. Each polyline shall have attributes that record:

i. Unique identifier,

ii. Start and end X/Y co-ordinates,

iii. Installation date,

iv. Nominal height (metres to one decimal place),

v. Length (metres),

vi. Barrier panel material type,

vii. Barrier manufacturer and product name,

viii. Graffiti coatings, and

ix. Paint colour
8. **POST-CONSTRUCTION REVIEW**

The Contractor shall conduct a post-construction review if there are more than 50 PPFs affected by the project, or if specified in the Contract documents.

The purpose of a post-construction review is to confirm the Best Practicable Option (BPO) for noise mitigation has been implemented in accordance with NZS 6806. It must be verified that the noise model used to determine the BPO for noise mitigation, as detailed in the NMP, appropriately represents the as-built road geometry, earthworks and PPFs. It must also be confirmed the as-built noise mitigation has been constructed as specified in the NMP. The post-construction review shall not be based on measurements of noise levels, as these will fluctuate from the design conditions and small changes in noise levels should not alter the BPO for noise mitigation.

The post-construction review shall be undertaken during the defects liability period after the final road surface has been implemented. The post-construction review shall comprise:

i. Noise modelling,

ii. Site inspection of noise barriers, and

iii. Site inspection of road surfaces.

The Contractor shall submit a report to the Principal detailing the findings of the post-construction review within one year of the state highway opening.

8.1 **Noise Modelling**

The as-built geometrics, barriers and traffic data shall be reviewed against the construction design.

The road and noise barrier alignments from the as-built drawings shall be re-imported into the noise model to confirm there are no significant changes from the road alignment used to design the noise mitigation, and from the barriers detailed in the NMP.

Traffic monitoring shall be conducted to establish traffic volumes, mix of heavy and light vehicles, and traffic speeds three to nine months after the state highway opening. A traffic modelling specialist shall confirm whether these data measured shortly after the state highway opening correspond to the future design year conditions used in the noise model.

If there are changes between the as-built and construction design noise models, which result in increased noise levels that change the NZS 6806 category of any PPFs, then the Contractor shall either modify the as-built noise mitigation to reduce noise levels to maintain the same NZS 6806 categories, or shall obtain written approval from the Principal for the as-built noise mitigation.
8.2 Noise barriers

A site inspection shall be performed by an acoustics professional (see Section 2.1) to confirm that noise mitigation has been installed as documented in the final NMP.

An inspection shall be made from the road corridor at the closest point to each PPF or cluster of PPFs. The reviewer shall stand at the far edge of the far-side traffic lane, and shall have a print-out or electronic display from the noise model showing a 3D view from the inspection point looking towards the PPF(s). A visual comparison shall be made of the PPF(s) as viewed on site to confirm if the visibility/screening of the PPF(s) from the road is approximately as modelled. A photograph shall be taken looking towards the PPF(s). If discrepancies are noted in this visual check then more detailed investigation of ground levels and barriers shall be undertaken.

The reviewer shall walk along the full length of each noise barrier and:

i. The height above local ground level of each noise wall shall be physically measured every 100 metres or each time the design height changes by 0.5 metres or more. The height shall be measured at a minimum of three locations for each wall. The measured heights shall be compared to the data in the final NMP. For noise bunds a visual inspection shall be made to confirm the heights are approximately as designed.

ii. A visual inspection shall be made to ensure that all noise barriers are approximately in the positions and of the lengths shown in final NMP.

iii. The noise barrier construction shall be inspected to check for any gaps, and to confirm that the materials are in accordance with the design.

8.3 Road surfaces

The road surface shall be visually inspected to confirm it is of the type detailed in the final NMP. If twin layer or high void porous asphalt has been used, a surfacings professional (see Section 2.1) shall confirm the final surface has been laid as documented in the final NMP.

9. REFERENCES


NZ Transport Agency. Transport noise & vibration website. acoustics.nzta.govt.nz

Auckland Motorways Alliance. What anti-graffiti products are approved for use on the Auckland Motorways? www.aucklandmotorways.com

NZ Transport Agency. Bridging the gap: NZTA urban design guidelines. 2013

NZ Transport Agency. Guidelines for highway landscaping. 2006


Ministry of Business, Innovation and Employment. NZ Electrical code of practice for electrical safe distances. 2001
