

Code of Practice

Noise attenuation walls

1. Introduction

BTN007 Noise attenuation walls states VicRoads' requirements for the structural and acoustic design of noise attenuation walls.

Bridge Technical Notes are a Code of Practice. Compliance with Bridge Technical Notes is mandatory.

Other than as stated in this document and relevant VicRoads standard specifications, the provisions of AS5100:2017 shall apply. Where this document differs from AS5100:2017, its requirements override those of AS5100:2017.

BTN007 is to read in conjunction with VicRoads Standards Specification Section 765.

In addition to structural design requirements, BTN007 includes certain requirements for acoustic design.

Noise attenuation walls shall also comply with AS5100.1 Cl.17.

The acoustic specification, type (reflective or absorptive), material (timber, concrete, steel, polycarbonate, or other composite materials) and location (including dimensions) of noise attenuation walls are determined by others prior to the structural design.

2. General requirements

Requirements for the structural and acoustic design, physical properties and location of noise attenuation walls are stated below.

In the absence of a NATA-approved laboratory, testing shall be conducted by a laboratory approved by VicRoads for this purpose. The laboratory and testing methodology shall be approved by VicRoads before testing commences.

2.1. Physical requirements

2.1.1. General

Requirements for physical properties:

- noise attenuation walls shall have the minimum area density stated in Standard Section 765
- the noise attenuation walls shall have sufficient intrinsic airborne sound insulation performance to ensure that, for all receivers, the sound transmitted directly through the

barrier is not less than 10 dB below the sound diffracted at the top of the barrier

The following is deemed to satisfy this requirement:

- a non-porous construction with no gaps and a surface density of at least 20 kg/m² at its thinnest point
or:
- a construction that has a sound insulation rating value of the weighted sound reduction index with spectrum adaptation term $R_w + C_{tr}$ of at least 25dB when determined in accordance with AS/NZS ISO 717-1 using results from a NATA-accredited laboratory.

The laboratory measurements of airborne sound insulation shall be conducted in accordance with AS 1191 or ISO 10140-2, with the test specimen mounted and assembled in the same manner as the manufactured device is used in practice. The side that would face the traffic shall face the source room. Where posts are employed in construction, at least one post shall be included in the specimen, with panels attached on both sides and the length of the panel on one side of the post shall be $\geq 2m$.

- noise attenuation wall components shall have the design life stated in Standard Section 765
- noise attenuation walls shall have no holes or gaps
- noise attenuation wall materials shall be resistant to vandalism such as impact damage, and components shall be readily replaceable
- noise attenuation walls shall be designed so that they will not reverberate or deflect excessively
- noise attenuation wall surfaces shall be smooth to facilitate removal of graffiti in accordance with Specification Section 685. Matt finishes shall not be permitted
- transparent panels adjacent to or over high-risk land such as rail or road ways shall incorporate filaments or some other means of preventing fragmentation and/or shattering of the panels in the event of an impact

The following general requirements shall also be considered:

- potential reflection of sunlight or vehicle headlights
- resistance of the proposed material to scratching or discolouration with age
- maintenance requirements for dust removal
- bird strike

2.1.2. Absorptive noise attenuation walls

In addition to the foregoing requirements, absorptive noise attenuation walls shall comply with the following:

Absorptive noise barriers shall have a sound absorption coefficient equal to or exceeding that shown in the table below, determined by measurements conducted in accordance with AS ISO 354 by a NATA-accredited laboratory.

The sound absorption measurements shall be conducted with the test specimen mounted and assembled in the same manner as the manufactured device that is used in practice with the same connections and seals between component parts. The test specimen shall be placed directly against one of the test chamber surfaces (floor, wall or ceiling) without gaps as far as possible. If posts are employed in construction, at least one post shall be included in the specimen with panels attached on both sides. The length of the panels on one side of the post shall be ≥ 2 m. The side that would face the traffic shall face the inner part of the test chamber.

Table 1 Coefficient of Absorption

Octave Band - Hz	125	250	500	1000	2000
Sound Absorption Coefficient	0.70	0.80	0.90	0.90	0.80

- the acoustic properties of sound absorptive materials shall not diminish over the design life of the noise attenuation wall.

2.1.3. Transparent noise attenuation walls

Material colour must not detract from road safety objectives or result in shadow tones being cast on private property. When transparent walls are used over, or adjacent to, a rail reserve the wall colour when viewed from the rail track must meet the requirements of the rail authority.

Materials for transparent noise attenuation walls:

- shall be resistant to scratching or discolouration with age
- shall be mounted in rubber gaskets to counteract the high coefficient of expansion
- may incorporate synthetic fibre reinforcement within the clear panel to increase strength.

2.2. Location

General requirements for location of noise attenuation walls:

- noise attenuation walls may be freestanding, or located on top of earth mounds or traffic barriers

- noise attenuation walls shall have sufficient clearance to avoid impact by high/wide vehicles
- noise attenuation walls shall be accessible from both sides for construction, repair and maintenance.

3. Design requirements

3.1. General

Timber posts shall not be used.

Fixings shall with the requirements of Standard Specification 765.

If a noise attenuation wall is located on a bridge over another road or a pedestrian path, the noise attenuation wall and its supporting structure shall be designed to prevent panels or fragments of panels from falling on to traffic or pedestrians as a result of vehicle impact (e.g. a continuous galvanised cable may be used to connect or support the panels).

If a noise attenuation wall is located on traffic barriers, it shall not include components that could penetrate an impacting vehicle.

Noise attenuation walls shall be designed in accordance with AS5100 together with additional criteria for wind loading as specified in Cl.3(b).

Designs that include materials outside of the scope of AS5100 shall be in accordance with the relevant Australian Standards.

Design details and components which could snag or penetrate impacting vehicles shall not be used.

3.2. Wind loading

Wind loads shall be derived from AS5100.2 Cl.25, with additional reference to AS/NZS1170.2, using the net design wind pressure for both serviceability and ultimate limit states.

The design wind speed shall be modified to reflect local terrain and topographic conditions as described below.

Under the action of serviceability wind-loading only, the maximum horizontal deflection of a wall post shall not exceed 1/125 of the post height.

3.2.1. Site conditions during the structure life

Site conditions leading to the highest design wind pressure shall be used in the design, e.g. the sheltering effect of buildings and trees in the vicinity of the noise attenuation wall shall be ignored.

3.2.2. Appendix D2 of AS/NZS 1170.2

The design shall allow for the increased wind load near the ends of noise attenuation walls in accordance with Appendix D2. Subject to consideration of acoustic performance, the height of noise attenuation walls at the ends may be reduced to reduce wind loads and improve appearance.

3.3. Foundation design

The foundation design shall meet the requirements of AS5100.3.

Noise attenuation wall foundations shall be checked for both serviceability and ultimate limit states, and designed to limit deflections to specified tolerances based on the requirements stated below.

Noise attenuation walls on earth mounds or on batters shall have a minimum 1m wide horizontal surface to both sides of the wall to:

- provide access for construction and maintenance
- ensure foundation stability (sliding and overturning)
- protect the foundation
- prevention the formation of gaps below the noise attenuation wall.

Spread (strip) foundations in earth mounds shall be a minimum of 1.5m from the edge of the filled batter.

Fill material for earth mounds shall, as a minimum, comprise Type B fill material placed and compacted to a minimum dry density of 98% standard compaction in accordance with Standard Specification 204.

Noise attenuation walls on disturbed material shall be provided with a piled foundation which shall be designed for the site conditions using appropriate soil parameters.

The effects of long term settlement and lateral movement of the noise attenuation wall due to embankment consolidation shall be considered in the design.

Foundation design for noise attenuation walls near the edge of embankments shall consider the potential embankment movement.

The designer shall specify requirements for earthworks on the drawings.

- The required construction tolerances are stated in Standard Section 765.

Principal Bridge Engineer VicRoads

For further information please contact:

Principal Bridge Engineer
Level 3, 60 Denmark Street
Kew Victoria 3101
Email: landDSrequests@roads.vic.gov.au

Bridge Technical Notes are subject to periodic review and may be superseded.