
TECHNICAL SPECIFICATION XXXX

Plastic Noise Walls

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1. SCOPE

- 1.1 This Austroads Technical Specification ATS XXXX sets out the requirements for the design, manufacture and installation of noise walls using plastic panels, including those manufactured from recycled plastic. It excludes:
- a) noise walls which are predominantly manufactured from materials other than plastic, such as aluminium, concrete, laminated safety glass, masonry, steel or wood; and
 - b) earth mounds created for noise attenuation purposes.
- 1.2 This Specification may also be used for the design, manufacture and installation of plastic panel walls erected for purposes other than noise attenuation (such as landscaping, fencing or aesthetics), in which case Clause 6 does not apply.

2. REFERENCED DOCUMENTS

- 2.1 The following documents are referenced in this Specification:

Australian Building Codes Board 2019, National construction code: volume one, amendment one, ABCB, Canberra, ACT.

Australian / New Zealand Standards

AS 1191	Acoustics - method for laboratory measurement of airborne sound insulation of building elements
AS 1530.8.1	Methods for fire tests on building materials, components and structures — Part 8.1 — Tests on elements of construction for buildings exposed to simulated bushfire attack — Radiant heat and small flaming sources
AS 5100	Bridge design
AS ISO 11654	Acoustics - Rating of sound absorption - Materials and systems

AS ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories
AS/NZ 1170.2	Structural design actions - Wind actions
AS/NZS ISO 717-1	Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation
AS/NZS ISO 9001	Quality management systems
AS/NZS 1580.601.1	Paints and related materials - Methods of test colour - Visual comparison
AS/NZS 2208	Safety glazing materials in buildings
AS/NZS 3837	Method of test for heat and smoke release rates for materials and products using an oxygen consumption calorimeter
AS/NZS 4766	Rotationally moulded buried, partially buried and non-buried storage tanks for water and chemicals
ISO 10140-2	Acoustics — Laboratory measurement of sound insulation of building elements — Part 2: Measurement of airborne sound insulation

ASTM

ASTM D1746	Standard Test Method for Transparency of Plastic Sheeting
ASTM D2565	Standard Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
ASTM D792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM E831	Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM G21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

European Standards

EN 1794-3	Road traffic noise reducing devices — Non-acoustic Part 3: Reaction to fire — Burning behaviour of noise reducing devices and classification
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3. DEFINITIONS

3.1 The following definitions apply to this Specification.

Bushfire attack level (BAL): The ability of an element of a component or structure to satisfy the applicable performance requirements when exposed to a nominated radiant heat flux. For example, BAL 12.5 is based on an incident radiation of 12.5 kW/m².

Design life: The specified period of time in design for which a structure or structural element is required to perform its intended purpose with periodic maintenance and without replacement or major structural repairs.

Façade: plastic wall component that does not serve a noise attenuation purpose and is utilised for practical purposes (i.e. fencing, or aesthetic). This includes but is not limited to decorative panels, architectural screens, cladding, fencing and landscaping components.

Maintenance free period: The period of time during which the asset is both operational and able to carry out its required function(s) without requiring maintenance. Maintenance-free period refers to main construction materials only and does not apply to paints, protective coating, sealing of joints and landscaping.

Manufacturer: Entity providing the total, substantive or final production and assembly process of the

noise wall.

Recycled plastic: Waste plastic that has been collected and processed, by physical, chemical, or other means, and developed into a new product.

4. QUALITY SYSTEM REQUIREMENTS

- 4.1 The panels must be manufactured under a quality management system which is certified to AS/NZS ISO 9001 by a JAS-ANZ accredited organisation (or accredited by another Accreditation Body Member of the International Accreditation Forum).
- 4.2 The Contractor must prepare and implement a Quality Plan that includes the documentation listed in Table 4.2.

Table 4.2 Quality Plan

Clause	Description of Document
5.24	Design documentation, including a Design Report and the Drawings
6.1	Acoustic Performance (only required if the wall is for the purpose of noise attenuation)
7.1	Details of the materials used in the panels
7.11	Test results of the materials used in the panels
8.8	Maintenance Manual

HOLD POINT 1.	
Process Held	Commencement of installation of a noise wall.
Submission Details	The Quality Plan must be provided to the Principal at least 10 working days prior to the commencement of the installation of plastic panels.

5. DESIGN REQUIREMENTS

General

- 5.1 Noise walls must be designed in accordance with this Clause 5 and any other requirements included in the Contract documents. If the noise wall is attached to a bridge or bridge approaches, the noise walls must also comply with AS 5100.1.
- 5.2 The design must comply with any additional requirements specified in the Contract documents, including:
 - a) acoustic specification (unless noise attenuation is not required);
 - b) material type (reflective or absorptive); and
 - c) wall location and dimensions.

If these are not included in the Contract documents, the Design Report must record these parameters and the decision making process used to determine them.
- 5.3 Noise walls must consist of replaceable plastic panels mounted in metal channels fixed to the posts, in which rubber or similar gaskets to grip the panels must be included. Panels must:
 - a) have sufficient freedom to allow their normal range of thermal expansion and contraction without damage to the posts or panels while maintaining acoustic sealing of joints; and

b) be readily replaceable.

- 5.4 The design must consider the pattern of the sun movement and directional lighting (including car headlights), with panels being angled as appropriate. If necessary, a matte finish must be applied to prevent reflective glare from the sun or headlights being experienced by road users.
- 5.5 The walls may be freestanding or located on top of earth mounds or traffic barriers. Freestanding noise walls are installed on individual foundations in the form of bored piles or spread footings. The foundations must not impede natural drainage flow paths. Those installed on traffic barriers are typically located on bridges and bridge approaches.
- 5.6 If a free standing noise wall is protected by a traffic barrier, there must be sufficient clear distance between the traffic barrier and noise wall to account for traffic barrier deflection.
- 5.7 Where a noise wall interacts with other engineering structures (retaining walls, bridges, road safety barriers, etc), design analysis of the supporting structures must account for the forces imposed by the noise wall on the structure.
- 5.8 Where noise walls are located on a bridge over a road or a pedestrian path, the design of the noise wall and supporting structure must prevent panels or fragments of panels from falling on to traffic or pedestrians as a result of vehicle impact. A continuous stainless steel cable may be used to connect or support the panels. Components that could penetrate an impacting vehicle must not be included where a noise wall is located on traffic barriers.
- 5.9 Panels adjacent to or over high-risk land must be designed to prevent fragmentation and/or shattering of panels in the event of impact. The impact of debris and stones must be considered.
- 5.10 Where a panel contains a central void, the panel must include a drainage hole, with a minimum diameter of 20 mm, to prevent any water pooling internally. The hole must be positioned at the base of the panel at the back, be out of sight and not impact the visual aesthetics of the panel.

Design life

- 5.11 Noise wall components must have the Design Life as follows:

Posts and other structural components: 50 years

Panels, panel fixings and fasteners: 30 years.

Design Loads

- 5.12 Where noise wall panels are vertically stacked, underlying panels must not deform when exposed to a load of 1.35 times of the overlaying self-weight of the panels.
- 5.13 Wind loads must be determined in accordance with AS/NZS 1170.2. If the panel is attached to a bridge, the requirements of AS 5100.2 also apply, using the net design wind pressure for ultimate limit states and serviceability.
- 5.14 Noise walls must be designed with an allowable deflection under wind loading of $L/130$.
- 5.15 The design wind speed must reflect local terrain and topographic conditions. The site conditions leading to the highest design wind pressure must be used in the design, i.e., the effect of sheltering from buildings and trees in the vicinity must be ignored.
- 5.16 The design must allow for the increased wind load near the ends of noise walls, according to Appendix D2 of AS/NZS 1170.2. Subject to achieving the required acoustic performance, the height of noise walls at the ends may be decreased to reduce wind loads and improve appearance.

Structural Design

- 5.17 The design must account for the effects of temperature, differential temperature, moisture, differential moisture, warping, twisting, and bowing.
- 5.18 Where the noise wall height is built up from vertically stacked panels, the load on panels must account for bowing of panels. The design must be based on the assumption that the panels will be

stacked with bowing of adjacent panels such that the load distribution produces the worst load effects.

- 5.19 The design must consider that the bottom edge of the wall panel is restrained for bowing and warping due to temperature, differential temperature and differential moisture.
- 5.20 All structural support systems (including flexible edge seals) must be designed to effectively seal against noise and restrain the panels, accounting for the movements associated with warping, twisting and bowing, temperature, differential temperature, moisture, differential moisture.
- 5.21 Under the action of serviceability wind-loading only, the maximum horizontal deflection of a wall post must not exceed 0.8% of the post height.

Structural Robustness

- 5.22 Noise walls must not become detached from their supports or fixings both in the horizontal and vertical planes when subjected the ultimate wind load and the highest combination of the allowable tolerances on the manufacture of panels and installation of a noise wall.
- 5.23 The design of the panels must take the following into account:
 - a) the creep deformation or rupture over the Design Life at the service conditions;
 - b) the panels must be sufficiently ductile to provide for deformation at the supports or alternatively flexible seals may be used.

Design Documentation

- 5.24 The design documentation (including a Design Report and the Drawings) must specify all requirements necessary to enable the noise wall to be manufactured and installed in accordance with this Specification. The Design Report must include design decisions, calculations and any other relevant information not included in the Drawings.
- 5.25 At a minimum, the Drawings must include:
 - a) type of noise wall;
 - b) acoustic requirements;
 - c) protective coatings;
 - d) foundation details;
 - e) alignment of the noise wall/s;
 - f) cadastral / road edge and property boundary;
 - g) existing and proposed infrastructure, drains, road safety barriers, signs, known utilities, fences and gates;
 - h) topographic data (existing and proposed) over the area of interest including the road;
 - i) height and length of noise wall, location of all footings and depths, geotechnical information of the alignment, supporting structures and the drainage requirements in longitudinal sections;
 - j) the method of fixing the panel;
 - k) the panel dimensions;
 - l) panel material composition for noise wall and the minimum thickness;
 - m) height and details of structures that interact with the noise wall in cross sections for each segment of the noise wall; and
 - n) design wind speeds.

Design for Inspection and Maintenance

- 5.26** Unless specified otherwise in the Contract documents, to provide for inspection, maintenance, repair and emergency access, the noise wall must:
- a) be accessible from both sides; and
 - b) if necessary, include openings to enable access for small maintenance machinery.
- 5.27** A free draining, near horizontal surface (minimum 1.0 m wide) must be constructed to both sides of any noise wall located on an earth mound or batter slope. The purpose of this surface is to:
- a) protect the foundation;
 - b) ensure stability foundation of (sliding and overturning);
 - c) prevent gap formation below the noise wall; and
 - d) provide construction and maintenance access.
- 5.28** Noise walls, when placed on or in front of a structure, must not obstruct maintenance of the structure.

6. ACOUSTIC REQUIREMENTS

- 6.1** This Clause 6 does not apply if the wall is not designed for noise attenuation.
- 6.2** The panels must be constructed of reflective and/or absorptive type material. Panels must have sufficient intrinsic airborne sound insulation performance to ensure that, for all receivers, the sound transmitted directly through the wall is ≥ 10 dB below the sound diffracted at the top of the wall. The following is deemed to satisfy this requirement:
- 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 determined in accordance with AS/NZS ISO 717-1.
- 6.3** The laboratory measurements of airborne sound insulation must be conducted in accordance with AS 1191 or ISO 10140-2, with the test specimen mounted and assembled as in its intended use (i.e. the correct side must face the loudspeaker(s) in the source). At least one post must be included in the test specimen, with panels attached on both sides, where posts are used in construction. The length of the panel on one side of the post must be ≥ 2 m.
- 6.4** In addition to the minimum R_w requirements in Clause 6.1, the following applies to absorptive noise walls:
- a) the Weighted Sound Absorption Coefficient of the noise wall panels must not be less than 0.8 (α_w) measured in accordance with AS ISO 11654;
 - b) the absorptive face must be on the traffic side; and
 - c) absorption is not required in the noise wall between 0 mm and 500 mm above the ground.
- 6.5** The acoustic properties of the panel must be retested if a substantial change is made to the design of the panel, which includes a variation to the wall thickness and front face shape.

7. CONSTITUENT MATERIALS

General requirements

- 7.1** The Quality Plan must include the following:
- a) the composition of the materials, including constituents and the percentage by weight in the finished product, demonstrated by laboratory analysis;

- b) the proportion of recycled materials in the finished product (as defined in AS 14021);
- c) the source of the component materials
- d) description of the process of recycling and combination of the materials (where applicable) including machinery, source, type and quantity of energy required by weight to produce the finished product; and
- e) test records demonstrating that the materials comply with Table 7.11.

7.2 Transparent panels must meet the following additional requirements:

- a) during the Design Life, mottling must not occur and a Colour Rating must be less than 2 according to AS/NZS 1580.601.1;
- b) the panels are to be tinted and patterned with thin opaque stripes (or similar) to avoid bird strikes.
- c) be made from acrylic (PMMA) or PC (polycarbonate) unless details of the material are included in the Quality Plan and its use has been approved by the Principal.

7.3 Unless approved otherwise by the Principal, testing must be performed by a laboratory which is accredited by a body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA). The National Association of Testing Authorities (NATA) and International Accreditation New Zealand (IANZ) are signatories to ILAC MRA.

In-service Requirements

- 7.4** Under service conditions, all materials must be stable when exposed to UV radiation over the Design Life. All plastics must contain UV inhibitor.
- 7.5** Noise wall materials must be resistant to impact damage caused by vandalism.
- 7.6** Graffiti must be readily removable with the application of soap and high-pressure water.
- 7.7** Panels must be resistant to scratching and discolouration with age.

Fire performance

7.8 Noise wall materials must achieve the requirements specified in Table 7.9.

Table 7.9 Fire Performance

Cause of Fire	Requirement
Small arson ignition	The fire does not spread beyond the immediate area of ignition.
Vehicle fire	The fire does not spread to the panel adjacent to the point of ignition.
Bushfire	The fire propagation along the wall is minimised when subject to BAL 12.5 (unless a higher BAL is specified in the Contract documents).

7.9 Panels must be tested for resistance to fire in accordance with AS 1530.8.1, with modifications as follows:

- a) For panels larger than 1.0 m x 1.0 m, a test specimen with minimum dimensions of 1.0 m x 1.0 m must be used.
- b) For panels with any dimensions smaller than 1.0 m, a test specimen of the largest dimensions available must be used.
- c) The test specimen must be supported in a vertical configuration.
- d) Crib type Class A must be used.

- e) The crib must be placed adjacent to and touching the test specimen.
- f) Flames must not spread to the extent of the tested specimen.

Testing

7.10 The materials used in the manufacture of the noise wall must be tested for conformance with the requirements in Table 7.11. The testing must be repeated in the event of a change to the constituent raw materials, design or colour of the panels.

Table 7.11 Materials Properties

Property	Test Method	Acceptance Criteria
Smoke release rate	AS/NZS 3837	The smoke growth rate ≤ 100 ⁽¹⁾
Density	ASTM D792	As specified by the designer
Strength	As specified by the designer	As specified by the designer
Transparency	ASTM D1746	As specified by the designer
Translucence	ASTM D1746	As specified by the designer
Resistance to ultraviolet-light exposure ('QUV Exposure')	ASTM D2565	No delamination, fading, discoloration, chalking, or embrittlement after 1,500 hours of exposure ⁽²⁾ .
Impact resistance	AS/NZS 4766 Appendix C Low temperature impact	Resist an impact energy of 90 J at -40°C.
Thermal expansion	ASTM E831	The average expansion of the panel material is below the nominal design maximum (refer Clause 5.3) for the material when exposed to weather conditions appropriate for location of noise wall
Resistance to vermin and micro-organisms	ASTM G21	No growth of fungus observed
Resistance to chemicals, including oils and acids	ASTM D543	No reported changes to panels in weight, dimensions, appearance, colour, strength, and other mechanical properties under exposure to methylated spirits, thinners and brake fluid,

Note:

- (1) Complies with NCC Vol 1, criteria for unsprinklered wall lining materials.
- (2) If only the material colour is changed, this test must be repeated, but the exposure period may be reduced to 500 hours.

Posts, Panel Fixings and Fasteners

7.11 Refer to the Contract documents for any additional requirements for the materials used in the posts, panel fixings and fasteners.

8. MANUFACTURE AND INSTALLATION

General

- 8.1** The noise wall must be manufactured and installed in accordance with the Drawings and this Specification.
- 8.2** Each panel must have clearly embossed markings in a location that can be easily accessed and inspected, with the following information;
- the Manufacturer's name, contact details and address;
 - month and year of manufacture;
 - clear identification the topside; and
 - the Plastics Identification Code identifying the type of plastic used in the panels.

WITNESS POINT 1.	
Process	Installation of noise walls
Notification Period	At least 2 working days before the commencement of work on Site.

- 8.3** Noise walls must be free of holes or gaps. This includes a gap between a panel and the earthworks or pavement material immediately below the panel.
- 8.4** Any drainage holes in a panel (refer Clause 5.10) must be free from obstructions and be free draining.
- 8.5** Panels must not be drilled for mounting purposes. Self-tapping screws must not be used.
- 8.6** Prior to any site modification of a panel, the approval of the designer must be obtained and a copy of that approval submitted to the Principal.
- 8.7** The handling, storage, transportation and erection of the panels and other components must be carried out in accordance with ATS 5850.

Maintenance Manual

- 8.8** The Quality Plan must include a Maintenance Manual which specifies the maintenance requirements and procedures for the noise wall, including:
- procedure for removing graffiti;
 - recommendations for painting or other maintenance measures;
 - procedure for replacement in the event of fire damage a panel; and
 - procedures for repair or replacement in the event of other damage to a panel.

Warranty

- 8.9** The panels must be supplied with a Manufacturer's warranty in the name of the Principal. The warranty must:
- cover defective design, material and manufacturing; and
 - continue for a minimum period of 5 years.

ANNEXURE A: Summary of Hold Points, Witness Points and Records

The following is a summary of the Witness Points / Hold Points that apply to this Specification and the Records that the Contractor must submit to the Principal to demonstrate compliance with this Specification.

CLAUSE	HOLD POINT	WITNESS POINT	RECORD
4.2	1. Installation of a noise wall.		Quality Plan
8.2		1. Installation of noise walls	

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AMENDMENT RECORD

Amendment no.	Clauses amended	Action	Date
-	New specification	New	XXX

Key

- Format Change in format
- Substitution Old clause removed and replaced with new clause
- New Insertion of new clause
- Removed Old clauses removed

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