Noise Wall Design Guide

Urban Design Principles and Objectives

LUD 003

Version 1.0

Purpose:	The purpose of this document is to encourage excellence and set minimum expectations for the design of noise walls, through the provision of key urban design principles and objectives. The document also provides urban design guidelines and project examples to demonstrate good quality noise wall outcomes. This document promotes context specific approaches to noise wall designs that consider pedestrians, cyclists, motorists, local community and the natural and built environment. Noise walls form part of projects that are within a variety of urban, suburban, peri-urban and rural contexts. Each project location has unique physical, ecological, social and cultural characteristics. Noise wall designs need to deliver well-considered identity and amenity outcomes that respond to and are integrated within the local context.
Scope:	This document focuses on the urban design of noise walls within road corridors. It covers: • urban design principles • urban design objectives, and • urban design guidelines, with project examples that demonstrate quality noise wall design. There are several approaches to managing the impact of transport noise, such as road grading, land forming, noise walls and off-site attenuation. Designers need to consider the best approach for each project. The scope of this document is primarily the design of noise walls. This document does not cover the acoustic and structural design requirements of noise walls.
Applicability:	The document applies to noise walls installed on the Victorian freeway and arterial road network. The document will guide designers on the architectural design of noise walls. It will also be of assistance to other professionals involved in noise wall design including engineers, project managers, contractors, as well as property and environmental managers.

1. Background

The Department of Transport and Planning recognises the impact road infrastructure has on shaping our cities and the importance of design in this process. Noise walls play an essential role in reducing road traffic noise in both urban and rural areas. They can also form large physical and visual element in our cities. Well designed and integrated noise walls should have a positive impact on transport users and the local community.

There are many high-quality noise walls in Victoria that contribute positively to the identity of the road network. However, there are also examples of where the quality and appearance of noise walls is variable from an urban design perspective. This design guide aims to encourage good design practice within road projects and describes the minimum design expectations.

To achieve good urban design, noise walls should be developed with a broad group of design professionals and stakeholders. This may include architects, landscape architects and engineers. Where relevant, input may be required from Traditional Owners, arborists, heritage and sustainability specialists. Structural integrity, safety, maintainability, functionality and the visual impact/aesthetics need to be considered in the design of all noise walls.

2. Urban Design Principles and Objectives

When designing a noise wall, there are four urban design principles that should be achieved.

The four principles are:

1.0 Integration

2.0 Identity and Amenity

3.0 Resilience and Sustainability

4.0 Safety

Twelve objectives are listed below that explain what is required to meet these principles. There are also forty-five urban design guidelines under six design themes that provide a detailed description on how these principles and objectives can be achieved.

Principle 1.0 – Integration

Integrate the noise walls with the surrounding environment, heritage, social and built context.

Objective 1.1 – Integrate with context

Provide a quality design that respects the topography, ecology, landscape character, views, user experience and cultural/historical heritage of the site.

Objective 1.2 – Alignment

Ensure the horizontal and vertical wall alignments consider the site context, cross connectivity, protecting existing vegetation, safe and efficient maintenance.

Objective 1.3 – Integrate with infrastructure

Design of noise walls should consider the design intent of other road infrastructure elements within the transport corridor.

Objective 1.4 – Landscape

Provide vegetation in the vicinity of noise walls to screen and enhance the visual experience for transport users and adjacent communities.

Principle 2.0 – Identity and Amenity

Provide noise walls with well-considered identity and amenity that are responsive and appropriate for transport users and local communities.

Objective 2.1 – Sense of place

Respond to local identity by designing noise walls that respect both the natural setting and the local community values and aspirations.

Objective 2.2 – Wayfinding and corridor identity

Ensure noise walls are engaging and memorable to assist with navigation and wayfinding along transport corridors.

Objective 2.3 – Visual amenity

Ensure the noise wall design responds to the site through well-considered architectural and structural design.

Principle 3.0 – Resilience and Sustainability

Noise wall designs should respond to the natural environment and use materials which are sustainable, enduring, and durable.

Objective 3.1 –Sustainability

Ensure the resource inputs, material lifecycle and recyclability are considered in the design of noise walls to maximise sustainable outcomes.

Objective 3.2 – Enduring and durable

Provide design solutions that are enduring in quality, readily maintainable and will age gracefully over the design life.

Objective 3.3 – Environment

Ensure the design avoids and minimises the impact to existing vegetation and maximises opportunities to connect biodiversity habitat.

Principle 4.0 – Safety

Provide noise walls that are safe for the motorists, active transport users, adjoining communities, and maintenance personnel.

Objective 4.1 – Safe environments

Ensure the design of noise walls follows and responds to Crime Prevention through Environmental Design (CPTED) principles.

Objective 4.2 – Operational safety

Ensure the design of noise walls provides for safe and efficient maintenance.

3. Urban Design Guidelines

This section lists the urban design guidelines that provide more information on how the noise wall design principles and objectives can be achieved. These guidelines are grouped under several design themes. The themes are also referenced in the Appendix to provide project examples that illustrate good design outcomes.

Alignment

1. The noise wall location should consider the context of the site topography. For example, where the road is elevated above the noise receptor, align the wall closer to the road to reduce the wall height and associated visual mass.
2. The noise wall should generally be sited to achieve the required noise attenuation with the shortest wall height.
3. The noise wall alignment and construction methodology should minimise removal and impact to existing trees and other important vegetation. Identified high and moderate retention value trees, as identified by the project arborist, should be prioritised.
4. Noise walls along freeways should be aligned to reduce public access to the freeway roadside.
5. Noise walls along freeways should aim to break up a continuous and monotonous length of noise wall by introducing overlaps, curving the wall alignment, changing materials or colours.

6. Context, amenity and passive surveillance should be considered when locating a noise wall near a shared user path (SUP). On arterial roads, it is recommended to align the noise wall on the road reserve boundary to ensure passive surveillance of people using the SUP. On urban freeways, it is preferable to locate the noise wall between the freeway and SUP as it mitigates the noise for people using the SUP. In circumstances where surveillance behind the noise wall is compromised or the space feels too confined, locating the SUP between the noise wall and the freeway may be preferable. Noise wall alignment should follow and respond to the CPTED principles.

(For Alignment examples refer to Figures 1, 2, 3, 4)

Integration

7. Earth mounds should be considered instead of noise walls in situations where; the context is appropriate, space permits, fill is surplus to the project and there is minimal impact to existing vegetation. Earth mounds can either be incorporated as a full height mound or partial earth mound and wall to assist in reducing the visual scale of the wall.
8. The noise wall design should respond to the architectural design and/or theme, regional and heritage contexts of the corridor. Additionally, noise walls within a road corridor should be designed as cohesive project wide elements. This approach can define precinct character as a gateway or celebrate the journey through a place.
9. When tying into existing quality noise walls, ensure the new noise walls are designed to complement the existing alignment, form, materials, patterns, and colours.
10. In road corridors, where the existing noise walls are of an inadequate quality, a new design intent should be developed, which improves the experience of transport users and adjacent communities.
11. An integrated design approach should be considered in the design of noise walls (e.g., architectural, artistic and structural solutions should be developed concurrently and complement each other).
12. Noise walls should integrate with other road structures and adjacent built form (e.g., integrate new noise walls with existing and proposed traffic barriers, noise walls, bridges, fences, retaining walls and paths).
13. The wall colour and material should be used sensitively to complement the context.

(For Integration examples refer to Figures 5, 6, 7)

Visual Amenity

14. Consider how noise walls can reflect local identity through design composition, materiality, colour and artwork narrative.
15. The design of noise walls should consider the scale of the wall and viewing speed (for example, the roadside face of the wall should be designed for viewing at high speeds e.g., 80-110 km/h).
16. Ensure the visual impact of both sides of the wall is well considered and appropriately treated within the site context.
17. Noise walls should eliminate overshadowing impacts on residential areas and aim to minimise overshadowing of waterways and areas of high ecological values. For further guidance on overshadowing in private property refer to DTP BTN 007 [1] and ResCode - Understanding the Residential Development Standards A13, A14, B20, B21 [2].
18. Transparent noise walls should be used in the design to capture significant views from the road, or in strategic locations to create interest and rhythm to break up long lengths of wall.
19. Design of noise walls should avoid literal interpretations of contexts and motifs. Where art or graphics are considered appropriate, they should form an integral part of the noise wall design which can be achieved through form, patterning or textures, rather than being an applied graphic.
20. Consider how natural and artificial light can be used to minimise visual bulk, create interest and express time of day by articulating shadows on wall elements that are curved, tapered, angled or textured.

(For Visual Amenity examples refer to Figures 8, 9, 10, 11, 12)

Construction and Materials

21. Construction materials and methodology should strive to reduce the embodied energy of the noise wall (e.g., maximising panel spans to reduce frequent posts and foundations).
22. Prioritise the re-used, recycled, and low-embodied energy materials where possible as per the Ecologiq Recycled First Policy 2020 [3].
23. Minimise the structural footprint and consider using root barriers to maximise tree planting opportunities.
24. Panels should be designed so that the architectural pattern repeat is seamless.
25. Where continuous wall profiles are not achievable and variations in wall heights are required, any stepping or overlapping should be carefully considered. Generally, when stepping is adopted, the steps should be equally spaced and the step height should be uniform, unless the design intent prescribes otherwise.
26. Consider gradual height transitions at noise wall terminations.
27. Consider concealing the noise wall posts on the side of the wall with the highest visual impact. In some contexts, it may be desirable to express the post as an architectural feature.
28. Horizontal and vertical panel joints should be carefully considered as part of the noise wall composition with consistent and equal spacings.
29. Select materials and colour that age well with environmental conditions such as UV impact and dirt build up.
30. Consider staining of materials on adjacent infrastructure when exposed to weather (e.g., ensure weathering steel noise walls are designed to avoid staining of concrete road barriers).
31. Use of timber; refer to DTP BTN007 [1] for timber requirements and DTP Standard Section 765 [4] regarding the preservative treatment requirements for timber panels in noise walls.
32. Use of un-reinforced concrete noise wall panels must be designed in accordance with AS 5100 [5].

(For Construction and Materials examples refer to Figures 13, 14, 15)

Landscape

33. Include landscaping in the vicinity of noise walls to soften their appearance and reduce visual scale, mitigate graffiti and better integrate them into the surrounding context. To achieve this, allow space for at least two rows of tall planting directly adjacent to both sides of the noise walls.
34. In constrained conditions where the SUP is located adjacent to the noise wall, consider climbers on frames (as outlined in DTP BTN 007 [1]) and low buffer planting to improve amenity and mitigate graffiti.
35. Tree planting in the vicinity of noise walls must comply with the requirements in DTP BTN 007, 5.1 Landscape Environmental Design [1].
36. Planting design must consider inspection access to noise walls, as outlined in DTP BTN 007 [1].
37. Plant species selection in the immediate vicinity of noise walls should consider safe access to noise walls (e.g., avoid plant species that may cause potential harm, such as those with thorns).
38. In regions prone to bushfires, or areas where vegetation planted near noise walls could potentially increase the risk of fire spread, landscaping may have to be avoided or appropriate plant species selected which have intrinsic characteristics that reduce the likelihood of ignition. Plants with low flammability rating may be recommended for some situations.

(For Landscape examples refer to Figures 16, 17, 18)

Safety and Maintenance

39. Noise walls should be designed to restrict access to the roadside face of the wall to reduce the likelihood of graffiti and subsequent graffiti removal adjacent to traffic. Additionally, public access should be prevented with an adequate landscape buffer. Refer to DTP BTN 007 [1] and DTP Standard Section 765 [4] for access and maintenance requirements.
40. Noise walls adjacent to paths and public realm should apply CPTED principles to ensure there are no concealed or confined spaces for people to hide or dwell.
41. In constrained areas where the noise wall and road safety barrier are located directly adjacent to the road, if no planting can be provided between them, it is recommended to combine both elements. This eliminates the risk associated with narrow and difficult to maintain spaces between the elements.
42. Material selection and the associated design life should consider frequency of inspections and maintenance to minimise worker exposure to traffic in high-risk environments. Consider the design life of materials and components.
43. Consider ease of noise wall panel replacement.
44. Provide easy access, particularly in the case of high noise walls requiring use of elevated working platforms.
45. Design noise walls to ensure the necessary clearance requirements are achieved – Refer to Austroads Part 6A for clearances [6].

(For Safety and Maintenance examples refer to Figures 19, 20)

4. Document Terms & References

4.1 Acronyms

Acronym	Term
DTP	Department of Transport and Planning
LUD	Landscape and Urban Design
RMP	Rotationally moulded panelling/or plastic
SUP	Shared User Path
CPTED	Crime Prevention Through Environmental Design

4.2 Terminology

Term	Description
Department of Transport and Planning	Means the Victorian (Australia) Department of Transport and Planning.
Principles	High level directives that guide and influence a design rationale
Objectives	Specific goals that need to be followed to achieve each principle and measure the quality of design
Guidelines	Detailed descriptions that inform how the objectives can be achieved
Noise walls	Engineered structures to reduce noise impacts on sensitive receptors. May also be referred to as noise attenuation walls, noise barriers or wall panels
Plastic	Refers to both extruded and rotationally moulded plastics
Rotationally moulded panelling	Rotationally moulded panelling/or plastic. RMP is a form of plastic moulding. Plastic powder is injected into a hollow mould, it is then slowly rotated and heated in an oven to solidify and create the hollow plastic panel
Transparent	Providing views through. Transparent panels are made from acrylic (PMMA) or polycarbonate (PC)

4.3 References and Related Documents

No.	ID/Ref	Title
[1]	DTP BTN 007	Bridge Technical Note 007, Noise Attenuation Walls
[2]	ResCode A13, A14, B20, B21	Understanding the Residential Development Standards
[3]	MTIA Policy	Ecologiq Recycled First Policy, 2020
[4]	DTP Section 765	Standard Section 765, Noise Attenuation Walls
[5]	AS 5100.2:2017	Bridge Design
[6]	AGRD Part 6A	Austroads Guide to Road Design Part 6A
-	DTP Policy	VicRoads Traffic Noise Reduction Policy, 2005
-	DTP Section 750	Standard Section 750, Routine Maintenance
-	DTP Section 766	Standard Section 766, Plastic Noise Walls
-	DTP RSIM	Road Structures Inspection Manual (RSIM)

-	ATS 4450-23	Austroads, Plastic Noise Walls
-	AP-R277/05	Austroads Modelling, Measuring and Mitigating Road Traffic Noise
-	AP-T162-11	Austroads Review Report; Traffic noise/Long-life Surfacing

4.4 Statutory Requirements

The following legislation was used in the development of this standard. Note that the following references do not constitute all legislation applicable to LUD 003 - Noise Wall Design Guide.

Title	Reference
Aboriginal Heritage Act 2006 (Victoria)	http://www.legislation.vic.gov.au
Disability Discrimination Act 1992	http://www.legislation.vic.gov.au
Environment Protection and Biodiversity Conservation Act 1999	http://comlaw.gov.au
Heritage Act 1995 (Victoria)	http://www.legislation.vic.gov.au
Occupational Health and Safety Act 2004	http://www.legislation.vic.gov.au
Transport Integration Act 2010 (Victoria)	http://www.legislation.vic.gov.au

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Preface

Under the Transport Integration Act 2010 (Vic) the functions of the Head, Transport for Victoria (**Head, TfV**) include the development and implementation of standards, guidelines and practices for the public transport system, the road system and related matters.

Standards and Guidelines are administered by the Department of Transport and Planning (**DTP**) on behalf of the Head, TfV.

DTP Standards and Guidelines respond to Head, TfV objectives and responsibilities, legislative requirements, Victorian Government policies and guidelines, industry best practice and emerging technologies.

Any reference in this document to another document, standard or procedure that is expressed to be a VicRoads, Roads Corporation, Department of Transport (**DoT**), or DTP document, standard or procedure shall be interpreted and applied as though it was a document, standard or procedure of Head, TfV. Any reference in any such document, standard or procedure to a legal right or obligation of VicRoads, Roads Corporation, DoT or DTP shall be deemed to be a right or obligation of Head, TfV.

Nomenclature

ⓘ This symbol intends the accompanying text to be read as INFORMATION. Common information accompanying this symbol includes RATIONALE and GUIDANCE for the associated requirement.

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Interpretation

In this document, except where the context otherwise requires—

- The words "shall" and "must" denotes a requirement which is mandatory.
- The word "should" denotes a requirement which is not mandatory but recommended.
- The word 'may' denotes a requirement which is not mandatory but is an allowance or suggestion.
- The word "includes" in any form is not a word of limitation. Mentioning anything after "includes" or similar expressions (including "for example") does not limit what else may be included.
- Reference to a section, clause, schedule or appendix is a reference to a section, clause, schedule or appendix of this document.

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Appendix A – Noise Wall Examples

Table of Figures

Alignment

Figure 1 – Alignment to retain existing trees, Western Freeway (Rockbank, Victoria) *(Image source: Google Maps)*

Weathered steel noise wall with an altered wall alignment, which minimises the removal and impact to trees by locating the pile foundations outside the Tree Protection Zone.

Figure 2 – Curvilinear alignment that responds to site topography, Eastern Freeway (Doncaster, Victoria)

Demonstrates quality concrete walls, where the curvilinear alignment responds well to site topography and assists in breaking down the visual scale of the wall. Additionally, various textures, monochromatic tones and well considered stepping provide interest for both road users and adjacent communities.

Figure 3 – Alignment to create a landscape buffer, Peninsula Link (Carrum Downs, Victoria) *(Image source: Google Maps)*

Demonstrates quality weathered steel wall, which has been aligned away from the road to accommodate a landscape buffer. Additionally, the wall location provides noise mitigation and amenity planting for SUP users behind the noise wall. However, a concrete maintenance strip should have been provided between the wire rope safety barrier and kerb to reduce ongoing maintenance.

Figure 4 – Alignment to create landscape planting pockets to break up the visual mass of the wall, Dingley Bypass (Clarinda, Victoria)

Demonstrates a painted steel (Colourbond®) noise wall on top of a concrete barrier. The wall transitions in height as it peels away from the road alignment to create a planting pocket, which breaks up the visual mass of the wall.

Integration

Figure 5 – Integration with seamless transition from noise wall to bridge, Craigieburn Bypass (Thomastown, Victoria)

Demonstrates the effective integration of engineering and urban design solutions. A holistic approach was adopted for the design of all road infrastructure elements, resulting in a seamless transition of the noise wall into the bridge and vice versa.

Figure 6 – Integration of noise walls with other roadside infrastructure elements, M80 Freeway (Gladstone Park, Victoria)

Demonstrates effective integration of concrete noise walls with other road infrastructure elements, including road barriers and retaining walls. The yellow/green colour palette assists with wayfinding and is a signature colour of the M80 road corridor.

Figure 7 – Integration with adjacent built form, M80 Freeway (Derrimut, Victoria) *(Image source: Google Maps)*

Demonstrates integration of concrete noise walls with adjacent residential development. The back walls of residential units, which are facing the freeway are designed to act as a noise wall. The form of the wall and the yellow colour match other noise walls on the freeway network.

Visual Amenity

Figure 8 – Visual Amenity creates a memorable gateway experience, Craigieburn Bypass (Thomastown, Victoria)

Demonstrates creative response to the noise wall design. The etched acrylic wall with repeated louvers, located along the residential interface provides high amenity for the locals, assists in wayfinding and creates a memorable gateway experience for motorists entering Melbourne from the north.

Figure 9 – Visual Amenity assists with wayfinding, M80 Freeway (Gladstone Park, Victoria)

Demonstrates a quality, opaque acrylic noise wall. The yellow colour assists with wayfinding and is a signature colour for the M80 road corridor.

Figure 10 – Visual Amenity, transparent panels capture views to open space, Eastlink (Wantirna, Victoria) *(Image source: Google Maps)*

Demonstrates acrylic noise walls on top of concrete barrier that reflect and capture views of the parklands and the local creek.

Figure 11 – Visual Amenity, quality design for the local community side of the wall, Eastern Freeway (Doncaster, Victoria)

Demonstrates concrete noise walls, which have been designed with a high-quality finish on both sides of the wall which responds to the local context.

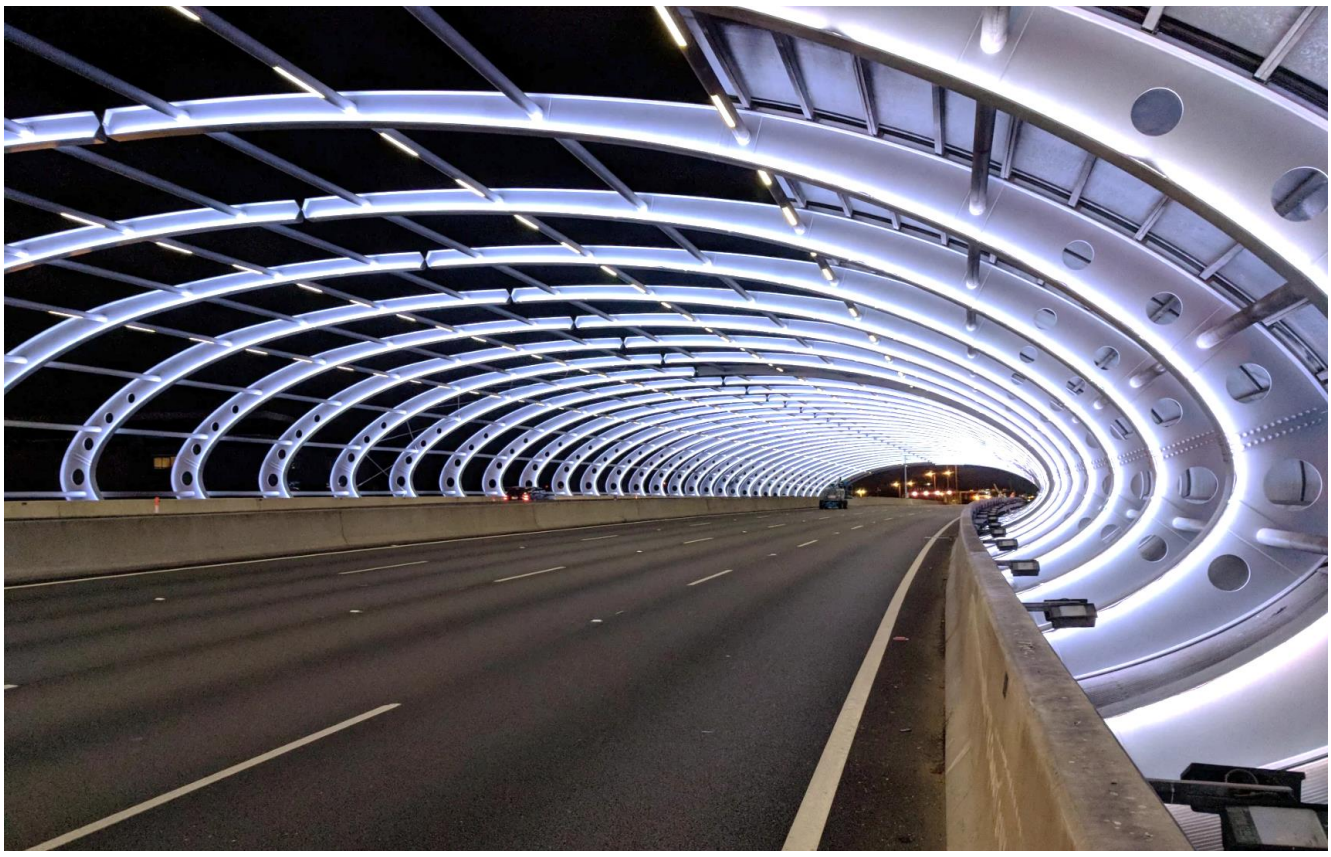

Figure 12 – Visual Amenity, noise wall that reads as urban sculpture, Citylink Sound Tube (Flemington, Victoria) *(Image source: Electrolight)*

Demonstrates quality metal semi-enclosed noise wall, which reads as an urban sculpture. It has been designed to be read at the speed of a moving car and it forms part of Melbourne city gateway.

Construction and Materials

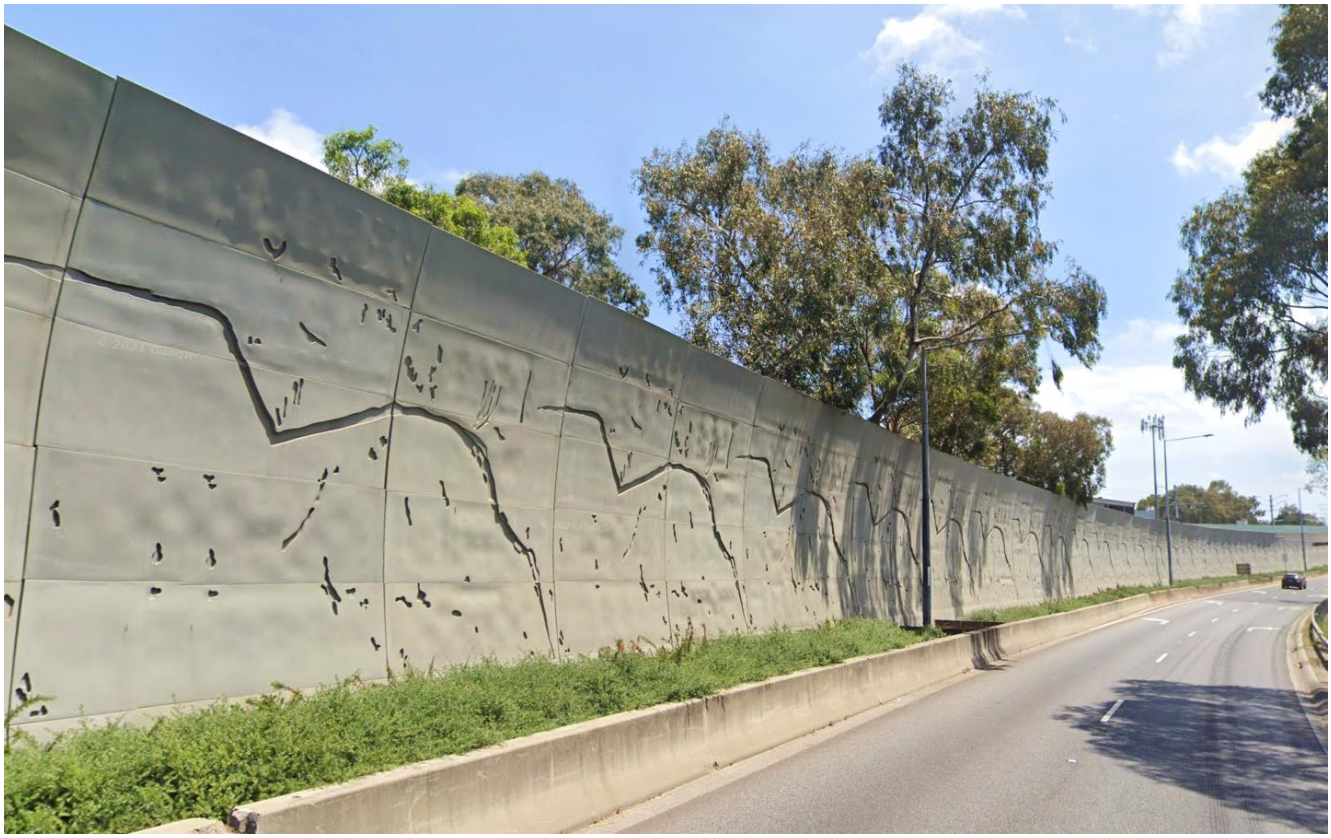

Figure 13 – Construction and materials, example of concealed noise wall posts and use of recycled materials, Monash Freeway, (Kooyong, Victoria) *(Image source: Google Maps)*

Demonstrates the use of Rotationally moulded panelling (RMP) in noise walls, with an architectural relief throughout the panel surface. Concealed posts, matching horizontal joints and seamless pattern repeat achieve quality outcomes. Some imperfections in surface texture require improvements.

Figure 14 – Construction and materials, example of weathered steel and a painted approach to avoid visible staining of concrete road barriers, Geelong Ring Road (Geelong, Victoria) *(Image source: Wood Marsh Architects)*

Demonstrates use of weathered steel in the noise wall design. The road barriers and retaining walls have been designed to match in colour, resulting in staining from weathered steel being disguised. Additionally, the acrylic panels provide interest and rhythm, breaking up the monotonous nature of the wall.

Figure 15 – Construction and materials, example of concrete noise wall with stepping, Eastlink (Dandenong North, Victoria) *(Image source: Google Maps)*

Demonstrates consistent stepping intervals. The concrete panels have been designed to break up the visual bulk of the wall and provide interest and rhythm by adopting patterns that create shadows. Landscaping assists with reducing the scale of the wall and mitigates graffiti.

Landscape

Figure 16 – Landscape buffer to better integrate walls into the surrounding context, Geelong Ring Road (Geelong, Victoria) *(Image source: Wood Marsh Architects)*

Demonstrates generous landscape buffers on both sides of the weathered steel noise walls, which enhances and softens their appearance, breaks down the visual scale and better integrates the walls into the surrounding context.

Figure 17 – Landscape that meets the CPTED principles, Mordialloc Freeway (Mordialloc, Victoria)

Demonstrates quality landscaping adjacent to noise wall, which restricts public access to the wall and reduces the likelihood of graffiti. Tall planting in the background screens imperfections in the recycled RMP surface. Small planting adjacent to the SUP adheres to CPTED principles. Clear trunked trees and low to medium sized plants allow for ease of noise wall inspections.

Figure 18 – Landscape to mitigate graffiti, Dingley Bypass (Clarinda, Victoria)

Demonstrates noise walls with quality landscaping, which restricts public access to the wall and reduces the likelihood of graffiti.

Safety and Maintenance

Figure 19 – Safety and Maintenance with well-considered noise wall overlaps providing access, Western Freeway (Deer Park, Victoria)

Demonstrates well considered architectural steel wall with horizontal patterns. The noise wall forms a sculptural element within the landscape with functional overlaps that provide efficient maintenance access.

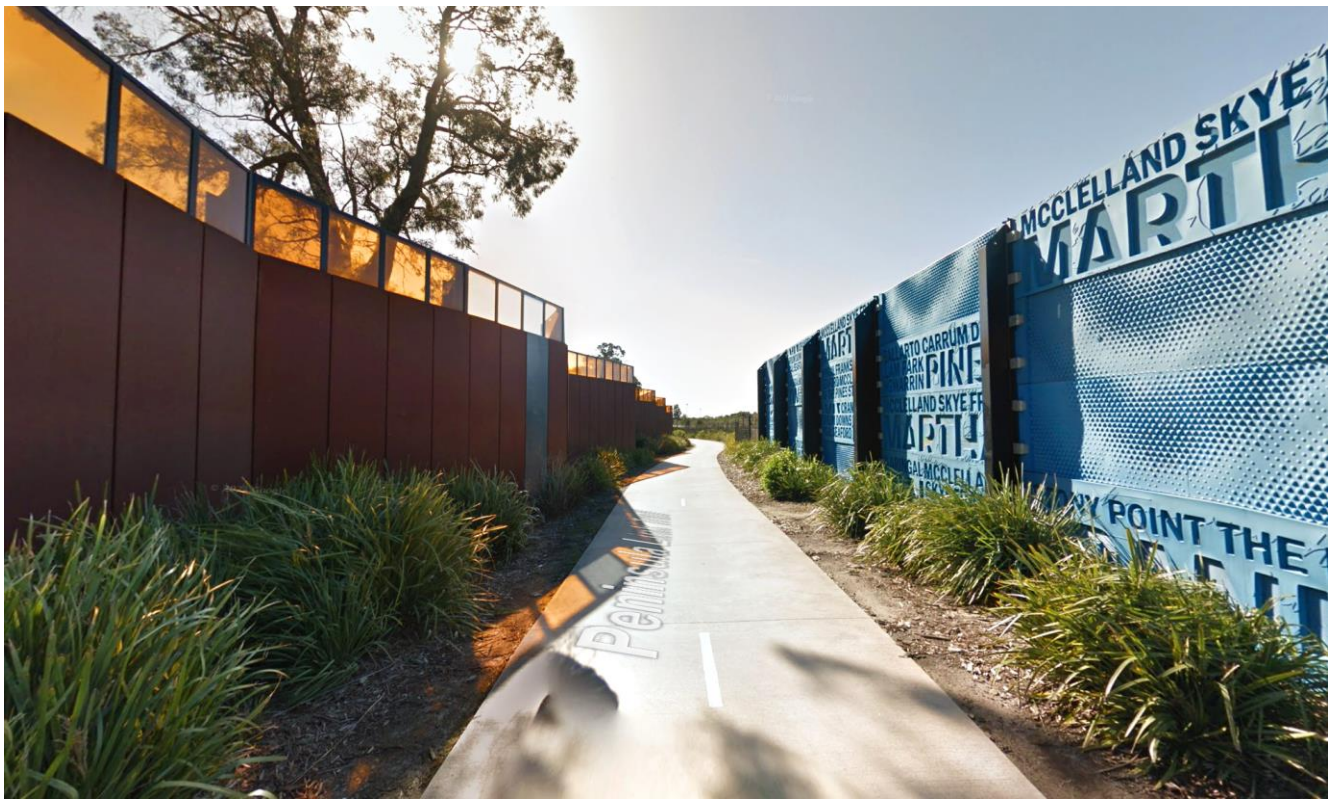

Figure 20 – Safety and Maintenance with no concealed or confined spaces, Peninsula Link (Karingal, Victoria) *(Image source: Google Maps)*

Demonstrates an example of coordinated design where noise wall placement, landscaping and path design consider CPTED principles. The design of generously spaced parallel walls does not create concealed or confined spaces for people to hide or dwell. Low growing plants allow for ease of noise wall inspections.