Protection Screens and Public Safety Barriers

BTN 035
Version 1.0
10 August 2023

1 Scope and Application

Bridge Technical Note BTN 035 – Protection Screens and Public Safety Barriers – states the Department of Transport and Planning 's (DTP) requirements for the design and construction of protection screens and public safety barriers on DTP's road network.

DTP was formerly known as Department of Transport (DoT) and VicRoads. DTP documents include relevant DoT and VicRoads documents which must also be complied with.

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

BTN 035 is to be read in conjunction with the following documents:

- DTP Standard Sections
- AS 5100 - Bridge Design Series
- BTN 001 - Traffic Barriers for Structures
- BTN 014 - Road Sign and Lighting Structures
- DTP - Risk Assessment for Reducing Risk of Throwing Objects from Overpass Structures Guidelines
- DTP - Network Technical Guideline (NTG) – Supplement to Austroads Guide to Road Design – Part 6: Roadside design, safety and Barriers
- Austroads Guide to Road Design, Part 6A: Paths for Walking and Cycling

Other than as stated in this document and the relevant DTP Standard Sections, the requirements of AS 5100 apply. Where this document differs from AS 5100, its requirements override those of AS 5100.

2 Definition

Protection Screens (also referred to as Anti-throw Screens) are screens designed to prevent objects falling or being thrown off bridges, walkways or other structures.

Public Safety Barriers are barriers or screens designed to prevent a person from performing self-harm activities or falling from bridges and other road related structures.

Appendix A provides examples of protection screens, public safety barriers and materials used for screens.

3 Protection Screens Design

The decision to install protection screens on new or existing structures on a State road is based on a risk assessment. The risk assessment must be conducted in accordance with the DTP - Risk Assessment for Reducing Risk of Throwing Objects from Overpass Structures Guidelines.

Protection screens must be designed in accordance with AS 5100.1 including the geometric requirements.

In addition to protection screens, other treatments are available to mitigate the risk of objects being thrown from structures. These include:

- Specifying grouted stone embankments to minimise source of throwable objects;
- Replacement of timber and metal delineator posts in the immediate vicinity of the structures with lightweight plastic alternatives;
- The removal of rocks or debris which may be used as projectiles;
- Modification or removal of other road furniture that could be used as throwable objects;
- Installation of new lighting or enhance existing lighting;
- Installation of video surveillance and signs.

The Designer must include treatment options to reduce the risk to an acceptable level in accordance with DTP - Risk Assessment for Reducing Risk of Throwing Objects from Overpass Structures Guidelines. Where alternative treatments are implemented, a post completion risk assessment must be conducted to ensure the level of risk is below the warrants for protection screens.

Where protection screens are required on a structure crossing over a railway or light rail, the protection screens may be incorporated into the public safety barriers if required by the relevant rail authority. Where this is proposed, the design must meet the design requirements for public safety barriers and any standards that the relevant authority(s) may have.

4 Public Safety Barriers Design

In accordance with DTP's policy, public safety barriers are to be installed on structures where there has been a history of incidents and are specified or included in the procurement contract. DTP may consider public safety barriers on new structures at locations where the risk of incidents is expected to be high.

If requested by the relevant rail authority, public safety barriers must be provided on bridges over rail where pedestrian access is possible.

The height of public safety barriers must be a minimum of 2.7m above the roadway, walkway surface, or any ledge that people can climb/stand on, such as traffic barriers, lighting masts, signs and kerbs except for fully or partially enclosed barriers (refer to Figure 1).

The public safety barriers must be designed with an outwardly incline of no greater than 15 degrees from the vertical, or partially enclosed as detailed in Figure 1. In addition, the public safety barriers is to be designed to be outside the working with of the concrete barrier as required under Section 6.2 of this BTN.

Capping must be provided to the top of public safety barriers . The profile of the cap must be designed, and proven through prototype testing, that a person is unable grip the capping and climb or lift themself over the barrier. Where a circular section type is to be adopted as the cap profile, the circular section must be a minimum of 150 mm in diameter.

Where a mesh/perforated metal material is to be used as a component of a public safety barrier, the mesh vertical gap size must be less than 10 mm, unless a fully or partially enclosed barrier design is adopted.

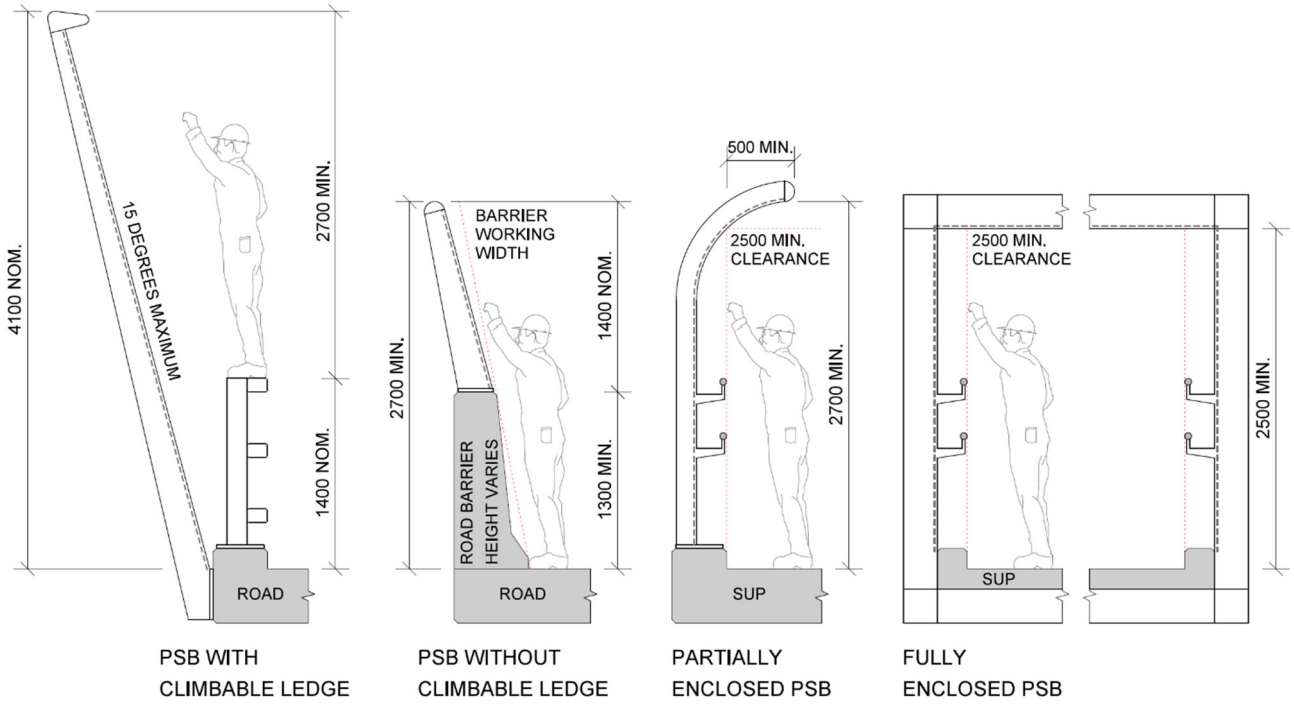

Figure 1 – Examples of Typical Public Safety Barriers showing minimum height and orientation requirements

5 Pedestrian or Cyclist Interfaces

In order to increase the aperture of the mesh / perforated metal, the public safety barriers can be designed to either fully or partially enclose the structure which they are installed on.

Partially enclosed public safety barriers must extend over the adjacent path by a minimum of 500 mm to restrict the ability to climb over the barrier (refer to Figure 1).

Clearances from Shared User Paths or footpaths must not be less than the clearance envelope as defined in the Austroads Guide to Road Design, Part 6A: Paths for Walking and Cycling.

6 Structural Design Requirements

6.1 Design Life

The design life of protection screens and public safety barriers, anchorages and other components must be at a minimum:

i. anchorages on bridges, culverts, structures and major retaining walls: 100 years
ii. screens, panels and other structural components: 50 years

6.2 General Structural Design

Where protection screens and public safety barriers are to be installed on an existing bridge, the bridge must be inspected and an assessment of the structural condition of the deck, superstructure, rails and bridge barriers take place. All bridge components must be assessed by a DTP prequalified Consultant. The prequalified Consultant must certify that the bridge and its components are is suitable for the attachment of any barrier prior to the design be completed and any installation works take place. In addition to the prequalified Consultant, the structure must also be structurally assessed and certified by a DTP Prequalified Proof Engineer.

Where protection screens or public safety barriers are connected to bridge traffic barriers, they must be designed to withstand the induced loads caused by vehicle impact to the bridge traffic barriers to prevent any structure or barrier components from falling onto traffic, rail or any paths below.

All elements of the protection screens and public safety barriers must be located outside of the barrier working width in accordance with the requirements of NTG - Supplement to Austroads Guide to Road Design - Part 6 and AS 5100.

Where the protection screens or public safety barriers are connected to the top of concrete traffic barriers with no steel rails, the minimum height of the concrete barriers must be 1300 mm above the finished road surface. In addition, the minimum barrier height must comply with the requirements of BTN 001. Protection screens and public safety barriers must not be connected to the top of steel barriers.

The anchorage connection system must be designed and located to ensure that they can be easily accessed for future inspections and maintenance activities without the need for specialised equipment, traffic management or service disruption.

6.3 Design Loads

Protection screens and public safety barriers must be designed in accordance with Clause 25 of AS 5100.2.

The fatigue design of steel post components and connections for protection screens and public safety barriers must comply with the fatigue requirements stated in BTN 014 Road Sign and Lighting Structures with the wind speed at 5 m/s and for 100 million cycles.

The fasteners must be designed for fatigue using a wind speed at 20 m/s and 200,000 cycles as a minimum.

7 Architectural Design

The architectural design requirements apply to both protection screens and public safety barriers, unless otherwise stated.

The design must:

- integrate with the form of the existing bridge/structure and consider existing materials, textures and colours;
- respect the existing site context, architectural design intent and theme of the bridge and/or transport corridor; and,
- explore various forms of the barrier design, which may include curvilinear, asymmetrical, set back, angled, fully or partially enclosed to enhance the user experience.

The screen/barrier posts must align with the existing road barrier posts or be spaced at consistent and alternating intervals to the existing bridge railing (refer to Appendix A, Figure 2).

If feature lighting is proposed, it must be seamlessly integrated into the post, handrail, or frame of the screen/barrier. Conduits must be concealed, and electrical infrastructure must be located off the structure.

To maximize visual permeability through the protection screens, the top horizontal supports (e.g., cross bracing, stiffeners) are to be engineered to give the screen a lighter/less bulky appearance. The mesh must also be orientated to provide maximum visibility from the primary driver viewing angle.

For fully enclosed public safety barriers where the barriers to be constructed using steel mesh, the aperture size must be maximised and within the range of 25 mm to 125 mm to enhance a person's feelings of safety and comfort (refer to example provided in Appendix A, Figure 5 & 6). In addition, it is recommended to maintain a post spacing greater than 2.5m.

A consistent taper or stepping of the barrier is recommended rather than an abrupt termination (refer example provided in Appendix A, Figure 8).

Use of colour: Environmental context, wayfinding, the users experience, and maintenance should all be considered in the selection of colours and finishes.

7.1 Material

Different materials can be used for various contexts. These include stainless steel mesh, woven mesh, welded mesh, extruded mesh, metal, acrylic and glass (refer to Appendix A, Figures 9 & 14).

Materials used for protection screens and public safety barriers must address environmental conditions to ensure that the specified design life requirements are met. In marine environments, galvanised steel or stainless steel must be used for protection screens and public safety barriers support structures. Galvanised or stainless steel must comply with the requirements of DTP Standard Sections 630 Fabrication of Steelwork and 631 Protective Treatment of Steelwork.

Designers must consider the possible staining arising from the use of some materials. Where weathered steel is used it must be designed to prevent staining of the concrete barriers or the pavement.

Where highly finished panels are used such as acrylic or glass, consideration must be given to orientation of the panels to prevent reflected sunlight affecting road user's vision or impacting adjacent land owners.

8 Design and Proof Engineering

The design of protection screens and public safety barriers must be conducted by an engineering consultancy that is prequalified at Structures – Simple (SS) level in accordance with DTP's Prequalification scheme.

All designs must be Proof-Engineered by a Proof Engineer that is prequalified in accordance with the DTP's Prequalification scheme.

Document Information

Criteria	Details
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Version	Date	Description
1.0	10 August 2023	Original Publication

Interpretation

In this document, except where the context otherwise requires—

- The word “must” is to be understood as denoting a requirement which is mandatory.
- The word “should” is to be understood as denoting a requirement which is not mandatory but recommended.
- 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.
- A reference to a section, clause, schedule or appendix is a reference to a clause of or schedule or appendix of this document.

Nomenclature

Where any of the following symbols are used within this document, the textual description provided to the right is its intended meaning:

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

Copyright

Disclaimer

Appendix A - Case Studies and Examples

Table of Figures*

(* Disclaimer: All figures are for visual representation purpose only)

Public Safety Barriers

Figure 1 – West Gate Bridge – Public Safety Barrier (Melbourne, Victoria)

Demonstrates architecturally designed public safety barriers, where the public safety and road barrier posts align. The permeable welded mesh is orientated in a way that ensures views to the city and surrounds are well maintained. The white cap on top of the barrier resembles an aerofoil and blends in with the sky and existing road barrier colour while at the same time preventing a person from getting a grip of it.

Figure 3 - Story Bridge – Protection Screens / Public Safety Barrier (Brisbane, Queensland)

Demonstrates a partially enclosed barrier that had been retrofitted onto a historic bridge. High-quality stainless-steel mesh supported by steel posts complements the original bridge and ensures pedestrian views of the river and city skyline are maintained.

Figure 4 - Bolte Bridge – Public Safety Barrier (Melbourne, Victoria)

(Image source: Ronstan Tensile Architecture)

Demonstrates a simple solution that addresses the structural limitations of retrofitting barriers. Stainless steel mesh maintains a transparency that ensures the panels have little impact on views of the bridge. Light colours chosen for the posts are less conspicuous and blend with the sky and surrounds.

Figure 5 – Flinders University Footbridge – Public Safety Barrier (Adelaide, South Australia)

(Image source: Ronstan Tensile Architecture)

Demonstrates an architecturally designed bridge with a fully enclosed public safety barriers. Stainless steel mesh, railing and barrier provide permeability and enhance views to the surrounding parklands and valley.

Figure 6 – Regency Rd to Pym St Pedestrian Bridge – Public Safety Barrier (Adelaide, South Australia)

(Image source: Ronstan Tensile Architecture)

Demonstrates a pedestrian bridge, where stainless steel tensile mesh has been used inside a truss structure. The stainless steel mesh provides good passive surveillance, making the space feel open and safe. The use of light colour against the sky ensures that the structure recedes within the background. Additionally the use of a highlight colour is subtle and provides wayfinding marker for freeway users.

Protection Screens

Figure 7 – Williams Landing – Protection Screens (Melbourne, Victoria)

(Image source: Kyriacou Architects Pty Ltd)

Demonstrates an example of partially enclosed welded mesh screen on a circular truss pedestrian bridge.

Figure 8 - Regional Rail Link, Derrimut Road – Protection Screens (Tarneit, Victoria)

(Image source: Google Maps)

Demonstrates the use of perforated metals in the design of protection screens. The transitions and angles make the barrier look three dimensional. The design would benefit if the panel segments aligned better with the posts.

Figure 9 – Box Hill to Ringwood Shared Path, Tennyson Street – Protection Screens (Mitcham, Victoria)

Demonstrates an example of 25 mm aperture welded mesh. The use of zig zag configuration in panel design assists with maintaining perpendicular views through the material. The use of dark colour against the cutting and background vegetation reduces the visual presence of the structure.

Materials

Figure 10 - Stainless steel tensile mesh (for Protection Screen only)

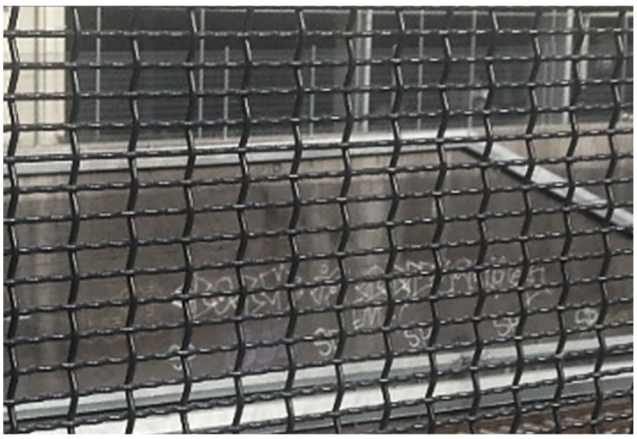

Figure 11 - Woven mesh

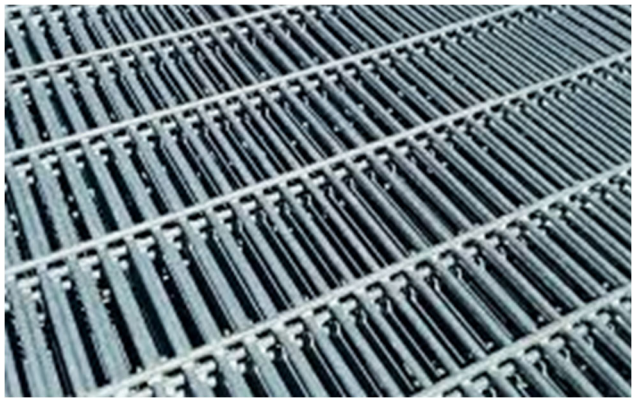

Figure 12 - Welded mesh

Figure 13 - Extruded mesh

Figure 14 - Perforated metal

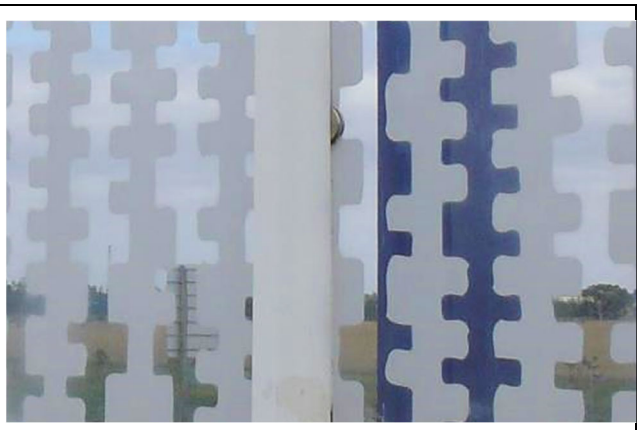

Figure 15 – Acrylic (Etched)

The above material examples demonstrate the different options suitable for Protection Screens and Public Safety Barriers under various conditions.