Road Design Note

Pedestrian Fencing

RDN 06-14

February 2020

1. Purpose

This Road Design Note (RDN) provides additional guidance on the design and selection of pedestrian fencing, including when installed adjacent to the road.

This RDN must be read in conjunction with the Austroads Guide to Road Design (particularly Part 6A and Part 6B), the Austroads Guide to Traffic Management, VicRoads Supplements and VicRoads Standard Drawings.

This RDN complements current guidelines and VicRoads should be sought for clarification, regarding any discrepancies.

2. Safe System

VicRoads' approach towards a Safe System requires practitioners to recognise that humans, as road users, are fallible and will continue to make mistakes when using our roads. In a Safe System, all elements of the transport system should be designed to reduce the occurrence and severity of crashes when they inevitably occur.

As part of the road infrastructure, pedestrian fencing should be designed and installed to ensure that it does not present undue risk to errant vehicles, motorcyclists, cyclists or pedestrians.

3. Benefits

Pedestrian fencing helps to direct people away from hazards (e.g. high-speed roads, steep batter slopes, drop-offs, bridges, waterways, etc) and guide them to a safer location (e.g. formal crossing points). Pedestrian fencing is not designed to stop an errant vehicle and must not be used as an alternative to a road safety barrier. Refer *RDN 06-04 VicRoads Accepted Safety Barrier Products*.

Pedestrians and cyclists will often attempt to use the shortest and most convenient path (called a desire line), which can lead to the use of unsafe crossing locations. The installation of pedestrian fencing can reduce this issue by adding a physical impediment, which in turn increases the desirability and convenience of the designated crossing points.

Figure 1 – Pedestrian fence example (SD3143)

While pedestrian fencing should not be a 'last resort', it is particularly useful at locations such as,

- Sites with high volume of vulnerable pedestrians, for example, school zones or public transport hubs;
- Higher speed arterial roads with consistent and substantial pedestrian presence;
- Sites with a crash history involving pedestrians crossing at inappropriate locations.

Where pedestrian fencing is used to delineate or protect pedestrians and cyclists from non-vehicle hazards and the fence may introduce risk to some road users, the net risk must be less than if the hazard were left untreated.

Pedestrian fencing should not be installed unless it serves a necessary purpose and should only be adopted after non-fencing solutions have been considered (refer Appendix A), such as relocating a pedestrian crossing, providing footpath improvements, and eliminating, relocating or reducing the risk of the hazard (designing-out).

Where pedestrian fencing is required, the design and type of fence must be suitable for the site and context.

4. Design

A good pedestrian fence design is tailored to the purpose, context and the fencing products available. To determine whether fencing is an appropriate treatment, designers must consider the actual and perceived benefits and effects of the fence installation.

Pedestrian fencing comes in various styles and configurations, and is often influenced by multiple standards and guidelines. While a pedestrian fence that exhibits all characteristics would be ideal, until a product is available, appropriate characteristics must be selected for the site and the fence layout must be designed to suit the purpose.

This section provides a combination of layout principles and fence characteristics that must be considered when designing a fence and selecting a suitable type of fence. Over time, these characteristics may influence future product iterations, in order to be more versatile or to optimise a certain purpose.

External sources should be used as necessary, refer Section 6.

4.1. General

All pedestrian fence designs must;

Layout:

- Eliminate or minimise adverse pedestrian desire lines, refer Appendix B;
- Maintain driver sight distances (e.g. at intersections, crossing points and on the inside of horizontal curves);
- Maintain pedestrian and cyclist sight distances (e.g. at crossing points, tight curves and at the fence terminals, with consideration of sightlines between drivers and children);

Characteristics:

- Be of a certain design (e.g. shape or number of horizontal members) to discourage pedestrians from crossing and/or climbing;
- Not have sharp or protruding elements that may snag or injure a road user;
- Enhance the local urban design requirements (e.g. be smooth and visually uncluttered of uniform colour);
- Accommodate all environmental loads (e.g. wind) imposed during normal operating condition;
- Terminate without sharp, protruding or spearing elements, and such that it can be flared away from users if needed;

Durability:

- Be composed of materials that do not create a hazard, (e.g. by shattering or disintegration into sharp edged fragments which would be a hazard to adjacent parties);
- Be durable (e.g. resistant to ignition by cigarettes or similar, or defacement by sharp implements);
- Be resistant to fatigue failure (e.g. due to cyclic wind loading including buffeting from truck movements);
- Be appropriate for the design life of the fence (subject to other principles and characteristics);

Other:

- Consider the ability for people to see through, lean/rest on and enjoy the view without interference – desirable in some situations;
- Reduce the risk to maintenance staff throughout the life of the asset (safety in design and OHS Act-Section 28);
- Be safely and economically maintained for whole-of life, including effects on drainage and debris collection.

4.2. Purpose-specific

4.2.1. Separation or delineation:

To provide a visible and physical impediment to pedestrians and cyclists, so they are guided, deterred or inhibited from areas that may pose a risk (e.g. to deter pedestrians from crossing at an inappropriate intersection or to help cyclists recognise a sharp turn).

In this regard, the fence design must;

- Be ≥ 1.2 m high minimum and of a certain design to discourage pedestrians from crossing and/or climbing;
- Be conspicuous from a distance (e.g. a different colour to the surrounding environment) to minimise the risk of pedestrians being trapped in the carriageway after attempting to cross the road or exiting a vehicle without noticing the fence;
- Guide pedestrians towards a safer crossing location (rather than only eliminating the unsafe crossing point), otherwise, pedestrians may attempt to climb over the fence and endure greater risks;
- When using pedestrian fence for delineation in a median, the median width shall be 1.2 m minimum, as per AGRD Part 3.

  Note: Where fencing is used explicitly for delineation in locations not adjacent to path users it may be acceptable to use 0.9 m min. high fences.

4.2.2. Path user protection:

To protect path users (pedestrians and cyclists) from hazards such as roadside furniture or vertical drops & steep batters, or to prevent pedestrian intrusion into the roadway.

In this regard, the fence design must:

- Extend for the full length of the hazard or high-risk area;
- Be ≥ 1.2 m high minimum;
- Be ≥ 1.4 m high minimum,
  - where the severity of the hazard is considered severe (e.g. high vertical drop from a structure to a body of water or rocks) or
  - at a location where there is a risk of cyclists being vaulted off their bicycle if they collide with the fence, such as on a sharp curve following a steep downhill grade;
- Provide ‘full barrier’ or ‘partial barrier’ fencing (Figure 2) based on the hazard severity and offset tables in AGRD Part 6A – Figure 5.10. For additional information, refer Section 5.0.

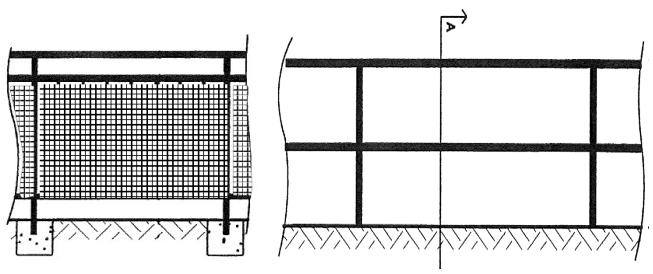

Figure 2 - Austroads full barrier fence (left) & partial barrier fence (right)

- Where 'full barrier' fencing is needed,
  - Vertical members must not be spaced more than 125mm clear; welded mesh or chain-wire are good options, as they provide a more forgiving fall environment, and
  - The spacing between the bottom rail and finished surface level must not exceed 125mm;
  - Be designed for the most extreme of the following loads as per AS1657 – Clause 6.1.1:
    - A horizontal force of 500 N;
    - A horizontal pressure of 1.0 kPa on any infill panel
    - Wind loading in accordance with AS/NZS1170.2 (external location, see Clause 3.1.2);
- Where 'partial barrier' fencing is needed,
  - The fence must comply with AS1657 (see Figure 3);
  - Be designed for the most extreme of the following loads as per AS1657 – Clause 6.1.1:
    - A force of 600 N acting outwards or downwards at any point on the top rail, intermediate rail or post;
    - A force of 350 N per linear metre acting outwards or downwards on the top rail or intermediate rail.
    - Wind loading in accordance with AS/NZS1170.2 (external location, see Clause 3.1.2)
  - One or more intermediate rails must be provided parallel with the top rail and spaced such that the maximum clear space between the rails or between the lowest rail and the toeboard, where fitted, must not exceed 450mm,
  - A toeboard conforming to the requirements of AS1657 Clause 6.1.2 must be installed on the edge of a walkway where there is no permanent structure within 10 mm of the edge, and from which an object could fall to where persons have access to the area below;
- Where no fencing is needed, but an intent to restrict path user deviation exists,
  - Consider non-fencing treatments (see Appendix A)
  - Pedestrian fencing to be 'last resort'
- Where fencing is to be used to protect pedestrians from errant vehicles, please refer Section 5.5.

Where the hazard is a culvert endwall, headwall or retaining wall, with a drop-height greater than 1.0m and access is only available for maintenance, a fence must be at least 1.2m high, shall comply with AS1657, and must extend for the full length necessary to prevent falling from a height greater than 1.0 metre. Refer Section 5.4.1.

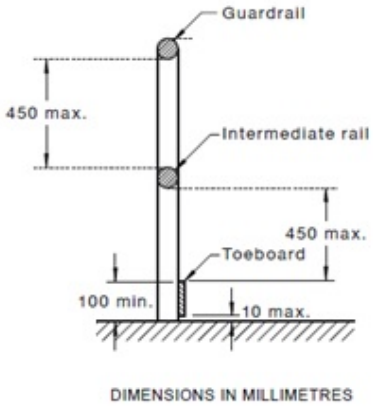

Figure 3 - Typical Guardrailing - Key Dimensions (Source: AS1657 Figure 6.1:)

4.3. Location-specific

4.3.1. Adjacent to traffic

While fencing should be located separate to traffic, either by being offset far enough from the traffic lane (AGRD Part 6, Section 4.2.2) or being outside the working width of a safety barrier, there may be locations where fencing is needed adjacent to traffic.

In this regard, the fence design must;

- Be 'crashworthy' for a defined speed environment, as demonstrated through:
  - Crash testing (preferred) in accordance with AS/NZS 3845.2:2017 – Road Safety Devices, Section 5 – Longitudinal Channelizing Devices, OR
  - A thorough & independent risk analysis (minimum) that investigates the predicted failure mechanism and impact behaviour of the fence, and its risk to an impacting vehicle and/or nearby road users. This may be provided by the pedestrian fence supplier;
- Not have horizontal rails that can separate from the rest of the fence and form a spearing hazard
  - E.g. 'no-weld' modular fencing systems. These systems are a spearing hazard (refer *Figures 8a and 8b*);
- Be at least 0.3m offset from the traffic lane (greater values preferred) to minimise nuisance hits, and to avoid the additional risks produced by damaged fencing;
- Minimise the risk of pedestrians being trapped in the carriageway after attempting to cross the road or exiting a vehicle without noticing the fence;
- Consider the parking requirements at the site (including loading zones, formal and informal drop off and pick up areas, etc).

4.3.2. Adjacent to other road users

Where pedestrian fencing is installed in areas with high volumes of a specific road user group, the fence design should be tailored to meet their needs. E.g. fences should be designed to be child-friendly when located near schools.

In this regard, the fence design should:

General

- Be installed with enough clearance (refer relevant guidance) from the footpath or shared path to reduce risks to pedestrians and cyclists (including minor injuries);
- Consider and mitigate reductions to the effective footpath width for cyclists and pedestrians, including wheelchairs;
- If needed, provide handrails in accordance with AS1657, to aid pedestrians at stairs and steep downgrades.

Cyclist-friendly

- Provide a 'smooth' contact face, designed to reduce the risk of bicycle handlebars & pedals becoming snagged
  - An infill panel made of a mesh or similar product with an aperture size or pitch clearance of no more than 25mm.
- if a 'smooth' contact face is not provided, the fence should have a cyclist deflection rail offset 150mm in-front of the balustrade as per *AGRD Part 6A Figure 5.12*.
  - Cyclists deflection rails enable a cyclist to deflect off the smooth horizontal rail striking the rail between the cyclist's shoulder and elbow (i.e. between 1.2m and 1.4m from path surface) so that handlebars (typically 1.0m from surface level) do not get caught in the vertical components of the fence.
- If a cyclist deflection rail is not provided, the fencing must be sufficiently offset from the cycling path.

Child-friendly

- Ensure that children cannot slip through the fence or get stuck. This may be achieved by reducing the spacing of the vertical bars or by providing a mesh screen attached to the fence. Refer AS2156.2 – Walking tracks: Infrastructure design.

Disability-compliant

- Comply with the VicRoads Traffic Engineering Manual (TEM) Volume 3, the Disability Discrimination Act (DDA) and AS1428 – Design and access for mobility.
- Have tactile and/or sound-reflective elements at ground level for vision-impaired pedestrians.

Workplace-compliant

- Comply with AS1657 - Fixed platforms, walkways, stairways and ladder, to reduce the risks to the safety of users

5. Types of pedestrian fencing

While VicRoads does not maintain a list of accepted pedestrian fences, several pedestrian fence types (public domain and proprietary) are being used commonly throughout Victoria. These have been discussed below to assist designers.

At the time of writing, the following public domain fences were recognised:

- VicRoads Welded Mesh Fence – SD3143
- RMS (NSW) Pedestrian Fencing – Type 1, Type 3, Type 5

Both public domain and proprietary fences should be assessed in accordance with this RDN before use. Where certain design characteristics are provided, these may be justified by the proprietary product supplier.

5.1. Selection summary

Table 5.1 provides a selection summary for the barrier types discussed below.

Table 5.1 – Selection summary

Purpose	Separation		User Protection	
Location	Adjacent to traffic	Separated from traffic	Adjacent to traffic	Separated from traffic
Full barrier fencing (5.2)	No	Yes	No	Yes (1)
Crashworthy fence (5.3)	Yes	Yes	Yes	No
Partial barrier fence (5.4)	No	Yes	No	Yes
Road safety barrier (5.5)	Yes (2)	No	Yes (2)	No

Notes:

1. 'AS5100 Pedestrian Barriers' are mandatory on bridges and other structures. Full barrier fencing may be used for all other hazards.
2. Where safety barriers are deemed suitable in lieu of pedestrian fencing, refer Section 5.5.

5.2. Full barrier fencing

'Full barrier' fencing (shown in AGRD Part 6A Section 5.5.3) is designed such that pedestrians are unable to pass/fall through the fence, due to a minimum infill or minimum opening space.

Full barrier fencing is used to protect path-users from severe hazards, such as vertical drops and steep batters. It can be

'smooth' to reduce the risk of bicycle handlebar snag and can be customised with handrails, cyclist protection rails, toeboards and other fence modifications.

Full barrier fencing must be separated from traffic, unless deemed crashworthy (including any modifications), and will often reduce sight lines.

Figure 4 – Pedestrian barrier with handrail attachment

5.2.1. AS5100 Pedestrian Barriers

'AS5100 Pedestrian Barriers' (Figure 4) are a type of 'full barrier' fence that comply with *AS5100 – Bridge Design*.

AS5100 Pedestrian barriers are mandatory on bridges and other structures that accommodate pedestrian and cyclist paths. In this case, AS5100 and relevant documents take precedence.

AS5100 Pedestrian barriers can be used in locations requiring pedestrian or crowd containment, such as stadiums and train stations. Refer AS5100.2 cl12.5 for additional information regarding crowd loading.

AS5100 Pedestrian barriers can be customised with handrails, rub-rails and other fence attachments in line with AS5100.

5.3. Crashworthy fencing

'Crashworthy fencing', also called Roadside Pedestrian Fencing, (Figure 1 & 5) is a type of fence that is deemed to be crashworthy for a defined speed environment and therefore may be installed adjacent to traffic (e.g. verge & medians).

These fences often adopt 'full barrier' characteristics to prevent pedestrians from falling though, and to discourage pedestrians from climbing. Crashworthy fencing may be used in areas of high pedestrian volumes, such as schools, shopping centres, bus stops, tram stops and near intersections.

Handrails, rub-rails and other fence modifications cannot be attached unless they are deemed crashworthy and do not change the behaviour of the fence during vehicle impact.

Crashworthy fencing is often designed to collapse during impact, therefore may not comply with *AS5100 – Bridge Design* (e.g. strength requirements) and cannot be used on bridges, other structures or for crowd containment. In this case, 'AS5100 pedestrian barriers' can be used and separated from traffic (via safety barrier or sufficient lateral offset) or a 'Road Safety Barrier' may be used (Section 5.5).

At the time of writing, the following public domain fences have been designed to withstand low and moderate speed vehicle impacts:

- VicRoads Welded Mesh Fence – SD3143
- RMS (NSW) Pedestrian Fencing – Type 1, Type 3, Type 5

  Note: VicRoads discourages the use of RMS Type 2 and Type 4 and Type 6 fencing due to the protruding elements that may snag or injure road users.

Figure 5 – Crashworthy fence, RMS (NSW) pedestrian fence

5.4. Partial barrier fencing

'Partial barrier fencing' (shown in AGRD Part 6A Section 5.5.3 & Figure 6) typically incorporates several horizontal rails, in accordance with AS1657, designed to prevent people from inadvertently leaving the path.

These fences provide guidance and/or pedestrian control and may be considered for use at path-sides where the hazard severity does not warrant 'full barrier' (e.g. shallow drains, landscaping and poor delineation).

While partial barrier fencing is lower cost, lighter weight and can be designed to be more aesthetic than full barrier fencing, the fence design may encourage climbing and the balustrades and handrails may snag bicycle pedals and handlebars, thereby reducing the effective path width.

Partial barrier fencing can be customised for minimum height requirements, handrails, toeboards and other fence modifications in line with AS1657.

Partial barrier fencing must be separated from traffic, unless deemed crashworthy (including any modifications).

Figure 6 – Partial barrier fence (with toeboard) delineating the path through a landscaped area (not adjacent to traffic)

5.4.1. Safety fencing

Safety fencing (Figure 7) is a type of 'partial barrier' fence that must be provided at the top of a 1.0m+ vertical drop, where general access is not intended but maintenance personnel, inspectors or members of the public may gain entry, such as culvert headwalls and retaining walls.

Where a 1.0m+ retaining wall is integrated into a concrete safety barrier (Figure C.2), the safety fence must be located outside the working width of the barrier, or a crashworthy fence must be used.

Safety fences must be at least 1.2m high, comply with AS1657 and extend for the full length necessary to prevent falling from a height that is greater than 1.0m.

Figure 7 – Safety fence on top of culvert

5.5. Road safety barriers in lieu of pedestrian fencing

While road safety barriers (RDN 06-04) are primarily designed for the protection of errant vehicles, they also protect path users from errant vehicles when placed between the carriageway and pedestrian/cyclist path.

Where an accepted safety barrier is tall enough or is deemed to deter unsafe crossing, it may be considered in lieu of pedestrian fencing.

Safety barriers less than 1.2m high (e.g. guard fence) may be used to protect path users from traffic in low risk departure conditions (i.e. without risk of path users vaulting the barrier, such as on a sharp curve following a steep downhill grade). Back-to-back guard fence may be used where the barrier is located close to path-users, to maximise the effective path width.

Figure 8 – Road safety barrier next to pedestrian path with cyclist friendly fencing.

Smooth concrete barriers (Figure 8) greater than 1.2m may be used in lieu of most pedestrian fencing types.

Otherwise, pedestrian railing (Figure 9) may be attached to the top of permanent rigid barriers to achieve height requirements for pedestrians (1.2m) or cyclists (1.4m) without altering the barrier containment level. Pedestrian railing must be located outside the barrier working width or deemed crashworthy (including termination points) in accordance with AS5100 and AS/NZS3845.

Figure 9– Pedestrian railing, a smaller longitudinal steel member welded to the rigid steel barrier.

6. References

1) Australian Standard AS1428.1:2009 – Design for access and mobility

2) Australian Standard AS1657:2018 – Fixed Platforms, Walkways, Stairways and Ladders - Design, Construction and Installation

3) Australian Standard AS2156.2:2001 – Walking tracks – Infrastructure design

4) Australian Standard AS5100:2017 – Bridge Design

5) Australian/New Zealand Standard AS/NZS 3845.2:2017 – Road Safety Barrier Systems and Devices

6) Austroads Guide to Road Design Part 4: Intersections and Crossings (General) (Aug 2009)

7) Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Second Edition, Oct 2010)

8) Austroads Guide to Road Design Part 4B: Roundabouts (Third Edition, Dec 2015)

9) Austroads Guide to Road Design Part 4C: Interchanges (Second Edition, Dec 2015)

10) Austroads Guide to Road Design Part 6: Roadside Design, Safety and Barriers (Second Edition, Aug 2010)

11) Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths (Oct 2009)

12) Austroads Guide to Road Design Part 6B: Roadside Environment (Aug 2009)

13) Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings (Second Edition, Apr 2013)

14) Department of Transport and Main Roads (QLD) Fencing and edging treatments for cycling infrastructure (Feb 2019)

15) VicRoads Standard Drawing SD3143

16) VicRoads Supplement to the Austroads Guide to Road Design Part 6A: Pedestrian and Cyclist Paths (Rev 2.0, Dec 2012)

17) VicRoads Supplement to the Austroads Guide to Road Design Part 6B: Roadside Environment (Rev 2.0, Jul 2011)

18) VicRoads Supplement to the Austroads Guide to Traffic Management Part 6 (Edition 1, Oct 2015)

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Appendices

APPENDIX A: Summary of non-fencing treatments

APPENDIX B: Evaluation of pedestrian desire lines

APPENDIX C: Examples of non-compliant fencing and spearing hazards

APPENDIX D: Pedestrian Fencing Checklist

APPENDIX E: Examples of fence type vs location

Revision History

Issue	Approved	Date	Amendment
06-14	M-RS&T	Feb 2020	First edition

Road Design Notes are subject to periodic review and may be superseded.

Appendix A – Summary of non-fencing treatments

There are several ways to accomplish a non-fencing solution for paths and they are often used in conjunction with each other to address multiple issues. Treatments that avoid the introduction of new hazards and do not reduce the effective path width are preferred. Refer AGRD Part 6A and Part 6B.

Delineation

Delineation treatments can be provided by line marking to delineate the path edge, features, hazards, or path centreline.

Rideable runout areas

Rideable runout areas are a flat or gently sloped area preferably 1.0m wide (0.6m minimum) to allow riders to correct their path of travel.

Landscaping

Landscaped areas adjacent to paths can be effective treatments to delineate path edges and provide a more forgiving fall environment. Vegetation and bedding should be relatively soft and ideally less than 0.5m high, especially where sight distance needs to be maintained between path users and vehicle drivers.

Edge treatments

Edge treatments come a variety of shapes and are best designed with an inclining but rideable surface and a smooth transition from the edge of the path.

Low Walls

Barriers between 0.45-1.0m high and 0.5-1.0m wide with a smooth surface that is unlikely to catch can be defined as a low wall.

Examples of non-fencing solutions

Figure A.1 – An existing path using delineation, rideable clear zone on the left, and inclined edge treatment on the right.

Figure A.2 – An existing path using landscaping on either side of the path and delineation on the centreline to aid cyclists around the tight curve

Figure A.3 – Edge treatments making use of existing kerbs and delineation to guide cyclists.

Appendix B – Evaluation of pedestrian desire lines

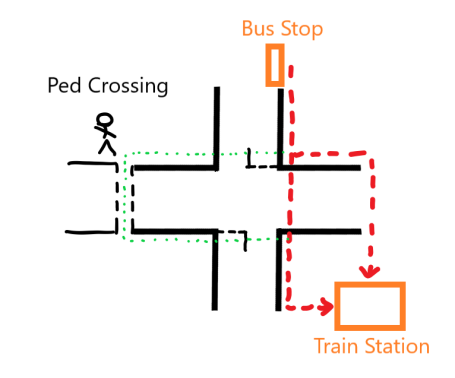
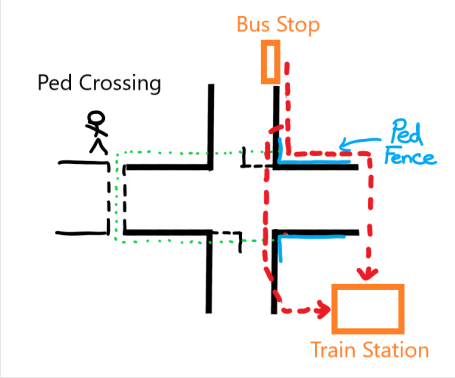
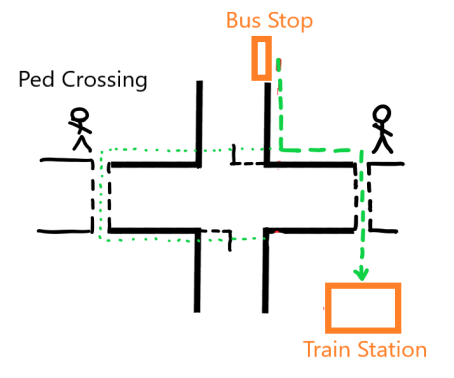
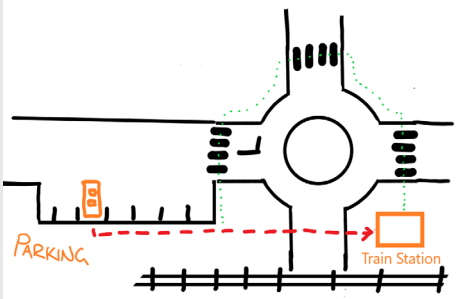
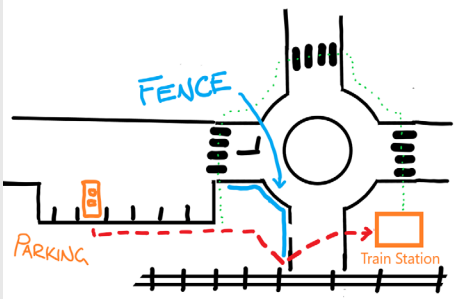
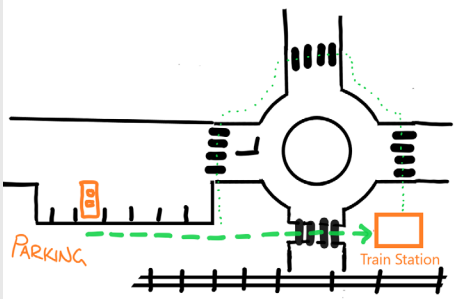
Pedestrians and cyclists will often attempt to use the shortest and most convenient path (called a desire line). This can lead to the use of unsafe crossing locations where the perceived benefit is greater than the perceived risk.

The installation of pedestrian fencing and non-fencing solutions can change a pedestrian's desire line by adding a physical impediment, which in turn, increases the desirability and convenience of the preferred crossing points.

However, in some cases, the installation of fencing can introduce worse desire lines as shown below, therefore it is essential that pedestrian desire lines are predicted and evaluated before the installation of pedestrian fencing.

The evaluation of pedestrian desire lines is not a prescriptive process but is very useful when identifying issues. It often requires a site-visit, an internal discussion/workshop and engineering judgement.

Table B.1 - Pedestrian desire line examples

Existing	Fencing option	Desirable option
		
Pedestrian crossing not located between the bus stop and train station. Undesirable crossing is occurring.	Fencing option likely to introduce adverse pedestrian desire lines, as some users will walk around the fence or use the same crossing location.	Desirable option is to relocate the pedestrian crossing between the bus stop and train station.
		
Pedestrian crossing not located between the car parking and train station. Undesirable crossing is occurring.	Fencing option likely to have little effect on pedestrian desire lines.	Desirable option is to relocate the pedestrian crossing between the bus stop and train station.

Appendix C – Examples of non-compliant fencing and spearing hazards

Non-compliant examples to avoid

Figure C.1 – An existing non-compliant separation fence arrangement installed to guide alighting tram patrons to safe crossing points. The fencing comprises horizontal rails, which if impacted by an errant vehicle can separate or detach from the supporting posts and form a spearing hazard.

Figure C.2 – Another existing non-compliant arrangement installed to protect maintenance workers. There is no physical separation in place to suggest an errant commercial vehicle would be protected from spearing hazard.

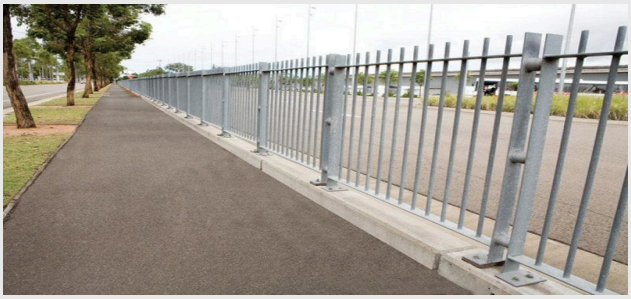


Figure C.3 – An existing non-compliant separation fence installation. The tips of the vertical bars are exposed and present an impaling risk to pedestrians.

Spearing hazards

Figure C.4 – Aftermath of an errant vehicle collision with a fencing arrangement similar to Figure C.1 & C.2.

Figure C.5 – Corresponding image to Figure 8a

Figure C.6 – Another example of an errant vehicle collision with a fencing arrangement similar to Figures C.1 & C.2

Appendix D – Checklist

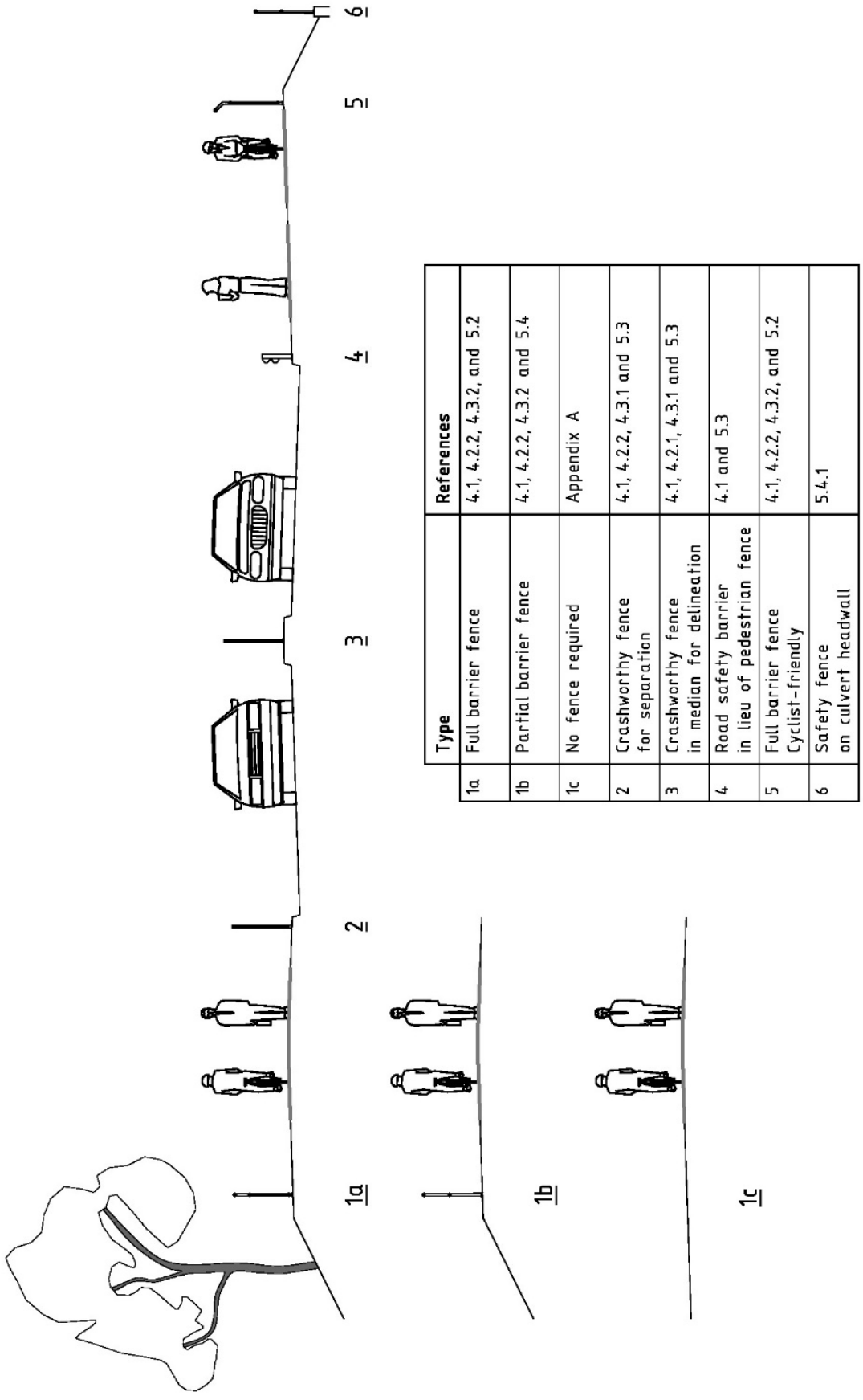
This table contains the information above, in a checklist format.

Although a fencing design is not required to meet all items on this list, it must be tailored to the purpose, context and the fencing product. This checklist provides a way to select (tick) the relevant characteristics that have been provide

	Layout:	
1	Adverse pedestrian desire lines are eliminated or minimised, refer Appendix B	
2	Driver sight distances are maintained (e.g. at intersections, crossing points and on the inside of horizontal curves)	
3	Pedestrian and cyclist sight distances are maintained (e.g. at crossing points, tight curves and at the fence terminals, with consideration of sightlines between drivers and children)	
4	Pedestrians are guided towards a safer crossing location (rather than only eliminating the unsafe crossing point)	
5	The offset to the traffic lane has been maximised to avoid nuisance hits and frequent repair and absolute minimum is 0.3m;	
6	Risk of pedestrians being trapped in the carriageway after attempting to cross the road or exiting a vehicle without noticing the fence has been minimised	
7	Parking requirements at the site have been maintained (including loading zones, formal and informal drop off and pick up areas, etc).	
8	Be installed with enough clearance (refer relevant guidance) from the footpath or shared path to reduce risks to pedestrians and cyclists (including minor injuries);	
9	The effective footpath width for cyclists and pedestrians, including wheelchairs, has been evaluated and is not adversely affected.	
10	The fence is separated from traffic, either by being offset far enough from the traffic lane (AGRD Part 6, Section 4.2.2) or by being outside the working width of a safety barrier, or the fence is deemed 'crashworthy'	
	Characteristics:	
11	Is ≥ 1.2 m high minimum, where the severity of the hazard is considered low or to guide path-users to a preferred crossing point;	
12	Is ≥ 1.4 m high minimum, where the severity of the hazard is considered severe (e.g. high vertical drop from a structure to a body of water or rocks) or the risk of cyclists being vaulted off their bicycle is higher, such as on a sharp curve following a steep downhill grade;	
13	Is designed to discourage pedestrians from crossing and/or climbing (e.g. shape and/or number of horizontal members)	
14	Has no sharp or protruding elements that may snag or injure a road user;	
15	Has no horizontal rails that can separate from the rest of the fence and form a spearing hazard (E.g. 'no-weld' modular fencing systems. These systems are a spearing hazard (refer Figures 8a and 8b))	
16	Terminate without sharp, protruding or spearing elements, and such that it can be flared away from users if needed;	
17	Enhances the local urban design requirements (e.g. be smooth and visually uncluttered of uniform colour);	
18	Is conspicuous from a distance (e.g. a different colour to the surrounding environment) to minimise the risk of pedestrians being trapped in the carriageway after attempting to cross the road or exiting a vehicle without noticing the fence;	
19	Provides handrails in accordance with AS1657, to aid pedestrians at stairs and steep downgrades.	
20	Provides a 'smooth' contact face, designed to reduce the risk of bicycle handlebars & pedals becoming snagged - A mesh or similar with an aperture size or pitch clearance of no more than 25mm.	
21	Provides a cyclist deflection rail offset 150mm in-front of the balustrade and located between the cyclist's shoulder and elbow (i.e. between 1.2m and 1.4m from path surface) as per AGRD Part 6A Figure 5.12.	
22	Ensures that children cannot slip through the fence or get stuck. E.g. by reducing the spacing of the vertical bars or by providing a mesh screen attached to the fence. Refer AS2156.2.	
23	Complies with the VicRoads Traffic Engineering Manual (TEM) Volume 3, the Disability Discrimination Act (DDA) and AS1428 – Design and access for mobility.	
24	Has tactile and/or sound-reflective elements at ground level for vision-impaired pedestrians.	
25	Complies with AS1657 - Fixed platforms, walkways, stairways and ladder, to reduce the risks to the safety of users	
26	Where the hazard is a culvert endwall, headwall or retaining wall, with a drop-height greater than 1.0m and access is only available for maintenance, a fence must be at least 1.2m high, shall comply with AS1657, and must extend for the full length necessary to prevent falling from a height greater than 1.0 metre. Refer Section 5.4.1.	

	Full barrier' vs 'partial barrier' (AGRD Part 6):	
27	Full barrier: Vertical members must not be spaced more than 125mm clear; welded mesh or chain-wire are good options, as they provide a more forgiving fall environment, and	
28	Full barrier: The spacing between the bottom rail and finished surface level must not exceed 125mm;	
29	Full barrier: Be designed for the most extreme of the following loads as per AS1657 – Clause 6.1.1: - A force of 600 N acting outwards or downwards at any point on the top rail, intermediate rail or post; - A force of 350 N per linear metre acting outwards or downwards on the top rail or intermediate rail. - Wind loading in accordance with AS/NZS1170.2 (external location, see Clause 3.1.2	
30	Partial barrier: The fence complies with AS1657	
31	Partial barrier: One or more intermediate rails must be provided parallel with the top rail and spaced such that the maximum clear space between the rails or between the lowest rail and the toeboard, where fitted, must not exceed 450mm,	
32	Partial barrier: A toeboard conforming to the requirements of AS1657 Clause 6.1.2 must be installed on the edge of a walkway where there is no permanent structure within 10 mm of the edge, and from which an object could fall to where persons have access to the area below;	
33	Partial barrier: Be designed for the most extreme of the following loads as per AS1657 – Clause 6.1.1: - A force of 600 N acting outwards or downwards at any point on the top rail, intermediate rail or post; - A force of 350 N per linear metre acting outwards or downwards on the top rail or intermediate rail. - Wind loading in accordance with AS/NZS1170.2 (external location, see Clause 3.1.2)	
	Durability:	
34	Is composed of materials that do not create a hazard (e.g. by shattering or disintegration into sharp edged fragments which would be a hazard to adjacent parties);	
35	Is durable (e.g. resistant to ignition by cigarettes or similar, or defacement by sharp implements);	
36	Is resistant to fatigue failure (e.g. due to cyclic wind loading including buffeting from truck movements).	
37	Is appropriate for the design life of the fence (subject to other principles and characteristics);	
	Other:	
38	Provides the ability for people to see through, lean/rest on and enjoy the view without interference – desirable in some situations;	
39	Reduces the risk to maintenance staff throughout the life of the asset (safety in design and OHS Act-Section 28);	
40	Can be safely and economically maintained for whole-of life, including effects on drainage and debris collection.	

Appendix E – Examples of Fence Type vs Location



	Type	References
1a	Full barrier fence	4.1, 4.2.2, 4.3.2, and 5.2
1b	Partial barrier fence	4.1, 4.2.2, 4.3.2 and 5.4
1c	No fence required	Appendix A
2	Crashworthy fence for separation	4.1, 4.2.2, 4.3.1 and 5.3
3	Crashworthy fence in median for delineation	4.1, 4.2.1, 4.3.1 and 5.3
4	Road safety barrier in lieu of pedestrian fence	4.1 and 5.3
5	Full barrier fence Cyclist-friendly	4.1, 4.2.2, 4.3.2, and 5.2
6	Safety fence on culvert headwall	5.4.1