

# Pedestrian Level Crossings

ETS-12-01

## Applicability

ARTC Network Wide SMS

## Publication Requirement

Internal / External

## Primary Source

ETD-16-03, ETD-16-04

## Document Status

Version #	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.0	05 Feb 23	Track and Civil Standards	Stakeholders	Manager Track & Civil Standards	Head of Engineering Standards 27/02/2023

## Amendment Record

Amendment Version #	Date Reviewed	Clause	Description of Amendment
1.0	05 Feb 23		First issue of document

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## 1 General

### 1.1 Reference Documents

The following documents support this procedure:

- RISSB AS 7658 Level Crossings
- AS 1742 Manual of uniform traffic control devices, Part 7: Railway crossings
- AS 1743 Road signs – Specification
- AS 1428 Design for Access and Mobility, Part 1 (2001): General requirements for access – new building work
- Australian/New Zealand Standard AS/NZS 1158 – Road Lighting

### 1.2 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Level Crossing	A location where the railway line and a road or pedestrian walkway cross paths on the same level.
Modular Crossing Surface	A level crossing manufactured in concrete, rubber, steel, etc. modular sections and assembled on site.
New Level Crossing	A level crossing installed on ARTC's rail network where none previously existed.
Relocated Level Crossing	A new level crossing installed at an adjacent or nearby location to replace an existing level crossing that is removed.
Right-angled ( $90^{\circ} \pm 20^{\circ}$ )	A pedestrian level crossing has an alignment at maximum 70 degrees to the railway track(s).
Sight Distance (SD)	At a railway crossing at which there is no active control for either road or pedestrian traffic, the sight distance (SD), in metres, to oncoming trains to enable pedestrians to cross safely.
TGSI	Tactile Ground Surface Indicators
Upgraded Level Crossing	An upgrade to the existing level crossing where it is re-designed (e.g. a site specific design process as per EGP-04-01).

## 2 Design

The design of new, relocated, and upgraded pedestrian and bicycle level crossings shall be based on relevant Australian Standards and supplements in this document. The treatment at each pedestrian level crossing shall provide for people with disability, including ambulant, vision and hearing impairment.

The mix of different types of pedestrians can increase the risk at level crossings. During design phase considerations should include but are not limited to the following.

- Pedestrians:
  - Without disability – including different demographics such as persons pushing a pram / stroller / baby buggy.
  - With disability – visual and audio impairment, using walking aids such as frames or walking sticks
- Cyclists and users of mobility devices such as wheelchairs and scooters.
- Animals accompanied by pedestrians
- Communities and facilities in proximity such as kindergartens and hospitals

Location consideration for any new pedestrian level crossing shall follow the requirements for road level crossing set out in ETS-12-00. Risk management for pedestrian level crossings should follow the guideline in ETS-12-00.

### 2.1 Level of Control

The level of control and at-crossing treatment should consider user types and volumes, train movements, adjacent road level crossing control and any other risk factors. The hierarchy of control shall be based on AS 1742.7 as follows:

- a) Passive control for pedestrians with or without adjacent vehicular traffic – minimum treatment
- b) Passive control for pedestrians with or without adjacent vehicular traffic – with pedestrian mazes
- c) Adjacent active control for vehicular traffic only (passive control for pedestrians with warning signs)
- d) Active signal control for pedestrians, without gates
- e) Active gated control for pedestrians

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*Note: Refer to AS 1742.7 for treatment details for each level of control*

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The level of treatment at each pedestrian level crossing shall be designed based on the individual State requirements where higher level of control is preferred if compatible.

Following considerations shall be included for the assessment of pedestrian level crossing treatment during design phase.

- Potential sight distance obstructions, such as fixed structures, eye level and high incidence of fog etc.
- The probability and frequency of pedestrian usage
- Special users, e.g.

- The crossing provides the only access to a platform or platforms for which there are regularly scheduled rail services, particularly where the crossing is over double lines.
- The crossing provides access to a school, or for primary school children to reach a school bus or transport to school etc.
- The crossing is not at a platform but has moderate or higher rail traffic volumes.
- Level crossing and adjacent environment, such as the likelihood of a pedestrian disobeying behaviour and audible warning devices near houses etc.
- Road level crossings used by pedestrians

## 2.2 Sight Distance

The minimum required sight distance (SD) at a passive pedestrian level crossing shall be calculated as per AS 1742.7, see Equation 2-1.

$$SD = \frac{V}{3.6} \left( \frac{d}{1.0} + 2 \right)$$

Equation 2-1: Sight Distance (SD)

- a) V = track speed of trains (km/h)
- b) d = pedestrian crossing distance (m), measured as follows.
  - (i) Where pedestrian mazes are provided – from one trackside maze opening to the other.
  - (ii) Where there are no pedestrian mazes but there are Tactile Ground Surface Indicators (TGSIs) at holding positions – from one trackside edge of the TGSIs to the other.
  - (iii) Where there are no pedestrian mazes or TGSIs – outer rail to outer rail plus 3m.

*Note: The above formula is based on a walking speed of 1.0 m/s and provides an extra safety margin 2 s. It is recommended that at crossings where there is likely to be significant use by people with disabilities, the travel speed be reduced to 0.8 m/s or less.*

*For rail traffic, use the highest applicable speed board for any track through the level crossing in any direction. In circumstances where all trains cannot achieve the normal speed board speed, it may be reasonable to use the highest actual speed.*

This sight distance may not be required at pedestrian crossings adjacent to an active road level crossing, where warning sign W7-14-6 as shown in Table 2-1 shall be used to guide the pedestrians. Refer to AS 1742.7 Clause 6.5.2 for details.

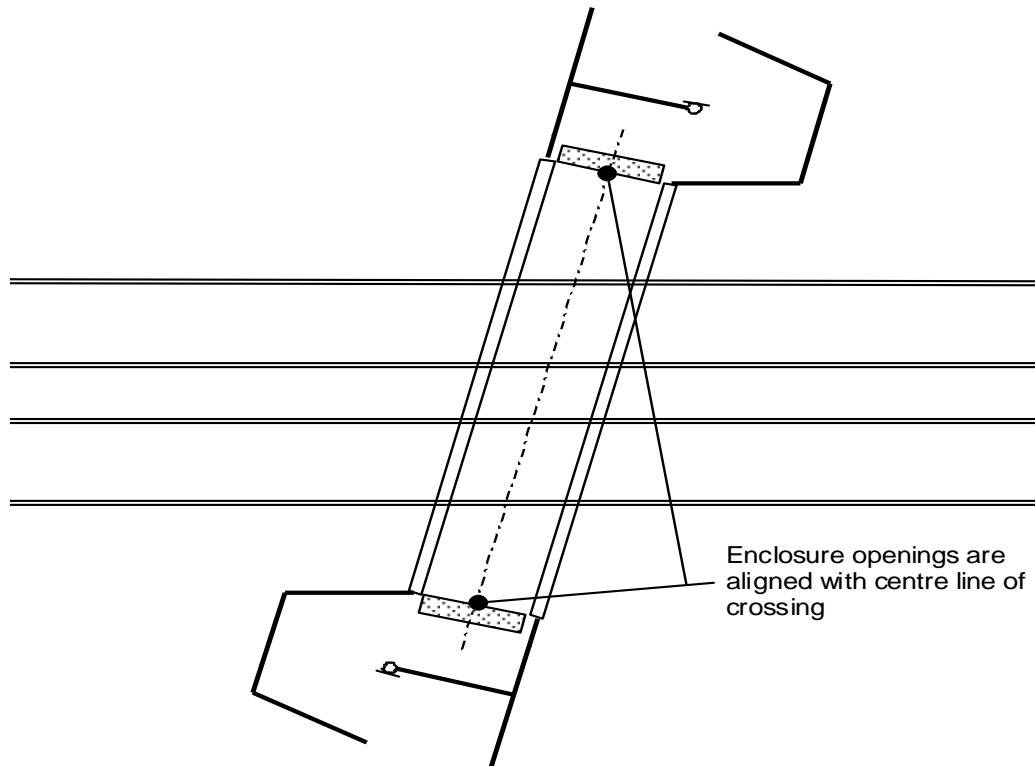
## 2.3 Angle of Crossing

To assist pedestrians with vision impairment or other disabilities, the alignment of the footpath across the crossing shall be not less than 70 degrees to the track centreline. Under the following circumstance a right-angled (90°±20°) crossing may not be practicable.

- The topography of the site is inhibitive.
- The crossing angle is restricted by the proximity of assets that cannot reasonably be relocated.

- The possibility that pedestrians would ignore a formal right-angled crossing and skirt around the crossing to find a shorter route (this can be particularly important if the crossing is adjacent to a lightly trafficked road crossing).

In every case the track-side openings in the Enclosures on each side of the tracks shall squarely face each other even if the pedestrian route itself is skew to the tracks (see Figure 2-1). Properly aligned Enclosure openings will provide better navigational cues for sight-impaired pedestrians.



**Figure 2-1 : Alignment of Enclosures on an Angled Crossing**

Where an angled crossing (i.e. outside of the specified tolerances for a right angled crossing) is deemed practical a site specific risk assessment shall be completed taking into account the following factors.

- The possibility of higher-standard surface finishes and maintenance across the tracks, or a reliable flangeway gap treatment that would reduce the problems of an angled crossing.
- The provision of adequate lines of sight when pedestrians are oriented at an angle to the track.
- The possibility of additional fencing or the realignment of approach paths to achieve a right-angled crossing.
- Comply with State Regulations.
- Other site-specific factors.

## 2.4 Pedestrian Enclosures

### 2.4.1 Mazes

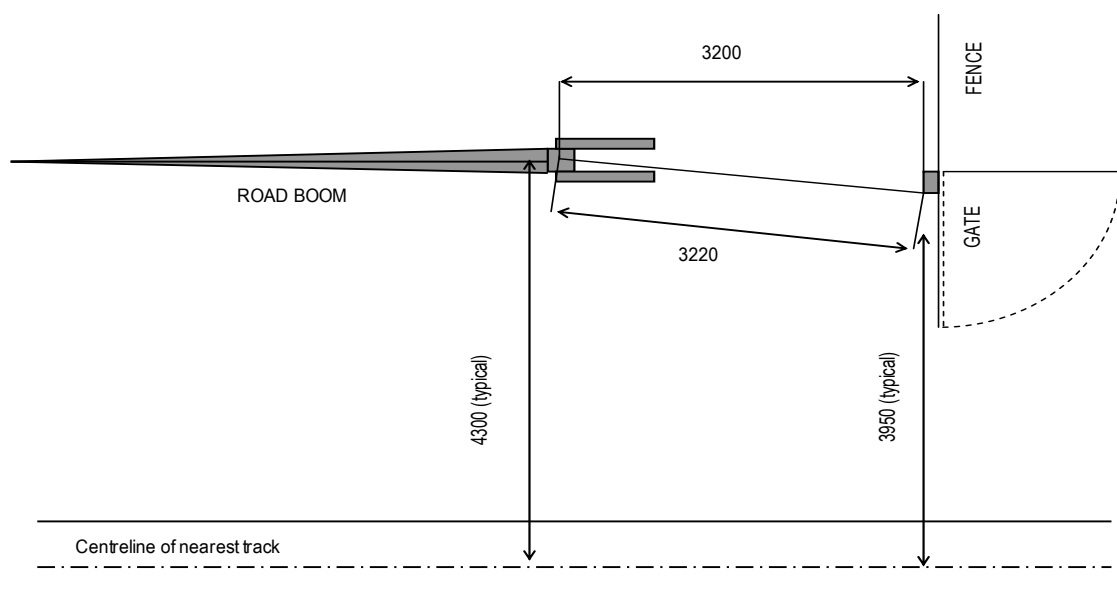
The purpose of a maze is to direct pedestrians to face each direction before crossing the rail tracks to observe if any trains are approaching. Mazes also provide signage and directional assistance for pedestrians crossing the tracks and provide a tactile navigational aid for pedestrians with impaired vision. Refer to AS 1742.7 Appendix F for typical arrangements for passive and active controlled pedestrian level crossings with mazes.

The design of the maze shall follow requirements in AS 1742.7 and allow the passage of the great majority of pedestrians with disabilities. Risk assessment is required to determine the appropriate control when the size of the wheelchair or motorized scooter exceed the clearance set out in AS 1742.7.

### 2.4.2 Gated Enclosures

In addition to passive treatment at a pedestrian level crossing, a gated enclosure also warns and holds pedestrian traffic during the approach and passage of a train with automated closure of the gate. Refer to AS 1742.7 Appendix F for typical arrangements for gated pedestrian level crossings.

Appropriate clearance shall be given when there is an adjacent road boom barrier. Figure 2-2 shows the normal minimum clearances to ensure the safety for maintenance workers when working on the equipment in an enclosed space.



**Figure 2-2: Nominal Minimum Clearances**

The clearances shown in Figure 2-2 may be reduced if it can be shown that equivalent levels of maintenance worker safety would still be maintained. Techniques that may be used to reduce these clearances include the following.

- Use of a shorter and heavier boom counterweight.
- Application of a machine guard around the outer end of the boom counterweight.
- Special safety procedures applied to staff undertaking maintenance.

- Increasing the difference between the offset from the rail track of the gate motor and the offset to the road boom. Oblique crossings will increase (or decrease) the effective lateral offset of the outer end of the boom counterweight depending on whether the angle is greater or less than 90 degrees.

### 2.4.3 Other Considerations

#### 2.4.3.1 Extended Fences

Where feasible, fences should extend for at least 30m in each direction on each side of the enclosure to prevent pedestrians crossing at points other than at the enclosure. A weldmesh fence or equivalent should be used.

#### 2.4.3.2 Visibility

In case where the gate or central fence has insufficient luminance contrast to distinguish it from the background chevron markings and/or signs should be used to assist pedestrians who have limited vision.

#### 2.4.3.3 Lighting

Adequacy of street lighting at a level crossing shall be assessed against the requirements in AS/NZS 1158 during a level crossing risk assessment. Street lighting provided for level crossings shall comply with AS/NZS 1158 and impacts on train drivers, road users and pedestrians shall be evaluated, and outcomes documented.

Where a pedestrian crossing is being upgraded, the level of existing lighting should be assessed to mitigate any potentially additional hazard to users.

## 2.5 Crossing Footpaths

Design of the footpath across rail tracks shall follow the requirements in AS 1742.7. The minimum clear width of crossing surface shall be as per AS 1742.7 Section 6 (i.e. 1200mm wide if the path distance between maze opening is less than 6.0m long, otherwise 1800mm wide).

The minimum requirement for the crossing surface shall be sealed or paved with slip resistance. Slip resistant surfaces should comply with SA HB 198. A general layout and minimum requirements are shown in AS 1742.7 Section 6.

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*Note: The design path width should accommodate all pedestrians that uses the level crossing including their walking aids equipment if applicable.*

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### 2.5.1 Modular Crossing Surface

Crossing panels provide many benefits in terms of facilitating disabled access as well as adding the ability to be temporarily removed during track reconstruction. They are not appropriate in all instances and should be avoided if the adjacent tracks are in any of the following conditions.

- Track contains an Insulated Rail Joint
- Track radius is less than 800 m
- Track's rail weight and sleeper type combination are not suitable.



## 2.6 Approach Paths

Walkways, ramps and landings shall comply with AS1428.1 and supplements in this section.

Walkways, ramps and landings shall have an unobstructed width of not less than 1200mm.

Ramps shall be provided with landings at the top and bottom of the ramp and at intervals not exceeding:

- for ramp gradients of 1 in 14: 9m;
- for ramp gradients of 1 in 19: 14m; and
- for ramp gradients between 1 in 19 and 1 in 14, intervals which shall be obtained by linear interpolation.

No landings need be provided on slopes flatter than 1 in 19.

### 2.6.1.1 Camber and Cross fall

The camber or cross fall shall not exceed 1 in 40.

### 2.6.1.2 Passing areas

Passing areas must have a minimum width of 1800mm and be provided at not more than 6m intervals.

### 2.6.1.3 Step Ramps

If step ramps are provided they shall conform to AS1428.1.




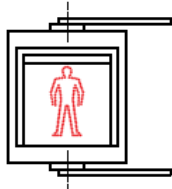

### 2.6.1.4 Handrails

When an approach path leads to a pedestrian crossing that is a means of access to a public transport facility, handrails shall be provided in accordance with AS 1428.1

## 2.7 Signage

Sign location, height and orientation shall conform to AS 1742.7, as shown in Table 2-1. Refer to AS 1742.7 Appendix F for details including typical arrangement for signs at passive and active controlled pedestrian level crossings, including cyclist signs.

**Table 2-1: Signs required at each level of control**  
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Level of control	Signs
a) Passive – Minimum treatment b) Passive – Maze	W7-14-4 or W7-14-5 
a) Passive – Minimum treatment b) Passive – Maze c) Active – Vehicular traffic only d) Active – Pedestrian traffic without gate e) Active – Pedestrian traffic gated	G9-58 
c) Active – Vehicular traffic only d) Active – Pedestrian traffic without gate e) Active – Pedestrian traffic gated	W7-14-6 
d) Active – Pedestrian traffic without gate e) Active – Pedestrian traffic gated	RX-12 
e) Active – Pedestrian traffic gated	G9-68 R2-4 

*Note: Compliant signs should be placed at the crossing with ARTC Enviroline information so that members of the public can register complaints. The sign shall contain a unique location number for identification.*

## 2.8 Risk Management

Safety risks at pedestrian level crossings shall be assessed as part of design phase or when there is a level crossing usage change (pedestrian access and rail). The assessment of level crossing risk profile and safety in design considerations shall be based on AS 7658.

ALCAM should be adopted to assess risk profile and treatment types.

### 2.8.1 Risk Assessment

The safety risk assessments for each level crossing shall consider the following issues but not limited to:

- Accident / Incident history
- Train type, frequency, and speeds. This is particularly relevant to routes where high-speed passenger trains operate, because of the increased risk to passengers and train drivers in a high-speed collision
- Pedestrian usage volume
- Walkway slope and condition

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*Note: This risk assessment may suggest that the perceived risk in safety does not justify the implementation of further risk controls based on the level of non-compliance, the frequency of rail traffic and pedestrian usage.*

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The following are examples of changes which are likely to change the level crossing risk profile and may require re-assessment of risk:

- Configuration changes (approach path change, number of rail tracks, rail alignment)
- Change to level crossing controls as a result of classification change
- Repeated incidents at level crossing
- Change in level crossing environment (nearby buildings, business activities etc.)

In the case of risk interface, ARTC may approach the relevant Road Authority on specific safety issues that may include, but not restricted to the following:

- Positioning of signs and signals at level crossings
- Provision of road markings
- Improving visibility
- Accident statistics
- Determination of sight conditions (refer to 2.2).

### 2.8.2 Moderating Strategies

The following options may be considered if further risk controls are required for level crossings with compromised sight distances (refer to 2.2).

- Removal of obstructions to achieve the required sight distance.
- Provision of active control.
- Grade separation, closure or relocation of the crossing.
- Reduction of train speed.

## 3 Construction and Maintenance

### 3.1 General

See ETS-12-00 for civil installation requirements, unless otherwise stated in this section.

New pedestrian crossings shall be constructed and maintained to the design requirement in AS 1742.7 and relevant design drawings.

Isolated pedestrian crossings shall be constructed using a track structure equivalent to plain track. Where the pedestrian crossing is adjacent to a road level crossing, the track structure shall conform to the requirements in ETS-12-00.

### 3.2 Crossing Footpaths

The crossing road surface is to be no higher than the rail level by design or during the service life of the pedestrian level crossing. The footpath surface shall have slip resistance throughout.

The following footpath materials should be used at a pedestrian level crossing:

- Asphaltic concrete
- Concrete
- Modular crossing surface

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*Note: Only type approved panel crossing systems shall be used.*

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#### 3.2.1 Asphaltic Concrete Surface

The path surface shall be constructed from the ballast/sleeper surface to the full rail height and extend 500-750mm either side of the rails (or the outside rails in multiple track crossings). Wheel flangeways shall be formed with timber 65mm wide and 40mm deep.

All surfaces in contact with the asphaltic concrete to be sprayed with bitumen emulsion.

#### 3.2.2 Modular Surface

The modular units used shall be specified by the Contractor and agreed with ARTC.

Prefabricated units, suitable for loadings up to 6 tonnes, shall be installed where pedestrian walkways cross the railway. These units shall be manufactured to allow easy removal from track to accommodate track maintenance requirements.

#### 3.2.3 Maintenance of the existing footpath

The defects at a pedestrian level crossing shall be assessed with consideration of its extent and severity. Appropriate restrictions and /or warnings shall be applied to protect users of the crossing.

ETW-16-01 should be followed when reinstating the flangeways through asphalt level crossing.

The repairment of modular crossing surface shall be as per manufacture's instruction.

### 3.3 Approach Path Surface

The approach path should be durable and maintainable asphalt, concrete, rubber or equivalent. It shall be slip resistant surface and with levels no greater than  $\pm 12$ mm from the design plane when constructed.

Approach paths shall be designed so that water does not accumulate on the surface. If gratings are located in a walking surface, they shall have spaces not more than 13mm wide and not more than 150mm long. If gratings have elongated openings, they shall be placed so that the long dimension is transverse to the dominant direction of travel.

### 3.4 Sighting Obstructions

Removal of obstructions includes any removal of material from a cutting face that will restore the required sight distance. Maintenance of plant growth will be needed to ensure retention of sight distance.

### 3.5 Signage

Signs are to be manufactured in accordance with the requirements of AS 1743.

Signs on the post should be erected in accordance with ETS-12-00 using the supporting structure as per STD-T0005. Signs fixed on the fence shall be based on the site condition and performance requirement.

## 4 Inspection and Assessment

### 4.1 Patrol Inspections

The interval between patrols of level crossings shall be at intervals as specified in the approved Technical Maintenance Plan or not exceed 7 days if not specified. Track patrols shall keep a lookout for defects and conditions (i.e. indicators of a defect) that may affect, or indicate problems with safe operations at a crossing, including:

- Flangeway obstructions
- Track geometry including approaches
- Crossing road surface condition
- Condition of fencing – frangible material
- Signage visibility
- Condition of walkways

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*Note: The inspection should be carried out at a speed consistent with the local conditions and the full scope of the inspection being carried out (e.g. the type and number of other infrastructure elements being inspected).*

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## 4.2 General Inspections

General Inspection are intended to observe deterioration of the condition of the level crossing from its new condition.

The inspection regime for pedestrian level crossings is consistent with the road level crossing and should be carried out at the same time. General inspections shall be at intervals as specified in the approved Technical Maintenance Plan or not greater than 365 days if not specified. The following tasks shall be followed during a general inspection (Table 12-1). Form ETS1201F-01 or equivalent Ellipse form shall be followed.

**Table 12-1: Pedestrian level crossing general inspection criteria**

Element	Task
Sighting	Check for obstructions to normal available sighting between the pedestrian and the approach train direction.
Signage	Signage is clear to read and intact, not faded or missing
Maze / Gate	Check for fencing damage that compromise the functionality of separating walkway from the track.
Marking	Check if Tactile ground surface indicators (TGSI) is intact and not faded.
Footpath	Check for potholes, damages and trip hazards on the crossing and approach paths. Check for damage and instability on panel crossing units
Civil	Modular crossings: Check for damage, cracks, or any movements (lateral and vertical) along the track(s) Non-modular: Check for potholes, lifting timber (if applicable) or other ineffective components Check flangeways for obstructions and clean out if possible Check for rail corrosion and rust flakes (tools may be used) through the flangeways Check track geometry including vertical alignment under traffic and approaches to crossings Check for mudholes, alignment or drainage deficiencies
Others	Other defects that could affect the safety of train operations or public access

## 4.3 General Inspection Assessment

The defects at a pedestrian level crossing shall be assessed in accordance with Table 12-2.

**Table 12-2: Pedestrian level crossing general inspection assessment**

Defect		Response time	Action
Sighting obstructions		7 days	Remove obstruction within the railway corridor;
Signs missing, damaged or unreadable		28 days	Repair or replace sign
Maze / Gate missing or damaged		Immediate	Restricting public access if detour is available, otherwise temp warning signs.
Hazardous or detrimental to public safety			
Note: not applicable to crossings that did not have a maze installed		28 days	Repair or replace; Inform Road Authority if not within ARTC maintenance responsibility.
Maze / Gate damaged		28 days	Repair or replace
Poor condition but still in function			Inform Road Authority if not within ARTC maintenance responsibility
TGSI damaged or faded		7 days	Repair or re-instate the painting
Footpath surface deformation (sealed) – pothole depth <sup>[Note]</sup>	20 mm to 40 mm	180 days	Monitor condition or repair.
	40 mm to 60 mm	90 days	Repair.
	Greater than 60 mm	28 days	Remediate as determined by site conditions and repair.
Modular footpath	Panel damage, cracks, or movements (lateral and vertical) along the track(s)	24 hours	Temp warning signs on site
		28 days	Remediate or monitor as determined by site conditions. Repair as per manufacturer's instruction.
	Signs of wheel contact with crossing surface	24 hours	Record as Known condition
Flangeway	Width > 75mm	24 hours	Record as Known Condition
	Width < 60mm	28 days	Remediate as determined by site conditions and repair.
	Depth > 50 mm	28 days	Remediate as determined by site conditions and repair.
Rail Condition	RCF, Shelling, Squats, Wheel burns, Rail flow, Corrosion and Mechanical damage etc.	24 hours	Report as Known Condition and manage as determined by site conditions (refer to Track & Civil Code of Practice Response Booklet)
Track Geometry	Suspected geometry fault	24 hours	
Gauge	Suspected gauge tightening / widening	24 hours	

Sleepers and Fastening	Suspected faults	24 hours	
Drainage	Evidence of mudholes or pumping of the crossing Drainage ineffective – fails to direct water from track	7 days	Report as Known Condition and manage as determined by site conditions.