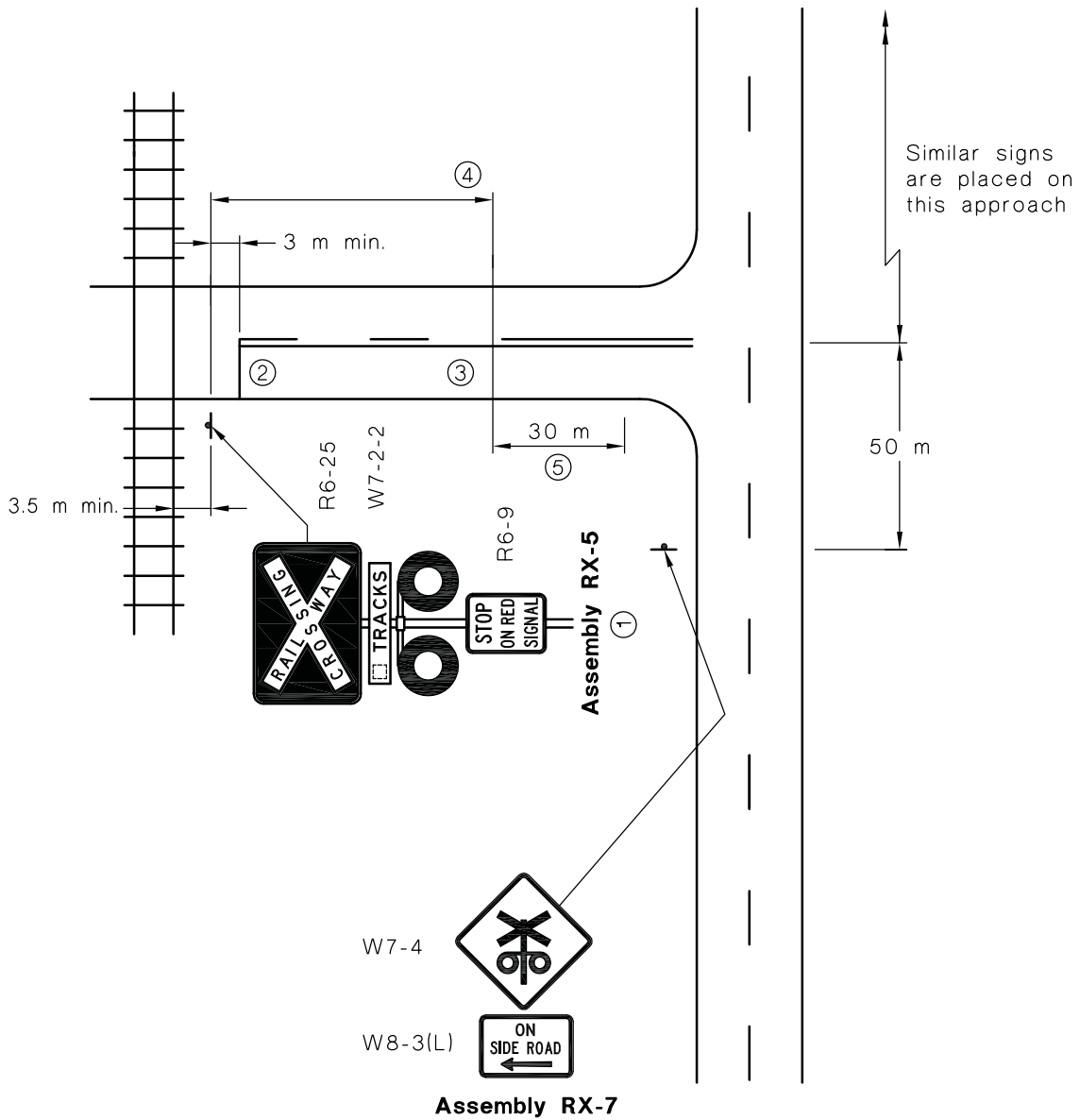


NOTES:

- 1 If more than one track, the TRACKS sign, W7-2-1 or W7-2-2, is added to the assembly. The RAILWAY CROSSING position sign may be either the R6-24 or R6-25 sign.
- 2 Stop lines (see Clause 3.3) are required on sealed roads at crossings controlled by STOP signs.
- 3 The barrier line (see Clause 3.5) extends from the crossing to the through road.
- 4 The crossing on side-road diagrammatic sign is required only if the intersection itself requires an intersection warning sign in accordance with Part 2 of the Manual. The various alternatives and uses for these signs are described in Clause 2.2.6.
- 5 If this distance is less than 50 m, the advance signs are placed as shown. If the distance is greater than 50 m but less than (50 + A) m, sign W3-1 is placed in the side road 50 m from the crossing, with assembly RX-4 only on the through road. If the distance is greater than (50 + A) m, all signs are placed in the side road in accordance with Figure 4.5.
- 6 If this distance is 25 m or less, an additional assembly RX-2 may be required (see Clause 4.4.1).
- 7 This dimension is measured from the point at which turns into the side road are completed. A single continuous line over this length may be substituted for the two-way barrier line.
- 8 Advance warning of the railway crossing is not required on this approach.

FIGURE 4.11 RAILWAY CROSSING ON A SIDE ROAD CONTROLLED BY STOP SIGNS (PASSIVE CONTROL)

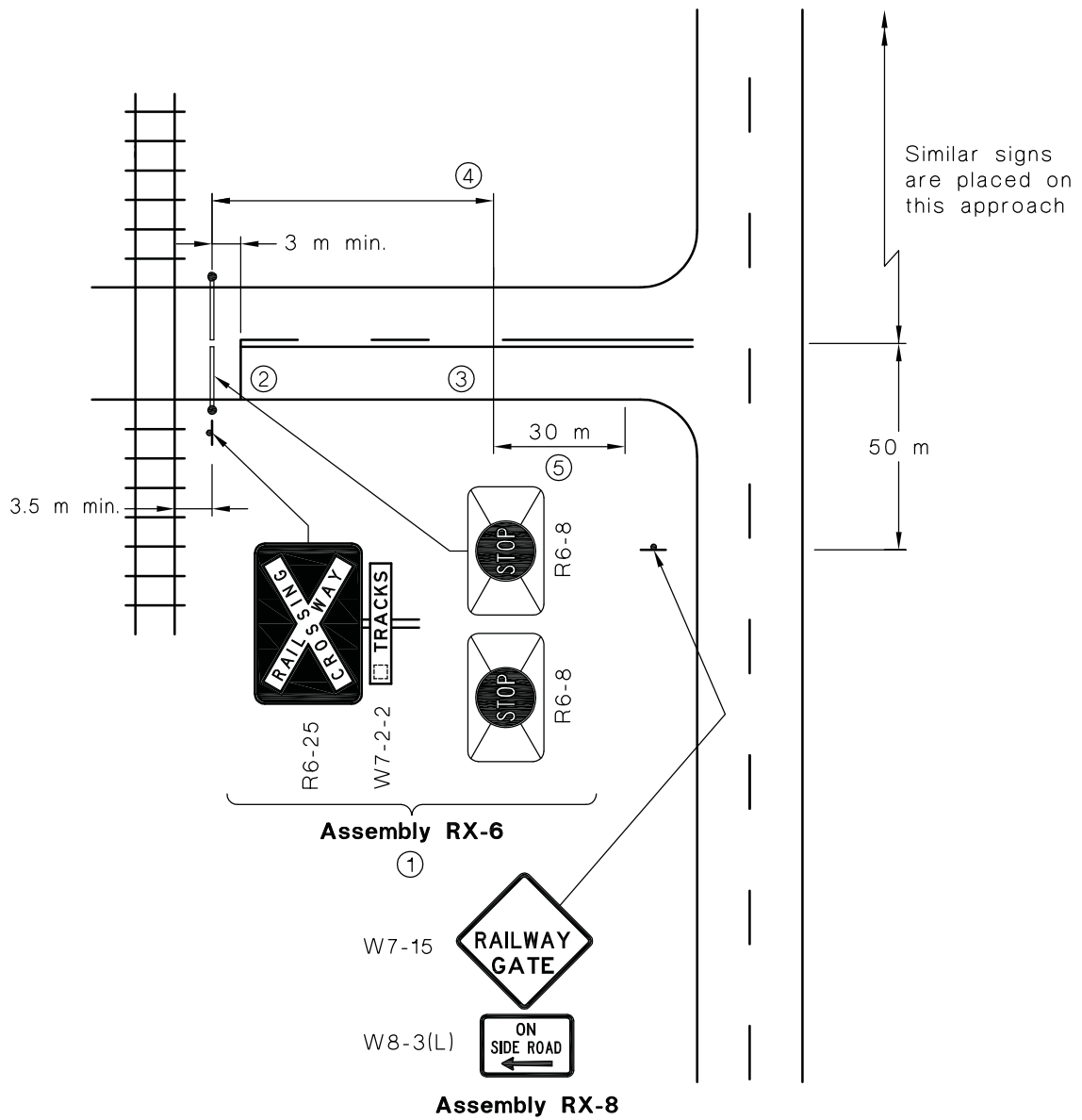
NOTE: This may be a low-resolution file intended for on-screen viewing only. This file cannot be printed. This file may be one part of a complete technical publication, and should not be read in isolation of the other parts of the publication. A full-resolution version of all parts of the publication can be obtained from the Department of Transport and Main Roads. www.tmr.qld.gov.au The Department of Transport and Main Roads takes no responsibility for any loss or damage resulting from the use of this low-resolution file.



NOTES:

- 1 If more than one track, the TRACKS sign, W7-2-1 or W7-2-2, is added to the assembly. The RAILWAY CROSSING position sign may be either the R6-24 or R6-25 sign.
- 2 Stop lines (see Clause 3.3) are required on sealed roads at crossings controlled by flashing lights.
- 3 The barrier line (see Clause 3.5) extends from the crossing to the through road.
- 4 This distance is less than that required to allow satisfactory display of the W7-4 sign on the side road in accordance with Figure 4.7. Where the crossing is very close to the main road a second position assembly may be required (see Clause 4.4.1).
- 5 This dimension is measured from the point at which turns into the side road are completed. A single continuous line over this length may be substituted for the two-way barrier line.

FIGURE 4.12 RAILWAY CROSSING ON ASIDE ROAD CONTROLLED BY FLASHING LIGHTS (ACTIVE CONTROL)



NOTES:

- 1 If more than one track, the TRACKS sign, W7-2-1 or W7-2-2, is added to the assembly. The RAILWAY CROSSING position sign may be either the R6-24 or R6-25 sign.
- 2 Stop lines (see Clause 3.3) are required on sealed roads at crossings controlled by gates.
- 3 The barrier line (see Clause 3.5) extends from the crossing to the through road.
- 4 This distance is less than that required to allow satisfactory display of the W7-15 sign on the side road in accordance with Figure 4.9. Where the crossing is very close to the main road, a second position assembly may be required (see Clause 4.4.1).
- 5 This dimension is measured from the point at which turns into the side road are completed. A single continuous line over this length may be substituted for the two-way barrier line.

FIGURE 4.13 RAILWAY CROSSING ON A SIDE ROAD CONTROLLED BY GATES (ACTIVE CONTROL)

NOTE: This may be a low-resolution file intended for on-screen viewing only. This file cannot be printed. This file may be one part of a complete technical publication, and should not be read in isolation of the other parts of the publication. A full-resolution version of all parts of the publication can be obtained from the Department of Transport and Main Roads. www.tmr.qld.gov.au The Department of Transport and Main Roads takes no responsibility for any loss or damage resulting from the use of this low-resolution file.

SECTION 5. AVOIDANCE OF TRAFFIC QUEUING ON CROSSINGS

5.1 GENERAL

Where an intersection or other possible traffic constriction is located downstream but in the near vicinity of a railway crossing such that queuing of traffic across the crossing could occur, steps shall be taken to avoid this happening as indicated below.

5.2 ELIMINATING THE PROBLEM

Attempts shall be made to eliminate the problem by the following means:

- (a) Closing, relocating or grade separating the crossing.
- (b) If the downstream intersection is not signalized -
 - (i) changing priority of movement at the intersection; or
 - (ii) installation of traffic signals and linking as indicated in Item (d).
- (c) If another downstream traffic constriction is the problem -
 - (i) removing the constriction or restoring capacity to the constriction; or
 - (ii) providing priority of movement through or past the constriction.
- (d) If the downstream intersection is signalized, by linking the signals to the railway signal circuits such that priority is given to signal phases which will allow the crossing to clear prior to closure and arrival of a train.
- (e) If there is a signalized intersection upstream of the crossing, by linking the intersection signals to the railway signal circuits so that traffic is restricted or prevented from reaching the crossing at critical times.

5.3 TREATMENT WITH WARNING DEVICES AND REFUGES

If elimination of the problem cannot be guaranteed by the steps set out in Clause 5.2, the following additional devices shall be installed at the crossing, either -

- (a) KEEP TRACKS CLEAR (G9-67-1) sign, see Clause 2.4.4; or
- (b) box markings, see Clause 3.6, and KEEP TRACKS CLEAR (G9-67-2), see Clause 2.4.4.

Escape or refuge areas should also be considered where practicable.

These steps should also be considered as interim solutions pending proposed implementation of any of the steps set out in Clause 5.2.

NOTE: The effects that the normal operation of the railway crossing may have upon traffic movements elsewhere in the vicinity, e.g. vehicles stopped at the railway crossing queuing through an intersection, thus affecting the flow of traffic not using the crossing, should also be considered.

5.4 SHORT STACKING

If the distance between the railway crossing and a downstream intersection or other constriction is not long enough to accommodate a long vehicle stopped at the intersection without fouling the tracks, either -

- (a) a detour for long vehicles shall be established and sign posted; or
- (b) appropriate escape or refuge areas for long vehicles shall be provided.

SECTION 6. PEDESTRIAN AND BICYCLE TREATMENTS AT RAILWAY CROSSINGS

6.1 GENERAL

At railway crossings where facilities are to be provided for pedestrians or bicycles, or both to cross the tracks an appropriate treatment selected from the hierarchy of controls set out in Clause 6.2 shall be used. The treatment shall provide for people with disabilities, including ambulant, vision and hearing impairment.

These requirements shall apply to pedestrian and bicycle crossings of all railways and tramways as defined in Clause 1.4.6 with the exception of tramway crossings treated entirely with road traffic signals.

Clause 6.2 to 6.5 deal primary with facilities for pedestrians. Facilities for cyclists are dealt with in Clause 6.6.

6.2 HIERARCHY OF CONTROL

Where at-grade crossing facilities are to be provided for pedestrians, the hierarchy of control shall be in ascending order of level of control as follows:

- (a) *Passive control for pedestrians with or without vehicular traffic - minimum treatment* A footway shall be provided across the railway tracks either as widening of the vehicular roadway or a separately defined footway.

Minimum surface conditions for the safe passage of pedestrians including flangeway gap (see Clause 6.3.3 (a)(iv)) shall be provided. Signs to warn pedestrians to look for trains shall be provided (see Clauses 6.5.1 and 6.5.2). At sealed or paved footpath crossings pavement markings including tactile ground surface indicators (TGSIs) to define the footway and pedestrian holding markings shall be provided.

- (b) *Passive control for pedestrians with or without vehicular traffic - with pedestrian mazes* A separately defined footway across the crossing with pedestrian mazes and signs to warn pedestrians to look for trains shall be provided. Pavement markings including TGSIs to define the footway and pedestrian holding markings shall also be provided. This applies also to a passive control pedestrian crossing remote from vehicular crossing.

- (c) *Active control for vehicular traffic only* A defined footway with or without pedestrian mazes shall be provided along with signs warning pedestrians not to cross when lights are displayed or alarm is sounding, and pavement markings as specified in Item (b).

- (d) *Active signal control for pedestrians* A defined footway with pedestrian mazes, red symbolic standing pedestrian signals, audible signals and signs warning pedestrians not to cross when signals are displayed or alarm is sounding shall be provided along with pavement markings as specified in Item (b).

- (e) *Active gated control for pedestrians* A defined footway with gated pedestrian enclosures, and signs and pedestrian signals as for Item (d), shall be provided. Escape gates shall also be provided for people caught on the crossing after the gates have closed prior to passage of a train. Pavement markings as specified in Item (b) shall be provided.

6.3 CROSSING ELEMENTS - DESIGN AND PERFORMANCE REQUIREMENTS

6.3.1 Sight distance at passive control crossings

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 shall be as follows:

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

where

V = track speed of trains, in kilometres per hour

d = pedestrian crossing distance in metres, 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 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 3 m.

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

If this sight distance is not available one or other of the following will be required:

- (a) Removal of obstructions to achieve the required sight distance.
- (b) Provision of active control.
- (c) Closure or relocation of the crossing.
- (d) Reduction of train speed.
- (e) Grade separation.

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

6.3.2 Provision and alignment of footpaths

Footpaths across railway crossings shall provide a continuous accessible path of travel as specified in AS 1428.1 to connect adjoining public footpaths on each side of the crossing.

NOTE: Excludes flangeway gaps, see Note 2 to Clause 6.3.3(a)(iv).

Footpaths across tracks together with associated pedestrian mazes or gated enclosures shall be aligned so that the centre of each maze or enclosure opening is on the centre line of the footpath across the crossings. The alignment of the footpath across the crossing shall be not less than 70 degrees to the track centre line.

NOTES:

- 1 An alignment at 90 degrees to the track is to be preferred.
- 2 An example of a crossing with the maximum skew is shown in Appendix F, Figure F4.

6.3.3 Footpath requirements

Requirements are as follows:

- (a) The section of footpath across the railway track in the track area as defined in Figure 6.1 shall be provided as follows:
 - (i) Minimum clear width shall be -
 - (A) 1200 mm where the distance between maze or enclosure openings, or other access points is less than 6 m and pedestrian volumes are low; or
 - (B) 1800 mm in all other cases.
 - (ii) Shoulders on footpaths across the track shall be treated with hazard warning yellow tactile ground surface indicator (TGSIs) edge strips to comply with AS/NZS 1428.4 and as shown in Figure 6.1.
 - (iii) The clearance from each fence opening, gateway or other access point to the nearest rail shall be 1500 mm minimum.
 - (iv) Flangeway gap shall be 65 mm for newly constructed crossings and maintained to 75 mm maximum. The maximum depth shall be 50 mm and the change in level between rail and adjacent footpath not more than 5 mm.

NOTES:

- 1 Flangeway gaps meeting these requirements cannot be provided on track curves of less than 1000 m radius.
- 2 At time of publication there was concern that a flangeway gap of 65 mm could be an entrapment hazard for wheelchairs or other mobility aids. This issue is yet to be resolved.

- (v) The slope of the footpath between the maze or enclosure opening, gateway or other access point and the first rail shall range from level to 1 in 40 uphill towards the rail.
- (b) Footpaths other than sections in the track area as specified in Item(a), shall be a minimum width of 1800 mm and have a maximum crossfall of 1 in 40.
- (c) Overhead clearance shall be 2500 mm minimum.
- (d) Kerb ramps, landings and ramp handrails shall be provided as specified in AS 1428.1.

- (e) Clearance from an unkerbed edge of an adjacent vehicular traffic lane to the clear access path shall be 2500 mm minimum.
- (f) Slip resistant surfaces shall be provided.
NOTE: Advice on this matter may be obtained from HB 197.
- (g) Pedestrian area lighting is specified in AS/NZS 1158.3.1.

NOTE: There is no lighting level specified in AS/NZS 1158.3.1 applying specifically to railway crossing pedestrian pathways. Pending a relevant future addition to that Standard, it is recommended that if lighting is required it be provided to Lighting Level P1 (horizontal luminance 7 lux min, uniformity 10).

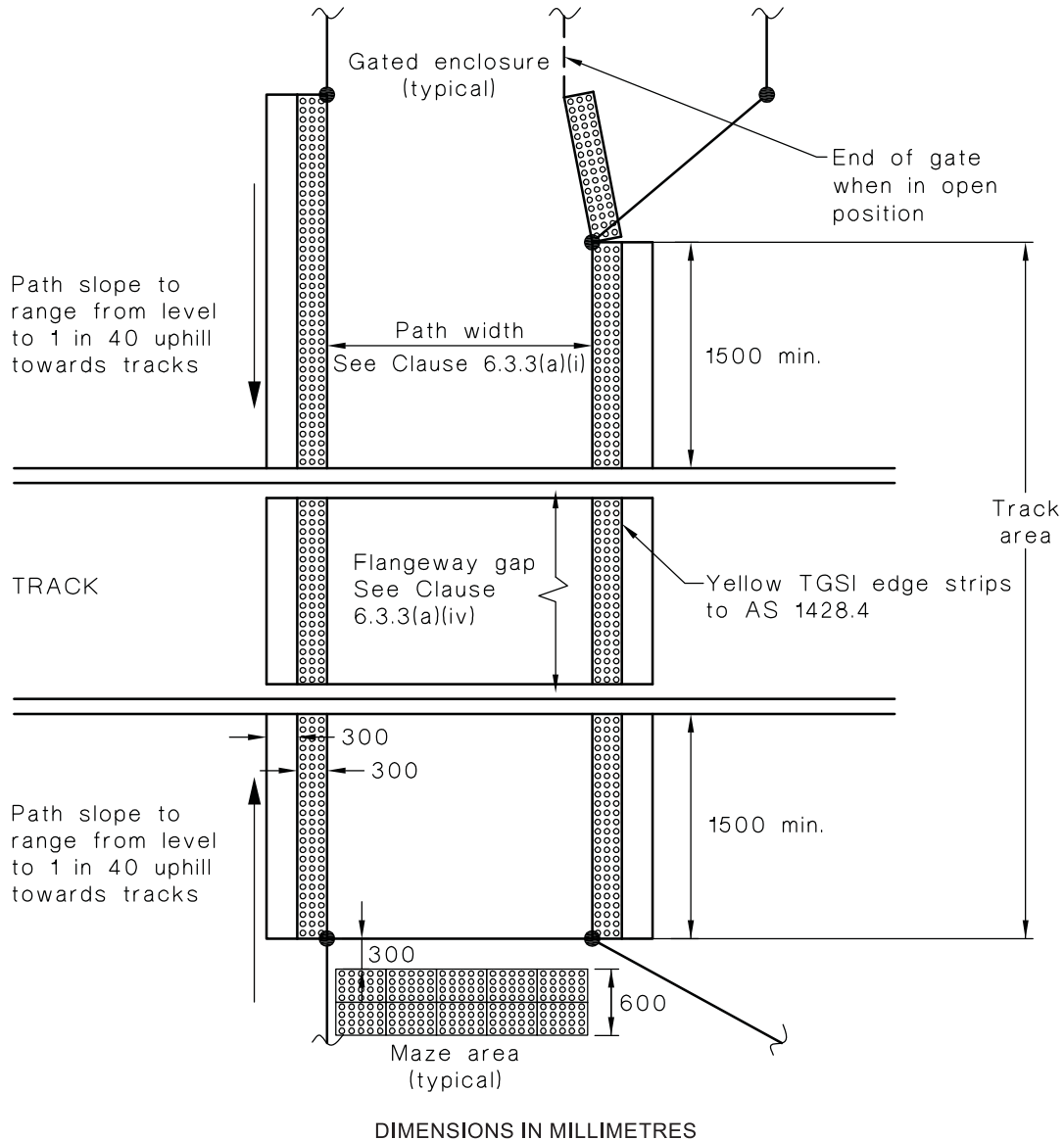


FIGURE 6.1 FOOTPATH ACROSS RAILWAY TRACK

6.3.4 Pedestrian enclosures - functional requirements

Pedestrian enclosures shall meet the following functional requirements:

- (a) **Mazes** Mazes shall direct pedestrians to cross the railway tracks in an orderly movement and orientate them so that in negotiating the mazes they are forced to make at least one 90 degree turn and in so doing, are directed to face towards each potential oncoming train direction at an angle of not more than 45 degrees.

The maze design shall also allow passage in a continuous manoeuvre of a wheelchair or motorized scooter of maximum dimensions 800 mm wide, 1300 mm long, one at a time and with a minimum swept path clearance of 150 mm to the sides of the maze.

- (b) *Gated enclosures* Gated enclosures shall be used to hold pedestrian traffic during automated closure of the gate in response to the approach and passage of a train.

The enclosure and main gateway shall be a minimum of 1500 mm wide.

An emergency escape for pedestrians caught on the crossing after the gates have closed, shall be provided. It shall be designed to be operated by a person in a wheelchair or motorized scooter, and a person with visual impairment. It shall also be designed to be resistant to unauthorized entry or other misuse.

The emergency gate shall be equipped with a push plate on the track side. The plate shall be 250 mm min high by the width of the gate and located 65 to 75 mm above pavement level under the closed gate.

6.3.5 Pedestrian enclosures - design elements

Additional design requirements for pedestrian enclosures are as follows:

- (a) Enclosure fences shall be a minimum of 1200 mm high. They shall be able to be seen through by people either sitting or of short stature, and shall not be readily scaleable by young children. There shall be a tapping rail 100 mm wide at the bottom of the fence 65 to 75 mm clear above the footpath surface.
- (b) If exposed to high-speed traffic, fences shall not be a hazard to occupants of errant vehicles, in particular, they should not have horizontal elements that can spear an impacting vehicle.
- NOTE: Guidance on the design of crashworthy pedestrian fencing can be found in Austroads GTEP, Part 13, Pedestrians.
- (c) Additional fencing to inhibit pedestrians from skirting the enclosure shall be provided as necessary.
- (d) Exit from the enclosure to the track area shall be aligned with the footpath across the track (even though the footpath is skewed to the track as in Appendix F, Figures F4 and F5).

NOTE: Examples of designs for pedestrian facilities at railway crossings which are deemed to comply with the requirements of this Section are given at Appendix F.

6.4 PEDESTRIAN HOLDING MARKINGS

Pedestrians holding markings to show the safe position to wait during passage of a train shall comprise a yellow hazard warning tactile ground surface indicator for the full width of the footpath or maze or gate opening and 600 mm wide:

- (a) *At pedestrian mazes* - inside the maze immediately behind the opening onto the track area.
- NOTE: Typical positioning is shown in Figure F1.
- (b) *At gated enclosures* - immediately before the start of the section of footpath across the track area as specified in Clause 6.3.3(a).
- NOTE: Typical positioning is shown in Figure F2.
- (c) *At minimum treatment crossings*, see Clause 6.2(a) - where used, markings shall be placed at a point behind which pedestrians can safely wait during passage of a train.

Clearance between the marking and nearest rail shall be 1500 mm minimum.

6.5 SIGNS AND SIGNALS

6.5.1 Look for trains, (number) tracks, (W7-14-4); Look for trains (W7-14-5)

These signs shall be used at crossings where no active devices are provided for either vehicular or pedestrian traffic. They shall be located so as to face pedestrians about to cross using defined footpaths or pedestrian mazes.

W7-14-5 sign shall be used if there is only one track. If there are two or more tracks, the W7-14-4 sign shall be used with the number of tracks inserted.

Mounting heights for these signs are specified in Appendix B, Paragraph B2.3.7. Typical locations are shown in Appendix F, Figures F3 and F7.



W7-14-4



W7-14-5

6.5.2 Do not cross while lights are displayed or alarm sounding, (number) tracks (W7-14-6)

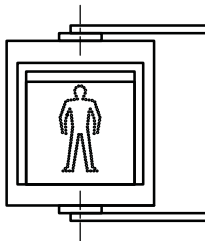


W7-14-6

The W7-14-6 sign shall be used at crossings where active devices are provided for adjacent road traffic only or for both road traffic and pedestrians. It shall be located to face pedestrians at the point behind which they should wait safely clear of a passing train.

The legend (number) TRACKS shall be deleted if there is only one track.

6.5.3 Red symbolic standing pedestrian signal assembly (RX-12)



RX-12

The RX-12 signal assembly shall be used where active control of pedestrian traffic is provided. The signal cycle commences with a flashing warning phase followed by a steady phase during the approach and passage of a train and for any additional time during which the crossing stays closed for a second train. It is switched off at other times.

Where there is a display of a green 'walking pedestrian' symbol when the crossing is open, the lantern should be placed below the RX-12 lantern preferably as an integral part of the assembly.

The length of the warning phase shall be the greater of -

- (a) 20s; and
- (b) the time in seconds required to move across the track area from one gate or maze opening to the other at a speed of 1.0 m/s, plus a safety margin of 2 s.

NOTE: It is recommended that at crossings where there is likely to be significant use by people with ambulant disabilities, the walking speed be reduced to 0.8 m/s.

The first 15 s of the warning phase shall be flashing red and the remainder, steady red.

6.5.4 Cyclists dismount (G9-58)



G9-58

This sign shall be used at crossings that are primarily used by pedestrians, i.e. that are not part of a shared path, but may be used by cyclists. It shall be located at the entry to each enclosure on the non-track approach.

NOTE: This sign is intended to emphasize to cyclists that it would be safer for both pedestrians and cyclists if they were to dismount and not ride across the crossing.

6.5.5 Audible signals

A cyclic audible signal shall be provided in conjunction with the RX-12 signal assembly where active control of pedestrian traffic is provided. The audible signal shall be sounded throughout the flashing warning period as well as the steady red period.

Audible signals provided at an adjacent road crossing may meet this requirement if the sound levels at the pedestrian crossing are adequate.

NOTE: A sound level of at least 10 dBA above ambient noise level, measured at 3 m, is normally required to ensure that the signal is heard.

6.5.6 Emergency gate signs

The following signs shall be used on either side of emergency exit gates at gated enclosures, the G9-68 sign facing pedestrians leaving the track area in an emergency, see Figure F6:

- (a) EMERGENCY EXIT, PUSH GATE (G9-68).
- (b) NO ENTRY (R2-4)

The legend in the lower part of the G9-68 sign shall be altered as necessary to indicate the action needed to open the gate.



G9-68



R2-4

6.6 FACILITIES FOR BICYCLES

Where a shared path or an exclusive bicycle path crosses a railway at a gated crossing, the crossing shall be installed similarly to a pedestrian crossing except that the path width through the gates and across the tracks shall be the same as the approach width of the shared or exclusive bicycle path.

Where a non-gated crossing of an exclusive bicycle path is to be provided with mazes, they shall be designed so as to encouraged cyclists to look both ways for trains.

NOTE: A cyclist at a combined road and pedestrian crossing can in most cases choose to use either the road across the crossing in which case the cyclist is subject to the same road rules as other vehicular traffic, or the cyclist may choose to use the pedestrian facility in which case the cyclist is expected to behave as a pedestrian, dismounting as advised by signs, or otherwise to avoid conflict with other users.

SECTION 7. CANE RAILWAY CROSSINGS

7.1 General

Cane railway crossings used in sugar growing areas are treated in a similar manner to railway level crossings.

7.2 Signs and devices

The signs, pavement markings and devices used in conjunction with cane railway crossings are those used for railway level crossings except for the signs and devices listed below.

7.2.1 Cane railway crossings for ... km (W5-Q01)



The CANE RAILWAY CROSSINGS FOR ... km sign is used to advise drivers of the presence of a number of cane railway crossings along a given length of road.

Three or more cane railway crossings may constitute a group provided that the distance between any two successive crossings in the group is not more than 5 km.

7.2.2 End of cane railway crossings (W5-Q02)



The END OF CANE RAILWAY CROSSINGS sign shall be erected so as to face departing traffic at the termination of a group of cane railway crossings.

The sign is only to be used in conjunction with the CANE RAILWAY CROSSINGS FOR ... km sign (W5-Q01).

7.2.3 Cane railway flashing signals

Flashing red signals at a cane railway crossing shall consist of twin red aspects arranged horizontally. These signals are used in lieu of railway level crossing flashing signals, at cane railway crossings. A white T signal aspect may be displayed to drivers of cane trains where cane railway flashing signals are used (see Part 14).

7.2.4 Cane railway level crossing pavement marking (barrier lines and RAIL X)

On undivided two-way roads, which have separation line markings, barrier lines shall be provided on the approaches to, and where necessary across, passive control cane railway level crossings. The need for barrier lines at active control crossings should be determined in accordance with the requirements of Part 2 of this Manual, excepting that they shall be provided where the flashing signals are not readily visible by overtaking motorists.

As cane railway crossings are used on a seasonal basis, pavement messages are not normally installed in advance of these crossings unless treating an existing safety issue.

7.2.5 Combined railway and cane railway crossings

Combined crossings are where a railway level crossing and a cane railway level crossing are adjacent to each other.

The signs and devices used at combined crossings are those used for railway level crossings.

APPENDIX A

ILLUMINATION AND REFLECTORIZATION OF SIGNS

(Normative)

A1 SCOPE

General principles which apply to illuminating or reflectorizing signs for night time use are set out in Clause 1.7.6 of Part 1 of this Manual.

A2 SPECIAL REQUIREMENTS FOR SIGNS AT CROSSINGS

All signs incorporated into the following sign assemblies used in the immediate vicinity of crossings, see Table 2.1 -

- (a) RX-1;
- (b) RX-2;
- (c) RX-5;
- (d) RX-6; and
- (e) RX-9;

shall be reflectorized using Class 1 retroreflective material in accordance with AS/NZS 1906.1.

APPENDIX B

INSTALLATION AND LOCATION OF SIGNS

(Normative)

B1 SCOPE

General principles for uniform installation and location of signs and guidance on the mounting angles required to ensure maximum effectiveness of signs are specified in Clause 1.12 in Part 1 of this Manual.

B2 UNIFORMITY OF LOCATION

B2.1 General

In addition to the general principles, care is needed in locating signs to ensure that they do not obscure one another or otherwise generally obscure visibility, particularly near the railway crossing.

B2.2 Longitudinal placement

Signs which give advance warning of a railway crossing shall be located sufficiently in advance to enable the driver to react appropriately. Distances and distance ranges are given in Figures 4.2 to 4.12. Locations outside these ranges may be required if a satisfactory site for a sign cannot otherwise be found.

B2.3 Lateral placement and height

B2.3.1 General

Principles for the lateral placement and height of roadside signs is given in Clause 1.12.3 in Part 1 of the Manual.

B2.3.2 Signs at pedestrian facilities

Signs in the W7-14 Series shall be mounted either on an internal maze fence 100 mm max. clear below the top of the fence or otherwise at a mounting height of 2 m min.

B2.4 Tolerances on positioning

Where this Part of the Manual gives a specific distance for the positioning of a sign or sign assembly with respect to other items or features, the following tolerances may be applied:

- (a) Minimum, 10% less than the distance given.
- (b) Maximum, 25% more than the distance given.

APPENDIX C
SELECTION OF APPROPRIATE SIGN SIZE
(Informative)

C1 SCOPE

Guidance for the selection of the appropriate size of sign for use at a particular location is provided in Clause 1.8 in Part 1 of the Manual.

APPENDIX D

SIGHT DISTANCE PROVISION AT PASSIVE CONTROL CROSSINGS

(Normative)

D1 GENERAL

This Appendix specifies the procedures to be followed in assessing the sight distance available at passive control crossings to determine the required control measure, i.e.

- (a) control by give-way sign;
- (b) control by stop signs; or
- (c) sight distance inadequate for safe control as a passive control crossings, i.e. the sight triangles from Paragraph D3 are not available.

The design vehicle to be adopted for these calculations shall be either the laden semi-trailer, the laden B-double or the laden road train according to the route designation assigned by the road authority. Parameters to be used for each of these vehicles are listed in Table D1.

NOTE: Vehicle dimensions and performance characteristics used in these procedures may be subject to change if new information becomes available.

D2 CROSSINGS PROTECTED BY GIVE WAY SIGNS - APPROACH VISIBILITY

A road vehicle driver approaching a crossing protected by give-way signs needs either to be able to see an oncoming train in time to stop before reaching the crossing or to be able to continue at the approach speed and cross the crossing safely ahead of a previously unseen train or a train far enough away to be clearly not a collision threat. The required sight triangles to achieve this in each case are shown in Figure D1 as follows:

- (a) *Vehicle stops after seeing train and before reaching the crossing*

The stopping distance requirement is given by S_1 in Figure D1.

The value of S_1 , the minimum distance of an approaching road vehicle from the nearest rail at which the driver must be able to see an approaching train in time to stop if necessary before reaching the crossing, i.e. to stop at the give-way line is given by:

$$S_1 = \frac{(R_T + B_T)V_v}{3.6} + \frac{V_v^2}{254(d + G)} + L_d + C_v \quad (1)$$

where

d = coefficient of longitudinal deceleration, see Paragraph D5.

G = approach grade in metres per metre, positive up-grade, negative down-grade

R_T = total perception reaction time in seconds (general case assumption 2.5 s)

B_T = brake delay time in seconds, see Table D1

For other notation, see Figure D1.

- (b) *Vehicle able to continue at speed and cross safely before train reaches crossing*

The sight triangle requirements are given by S_1 and S_2 in Figure D1.

The value of S_1 is the same as in Item (a).

The value of S_2 , the minimum distance at which the road vehicle driver needs to be able to see the train in order to cross safely ahead of it is given by:

$$S_2 = \frac{V_T}{V_v} \left(\frac{(R_T + B_T)V_v}{3.6} + \frac{V_v^2}{254(d + G)} + \frac{W_T}{\sin Z} + 2C_v + C_T + L \right) \quad (2)$$

for a train approaching from either direction.

L = length of design vehicle, see Table D1.

For other notation in formulae, see Equation (1) and Figure D1.

A train if present, needs to be visible to a road vehicle driver between any two points within the sight triangle.

D3 CROSSINGS PROTECTED BY STOP SIGNS - CROSSING VISIBILITY

A road vehicle driver approaching a crossing protected by stop signs, when stopped at the stop line needs to be able to see far enough along the railway to be able to start off, cross and clear the crossing safely before the arrival of any previously unseen train. The required sight triangles to achieve this are shown in Figure D2.

Distance S_3 is the minimum distance at which an approaching train must be seen in order for the design vehicle to start off and clear the crossing by the safety margin shown in Figure D2. Distance S_3 is given by the following:

$$S_3 = \frac{V_T}{3.6} \left(J + G_s \left(2 \frac{W_R + \frac{W_T}{\sin Z} + 2C_V + C_T + L}{a} \right)^{1/2} \right) \tag{3}$$

for a train approaching from either direction.

Notation in Equation (3) is given in Figure D2 and as follows:

J = sum of the perception time and time to depress clutch (general case assumption 2.0 s).

L = length of design vehicle, see Table D1.

a = average acceleration of the design vehicle in starting gear, see Table D1.

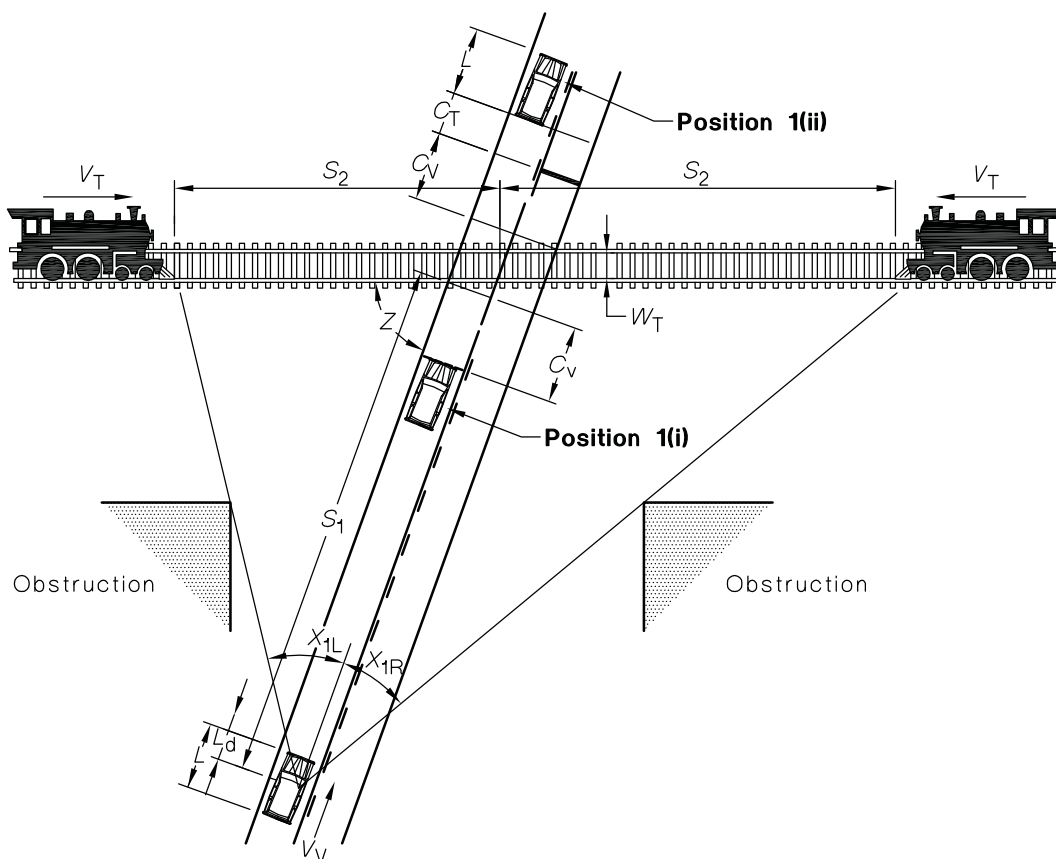
G_s = grade correction factor, see Table D2.

TABLE D1 DESIGN VEHICLE STOPPING, START-UP AND CLEARANCE PARAMETERS

Vehicle type	B_T (s)	J(s)	L (m)	a (m.s ⁻²)
Semi-trailer	1.0	2.0	19.0	0.36
B-double	1.0	2.0	25.0	0.36
Road train-double	1.5	2.5	36.5	0.29
Road train-triple	2.0	2.5	53.5	0.29

TABLE D2 GRADE CORRECTION FACTORS

Grade m/m	Grade correction factor (Gs)
-0.12	0.52
-0.10	0.57
-0.08	0.63
-0.06	0.70
-0.04	0.79
-0.02	0.88
0	1.00
0.02	1.12
0.04	1.25
0.06	1.39
0.08	1.54
0.10	1.69
0.12	1.85



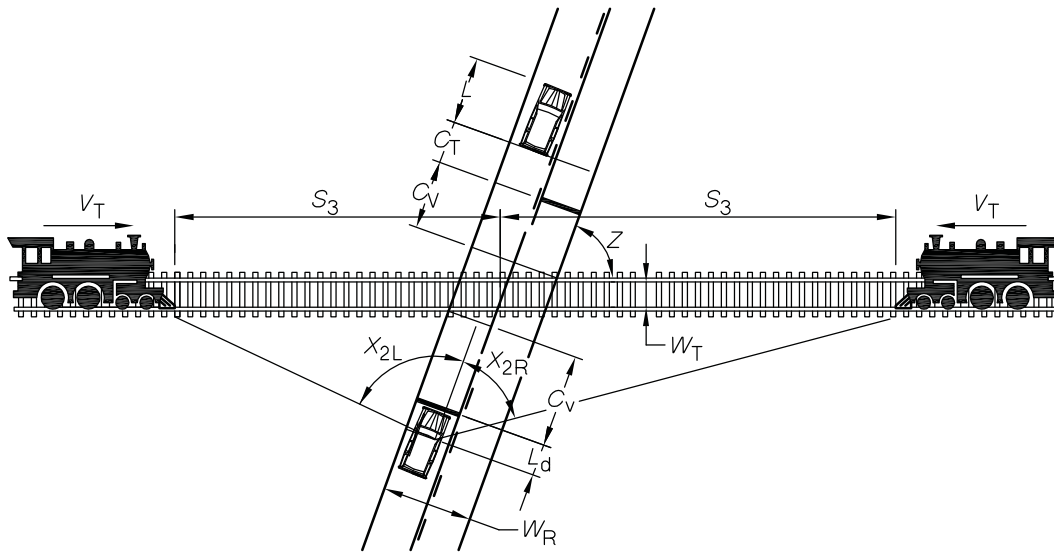
Position 1(i) Driver approaching crossing sights train, judges that a stop is needed, decelerates and stops at the give-way line.

Position 1(ii) Driver approaching the crossing either cannot see approaching train or sights train too far distant to be a collision threat, continues at speed and crosses ahead of the train.

LEGEND (general case assumptions are shown in Brackets):

- S_1 = minimum distance of an approaching road vehicle from the nearest rail when driver must be able to see an approaching train in time to stop if necessary before reaching the crossing (metres).
- S_2 = Minimum distance of a train from the crossing at which a road vehicle driver at distance S_1 from the crossing can proceed at speed and safely clear the crossing ahead of that train, (metres).
- V_T = the speed of the train approaching the crossing (kilometres/hour).
- V_V = the 85th %ile road vehicle speed in the vicinity of the crossing (kilometres/hour). The road speed limit plus 10% may be used where the 85th %ile speed is not known.
- C_V = clearance from the vehicle stop or give-way line to the nearest rail (general case assumption = 3.5 metres).
- C_T = clearance or safety margin from the vehicle stop or give-way line on the departure side of the crossing (general case assumption = 5 metres).
- L_d = distance from the driver to the front of the vehicle (general case assumption = 1.5 metres).
- W_T = width, outer rail to outer rail, of the rail tracks at the crossing (metres).
- X_{1L} = sighting angles, see Paragraph D4.
- X_{1R} = sighting angles, see Paragraph D4.
- Z = angle between the road and the railway at the crossing (degrees).

FIGURE D1 APPROACH VISIBILITY AT PASIVE CONTROL RAILWAY CROSSINGS



Motorist stopped at crossing requires adequate time to accelerate and safely clear the crossing.

LEGEND (general case assumptions are shown in brackets):

S_3 = minimum distance of an approaching train from the centre of the crossing, when the driver of the road vehicle must first see an approaching train in order to safely cross the tracks (metres).

V_T = the speed of the train approaching the crossing (kilometres/hour)

L_d = distance from the driver to the front of the vehicle (general case assumption = 1.5 metres).

C_V = clearance from the vehicle stop line to the nearest rail (general case assumption = 3.5 metres).

C_T = clearance or safety margin from the vehicle stop line on the departure side of the crossing (general case assumption = 5 metres).

W_R = width of the travelled way (portion of the roadway allocated for the movement of the vehicles) at the crossing (metres).

W_T = width, outer rail to outer rail, of the rail tracks at the crossing (metres).

X_{2L} = sighting angles measured from the stop line, see Paragraph D4.

X_{2R} = sighting angles measured from the stop line, see Paragraph D4.

Z = angle between the road and the railway at the crossing (degrees).

FIGURE D2 CROSSING VISIBILITY AT PASIVE CONTROL RAILWAY CROSSINGS

D4 SIGHTING ANGLES

In order to ensure that a motor vehicle driver can see along the prescribed sight triangles without excessive head movement or sight obstruction by parts of the vehicle itself the following maximum sighting angles as shown in Figures D1 and D2, measured from the direction of travel of the vehicle at the point or points at which sightings must be made, need to be available:

(a) *Approaching give-way sign controlled crossings*

The maximum angles are -

(i) to the left (X_{1L}) - 95 degrees; and

(ii) to the right (X_{1R}) - 110 degrees,

(b) *Approaching stop sign controlled crossings*

The maximum angles are -

(i) to the left (X_{2L}) - 110 degrees; and

(ii) to the right (X_{2R}) - 140 degrees.

For the purpose of calculating sight triangles, the following figures shall be used:

Distance from driver's eye to the nearest rail when stopped at the stop line - 5 m.

Height of driver's eye above road level - 1.05 m for cars, 2.40 m for trucks.

Height of train above rails:

Main line railway - 4.0 m.

Cane railway - 2.3 m.

D5 VEHICLE DECELERATION FACTORS

The value 'J' in Equations 1 to 3, the adopted uniform deceleration rate for a vehicle approaching a crossing which may be required to stop on the approach or presence of a train, is given in Table D3. Values for trucks have been adopted for this purpose.

TABLE D3 COEFFICIENT OF DECELERATION FOR ROAD VEHICLES (TRUCKS)

Vehicle speed km/h	Coefficient of deceleration (d)
<95	0.29
95-105	0.28
106-115	0.26
>115	0.25