



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Track & Civil)

Category: Standard

# Level Crossings – Design and Installation

## ETD-16-02

### Applicability

New South Wales	✓	CRIA (NSW CRN)	
-----------------	---	----------------	--

### Primary Source

ARTC NSW Standard XDS 02
--------------------------

### Document Status

Version	Date Reviewed	Prepared by	Reviewed by	Endorsed	Approved
1.2	29 Nov 11	Standards	Track Standards Engineer	Manager Standards	Executive General Manager Technical Services 30/11/2011

### Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.0	01 Dec 09		Implementation draft. Supersedes NSW Standard XDS 02 v1.2
1.1	18 Jun 10		Banner added regarding mandatory requirements in other documents and alternative interpretations.
1.2	29 Nov 11	2, 3	Minor editorial amendments to replace incorrect references to ETD-16-01 with ETD-16-04.

© Australian Rail Track Corporation Limited 2011

#### Disclaimer:

This document has been prepared by ARTC for internal use and may not be relied on by any other party without ARTC's prior written consent. Use of this document shall be subject to the terms of the relevant contract with ARTC.

ARTC and its employees shall have no liability to unauthorised users of the information for any loss, damage, cost or expense incurred or arising by reason of an unauthorised user using or relying upon the information in this document, whether caused by error, negligence, omission or misrepresentation in this document.

**This document is uncontrolled when printed.**

Authorised users of this document should visit ARTC's intranet or extranet ([www.artc.com.au](http://www.artc.com.au)) to access the latest version of this document.

# Contents

<b>1</b>	<b>General Description .....</b>	<b>4</b>
<b>2</b>	<b>Definitions and Abbreviations.....</b>	<b>4</b>
<b>3</b>	<b>References.....</b>	<b>5</b>
<b>4</b>	<b>Design Requirements.....</b>	<b>6</b>
4.1	General .....	6
4.2	Location .....	6
4.3	Signage.....	6
4.3.1	General.....	6
4.3.2	Sign location.....	6
4.3.3	Sign size .....	6
4.3.4	Sign illumination .....	7
4.3.5	Sign manufacture.....	7
4.4	Minimum Sight Distances (Passive Control).....	7
4.5	Body of Level Crossing.....	7
4.5.1	General.....	7
4.5.2	Flangeway clearance.....	7
4.5.3	Surface .....	8
4.6	Road Configuration.....	8
4.6.1	Public Level Crossing .....	8
4.6.2	Private and Service Level Crossings .....	9
4.7	Fencing and Cattle Stops.....	9
4.7.1	Public Level Crossings.....	9
4.7.2	Private Level Crossings .....	9
4.8	Barriers .....	9
4.8.1	Service Level Crossings.....	9
<b>5</b>	<b>Sight Distance Assessment.....</b>	<b>10</b>
5.1	General .....	10
5.2	Public Level Crossings.....	10
5.2.1	Establish road traffic characteristics .....	10
5.2.2	Establish rail traffic characteristics .....	10
5.2.3	Determine sight distances available .....	10
5.2.4	Assess adequacy of sight distances for position or stop sign .....	10
5.2.5	Non-Compliant Level Crossings .....	11
5.3	Private and Service Level Crossings .....	11
5.4	Safety Risk Assessment .....	11

---

5.5	Moderating Strategies.....	12
5.6	Management of Non-Compliant Level Crossings.....	12
<b>6</b>	<b>Design Documentation Requirements .....</b>	<b>13</b>
<b>7</b>	<b>Installation Requirements .....</b>	<b>13</b>
<b>8</b>	<b>Appendix 1 — Safe Stopping Distance Table for Position Signs .....</b>	<b>14</b>
<b>9</b>	<b>Appendix 2 — Sight Distance Tables for Position Signs at Public Level Crossings .....</b>	<b>15</b>
9.1	2A — Minimum Standard Sight Distances for Position Signs at Public Level Crossings.....	15
9.2	2A — Minimum Standard Sight Distances for Position Signs at Public Level Crossings (continued) .....	16
9.3	2B — Minimum Base Condition Sight Distances for Position Signs at Public Level Crossings.....	17
9.4	2B — Minimum Base Condition Sight Distances for Position Signs at Public Level Crossings (continued) .....	18
<b>10</b>	<b>Appendix 3 — Sight Distance Tables for Stop Signs at Public Level Crossings .....</b>	<b>19</b>
10.1	3A — Minimum Standard Sight Distances for Stop Signs at Public Level Crossings.....	19
10.2	3B — Minimum Base Condition Sight Distances for Stop Signs at Public Level Crossings.....	19
<b>11</b>	<b>Appendix 4 — Sight Distance Tables for Position Signs at Private &amp; Service Level Crossings .....</b>	<b>20</b>
11.1	4A — Minimum Standard Sight Distances for Position Signs at Private & Service Level Crossings.....	20
11.2	4A — Minimum Standard Sight Distances for Position Signs at Private & Service Level Crossings (continued) .....	21
11.3	4B — Minimum Base Condition Sight Distances for Position Signs at Private & Service Level Crossings.....	22
11.4	4B — Minimum Base Condition Sight Distances for Position Signs at Private & Service Level Crossings (continued) .....	23
<b>12</b>	<b>Appendix 5 — Sight Distance Tables for Stop Signs at Private &amp; Service Level Crossings.....</b>	<b>24</b>
12.1	5A — Minimum Standard Sight Distances for Stop Signs at Private & Service Level Crossings.....	24
12.2	5A — Minimum Standard Sight Distances for Stop Signs at Private & Service Level Crossings (continued) .....	25
12.3	5B — Minimum Base Condition Sight Distances for Stop Signs at Private & Service Level Crossings.....	26
12.4	5B — Minimum Base Condition Sight Distances for Stop Signs at Private & Service Level Crossings (continued) .....	27
<b>13</b>	<b>Appendix 6 – Sight Distance Assessment Flowchart .....</b>	<b>28</b>

**Mandatory requirements also exist in other documents.**

**Where alternative interpretations occur, the Manager Standards shall be informed so the ambiguity can be removed. Pending removal of the ambiguity the interpretation with the safest outcome shall be adopted.**

## 1 General Description

This standard specifies the design and installation requirements and the sight distance assessment methodology for Level Crossings on railway lines owned by the Australian Rail Track Corporation.

It provides guidelines for determining the most appropriate level of protection to be given to Level Crossings relative to the degree of safety risk involved, based on sight distances, train speeds, train frequencies and usage.

## 2 Definitions and Abbreviations

The following defined terms are used throughout this standard:

Level Crossing:	See ETD-16-04
Additional Level Crossing:	A Level Crossing other than a Relocated Level Crossing installed on ARTC's rail network where none previously existed  A Level Crossing on a railway line acquired by ARTC, either from a construction authority or another railway owner
Relocated Level Crossing:	A Level Crossing installed to replace an existing Level Crossing, which is then removed
Significantly Changed Level Crossing:	An existing Level Crossing where the functional specification is modified by:  usage changes (traffic type, traffic direction, volume of traffic, speed of traffic, ownership of the property served) configuration changes (road width, number of rail tracks, road or rail alignment); and change to the level of protection
Public Level Crossing:	See ETD-16-04
Private Level Crossing:	See ETD-16-04
Service Level Crossing:	See ETD-16-04
Non-Compliant Level Crossing:	A passively-controlled Level Crossing that does not comply with Base Condition Sight Distances
Standard Sight Distances:	Sight distances that comply with the 1994 RTA Guidelines
Base Condition Sight Distances:	Sight distances that comply with the 1987 DMR Guidelines as modified by this standard
Rail Creep:	The longitudinal movement of a running rail other than attributed to rail expansion or contraction
Fixed Point:	Infrastructure configuration where Rail Creep is not normally possible.
Road Authority:	See ETD-16-04

**See relevant ARTC standards for definitions of other terms.**

### 3 References

The principal references used in this standard are:

- AS 1100.401 Technical drawing — Engineering survey and engineering survey design drawing
- AS 1742. 7 Manual of uniform traffic control devices, Part 7: Railway crossings
- AS 1743 Road signs — Specification
- Traffic Engineering Manual, Section 6: Railway Level Crossings, NSW Roads and Traffic Authority, draft (1994)
- Guidelines for railway level crossing protection devices in New South Wales — Department of Main Roads NSW, 1987
- ETD-16-04, Level Crossings — Configuration Standards
- ETD-00-03, Survey Definition of Alignment and Kilometrage
- ETD-00-01, Drawing Standard for Plans Showing Horizontal Alignment
- ETD-16-03, Pedestrian Level Crossings - Design and Installation

## 4 Design Requirements

### 4.1 General

Level Crossings represent significant safety risk to passengers, train crews, pedestrians and road motor vehicle occupants.

Before undertaking the design and installation of a Level Crossing, all alternative means of access must be considered and grade separation (and also closure in the case of existing Level Crossings) must be vigorously investigated and sought.

The design of a Level Crossing is to be undertaken only after the safety risk and all other factors have been fully assessed and resolved.

The design of Level Crossings is to be based on relevant Australian Standards and Codes of Practice and performance requirements specified in this document.

The design of pedestrian level crossings - public, private and service – is to be based on the requirements specified in ETD-16-03.

### 4.2 Location

All Level Crossings are to be located in accordance with AS1742.7 and the sight distance requirements detailed at Section 5.4 of this standard.

All Level Crossings must be located clear of:

- the length of track occupied by trains standing at railway signals
- turnouts and insulated joints
- existing installations which restrict sight distance

All Level Crossing location decisions are to give due consideration to the Level Crossing's effect on the sight distance requirements of trains on other tracks, including sidings and crossing loops.

### 4.3 Signage

#### 4.3.1 General

AS 1742.7 defines the standard configurations for traffic control signage and pavement marking at railway Level Crossings.

The RTA Traffic Engineering Manual defines requirements for Level Crossings on public roads in NSW.

The Australian Rail Track Corporation has adopted the requirements of AS 1742.7 and the RTA Traffic Engineering Manual and applied them to Private and Service Level Crossings as well as Public Level Crossings.

The minimum requirement for passive control of Public and Private Level Crossings is a "Give Way" sign.

At Service Level Crossings a "Stop" sign plus an "Authorised Vehicles Only" sign is to be installed.

#### 4.3.2 Sign location

Sign location, height and orientation are to be in accordance with AS 1742.7.

#### 4.3.3 Sign size

Sign size is to be in accordance with AS 1742.7.

#### 4.3.4 Sign illumination

Signs are to be illuminated or reflectorised in accordance with AS 1742.7.

#### 4.3.5 Sign manufacture

Signs are to be manufactured in accordance with AS 1743.

### 4.4 Minimum Sight Distances (Passive Control)

The methodology adopted by ARTC for determining the minimum sight distance requirements of a Level Crossing (Public, Private or Service) is that used by road authorities for Public Level Crossings. ARTC has extended its use to cover Private and Service Level Crossings.

The traffic mix on public roads always includes a substantial percentage of trucks. The sight distance requirements for trucks are more stringent than those for cars, consequently trucks set the minimum acceptable sight distance requirements for Public Level Crossings.

This standard categorises sight distances for passive control as either Standard or Base Condition.

Additional, Relocated and Significantly Changed Level Crossings are to comply with the Standard Sight Distance requirements.

Existing Level Crossings that do not comply with the Standard Sight Distance requirements are to be upgraded to comply with the Standard Sight Distance requirements.

ARTC recognises that it will take considerable time and funding to upgrade the many existing Level Crossings that do not comply with the Standard Sight Distance requirements. In the interim, compliance with the Base Condition Sight Distance requirements is acceptable for existing Level Crossings waiting upgrading.

Minimum sight distance tables for Public Level Crossings are in Appendices 2 and 3 of this standard. Cars are not included in the sight distance tables for Public Level Crossings.

Minimum sight distance tables for Private and Service Level Crossings are in Appendices 4 and 5 of this standard.

### 4.5 Body of Level Crossing

#### 4.5.1 General

Level Crossings are to be designed as track Fixed Points.

Designs are to include:

- suitable rail anchoring arrangements
- insulated joints where required
- provision of a suitable wheel flangeway
- track drainage
- provision for road surface water to flow away from the crossing

#### 4.5.2 Flangeway clearance

Level Crossings are to have minimum flangeway clearance of 60mm.

Where guard rails are installed, the length of the guard rails is to be the design width of the road plus the design width of the two road shoulders, plus 600mm for each tapered end (run-in) of the guard rail.

The top of the guard rail is to be level with the top of the running rail.

### 4.5.3 Surface

Level Crossing surface type is to be selected using a systems engineering approach taking into account:

- road vehicle type, volume, speed and weight
- use of road by cyclists
- presence of impact initiators such as vertical dips in the road
- angle of attack of road vehicles
- road surface grip under all conditions
- surface and sub-surface drainage
- compatibility with the adjacent road surface
- durability
- resistance to UV and chemical attack
- rail traffic volume, speed and axle load
- track configuration
- road configuration
- electrical resistance
- stray currents
- track maintainability requirements including ease of removal for track maintenance
- effect of Level Crossing components on track component wear and corrosion
- life cycle cost

The road surface is to be no higher than the rail level by design or during the service life of the Level Crossing.

## 4.6 Road Configuration

### 4.6.1 Public Level Crossing

The design width of a Public Level Crossing is to suit the application and will depend on the number of rail tracks to be crossed.

The design length of a Public Level Crossing is to be the design width of the road plus the design width of the two shoulders.

The design width of the road plus the design width of the two shoulders is to suit the requirements of the Road Authority. It should be able to accommodate the largest vehicle authorised to use the crossing.

The approach road is to be designed so as to not compromise the ability of vehicles to safely enter and exit the Level Crossing at the design speed.

Vertical curves and changes of grade on the approach road and through the Level Crossing are to comply with the Road Authority's road design standards to the extent possible.

Where the configuration of the approach road or the body of the Level Crossing does not permit a smooth transition of the road gradient through the Level Crossing in compliance with the Road Authority's standards, the maximum allowable speed of the road traffic approaching and passing through the Level Crossing is to be reduced accordingly.

The surface of the approach road, including the shoulder area is to be sealed for at least 7m on each side of the rail track(s).

Where an existing Public Level Crossing is shorter than the approach road design width, the taper of the road is to be to standards established by the local Road Authority.

Pavement markings are to be in accordance with AS 1742.



## 4.6.2 Private and Service Level Crossings

The design length of a Private or Service Level Crossing is to suit the reasonable requirements of the user. It should be able to accommodate the largest vehicle using the crossing.

The approach road is to be designed so as to not compromise the ability of vehicles to safely enter and exit the Level Crossing at the design speed.

Where Protection level 1A is proposed (i.e. Position Signs) the design maximum speed is 60km/h.

The minimum standard is a formed gravel road extending from the track either 7m or to the rail corridor boundary, whichever distance is the shortest.

## 4.7 Fencing and Cattle Stops

### 4.7.1 Public Level Crossings

At Public Level Crossings, railway level crossing width marker assemblies (RX-9) are to be used.

When an existing Level Crossing is to be refurbished any existing wing fences are to be replaced with RX-9 assemblies.

Where wing fences are used at existing Level Crossings, the fence height is to be reduced to ensure that a road vehicle driver's line of sight is not restricted by the panels.

The risk of stock entering the rail corridor at open Level Crossings on fenced lines is to be assessed. Where risk assessment determines that they are necessary, cattle stops are to be provided.

All fencing at existing Level Crossings is to be assessed to determine its potential for reducing safety and increasing damage in the event of an incident. Where risk assessment determines that it is necessary, the fencing configuration and/or materials are to be changed.

### 4.7.2 Private Level Crossings

At new Private Level Crossings, gates or cattle grids are to be placed in the boundary fence. Gates are to be kept closed and locked except when opened for road vehicle passage.

For existing Private Level Crossings, the provisions of 5.8.1 apply.

## 4.8 Barriers

### 4.8.1 Service Level Crossings

Service Level Crossings are to undergo risk assessment to determine whether barriers need to be installed to obstruct the use of the crossing when required protection is not available (e.g. where a crossing is used during working hours under the control of worksite protection personnel).

Such barriers are to be installed at Service Level Crossings where risk assessment determines that they are necessary.

## 5 Sight Distance Assessment

### 5.1 General

The methodology described below for assessing the sight distances at a Level Crossing (Public, Private or Service) is applicable to:

- installation of Additional, Relocated and Significantly Changed Level Crossings;
- whenever there is any change at a Level Crossing that requires the sight distances to be reassessed; and
- on-going assessment of the existing configuration of a Level Crossing.

### 5.2 Public Level Crossings

#### 5.2.1 Establish road traffic characteristics

Establish the road traffic mix that will use the Level Crossing.

The minimum required sight distances should be based on the road traffic that will normally use the level crossing. It is not intended that they be based on the rare occurrence of a heavier or longer road vehicle.

As a guide, vehicle types that comprise less than 5% of the vehicles using the Level Crossing should not usually be included.

Ascertain the road vehicle approach speed.

#### 5.2.2 Establish rail traffic characteristics

Use the highest speed board speed.

In circumstances where all trains cannot achieve the normal speed board speed, it may be reasonable to use the highest reduced speed.

#### 5.2.3 Determine sight distances available

Use the method described in the RTA Traffic Engineering Manual to determine the sight distances available.

#### 5.2.4 Assess adequacy of sight distances for position or stop sign

Assess the adequacy of the available sight distances for position or stop signs using the methodology detailed in the RTA Traffic Engineering Manual and the tables in Appendices 2 and 3 of this standard.

---

*Note: The tables in Appendices 2 and 3 are applicable for Single Track ONLY. Additional sighting distances will apply for Level Crossings over multiple tracks.*

---

A flow chart is provided at Appendix 6 to guide users in the process.

##### 5.2.4.1 Additional, Relocated and Significantly Changed Level Crossings:

If sufficient sight distance is not available to meet the minimum Standard Sight Distance for stop signs, active control is required at the Level Crossing.

### 5.2.4.2 Existing Level Crossings where Base Condition Sight Distances apply

If sufficient sight distance is not available to meet the minimum Base Condition Sight Distance for stop signs, the Level Crossing is to be categorised as a Non-Compliant Level Crossing and managed accordingly.

### 5.2.5 Non-Compliant Level Crossings

Non-Compliant Level Crossings are to be:

- protected by a stop sign; and
- assessed for safety risk

Appropriate risk reduction strategies are to be implemented.

## 5.3 Private and Service Level Crossings

The assessment for Public Level Crossings is based on level sealed surfaces, but most Private and Service Level Crossings have other road surface configurations.

Assess the adequacy of the available sight distances for position or stop signs using the methodology for Public Level Crossings described in Section 6.2 and the tables for different vehicle and road surface types in Appendices 4 and 5 of this standard. At locations where large agricultural machinery regularly use the Level Crossings, the sighting distances for B-Doubles will apply (this is based on the assumption that the clearance time is similar).

The sight distances for position signs in Appendix 4 are based on the formula from the RTA Traffic Engineering Manual and assume a reduction in deceleration on a formed gravel road surface of 40%.

If the sight distances for position signs are satisfied but the road profile is humped, consideration should be given to installing stop signs or signage alerting road vehicle drivers to the existence of the hump.

*Note: The tables in Appendices 4 and 5 are applicable for Single Track ONLY. Additional sighting distances will apply for Level Crossings over multiple tracks.*

The sight distances for stop signs in Appendix 5 are based on the formula from the RTA Traffic Engineering Manual and assume a reduction in clearance speed on different road surfaces as follows:

Road profile	Level				Humped		
	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
% Reduction in clearance speed	0	10	20	30	55	60	65

## 5.4 Safety Risk Assessment

The safety risk assessments for each Level Crossing should consider at least the following issues:

- 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
- Road traffic level and mix. A lower volume of traffic presents a reduced risk. The mix of traffic is important in assessing the type of vehicle to be nominated for sight distance calculations. If longer/heavier vehicles rarely or only occasionally use a crossing, reduction in sight distance requirements may be justified
- Road grade and condition

## 5.5 Moderating Strategies

The following strategies are examples of possible approaches to reducing safety risks at level crossings caused by insufficient sight distances:

- Consult with Road Authority to reach agreement on treatment of crossing
- Grade separation
- Road Safety Awareness Campaign
- Installation of additional signage (e.g. limited visibility, cross quickly, slow vehicles prohibited, Emergency Use only)
- Establishing Load limits similar to road overbridges, but targeting longer, slower vehicles for prohibition
- Clearance markers closer to track
- Agreement with landholders on usage
- Information to landholders
- Relocation to improve sight distances
- Closure of the Level Crossing
- Speed restriction
- Improvements to sight distances (e.g. removal of obstructions)
- Inclusion in the Level Crossing Protection Upgrade Program
- Use of mirrors (not recommended)

## 5.6 Management of Non-Compliant Level Crossings

A Register of Level Crossings is to be maintained that:

- lists the sight distance standard each crossing is to comply with;
- records the sight distances available at each crossing; and
- includes details of sight distance assessment, date of assessment, details of safety risk assessment and moderating strategies adopted for non-compliant crossings

Non Compliant Level Crossings are managed as other elements of the rail infrastructure (e.g. non standard track clearances) are managed.

## 6 Design Documentation Requirements

Design documentation shall comply with.

AS 1100.401 Technical drawing — Engineering survey and engineering survey design drawing

ETD-00-03, Survey Definition of Alignment and Kilometrage

ETD-00-01, Drawing Standard for Plans Showing Horizontal Alignment

Drawings are to include details of:

- site survey and plan
- track and road alignments and levels
- sight distances
- signage specifications
- Level Crossing track and flangeway configuration
- drainage requirements
- locations of insulated joints (where signalling is affected)
- fencing and cattle stops
- barriers

## 7 Installation Requirements

Standard of finish requirements for new construction and upgrading of level crossings are detailed in the ARTC T&C CoP.

Signage and other associated equipment are to be installed as detailed in the design.

The sight distances specified in the design must be checked at the site.

Level Crossings are to be installed as Fixed Points.

## 8 Appendix 1 – Safe Stopping Distance Table for Position Signs

Vehicle Speed km/h	Sight Distance S <sub>1</sub> (m)				
	Car	Truck	Semi	B-Double	Road Train
20	22	28	28	29	29
40	45	65	65	67	69
60	77	116	116	120	124
80	120	184	184	191	198
100	175	275	275	286	-
120	250	-	-	-	-

## 9 Appendix 2 – Sight Distance Tables for Position Signs at Public Level Crossings

### 9.1 2A – Minimum Standard Sight Distances for Position Signs at Public Level Crossings

TRUCK	Sight Distance S <sub>2</sub> (m)				
	Vehicle Speed (km/h)				
Train Speed (km/h)	20	40	60	80	100
20	73	74	88	103	126
40	146	148	176	207	252
60	219	222	264	310	378
80	292	296	351	413	504
100	365	370	439	517	630
120	438	444	527	620	755
140	511	518	615	723	881
160	585	593	703	827	1007
180	658	667	791	930	1133
200	731	741	879	1033	1259

Table 2.A.1 – Public Level Crossings: Standard S<sub>2</sub> values for Trucks

SEMI	Sight Distance S <sub>2</sub> (m)				
	Vehicle Speed (km/h)				
Train Speed (km/h)	20	40	60	80	100
20	80	74	88	103	126
40	159	148	176	207	252
60	239	222	264	310	378
80	318	296	351	413	504
100	398	370	439	517	630
120	477	444	527	620	755
140	557	518	615	723	881
160	637	593	703	827	1007
180	716	667	791	930	1133
200	796	741	879	1033	1259

Table 2.A.2 – Public Level Crossings: Standard S<sub>2</sub> values for Semi-Trailers

**9.2 2A – Minimum Standard Sight Distances for Position Signs at Public Level Crossings (continued)**

<b>B-DOUBLE</b>	<b>Sight Distance S<sub>2</sub> (m)</b>				
	<b>Vehicle Speed (km/h)</b>				
<b>Train Speed (km/h)</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>80</b>	<b>100</b>
20	86	76	90	107	131
40	171	152	181	213	261
60	257	228	271	320	392
80	342	304	362	427	522
100	428	380	452	534	653
120	513	456	543	640	784
140	599	532	633	747	914
160	685	608	723	854	1045
180	770	684	814	961	1175
200	856	760	904	1067	1306

**Table 2.A.3 – Public Level Crossings: Standard S<sub>2</sub> values for B-Doubles**

<b>ROAD TRAIN</b>	<b>Sight Distance S<sub>2</sub> (m)</b>			
	<b>Vehicle Speed (km/h)</b>			
<b>Train Speed (km/h)</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>80</b>
20	113	90	93	110
40	226	181	186	220
60	339	271	279	331
80	452	361	372	441
100	565	452	465	551
120	678	542	558	661
140	791	633	651	771
160	905	723	744	881
180	1018	813	837	992
200	1131	904	930	1102

**Table 2.A.4 – Public Level Crossings: Standard S<sub>2</sub> values for Road Trains**



### 9.3 2B – Minimum Base Condition Sight Distances for Position Signs at Public Level Crossings

TRUCK	Sight Distance S2 (m)				
	Vehicle Speed (km/h)				
Train Speed (km/h)	20	40	60	80	100
20	43	40	44	50	60
40	87	81	88	100	120
60	130	121	132	150	180
80	174	162	175	199	241
100	217	202	219	249	301
120	261	242	263	299	361
140	304	283	307	349	421
160	348	323	351	399	481
180	391	364	395	449	541
200	435	404	439	499	601

Table 2.B.1 – Public Level Crossings: Base Condition S2 values for Trucks

SEMI	Sight Distance S2 (m)				
	Vehicle Speed (km/h)				
Train Speed (km/h)	20	40	60	80	100
20	50	44	46	51	61
40	100	87	92	103	123
60	150	131	138	154	184
80	200	175	184	206	246
100	250	218	230	257	307
120	300	262	276	309	369
140	350	305	322	360	430
160	400	349	368	412	491
180	450	393	414	463	553
200	500	436	460	515	614

Table 2.B.2 – Public Level Crossings: Base Condition S2 values for Semis

**9.4 2B – Minimum Base Condition Sight Distances for Position Signs at Public Level Crossings (continued)**

B-DOUBLE	Sight Distance S2 (m)				
	Vehicle Speed (km/h)				
Train Speed (km/h)	20	40	60	80	100
20	56	47	49	55	65
40	112	95	98	109	130
60	168	142	147	164	195
80	224	189	197	218	259
100	280	236	246	273	324
120	336	284	295	327	389
140	392	331	344	382	454
160	448	378	393	437	519
180	504	426	442	491	584
200	560	473	491	546	649

Table 2.B.3 – Public Level Crossings: Base Condition S2 values for B-Doubles

ROAD TRAIN	Sight Distance S2 (m)			
	Vehicle Speed (km/h)			
Train Speed (km/h)	20	40	60	80
20	83	62	59	63
40	167	123	119	126
60	250	185	178	189
80	334	247	238	252
100	417	308	297	315
120	501	370	357	378
140	584	432	416	441
160	668	494	475	504
180	751	555	535	567
200	835	617	594	630

Table 2.B.4 – Public Level Crossings: Base Condition S2 values for Road Trains

## 10 Appendix 3 – Sight Distance Tables for Stop Signs at Public Level Crossings

### 10.1 3A – Minimum Standard Sight Distances for Stop Signs at Public Level Crossings

Train Speed km/h	Sight Distance S <sub>3</sub> (m)			
	Truck	Semi	B-Double	Road Train
20	79	98	103	146
40	159	196	207	292
60	238	293	310	438
80	318	391	413	584
100	397	489	517	731
120	477	587	620	877
140	556	684	723	1023
160	636	782	827	1169
180	715	880	930	1315
200	794	978	1033	1461

Table 3.A.1 – Public Level Crossings: Standard S<sub>3</sub> values

### 10.2 3B – Minimum Base Condition Sight Distances for Stop Signs at Public Level Crossings

Train Speed km/h	Sight Distance S <sub>3</sub> (m)			
	Truck	Semi	B-Double	Road Train
20	50	68	73	115
40	100	135	146	229
60	150	203	219	344
80	200	271	292	458
100	250	339	366	573
120	300	406	439	687
140	350	474	512	802
160	400	542	585	916
180	450	610	658	1031
200	500	677	731	1145

Table 3.B.1 – Public Level Crossings: Base Condition S<sub>3</sub> values

# 11 Appendix 4 – Sight Distance Tables for Position Signs at Private & Service Level Crossings

## 11.1 4A – Minimum Standard Sight Distances for Position Signs at Private & Service Level Crossings

CAR	Sight Distance S <sub>2</sub> (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	63	59	69
40	125	117	138
60	188	176	208
80	251	235	277
100	314	293	346
120	376	352	415
140	439	410	485
160	502	469	554
180	564	528	623
200	627	586	692

Table 4.A.1 – Private & Service Level Crossings: Standard S<sub>2</sub> values for Cars

TRUCK	Sight Distance S <sub>2</sub> (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	77	87	106
40	153	174	213
60	230	261	319
80	307	348	425
100	383	435	532
120	460	522	638
140	537	609	744
160	613	696	851
180	690	783	957
200	767	870	1063

Table 4.A.2 – Private & Service Level Crossings: Standard S<sub>2</sub> values for Trucks

## 11.2 4A – Minimum Standard Sight Distances for Position Signs at Private & Service Level Crossings (continued)

SEMI	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	83	87	106
40	166	174	213
60	250	261	319
80	333	348	425
100	416	435	532
120	499	522	638
140	582	609	744
160	665	696	851
180	749	783	957
200	832	870	1063

Table 4.A.3 – Private & Service Level Crossings: Standard S2 values for Semi Trailers

B-DOUBLE	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	89	90	110
40	179	179	220
60	268	269	330
80	357	358	440
100	447	448	550
120	536	537	660
140	626	627	770
160	715	716	880
180	804	806	989
200	894	895	1099

Table 4.A.4 – Private & Service Level Crossings: Standard S2 values for B Doubles

### 11.3 4B – Minimum Base Condition Sight Distances for Position Signs at Private & Service Level Crossings

CAR	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	33	30	33
40	66	60	65
60	99	90	98
80	133	119	131
100	166	149	163
120	199	179	196
140	232	209	229
160	265	239	261
180	298	269	294
200	331	299	327

Table 4.B.1 – Private & Service Level Crossings: Base Condition S2 values for Cars

TRUCK	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	47	47	53
40	94	94	106
60	141	141	159
80	188	187	212
100	235	234	265
120	283	281	319
140	330	328	372
160	377	375	425
180	424	422	478
200	471	469	531

Table 4.B.2 – Private & Service Level Crossings: Base Condition S2 values for Trucks

### 11.4 4B – Minimum Base Condition Sight Distances for Position Signs at Private & Service Level Crossings (continued)

SEMI	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	54	50	55
40	107	100	111
60	161	150	166
80	214	200	221
100	268	251	276
120	322	301	332
140	375	351	387
160	429	401	442
180	482	451	497
200	536	501	553

Table 4.B.3 – Private & Service Level Crossings: Base Condition S2 values for Semi Trailers

B-DOUBLE	Sight Distance S2 (m)		
	Vehicle Speed (km/h)		
Train Speed (km/h)	20	40	60
20	60	54	59
40	120	108	118
60	179	162	177
80	239	217	236
100	299	271	294
120	359	325	353
140	419	379	412
160	478	433	471
180	538	487	530
200	598	541	589

Table 4.B.4 – Private & Service Level Crossings: Base Condition S2 values for B Doubles

## 12 Appendix 5 – Sight Distance Tables for Stop Signs at Private & Service Level Crossings

### 12.1 5A – Minimum Standard Sight Distances for Stop Signs at Private & Service Level Crossings

CAR	Sight Distance S <sub>3</sub> (m)						
		Level			Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	59	62	67	72	97	106	117
40	118	125	133	144	194	211	233
60	177	187	200	217	291	317	350
80	236	249	267	289	388	422	467
100	294	312	333	361	485	528	583
120	353	374	400	433	581	633	700
140	412	436	467	506	678	739	817
160	471	499	533	578	775	844	933
180	530	561	600	650	872	950	1050
200	589	623	667	722	969	1056	1167

Table 5.A.1 – Private Level Crossings: Standard S<sub>3</sub> values for Cars

TRUCK	Sight Distance S <sub>3</sub> (m)						
		Level			Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	79	85	92	102	143	157	175
40	159	170	185	203	285	314	351
60	238	256	277	305	428	471	526
80	318	341	369	406	570	628	702
100	397	426	462	508	713	785	877
120	477	511	554	610	856	942	1052
140	556	596	647	711	998	1099	1228
160	636	681	739	813	1141	1256	1403
180	715	767	831	914	1283	1413	1579
200	794	852	924	1016	1426	1569	1754

Table 5.A.2 – Private Level Crossings: Standard S<sub>3</sub> values for Trucks



## 12.2 5A – Minimum Standard Sight Distances for Stop Signs at Private & Service Level Crossings (continued)

SEMI	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	98	106	115	128	183	203	228
40	196	211	231	256	367	406	456
60	293	317	346	383	550	608	683
80	391	422	461	511	733	811	911
100	489	528	576	639	917	1014	1139
120	587	633	692	767	1100	1217	1367
140	684	739	807	894	1283	1419	1594
160	782	844	922	1022	1467	1622	1822
180	880	950	1038	1150	1650	1825	2050
200	978	1056	1153	1278	1833	2028	2278

Table 5.A.3 – Private Level Crossings: Standard S<sub>3</sub> values for Semis

B-DOUBLE	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	103	112	122	136	196	217	244
40	207	223	244	271	391	433	487
60	310	335	367	407	587	650	731
80	413	447	489	543	783	867	975
100	517	559	611	679	978	1083	1218
120	620	670	733	814	1174	1300	1462
140	723	782	856	950	1370	1517	1706
160	827	894	978	1086	1565	1733	1949
180	930	1006	1100	1221	1761	1950	2193
200	1033	1117	1222	1357	1957	2167	2437

Table 5.A.4 – Private Level Crossings: Standard S<sub>3</sub> values for B-Doubles

### 12.3 5B – Minimum Base Condition Sight Distances for Stop Signs at Private & Service Level Crossings

CAR	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	30	33	38	43	67	75	86
40	60	67	75	86	134	151	172
60	90	100	113	129	201	226	258
80	120	134	151	172	268	301	344
100	151	167	188	215	335	376	430
120	181	201	226	258	401	452	516
140	211	234	263	301	468	527	602
160	241	268	301	344	535	602	688
180	271	301	339	387	602	677	774
200	301	335	376	430	669	753	860

Table 5.B.1 – Private Level Crossings: Base Condition S<sub>3</sub> values for Cars

TRUCK	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	50	56	63	71	111	125	143
40	100	111	125	143	222	250	286
60	150	167	188	214	333	375	429
80	200	222	250	286	444	500	571
100	250	278	313	357	556	625	714
120	300	333	375	429	667	750	857
140	350	389	438	500	778	875	1000
160	400	444	500	571	889	1000	1143
180	450	500	563	643	1000	1125	1286
200	500	556	625	714	1111	1250	1429

Table 5.B.2 – Private Level Crossings: Base Condition S<sub>3</sub> values for Trucks

## 12.4 5B – Minimum Base Condition Sight Distances for Stop Signs at Private & Service Level Crossings (continued)

SEMI	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	68	75	85	97	151	169	194
40	135	151	169	194	301	339	387
60	203	226	254	290	452	508	581
80	271	301	339	387	602	677	774
100	339	376	423	484	753	847	968
120	406	452	508	581	903	1016	1161
140	474	527	593	677	1054	1185	1355
160	542	602	677	774	1204	1355	1548
180	610	677	762	871	1355	1524	1742
200	677	753	847	968	1505	1694	1935

Table 5.B.3 – Private Level Crossings: Base Condition S<sub>3</sub> values for Semis

B-DOUBLE	Sight Distance S <sub>3</sub> (m)						
	Level				Humped		
Train Speed (Km/hr)	Sealed	Formed	Timber	Ballast	Formed	Timber	Ballast
20	73	81	91	104	162	183	209
40	146	162	183	209	325	366	418
60	219	244	274	313	487	548	627
80	292	325	366	418	650	731	836
100	366	406	457	522	812	914	1045
120	439	487	548	627	975	1097	1253
140	512	569	640	731	1137	1280	1462
160	585	650	731	836	1300	1462	1671
180	658	731	823	940	1462	1645	1880
200	731	812	914	1045	1625	1828	2089

Table 5.B.4 – Private Level Crossings: Base Condition S<sub>3</sub> values for B-Doubles

# 13 Appendix 6 – Sight Distance Assessment Flowchart

