Practice Note 09

Sight distances at Zebra Crossings

Supplement of Engineering Design Code – Urban and Rural Roadway Design

Edition 1.1, January 2026

Contents

Edition 1.1 Error correction to formula in Section 4.5

Inserted $V = \sqrt{12.9 * R * CA}$ in place of incorrect $V = \sqrt{127 * R * CA}$

1 Purpose

Austroads Guide to Road Design (AGRD) Part 4A: Unsignalised and Signalised Intersections Section 3.3 contains the requirements for determining safe intersection sight distance (SISD,) approach sight distance (ASD) and crossing sight distance (CSD) for crossing facilities. NZTA Pedestrian Network Guidance (PNG) provides further detailed guidance for all types of pedestrian crossings. At present, these standards do not distinguish between crossings with vehicle priority and those with pedestrian priority.

Current standards in AT TDM Engineering Design Code – Urban and Rural Road Design (EDC) and in AC Code of Practice for Land Development and Subdivision (AC CPLDS) Chapter 3: Transport do not include the latest changes recommended by Austroads and NZTA and those adopted by Auckland Transport.

CSD requires a sight distance that presumes vehicles do not give way to pedestrians. It is very difficult to provide this long distance in urban streets, particularly where communities require kerbside parking. A safe sight distance that allows vehicles to give way to pedestrians can be significantly less and so be easier to achieve with less effect on opportunity for on-street parking.

Austroads is developing amendments to AGRD 4A to deal with this. Until that is adopted, this Practice Note (PN) provides the approach to be adopted for all designs of priority pedestrian crossings (Zebra crossings) on Auckland Transport public roads for consistency.

It introduces requirements specific to Auckland:

- A new Priority Crossing Sight Distance (PCSD) standard
- Changes to the stopping point location for construction of sight lines.

Implementation comes into effect immediately on the signed date at the end of this PN.

2 Scope

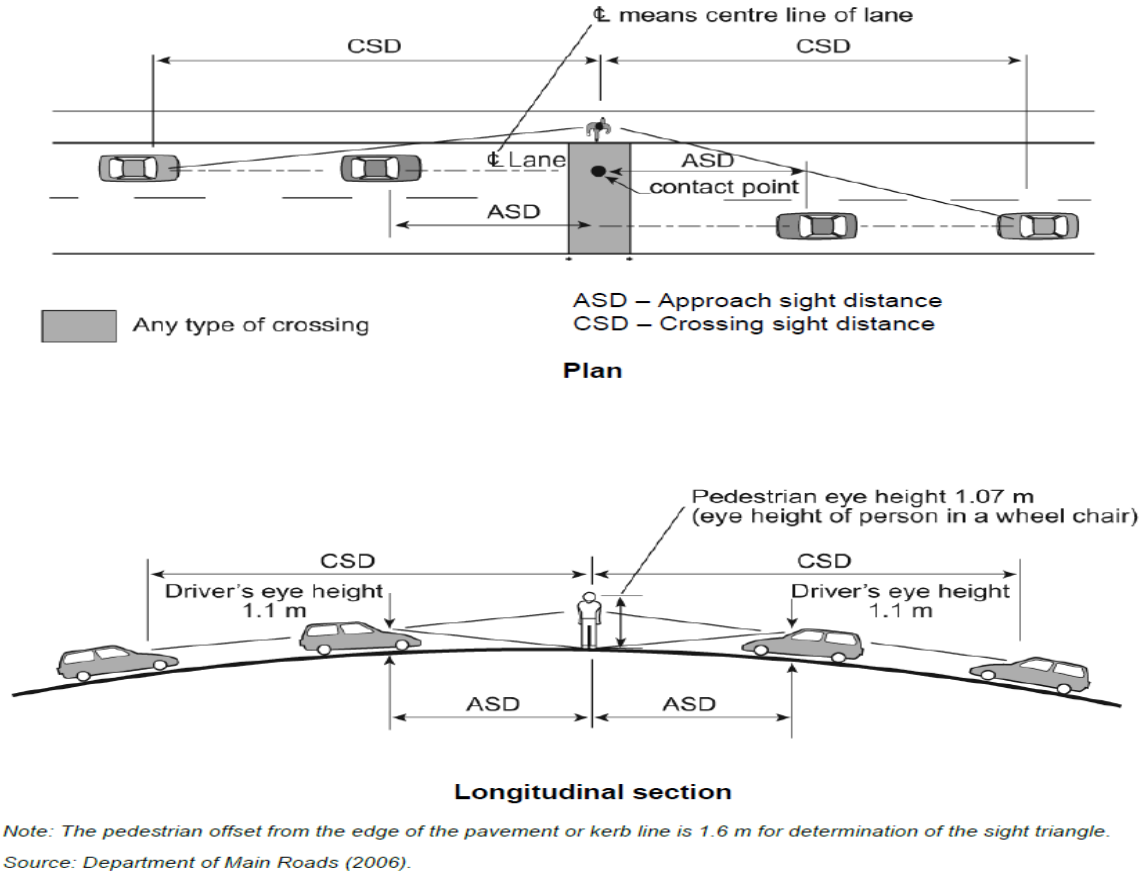
This Practice Note applies to:

- All AT projects initiated after implementation of this PN.
- All Consents or ENGs lodged after implementation of this PN.
- Any AT project commenced but not yet constructed or any Consent or ENG lodged with Auckland Council:
    - If the Manager – Design & Standards considers that an issue would arise if the design is not changed
    - and if it is practicable to change the design prior to construction.
    - and the cost of changing the design can be agreed to.
- Any review of the safety of an existing priority crossing.

3 Context

3.1 Austroads requirements (AGRD4A Ed 3.2 May 2023)

A recent revision, Edition 3.2 of the AGRD Part 4A: Unsignalised and Signalised Intersections Section 3.3 has recommended two key sight distance requirements at pedestrian crossing facilities: ASD and crossing sight distance (CSD). Figure 1 illustrates these two sight distance criteria.



Note: The pedestrian offset from the edge of the pavement or kerb line is 1.6 m for determination of the sight triangle.

Source: Department of Main Roads (2006).

Figure 1: sight distance requirement for crossing facility from AGRD 4A

ASD ensures that approaching drivers are aware of the presence of a pedestrian crossing facility. It is important that this line of sight is not obstructed as it ensures that even if there is no pedestrian actually on the crossing, the driver should be aware of the crossing by seeing the associated pavement markings and other cues and therefore be alerted to take the appropriate action if a pedestrian steps onto the crossing.

CSD ensures that the pedestrian can see approaching traffic in sufficient time to judge a safe gap and cross the roadway. It also ensures a clear view for approaching drivers to sight pedestrians waiting to cross the roadway. This does not distinguish crossings where pedestrians have priority.

A priority pedestrian crossing must have a maximum of one traffic lane in each direction to avoid vehicle in adjacent lanes blocking visibility of people crossing or waiting to cross.

This PN is to provide guidance in terms of AT's response to changes when designing for a zebra crossing, including a new Pedestrian Crossing Sight Distance (PCSD) standard.

Standards varied by this Practice Note are set out in Table 1.

Item	AGRD	NZTA PNG	TDM EDC	AC CPLDS Ch3	PN-09
Object height for bus and truck.	Part 3: 5.2.1 Object height				4.2.2, 4.2.3
Reaction time	Part 3: 5.2.2 Table 5.2	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Observation and reaction time	3.3.1.3	4.6 Table 2
Deceleration	Part 3: 5.2.3 Longitudinal Deceleration Table 5.3	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Deceleration rate	3.3.1.3	4.6 Table 2
SSD for buses added	Part 3: 5.3 Stopping Sight Distance (SSD)	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Safe Avoidance	3.3.1.3	4.3 & 4.6 Table 2
Departure from Standard applies to EDD	Part 3: Appendix A 3 EDD for Stopping Sight Distance			3.1.3	4.2.1 & 4.6 Table 2
PCSD used in place of CSD	Part 4A: 3.3 Pedestrian Sight Distance Requirements	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Safe to Go	3.3.1.3	4.2 & 4.6
Calculation for decelerating approach (DSD) added	Part 4A: 3.3 Pedestrian Sight Distance Requirements	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Deceleration rate	3.3.1.3	4.5, 5 Ex2B
SSD for buses & trucks added	Part 4A: 3.3 Pedestrian Sight Distance Requirements	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Safe Avoidance	3.3.1.3	4.3
Construction of sightlines	Part 4A: 3.3 Pedestrian Sight Distance Requirements	3.4.3d Sight distances	Urban and rural roadway design: 4.3 Safe Avoidance	3.3.1.3	4.2
Note on Design Speed	Part 3: 3.3 Operating Speeds on Urban Roads		Urban and rural roadway design: 4.1 Design Speed, 4.3 Initial speed	3.3.1.1	4.4
Pedestrian crossings			Footpaths and the public realm: 3.8 Pedestrian crossings	3.4.2.8	All

Table 1: Details of Standards varied by PN-09

3.2 System Design regarding Principles of Visibility

Chapter 1 of the Urban Street and Road Design Guide provides guidelines on this.

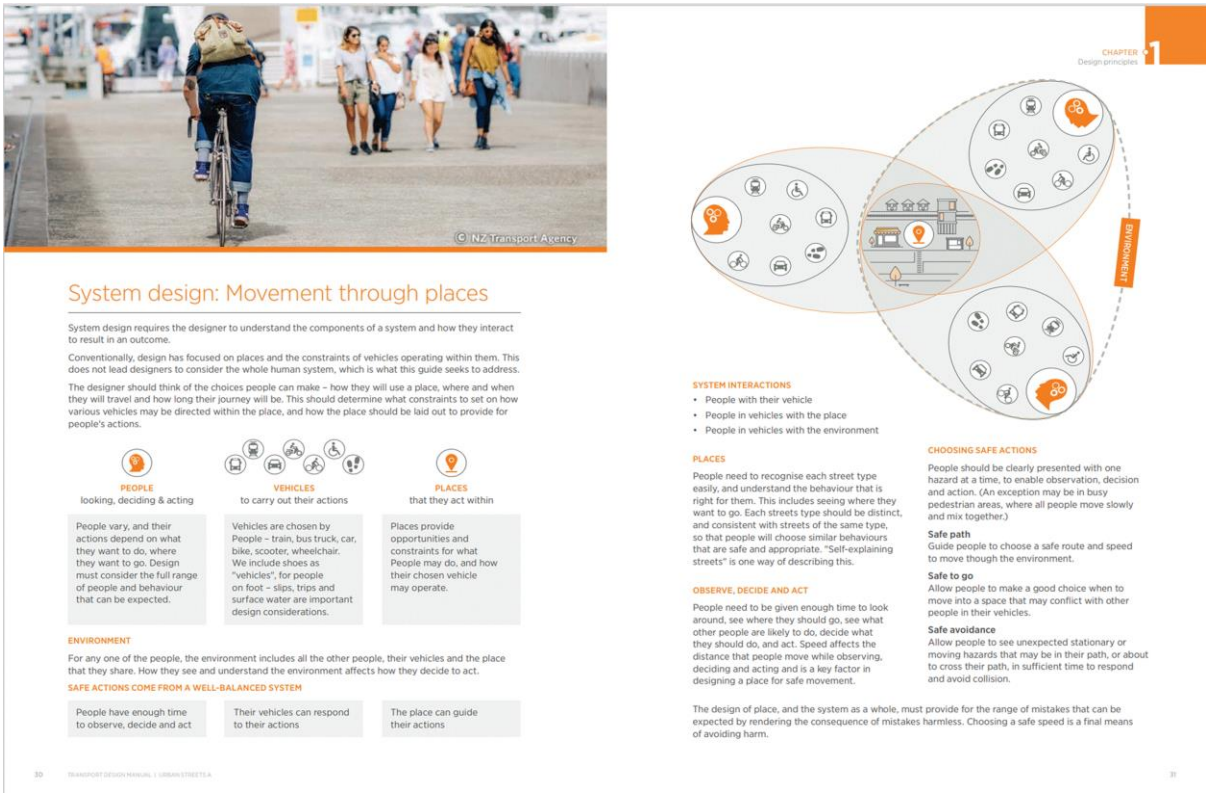


Figure 2: Pages from Urban Street and Road Design Guide

Applying this to zebra crossings:

- **Safe Path**
  - A driver must be able to recognize a zebra crossing and the associated zebra crossing limit line and become alert and ready to give way to pedestrians about to cross.

- **Safe to Go**
  - A pedestrian must be able to judge that an approaching vehicle will give way to allow them to proceed across. However, it is not necessary for a pedestrian to wait for a gap within the traffic and have sufficient clearance to be able to complete the crossing as required for Crossing Sight Distance (CSD) where vehicles have priority. Therefore, CSD is not required in the design of the zebra crossing. Instead, Priority Crossing Sight Distance (PCSD) is used.
  - A driver must be able to judge that the crossing will be clear when passing it or be able to stop at the limit line if it is not clear.

- **Safe Avoidance**
  - A driver of a car, bus or truck must be able to stop safely without entering the crossing if they observe that it is not clear.

4 AT sight distance requirements for pedestrian zebra crossings

There are now three sight distance requirements at pedestrian crossing facilities: Approach Sight Distance, Priority Crossing Sight Distance and Stopping Sight Distance.

4.1 Approach Sight Distance (ASD)

Safe path: ASD as defined in AGRD Part 4A: Unsignalised and Signalised Intersections (Edition 3.2) ensures that approaching drivers are aware of the presence of a pedestrian crossing facility. It is important that this line of sight is not obstructed as it ensures that even if there is no pedestrian actually on the crossing, the driver should be aware of the crossing by seeing the associated pavement markings and other cues, and therefore be alerted to take the appropriate action if a pedestrian steps onto the crossing. ASD should be provided between approaching vehicles (1.1m eye height) and the surface of the roadway (generally 0m) at all pedestrian crossings.

4.2 Priority Crossing Sight Distance (PCSD)

Safe to Go: It is also important to check the Sight Line from an alert driver to the pedestrian about to cross and from the pedestrian about to cross to the approaching vehicle so that both are able to judge whether to go onto the crossing. The new sight line construction helps to determine the parking restrictions required to achieve a sight line so that there is unimpeded visibility between drivers and pedestrians that are waiting to cross at the zebra crossing (see Section 4.2.3). This sightline is to be constructed from the eye height of the driver (1.1m) to the pedestrians on the footpath (1.07m) as shown in Figure 3.

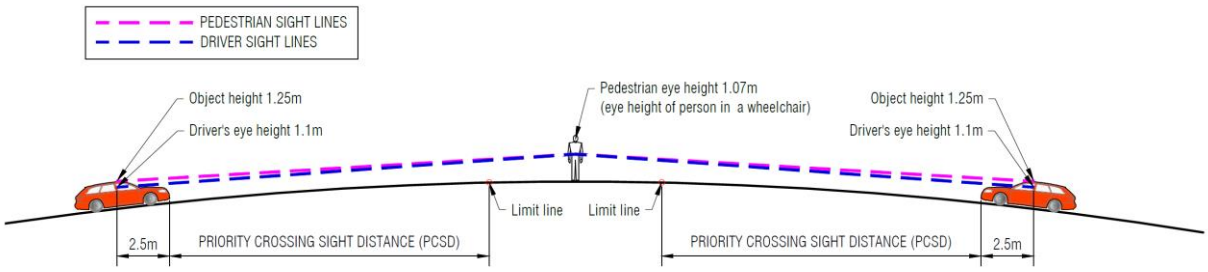


Figure 3: Sight line construction

Austroads ASD is measured to the conflict point (see Fig 4A). PCSD is measured to the vehicle limit line. This provides for stopping at the limit line (see Fig 4B).

In the situation where there is no limit line, then PCSD should be measured to 1.5 m from the edge of the zebra crossing bars (see Fig 4C). At intersections, where clearance from a traffic lane past a stopped car is significant, this may be reduced to 0.5m (see Fig 4D).

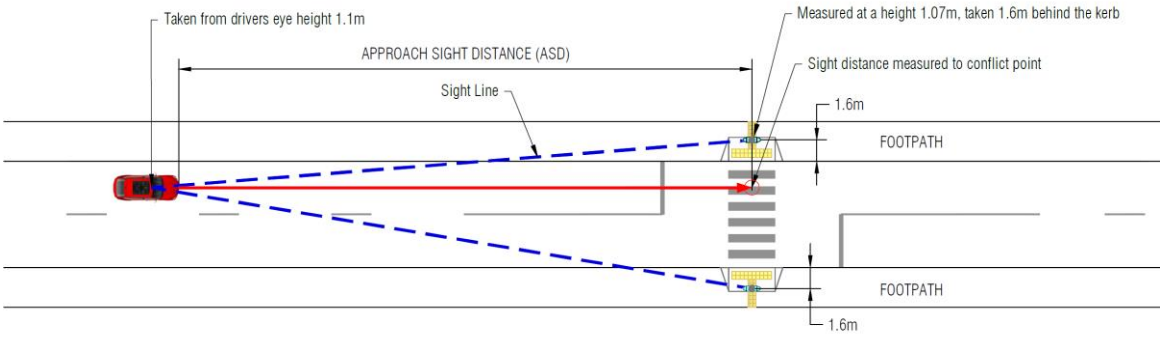


Figure 4A: Sightline construction for Austroads ASD

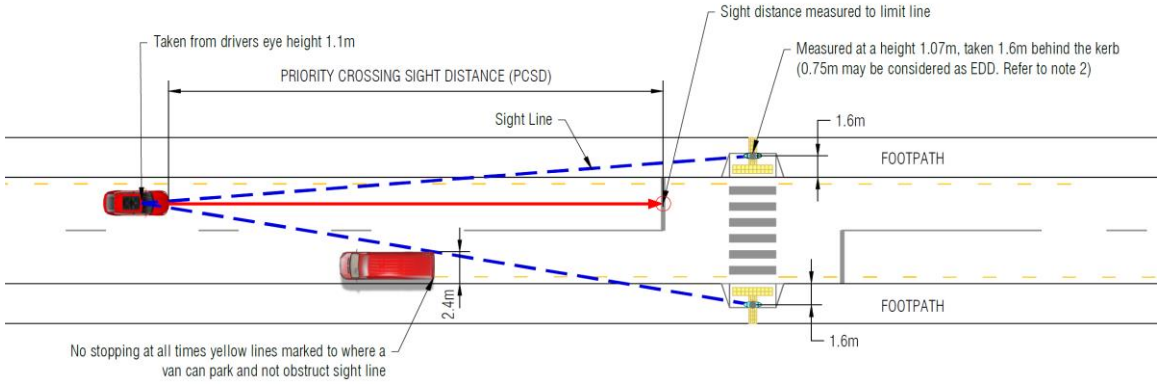


Figure 4B: Sightline construction for PCSD with limit line

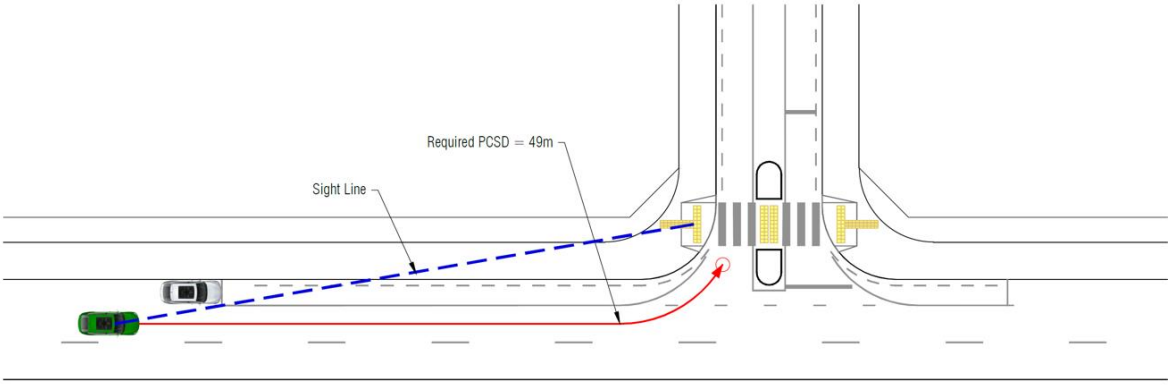


Figure 4C: Sightline construction for PCSD with no limit line

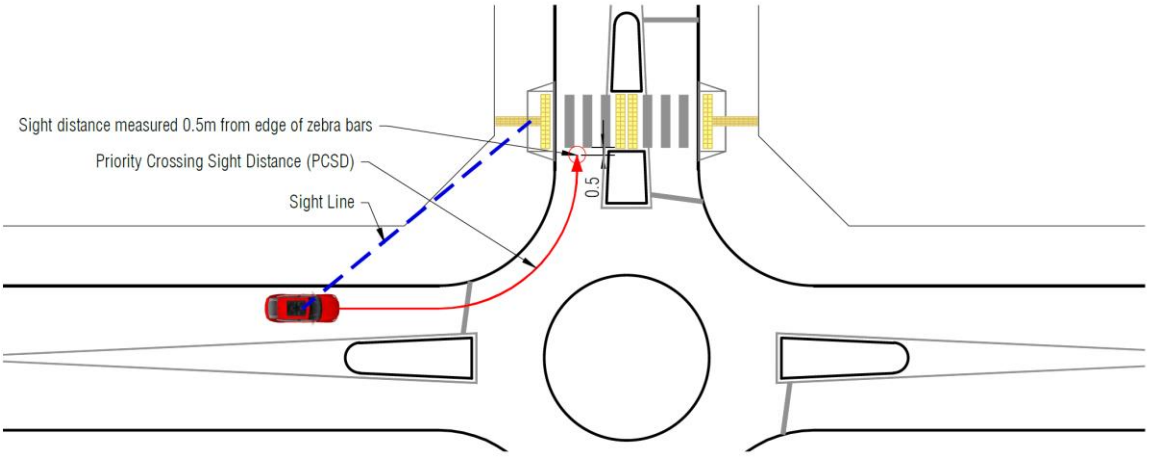


Figure 4D: Sightline construction for PCSD with no limit line

When determining PCSD sightline, both horizontal and vertical alignments must be assessed. This ensures that a driver approaching a crossing or intersection has sufficient visibility to detect and respond to pedestrians or other hazards in time. Gradient corrections are also required.

The Extended Design Domain (EDD) is a concept used to allow flexibility in road design where standard criteria cannot be met, typically in constrained environments. Zebra crossings are priority pedestrian facilities, meaning vehicles must yield to pedestrians. Any reduction of parameters under EDD must ensure that drivers are still able to react and avoid pedestrians, who must also have confidence to cross safely and that any mistakes do not result in serious injury.

Where the pedestrian observer set-back of 1.6m is difficult to achieve a minimum setback of 0.75m may be considered as EDD. This requires report and approval of a Departure from Standard, which will be assessed for the site context.

4.2.1 Sightline construction for buses

On a bus route, PCSD should be measured from driver eye height 1.8m to a pedestrian at the observer position, with object height 3.0m of bus viewed by pedestrian. PCSD for buses is numerically the same as the ASD values for buses provided in AGRD Part 3 and Part 4A.

4.2.2 Sightline construction for trucks

On category 1-3 freight routes, PCSD should be measured from driver eye height 2.4m to a pedestrian at the observer position, with object height 2.4m of truck viewed by pedestrian. PCSD for trucks is numerically the same as the ASD values for trucks provided in AGRD Part 3 and Part 4A.

4.2.3 Sightline construction with kerbside parking and bus stops

It is often desirable to minimise removal of kerbside parking on the approach to a crossing. Also, a bus stop may be required close to a crossing if it cannot be located on the far side of the crossing. These parking and stopping places will have intermittent obstructions to visibility.

A small car may not obstruct a sightline completely, but if a large ute (light truck), SUV or van is legally parked or a bus is stopped it will be a significant obstruction. The width of the possible obstruction should be drawn at 2.1 m from the kerb for a car parking space or 2.8 m for a bus or heavy truck. Where the sightline crosses the obstruction width is closest point to the crossing that stopping is permitted. No Stopping lines should be provided between that point and the crossing.

For a bus stop that is not a timing point, a short dwell time can be considered under a Departure from Standard with regard to risk of a pedestrian not waiting until the bus has departed before starting to cross and whether they can be seen by a driver passing the stopped bus.

4.3 Stopping sight distance (buses & trucks)

Safe Avoidance: Stopping sight distance for buses is to be checked if the zebra crossing is on a bus route and PCSD for buses cannot be fully provided. This is to enable buses to decelerate to stop safely at a rate that is comfortable and safe for the occupants inside the bus to avoid an unexpected pedestrian, from the 85th percentile operating speed of buses. SSD for buses on zebra crossing approaches should be measured from driver eye height (1.8m) to all parts of the Conflict Zone (the extent of zebra stripes within traffic lanes). Stopping sight distances for buses are numerically the same as the ASD values for buses provided in AGRD Part 3.

SSD for trucks on any road (other than a bus route) should also be considered where this may be greater than PCSD available for cars. This should be necessary only where a Departure from Standard has been approved for PCSD.

4.4 Determining Design Speed

The adopted design speed for assessing Approach Sight Distance (ASD) must reflect actual operating conditions. It can be determined using one of the following methods:

- **Free-flow operating speed** measured directly on-site using a radar gun or calibrated video.
- **85th percentile operating speed**, preferably obtained via:

Tube counts or other reliable on-site speed surveys.**Avoid using TomTom or similar corridor-level data** as a proxy, since these do not accurately reflect vehicle speeds on the approach to a crossing.

4.5 Adjustments for nearby Speed Management Features

Where a zebra crossing is located near an intersection, roundabout, or speed management feature (e.g., raised platform), a linear deceleration model should be applied. This accounts for the reduction in vehicle speed as drivers approach the crossing. Distance travelled during the reaction time is to be at the **free-flow approach speed before deceleration begins**. An average speed estimate should not be used.

- The deceleration should begin **after the reaction time phase** used in ASD calculations.
- The **final speed at the crossing** should be based on:
    - A **standard speed** associated with the specific management device, or
    - A speed derived from the **turning radius**, using centripetal acceleration (CA):
        - **4.5 m/s²** for cars
        - **2.0 m/s²** for trucks or buses

$$V = \sqrt{12.9 * R * CA}$$

Where *V* = turning speed (km/h), *R* = turning radius (m) and *CA* = centripetal acceleration.

- The deceleration length is calculated from the free-flow approach speed to the turning speed using the formula

$$D = \frac{V_1^2 - V_2^2}{254d}$$

Where *D* = deceleration distance, V_1 = Initial speed, V_2 = turning speed and *d* = coefficient of deceleration (0.36).

These values ensure realistic deceleration profiles and help maintain safe and predictable vehicle behaviour near pedestrian facilities. Section 5 Examples 2A and 2B shows the effect of this calculation method.

Section 5 Examples 1A and 1B show the effect of managing the speed on the approach to a crossing as well as at the crossing, not only an isolated mid-block Raised Crossing. This is significant when kerbside parking may be affected.

4.6 Stopping Distance Calculation

This formula is used for ASD, PCSD and SSD, using the parameters in Table 1.

The standard formula is:

$$SD = \frac{R_T V}{3.6} + \frac{V^2}{254(d + 0.01a)}$$

Where

R_T = reaction time (sec)
V = operating speed (km/h)
d = coefficient of deceleration
a = longitudinal gradient (%, + for upgrade and – for downgrade)

4.7 Design Parameters

Sight Distance case	R_T (1)	d	Gradient Correction
ASD	2.0 sec	0.36	± 0.01a
PCSD	1.5 sec	0.36	± 0.01a
Truck – SSD with sightline (conflict zone)	1.5 sec	0.29	± 0.01a
Bus – SSD with sightline (conflict zone)	1.5 sec	0.15	None (2)
Extended design domain (EDD) AGRD 4A App A2 may be used at constrained places (locations with kerbside parking or other obstructions where a DfS has been approved)	2.0 sec	0.46	± 0.01a
Absolute minimum situation – through the DfS process	1.5 sec	0.46	± 0.01a

(1) The driver reaction times are representative for cars at the 85th percentile speed and for heavy vehicles. The deceleration rates for heavy vehicles cover the inherent delay times in the air braking systems for these vehicles.
The above times typically afford an extra 0.5 to 1.0 s reaction time to drivers who have to stop from the mean free speed. It is considered, for example, that the mean free speed is more representative of the speed travelled by older drivers.

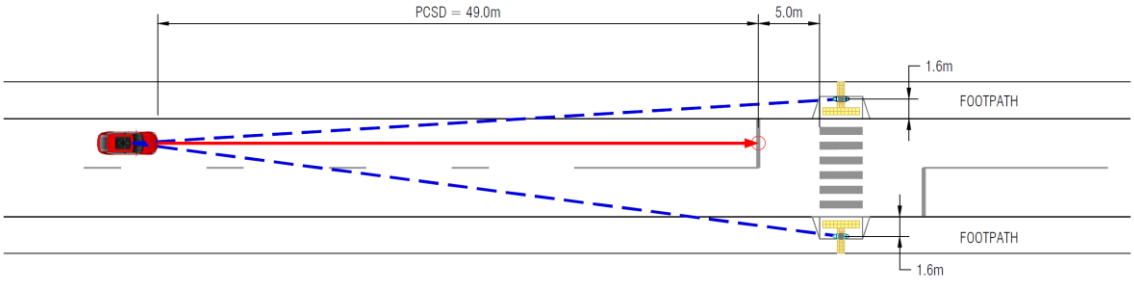
(2) None, as buses are able to brake at d=0.15 on most gradients

Table 2: Parameters for calculations

5 Practical Examples

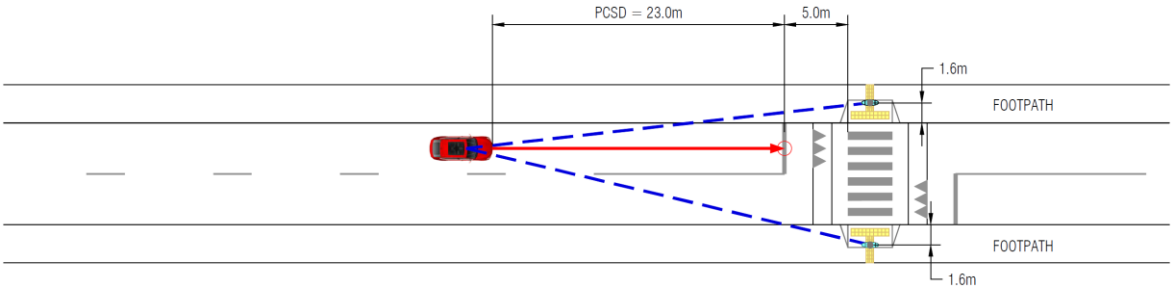
Example 1A: Through lane approach to a flush priority crossing

PRIORITY CROSSING SIGHT DISTANCE (PCSD)				
85th PERCENTILE SPEED (km/h)	COEFFICIENT OF DECELERATION	LONGITUDINAL GRADE (%)	REACTION TIME (secs)	REQUIRED PCSD (m)
50	0.35	0	1.5	49



Example 1B: Through lane approach to a priority crossing on RSP.

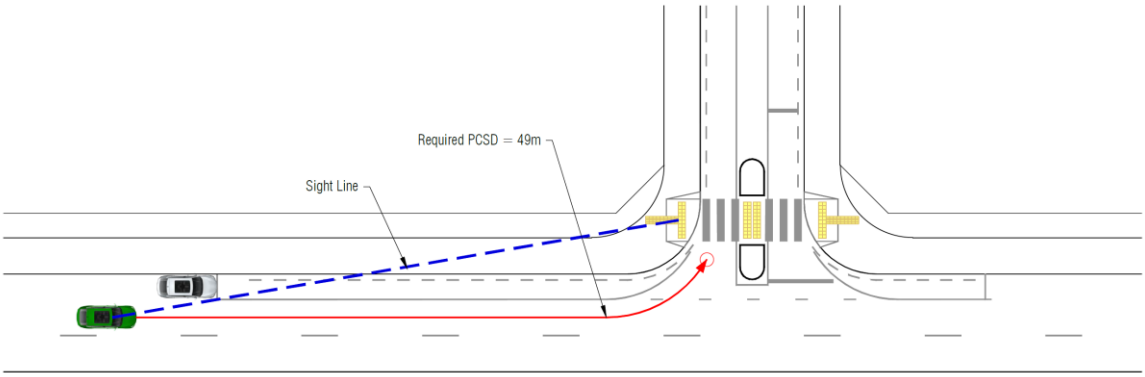
PRIORITY CROSSING SIGHT DISTANCE (PCSD)				
85th PERCENTILE SPEED (km/h)	COEFFICIENT OF DECELERATION	LONGITUDINAL GRADE (%)	REACTION TIME (secs)	REQUIRED PCSD (m)
30	0.35	0	1.5	23



These show the advantage of reducing the approach speed where kerbside parking is desired as close as is safe to the crossing. Example 1B shows the effect of reduced free flow speed in conjunction with other speed management measures. See Practice Note 02 for the effective speed at various types of vertical device.

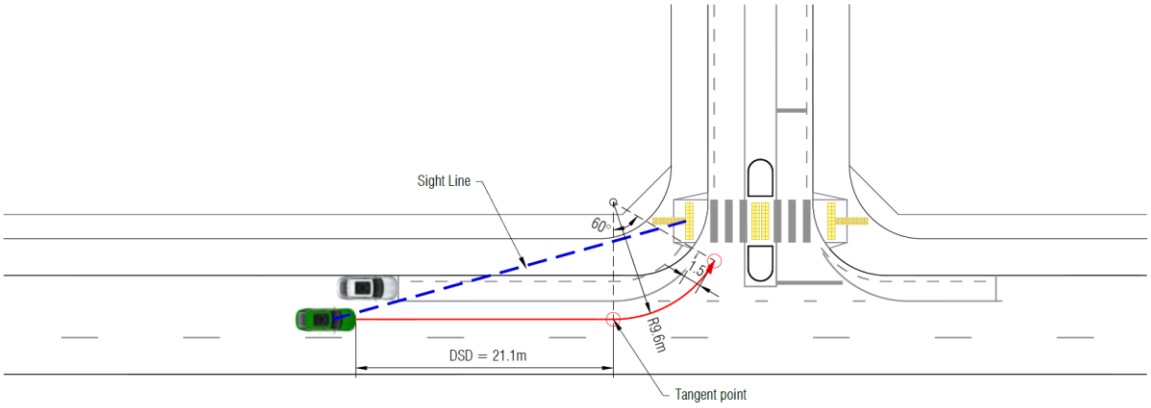
Example 2A: Priority crossing of a side street using constant approach speed.

PRIORITY CROSSING SIGHT DISTANCE				
85th PERCENTILE SPEED (km/h)	COEFFICIENT OF DECELERATION	LONGITUDINAL GRADE (%)	REACTION TIME (secs)	REQUIRED PCSD (m)
50	0.35	0	1.5	49



Example 2B: Priority crossing of a side street using dynamic approach speed.

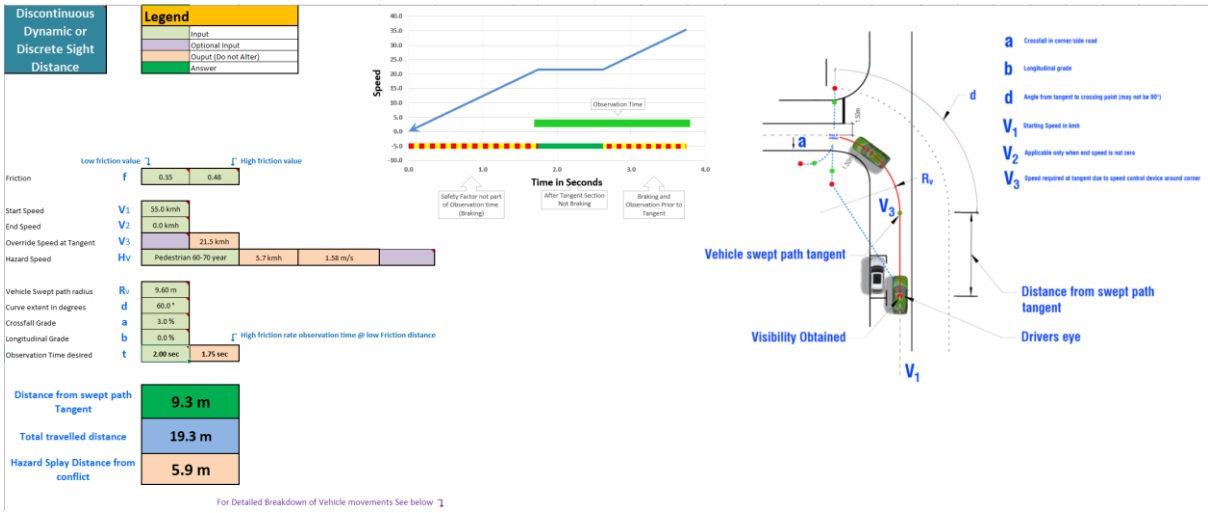
DYNAMIC SIGHT DISTANCE								
85th PERCENTILE INITIAL SPEED (km/h)	85th PERCENTILE SPEED AT TANGENT POINT (km/h)	COEFFICIENT OF DECELERATION	LONGITUDINAL GRADE (%)	ROAD CROSSFALL (%)	SWEPT PATH RADIUS (m)	OBSERVATION TIME (secs)	CURVE ANGLE (degrees)	REQUIRED DSD (m)
50	25	0.35	0	3	9.6	1.5	60	21.1m



These show that calculating the deceleration towards a corner affects the sight distance required. ASD is still required to observe some part of the pedestrian crossing to be able to recognise its priority control and its location, but not necessarily to observe a pedestrian until a little closer to the crossing. The method in 2B may also be used for a mid-block isolated feature where the speed at the device might be 10-20 km/h less than the initial speed.

Tools for calculating Dynamic Sight Distance are available on request from AT.

Example 2C: Priority crossing of a side street using AT DSD spreadsheet tool.



Visibility Obtained 9.3m from the swept path Tangent point.

Vehicle is travelling at 21.5kph at the Tangent point.

Low Friction Rate Details

	Speed (kph)	Time	Distance (m)	Running distance	Running Time
Conflict Speed	0.0	0.0			
To Stop	↑	1.74	4.8	0.0	0.0
Observe after Tangent		0.88	5.3	4.8	1.7
Tangent	21.5		0.0	10.1	2.6
Prior to Tangent (decel section)	35.4	1.1	9.3	19.3	3.7
Observe Prior to Decel					

0.0

0

64.55733625

High Friction Rate Details

	Speed (kph)	Time	Distance (m)	Running Distance	Running Time
Conflict Speed	0.0	0.0			
To Stop	↑	1.47	4.8	0.0	0.0
Observe after Tangent		0.76	5.3	4.8	1.5
Tangent	24.9		0.0	10.1	2.2
Prior to Tangent (decel section)	46.0	1.2	12.5	22.6	3.5
Observe Prior to Decel					
Correction for Higher Friction Rate		0.3		3.3	

G	9.80665	
Start Speed m	15.28 m/s	
end speed m/	0.00 m/s	
Deceleration I	3.43 m/s²	4.71 m/s²
Time	4.45 sec	3.25 sec
Curve Distanc	10.05 m	10.05 m
Speed at Tang	21.5 kmh	24.9 kmh

Moving Hazard Datatable

	Type	Ability	Speed
Pedestrian 3-5 Year	Pedestrian	3-5 Year	1.5
Pedestrian 6-8 Year	Pedestrian	6-8 Year	1.6
Pedestrian 9-11 Year	Pedestrian	9-11 Year	1.9
Pedestrian 12-15 Year	Pedestrian	12-15 Year	1.9
Pedestrian 16-18+ year	Pedestrian	16-18+ year	2.0
Pedestrian 60-70 year	Pedestrian	60-70 year	1.6
Pedestrian 70-80 year	Pedestrian	70-80 year	1.5
Pedestrian 80-90 year	Pedestrian	80-90 year	1.2
Cyclist Basic	Cyclist	Basic	4.4
Cyclist Competent	Cyclist	Competent	5.4
Cyclist Expert	Cyclist	Expert	7.2
Rollersking Basic	Rollersking	Basic	4.4
Rollersking Competent	Rollersking	Competent	4.7
Rollersking Expert	Rollersking	Expert	5.0
Rollerblades Basic	Rollerblades	Basic	2.8
Rollerblades Competent	Rollerblades	Competent	3.6
Rollerblades Expert	Rollerblades	Expert	4.4
Jogger Basic	Jogger	Basic	2.8
Jogger Competent	Jogger	Competent	3.3
Jogger Expert	Jogger	Expert	3.9

This tool shows how a sightline splay can allow for footpath users to be seen approaching the crossing at varying speeds. The difference from Example 2B is the turning speed at the tangent calculated as 21.5 km/h rather than assumed 25 km/h.

6 Departure from Standard

A Departure from Standard may be considered where site constraints prevent full clear visibility to the Standards above. A Report must be completed justifying the Departure.

7 Definitions

Term	Definition
ASD	**Approach Sight Distance** serves to alert a driver to the presence of a crossing and to be ready to stop.
CSD	**Crossing Sight Distance** ensures that the pedestrian can see approaching traffic in sufficient time to judge a safe gap and cross the roadway where vehicles have priority. It also ensures a clear view for approaching drivers to sight pedestrians waiting to cross the roadway.
SSD	**Stopping sight distance** for buses is to be checked if the zebra crossing is on a bus route. This is to enable buses to decelerate in a rate that is comfortable and safe for the occupants inside the bus, at the 85th percentile operating speed of buses, can stop safely. SSD check should only be needed for buses on the bus route.
PCSD	**Priority Crossing Sight Distance** gives the driver time to observe a pedestrian and be able to stop at the limit line (at least 5 m before the conflict area). PCSD also ensures that a pedestrian has clear sight of any vehicle that will be able to stop, so that they can enter the crossing with confidence.

8 Supporting Information

Supporting documents	• Auckland Transport – Transport Design Manual • Auckland Council Code of Practice for Land Development and Subdivision Chapter 3: Transport • AGRD -3 Geometric design • AGRD 4A Unsignalised and Signalised Intersections
Related documents	• Practice Note 02, edition 2 (June 2024) - Use of raised devices on the AT Network • NZTA Pedestrian Network Guidance 3. Design – 3.4. Crossings

9 Approval

Practice Note Contact:	Andy Irwin SME Transport Design	DocuSigned by: E0C59C1A0AD541D...	25 March 2026
Endorsed by:	Irene Tse Technical Lead - Transport Safety	Signed by: F2184139D64E497...	05 April 2026
Authorised by	Chris Beasley Transport Design & Standards Manager	DocuSigned by: 646D1613508748A...	07 April 2026
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