Design Manual for Roads and Bridges

Road Layout
Design

CD 123
Geometric design of at-grade priority and signal-controlled junctions

(formerly TD 41/95, TD 42/95, TD 40/94, and those parts of TD 50/04 and TD 70/08 relating to priority and signal-controlled junctions.)

Version 2.1.0

Summary
This document provides requirements for the geometric design of at-grade priority and signal-controlled junctions.

Application by Overseeing Organisations
Any specific requirements for Overseeing Organisations alternative or supplementary to those given in this document are given in National Application Annexes to this document.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated National Highways team. The email address for all enquiries and feedback is: Standards_Enquiries@highwaysengland.co.uk

This is a controlled document.

Contents

Latest release notes

Document code	Version number	Date of publication of relevant change	Changes made to	Type of change
CD 123	2.**1**.0	November 2021	Core document	Incremental change to requirements

Revision 2.1.0 – the scope of use for direct accesses has been expanded to include single use public utilities site and single use highway maintenance site; the definition of a through-route now includes 'for public use'; new geometrical parameters for such junctions where right turns out of the minor road are prevented have been included; the minimum spacing distance between the end of dual carriageway to a priority junction has been reduced from 1km to 500 metres (para 2.11); the way that traditional relaxation clauses are presented has been updated to be clearer; plus various wording improvement/corrections.

Previous versions

Document code	Version number	Date of publication of relevant change	Changes made to	Type of change
CD 123	2	August 2020		
CD 123	1	June 2020		
CD 123	1	January 2020		
CD 123	0	August 2019		

Foreword

Publishing information

This document is published by National Highways.

This document supersedes TD 41/95 and TD 42/95. In combination with CD 122 [Ref 4.N], this document supersedes TD 40/94. In combination with CD 116 [Ref 1.I], this document supersedes TD 50/04. This document also supersedes elements of TD 70/08 that relate to priority and signal-controlled junctions.

Contractual and legal considerations

This document forms part of the works specification. It does not purport to include all the necessary provisions of a contract. Users are responsible for applying all appropriate documents applicable to their contract.

Introduction

Background

This document provides requirements and advice on the geometrical design of at-grade priority and signal-controlled junctions.

In addition to signal controlled junctions, this document provides a single point of reference for the geometric design of at-grade priority junctions that has been historically split across a number of documents. It merges and rationalises the content of TD 41/95 and TD 42/95 and incorporates the priority junction elements of compact grade separated junctions and wide single 2+1 lanes, which were previously covered by TD 40/94 and TD 70/08 respectively.

In order to remove duplication across the various types of priority junctions defined by the previous documents, priority junctions are now formed of two key elements. These two elements are the priority junction (the layout of the minor road arm) and the major road central treatment (the layout of the major road aspect of the junction, e.g. a ghost island arrangement). This approach allows for flexibility of varying the form of the layout of the minor road and/or major road while removing the repetition and ambiguity resulting from the entire junction being treated as a single component in the previous documents.

In order to rationalise and remove duplication between direct access layouts, the definition of a direct access is now only used for a single field, single dwelling, single-use public utilities site or single-use highway maintenance site. A priority junction is for anything greater; however, the requirements/advice for a priority junction differ depending on whether the road provides a through route or not (i.e. an entrance to a business park or development). (i.e. an entrance to a business park or development).

Other notable changes/additions from the previous documents listed above include:

1) advice on permitting particular movements at single lane dualling and dual carriageway priority junctions (predominantly relating to the right turns out of the minor road), along with new geometrical parameters for such junctions where right turns out of the minor road are prevented;
2) expanded advice on the use of nearside passing bays, including recommended dimensions; and,
3) improvements made to the way visibility splays are defined at priority junctions to ensure that a full splay is provided rather than just a line of visibility from the minor road set back point.

Assumptions made in the preparation of this document

The assumptions made in GG 101 [Ref 6.N] apply to this document.

Abbreviations

Abbreviations

Abbreviation	Definition
AADT	Annual average daily traffic
ASL	Advance stop-line
HGV	Heavy goods vehicle
SLD	Single lane dualling
SSD	Stopping sight distance
S2	Single carriageway cross-section, 1 lane each direction (see CD 127 [Ref 1.N])
WS2	Wide single-carriageway cross-section, 1 lane each direction (see CD 127 [Ref 1.N])
WS2+1	Wide single 2+1 carriageway cross-section, 2 lanes one direction, 1 lane opposing direction (see CD 127 [Ref 1.N])

Terms and definitions

Terms

Term	Definition
Auxiliary lane	An additional lane provided on the nearside of the major road carriageway at junctions to increase merge or diverge opportunity and/or provide additional space for weaving traffic.
Changeover	A carriageway layout which effects a change in the designated use of the middle lane of a WS2+1 road from one direction of traffic to the opposite direction.
Collector road	A road separate to the junction which collects other local roads and accesses into a link that connects to the minor road in advance of the junction.
Compact grade separated junction	A grade separated junction designed with a two-way unsegregated connector road between the major and minor road. The connector road joins the major road via a priority junction designed to this document.
Corner taper	A short taper following the corner radius provided to accommodate the swept path of larger vehicles.
Crossroads	For the purpose of this document, crossroad junctions are where the centre line of a minor road, when extended across the major road, fits within the carriageway of an opposing priority junction.
Design vehicle	The design vehicle for at-grade priority and signal controlled junctions is a 16.5 metres long articulated heavy goods vehicle (HGV).
Desirable minimum stopping sight distance	Desirable minimum stopping sight distance (SSD) is as defined in CD 109 [Ref 5.N].
Direct access	A connection to an all-purpose trunk road providing access to only one of the following, which does not provide a through route: 1) a single dwelling; 2) a single field; 3) a single-use public utilities site (such as an electric substation) where access is needed for maintenance of that specific site only; or, 4) a single-use highway maintenance site (such as an attenuation pond) where access is needed for maintenance of that specific site only.
Duplicate primary signal(s)	Where there is more than one primary signal, additional signals erected to the offside are duplicate primary signal(s).
Ghost island	A major road central treatment that uses road markings to create an additional lane to allow traffic waiting to turn right from the major road into the minor road to do so without impeding through traffic movement.

Terms (continued)

Term	Definition
Hatched area	An area of road marking hatching used to discourage and/or channel vehicle movements.
Intervisibility zone	The area within a signal-controlled junction that ensures road users can see other road users (including pedestrians) between each stop line.
Major road central treatment	A collective term for the central treatments associated with ghost island, single lane dualling or dual carriageway junctions.
Major road	A road on which traffic has priority of movement over adjoining roads.
Minor road	A road on which traffic concedes priority to traffic on the major road.
Overtaking sections	Sections of two-lane single carriageway where the combination of horizontal and vertical alignment, visibility and or width is such that there are clear opportunities for overtaking using the opposing lane, as described in CD 109 [Ref 5.N].
Phase	The sequence of conditions applied to one or more streams of vehicular traffic or pedestrian traffic which always receive identical light signal indications.
Primary signal	A light signal erected near the stop line. NOTE: Where there is more than one signal located near a stop line, the signal on the nearside is the primary signal.
Priority junction	A junction controlled by a 'Give Way' or 'Stop' arrangement. NOTE 1: Stop arrangements are only used where there are severe visibility restrictions. NOTE 2: Direct accesses can operate in a similar manner but are not classed as priority junctions. NOTE 3: A priority junction can include a merge taper where the formal 'Give Way' road marking is replaced by an edge of carriageway road marking.
Reservoir length	The length required for queuing between the opposing arms of a staggered junction.
Rural roads	Rural roads are as defined in CD 109 [Ref 5.N].
Secondary signal	Traffic signals located beyond the primary signal, facing the same direction of traffic flow. NOTE: The information given by a secondary signal is the same as that given by the primary signal with which it is associated, but additional information compatible with that of the primary can also be given.
Signal-controlled junction	A junction that has full or part-time signals on one or more of its arms.

Terms (continued)

Term	Definition
Simple priority junction	A form of priority junction where there is no major road central treatment, such as a ghost island or single lane dualling, and no merging/diverging tapers or auxiliary lanes.
Single lane dualling	A single carriageway major road central treatment that uses physical traffic islands to provide space for right turning movements in and/or out of the minor road in order to not impede through traffic movement.
Stagger distance	The distance along the major road between the centre lines of the two minor roads at a staggered junction.
Staggered junction	A junction arrangement where the major road is continuous through the junction and two opposing minor roads form priority junctions that are offset from one another. NOTE: Two opposing priority junctions are not staggered when the layout of any central treatments do not overlap or the junction spacing is greater than the major road SSD.
Storage length	Storage length is the length over which vehicles can queue without causing obstruction to, or being obstructed by, vehicles in the adjacent lane.
Swept path	The swept path of a vehicle is the movement and path of different parts of a vehicle when that vehicle is undertaking a turning manoeuvre. It is the envelope swept out by the sides of the vehicle body, or any other part of the structure of the vehicle.
Taper merge / diverge	An area of additional carriageway that is tapered to/from the major road, which is provided on the nearside of the major road carriageway at junctions to increase merge or diverge opportunity.
Through route	A road that is for public use, which provides a connection to the wider road network. NOTE: A road that does not form part of a through route requires a road user to access and leave a site through the same junction.
Traffic island	A traffic island is a raised (kerbed) or marked-off area on the road. NOTE: A traffic island can be used to accommodate pedestrian refuges and traffic signals, and as a means of separating lanes of traffic or opposing traffic flows.
Urban roads	Urban roads are as defined in CD 109 [Ref 5.N].
WS2+1 roads	A wide single carriageway road with two lanes of travel in one direction and a single lane in the opposite direction, with a 1 metre hatch separating opposing traffic flows.

1. Scope

Aspects covered

1.1 This document shall be used for the geometric design of at-grade priority junctions and signal-controlled junctions.

NOTE 1 This document is applicable to both new and improved junctions.

NOTE 2 This document does not cover the general provision of walking, cycling and horse riding facilities at at-grade priority junctions. Requirements and advice relating to this are provided in CD 143 [Ref 3.N] and CD 195 [Ref 2.N].

1.2 This document shall be used for the geometric design of the priority junction element of a compact grade separated junction.

NOTE Requirements for the link road element of a compact grade separated junction are provided in CD 122 [Ref 4.N].

Implementation

1.3 This document shall be implemented forthwith on all schemes involving the geometric design of at-grade priority and/or signal controlled junctions on the Overseeing Organisations' all-purpose trunk roads according to the implementation requirements of GG 101 [Ref 6.N].

Use of GG 101

1.4 The requirements contained in GG 101 [Ref 6.N] shall be followed in respect of activities covered by this document.

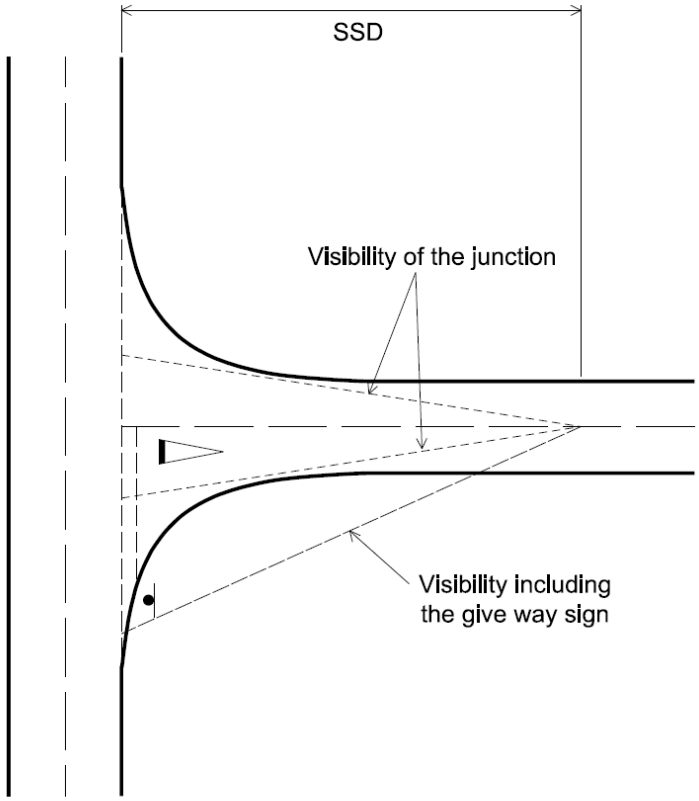
3. Visibility

Minor road approach visibility

Priority junctions

3.1 On a minor road approach to a priority junction, there shall be unobstructed visibility of the junction from a distance corresponding to the desirable minimum SSD for the design speed of the minor road, including the 'give way' sign where present, as illustrated in Figure 3.1.

Figure 3.1 Priority junction approach SSD visibility



NOTE *SSD is measured from the eye heights and to the object heights given in CD 109 [Ref 5.N].*

3.2 An approaching road user shall be able to clearly see the junction form from a minimum distance of 15 metres back along the centreline of the minor road, measured from the continuation of the line of the nearside edge of the running carriageway of the major road (as illustrated in Figure 3.2a and 3.2b).

Figure 3.2a Priority junction approach visibility

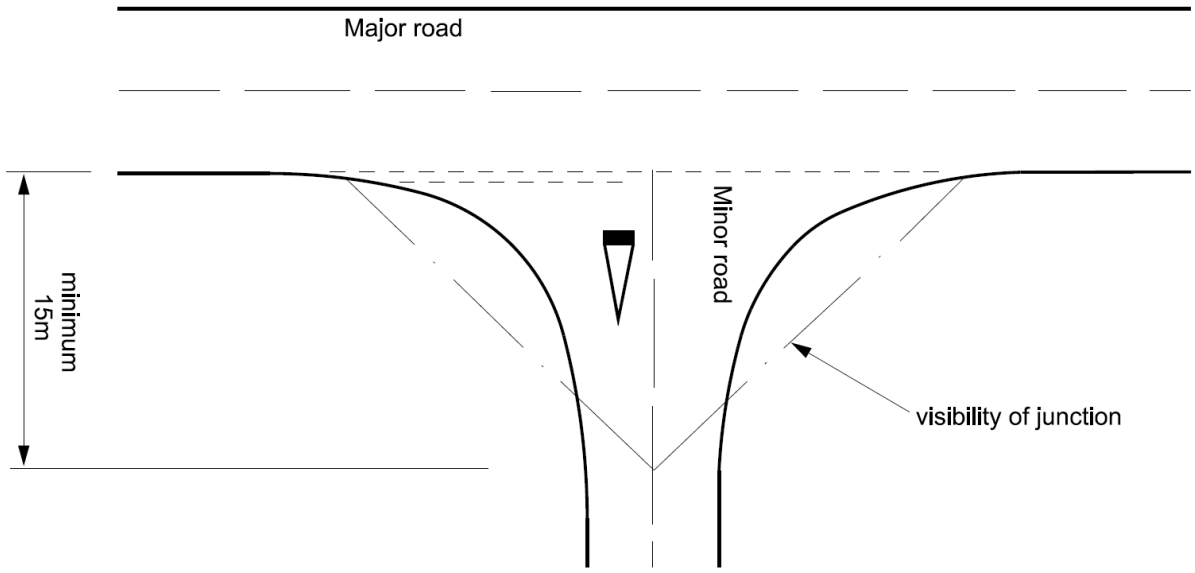
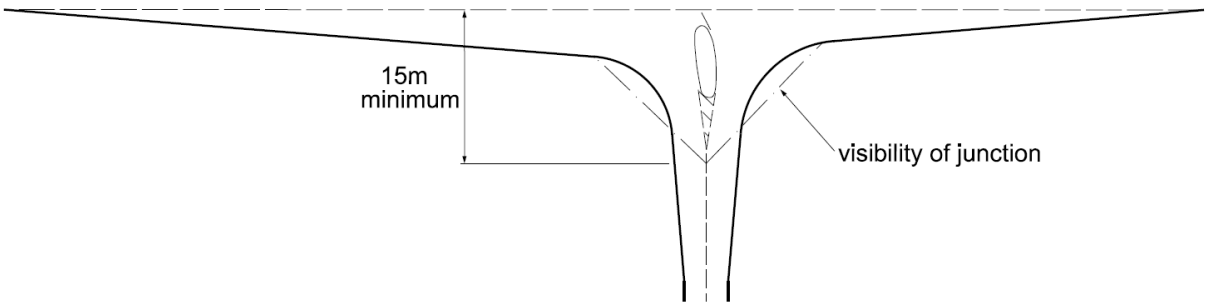


Figure 3.2b Priority junction approach visibility (incorporating tapers on the mainline and traffic island on the minor road)



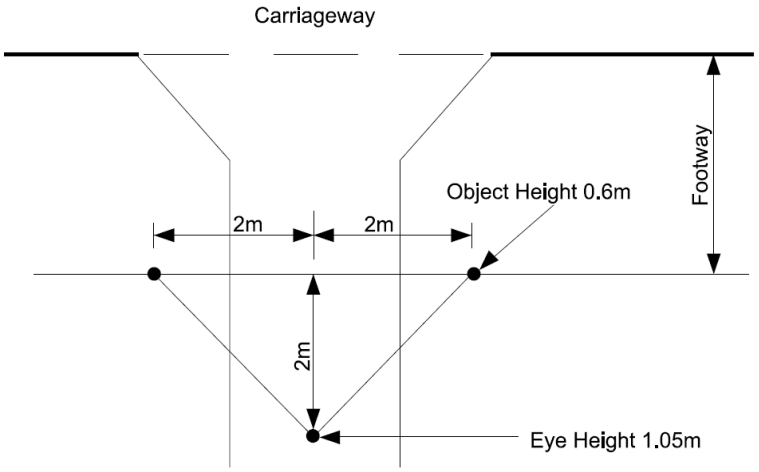
NOTE 1 *The 15 metre measurement is from the continuation of the line of the nearside edge of the running carriageway not the continuation of the back of the major road hard strip if present.*

NOTE 2 *Visibility is measured from the eye heights and to the object heights using the envelope of visibility in CD 109 [Ref 5.N].*

Direct accesses

3.3 Where a direct access crosses a footway, a visibility splay shall be provided in accordance with Figure 3.3.

Figure 3.3 Visibility at the back of footway crossing



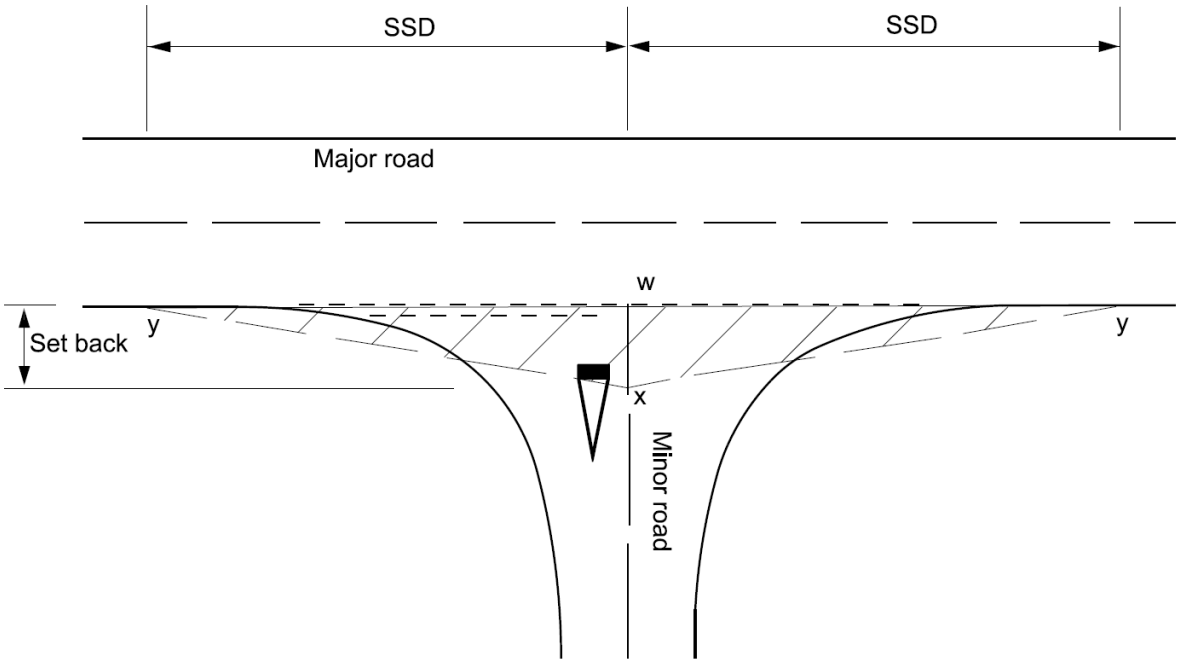
Junction visibility

Measurement of visibility at minor roads and direct accesses

3.4 Unobstructed visibility shall be provided at all priority junctions and direct accesses by a visibility splay formed between the following three points, as illustrated in Figure 3.4:

1) a point W corresponding to the intersection point between the minor road centreline and the major road edge of carriageway;
2) a point X setback along the minor road centreline measured from the continuation of the line of the nearside edge of the running carriageway of the major road; and,
3) a point Y on the major road nearside edge of carriageway, corresponding to the desirable minimum SSD for the speed of the major road measured along the edge of the major road carriageway from point W.

Figure 3.4 Priority junction visibility splays



NOTE 1 *Visibility is measured from the eye heights and to the object heights given in CD 109 [Ref 5.N].*

NOTE 2 *The visibility splays shown are for a junction where left and right splays are required.*

NOTE 3 *Where there are hard strips on the major road, point X is measured from the continuation of the line of the nearside edge of the running carriageway of the major road.*

NOTE 4 *Inappropriate positioning of lay-bys, bus stops, traffic signs and other street furniture can result in obstruction to visibility splay.*

NOTE 5 *Parked vehicles can obstruct visibility splays and where necessary restrictions can be introduced to mitigate this risk.*

3.5 The speed of the major road for determining point Y in the visibility splay shall be based on:

1) design speed only for direct accesses and priority junctions on new major roads;
2) design speed only for priority junctions that form part of a through route on existing major roads; and,
3) design speed or speed measurement for direct accesses and priority junctions that do not form part of a through route on existing major roads.

NOTE *Speed measurement of an existing major road involves calculating the 85th percentile speed of traffic.*

3.6 A visibility splay to the right on the minor road shall be provided:

1) at all priority junctions and direct accesses where minor road traffic can join a 2-way major road; and,
2) at all priority junctions and direct accesses where minor road traffic can turn left to join a 1-way major road.

3.6.1 Visibility splays to the right on the minor road should also be provided at priority junctions and direct access where minor road traffic can turn right to join a 1-way major road and there are contraflow provisions (e.g. for cyclists).

3.7 A visibility splay to the left on the minor road shall be provided:

1) at all priority junctions and direct accesses where minor road traffic join a 2-way single carriageway major road;
2) at all priority junctions and direct accesses where minor road traffic can turn right to join a 2-way dual-carriageway road and the central reserve gap is not wide enough to accommodate a waiting design vehicle; and,
3) at priority junctions and direct accesses where minor road traffic can turn right to join a 1-way major road.

3.7.1 Visibility splays to the left on a 1-way road should also be provided at priority junctions and direct access where minor road traffic can turn left to join a 1-way major road and there are contraflow provisions (e.g. for cyclists).

NOTE *Where the minor road is one way leading from the major road, no visibility splays for vehicles turning out of the minor road are required as these movements are not permitted.*

3.7.2 On a 1-way major road, visibility splays may be provided in both directions for vehicles turning out of the minor road.

NOTE *Visibility splays in both directions at a 1-way major road provides a level of future proofing, and accommodates potential traffic management arrangements.*

3.8 The minimum distance used to locate point X shall satisfy one of the following:

1) for direct access:
   a) 4.5 metres; or,
   b) 2.0 metres.
2) for simple priority junctions:

a) 9.0 metres; or,
b) 2.4 metres.

3) for all other priority junctions:

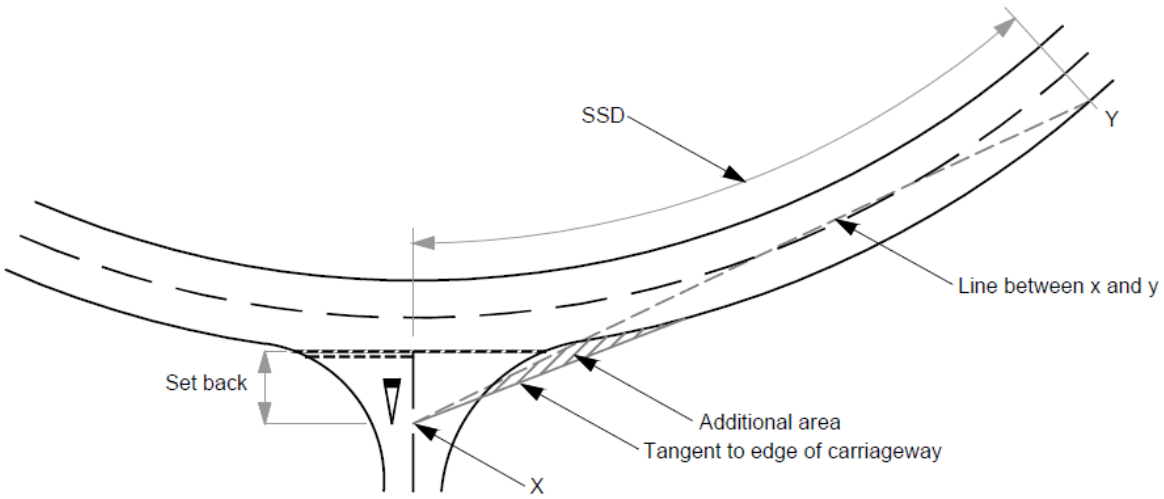
a) 9.0 metres; or,
b) 4.5 metres.

3.8.1 The minimum distance used to locate point X should be in accordance with a) for each junction/access type.

3.8.2 Where it is not feasible to locate point X fully in accordance with a), the minimum distance used to locate point X should be as close to a) as practicable, but no less than b).

3.9 Where the line between points X and Y falls partially within the major road carriageway, an additional area shall be added to the visibility splay formed by drawing a line from X to a point tangential to the nearer edge of the major road running carriageway, as illustrated in Figure 3.9.

Figure 3.9 Additional area of visibility on the outside of a curved major road

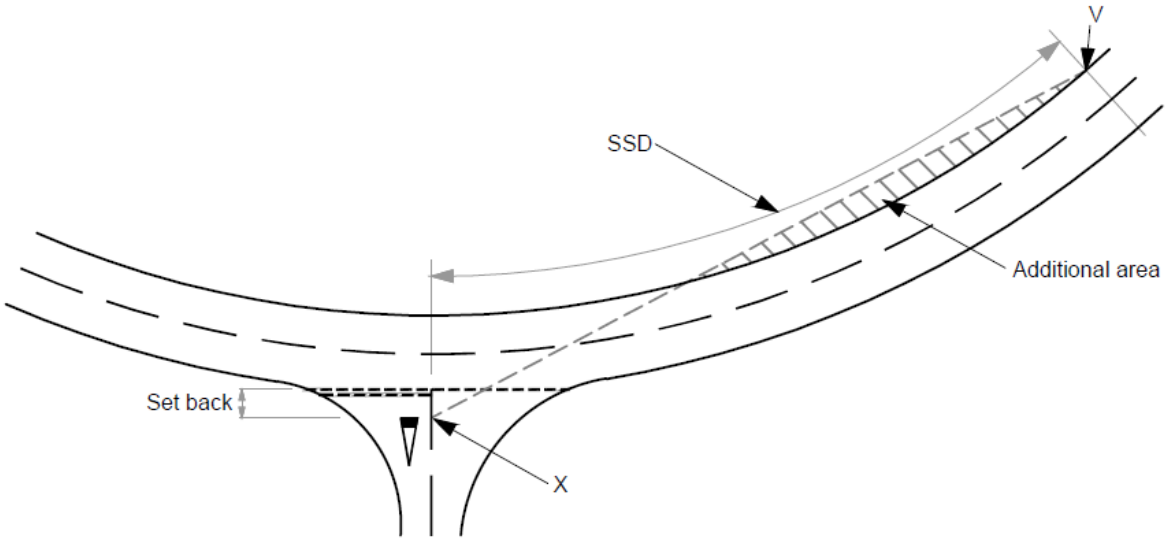


NOTE *The additional area of visibility on the outside of the curve (as illustrated in Figure 3.9) applies to both the left and right of a priority junction/direct access.*

3.10 Where a priority junction/direct access is located on the outside of a major road curve, an additional area shall be added to the visibility splay in the verge on the inside of the major road curve, formed by a line between the following two points, as illustrated in Figure 3.10:

1) a point X at a set back distance of 2.4 m; and,
2) a point V on the major road offside edge of running carriageway, corresponding to the desirable minimum SSD for the speed of the major road.

Figure 3.10 Additional area of visibility on the inside of a curved major road



NOTE 1 *The additional area of visibility on the inside of the curve (as illustrated in Figure 3.10) applies to both the left and right of a priority junction/direct access.*

NOTE 2 *Where there are hard strips on the major road, point V is measured to the nearside edge of the running carriageway not the back of the major road hard strip.*

NOTE 3 *Providing the additional visibility in the verge on the inside of a major road curve allows drivers to see the full extent of the carriageway and approaching vehicles for the desirable minimum SSD.*

3.11 The desirable minimum SSD at all priority junctions shall not be available from an X distance greater than 9 metres.

NOTE *In open areas, it can be necessary to artificially restrict the visibility splay to prevent the desirable minimum SSD being available from an X distance of greater than 9 metres.*

Measurement of visibility in the central reserve

3.12 Unobstructed visibility shall be provided in the centre of the major road, on dual carriageway and SLD junctions where right turns are permitted, by a visibility splay formed between the following three points, as illustrated in Figure 3.12:

1) the intersection point between the centre of the opening and the offside edge of major road carriageway;
2) a point 2.4 metre setback along the centre of the opening measured from the continuation of the line of the offside edge of the running carriageway of the major road; and,
3) a point Y on the major road offside edge of carriageway, corresponding to the desirable minimum SSD for the design speed of the major road measured from the 2.4 metre setback point.