Stopping Sight Distance (SSD)

Part 3.3

3.3.1 SSD is the distance a driver needs to be able to see ahead to have enough time to avoid an obstacle from a given speed. It is calculated from the speed of the vehicle, the time required for a driver to identify a hazard and then begin to brake (the perception-reaction time), and the vehicle's rate of deceleration. For new streets, the design speed for the location under consideration is set by the designer. For existing streets, the measured 85th percentile wet weather speed is used.

SSD is calculated using the following equation:

SSD = $vt+(v^2/2(d+0.1a))$

v = speed (or velocity) (m/s) (85%ile wet weather measured speed)

Note: Dry weather speeds can be converted to wet weather by deducting 4kph (2.48mph)

t = driver perception-reaction time (s)

t = 1.5s if ≤ 37 mph (60 kph) 85%ile wet weather measured speed

t = 2.0s if ≥ 37 mph (60 kph) 85%ile wet weather measured speed

d = deceleration (m/s^2)

d = 4.41 m/s^2 if < 5% HGVs

d = 3.68 m/s^2 if > 5% HGVs or bus lane

d = 2.45 m/s if ≥ 37 mph (60 kph) 85%ile wet weather measured speed

Example <5% HGVs

37mph measured wet weather speed x 2.237 = 16.54m/s velocity

16.54 x 1.5 = 24.81

16.542 = 273.58

2 x 4.41 = 8.82

8.82 + (0.1 x 5) = 9.32 (5% uphill gradient)

273.58 ÷ 9.32 = 29.35

24.81 + 29.35 = 54.16

54.16 + 2.4 = 56.56m (visibility splay adjusted for bonnet length)

3.3.2 Speed is either a design parameter or a measured value. Deceleration depends on the carriageway surface and weather conditions as well as the braking capabilities of motor vehicles. Reaction times may increase on higher speed roads because there are usually fewer visual influences. It is inappropriate for designers to 'experiment' with these values without this being

supported by credible rationale and risk assessment. It follows that for design purposes it is only speed (v) and gradient (a) that really need to be considered as variables in the SSD equation.

Figure F3.1.1 - SSD guidance table for speeds < 60km/h

Speed	kph	16	20	24	25	30	32	40	45	48	50	60
	mph	10	12	15	16	19	20	25	28	30	31	37
SSD adjusted for bonnet length nil gradient ('Y' & 'V' Distance (m))		11	14	17	18	23	25	33	39	43	45	59
SSD adjusted for bonnet length nil gradient > 5% HGVs ('Y' & 'V' Distance (m))		12	15	19	21	25	27	37	43	47	50	65

Figure F3.1.2 - SSD guidance table for speeds > 60km/h

Speed	kph	70	85	100	120
	mph	43	53	62	75
SSD ('Y' & 'V' Distance (m))		120	160	215	295

Visibility Splays

Visibility splays at junctions and direct accesses

3.3.3 Junction visibility splays cover the areas of land required to enable a drive to see approaching traffic when waiting to emerge from a junction or access. Splays are formed by linking the X-distance (the driver's position) with the Y-distance (the SSD).

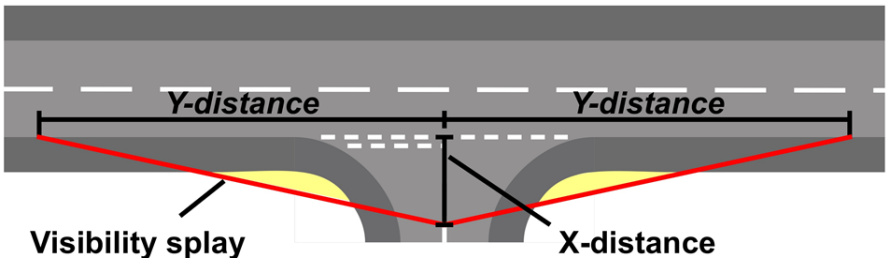
X-distance

3.3.4 In most circumstances, the X-distance is measured along the side street or access centreline from the edge of the carriageway of the street with priority. In most built-up situations the X-distance is 2.4m as this allows a driver to see without their vehicle protruding beyond the junction into the path of passing traffic. Where the speed of traffic exceeds 60 km/h, the minimum X-distance is 2.4m for a simple priority junction (see paragraph 3.3.17 for agricultural access). That is a junction where there is no central treatment on the road with priority, such as a ghost island or single lane dualling, and there are no merging/diverging tapers or auxiliary lanes. For all other priority junctions, the X-distances is 4.5m. The X-distance, from which the full Y-distance visibility is provided, shall not be more than 9.0m as this encourages high minor road approach speeds into the junction, and leads to excessive land take.

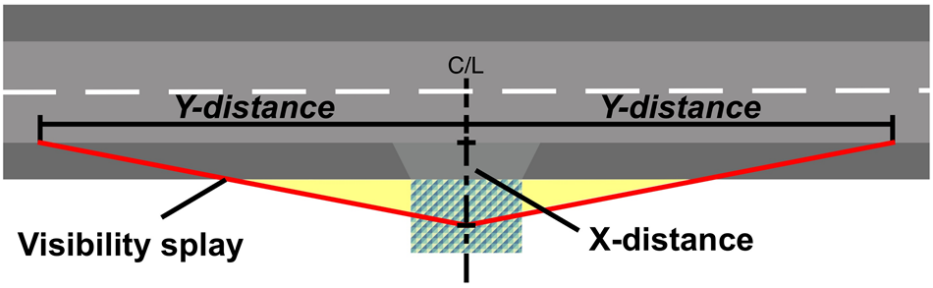
Y-distance

3.3.5 The Y-distance is equal to the SSD and is usually measured from the centreline of the side street or access along the nearside channel of the street with priority in both directions.

Priority junction

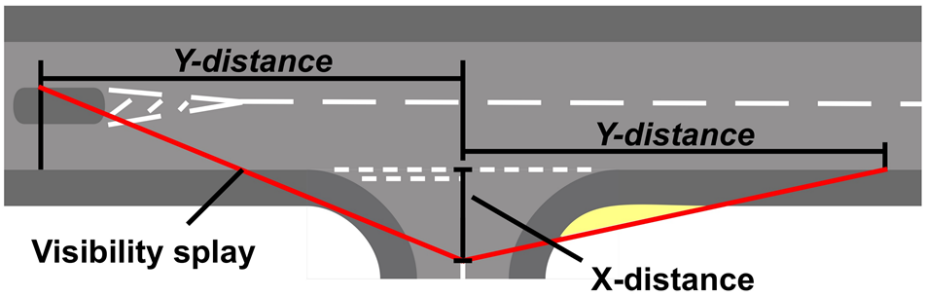


Private access



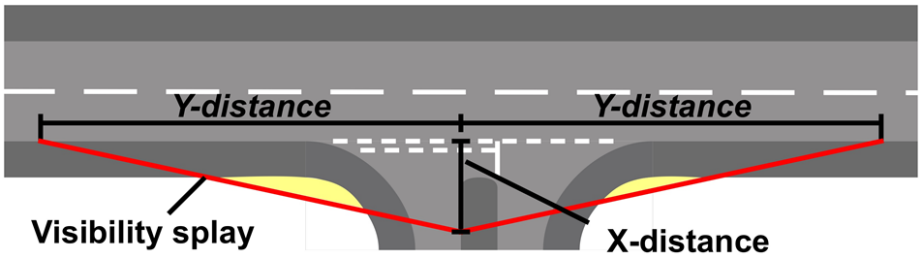
3.3.6 If vehicles approaching from the left are physically unable to cross the centreline, usually by a refuge or central reservation, the Y-distance can be measured to the centreline.

Refuge preventing vehicles from crossing the centreline



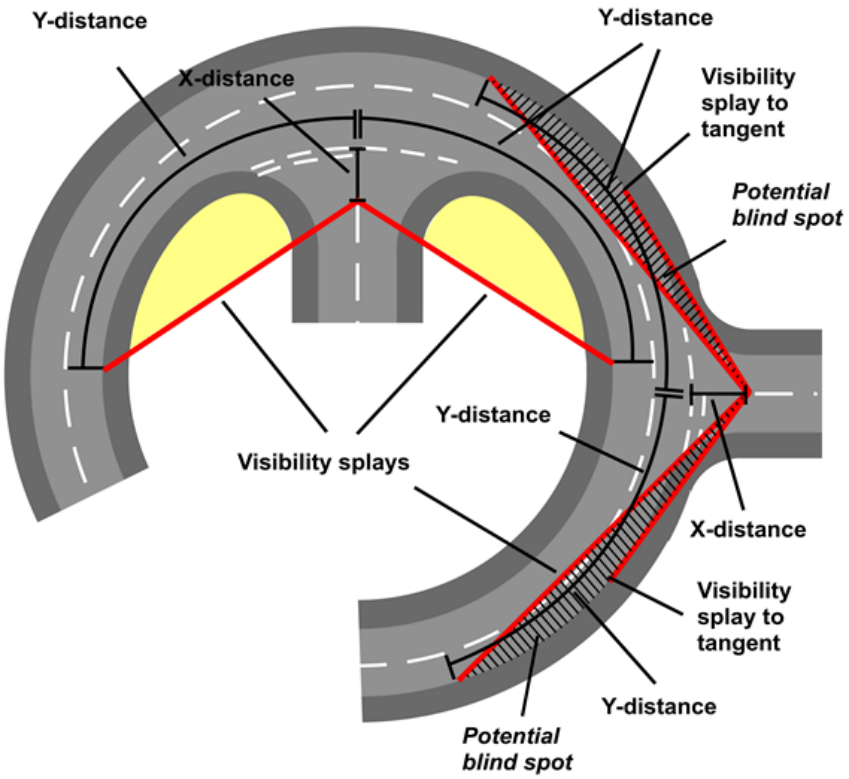
3.3.7 Where there is a wide splitter island within the mouth of the junction or more than one junction approach lane, it will be more appropriate to measure the X-distance from the actual position of the driver. The measurement of the Y-distance is then adjusted accordingly.

Priority junction with splitter island



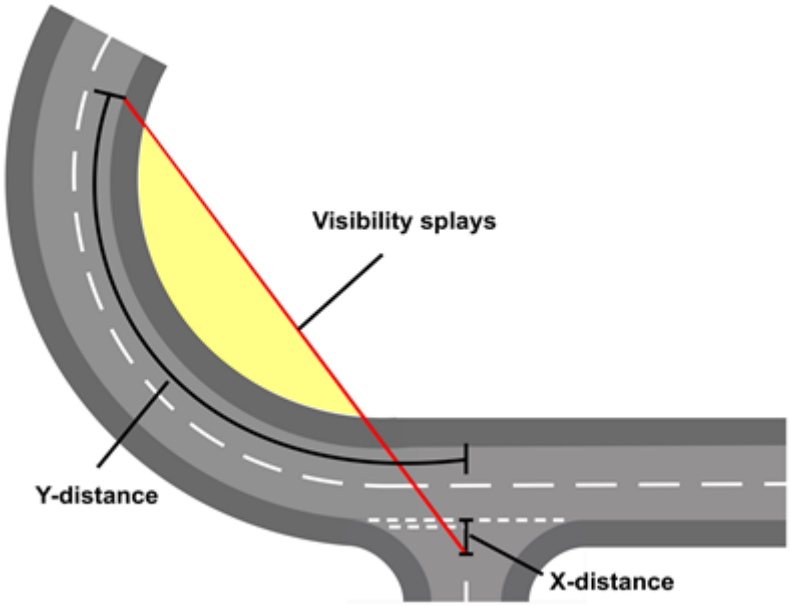
Visibility splays on bends

3.3.8 It is usually preferable to position a new junction or access away from the inside of a bend as the visibility splays may otherwise require large swathes of land to be kept clear. On the outside of a bend, where the line between the X-distance and Y-distance falls partially within the street with priority's carriageway, an additional area shall be added to the visibility splay formed by drawing a line from the X-distance to a point tangential to the nearer edge of the carriageway to ensure that there is not a potential blind spot.



Priority junction and direct access offside visibility splays when emerging on to a curved street

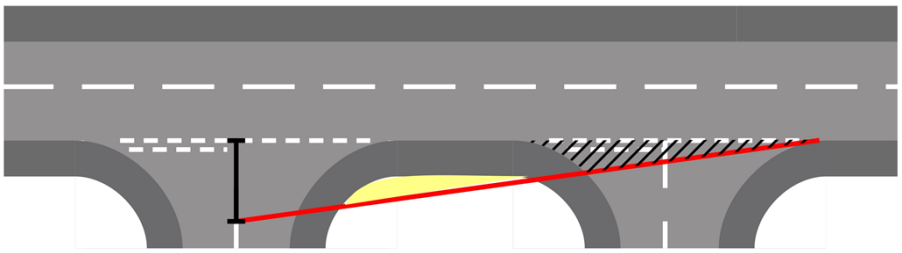
3.3.9 Where a junction is located on the outside of a bend, an additional area of visibility splay may be required from the inside of the bend, formed by drawing a line from the X-distance of the side street or access to the Y-distance measured along the offside channel of the street with priority from the junction or access centreline.



Notes: Visibility splays must be either within the public highway or over land in the control of the developer to ensure that they remain free from obstruction whilst ever the development remains in existence. Hedges should not be planted within 1.0m of the visibility splay if there is potential for the visibility splay to be encroached upon by vegetation during periods of rapid growth.

Where a visibility splay crosses multiple plots or frontages that could be obstructed in the future, the visibility splay must be incorporated into the footway.

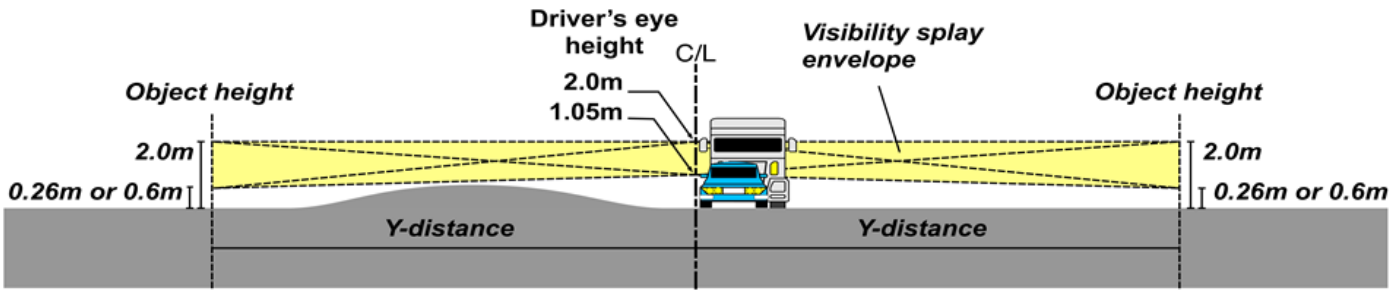
New priority junctions on through routes shall not be sited where they encroach on the visibility requirements of adjacent priority junctions on streets with a speed limit >40mph or a speed limit ≤ 40mph where the side street forms part of a through route.



All visibility splays are to be kept clear from a height of 0.26m or 0.6m, depending on the speed of traffic, over the entire length of the splay to account for changes in the driver's position as they travel along the street with priority. However, it may be acceptable to locate street lighting, road signs, small utility cabinets, etc. within a visibility splay if they are unlikely to obstruct the view of drivers materially and where this is unavoidable. However, care must be taken to ensure that a group of objects placed along a splay do not form a solid barrier to the line of sight.

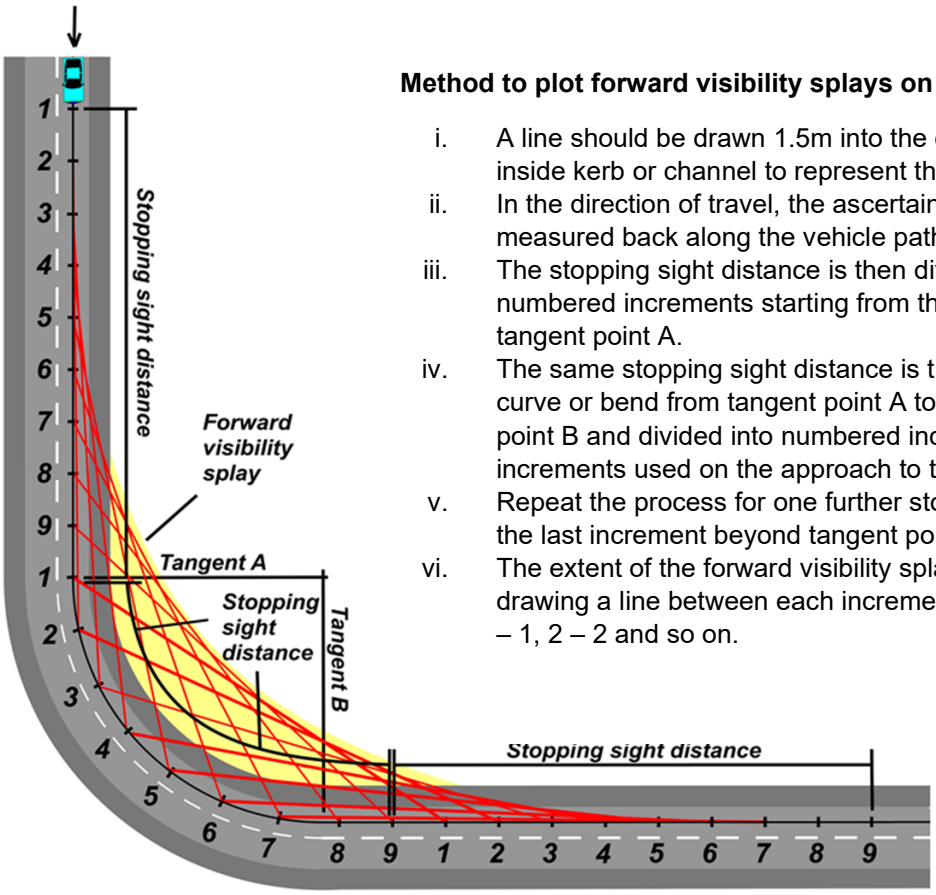
Visibility splays at junctions in the vertical plane

3.3.10 To enable drivers to see oncoming vehicles from side streets and accesses, it is necessary to consider the driver's line of vision in the vertical plane from an eye height of between 1.05m and 2.0m (see paragraph 3.3.17 for agricultural access). A clear view of an obstacle must be available from a height of 0.6m to 2.0m within the visibility splay. This will reduce to a height of 0.26m where the speed of traffic is >60kp/h.



Forward visibility splays

3.3.11 Forward visibility is the distance a driver needs to see ahead to stop safely to avoid an obstruction in the road. The minimum forward visibility required is equal to the minimum SSD. It is checked by measuring between points on a curve along the centreline of the inner traffic lane.

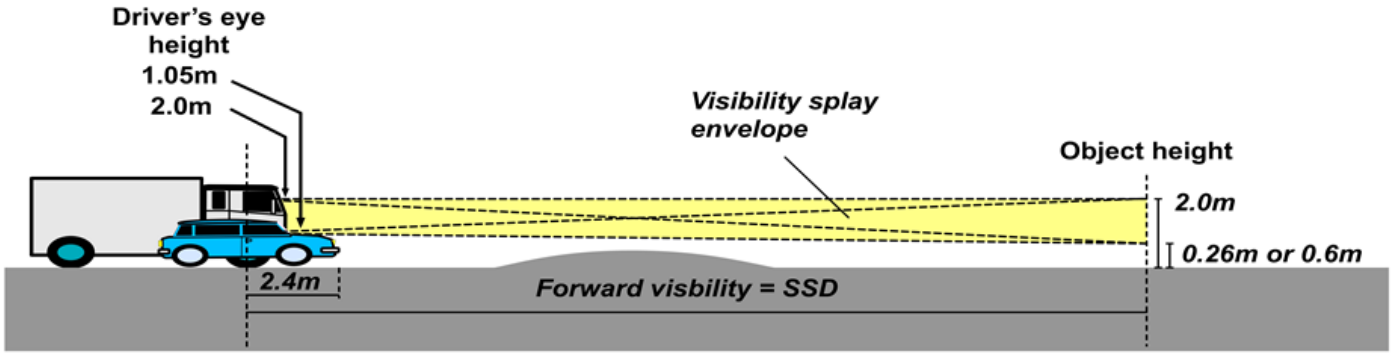


Method to plot forward visibility splays on curves and bends

i. A line should be drawn 1.5m into the carriageway parallel to the inside kerb or channel to represent the path of a vehicle.
ii. In the direction of travel, the ascertained stopping sight distance is measured back along the vehicle path from tangent point A.
iii. The stopping sight distance is then divided into several equal numbered increments starting from the increment furthest from tangent point A.
iv. The same stopping sight distance is then measured around the curve or bend from tangent point A to a point beyond tangent point B and divided into numbered increments equal to the increments used on the approach to the bend (iii above).
v. Repeat the process for one further stopping sight distance from the last increment beyond tangent point B.
vi. The extent of the forward visibility splay is then established by drawing a line between each increment of the same number i.e., 1 – 1, 2 – 2 and so on.

Forward visibility splays in the vertical plane

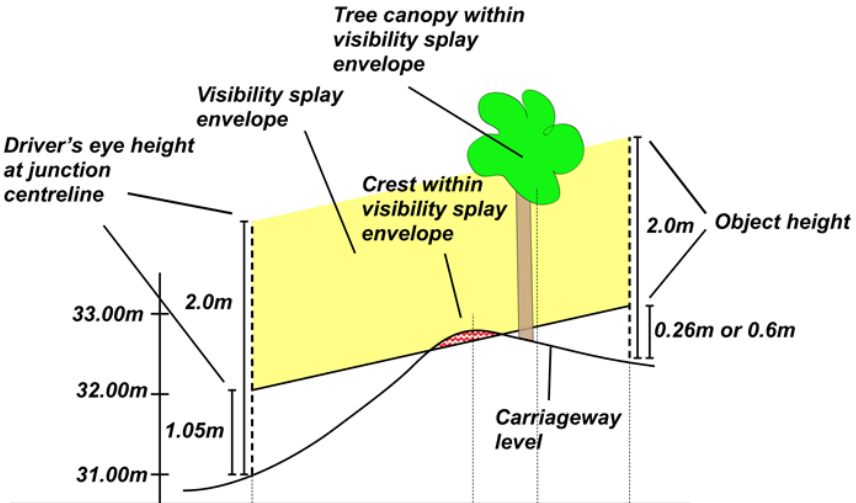
3.3.12 To enable drivers to see a potential hazard in time to slow down or stop comfortably before reaching it, it is necessary to consider the driver's line of vision in the vertical plane from an eye height of between 1.05m and 2.0m. A clear view of an obstacle must be available from a height of 0.6m to 2.0m within the visibility splay. This will reduce to 0.26m where the speed of traffic is >60kp/h.



Precise measurement

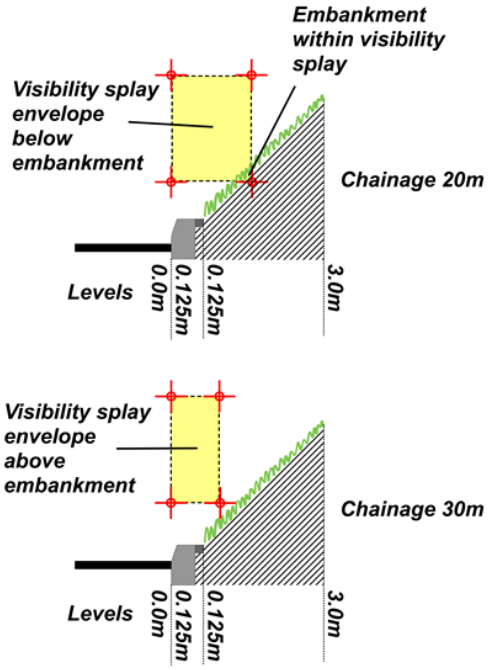
3.3.13 If there is any doubt that an adequate visibility splay is achievable vertically in any direction, it may be necessary to procure a topographical survey and to provide a long section with the carriageway level and the visibility splay plotted. This may require supporting by cross sections where the visibility splay crosses land at the edge of the carriageway that is elevated or contains features that are above carriageway level such as a roadside embankment.

Long section

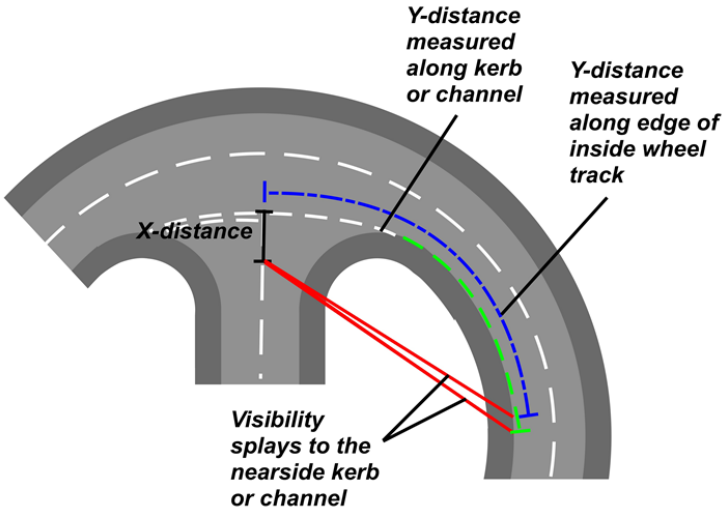


Chainage	0m	10m	20m	27m	30m	36m	40m	47m	50m
Levels along splay	31.00m	31.55m	32.35m	32.80m	32.75m	33.75m	32.50m	32.50m	32.35m
Bottom of visibility splay height	32.05m							33.10m	
Top of visibility splay height	33.00m							34.50m	

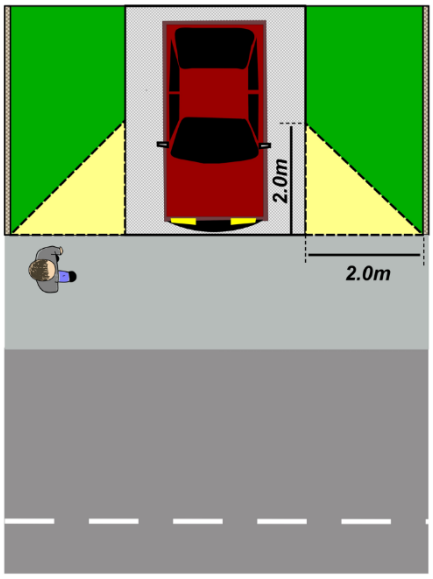
Cross sections



3.3.14 It is accepted that a visibility splay may be more accurately plotted by measuring the Y-distance along the inside wheel track. The likely position of the wheel track from the edge of the carriageway will vary depending on the width of the carriageway and roadside features. This must not be overestimated.



Pedestrian visibility splays

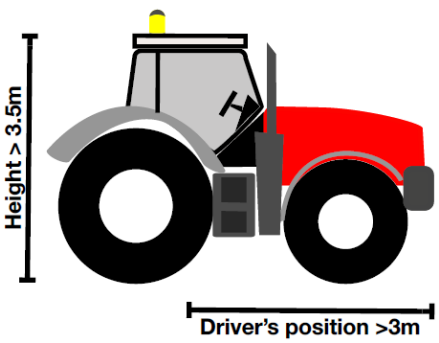


3.3.15 Pedestrian visibility splays will commonly be required adjacent private accesses in areas of moderate to high pedestrian activity. This is usually achieved by setting back walls or fences with the area then kept clear above 0.6m.

3.3.16 A vehicle emerging from a driveway at the back edge of a footway will require the driver to consider the possible presence of pedestrians. The absence of pedestrian visibility splays may encourage drivers to emerge more cautiously. Consideration should be given as to whether the absence of splays is appropriate, considering the frequency of vehicle movements, the amount of pedestrian activity, and the width of the footway.

Agricultural accesses

3.3.17 The driver's position in an agricultural vehicle is often much higher than in a car, van, or lorry, and the driver is often sat much further back from the front of the vehicle. The elevated position of the driver may allow a clear line of sight in the vertical plane over field boundaries. However, obstacles such as tree canopies, traffic signs, or bridges, may obstruct the driver's visibility from the elevated position. Where an agricultural access is proposed or it is likely that the use of an existing agricultural access will increase, it will be necessary to demonstrate that a clear line of vision would be available from the access at an X-distance of 4.5m, from a height of between 2.0m and 3.5m above carriageway level to a height of 2.0m over the stopping sight distance, as well as demonstrating that the general visibility splay requirements set out in this chapter are achievable.



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