

APPENDIX M:

Intersection Sight Distance Requirements



Stopping sight distance is the sum of the distance travelled during the perception and reaction time and the braking distance.

$$SSD = 0.278Vt + 0.039 \frac{V^2}{a} \quad (2.5.2)$$

Where:

SSD = Stopping sight distance (m)
t = Brake reaction time, 2.5 s
V = Design speed (km/h)
a = Deceleration rate (m/s^2)

Table 2.5.2 gives the minimum stopping sight distances on level grade, on wet pavement, for a range of design speeds. These values are used for vertical curve design, intersection geometry and the placement of traffic control devices. The stopping sight distances quoted in **Table 2.5.2** may need to be increased for a variety of reasons related to grade and vehicle type as noted below.

Table 2.5.2: Stopping Sight Distance on level roadways for Automobiles⁵⁴

| Design speed (km/h) | Brake reaction distance (m) | Braking distance on level (m) | Stopping sight distance | |
|------------------------|--------------------------------|----------------------------------|-------------------------|------------|
| | | | Calculated (m) | Design (m) |
| 20 | 13.9 | 4.6 | 18.5 | 20 |
| 30 | 20.9 | 10.3 | 31.2 | 35 |
| 40 | 27.8 | 18.4 | 46.2 | 50 |
| 50 | 34.8 | 28.7 | 63.5 | 65 |
| 60 | 41.7 | 41.3 | 83.0 | 85 |
| 70 | 48.7 | 56.2 | 104.9 | 105 |
| 80 | 55.6 | 73.4 | 129.0 | 130 |
| 90 | 62.6 | 92.9 | 155.5 | 160 |
| 100 | 69.5 | 114.7 | 184.2 | 185 |
| 110 | 76.5 | 138.8 | 215.3 | 220 |
| 120 | 83.4 | 165.2 | 248.6 | 250 |
| 130 | 90.4 | 193.8 | 284.2 | 285 |

Note: Brake reaction distance predicated on a time of 2.5 s; deceleration rate of 3.4 m/s^2 used to determine calculated sight distance.

Table 9.9.3: Time Gap for Case B1, Left Turn from Stop

| Design Vehicle | Time Gap (t_g)(s) at Design Speed of Major Road |
|-------------------------------------|---|
| Passenger car | 7.5 |
| Single-unit truck | 9.5 |
| Combination truck (WB 19 and WB 20) | 11.5 |
| Longer truck | To be established by road authority |

Notes: Time gaps are for a stopped vehicle to turn left onto a two-lane highway with no median and with grades of 3% or less. The table values should be adjusted as follows:

- For multi-lane highways: For left turns onto two-lane highways with more than two lanes, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.
- For minor approach grades: If the approach grade is an upgrade that exceeds 3%, add 0.2 s for each percent grade for left turns.
- Some road authorities use higher values for certain specialized vehicles (e.g., Alberta uses 22 s for very long log trucks).

The intersection sight distance along the major road (distance b in **Figure 9.9.2**) is determined by:

$$ISD = 0.278 V_{\text{major}} t_g \quad (9.9.1)$$

Where:

ISD = intersection sight distance (length of the leg of sight triangle along the major road) (m)

V_{major} = design speed of the major road (km/h)

t_g = time gap for minor road vehicle to enter the major road (s)

For example, a passenger car turning left onto a two-lane major road should be provided sight distance equivalent to a time gap of 7.5 s in major-road traffic. If the design speed of the major road is 100 km/h, this corresponds to a sight distance of $0.278(100)(7.5) = 208.5$ or 210 m, rounded for design.

A passenger car turning left onto a four-lane undivided roadway will need to cross two near lanes, rather than one. This increases the recommended gap in major-road traffic from 7.5 to 8.0 s. The corresponding value of sight distance for this example would be 223 m. If the minor-road approach to such an intersection is located on a 4% upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in **Table 9.9.4**. **Figure 9.9.4** includes design values, based on the time gaps for the design vehicles included in **Table 9.9.3**.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3%, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

Table 9.9.4: Design Intersection Sight Distance – Case B1, Left Turn From Stop

| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars | |
|------------------------|--------------------------------|--|------------|
| | | Calculated (m) | Design (m) |
| 20 | 20 | 41.7 | 45 |
| 30 | 35 | 62.6 | 65 |
| 40 | 50 | 83.4 | 85 |
| 50 | 65 | 104.3 | 105 |
| 60 | 85 | 125.1 | 130 |
| 70 | 105 | 146.0 | 150 |
| 80 | 130 | 166.8 | 170 |
| 90 | 160 | 187.7 | 190 |
| 100 | 185 | 208.5 | 210 |
| 110 | 220 | 229.4 | 230 |
| 120 | 250 | 250.2 | 255 |
| 130 | 285 | 271.1 | 275 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right turns (case B2) will provide sufficient sight distance for a passenger car to cross the near roadway to reach the median. Possible exceptions are addressed in the discussion of case B3.

The time gaps in **Table 9.9.3** can be decreased by 1.0 s for right-turn maneuvers without undue interference with major-road traffic. These adjusted time gaps for the right turn from the minor road are shown in **Table 9.9.5**. Design values based on these adjusted time gaps are shown in **Table 9.9.6** for passenger cars. **Figure 9.9.5** includes the design values for the design vehicles for each of the time gaps in **Table 9.9.5**.

Table 9.9.5: Time Gap for Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

| Design Vehicle | Time Gap (t_g)(s) at Design Speed of Major Road |
|---|---|
| Passenger car | 6.5 |
| Single-unit truck | 8.5 |
| Combination truck (WB 19 and WB 20) | 10.5 |

Note: Time gaps are for a stopped vehicle to turn left onto a two-lane highway with no median and with grades of 3% or less. The table values should be adjusted as follows:

- For multi-lane highways: For left turns onto two-lane highways with more than two lanes, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.
- For minor approach grades: If the approach grade is an upgrade that exceeds 3%, add 0.1 s for each percent grade for left turns.

Table 9.9.6: Design Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver

| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars | |
|---------------------|-----------------------------|--|------------|
| | | Calculated (m) | Design (m) |
| 20 | 20 | 36.1 | 40 |
| 30 | 35 | 54.2 | 55 |
| 40 | 50 | 72.3 | 75 |
| 50 | 65 | 90.4 | 95 |
| 60 | 85 | 108.4 | 110 |
| 70 | 105 | 126.5 | 130 |
| 80 | 130 | 144.6 | 145 |
| 90 | 160 | 162.6 | 165 |
| 100 | 185 | 180.7 | 185 |
| 110 | 220 | 198.8 | 200 |
| 120 | 250 | 216.8 | 220 |
| 130 | 285 | 234.9 | 235 |

Note: Intersection sight distance shown is for a stopped passenger car to turn right onto or to cross a two-lane highway with no median and with grades of 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

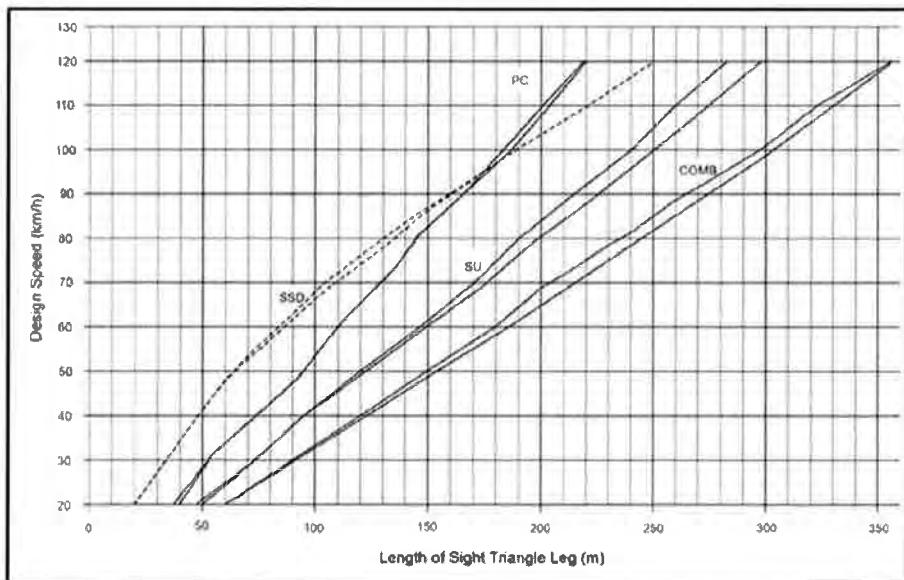


Figure 9.9.5: Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver (Calculated and Design Values Plotted)

Case F – Left Turns from the Major Road

All locations along a major highway from which vehicles are permitted to turn left across opposing traffic, including intersections and driveways, should have sufficient sight distance to accommodate the left-turn maneuver. Left-turning drivers need sufficient sight distance to decide when to turn left across the lane(s) used by opposing traffic. Sight distance design should be based on a left turn by a stopped vehicle, since a vehicle that turns left without stopping would need less sight distance. The sight distance along the major road to accommodate left turns is the distance traversed at the design speed of the major road in the travel time for the design vehicle given in **Table 9.9.11**.

Table 9.9.11: Time Gap for Case F, Left Turns from the Major Road

| Design Vehicle | Time Gap (t_g)(s) at Design Speed of Major Road |
|-------------------------------------|---|
| Passenger car | 5.5 |
| Single-unit truck | 6.5 |
| Combination truck (WB 19 and WB 20) | 7.5 |

Note: Adjustment for multi-lane highways: For turning vehicles that cross more than one opposing lane, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane to be crossed.

The table also contains appropriate adjustment factors for the number of major-road lanes to be crossed by the turning vehicle. The unadjusted time gap in **Table 9.9.11** for passenger cars was used to develop the sight distances in **Table 9.9.12** and is illustrated in **Figure 9.9.8**.

Table 9.9.12: Intersection Sight Distance – Case F, Left Turn from the Major Road

| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance | |
|------------------------|--------------------------------|-----------------------------|------------|
| | | Passenger Cars | |
| | | Calculated (m) | Design (m) |
| 20 | 20 | 30.6 | 35 |
| 30 | 35 | 45.9 | 50 |
| 40 | 50 | 61.2 | 65 |
| 50 | 65 | 76.5 | 80 |
| 60 | 85 | 91.7 | 95 |
| 70 | 105 | 107.0 | 110 |
| 80 | 130 | 122.3 | 125 |
| 90 | 160 | 137.6 | 140 |
| 100 | 185 | 152.9 | 155 |
| 110 | 220 | 168.2 | 170 |
| 120 | 250 | 183.5 | 185 |
| 130 | 285 | 198.8 | 200 |

Note: Intersection sight distance shown is for a passenger car making a left turn from an undivided highway. For other conditions and design vehicles, the time gap should be adjusted and the sight distance recalculated.

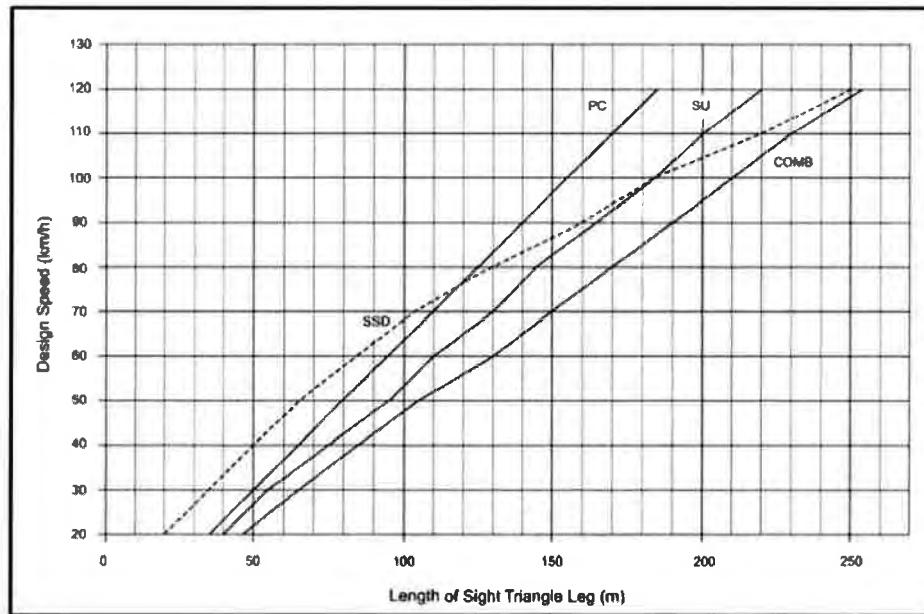


Figure 9.9.8: Intersection Sight Distance – Case F, Left Turn from the Major Road