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20 January 2016
Project: 152170S

Greg Poole
Greg Pool & Associates
Land Use Planning and Development Consultants
7 Millikin Drive
Winona, ON L8E 5L2

Dear Mr. Poole:

RE: SIGHT DISTANCE ACCESS REVIEW – PROPOSED FELLOWSHIP CHURCH AT 1350 WATERDOWN ROAD, BURLINGTON

This letter summarizes our sight distance access review for the proposed Fellowship Church at 1350 Waterdown Road in the City of Burlington and provides input to address any sight distance deficiencies along Waterdown Road.

Site Description

The proposed Fellowship Church is located north of Craven Avenue and west of Waterdown Road in the City of Burlington (**Figure 1**). The land is currently unoccupied with low density residential land uses immediately adjacent to the site. The lands encompass an area of approximately 1.52 hectares (3.75 acres).

The subject site is proposed to be developed as the Fellowship Church with a gross floor area of approximately 1,178 square metres (12,680 square feet). The site concept plan is illustrated in **Figure 2** (attached). Vehicular access to the site is proposed to be provided by two new driveway connections: The first connection is provided via Waterdown Road and the second will connect to the existing Nevarc Drive. The driveway to Waterdown Road is proposed to be located approximately 12.2 metres north of the southerly property line.

Existing Roadway Conditions

Waterdown Road, is a north-south two-lane arterial roadway which transitions to a four-lane cross-section south of Craven Avenue. The City of Burlington and the City of Hamilton are planning to ultimately widen Waterdown Road to a four-lane cross-section from Craven Avenue to Mountain Brow Road. During the interim, a three-lane cross-section will be developed to include a centre two-way left-turn lane. The posted speed limit along this roadway is 50 kilometres per hour.

Nevarc Drive is a north-south two-lane local roadway with a posted speed limit of 50 kilometres per hour.

At present, sidewalks are provided only on the west side of Waterdown Road, south of Craven Avenue. Ultimately, this sidewalk will be extended north when Waterdown Road is reconstructed. There are no sidewalks provided on Nevarc Drive.

Sight Distance From Proposed Site Driveway

Sight distance measurements were taken for both the northbound and southbound directions at the proposed driveway connection to Waterdown Road. The measurements were taken from a point one (1) metre south of the centerline of the driveway with a target at a height of 0.38 metres along a line of sight within the right-of-way to the furthest point at 1.05 metres above the pavement.

The Transportation Association of Canada (TAC) manual states that the sight distance for a minor road with stop control should be at least the “distance traveled in three (3) seconds at design speeds to decision sight distance”¹. For a driveway connection to a public roadway, it is recommended that the minimum stopping sight distance should be provided since it exceeds the distance traveled in three (3) seconds by a vehicle traveling at the design speed.

From a stop controlled approach, the sight triangles are a function of the vehicle speeds on the major roadway and the crossing or turning departure manoeuvre of the vehicle leaving from a stopped condition. The TAC sight distances for turning movements from a stop are noted as follows:

- ▶ The sight distance for a passenger vehicle turning left onto a two-lane roadway across a passenger vehicle approaching from the left is approximately 120 metres². The sight distance for a passenger vehicle approaching from the right is approximately 160 metres³
- ▶ The sight distance for a passenger vehicle to turn right onto a two-lane roadway and attain 85 percent of the design speed without being overtaken by a vehicle approaching from the left and reducing travel speed from design speed to 85 percent of the design speed is approximately 160 metres⁴.
- ▶ The minimum sight distance for a passenger vehicle approaching an object on the roadway is:
 - Distance travelled in 3 seconds: 50 metres.
 - Minimum stopping sight distance: 85 metres.
 - Minimum decision sight distance: 170 metres; and
 - Desirable decision sight distance: 235 metres.

The sight distance on Waterdown Road to the south extends for more than 400 metres. There are no sightline concerns in the southbound direction.

The sight distance available along Waterdown Road to the north extend for approximately 111 metres and is limited by the horizontal curvature of Waterdown Road. The vertical curvature of Waterdown Road has little impact on sightlines at this location.

¹ TAC Figure 2.3.3.6 – Decision Sight Distance

² TAC Figure 2.3.3.4a – Sight Distance for Turning Movements from Stop Line B-1 – 60 kilometre per hour design speed

³ TAC Figure 2.3.3.4b – Sight Distance for Turning Movements from Stop Line Cb & B-2b - 60 kilometre per hour design speed

⁴ TAC Figure 2.3.3.4 – Sight Distance for Turning Movements from Stop Line Cb – 60 kilometre per hour design speed



Vehicles wishing to turn right or left from the site driveway would not have sufficient departure sight distances available without negatively impacting the travel speed of an approaching vehicle on Waterdown Road.

While this condition is not ideal the most critical sight distance for vehicles traveling along Waterdown Road is stopping sight distance. Stopping sight distance is the distance that a motorist needs to bring a vehicle safely to a stop to avoid a collision with an object on the road. In this case, a turning or stopped vehicle exiting the subject site.

The minimum stopping sight distance as described by TAC is 85 metres for a 60 kilometre per hour design speed. The available sight distances for a vehicle travelling along Waterdown Road was measured in the field to be approximately 111 metres. This measurement was taken from within the roadway's right-of-way.

The available stopping sight distances for a vehicle approaching the site driveway at a design speed of 60 kilometres per hour is considered sufficient. A southbound vehicle on Waterdown Road would in theory be able to avoid conflict with an object on the roadway at the proposed site driveway connection.

Crossing Sight Distance

The required minimum departure sight distance along the major roadway can be calculated⁵ using a series of assumptions related to design speed, perception/reaction time, crossing distance, vehicle length and acceleration time. The crossing sight distance calculations can be found attached and reflects a crossing distance of 4.00 metres. The resulting sight distance required for a vehicle to turn left from Waterdown Road into the site driveway is 100 metres. **Therefore there is sufficient sight distance for a passenger car to turn into the subject site from Waterdown Road under existing conditions.**

Prior to the reconstruction of Waterdown Road, turning traffic on Waterdown Road during worship service times could present a hazard. When the number of left-turning vehicles is such that it creates a hazard and reduces capacity, consideration should be given to the provision of a separate left-turn lane.

Waterdown Road Reconstruction – Interim Condition (TWLTL)

The City of Burlington and the City of Hamilton are planning the reconstruction of Waterdown Road. The reconstruction will ultimately see Waterdown Road widened to a four-lane cross-section. During the interim the roadway will be widened to its ultimate width but will be delineated to include on-street bicycle lanes in both directions, one travel lane in both directions and a centre Two-Way Left-Turn Lane (TWLTL). During this period the crossing sight distance is increased to approximately 4.95 metres (1.70 metre on-street bicycle lane and 3.25 metre travel lane). The resulting sight distance required for a vehicle to turn left from Waterdown Road into the site driveway is 104 metres. The crossing sight distance calculations can be found attached. **Therefore the reconstruction of this**

⁵ TAC Section 2.3.3.3 – Sight Distance for Specific Traffic Control Devices subsection a) Crossing Sight Distance



roadway is estimated to allow for sufficient sight distance for a passenger car to turn into the subject site from Waterdown Road.

Waterdown Road Reconstruction – Four-Lane Cross-Section

The distance estimated to be the future width of Waterdown Road following the remarking of Waterdown Road to a four-lane cross-section is approximately 8.0 metres. The resulting sight distance required for a vehicle to turn left from Waterdown Road into the site driveway is 113 metres. The crossing sight distance calculations can be found attached. Therefore there is insufficient sight distance for a passenger car to turn into the subject site from Waterdown Road. Prior to the remarking of the roadway to develop the four travel lanes it is recommended that sight distances be reviewed and appropriate mitigation measures be implemented to address any potential deficiency. The mitigation measures could include advanced warning signage for southbound vehicles (Hidden driveway and/or advisory speed warning signs) or reducing speed limit through the area during worship service time periods (flashing 40 km/h zone).

Collision History

The City of Burlington has provided the five-year collision history for the intersection of Waterdown Road with Flatt Rd and the segment of Waterdown Road from Flatt Road to Craven Avenue. In total 13 reported collisions are documented. Of the reported collisions, single motor vehicle and rear end collision impact types were the most highly reported. These collision types account for approximately 85 percent of all reported collisions.

Overall, there appears to be no significant collision pattern in this area. The City of Burlington actively monitors and documents collision history and identifies locations where collision activity is unusually high or significant. When a location is identified remedial measures are usually examined by City Staff.

Conclusions and Recommendations

The driveway connection proposed to Waterdown Road can function with sufficient minimum stopping sight distances in both directions under existing and future conditions. However, the departure sight distance for vehicles exiting the site is limited. This presents a potential safety concern. To address the deficient sight distance to the north, it is recommended that the southbound approach of Waterdown Road be signed with advanced warning signage to indicate the hidden driveway and that consideration be given to implementing a flashing 40 km/h zone across the site's frontage during the worship service time periods.

The City of Burlington review the need for a temporary northbound left-turn lane on Waterdown Road at the proposed site driveway connection prior to the reconstruction of the roadway. The interim construction of a northbound left-turn lane would improve the operations of the site driveway connection.

If you have any questions regarding our review of the sight distances please contact me at (905) 381-2229 x103 or (519) 896-3163 x103 or by email at selkins@ptsl.com. Thank you very much for this opportunity to provide our services.



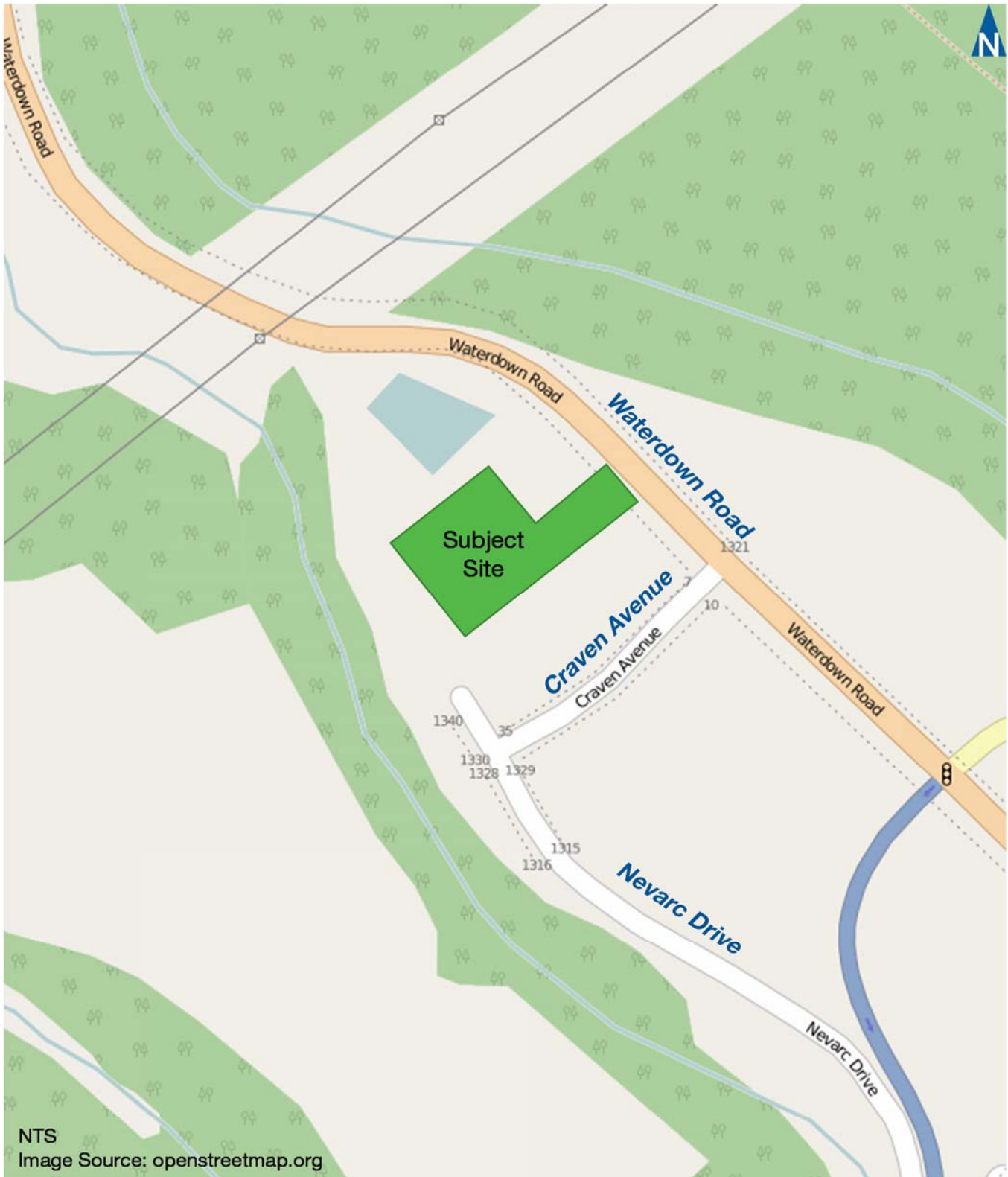
Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

A handwritten signature in black ink, appearing to read 'Stew Elkins', with a long horizontal flourish extending to the right.

Stew Elkins
B.E.S., MITE
Vice-President





Location of Subject Site

1350 Waterdown Road
152170

Figure 1

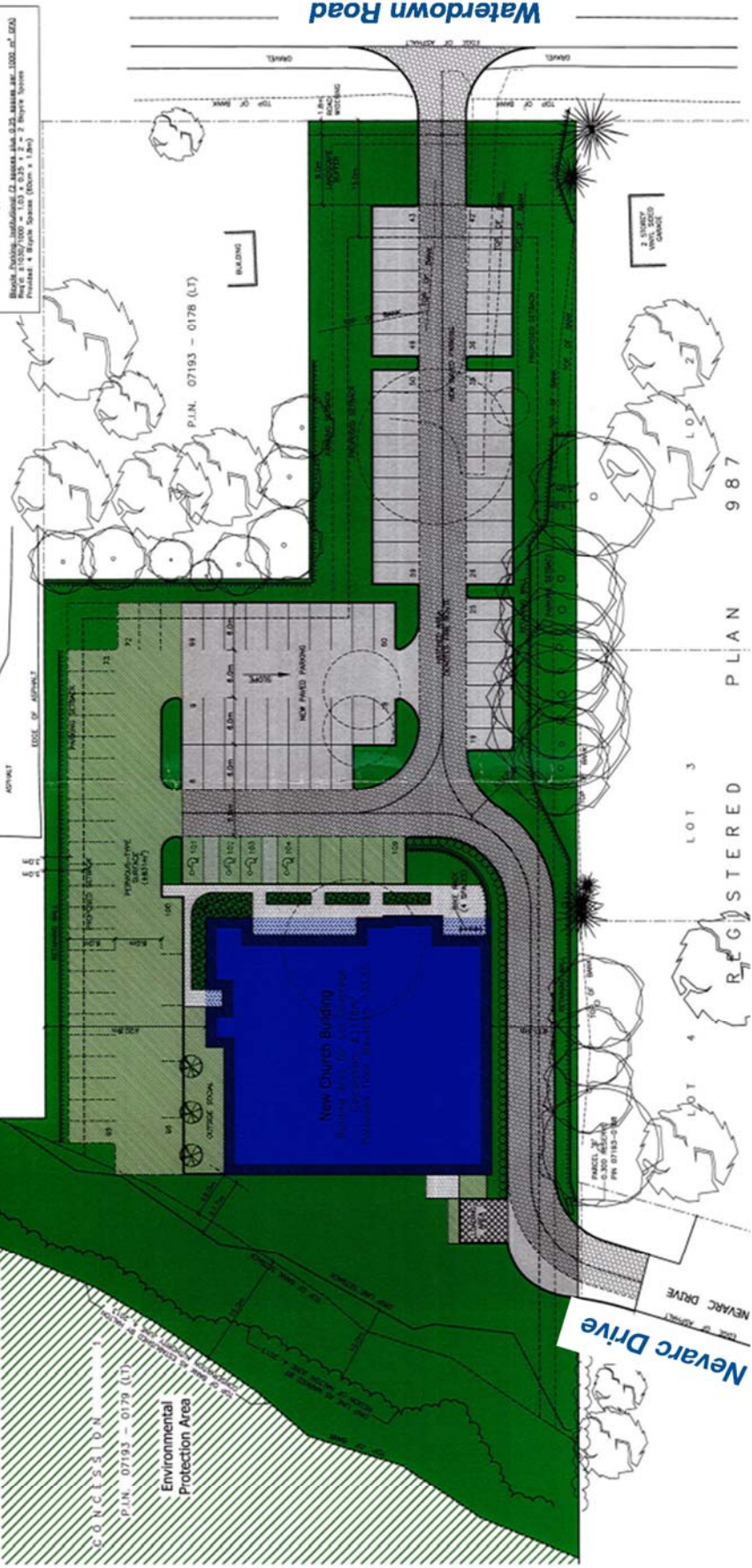
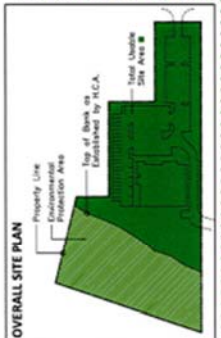
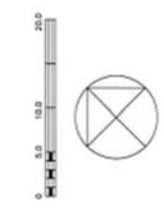
Site Area
 Total Site Area: 131,772 m² (31,795 acres)
 Approx. Bay Area: 1,128 m² (0.276 acres)
 Approx. Total Area: 132,900 m² (32,071 acres)

Property Use
 Environmental Protection Area
 Top of Bank, as Established by T.C.A.
 Total Usable Site Area

Site Area
 Total Site Area: 131,772 m² (31,795 acres)
 Approx. Bay Area: 1,128 m² (0.276 acres)
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1350 Waterdown Road
 152170

Site Plan

Figure 2

Waterdown Road – Existing Cross-Section

Crossing Sight Distance

TAC Section 2.3.3.3 Part a (Page 2.3.3.5)

The required minimum departure sight distance along the major roadway is given by the expressions:

$$D = \frac{V(J + t)}{3.6}$$

D = Minimum crossing sight distance along the major roadway from intersection

V = Design speed of major roadway (km/h) – 60 km/h

J = Perception and reaction time of crossing driver (s) – 2.0 seconds

t = Time to cross the major roadway pavement (s)

Variables

V = 60 km/h

J = 2.0 seconds

t = the time t is given for a range of crossing distances, s, by the curves for four design vehicles in Figure 2.3.3.3. The crossing distance is computed using the formula:

$$s = d + w + L$$

s = distance traveled during acceleration (m)

d = distance from near edge of pavement to front of stopped vehicle (m), generally assumed to be 3.0 m

w = width of pavement along the path of the crossing vehicle (m) – 4.0 m

L = overall length of the crossing vehicle (m) – TAC P 5.6 m

$$s = 3.0 + 4.0 + 5.6$$

$$s = 12.6$$

Figure 2.3.3.3 t value = 4.0 seconds

Departure Sight Distance Calculations

$$D = \frac{V(J + t)}{3.6}$$

$$D = \frac{60(2.0 + 4.0)}{3.6}$$

$$D = \frac{60(6)}{3.6}$$

$$D = \frac{360}{3.6}$$

D = 100 metres



Waterdown Road – TWLTL Cross-Section

Crossing Sight Distance

TAC Section 2.3.3.3 Part a (Page 2.3.3.5)

The required minimum departure sight distance along the major roadway is given by the expressions:

$$D = \frac{V(J + t)}{3.6}$$

D = Minimum crossing sight distance along the major roadway from intersection

V = Design speed of major roadway (km/h) – 60 km/h

J = Perception and reaction time of crossing driver (s) – 2.0 seconds

t = Time to cross the major roadway pavement (s)

Variables

V = 60 km/h

J = 2.0 seconds

t = the time t is given for a range of crossing distances, s, by the curves for four design vehicles in Figure 2.3.3.3. The crossing distance is computed using the formula:

$$s = d + w + L$$

s = distance traveled during acceleration (m)

d = distance from near edge of pavement to front of stopped vehicle (m), generally assumed to be 3.0 m

w = width of pavement along the path of the crossing vehicle (m) – 4.95 m

L = overall length of the crossing vehicle (m) – TAC P 5.6 m

$$s = 3.0 + 4.95 + 5.6$$

$$s = 13.55$$

Figure 2.3.3.3 t value = 4.25 seconds

Departure Sight Distance Calculations

$$D = \frac{V(J + t)}{3.6}$$

$$D = \frac{60(2.0 + 4.25)}{3.6}$$

$$D = \frac{60(6.25)}{3.6}$$

$$D = \frac{375}{3.6}$$

D = 104 metres



Waterdown Road – Four-Lane Cross-Section

Crossing Sight Distance

TAC Section 2.3.3.3 Part a (Page 2.3.3.5)

The required minimum departure sight distance along the major roadway is given by the expressions:

$$D = \frac{V(J + t)}{3.6}$$

D = Minimum crossing sight distance along the major roadway from intersection

V = Design speed of major roadway (km/h) – 60 km/h

J = Perception and reaction time of crossing driver (s) – 2.0 seconds

t = Time to cross the major roadway pavement (s)

Variables

V = 60 km/h

J = 2.0 seconds

t = the time t is given for a range of crossing distances, s, by the curves for four design vehicles in Figure 2.3.3.3. The crossing distance is computed using the formula:

$$s = d + w + L$$

s = distance traveled during acceleration (m)

d = distance from near edge of pavement to front of stopped vehicle (m), generally assumed to be 3.0 m

w = width of pavement along the path of the crossing vehicle (m) – 8.0 m

L = overall length of the crossing vehicle (m) – TAC P 5.6 m

$$s = 3.0 + 8.0 + 5.6$$

$$s = 16.6$$

Figure 2.3.3.3 t value = 4.8 seconds

Departure Sight Distance Calculations

$$D = \frac{V(J + t)}{3.6}$$

$$D = \frac{60(2.0 + 4.8)}{3.6}$$

$$D = \frac{60(6.8)}{3.6}$$

$$D = \frac{408}{3.6}$$

D = 113 metres

