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ACADIA ENGINEERING

Slight Lines Analysis Brief

Park Meadow Court Development
Farnham Road, Belleville, ON

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Appendices

1 Introduction

Acadia Engineering Inc. (Acadia) has been retained by GCL Developments Ltd. to complete a Sight Line Analysis Brief in response to a request by the City of Belleville. The proposed subdivision development will front on Farnham Road and is located south of 176 Farnham Road in the City of Belleville.

The Sight Line Analysis Brief includes the following study components:

- A review of the development proposal.
- A review and assessment of the existing, and future road network, including a field visit.
- A review of driver sight distance analysis of the existing and future alignment.

1.1 Background and Site Location

The subject site is in Belleville, Ontario, approximately 950 metres (m) from Highway 62, 1.06 kilometres (km) north of Maitland Drive, and 1.0km west of the Moira River. The property, which is currently an active farm field, is adjacent to Farnham Road and will be developed into a subdivision consisting of single-detached homes, semi-detached homes, and townhomes, each with driveway parking space.

It is understood that Farnham Road is currently undergoing a phased realignment of the roadway, from 350m east of Highway 62 to the roundabout intersection with Maitland Drive and Moira Lee Court. The area surrounding the site is primarily residential and agricultural, with significant tree and brush coverage around the perimeter and along the middle of the site. The proposed subdivision is adjacent to other completed subdivisions to the east and southeast. The site has a total area of 46,478.4 square metres (m^2) or 4.64 hectares (ha). The proposed development will have one entrance on Farnham Road.

2 Existing Conditions and Future Conditions

The roadway located within the study area for both the existing and future conditions are described below:

Farnham Road (Existing): This is a major undivided arterial road that runs in a north-south direction near the entrance of the proposed subdivision. Currently, it has two travel lanes, one in each direction. Approximately 60m north of the site, the roadway has a horizontal bend to the west. The speed limit on the roadway is 50km/h.

Farnham Road (Future): This roadway will remain a major undivided arterial road, continuing to run in a north-south direction near the entrance of the proposed subdivision. It will retain two travel lanes, one in each direction. It is assumed that the speed limit will remain 50km/h.

Street A (Proposed): This will be a local road serving as the primary entry and exit point of the subdivision. It will have two travel lanes with an unmarked centreline. It is assumed that the speed limit will be 50km/h. Street A is proposed to have a 20m road allowance.

The intersection of Farnham Road and Street A will be unsignalized, with a stop sign on Street A.

3 Site Plan Review

Acadia conducted a visual assessment of the sight lines for both the existing and future alignments of Farnham Road. The assessment was conducted from the proposed entrance location of the subdivision, at the future intersection of Farnham Road and Street A looking along the north and south directions.

Figure 1 shows the site area and location in relation to the existing alignment of Farnham Road. Street A (the entry and exist point of the subdivision) will be located on the northern side of the property.

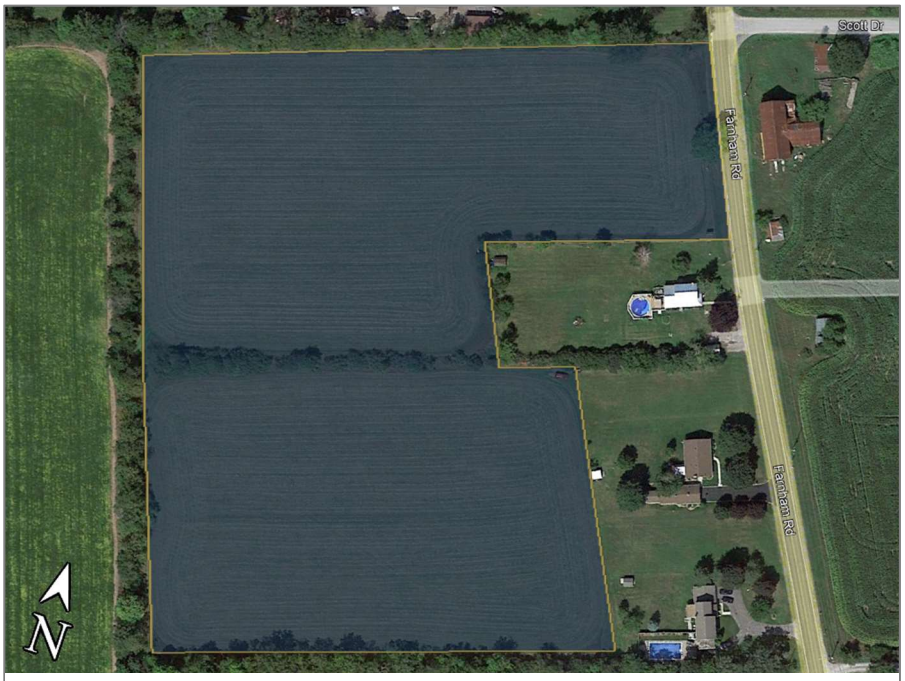

Figure 1: Subject Site Outline (Current Farnham Road Alignment)

The sight distance measurements were conducted on Tuesday, September 24, 2024, with clear weather conditions.

Two surveyors were present at the site and measured the sight distance using a measuring wheel. Physical obstructions, natural features, and horizontal and vertical bends along the roadway were noted.

3.1 Sight Lines Review

Minimum sight distance requirements were determined using Table 9.9.4 and Table 9.9.6 from the Transportation Association of Canada (TAC) Manual. The design speed was taken as 20km/h over the posted speed limit on the roadway which is 50km/h on Farnham Road and on Street A. The analysis was done only for passenger car traffic as Street A is proposed to be a local residential road. A summary of the review is provided in Table 1 and Table 2, and site photos taken from Street A can be found in Appendix B.

Table 1: Sight Distance Review Summary for Existing Farnham Road

Existing Farnham Road Alignment						
Design Vehicle	Location	Direction	Measured Sight Distance (m)	Criteria	Required Sight Distance (m)	Requirement Met (Yes/No)
Passenger Cars	Looking down Farnham Road from Street A	North	130	SSD	105	No
				Calculated	146.0	
				Design	150	
		South	~550	SSD	105	Yes
				Calculated	126.5	
				Design	130	

Table 2: Sight Distance Review Summary for Future Farnham Road

Future Farnham Road Alignment						
Design Vehicle	Location	Direction	Measured Sight Distance (m)	Criteria	Required Sight Distance (m)	Requirement Met (Yes/No)
Passenger Cars	Looking down Farnham Road from Street A	North	179	SSD	105	Yes
				Calculated	146.0	
				Design	150	
		South	~550	SSD	105	Yes
				Calculated	126.5	
				Design	130	

The grade of Farnham Road is less than 3%, and no median is present therefore the gap time and sight distance were not adjusted.

The available sight distance looking north and south along the current Farnham Road alignment is approximately 130m and 550m, respectively. Along the future alignment, the north and south sight distance is approximately 179m and 550m, respectively. The field inspectors noted that the north sight distance from the proposed Street A has trees blocking the view of the horizontal bend of Farnham Road.

The sight lines for the existing alignment meets the minimum stop sight distance and meets the south sight distance, however it does not meet the north design sight distance. The sight lines for the future alignment meets all requirements for stop sight distance and design sight distance for passenger car traffic.

Considering that the alignment of Farnham Road is being completed to offer better sight line distances for vehicle traffic it can be assumed that future alignment will offer better sight distance and stopping sight distance compared to the existing. This was confirmed to be true as the sight distance for the future alignment was measured to be 31.7% better than the existing alignment and surpassing the minimum by 17.6% for passenger car traffic.

It is important to note that landscaping or decorative features located within the departure sight triangles would most likely have an impact on the departure sightlines, unless it is lower than 0.5m in height due to the horizontal bend of Farnham Road.

With a 10 km/h increase over the posted speed limit (50 km/h) applied to the design speed, the stopping sight distance (SSD) is 85 m. The calculated SSD is 125.1 m, and the design SSD is 130 m. Therefore, the measured sight distance requirement is met.

3.2 Guidelines & Criteria

Acadia has utilised the following standards and guidelines to prepare the Slight Lines Analysis Brief:

- Transportation Association of Canada Guidelines (2011)
- City of Belleville Engineering Design Standards
- Geometric Design Standards for Ontario Highways

4 Summary

This Sight Line Analysis Brief was prepared in support of a proposed subdivision development fronting on Farnham Road. The departures sight lines study for the existing and the future alignment of Farnham Road from Street A was conducted. The following is the summary of results and conclusion of the study conducted.

- The proposed subdivision development consists of dwelling units with individual driveways.
- A field visit and driver sight distance measurements were conducted by Acadia staff during daytime hours on Tuesday, September 24, 2024. The sight distance was measured from the proposed intersection with Farnham Road.
- The sight distance review indicates that there are adequate sightlines for right turn looking south, however the left turn heading north does not meet the design sight distance for the existing road with the 20km/h design speed increase, though the sight lines are met when there is a 10 km/h design speed increase. The slight distance

meets all requirements for vehicles to safely enter and exit the site on the future alignment.

- Landscaping features within the departure sight triangles should be kept less than 0.5m in height to maintain driver sight distance at the intersection.

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Appendix A:
Excerpts of TAC Guidelines

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9.9.2.2 Departure Sight Triangles

A second type of clear sight triangle provides sight distance sufficient for a stopped driver on a minor-road approach to depart from the intersection and enter or cross the major road. **Figure 9.9.2** shows typical departure sight triangles to the left and to the right of the location of a stopped vehicle on the minor road.

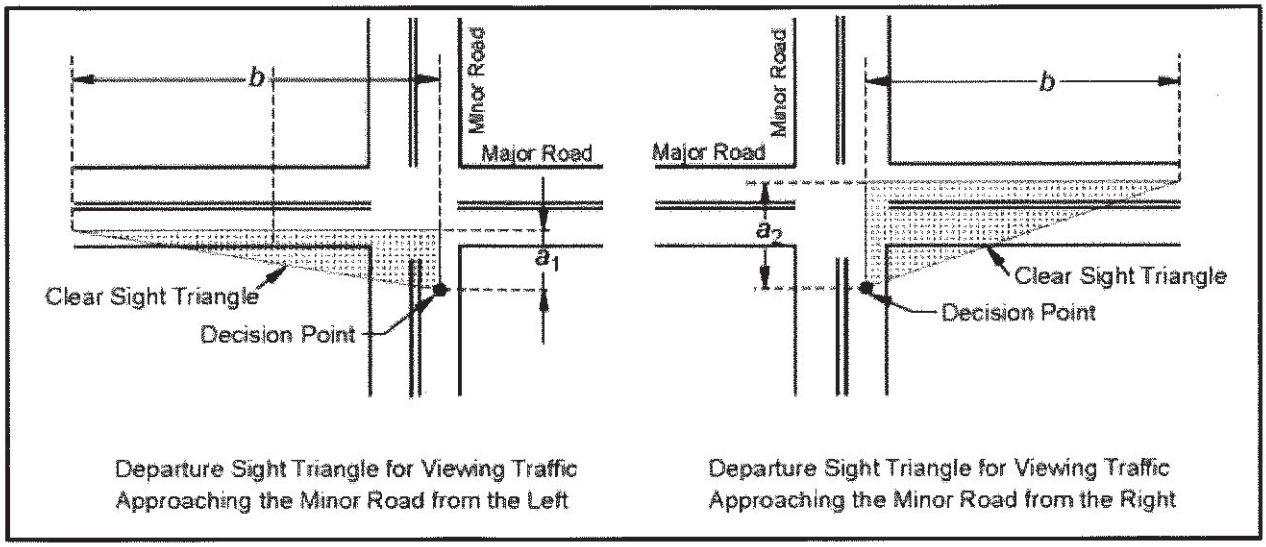

Figure 9.9.2: Departure Sight Triangles (Stop-Controlled)

Departure sight triangles should be provided in each quadrant of each intersection approach controlled by stop or yield signs. Departure sight triangles should also be provided for some signalized intersection approaches. Distance a_2 in **Figure 9.9.2** is equal to distance a_1 plus the width of the lane(s) departing from the intersection on the major road to the right. Distance a_2 should also include the width of any median present on the major road, unless the median is wide enough to permit a vehicle to stop before entering or crossing the roadway beyond the median. The appropriate measurement of distances a_1 and a_2 for departure sight triangles depends on the placement of any marked stop line that may be present and may therefore vary with site-specific conditions.

The recommended dimensions of the clear sight triangle for desirable traffic operations where stopped vehicles enter or cross a major road are based on assumptions derived from field observations of driver gap-acceptance behaviour.[66] Providing clear sight triangles like those shown in **Figure 9.9.2** also allows the drivers of vehicles on the major road to see any vehicles stopped on the minor-road approach and to be prepared to slow or stop, if needed.

9.9.2.3 Intersection Control

The recommended dimensions of the sight triangles vary with the type of traffic control used at an intersection because different types of control impose different legal constraints on drivers and, therefore, result in different driver behaviour. Procedures to determine sight distances at intersections are presented below, according to different types of traffic control, as follows:

- Case A – Intersections with no control
- Case B – Intersections with stop control on the minor road

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.

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.

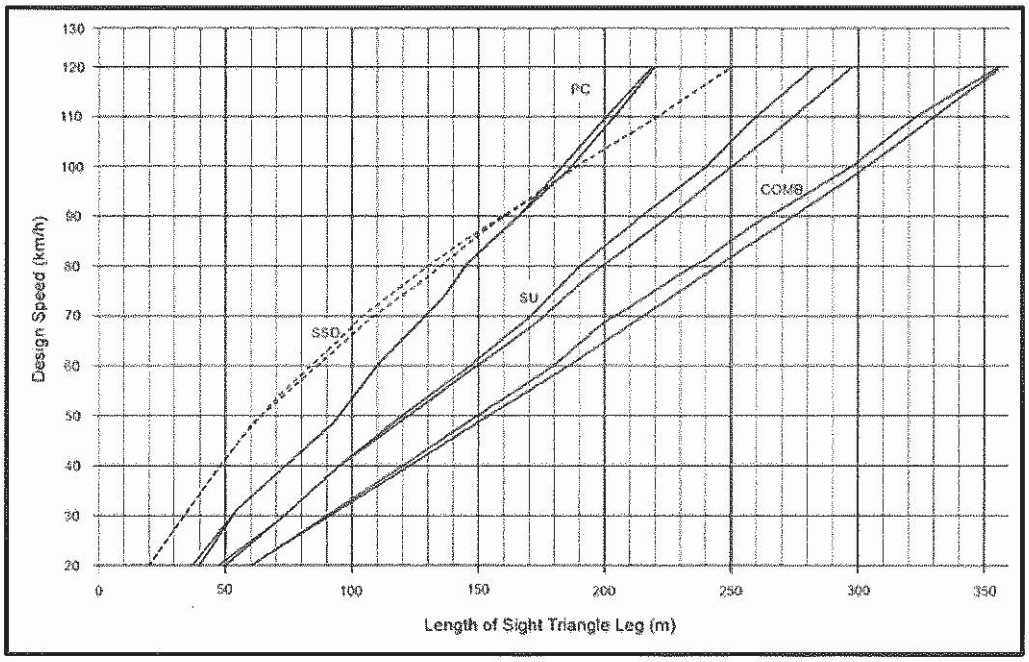

Figure 9.9.5: Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver (Calculated and Design Values Plotted)

Appendix B:
Site Photos

Standing at the proposed intersection of Street and Farnham Road (looking south)

Standing at the proposed intersection of Street and Farnham Road (looking north)

Looking south at 105m from the proposed intersection

Looking south at 110m from the proposed intersection