



Clark Boulevard Extension and Eastern Avenue Improvements Environmental Assessment Study

Rutherford Road to Kennedy Road

Safety Analysis Report
City of Brampton

May 3, 2021

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Disclaimer

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1 Introduction

HDR was retained by City of Brampton to undertake a Schedule 'C' Class Environmental Assessment (EA) Study for the extension of Clark Boulevard from Rutherford Road to Hansen Road South and improvements to Eastern Avenue from Hansen Road South to Kennedy Road. The safety analysis memorandum includes collision analysis for Eastern Avenue at Kennedy Road, Eastern Avenue at Hansen Road, and Clark Boulevard at Rutherford Road as well as a geometric review within the EA study area. It should be noted that Eastern Avenue at Kennedy Road and Hansen Road are minor stop control intersections while Clark Boulevard at Rutherford Road is a signalized intersection.

1.1 Methodology

The collision analysis for Eastern Avenue includes an analysis of five year collision data (**Appendix A**) on a macro level, which breaks down the collision types by year, month, impact type, time of day, and severity. A geometric review was carried out to examine access spacing and sight distances for driveways and intersections along Eastern Ave. The need for traffic control devices is based on operational performance and further discussed in the traffic operation section.

2 Collision Analysis

A 5-year collision analysis for the EA study area was undertaken using data between 2014 and 2018. All of the collision data observed during this period were attributed to the intersections at Eastern Avenue/Kennedy Road, Eastern Avenue/Hansen Road, and Clark Boulevard/Rutherford Road. **Table 2-1** provides a breakdown of collisions for the intersection of Eastern Ave at Kennedy Rd.

Table 2-1: Collision Analysis Summary - Eastern Ave / Kennedy Rd

Location		Initial Impact Type	No of Collisions
Eastern Ave at Kennedy Rd		Angle	5
		Rear end	2
		Sideswipe	2
		Turning Movement	1
		SMV Other	1
		Other	1

Year	No of Collisions
2014	1
2015	1
2016	2
2017	6
2018	2

Month	No of Collisions
January	1
February	2
March	0
April	2
May	0
June	1
July	0
August	0
September	2
October	1
November	1
December	2

Environment Condition	No of Collisions
Clear	10
Fog, Mist, Smoke, Dust	1
Snow	1

Light	No of Collisions
Daylight	8
Dawn	1
Dusk	1
Dark	1
Dark, Artificial	1

Classification of Accident	No of Collisions
Non-fatal Injury	3
P.D. Only	9

The analysis showed 12 collisions within the 5-year period with 50% of the collisions occurring in 2017. The majority of the collisions occurred during daylight (60%) and clear (83%) conditions. Property Damage (P.D.) collisions accounted for 75% of the collisions, while non-fatal injury accounted for 25% of the collisions. The relatively high number of angle collisions may indicate the users' disregard of stop control intersection rules.

Two collisions were also reported on Eastern Avenue between Kennedy Road and Hansen Road and at the intersection of Eastern Avenue at Hansen Road. Both collisions were classified under the category of clear environmental conditions and occurred during the years 2013 and 2017 respectively. The collision on Eastern Avenue between Kennedy Road and Hansen Road occurred during the month of July and was classified as PD only, while the collision on Eastern Avenue at Hansen Road occurred during the month of May and classified as PD Only as well.

Table 2-2 provides a breakdown of collisions for the intersection of Clark Boulevard/ Rutherford Road. The analysis showed 25 collisions within the 5-year period. The majority of the collisions occurred during daylight (84%) and clear (72%) conditions. Property Damage (P.D.) collisions accounted for 92% of the collisions, while non-fatal injury accounted for 4% of the collisions. The relatively high number of rear end collisions at a signalized intersection may indicate disregard for safe distance between vehicles.

Table 2-2: Collision Analysis Summary – Clark Blvd/ Rutherford Rd

Location		Initial Impact Type	No of Collisions
Clark Blvd at Rutherford Rd		Angle	8
		Rear end	9
		Sideswipe	2
		Turning Movement	4
		SMV Other	2

Year	No of Collisions
2014	8
2015	6
2016	3
2017	6
2018	2

Month	No of Collisions
January	2
February	0
March	4
April	2
May	2
June	2
July	4
August	5
September	2
October	2
November	0
December	0

Environment Condition	No of Collisions
Clear	18
Rain	6
Snow	1

Light	No of Collisions
Daylight	21
Dawn	0
Dusk	1
Dark	2
Dark, Artificial	1

Classification of Accident	No of Collisions
Non-fatal Injury	1
P.D. Only	23
Non-reportable	1

3 Geometric Review

This section of the Safety Analysis report documents the existing geometric deficiencies for the Eastern Avenue corridor from Kennedy Road S to Hansen Road S. The existing intersection geometric elements were reviewed based on the base file provided by the City of Brampton. Geometric elements were reviewed and compared to the following design standards in hierarchical order and based on available standards:

- City of Brampton Engineering and Design Standards
- Region of Peel Design Standards
- Transportation Association of Canada (TAC) Manual (2017)
- Ontario Traffic Manual (OTM) Books (2015)

3.1 Posted Speed and Design Speed

The Posted Speed for the Eastern corridor is 50 km/h under City of Brampton jurisdiction. The Design Speed for the same corridor is assumed to be 10 km/h over the posted speed, which equates to 60 km/h.

3.2 Right-of-Way (ROW)

Based on the Land Parcel Mapping GIS file provided by the City of Brampton, the existing ROW are as follows:

- Kennedy Road to 300 m eastward = 30.0 m
- 300 m east of Kennedy Road to Hansen Road = 32.0 m

3.3 Horizontal Alignment

Although the existing Eastern Avenue corridor from Kennedy Road S to Hansen Road S is a relatively straight alignment, the upstream alignment along Eastern Avenue, west of Kennedy Road S, is slightly skewed. In order to accommodate the existing skewed alignments, an existing 200m radius is filleted between the existing alignments.

Table 3-1: Horizontal Alignment Standards

Parameter	Existing Conditions	Design Standard	Meets or Exceeds Standards
Minimum R	200 m	1290 m	No

3.4 Vertical Alignment

Table 3-2: Vertical Alignment Standards

Design Speed	Existing Conditions	Design Standards	Meets or Exceeds Standards
Crest (K_{min})	1	11	No
Sag (Comfort Control) (K_{min})	2	18	No

3.5 Minimum Stopping Sight Distance

Table 3-3: Stopping Sight Distance Standards

Design Speed	Existing Conditions	Design Standard	Meets or Exceeds Standards
60 km/h	123	85 m	Yes

3.6 Cross Section Elements

3.6.1 Lane Widths and Shoulder

The existing Eastern Avenue typical cross-section reflects a Rural Collector Undivided Road as per TAC 2017 Chapter 4, Figure 4.13.4 as shown in **Figure 3-1**

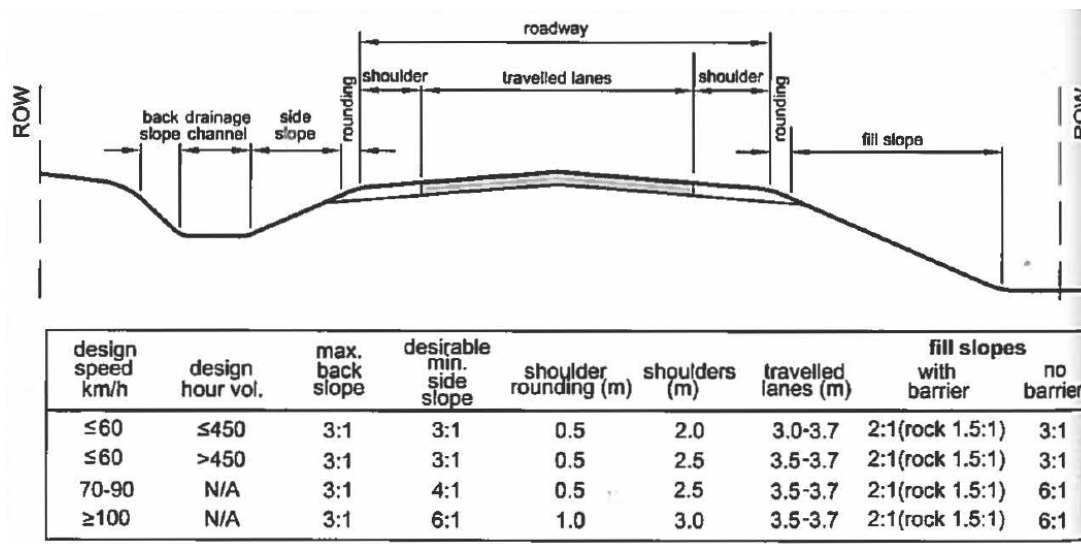


Figure 3-1: Typical Rural Collector Undivided Road Standard

Given the design speed of 60 km/h, Table 3-4 summarizes the cross-section elements of Eastern Avenue compared to the standard cross-section shown above.

Table 3-4: Existing Pavement Width and Shoulder Width

Elements	Existing Conditions	Design Standards	Meets or Exceeds Standards
Pavement Width	WB = 4.73 m (approx.) EB = 4.78 m (approx.)	3.3 m – 3.5 m	Yes
Shoulder (Width + Rounding)	Varies (1.60 m – 2.00 m)	3.0 m (2.5 m Shoulder + 0.5 m Rounding)	No
Back Slope	2.1:1 (approx.)	3:1 (max)	No
Side Slope	1:1 (approx.)	3:1 (min)	Yes

3.6.2 Pavement Crossfall

For resurfacing projects, the design guideline for pavement crossfall with a design speed of 60 km/h is 2.0%. Acceptable limits range from 1.5% to 4.0% as per TAC 2017 Chapter 3, Table 3.5.1.

The existing pavement crossfall along Eastern Avenue between Kennedy Road S and Hansen Road S generally varies between 1.3% to 2.7%. In order to meet or exceed the design standards from TAC 2017, the lower range will need to be increased to a minimum of 1.5%.

3.6.3 Clear Zone

The clear zone is the total width of fixed object-free area measured from the edge of the travel lane. Based on TAC 2017 Chapter 7, Table 7.3.1, the clear zone width is determined by the design speed, the average daily traffic volume (ADT), and fill slopes/cut slopes. In the context of Eastern Avenue, the embankment slope is relatively steep (3:1 or greater), which is deemed non-recoverable if drivers were to traverse onto the embankment and into the toe of the ditch. Since the existing ditches on Eastern Avenue are V-shaped, no clear run-out area is provided for vehicles to stop safely (TAC 2017 Chapter 7, Section 7.4.1.1).

Additionally, cross slopes in these ditches, such as driveway along Eastern Avenue, are replaced with headwalls, which does not meet the recommended cross slope of 6:1 (TAC 2017 Chapter 7, Section 7.4.1.2). Thus, it is unsafe for vehicles that may traverse into the embankment and onto the headwall.

Since the future of Eastern Avenue (and Clark Boulevard extension) will be urbanized with curb and gutter, achieving clear zone standards may not be practical from the perspective of street character and context. In urban environments, where curb is used, the lateral clearance of 0.5m (minimum) should be provided from the face of curb to the hazard in the boulevard (TAC 2017 Chapter 7, Section 7.7.1 – 7.7.2).

3.6.4 Street Lighting

Existing streetlights are located on the south side of Eastern Avenue behind the ditch. As per City of Brampton’s Design Drawing Standard number 210, rural arterial roads require street lighting on one side of the road as a minimum. See **Table 3-5**.

Table 3-5: Existing Lighting Locations

Elements	Existing Conditions	Design Standards	Meets or Exceeds Standards
Light Locations	South Side Only	One Side (Any Side)	Yes

3.7 Intersection Standards

3.7.1 Intersection Angle

The existing intersections at Kennedy Road N and Hansen Road S are approximately 90° to Eastern Avenue, which is ideal for the benefits of 90° angle intersections. These benefits include (as per TAC 2017 Chapter 9, Section 9.7.2):

- Improving driver visibility
- Reducing length of time to complete a crossing maneuver
- Decreasing the severity of collisions

3.7.2 Turning Lanes

The existing Eastern Avenue contains no dedicated storage, parallel, and taper lanes onto Kennedy Road N nor Hansen Road S. Eastern Avenue only has two continuous through lanes from Kennedy Road N and Hansen Road S with no turning restrictions. Storage, parallel, and turning lane requirements will be determined through traffic analysis and preliminary design in the preferred design.

3.7.3 Departure Sight Distance

The departure sight distance was measured from where a vehicle stops 1.5 metres behind the existing back-of-sidewalk to replicate the missing stop bar pavement markings on Eastern Avenue. The distance between any obstructions that may limit the driver's visibility to a certain distance, such as buildings or fences, are compared to the sight distance design standard from TAC 2017 Chapter 9, Section 9.9.2.2 for Case B1 and B2 for a minor road stop control condition at Kennedy Road N and Hansen Road S in **Table 3-6**.

Table 3-6: Departure Sight Distance

Intersecting Roads	Intersection Control Type	Left Turns (m) Case B1		Right Turns (m) Case B2		Meets or Exceeds Standards
		Existing Condition	Design Standard	Existing Condition	Design Standard	
Kennedy Road N	Stop Control	>150	150	>130	130	Yes
Hansen Road S	Stop Control	>150	150	>130	130	Yes

Approach sight distance analysis is not needed at these two intersections as the intersection are controlled by stop signs as per TAC 2017 chapter 9, section 9.9.2.1.

3.7.4 Daylight Triangles

Based on the Land Parcel Mapping GIS file provided by the City of Brampton, the existing daylight triangles are as per **Table 3-7**:

Table 3-7: Existing Daylight Triangle Conditions

Intersection	Existing Conditions	Design Standards	Meets or Exceeds Standards
Kennedy Road N	NE Parcel = 0 m SE Parcel = 0 m	15 m (Minor Collector to Arterial)	NE Parcel = No SE Parcel = No
Hansen Road S	NW Parcel = 15 m SW Parcel = 0 m	7.5 m (Minor Collector to Local)	NW Parcel = Yes SW Parcel = No

3.7.5 Traffic Control

Kennedy Road N and Hansen Road S are both stop-controlled intersections on Eastern Avenue. Further investigation whether both intersections warrant signalized controls shall be determined through traffic analysis documented separately.

3.8 Driveways

The existing layout for driveway accesses are shown in **Figure 3-2**. The spacing between accesses were analyzed based on TAC 2017, Section 3.2.9.8, shown in **Appendix B**. The suggested minimum spacing requirement for driveway spacing for local and collector roads is 3 m for both commercial and industrial land uses. If, however, there is a need to provide parallel parking between driveways along the roadway, a spacing of 6.0 to 7.5 m is suitable.

The general spacing of accesses meet the minimum spacing requirements for the commercial / industrial land use, with the exception of the two accesses shown in red circle in **Figure 3-2**, which are located adjacently. Several accesses along Eastern Avenue present opportunities for consolidation. Consolidation of accesses would reduce conflict points (**Figure 3-3**) which will in turn enhance safety along the corridor.



Figure 3-2 Existing Driveway Access – Eastern Avenue (Source: Google Maps)

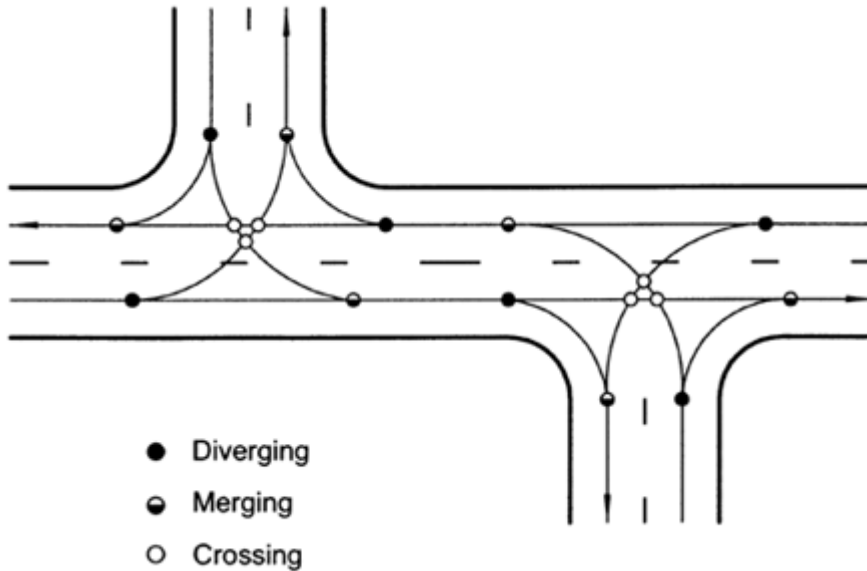


Figure 3-3 Conflict point diagram for two closely spaced t-intersections¹ (Source: FHWA)

Sightlines were also analyzed based on City Standard 245 for daylighting triangles and City By-Law 93-93 – Section 41, shown in **Appendix C**. Accesses along Eastern Ave generally don't have any slight line obstructions from on-coming vehicles, as there are very few signs or road side obstruction along the corridor. Accesses generally have wide radii with no curb lines, which were designed to accommodate commercial vehicles. Thus it was concluded that the intersections within the study area are compliant with the City sightline guidelines.

3.9 Pavement Markings and Signage

3.9.1 Pavement Markings

Existing pavement markings on Eastern Avenue are not visibly delineated. This includes lane lines, stop bars, and pedestrian crossings. Specifically to Eastern Avenue, lane lines should be used where the following conditions exist as per OTM Book 11 page 40:

- At the approaches to intersections with other roads
- At crosswalks

Based on **Figure 3-4** through to **Figure 3-6**, lane lines are not shown under these two conditions.

¹ <https://www.fhwa.dot.gov/publications/research/safety/04091/10.cfm>



Figure 3-4: Kennedy Road and Eastern Avenue (Source: Google Earth, September 2020)



Figure 3-5: Hansen Road and Eastern Avenue (Source: Google Earth, September 2020)



Figure 3-6: Eastern Avenue Looking Eastward (Source: Google Earth, September 2020)

A typical standard for unsignalized intersections is shown **Figure 3-7** as per OTM Book 11, Page 72, Figure 26. At both urban and rural intersections, a stop bar must be shown to indicate the point at which a vehicle must stop in compliance with the STOP sign as shown in **Figure 3-7**.

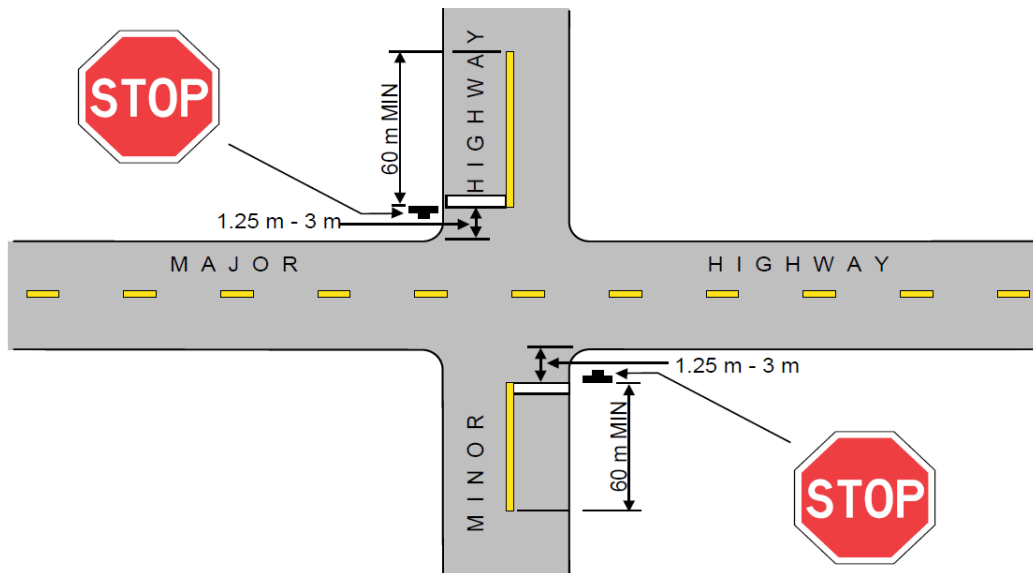
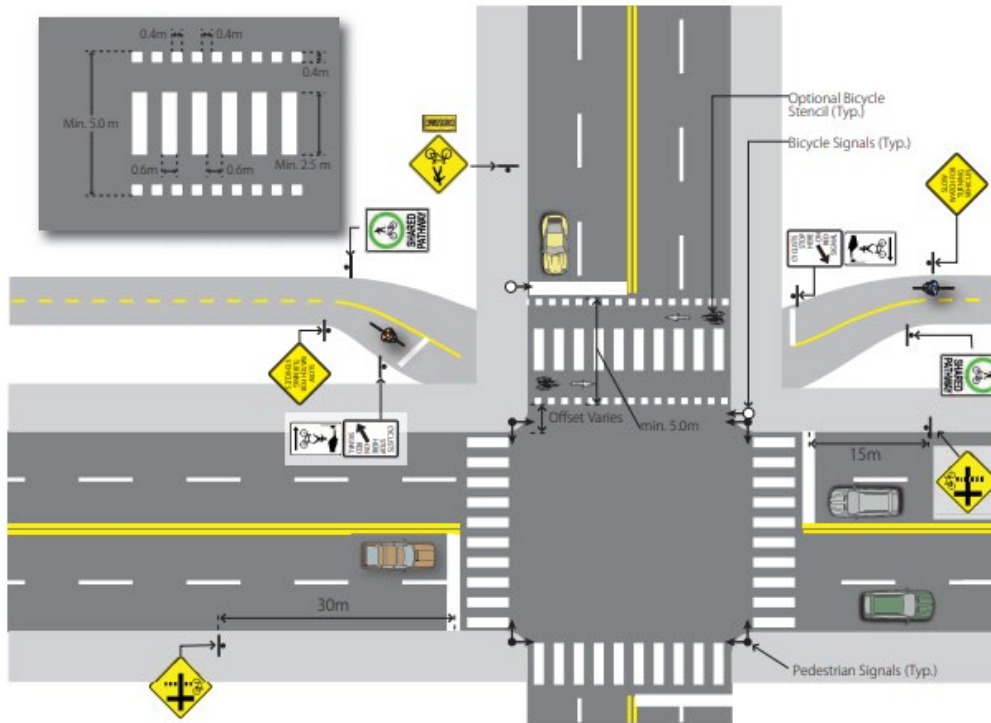


Figure 3-7: Approach to Unsignalized Intersections (Source: OTM Book 11, Page 72, Figure 26)

In addition, both Kennedy Road and Hansen Road have a pedestrian crosswalk, and thus a clear separation between the stop bar and a crosswalk line must be in place per applicable design standards.

To accommodate future pedestrians and cyclists at the intersections of Kennedy Road and Hansen Road, unsignalized and signalized intersections for crossings can consider guidelines for crossrides as listed in OTM Book 18. Examples of unsignalized and signalized intersections can be found in **Figure 3-8** and **Figure 3-9** respectively.



Source: MMM/ALTA, 2013

Figure 3-8: Separate Pedestrian and Cyclist Crossride at Signalized Intersections (OTM Book 18 Figure 4.102)

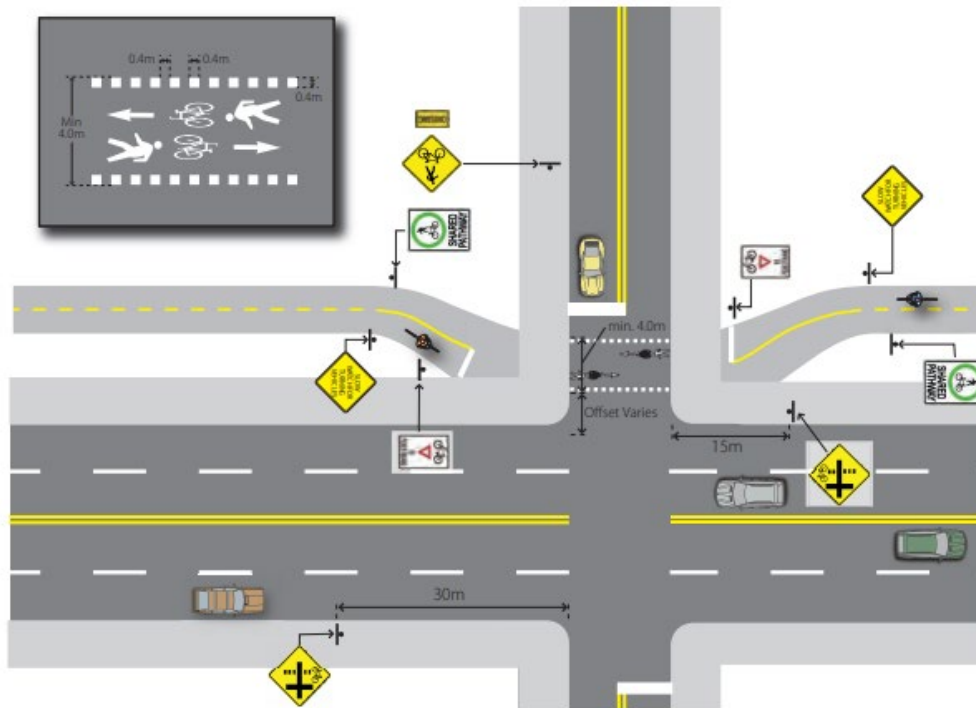


Figure 3-9: Mixed Pedestrian and Cyclist Crossroad at Unsignalized Intersections (OTM Book 18 Figure 4.103)

3.9.2 Signage

In general, existing STOP signs and by-law signs have their own individual sign posts and are mounted on the front-of-ditch embankment. Existing signage were not mounted on existing utility/street light poles because they are located in the back-of-ditch, which would not have been visible to drivers. Some of these signs are slightly slanted and will require re-mounting for better visibility to drivers. Sign offsets, location, and mounting specifications should be in accordance with the Highway Traffic Act's Schedule RRO19190 Regulation 615, and either Region of Peel's Sign Mounting Specifications Standard Drawing 5-3-1 or City of Brampton's Regulatory Sign Standard Drawing 430.

3.10 Pedestrian and Cyclists

As discussed in the Pedestrian Level of Service analysis documented in the Transportation Report, the Eastern Ave corridor currently provides no pedestrian crosswalks. There is currently an established commercial development at 80 Eastern Ave (shown in **Figure 3-10**) with urbanized roadside features (sidewalks of 1.47 m and curbs), however the sidewalks are discontinued beyond the commercial property. Although patrons to this plaza typically arrive by personal vehicle, the future continuity of the sidewalk along the corridor is required for the existing sidewalk to be utilized.

The discontinued sidewalk was compared to City of Brampton's Standard 203 and the results are as follows in **Table 3-8**:



Figure 3-10: Discontinued Sidewalk at 80 Eastern Ave (Source: Google Streetview, September 2020)

Table 3-8: Existing Sidewalk Condition and Standards

Elements	Existing Conditions	Design Standards	Meets or Exceeds Standards
Sidewalk Width	1.48 m	1.8 m	No

No cycling facilities are provided on the Eastern Avenue corridor. If cyclists were to cycle through the corridor, they would have to share the road with the existing traffic, imposing an unsafe environment for cyclists.

3.11 At-Grade CN Rail Crossing

The Eastern Avenue rail crossing between Kennedy Road South and Hansen Road South is an unprotected (without warning systems) at-grade-crossing with a CN Railway Industrial Spur Line. The crossing is located at Mile 0.45 of the Industrial Spur, which branches off the North Main track of the CN Halton Subdivision at Mile 14.10. It is currently a low rail volume, low rail frequency Spur Line off the Halton Subdivision serviced by local work trains during non peak hours. The existing roadway carries 2 lanes of traffic (without a median), gravel shoulders and an existing drainage ditch running beneath the tracks on both north and south boulevards with concrete culverts. North of Eastern Avenue is an existing rail garage where two tracks service the garage and converge into one track just south of Eastern Avenue. The industrial rail track is restricted to a maximum of 10MPH.

The existing crossing is shown in **Figure 3-11**.



Figure 3-11 - Existing Uncontrolled Rail Crossing on Eastern Ave 200m East of Kennedy Rd (Source: Google Streetview, September 2020)

The crossing is without warning systems such as gates and signals. There are faded pavement markings east and west of the crossing along with small rail crossing signage, located immediately east and west of the crossing. There is no rail crossing ahead signage nor advanced pavement markings to denote a rail crossing. There are no sidewalks. Hydro poles and illumination are located on the south boulevard. No-passing markings are not visible to prohibit passing by vehicles approaching the railway crossing.

Thus, the existing at-grade rail crossing pavement marking and signage does not meet standard shown in OTM Book 11 Figure 46, Page 100 in and shown in **Figure 3-12**.

* Same Signs in Opposite Direction

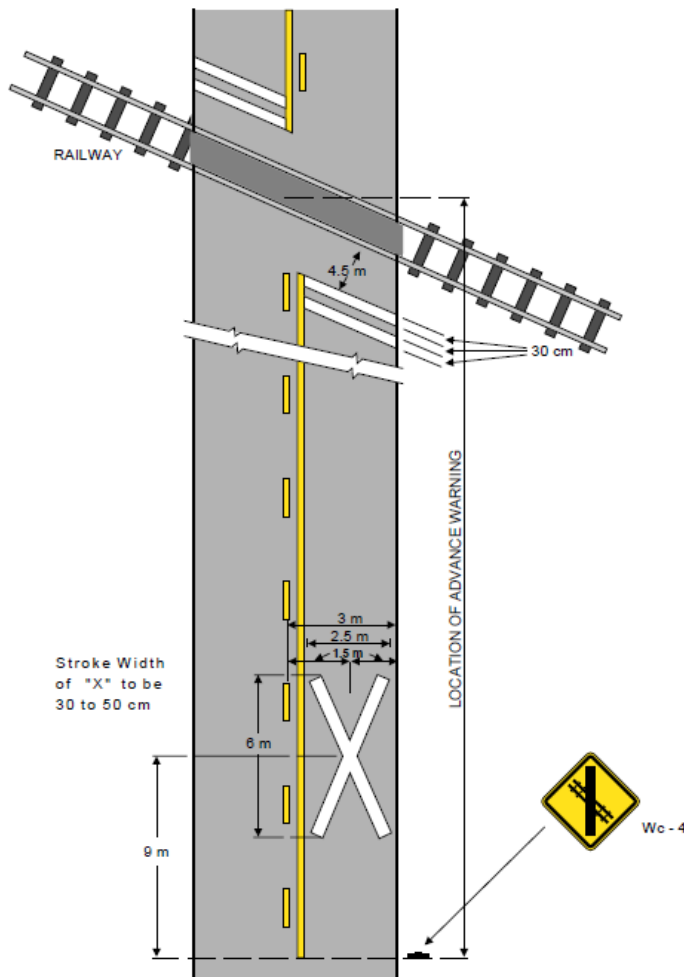


Figure 3-12: At-Grade Rail Crossing Pavement Marking and Signage Standard

The frequency for rail vehicles at this crossing is unclear, however, the need for potential upgrade to traffic control devices should be considered for future alternatives where increased traffic and active road users are expected.

Transport Canada’s guidelines for the minimum railway/ road crossing sightline requirement for grade crossings without automatic warning devices are shown in **Figure 3-13**. The proposed improvements to the Eastern Avenue corridor will consider improvements to the existing crossing. The study will consider pavement markings, signage and if automatic warning devices are required to improve the safety of the crossing to accommodate all travel modes as continuous pedestrian and cyclist facilities are identified as part of the Preferred Solution for the corridor. Recommendations will be based on consideration of current and applicable crossing guidelines and in consultation with the rail authority to address applicable standards.

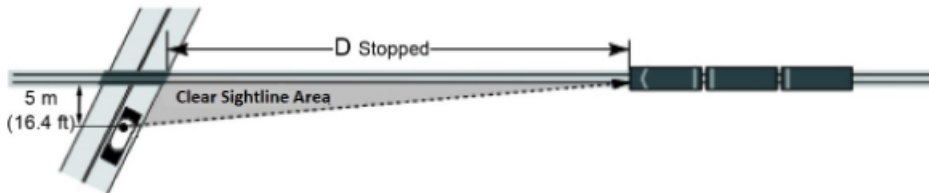
Formula: $D_{SSD} = 0.278 \times V_t \times T_{SSD}(m)$ ** Convert mph -> km/h: mph x 1.6 **

Where :

V_t = railway design speed (km/h)

$T_{SSD} = ((SSD + cd + L) / (0.278 \times V_t))$ Stopping Sight Distance Time

a) Sightlines for users stopped at a grade crossing
(applicable to all quadrants)



b) Sightlines for users approaching a grade crossing
(applicable to all quadrants)

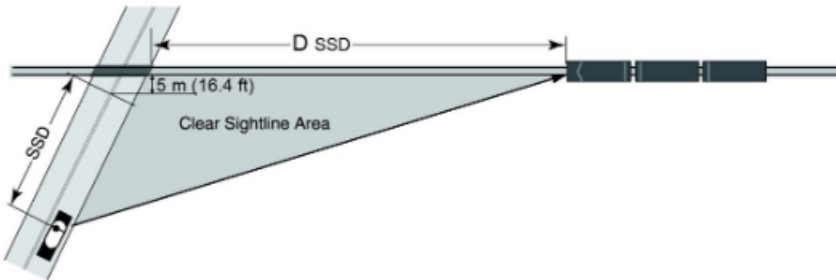


Figure 3-13 - Minimum Sightlines – Grade Crossings (Source: Transport Canada (2019))

3.12 On-street / Illegal Parking

Based on existing industrial land use for the Eastern Avenue corridor, parking along the right of way is unrestricted on the south side but prohibited on the north side. Based on observations, there are many instances where large commercial vehicles occupy the north side of Eastern Avenue, shown in **Figure 3-14** and **Figure 3-15**.



Figure 3-14 Existing Parking and Roadside Obstructions (Source: Google Streetview, 2018)



Figure 3-15 Illegal Parking on North Side of Eastern Avenue (Source: Google Streetview, 2018)

Due to the generally low volume on Eastern Avenue, there is a lack of parking enforcement on Eastern Avenue. Although the illegal parking does not pose a substantial impact to traffic operation, they do significantly hinder sightlines for turning traffic from driveways. When the roadway expansion and potential connection to Clark Boulevard are provided for Eastern Avenue, vehicles are less likely to park along a higher volume corridor. However, enforcement measures to prevent vehicle blockages may be required in the future should this issue persist.



Appendix A – Collision Data

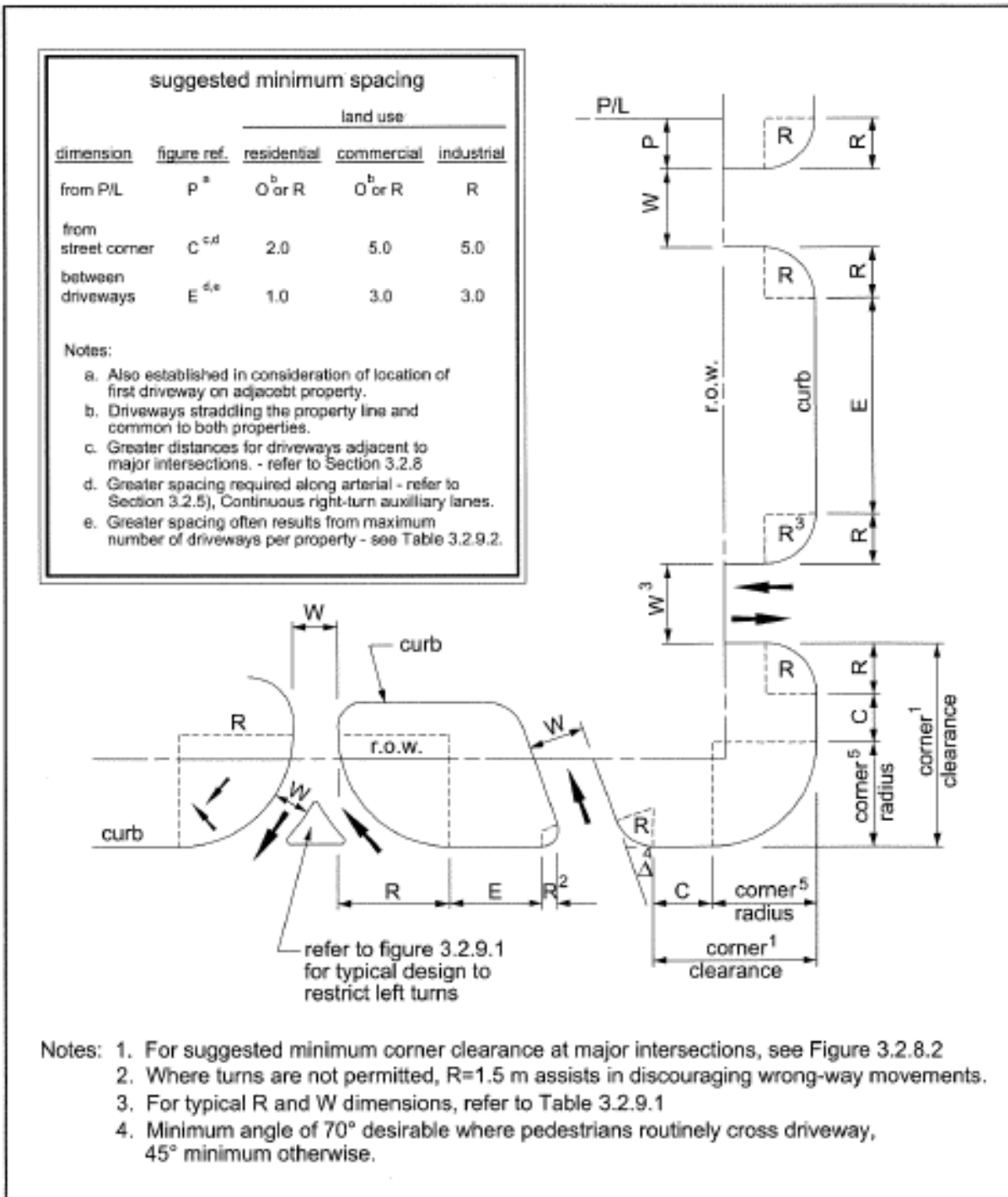
Collisions on Eastern Avenue at Kennedy Road (Source: City of Brampton)

Accident No.	Description	Accident Year	Accident Date	Accident Time	Environment Condition 1	Light	Road 1 Surface Condition	Road 2 Surface Condition	Apparent Driver 1 Action	Apparent Driver 2 Action	Classification Of Accident	Vehicle 1 Initial Direction	Vehicle 2 Initial Direction	Initial Impact Type	Vehicle 1 Manoeuvre	Vehicle 2 Manoeuvre
13559716	EASTERN AV @ KENNEDY RD S	2013	9/26/2013	17:15	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	06 - Improper turn	01 - Driving properly	02 - Non-fatal injury	02 - South	01 - North	05 - Turning movement	04 - Turning left	01 - Going ahead
13123765s	EASTERN AV @ KENNEDY RD S	2013	3/1/2013	17:45	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	01 - Driving properly		03 - P.D. only	04 - West	03 - East	01 - Approaching	10 - Stopped	
140078204	EASTERN AV @ KENNEDY RD S	2014	2/11/2014	16:44	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	08 - Failed to yield right-of-way	01 - Driving properly	03 - P.D. only	01 - North	02 - South	05 - Turning movement	04 - Turning left	01 - Going ahead
150129208	EASTERN AV @ KENNEDY RD S	2015	4/1/2015	18:05	01 - Clear	01 - Daylight	01 - Dry	01 - Dry			03 - P.D. only	04 - West	02 - South	99 - Other		
160335968	EASTERN AV @ KENNEDY RD S	2016	9/6/2016	14:59	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	06 - Improper turn	01 - Driving properly	03 - P.D. only	03 - East	01 - North	02 - Angle	04 - Turning left	04 - Turning left
160212740	EASTERN AV @ KENNEDY RD S	2016	6/4/2016	15:55	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	04 - Speed too fast for condition	01 - Driving properly	03 - P.D. only	01 - North	01 - North	03 - Rear end	01 - Going ahead	10 - Stopped
170351599	EASTERN AV @ KENNEDY RD S	2017	9/19/2017	11:44	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	10 - Lost control	01 - Driving properly	02 - Non-fatal injury	02 - South	02 - South	03 - Rear end	01 - Going ahead	10 - Stopped
170368272	EASTERN AV @ KENNEDY RD S	2017	10/1/2017	20:15	01 - Clear	07 - Dark	01 - Dry	01 - Dry	99 - Other	01 - Driving properly	03 - P.D. only	03 - East	02 - South	02 - Angle	04 - Turning left	01 - Going ahead
170477875	EASTERN AV @ KENNEDY RD S	2017	12/22/2017	15:41	03 - Snow	01 - Daylight	02 - Wet	02 - Wet	01 - Driving properly		02 - Non-fatal injury	02 - South		07 - SMV other	99 - Other	
170427062	EASTERN AV @ KENNEDY RD S	2017	11/14/2017	17:15	01 - Clear	05 - Dusk	01 - Dry	01 - Dry	12 - Improper lane change	01 - Driving properly	03 - P.D. only	01 - North	01 - North	04 - Sideswipe	07 - Changing lanes	01 - Going ahead
170475440	EASTERN AV @ KENNEDY RD S	2017	12/20/2017	17:45	01 - Clear	08 - Dark, artificial	01 - Dry	01 - Dry	01 - Driving properly	01 - Driving properly	03 - P.D. only	02 - South	04 - West	02 - Angle	01 - Going ahead	01 - Going ahead
170029172	EASTERN AV @ KENNEDY RD S	2017	1/23/2017	7:24	07 - Fog, mist, smoke, dust	03 - Dawn	02 - Wet	02 - Wet	06 - Improper turn	01 - Driving properly	02 - Non-fatal injury	03 - East	01 - North	02 - Angle	04 - Turning left	01 - Going ahead
180064357	EASTERN AV @ KENNEDY RD S	2018	2/18/2018	8:38	01 - Clear	01 - Daylight	01 - Dry		01 - Driving properly	01 - Driving properly	03 - P.D. only	02 - South	02 - South	04 - Sideswipe	01 - Going ahead	01 - Going ahead
180150572	EASTERN AV @ KENNEDY RD S	2018	4/23/2018	15:37	01 - Clear	01 - Daylight	01 - Dry	01 - Dry	06 - Improper turn	01 - Driving properly	03 - P.D. only	04 - West	02 - South	02 - Angle	04 - Turning left	01 - Going ahead
TOTAL COLLISION:14																

Table 4 Collisions on Eastern Ave (Source: City of Brampton)

Location	Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
Eastern Avenue between Kennedy Road and Hansen Road	7/11/2013	2013	18:40	01 - Clear	03 - P.D. only	01 - Approaching
Eastern Avenue at Hansen	5/22/2017	2017	7:00	01 - Clear	03 - P.D. only	07 - SMV other

Appendix B – TAC Driveway Spacing Guidelines – Locals and Collectors



Source: TAC Geometric Design Guide for Canadian Roads p.3.2.9.82.

Appendix C

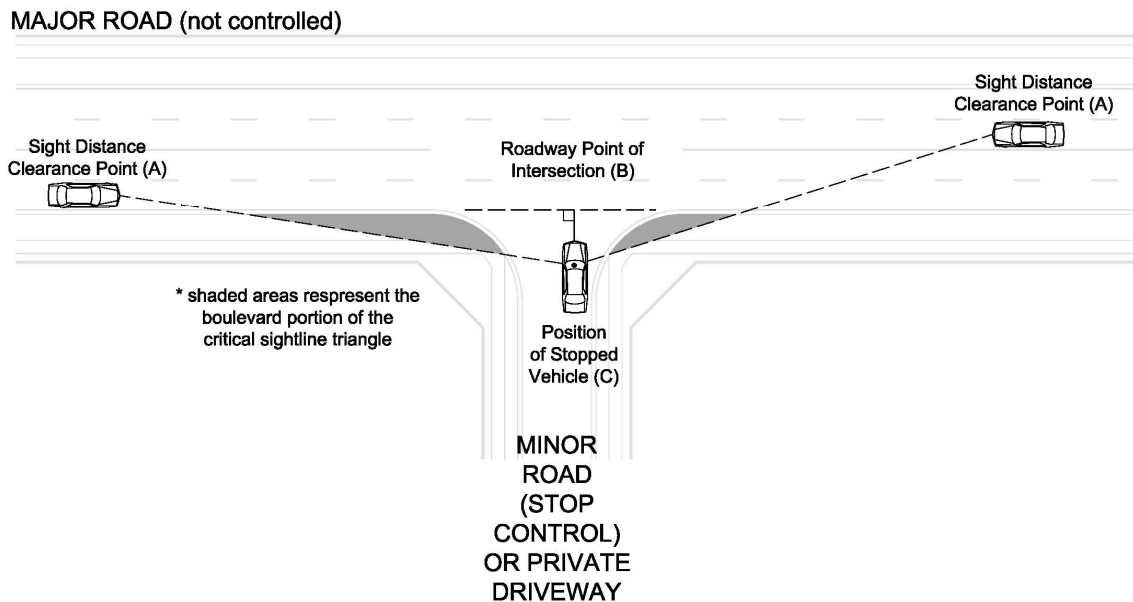
BY-LAW NO. 93-93

SCHEDULE XLI

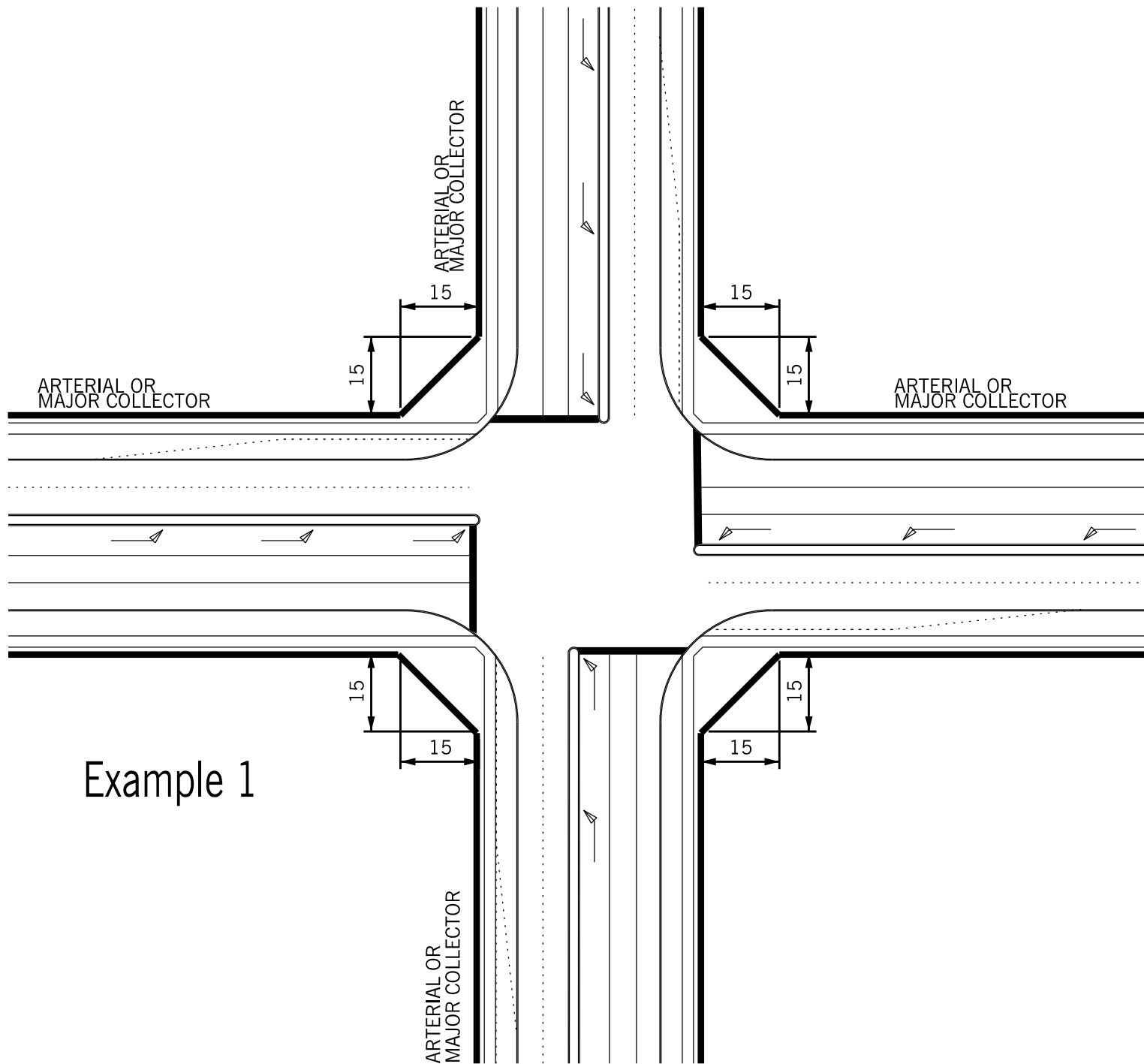
INTERSECTION SIGHTLINE TRIANGLE

Revision/Printing Date: 2020/10/23

1. The following diagram illustrates the intersection sightline triangle.



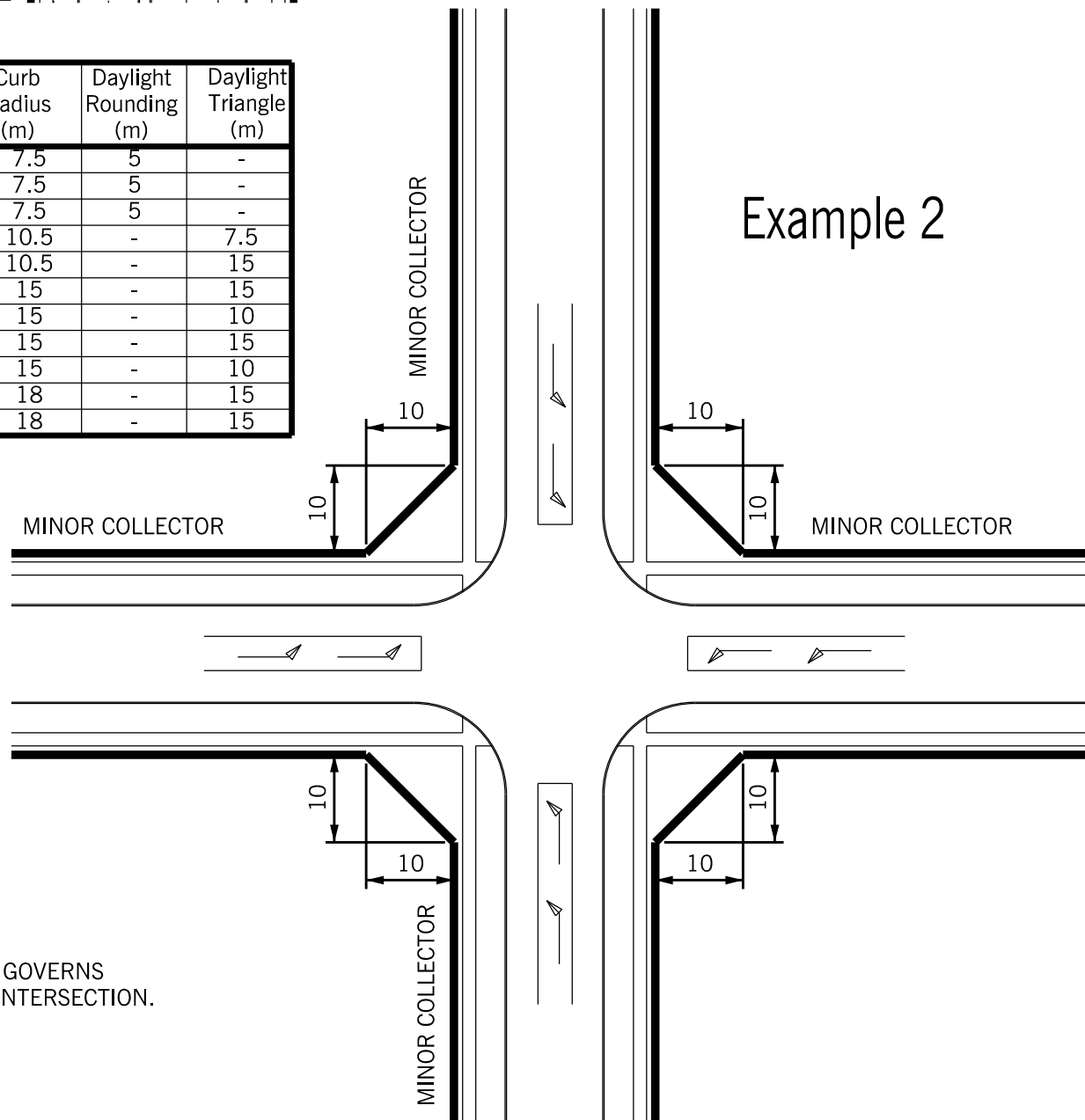
Points of the Sight Triangle	Description	
Site Distance Clearance Points (A)	40 to 50 km/hour Major Road	90 metres
	60 to 70 km /hour Major Road	120 metres
Roadway Point of Intersection (B)	Point where the driver's position of the approach vehicle on the minor road intersects the edge of the outside travel lane of the major road.	
Position of Stopped Vehicle (C)	The driver's position of a vehicle stopped on the minor road. This point is set 4.5 metres back from the Roadway Point of Intersection (B).	



Example 1

Intersection Treatment Table

Street to Street	Curb Radius (m)	Daylight Rounding (m)	Daylight Triangle (m)
Laneway to Local	7.5	5	-
Minor Local to Minor Local	7.5	5	-
Local to Local	7.5	5	-
Minor Local/Local to Minor Collector	10.5	-	7.5
Minor Local/Local to Major Collector	10.5	-	15
Minor Local/Local to Arterial	15	-	15
Minor Collector to Minor Collector	15	-	10
Minor/Major Collector to Major Collector	15	-	15
Industrial Street to Industrial Street	15	-	10
Minor/Major/Industrial Collector to Arterial	18	-	15
Arterial to Arterial	18	-	15



Example 2

NOTES:

1. ALL DIMENSIONS IN METERS.
2. THE ROAD WITH THE LARGE RIGHT OF WAY GOVERNS THE DAYLIGHTING REQUIREMENTS AT THE INTERSECTION.