

TECHNICAL MEMORANDUM

City of Brampton

Denison Avenue Extension Safety Review



December 2019

ASSOCIATED ENGINEERING QUALITY MANAGEMENT SIGN-OFF
Signature
Date

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TECHNICAL MEMORANDUM

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TECHNICAL MEMORANDUM

Safety Review

Issued: May 2019
Previous Issue: April 2019 (Draft)

1 Introduction

The City of Brampton retained Associated Engineering (AE) to undertake a Municipal Class Environmental Assessment (EA) Study for the extension of Denison Avenue from Park Street to Mill Street. The City of Brampton's 2015 Master Plan Update has identified the need for the extension of the road by 2021. The Class EA Study will evaluate traffic and connectivity needs, identify alternative road alignments, safety and operational improvements, land use implications, active transportation considerations, natural environment impacts and mitigation measures. The study is being carried out in accordance with the planning and design process for Schedule 'B' projects as outlined in the Municipal Class Environmental Assessment (October 2000, as amended in 2007, 2011 and 2015), which is approved under the Ontario Environmental Assessment Act.

This safety memorandum has been prepared as part of the EA study and is intended to provide the results of the road safety assessment and provide an analysis of the future conditions with and without the proposed extension of Denison Avenue.

1.1 STUDY AREA

The City identified an extension of Denison Avenue from Park Street to Mill Street in its 2015 Transportation Master Plan to improve connectivity and capacity in the local transportation network. The objective of this study is to evaluate existing conditions from a safety perspective and identify potential improvements as part of the proposed extension.

The location of the proposed extension of Denison Avenue is shown in **Figure 1-1**. However, the safety review included an analysis for the surrounding intersections, as shown in **Figure 1-2**, which included the following:

1. West Street @ Denison Avenue (existing 4-leg intersection – two-way stop);
2. Park Street @ Denison Avenue (existing 3-leg intersection – stop control at Park St.);
3. Park Street @ Nelson Street W (existing 4-leg intersection – two-way stop);
4. Mill Street N @ Nelson Street W (existing 4-leg intersection – four-way stop); and,
5. Mill Street N @ Railroad Street (existing 4-leg intersection – two-way stop).

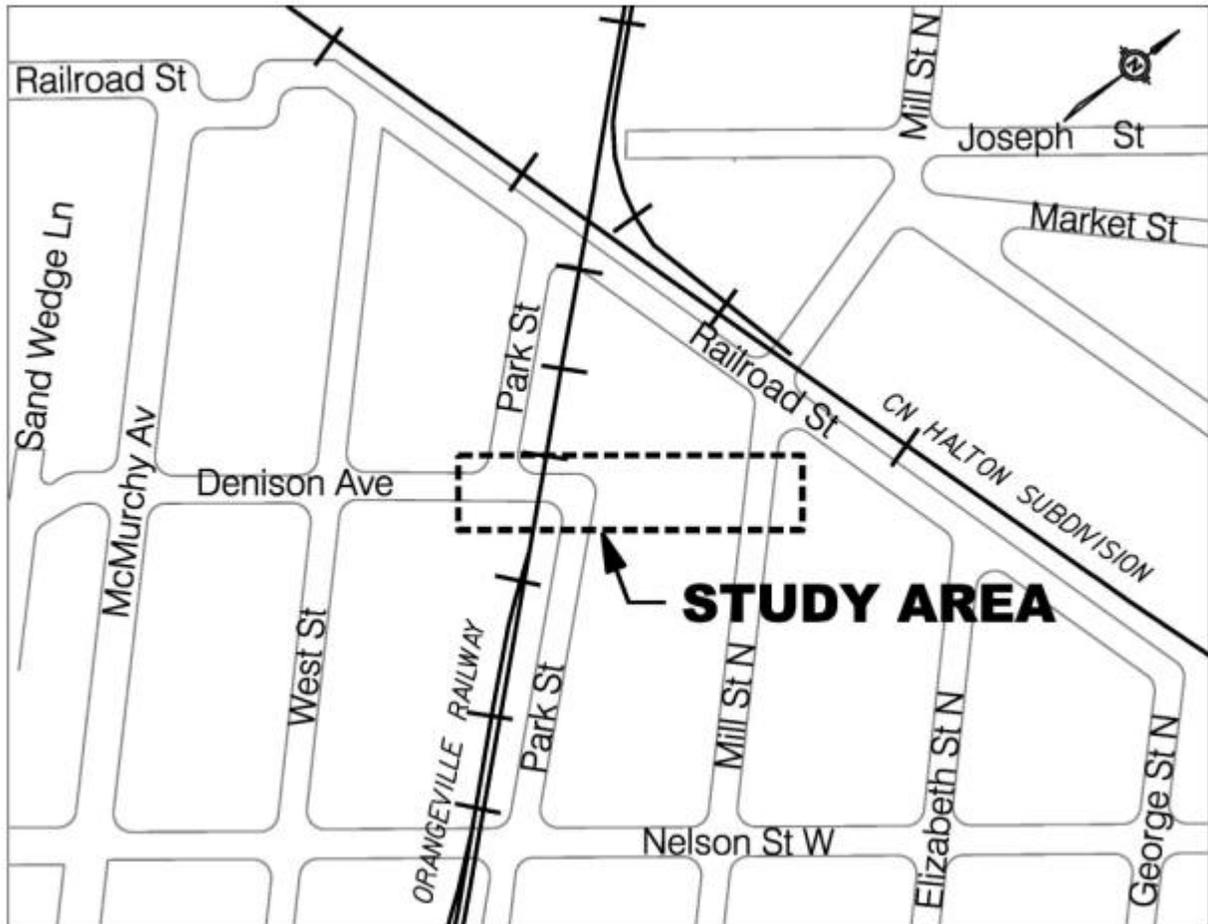


Figure 1-1
Study Area Defined in the RFP for the Denison Avenue Extension

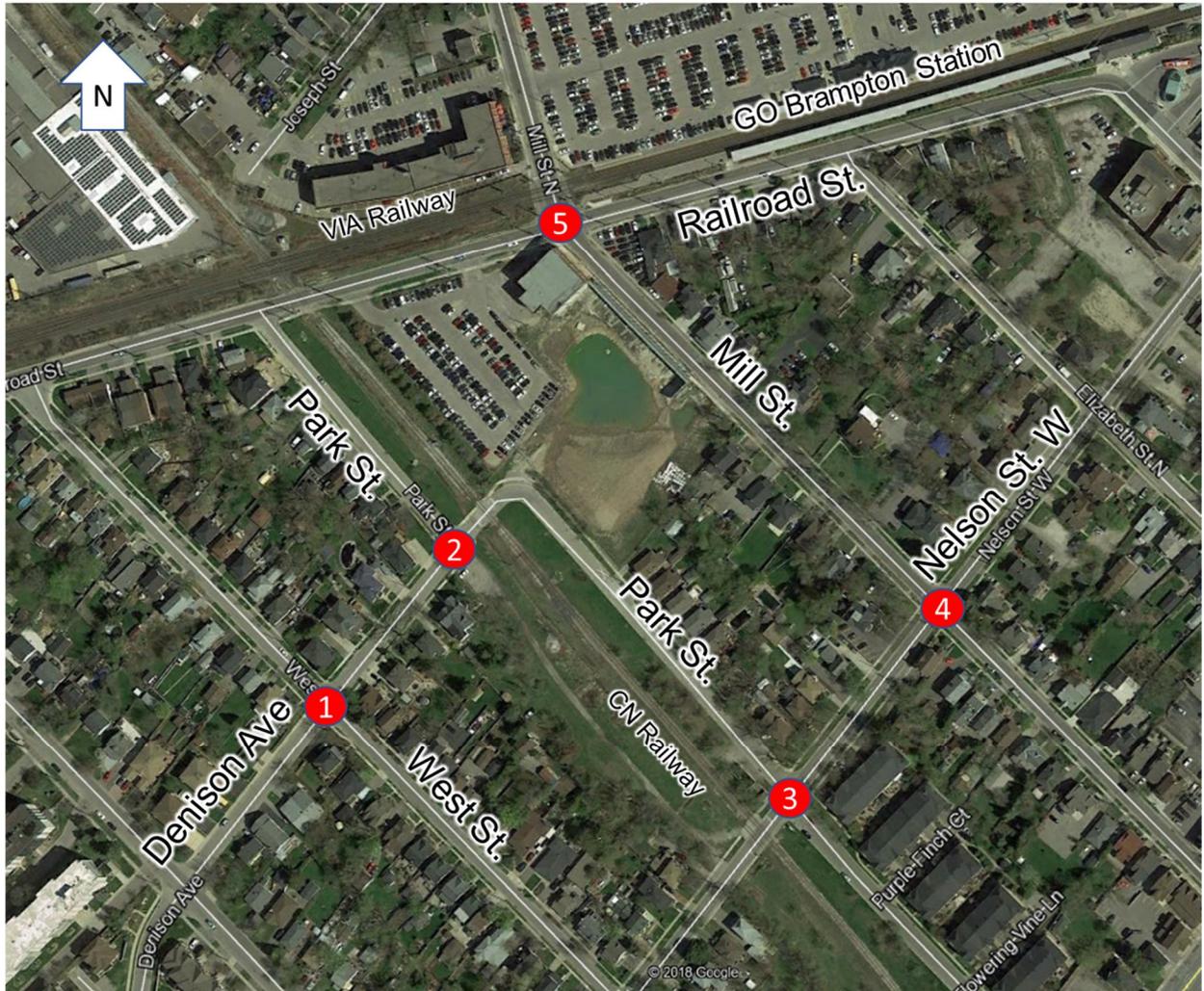


Figure 1-2
Study Intersections

1.2 METHODOLOGY

A road safety review was conducted on Denison Avenue and existing intersections within the study area using the Safe System approach to identify all road safety issues and any opportunities that may improve safety. This included a review of geometry, sightlines, conformance to engineering standards, pavement markings and signage. The project team also assessed the safety of the existing railway crossing, geometry, sightlines and its proximity to nearby intersections in accordance with Transport Canada's *Grade Crossing Standards*¹.

¹ The latest version of the *Grade Crossing Standards* was last updated on March 1st, 2019 and is available at the following link - <http://www.tc.gc.ca/eng/railsafety/grade-crossings-standards.htm>.

Each safety issue identified will be described in addition to its potential collision type, severity along with the improvement recommendations to mitigate the safety issue, if applicable. This will be considered as an in-service safety review and will inform the next tasks for identifying the required improvements.

1.3 DESCRIPTION OF KEY FEATURES

The following presents a description of key features in the study area.

Study Intersections

West Street at Denison Avenue is a two-way stop-controlled intersection, with the stop control on Denison Avenue. Park Street at Nelson Street is a two-way stop-controlled intersection with the stop control on Park Street. Mill Street at Nelson Street is a four-way stop controlled intersection. Park Street at Denison Avenue is a stop controlled three-legged intersection, with the stop control on Park Street, and a set of train tracks directly to the northeast. Mill Street at Railroad Street is a two-way stop-controlled intersection (Mill Street operates free flow with Railroad Street having stop controls), with two sets of train tracks crossing the road on the north leg of Mill Street. Railroad Street at Park Street is a stop controlled three-legged intersection, with the stop control on Park Street. All roads have assumed statutory speed limits of 50 km/h.

Brampton GO Station and Orange-Brampton Railway

To the northeast of the site is the Brampton GO station, with eastbound trains departing from 5:45 AM to 4:01 PM, and westbound trains arriving from 9:38 AM to 7:40 PM during the week. There is also frequent GO bus service provided at the terminal east of the study area at 8 Nelson Street. The terminal provides off street bus connections. There are two parking lots servicing the GO station; the main lot which provides two accesses on Church Street, and one on Mill Street (north of the tracks). The second lot is on Railroad Street, with two accesses leading onto Railroad Street (south of the tracks). GO and CN share use of the tracks running east-west, and Orangeville-Brampton Railway (operated by Cando Rail Services) operates the north-south rail line with a grade crossing on Denison Avenue. Orangeville-Brampton Railway (OBRY) operates the tracks that cross over Park Street and Railroad Street.

2 Safety Assessment

The following section presents the results of the safety assessment of the study area, specifically focusing on the study intersections and the grade crossing on Park Street.

2.1 COLLISION DATA

Collision data from a five-year period (January 2013 – December 2018) was reviewed as part of this assessment. As seen in **Figure 2-1** and summarized in **Table 2-1** below. None of the collisions involved pedestrians or cyclists, nor did any involve trains. **Appendix A** contains further details on the collision data provided by the City.

Table 2-1
Summary of Collision Data

Intersection/Road	Frequency	Classification	Impact Type
Mill Street/Railroad Street	6	<ul style="list-style-type: none"> 4 PDO 2 Non-fatal injury 	<ul style="list-style-type: none"> 5 Angle 1 Turning Movement
Park Street/Nelson Street	5	<ul style="list-style-type: none"> 4 PDO 1 Non-fatal injury 	<ul style="list-style-type: none"> 4 Angle 1 Sideswipe
Mill Street/Nelson Street	4	<ul style="list-style-type: none"> 4 PDO 	<ul style="list-style-type: none"> 2 Angle 1 Turning Movement 1 SMV Other
Park Street/Railroad Street	1	<ul style="list-style-type: none"> 1 PDO 	<ul style="list-style-type: none"> SMV Other
West Street	1	<ul style="list-style-type: none"> 1 PDO 	<ul style="list-style-type: none"> Rear End
Park Street	1	<ul style="list-style-type: none"> 1 PDO 	<ul style="list-style-type: none"> SMV Other
Mill Street	1	<ul style="list-style-type: none"> 1 PDO 	<ul style="list-style-type: none"> Rear End



Figure 2-1
Collisions in Study Area (2013-2018)

2.2 TRAIN DATA

GO train service on the Brampton Line impacts traffic at the intersection of Mill Street and Railroad Street. The first eastbound GO train departs the Brampton GO station at 5:45 AM, with trains departing approximately every 20 minutes until 8:25 AM, when service becomes hourly. Westbound trips departing from Union Station in Toronto begin at 9:38 AM with hourly service until 4:24 PM when trains arrive approximately every 20 minutes, and the last train arriving at 7:40 PM. The trains that detrain between 5 PM – 6 PM result in the largest generators of vehicle trips, pedestrians, and bus connections. CN owns the east-west tracks which GO Transit operates on, and CN does operate freight trains through the area

The following information was provided by City of Orangeville staff, which operate the Orangeville-Brampton Railway (OBRY). OBRY operates the tracks that cross over Park Street, Railroad Street, and the CN/GO tracks in a north-south direction. There is an average of 4 – 5 one-way train trips per day (typically Tuesdays and Fridays) between 7:00 AM and 11:00 PM, with no traffic scheduled between 11:00 PM and 7:00 AM on the east-west CN tracks. Due to testing and scheduling issues, overnight trips do occur, but they are infrequent. Service could potentially expand to 5 – 6 days per week as service on the OBRY Line as efforts are currently underway to expand service on that track. There are typically 8 – 12 cars per locomotive, and the maximum speed through the corridor is 25 mph (approximately 40 km/h).

Trains are required under the *Railway Safety Act* of 1988 to whistle at all public crossings and those areas along the track where vehicles and pedestrians cross. Trains must begin sounding its whistle a quarter mile from the crossing and repeat whistling until the train is on the crossing. Train crews also sound the whistle if their view is restricted or they perceive a danger, such as someone walking on the track. These rules apply 24 hours a day and whistles must be sounded even if a crossing has lights, bells and crossing gates. There are no immediate plans to upgrade any of the tracks in the area. Email correspondence from City of Orangeville relating to this crossing is provided as **Appendix B**.

2.3 45 RAILROAD STREET DEVELOPMENT

45 Railroad Street is a mixed use commercial residential complex currently under development by Preston Group. There are currently two towers (Towers 1 and 2) planned with a day nursery on the ground floor of Tower 1 with the rest being rental apartment units (remainder of Tower 1 and Tower 2). During Phase 1, the entrance to the property will be off Railroad Street, between the east access to the existing overflow GO parking lot and Mill Street. Phase 2 would see the addition of an access onto Park Street, southeast of the 90-degree horizontal curve in the road abutting the property. Phase 2 would also have the addition of an access to the GO parking lot via Park Street. An excerpt of the site plan is provided in **Figure 2-2**.

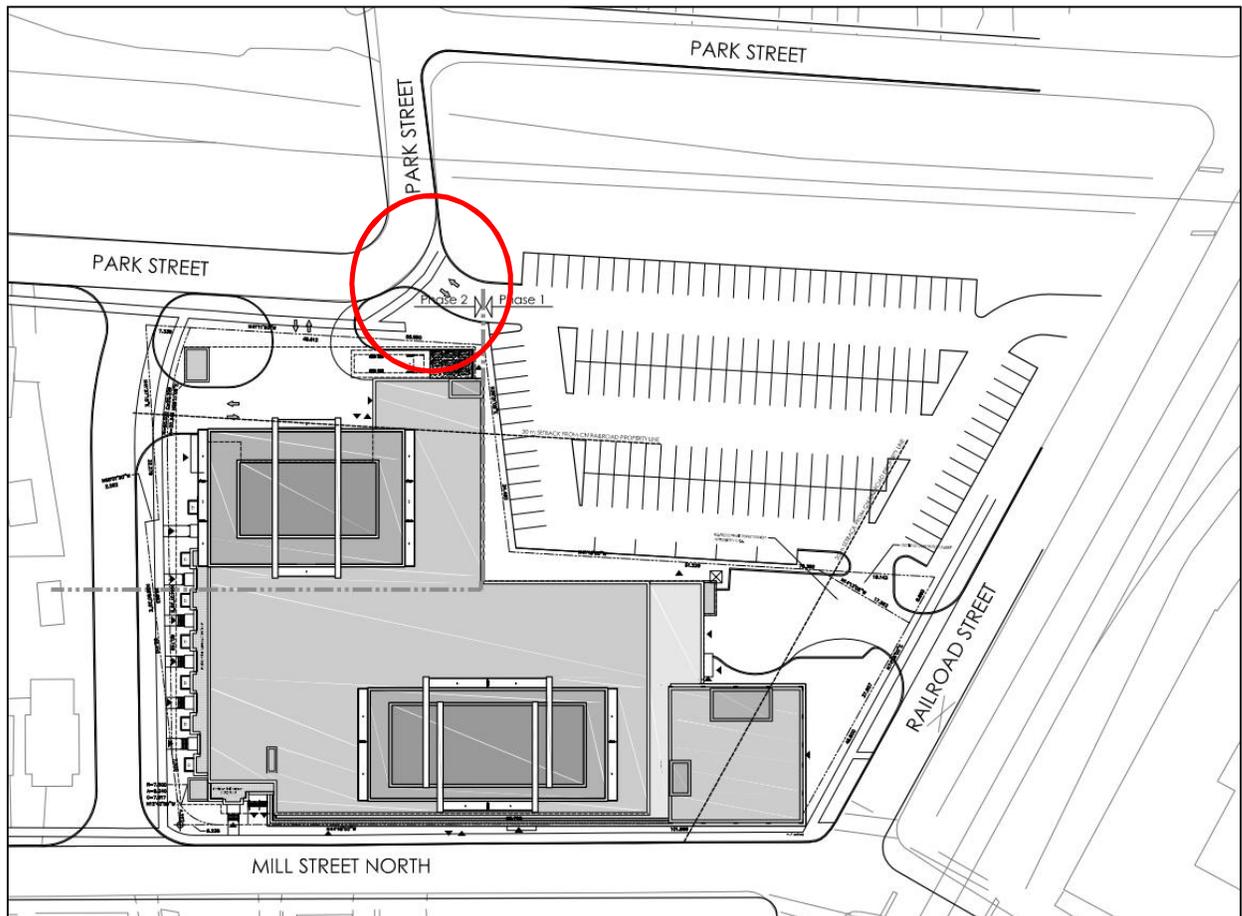


Figure 2-2
Site plan for 45 Railroad Street Development (areas of safety concern circled)

Areas of safety concern are highlighted in **Figure 2-2**. Placement of an access to the GO parking lot within the horizontal curve is considered problematic. According to the Transportation Association of Canada's (TAC) *Geometric Design Guide for Canadian Roads – Section 8.4.1*, 'accesses on horizontal curves are undesirable and should be avoided whenever possible'. The TAC Guide recommends that accesses be placed at least 150 metres from the end of a horizontal curve. Moreover, accesses on horizontal curve will have issues with decreased visibility, increased conflict potential for vehicles crossing the major roadway and pavement widening requirements through the horizontal curve. These safety concerns are somewhat mitigated given that the access is on the outside of the horizontal curve, offering adequate sightlines along both Park Street to the south and Denison Avenue to the west, along with the relatively low volume of traffic on these two roadways. Discussion on the proximity of the Metrolinx access on Park Street to the OBRY grade crossing is discussed in **Section 2.5**.

2.1 FIELD INVESTIGATION

On February 4th, 2019, a field investigation was completed to assess the current level of safety at the study intersections and the associated road sections, with an emphasis on the OBRY grade crossing and Denison Avenue between West Street and Park Street and Park Street between Denison Avenue and Nelson Street. The following was noted:

Sidewalk width and condition

Sidewalk widths on Denison Avenue between West Street and Park Street were noted as in the range of 1.20 – 1.22 metres (both sides). Sidewalk widths on Park Street between Denison Avenue and Nelson Street (east side only) were noted to be adequate (1.50 metres). The sidewalk is heaving on the southwest corner of Denison Avenue and Park Street

Mitigating Measure: Short term – Repair sidewalk slab on southwest corner of Denison Avenue and Park Street
Long term – Replace existing 1.2 metre sidewalk on Denison Avenue with 1.5 metre sidewalk as part of future reconstruction project

Fixed objects within clear zone

Throughout the study area, fixed objects (trees/utility poles), are noted in close proximity to the roadway as outlined in **Table 2-2** and **Table 2-3**. According to the 2017 Transportation Association of Canada's *Geometric Design Guide for Canadian Roads*, the clear zone design domain is intended for use on rural highways, urban and rural freeways and urban expressways, where speeds are generally higher (greater than 70 km/h) and vehicles are operating under free flow conditions. In an urban context, establishing a clear zone on low speed urban roadways is not practical and sometimes not desirable. This is due to the typical conditions along urban streets with lower target operating speeds, denser development, limited right of way, closely spaced intersections, and multimodal street users. However, guidance in the *Geometric Design Guide for Canadian Road* further indicates that a lateral offset of 1.2 to 1.8 metres (to utilities/trees, beyond a curb) is desirable to mitigate risk associated with loss of control collisions in urban areas².

² 2017 Transportation Association of Canada's *Geometric Design Guide for Canadian Roads* – Section 7.7.2

**Table 2-2
Fixed Object Hazards on Park Street between Denison Avenue and Nelson Street**

Direction	Fixed Object	Offset (m)	Reference Location
NB	HLP	1.74	Beginning of radius on Park Street onto Denison Avenue
	HLP	1.53	In front of #34 Park Street
	HP	1.50	In front of #28 Park Street
	HLP	1.25	In front of #26 Park Street
	HP	1.18	30m south from pole in front of #26 Denison Avenue

**Table 2-3
Fixed Object Hazards on Denison Avenue between Park Street and West Street**

Direction	Fixed Object	Offset (m)	Reference Location
WB	LP	1.74	In front of #2 Denison Avenue
	Tree	1.53	In front of #4 Denison Avenue
	HLP	1.50	In front of #6 Denison Avenue
	Tree	1.25	In front of #6 Denison Avenue
	HLP	1.18	NE corner of West St and Denison Avenue
EB	Tree	0.94	SW corner of Park St and Denison Avenue

Mitigating Measure: Long term - As part of future reconstruction, review opportunities to remove fixed objects located within 1.8 metres of the travel lane.

Denison Avenue and West Street

Denison Avenue at West Street is a four-legged intersection, with stop control on Denison Avenue. Sightlines were noted as being adequate at the stop signs and the approaches to the intersection. The stop signs are clearly visible and are in accordance with *Ontario Traffic Manual Book 5: Regulatory Signs*. No pavement markings (stop bars) are provided. Stop bars, if provided, would reinforce the need to stop. As noted earlier, no collisions occurred at this intersection.

Mitigating Measure: Short term - Install stop bars on Denison Avenue approaches to reinforce the need to stop.

Denison Avenue and Park Street

Denison Avenue at Park Street is a three-legged intersection, with stop control on Park Street (north approach). The 'fourth' leg is a driveway to a multi-unit dwelling on the south side of Denison Avenue. Sightlines were noted as being adequate at the stop sign and at the north and south approach to the intersection. The stop sign is clearly visible and are in accordance with *Ontario Traffic Manual Book 5: Regulatory Signs*. No pavement markings (stop bars) are provided on the Park Street approach. Stop bars, if provided, would reinforce the need to stop. As noted earlier, no collisions occurred at this intersection. The OBRY grade crossing is discussed later in this report.

Mitigating Measure: Short term - Install stop bars on Park Street approaches to reinforce the need to stop.

Park Street and Nelson Street

Park Street at Nelson Street is a four-legged intersection, with stop control on Park Street. Sightlines are adequate on the south, east and west approaches, however on the north approach (Park Street), sightlines to the west are limited (at the stop bar) due to a building (Peel Ice and Fuel) on the northwest corner of the intersection. Southbound drivers wishing to proceed into the intersection do however have a clear line of sight if they pull up to the intersection. The stop signs are clearly visible and are in accordance with *Ontario Traffic Manual Book 5: Regulatory Signs*. No pavement markings (stop bars) are provided on the Park Street approach. Stop bars, if provided, would reinforce the need to stop. Directly to the west of the intersection is the OBRY line that crosses Park Street to the north. This crossing has flashing lights and bells that are visible an adequate distance upstream of the intersection.

This intersection experienced four 'angle' collisions, with the fifth collision noted as a 'sideswipe'. One of the angle collisions resulted in a non-fatal injury. The angle collisions may be occurring due to the sight restriction on the northwest corner of the intersection (drivers on the north approach failing to see approaching vehicles on the west approach).

Mitigating Measure: Short term - Install stop bars on Park Street approaches to reinforce the need to stop.

Park Street and Railroad Street

Park Street at Railroad Street is a three-legged intersection with stop control on Park Street. Sightlines were noted as being adequate at the stop sign and the south approach to the intersection. Park Street is skewed in relationship to Railroad Street, somewhat increasing the functional area of the intersection, however, very little traffic was observed using this intersection. The stop sign is clearly visible and its placement is in accordance with *Ontario Traffic Manual Book 5: Regulatory Signs*. No pavement markings (stop bars) are provided. Stop bars, if provided, would reinforce the need to stop. The OBRY tracks cross Railroad Street directly to the east of the intersection.

Mitigating Measure: Install stop bars on Park Street approach to reinforce the need to stop.

Mill Street and Nelson Street

Denison Avenue at West Street is a four-legged intersection, with all-way Stop control. Traffic flow is balanced on all four approaches. Sightlines were noted as being adequate on the approaches to the intersection. The stop signs are clearly visible and are in accordance with *Ontario Traffic Manual Book 5: Regulatory Signs*. Stop bars and crosswalks are provided at the intersection. As noted earlier, four collisions occurred at this intersection, however they were all property damage only. No potential safety issues were identified.

Mill Street and Railroad Street

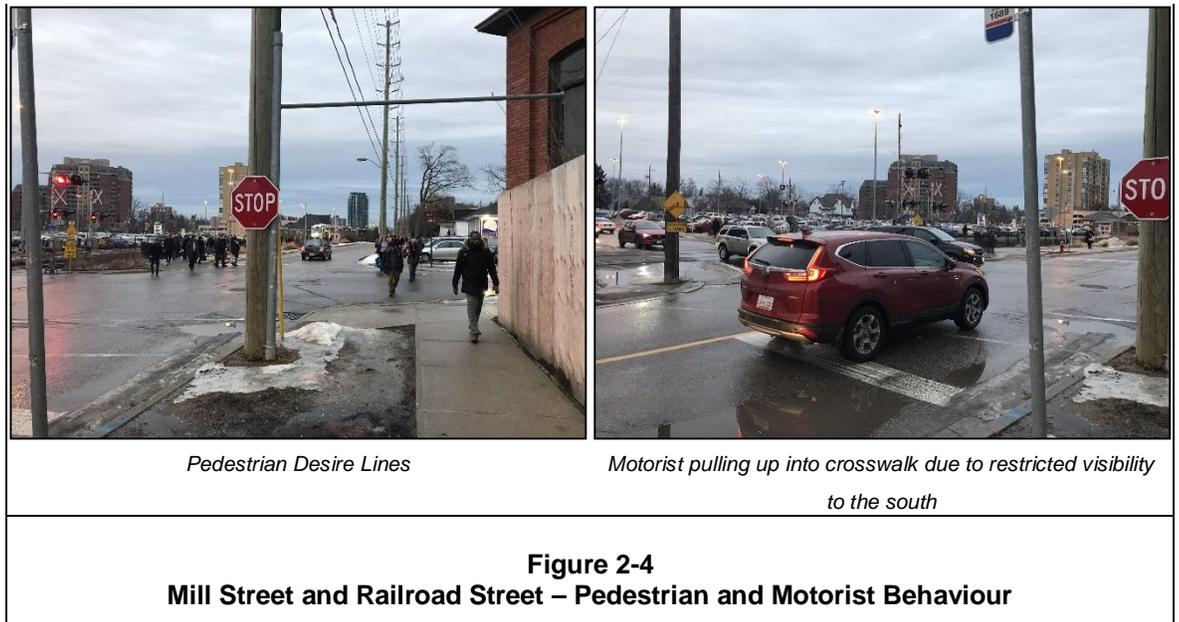
Mill Street at Railroad Street is a unique four-legged intersection, with stop control on Railroad Street. Views of the intersection are shown in **Figure 2-3**. Directly to the north is a set of double train tracks, operated by GO Transit and CN. Visibility on the northbound and eastbound approaches is limited due to the building on the southwest corner of the intersection. Drivers were observed creeping up past the stop bar to gain adequate visibility of northbound/southbound traffic. A review of the collision history suggests that the sightlines may be contributing to a pattern of angle collisions/turning movement collisions at the intersection. Six collisions were noted at this intersection, all were noted as 'angle' or 'turning movement'.



When a train arrives at the Brampton GO station, the train stops at the platform east of Mill Street. The gate at the crossing on Mill Street drops and remains down for approximately 2 minutes. This causes significant vehicle queues to form on all four approaches. The gates are raised for a short amount of time while passengers disembark, then are lowered when the train is ready to depart the station. At this point, commuters have walked to their vehicles and are attempting to leave the main lot via one of the three exits (one on Mill Street, the other two on Church Street, or from the two exits from the overflow parking lot on Railroad Street). Once the train has left, the gates are raised and traffic clears the area after a few minutes.

Traffic movements can be compounded by the significant number of pedestrians, either walking to the overflow lot, one of the two bus stops at Mill Street and Railroad Street, or walking along Mill Street and Railroad Street. The free flow operation on Mill Street makes eastbound and westbound movements at this intersection difficult during the period immediately following the train's departure. During the site visit, many pedestrians were noted as crossing the road in area where no crosswalks are provided, and drivers were

noted turning with obstructed views. Issues with pedestrian and motorist behaviour are shown in **Figure 2-4**.



Mitigating Measure:

To address the visibility issue, the City of Brampton may wish to consider eliminating the pedestrian walkway and crosswalk on the west approach to the intersection in combination with shifting the stop bar closer to the intersection. This would provide motorists on the west approach with improved visibility of northbound and southbound traffic on Mill Street and simplify the driving task.



Figure 2-5
Pedestrian path across tracks on west side of Mill Street

Mitigating Measure:

It has been noted that the path on the west side of Mill Street across the tracks is substandard in width due to the placement of a utility pole and is not AODA compliant, as shown in **Figure 2-5**. To discourage pedestrians from jaywalking, directing them to cross at a location where motorists will expect them, it is recommended that zebra crosswalks be installed on the east and south approaches to the intersection.

2.2 PARK STREET GRADE CROSSING

The OBRY grade crossing on Denison Avenue was reviewed to determine compliance with Transport Canada's *Grade Crossing Standards*. The City of Brampton provided data collected at the crossing relating to the skew, grade, sight distance and clearance times that was used to review the crossing. **Figure 2-6** shows the grade crossing. The new *Grade Crossing Standards* (hereafter referred to as the Standards), finalized in 2014, are intended to improve safety performance at grade crossings on all federally regulated railroads and reduce fatalities, injuries, property damage, and environmental damage at crossings. Transport Canada requires that all applicable grade crossings comply with the Standards within seven years (2021) of the date published.



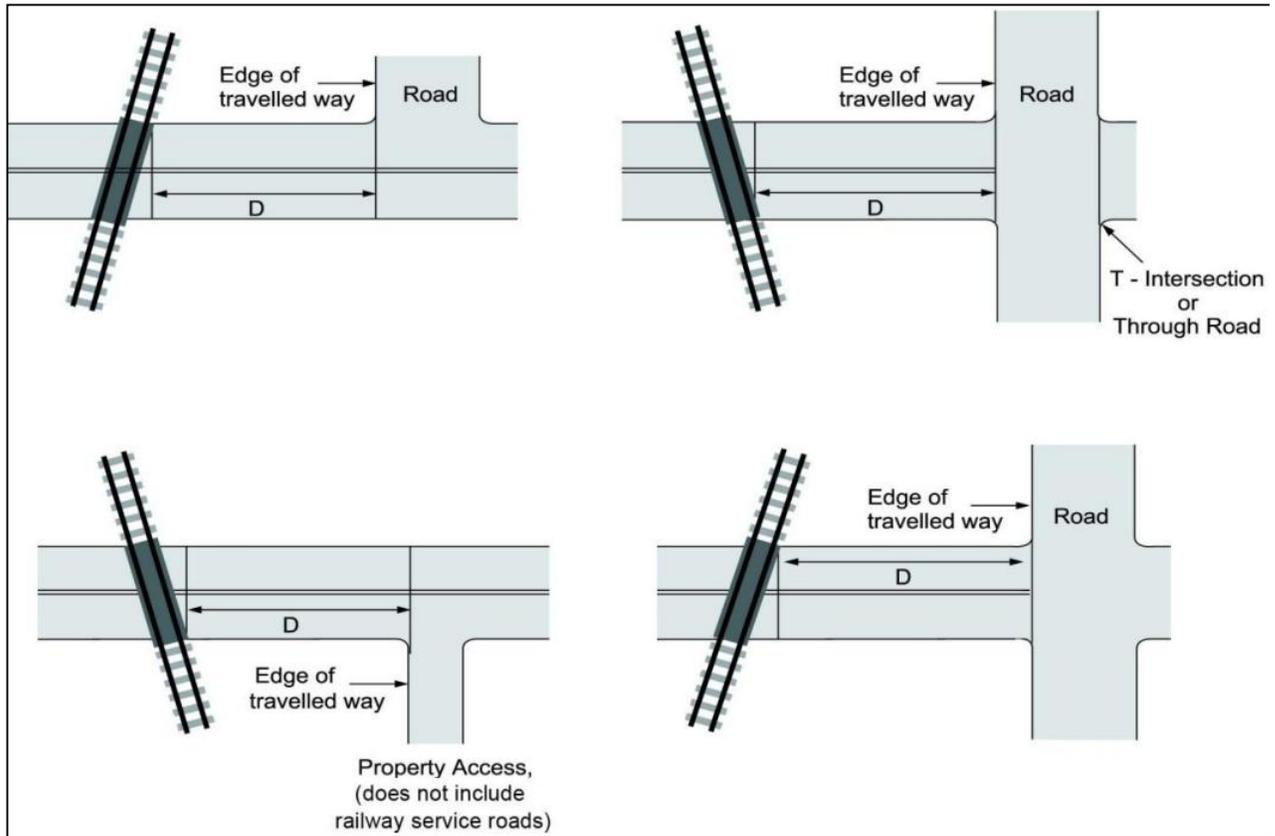
Figure 2-6
ORBY Grade Crossing (Park Street looking west)

2.2.1 Skew

According to the Standards, the grade crossing angle shall not be less than 70 degrees or greater than 110 degrees where the railway operating speed exceeds 15 mph and there is no active warning system (*Section 6.5*). Skewed crossings increase vehicle clearance times (due to the greater travel distance required), have a higher likelihood of issues with sightlines, and increase driver workload (at passive crossings). This requirement is only intended for new crossings. Transport Canada has indicated that there will be no requirement for existing crossings to comply provided that sightlines are adequate. At a skew of 82 degrees, this crossing is currently in compliance with these standards.

2.2.2 Nearby intersections and accesses

According to the Standards, upstream and downstream accesses should not be built any closer than 30 metres from the nearest rail of the grade crossing (*Section 11.1*) as shown in **Figure 2-7**.



**Figure 2-7
Proximity Restrictions³**

Park Street intersects Denison Avenue approximately 13 metres west of the OBRY grade crossing. Field reviews confirm that, given the very low observed volume of traffic at the time of observation, it was not evident that there was any traffic regularly queuing across the tracks. While this intersection is currently non-compliant, its construction and use pre-dates the changes in the Standards.

The proposed Metrolinx access to the rear entry of the development at 45 Railroad Street is currently shown to be within 30 metres to the rail crossing, which is not compliant with the Standards, as shown in **Figure 2-7**. Section 11 of the Grade Crossing Standards states that “A public grade crossing where the railway design speed is more than 25 km/h (15 mph) must be constructed so that no part of the travelled way of an intersecting road or entranceway (other than a railway service road), is closer than 30 m to the nearest rail of the grade crossing”.

³ Figure 11-1 from Grade Crossing Standards.

2.2.3 Road surface and sidewalk extensions

According to *Figure 5-1a* of the Standards, the road surface should extend 0.5 metres (or more) beyond the travelled surface where there is no shoulder, and 0.5 metres (or more) beyond the shoulder where there is one. The 0.5 metre extension provides additional width at the crossing for vehicles, reducing the risk of an errant vehicle hitting the railway ties. According to *Figure 5-1b* of the Standards, an extension of 0.5 metres (or more) beyond the travelled surface of the sidewalk must be provided. Both the road surface and sidewalk extensions on the approaches to the railway crossing are present and in adequate condition.

2.2.4 Road condition and approaches

According to *Section 6.1* of the Standards, the horizontal and vertical alignment of the road approach and the crossing surface must be smooth and continuous. The condition of the road directly surrounding the rail crossing are in poor condition and should be repaved.

In regard to the approach grade, the maximum gradient between the road approach gradient and the railway approach cross-slope must not exceed two (2) percent within eight (8) metres from the nearest rail (*Section 6.3*). According to the data provided by the City, the approach grade on both approaches is -1.2%. This is in compliance with the standards.

2.2.5 Sidewalk condition and approach grades

The allowable difference between a sidewalk approach gradient and the railway approach cross-slope must be in accordance with *Grade Crossing Standards (Section 6.1 – Table 6-1)*, and the maximum gradient must not exceed two (2) percent within five (5) metres of the nearest rail for sidewalks, paths, or trails (*Section 6.3*) for all new crossings.

As shown in **Figure 2-8**, the sidewalk approaching the rail crossing has an uneven surface due to broken slabs. The sidewalk should also be repaired along with the road at the crossing. The repaired sidewalk should have a grade that is in conformance with the Grade Crossing Standards (not exceeding 2 percent). If the sidewalk is intended to be accessible, the grade should not exceed 1 percent.



Figure 2-8
Current Condition of Sidewalk

Mitigating Measure:

The sidewalk should also be repaired along with the road at the crossing. The repaired sidewalk should have a grade that is in conformance with the Grade Crossing Standards (not exceeding 2 percent). If the sidewalk is intended to be accessible, the grade should not exceed 1 percent.

2.2.6 Sight distance

Stopping Sight Distance

Adequate sight distance approaching at-grade crossings is critical to their safe operation. For passive crossings, road users must be able to see the crossing and its traffic controls (crossbuck; or crossbuck plus Stop sign) in sufficient time to perceive and react to the need to stop. This is referred to as Stopping Sight Distance (SSD) and is measured from five (5) metres in advance of the nearest rail. SSD is dependent on the design speed of the roadway, and on whether there is an up-grade or down-grade on the approach. If SSD to a passive crossing cannot be provided, then the crossing requires a Stop sign at the crossing, and a Stop Ahead sign in advance.

The stopping sight distance to the tracks, based on the design speed of the roadway (60 km/h) is 85 metres, according to Table 2.5.2 of the Transportation Association of Canada's *Geometric Design Guide for*

Canadian Roads, 2017. A review of sightlines on both the Denison Avenue and Park Street approaches to the grade crossing indicated that adequate stopping sight distance is provided.

Decision Stopping Sight Distance

At passive crossings, as drivers arrive at the point where SSD begins, they must have sufficient view along the tracks to the left and to the right to detect and respond to an approaching train by stopping (**Figure 2-9**). This is referred to as Decision Stopping Sight Distance (D_{SSD}). D_{SSD} is dependent on the operating speed of the railway. The triangular area formed by the roadway, the railway, and the sightline of the approaching driver to the approaching train must be free of obstructions. In the case of the OBRY grade crossing, Decision Stopping Sight Distance is not achieved due to the curvature of the roadway on the Park Street approach along with other visual obstructions. To address this issue, the passive crossing must either be Stop-controlled, or upgraded to an active crossing. Currently, there is no Stop sign located at the crossing, however it is understood that the City will be installing them at this location.

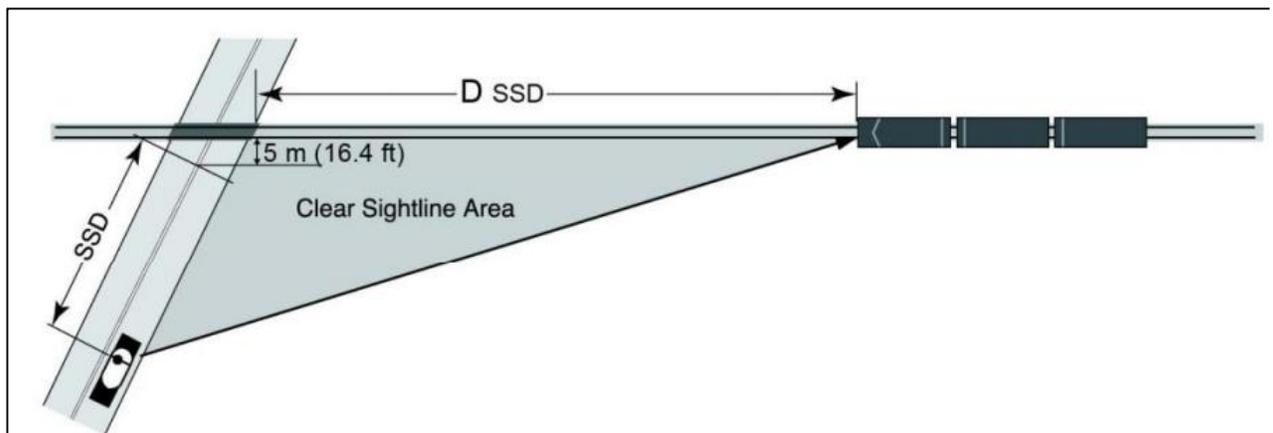
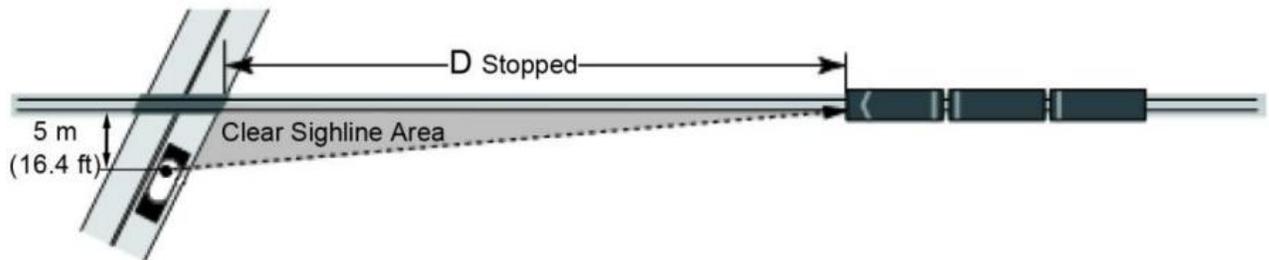


Figure 2-9
Illustration of Clear Sightline Area (No Stop Control)

Stop-controlled passive crossings have a different set of sightline requirements that apply (**Figure 2-10**). This is referred to as Decision Stopped Sight Distance ($D_{STOPPED}$). Under the criteria for $D_{STOPPED}$, the vehicle is assumed to be stopped five (5) metres in advance of the crossing. Again, the driver must have sufficient view along the tracks to the left and to the right to detect and respond to an approaching train by remaining stopped until the train has passed. The triangular area formed by the roadway, the railway, and the sightline of the stopped driver to the approaching train must be free of obstructions.



**Figure 2-10
Illustration of Clear Sightline Area (Stop Control)**

$D_{STOPPED}$ is dependent on both the design vehicle at the crossing and the operating speed of the railway. Larger, longer, heavier vehicles take longer to clear a crossing than passenger vehicles. While these vehicles are likely to use the crossing, their operating characteristics must be taken into consideration by selecting a representative Design Vehicle. The driver's sightline from the stopped position to an approaching train must be sufficient to allow for perception/reaction time, getting the vehicle underway, entering the crossing and passing through it, and finally having the rear of the vehicle fully-clear of the furthest rail before the train arrives. If $D_{STOPPED}$ cannot be met at a passive crossing which is already Stop-controlled, then the crossing should be upgraded to an active crossing.

Sight Distance Along Tracks - $D_{STOPPED}$

In the data provided by the City, the required vehicle clearance was calculated to be 13.53 seconds along both approaches. At a speed of 25 m/h (40.2 km/h), a driver (at a position 2 metres back from the stop bar) requires a view in all directions of 151 metres. A review of the approaches indicates that there is adequate visibility on both approaches (on Park Street) to the left and right along the tracks.

2.2.7 Warning signs

As noted in Section 3.1, the placement of Wc-4 railway crossing ahead signs are correct, as are the restricted visibility and 20 km/h tabs on the northbound approach.

2.2.8 Regulatory signs

The crossbucks on both approaches are in adequate condition, however the paint on the posts has deteriorated, reducing their reflectivity. Reflective strips are provided on the back of the signs.

2.2.9 Pavement markings

Both the stop bars and painted X's are appropriately placed, and the paint is currently in suitable condition. However, the yellow centrelines were absent from this crossing location. Once construction at 45 Railroad

is completed, the stop bars and X's should be repainted, and the yellow centreline should be added. **Figure 2-11** shows the pavement markings to be provided at a railway crossing, as per OTM Book 11.

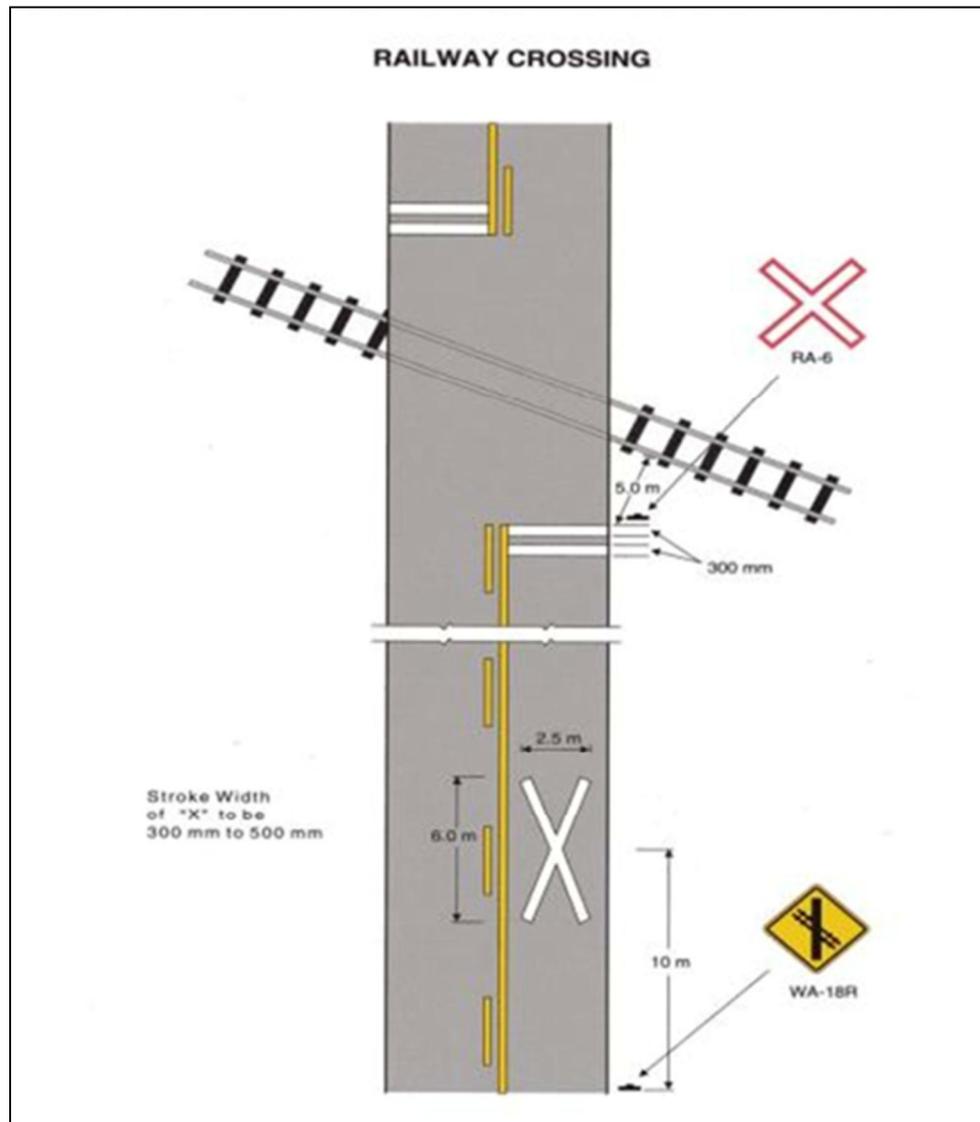


Figure 2-11
OTM Book 11 – Pavement Markings at Railway Crossings

2.2.10 Warrants for lights, bells and gates

Warrants to upgrade the existing passive crossing to an active crossing, based on cross-product thresholds of the number of vehicles and trains using the crossings, were calculated based upon the most up-to-date information on usage. The passive crossing does not meet the warranting criteria for an active warning

system, composed of lights, bells, and gates, given the very low observed traffic volumes on Denison Avenue and Park Street, combined with the low volume of observed trains crossing at this location. If OBRY plans to expand train service at the Park Street, the warrant should be re-evaluated.

3 Safety Assessment of Future Conditions

Based on discussions with the City of Brampton, a segment of the alignment for the Denison Avenue extension connecting Park Street and Mill Street at the very south limit of the 45 Railroad Street property has already been approved through the City's approval and acceptance of the site plan application for the development.

The preferred alignment for Denison Avenue can be seen in Figure 2-2 presented earlier in this report. The implications of this are that Denison Avenue to the west and Park Street to the south would remain in their current configuration with the 90-degree horizontal curve just east of the railway crossing. In addition, Denison Avenue through-traffic would be required to make two successive turns to travel between Mill Street and McMurchy Avenue. Given the anticipated low operating speeds and traffic volumes associated with the Denison Avenue extension, no safety issues are anticipated with the preferred alignment. Sightlines to the proposed new intersection on Park Street and Mill Street will be adequate.

However, as discussed in Section 2.2.2, the new proposed GO overflow parking lot access does not conform to the *Grade Crossing Standards* set out by Transport Canada.

4 Conclusions and Recommendations

On the basis of the safety assessment, the following is noted:

4.1 OFFICE REVIEW

- A review of collisions indicated no significant clusters of collisions, aside from at the intersection of Mill Street and Railroad Street, which had six collisions, all of which involved either an angle or a turning movement;
- GO train service on the Brampton Line impacts traffic at the intersection of Mill Street and Railroad Street, with scheduled stops at the adjacent Brampton GO Train Station in the morning and late afternoon/evening hours;
- The Orangeville-Brampton Railway (OBRY) operates 4 – 5 train trips per day across Park Street;
- The planned development at 45 Railroad Street will introduce two new accesses on Park Street, one to be a rear entrance to an overflow parking lot on Railroad Street for GO train patrons and the other to be a rear entrance to the 45 Railroad Street development itself; and
- The proposed rear entrance to the overflow parking lot on Railroad Street provided for GO train patrons is located within a horizontal curve and is not suitable/desirable from a road design perspective.

4.2 FIELD REVIEW

- The following was noted in the field review:
 - Sidewalk width on Denison Avenue between West Street and Park Street is in the range of 1.20 – 1.22 metres (both sides);
 - Sidewalk heaving on the southwest corner of Denison Avenue and Park Street;
 - Utility poles/trees within the clear zone along Denison Avenue between West Street and Park Street and on Park Street between Denison Avenue and Nelson Street as noted in **Table 2-2** and **Table 2-3**;
 - Stop bars not provided at Denison Avenue and West Street, Denison Avenue and Park Street, Park Street and Nelson Street, and Park Street and Railroad Street;
 - A minor sightline issue at the intersection of Park Street and Nelson Street due to a structure on the northwest corner of the intersection. Drivers however have a clear line of sight if they pull up to the intersection; and
 - A sightline issue at the intersection of Mill Street and Railroad Street due to the geometry of the intersection and a structure on the southwest corner of the intersection. Traffic congestion was noted in conjunction with the afternoon arrival of the GO Train at various times. Field observations noted that motorists were required to creep up into the crosswalk on the west approach to observe northbound-southbound traffic flow. Pedestrians were noted walking diagonally across this intersection.

- The following was noted in the review of the Denison Avenue railway crossing:
 - The proposed access (owned by Metrolinx) noted in the 45 Railroad Street Site Plan (Figure 2-2) will fall within 30 metres of the railway crossing, as such it does not conform to the minimum requirements of the *Grade Crossing Standards*;
 - The sidewalk on the north side of Park Street at the railway tracks is uneven due to broken slabs;
 - The existing pavement structure was in poor condition;
 - With the introduction of a Stop sign, installed after the field visit, sightlines on the approaches to the railway crossing and at the location of the stop bars, are adequate;
 - Yellow centreline markings are not provided on the two approaches to the railway crossing;
 - The paint on the crossbucks has deteriorated, reducing their reflectivity; and
 - Given the low volume of traffic at this crossing, upgrades to the passive warning system (to an active system) is not warranted.

4.3 RECOMMENDATIONS

The following recommendations are made in the context of the above review:

General

- Install a 1.5 metre sidewalk on Denison Avenue between Park Street and West Street (both sides) as part of a future reconstruction project;
- In the short term, replace damaged sections of sidewalk on the southwest corner of Denison Avenue and Park Street;
- As part of future reconstruction, review opportunities to remove fixed objects within 1.2 – 1.8 metres of edge of roadway as specified in **Table 2-2** and **Table 2-3**; and
- Provide stop bars at all stop-controlled intersection.

Railroad Street and Mill Street

- To improve sightlines at the intersection of Railroad Street and Mill Street for eastbound motorists and address the issue with jaywalking it is recommended that the City consider:
 - Removing the pedestrian walkway on the west side of Railroad Street at the GO Train tracks, given its condition and AODA non-compliance;
 - Removing the crosswalk on the west approach; and,
 - Installing zebra crosswalks on the south and east approaches to the intersection.

TECHNICAL MEMORANDUM

Closure

This report was prepared for the City of Brampton for the assessment of safety for the Denison Avenue Extension Study.

The services provided by Associated Engineering (Ont.) Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No other warranty expressed or implied is made.

Respectfully submitted,
Associated Engineering (Ont.) Ltd.

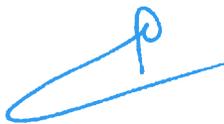
Prepared by:

Reviewed by:



Jeff Suggett
Transportation and Road Safety Lead

Marko Paranosic, P.Eng.,
Project Manager



Haytham Sadeq, MAsc, PMP, PEng. (BC)
Transportation Planning Engineer

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Respectfully submitted,
Associated Engineering (Ont.) Ltd.

Prepared by:

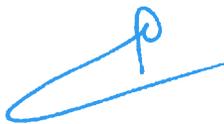


Jeff Suggett
Transportation and Road Safety Lead

Reviewed by:



Marko Paranosic, P.Eng.,
Project Manager



Haytham Sadeq, MAsc, PMP, PEng. (BC)
Transportation Planning Engineer

TECHNICAL MEMORANDUM



Appendix A - Collision Data

Intersections		
DENISON AVE @ PARK ST	0	Reported collisions
DENISON AVE @ WEST ST	0	Reported collisions
NELSON ST W @ PARK ST	5	Reported collisions
PARK ST @ RAILROAD ST	1	Reported collisions
NELSON ST W @ WEST ST	0	Reported collisions
MILL ST N @ RAILROAD ST	6	Reported collisions
MILL ST N @ NELSON ST W	4	Reported collisions
Midblocks		
PARK ST btwn DENISON AVE & RAILROAD ST	0	Reported collisions
PARK ST btwn DENISON AVE & NELSON ST W	1	Reported collisions
MILL ST N btwn NELSON ST W & RAILROAD ST	1	Reported collisions
ELIZABETH ST N btwn NELSON ST W & RAILROAD ST	0	Reported collisions
WEST ST btwn DENISON AVE & RAILROAD ST	1	Reported collisions

Nelson at Park

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
9/5/2013	2013	14:47	01 - Clear	03 - P.D. only	04 - Sideswipe
1/28/2016	2016	7:45	03 - Snow	03 - P.D. only	02 - Angle
6/27/2016	2016	15:32	01 - Clear	03 - P.D. only	02 - Angle
3/16/2017	2017	19:00	01 - Clear	03 - P.D. only	02 - Angle
3/17/2017	2017	19:57	01 - Clear	02 - Non-fatal injury	02 - Angle

5

Park at Railroad

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
1/28/2018	2018	1:51	01 - Clear	03 - P.D. only	07 - SMV other

Mill at Railroad

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
11/4/2013	2013	16:51	01 - Clear	02 - Non-fatal injury	02 - Angle
11/16/2013	2013	13:10	01 - Clear	03 - P.D. only	02 - Angle
6/4/2014	2014	14:15	01 - Clear	03 - P.D. only	02 - Angle
1/2/2015	2015	16:15	01 - Clear	03 - P.D. only	02 - Angle
10/11/2016	2016	22:00	01 - Clear	03 - P.D. only	05 - Turning movement
10/6/2017	2017	10:03	99 - Other	02 - Non-fatal injury	02 - Angle

Mill at Nelson

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
1/9/2014	2014	7:30	01 - Clear	03 - P.D. only	07 - SMV other
1/17/2014	2014	15:00	01 - Clear	03 - P.D. only	05 - Turning movement
11/20/2016	2016	19:18	01 - Clear	03 - P.D. only	02 - Angle
3/23/2017	2017	10:49	01 - Clear	03 - P.D. only	02 - Angle

Park between Denison and Nelson

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
4/2/2015	2015	22:45	01 - Clear	03 - P.D. only	07 - SMV other

Mill between Nelson and Railroad

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
8/12/2016	2016	13:30	01 - Clear	03 - P.D. only	03 - Rear end

West between Denison and Railroad

Accident Date	Accident Year	Accident Time	Environment Condition 1	Classification Of Accident	Initial Impact Type
9/14/2015	2015	16:23	01 - Clear	03 - P.D. only	03 - Rear end

TECHNICAL MEMORANDUM



Appendix B - Email Correspondence from City of Orangeville

Jeff Suggett

From: Tony Dulisse <tdulisse@orangeville.ca>
Sent: Wednesday, January 23, 2019 10:07 AM
To: Jeff Suggett
Cc: Marko Paranosic; Christine Kinahan; bobwilson.obrag@gmail.com
Subject: RE: Denison Avenue Railway Crossing

Hi Jeff. Further to your query, please see our response below.

1. The train movements in the vicinity of the location requested comprise entirely of freight movements with an average between 4 and 5 one-way trips per day, to the industries being serviced, during the hours of 07:00 – 23:00; no traffic is scheduled between 23:00 – 07:00 at this time and movements are usually scheduled on Tuesdays and Fridays. However, due to scheduling and testing, night trips and trips on other weekdays have and will occasionally occur. Service could increase to 5 or 6 days per week as efforts are being made to expand OBRY traffic. The average number of locomotives per trip is one although ORDC may use two on occasion as growth and volumes demand.
2. The average number of cars per train is approximately 8 to 12 per trip. It must be noted that special shunts might be requested by the industries being serviced on days other than those noted above.
3. The maximum speed of each train is 25 mph. There are no welded rails along this stretch of line (jointed track only).
4. Trains are required under the Railway Safety Act of 1988 to whistle at all public crossings and those areas along the track where vehicles and pedestrians cross. Trains must begin sounding its whistle a quarter mile from the crossing and repeat whistling until the train is on the crossing. Train crews also sound the whistle if their view is restricted or they perceive a danger, such as someone walking on the track. These rules apply 24 hours a day and whistles must be sounded even if a crossing has lights, bells and crossing gates as does the crossing at Bovaird. For study purposes, assume that the crossings are whistle stop, the rail right-of-way is 30 metres in width and the train whistle will be sounded approximately a quarter mile on either side of the crossing.
5. There are no immediate plans to upgrade/replace the tracks or any other work at the level crossing at this time.
6. ORDC has not conducted a safety assessment of the crossing. Any safety assessment should be completed as part of the EA process for the proposed work.
7. It should be noted that a new ORDC crossing application may be required to facilitate the completion of the crossing. When the City has reached that stage, please contact me and I will provide the required applications and process.

If there are any further questions, please call.

Thanks.

Tony Dulisse, CET | Transportation and Development Technologist | Infrastructure Services-ORDC
Town of Orangeville | 87 Broadway | Orangeville, ON L9W 1K1
Office Number- 519-941-0440 Ext. 2248 | Toll Free 1-866-941-0440 Ext. 2248 | Cell: 519-942-6885
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Connect with the Town of Orangeville online!



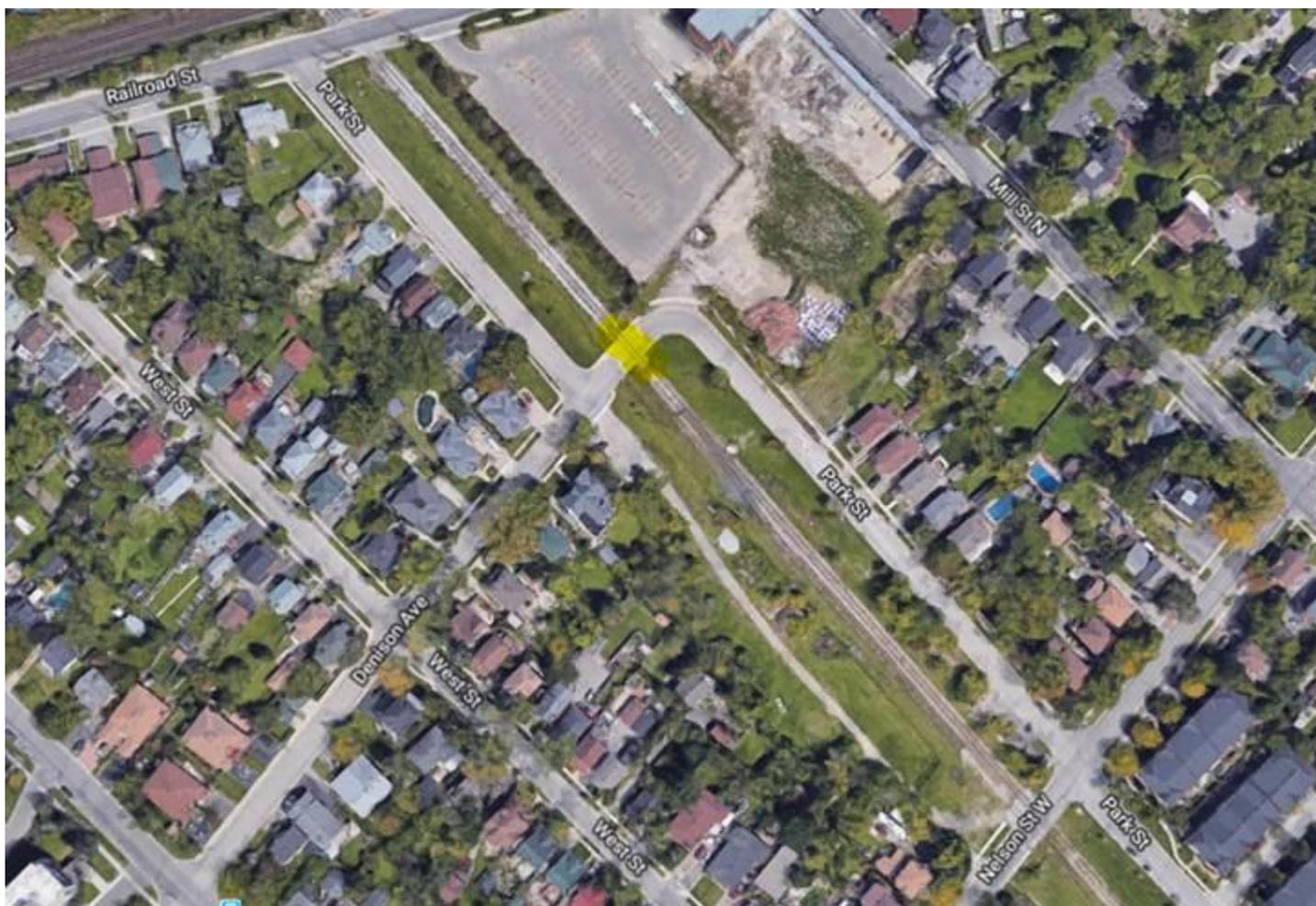
From: Jeff Suggett [mailto:suggettj@ae.ca]
Sent: Friday, January 18, 2019 3:09 PM
To: Tony Dulisse <tdulisse@orangeville.ca>
Cc: Marko Paranosic <paranosicm@ae.ca>; Christine Kinahan <kinahanc@ae.ca>
Subject: Denison Avenue Railway Crossing

Greetings Tony,

We were given your contact information by the City of Brampton. We are currently doing an Environmental Assessment of Denison Avenue which will include a review of the existing crossing of Denison Avenue at the Orangeville-Brampton Railway Line (see below). We are considering a number of options for Denison Avenue which will impact the crossing (i.e. realignment of Denison Avenue).

Questions we have for you are:

- 1) What is the assumed design speed on the railway tracks?
- 2) How often do trains travel along the tracks?
- 3) Are there any plans (short term/long term) for any improvements/modifications to the crossing?
- 4) Has the City conducted a safety assessment of the crossing recently and if so, would they be willing to share the results?



Best Regards,

Jeff Suggett, M. Sc.
Acting Manager, Transportation
Associated Engineering (Ont.) Ltd.
509 Glendale Avenue East, Suite 300, Niagara-on-the-Lake, ON L0S 1J0
Tel: 289-974-0351 | Cel: 905-380-3601



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