Appendix I Noise Analysis

Stantec

Memo

To:	The City of Brampton	From:	Fabian Alvarado, Mohammed Salim Stantec Consulting Ltd.
Project/File:	165010590	Date:	May 12, 2023

Reference: Bramalea Road Corridor Improvements, City of Brampton, Schedule C Municipal Class Environmental Assessment Study – Noise Impact Assessment

1 Introduction

The City of Brampton (the City) retained Stantec Consulting Ltd. (Stantec) to conduct a road traffic noise assessment for the proposed Bramalea Road Corridor Improvements from Queen Street East to the South City limit (the Project). This assessment is intended to support the Schedule C Municipal Class Environmental Assessment (Class EA) for the Project. The assessment evaluates the noise impacts of the preferred alternative design in accordance with the applicable Provincial and Municipal noise guidelines.

1.1 Project Description and Study Area

Improvements to Bramalea Road are vital for connectivity and relief to the existing congested road corridor. Improvements will provide opportunities for better links to active transportation, will facilitate more efficient transit connections within and beyond the City of Brampton, and will provide accessibility improvements for users of all ages and abilities. Bramalea Road improvements include reduced lanes widths throughout the corridor, as well as adding, 2-way left lanes, Queue Jump Lanes[1], Active Transportation Facility and Bus Pads.

The study area is located in the City of Brampton and encompasses Bramalea Road from Queen Street East to the South City limit, approximately 790 m South of Highway 407. The study area is largely zoned residential land north of Avondale Boulevard-Dearbourne Boulevard, and industrial land towards the south (The City of Brampton 2004).

The approximate limits of the study area are shown in Figure 1-1.

[1] Queue Jump Lanes are dedicated lanes that provide opportunities for buses to move to the front of the queue.

Reference: Bramalea Road Corridor Improvements, City of Brampton, Schedule C Municipal Class Environmental Assessment Study – Noise Impact Assessment

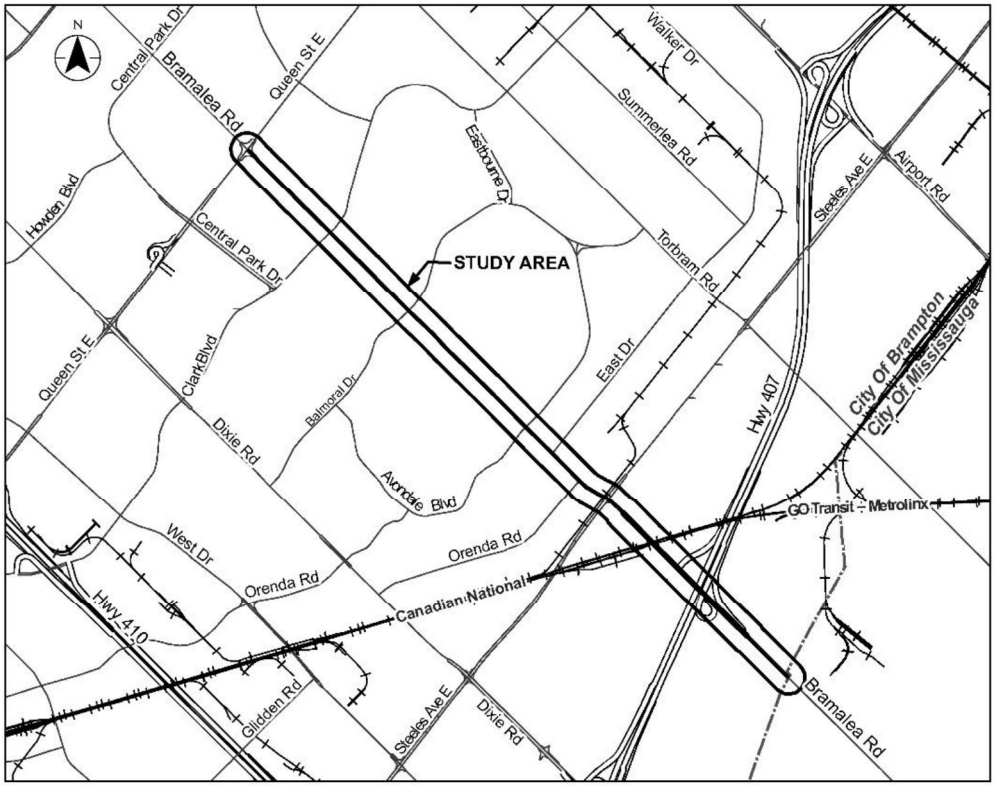

Figure 1-1 Study Area

1.2 Summary of Preferred Alternative Design

The overall preferred alternative design for the Bramalea Road corridor includes reduced lanes widths throughout the corridor, as well as the following improvements by segment:

- **Bramalea Road and Queen Street East Intersection –** Queue Jump Lanes[2] with Bus Pads and Active Transportation Facilities[3]
- **Queen Street East to Dearbourne Boulevard (Segment 1) –** Active Transportation Facility and Bus Pads
- **Dearbourne Boulevard to Steeles Avenue (Segment 2) –** Active Transportation Facilities, Continual Queue Jump Lanes with Bus Pads, Two-way Left Turn Lane
- **Bramalea Road and Steeles Avenue East Intersection –** Queue Jump Lanes with Bus Pads and Active Transportation Facilities
- **Steeles Avenue East to Southern City Limits (Segment 3) –** Active Transportation Facilities

[3] Active Transportation Facilities include Multi-Use Paths for pedestrians and cyclists.

A map of the Bramalea Road corridor with the segment details is shown in Figure 1-2.

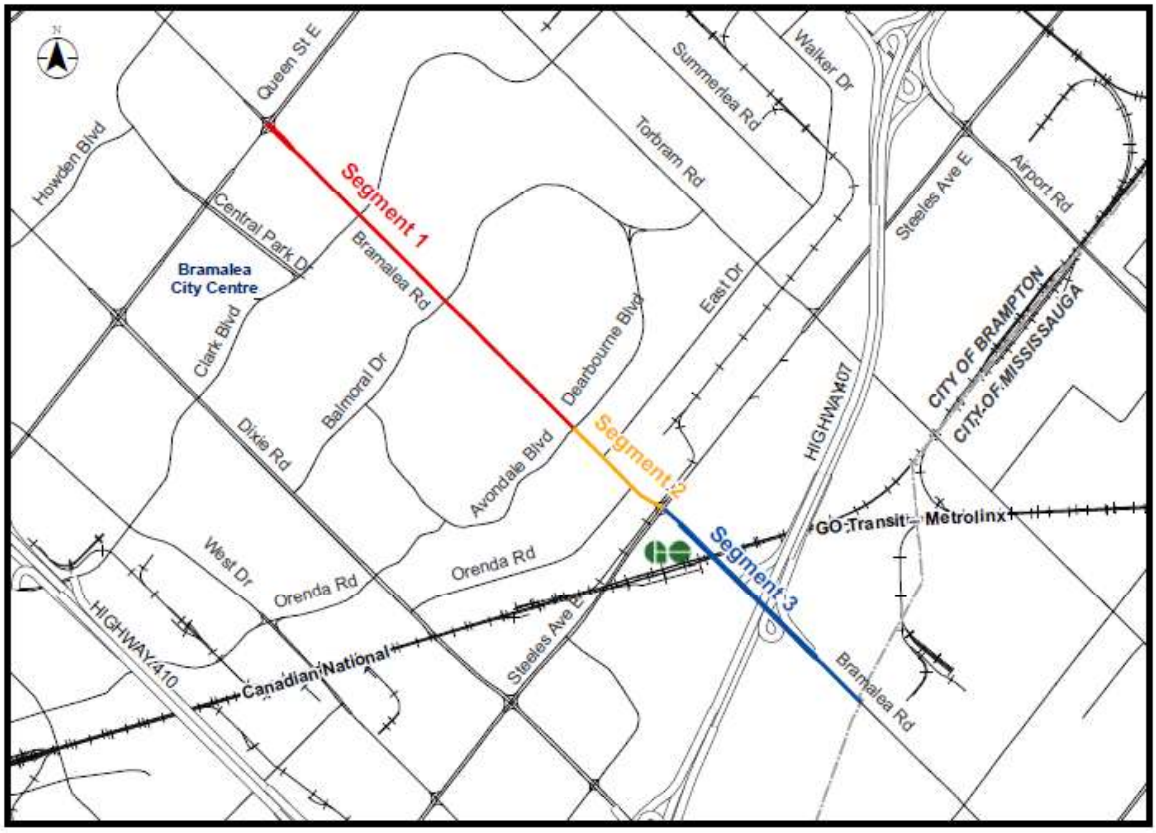

Figure 1-2 Bramalea Road Corridor

2 Guidelines and Noise Criteria

The following sub-sections present the guidelines and noise criteria used for the noise assessment.

2.1 Ontario Provincial Guidelines and Policies

As per RFP 2018-22 (The Corporation of the City of Brampton 2018), this assessment adapts the impact assessment and mitigation investigation approach from the Ontario Ministry of Transportation (MTO) Environmental Guide for Noise (Ontario Ministry of Transportation 2022).

The Project noise impact is defined as the difference in the predicted future noise level with the Project (Future Build) and without the Project (Future No-build). Where the Project noise impact exceeds 5 dB, mitigation measures are to be investigated within the right-of-way. Additionally, mitigation measures are to be investigated where Future Build noise levels equal or exceed 65 dBA.

The MTO Environmental Guide for Noise (MTO Guide) specifies that for the mitigation measure(s) to be technically feasible, it must achieve a minimum 5 dB noise level reduction averaged over the first row of receptors.

As per MTO Guide, the Project noise is assessed in terms of the equivalent sound level over the period between 07:00 and 23:00 (L_{eq-16}). This is considered appropriate for municipal and regional roadways since most of the road traffic volume is expected to occur during the daytime.

The Ministry of the Environment, Conservation and Parks (MECP) Publication NPC-300 Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning should be considered for the noise study for any noise-sensitive land uses proposed along Bramalea Road in the future, and is not applicable for this road improvement project.

2.2 City of Brampton – Noise Wall Policy

The City of Brampton Noise Wall Policy (City of Brampton 2023) provides criteria for the consideration of noise walls. To qualify for a noise wall along the roads under this Policy, the L_{eq-16} must be over 60 dBA.

The City's minimum requirement for technical feasibility is that the noise wall achieve at least 5 dB noise reduction at the receptor and be no more than 2.2 m above ground. Notwithstanding this, the City has requested that 2.4 m high noise walls be considered where achieving at least 5 dB noise reduction and 60 dBA or lower at the receptor is not technically feasible with 2.2 m high noise walls.

2.3 Applicable Noise Criteria

Table 1 lists a summary of the noise criteria that triggers a mitigation investigation along with the mitigation effort required for the Project. This assessment focuses on assessing the technical feasibility of noise mitigation within the City of Brampton right-of-way.

Table 1 Applicable Noise Criteria

Noise Criteria	Mitigation Effort Required
Noise Impact >= 5 dB OR L_{eq-16} >= 65 dBA	• Investigate mitigation in general conformance with the MTO Environmental Guide • Investigate noise mitigation within the right-of-way • Noise mitigation, where introduced should achieve a minimum of 5 dB attenuation averaged over the first row of receptors
L_{eq-16} > 60 dBA	• Investigate noise mitigation in accordance with City of Brampton Noise Attenuation Policy • Noise walls, where introduced, are limited to a height of 2.4 m above ground and should achieve a minimum of 5 dB attenuation and 60 dBA or lower at the receptor • The City of Brampton has other requirements, including economic and administrative, which should be met to warrant implementing mitigation
All other cases	None

3 Assessment Methods

As per the MTO Guide, the assessment should be based on a minimum 10-year future horizon year traffic data from the date of completion of the project. This assessment evaluates Project noise levels for the 2041 horizon year, as established for the Project by the traffic team. The assessment involves the following steps:

1. Through noise modelling, predict road traffic noise levels with and without the Project at the noise sensitive areas (NSAs) along the Bramalea Road
2. Compare the predicted road traffic noise levels against the noise criteria for noise mitigation investigation, and where warranted, investigate mitigation with the City of Brampton right-of-way

The following sub-sections present the noise assessment methods used in this study.

3.1 Modelling Scenarios

The assessment predicts road traffic noise levels for the following scenarios:

1. Existing (2023) – for information purposes only
2. Future No-build (without Project) scenario (2041)
3. Future Build (with Project) scenario (2041) representing the following elements of the preferred design:
   - **Bramalea Road & Queen Street East Intersection –** Queue Jump Lanes with Bus Pads and Active Transportation Facilities (i.e., Multi-use Pathway)
   - **Queen Street East to Dearbourne Boulevard (Segment 1) –** Active Transportation Facility and Bus Pads
   - **Dearbourne Boulevard to Steeles Avenue East (Segment 2) –** Active Transportation Facilities, Continual Queue Jump Lanes with Bus Pads, Two-way Left Turn Lane

Existing road traffic noise levels (2023) were predicted and reported in this memo for additional context, as requested by the City.

The Future No-build scenario was not separately modelled as it is expected to be acoustically equivalent to the Future Build scenario as explained below. Based on the Stantec transportation study for the Project (Stantec Consulting Ltd. 2020), traffic volume demand is not expected to be impacted by the preferred design. Other design elements such as roadway alignment changes are small in comparison to what typically can cause a net change in traffic noise levels at the NSAs considered in this assessment. In other words, future road traffic noise levels with and without the Project are expected to be the same. Therefore, only the Future-Build scenario was modelled and assessed against the 60 and 65 dBA limits under the City of Brampton Noise Wall Policy and the MTO Guide, respectively.

The segment south of Steeles Avenue East (Segment 3) is a largely industrial area with no identified NSAs. Based on proximity and the noise shielding provided by the intervening industrial and commercial buildings, the influence of Segment 3 at the NSAs is expected to be negligible relative to Segments 1 and 2. As such, Segment 3 is not considered further in this assessment.

Road traffic noise level contributions from Queen Street East, Clark Boulevard, and Balmoral Drive were considered in this assessment since they are expected to affect overall noise levels at the NSAs near those intersections.

3.2 Road Traffic Data

The road traffic data provided by the traffic team included Annual Average Daily Traffic (AADT) and truck volumes as a percentage of AADT for Bramalea Road and Queen Street East. This data was supplemented with publicly available AADT (The City of Brampton 2019; Regional Municipality of Peel 2020), turning movement counts collected by Stantec in 2018 (Attachment A), and medium/heavy truck compositions identified in the MTO Guide. Table 2 lists a summary of the road traffic data used for the assessment.

Table 2 Road Traffic Data

Road	Segment	AADT		Traffic Volumes as a Percentage of AADT			Modelled Traffic Speed [b] (km/h)
		Existing 2023	Future No-build/Build 2041	Vehicles during Daytime (%) [a]	Medium Trucks (%)	Heavy Trucks (%)	
Bramalea Road	Segment 1	24,394	29,400	90	1.6	2	60
	Segment 2	24,889	29,600	90	1.5	2.2	60
	Segment 3 [c]	25,385	29,800	90	1.6	1.8	N/A
Queen Street East	West of Bramalea Road	50,507	60,000	90	2.8 [d]	4.1 [d]	60
	East of Bramalea Road	32,112	38,100	90	2.8 [d]	4.1 [d]	60
Clark Boulevard	West of Bramalea Road	16,685 [e]	20,173 [e]	90	1.1 [f]	2.1 [f]	50
	East of Bramalea Road	14,238 [e]	17,031 [e]	90	1.1 [f]	2.1 [f]	50
Balmoral Drive	West of Bramalea Road	7,351 [e]	8,793 [e]	90	1.1 [f]	2.1 [f]	50
	East of Bramalea Road	5,140 [e]	6,149 [e]	90	1.1 [f]	2.1 [f]	50

NOTES:

[a] Daytime is defined as the period from 07:00 to 23:00. Set as the daytime proportion for regional roadways recommended in the ORNAMENT Technical Document.

[b] Modelled Traffic Speed set at the posted speed limit

[c] Although Segment 3 is not considered in the assessment, the traffic data is included for completeness

[d] Medium and heavy truck % was obtained by applying the MTO Guide 40/60 split to the overall truck percentages provided by the traffic team

[e] AADT was estimated using a 1% annual growth rate applied to the latest publicly available AADT. The 1% annual growth rate was based on the traffic forecast model used in the Stantec transportation study (Stantec Consulting Ltd. 2020).

[f] Truck percentages were based on turning movement counts collected by Stantec in 2018

3.3 Noise Modelling

The MECP provided guidelines assessing road in its recently published *Methods to Determine Sound Levels Due to Road and Rail Traffic NPC-306*, dated February 2020, which is currently in draft (Ontario Ministry of the Environment, Conservation and Parks 2020). The NPC-306 guideline is to ensure that proponents use up to date noise prediction methods when determining sound levels caused by road and rail traffic.

NPC-306 identifies that the most current version of the United States Federal Highway Administration (FHWA) Traffic Noise Model (TNM) be used for road traffic noise predictions; TNM is also accepted by the MTO.

Road traffic noise levels for the Project were predicted using TNM version 3.1. The noise model accounts for acoustical parameters such as road traffic volumes and speed, roadway geometry, local topography, and shielding from intervening obstacles (e.g., residential buildings).

The local topography was modelled as flat (except for some NSAs identified in Section 3.5) based on site observations and a review of elevation data from the City of Brampton's GeoHub data base (City of Brampton 2019).

The noise model also accounts for the noise reduction due to the existing noise walls, and they are discussed in the section below.

3.4 Existing Noise Walls

Stantec personnel visited the study area on November 3, 2022 to verify the existing noise walls identified within the study area and review their condition as it relates to acoustical performance.

The noise model considers the noise reduction provided by existing noise walls of solid construction and in good condition. Existing privacy fences were not considered in the assessment as they were observed to have visible gaps which can significantly reduce the expected acoustical performance of the noise wall. The existing noise walls considered in this assessment are listed in Table 3 and shown in Attachment B – Figure B.1.

Table 3 Existing Noise Walls Considered in the Assessment

Noise Wall ID	Height (m)	Roadway/Property Address	Description
ENW1	2.4	Queen Street East	Concrete wall at the northeast section of the Bramalea Road and Queen Street East Intersection
ENW2	2	Bramalea Road	Concrete wall along east side of Bramalea Road between Darras Court and Balmoral Drive
ENW3	2		

3.5 Noise Sensitive Areas and Receptors

This assessment considers traditional noise sensitive areas (NSAs), as defined in the MTO Guide. Traditional NSAs include the following land uses, with an outdoor living area[4] (OLA):

- Private Homes
- Townhouses
- Multiple unit buildings (e.g., as apartments with OLAs used by all occupants)
- Hospitals and nursing homes for the aged, where there are OLAs for the patients

This assessment focused on existing residential dwellings adjacent to Bramalea Road (i.e., first-row dwellings) between Dearbourne Boulevard and Queen Street East. From discussions with the City, it is understood that nearby residential areas north of Queen Street will be addressed under a separate noise study and are thus not considered or discussed further in this assessment.

The first-row dwellings were identified from a review of aerial imagery verified with site observations. No new noise sensitive land developments were identified along Bramalea Road within the study area from a review of the City of Brampton planning web site (The City of Brampton 2020).

Road traffic noise levels were predicted at 25 representative receptors within the study area, representing the OLAs of the first-row dwellings. Based on proximity, the first-row dwellings are expected to sustain the highest road traffic noise levels from Bramalea Road.

The receptors were located at 3 m from the dwelling façade and at a height of 1.5 m above ground, typically situated in the backyard. Table 4 lists a summary of the receptors including the represented noise sensitive areas and OLAs. A map of the receptors is provided in Attachment B – Figure B.1.

Table 4 Receptors and Noise Sensitive Areas

Receptor ID	UTM Coordinates, Zone 17		NSA Description	Number of Represented OLAs
	Easting (m)	Northing (m)		
R1	603386	4842042	Dwellings - 89 to 92 Gates of Bramalea	4
R2	603417	4841995	Dwellings - 93 to 104 Gates of Bramalea	12
R3	603509	4841904	Dwellings - 105 to 120 Gates of Bramalea	16
R4	603551	4841870	Dwellings - 1 to 4 Gates of Bramalea	4
R5	603577	4841831	Dwellings - 51 to 56 Bramalea Road	6
R6	603621	4841787	Dwellings - 57, 58, 74 to 78 Fleetwood Crescent	8
R7	603644	4841767	Dwellings - 87, 88 Fleetwood Crescent	2

[4] As per the MTO Guide, an Outdoor Living Area (OLA) means an area at ground level, adjacent to an NSA, intended and designed for the enjoyment of the outdoor environment.

Receptor ID	UTM Coordinates, Zone 17		NSA Description	Number of Represented OLAs
	Easting (m)	Northing (m)		
R8	603710	4841697	Dwellings - 89, 90 Fleetwood Crescent, 106 to 133 Bramalea Road	30
R9 [a]	603826	4841601	Dwellings - 134, 135 Fleetwood Crescent	2
R10 [a]	603851	4841561	Dwellings - 21 to 24, 32, 33 Eden Park Drive	6
R11	603764	4841480	Dwellings - 65 to 67 Craigleigh Crescent	3
R12	603955	4841481	Dwellings - 6 Easton Place	1
R13	603932	4841390	Dwellings - 41 to 55 Cathcart Crescent	8
R13a	603861	4841420	Dwellings - 57,59 Cathcart Crescent	2
R13b	603972	4841318	Dwellings - 37, 39 Cathcart Crescent	2
R14	604030	4841388	Dwellings - 16 to 38 Edenborough Drive and 12,14,16 Essex Place	15
R15	604324	4841221	Dwellings - 10,12,14 Exeter Place	3
R16	604340	4841085	Dwellings - 22 to 26 Darras Court	6
R16a	604389	4841021	Dwellings - 28 to 76 Darras Court	25
R16b	604482	4840934	Dwellings - 78 to 82 Darras Court	3
R17	604435	4840898	Dwellings - 6 to 14 Alton Crescent, 4 Algonquin Boulevard	5
R18	604644	4840787	Dwellings - 11 to 29 Durham Crescent	10
R19	604607	4840742	Dwellings - 41 to 87 Autumn Boulevard, 2 Alexandria Gate	25
R20	604873	4840474	Dwellings - 1 to 37 Autumn Boulevard, 1 Alexandria Gate, 2 Avondale Boulevard	20
R21	604937	4840489	Dwellings - 15 to 53 Dalraith Crescent	20

NOTE:

[a] Refers to receptors that were modelled with an elevated ground height of approximately 1 m, based on site observations.

4 Noise Assessment

Sound levels for the modelled scenarios are predicted at the representative receptors. The following subsections present and discuss noise modelling results, investigation of noise mitigation and recommendation of noise walls.

4.1 Noise Modelling Results

The predicted road traffic noise levels for the Existing and Future Build scenarios are listed in Table 5 along with the receptors identified for mitigation. The Existing scenario noise levels are presented in this study for context and are not used to evaluate the Project noise impact or mitigation.

Reference: Bramalea Road Corridor Improvements, City of Brampton, Schedule C Municipal Class Environmental Assessment Study – Noise Impact Assessment

Table 5 Predicted Road Traffic Noise Levels and Mitigation Consideration

Receptor ID	Predicted Road Traffic Noise Level, L_{eq-16} (dBA)		Predicted Noise Impact per MTO Guide		Predicted Noise Impact per City of Brampton Noise Wall Policy	
	Existing (2023)	Future Build (2041) [a]	Future Build Noise Level Greater than or Equal to 65 dBA? (Y/N)	Mitigation Consideration Required? (Y/N)	Future Build Noise Level greater than 60 dBA? (Y/N)	Mitigation Consideration Required? (Y/N)
R1	64	64	N	N	Y	Y
R2	65	66	Y	Y	Y	Y
R3	64	65	Y	Y	Y	Y
R4	62	63	N	N	Y	Y
R5	65	66	Y	Y	Y	Y
R6	65	66	Y	Y	Y	Y
R7	63	64	N	N	Y	Y
R8	65	66	Y	Y	Y	Y
R9	65	65	Y	Y	Y	Y
R10	65	66	Y	Y	Y	Y
R11	63	64	N	N	Y	Y
R12	62	62	N	N	Y	Y
R13	63	63	N	N	Y	Y
R13a	60	61	N	N	Y	Y
R13b	60	61	N	N	Y	Y
R14	64	64	N	N	Y	Y
R15	57	58	N	N	N	N
R16	62	62	N	N	Y	Y
R16a	60	60	N	N	N	N
R16b	60	60	N	N	N	N

Reference: Bramalea Road Corridor Improvements, City of Brampton, Schedule C Municipal Class Environmental Assessment Study – Noise Impact Assessment

Receptor ID	Predicted Road Traffic Noise Level, L_{eq-16} (dBA)		Predicted Noise Impact per MTO Guide		Predicted Noise Impact per City of Brampton Noise Wall Policy	
	Existing (2023)	Future Build (2041) [a]	Future Build Noise Level Greater than or Equal to 65 dBA? (Y/N)	Mitigation Consideration Required? (Y/N)	Future Build Noise Level greater than 60 dBA? (Y/N)	Mitigation Consideration Required? (Y/N)
R17	63	64	N	N	Y	Y
R18	62	63	N	N	Y	Y
R19	66	66	Y	Y	Y	Y
R20	65	66	Y	Y	Y	Y
R21	63	64	N	N	Y	Y

NOTE:

[a] Road traffic noise levels for Future Build (with the Project) and Future No-Build (without the Project) are expected to be the same, as there is no change in traffic.

As discussed in Section 3.1, future traffic with and without the Project are expected to be the same. Therefore, the change in noise level from the Project is not assessed.

The Future Build noise level is 65 dBA or greater (MTO noise limit) at nine receptors (R2, R3, R5, R6, R8, R9, R10, R19 and R20) and exceeds the City of Brampton noise limit of 60 dBA at all modelled receptors except R15, R16a, R16b. Therefore, noise mitigation investigation is warranted for the exceeding receptors.

The noise mitigation investigation for the warranted receptors is discussed in the following section.

4.2 Mitigation Investigation

The results in Table 5 show that mitigation investigation is warranted for nine (9) receptors under the MTO Guide and twenty-two (22) receptors under the City of Brampton Noise Wall Policy. The noise mitigation investigation considers typical 2.2 m high noise walls and where needed it considers a maximum height of 2.4 m.

The noise barriers are evaluated for technical feasibility and the barriers must provide a minimum of 5 dB noise reduction averaged over the first row of receptors. As per the City, the barriers should be considered to reduce receptor levels to 60 dBA where feasible.

Table 6 lists the results of the mitigation investigation which compares the predicted road traffic noise levels of the Future Build scenario to two separate investigation scenarios: Future Build with 2.2 m high Noise Walls and Future Build with 2.4 m high Noise Walls. The length of the investigated noise walls is listed in Table 6 and the extent of the noise walls is shown in Attachment B – Figure B.1.

Table 6 Noise Wall Investigation

Noise Wall ID	Noise Wall Length (m)	Receptor ID	Future Build (2041)	Future Build (2041) with 2.2 m Noise Walls	Noise Reduction (dB)	Meets 5 dB Reduction and <=60 dBA?	Future Build (2041) with 2.4 m Noise Walls	Noise Reduction (dB)	Meets 5 dB Reduction and <=60 dBA?
NW1	101	R1	64	58	6	Y	57	7	Y
NW2	174	R2	66	61 [a]	5	N	61 [a]	5	N
		R3	65	60	5	Y	60	5	Y
NW3	24	R4	63	59	4 [b]	N	59	4	N
NW4	43	R5	66	60	6	Y	60	6	Y
NW5	60	R6	66	61	5	N	60	6 [c]	Y
NW6	32	R7	64	60	4 [b]	N	60	4	N
NW7	233	R8	66	60	6	Y	59	7	Y
NW7a	39	R9	65	61	4	N	60	5	Y
NW8	168	R10	66	62	4	N	60	6	Y
NW8a	41	R12	62	58	4 [b]	N	58	4	N
NW9	16	R11	64	61	3	N	61	3	N
NW10	460	R13	63	58	5	Y	58	5	Y

Noise Wall ID	Noise Wall Length (m)	Receptor ID	Future Build (2041)	Future Build (2041) with 2.2 m Noise Walls	Noise Reduction (dB)	Meets 5 dB Reduction and <=60 dBA?	Future Build (2041) with 2.4 m Noise Walls	Noise Reduction (dB)	Meets 5 dB Reduction and <=60 dBA?
		R13a	61	57	4 [b]	N	57	4	N
		R13b	61	56	5	Y	56	5	Y
NW11	326	R14	64	59	5	Y	58	6	Y
NW12	73	R16	62	58	4	N	57	5	Y
NW13	131	R17	64	58	6	Y	58	6	Y
NW14	213	R18	63	56	7	Y	55	8	Y
NW15	275	R19	66	60	6	Y	59	7	Y
NW16	309	R20	66	60	6	Y	59	7	Y
NW17	349	R21	64	56	8	Y	55	9	Y

NOTE:

[a] R2 exceeds 60 dBA with implementation of NW2 (2.2 m or 2.4 m)

[b] Although the noise reduction does not meet the minimum 5 dB requirement to be warranted under the City of Brampton Noise Policy, implementing 2.2 m high noise wall may be implemented to reduce road traffic noise levels to 60 dBA or less

[c] Although the 2.2 m high NW5 meets the minimum 5 dB noise reduction requirement to be warranted under the City of Brampton Noise Policy, implementing the 2.4 m high NW5 may be implemented to reduce road traffic noise levels to 60 dBA

The results (Table 6) shows that the following 2.2 m high noise walls can achieve at least 5 dB noise reduction and 60 dBA or lower at the warranted receptors: NW1, NW2, NW4, NW7, NW10, NW11, and NW13 to NW17.

The following noise walls can achieve least 5 dB noise reduction and 60 dBA or lower at the receptor with 2.4 m high noise walls, but not with 2.2 m high noise walls: NW5, NW7a, NW8, and NW12.

The effectiveness of other noise walls considered in this assessment were limited by one or more of the following factors: noise wall height constraints, setback distances to the receptor, receptor elevation, existing noise walls, and exposure to road traffic noise from Queen Street East, Clark Boulevard, and Balmoral Drive.

4.3 Recommended Noise Walls

To meet the minimum 5 dB noise reduction and road traffic noise level of 60 dBA or lower at the targeted receptor, the following noise walls and heights are recommended for implementation:

- NW1, NW2, NW4, NW7, NW10, NW11, NW13 to NW17 – 2.2 m high
- NW5, NW7a, NW8, and NW12 – 2.4 m high

The following noise walls and heights did not meet the minimum 5 dB noise reduction to be warranted under the City of Brampton Noise Policy, but may be considered for implementation to reduce road traffic noise levels to 60 dBA at the at the targeted receptor:

- NW3, NW6, and NW8a – 2.2 m high

During the detail design of the Project, the noise walls should be constructed at a 0.3 m offset from property line, on City ROW, and designed to maintain any existing overland flow and drainage features.

5 Construction Noise

Construction noise impacts are temporary in nature, and largely unavoidable. With adequate controls, impacts can be reduced. However, for some periods of time and types of work, construction noise will be noticeable at some receptor locations.

This section of the report provides an evaluation of construction equipment noise and discusses guidelines and Code of Practice to reduce construction impacts.

5.1 Local Noise Control By-law

The City noise by-law 93-84 (The Coporation of the City of Brampton 1984) prohibits and regulates noise within the City. Section 4 (10) of the by-law exempts any sound arising from road work and road improvements undertaken by or on behalf of the MTO or the Region of Peel and the presence of these sounds is not to be considered a contravention of the by-law. Section 4.2 of the by-law indicates that the Chief of Planning and Infrastructure Services can grant an exemption to provisions of the by-law subject to conditions specified in Section 4.2 (1).

5.2 MECP Model Municipal Noise Control By-law

The Ontario Ministry of the Environment, Conservation and Parks (MECP) stipulates limits on noise emissions from each equipment, rather than for overall construction noise. In the presence of persistent noise complaints, sound emission standards for the various types of construction equipment used on the Project should be verified to ensure that they meet the specified limits contained in MECP Publication NPC-115 (Ontario Ministry of the Environment, Conservation and Parks 1977) and NPC-118 (Ontario Ministry of the Environment, Conservation and Parks 1982) as summarized in Table 7.

Table 7 Construction Noise Emission Limits (NPC-115 and NPC-118)

Type of Unit	Maximum Allowed Sound Pressure Level [a] (dBA)	Distance at Which Sound Levels are Measured (m)	Power Rating (kW)
Excavation Equipment [b]	83	15	Less than 75 kW
	85	15	75 kW or Greater
Pneumatic Equipment [c]	85	7	-
Portable Compressors	76	7	-
Track Drills	100	15	-
Heavy Vehicles with Governed Diesel Engines	95	15	-

NOTES:

[a] Maximum permissible sound levels presented here are for equipment manufactured after Jan 1, 1981

[b] Excavation equipment includes bulldozers, backhoes, front end loaders, graders, excavators, steam rollers and other equipment capable of being used for similar applications

[c] Pneumatic equipment includes pavement breakers

5.3 Assessment Methods

The construction noise impact assessment considered effects of various types of construction equipment. As part of assessing the noise effects due to the use of construction equipment, the maximum sound levels resulting from operation of typical construction equipment was determined and compared with the applicable criteria limits.

The expected construction activities within the Bramalea Road improvements include:

- Road paving/repaving and widening in some areas
- Construction of multi-use paths, bus passenger waiting pads, active transportation facility and medians

5.4 Construction Noise Levels

Construction activities will vary temporally and spatially as the Project progresses. Noise levels from construction at a given receptor location will also vary over time as different activities take place, and as those activities change location within the right-of-way.

Table 8 lists the construction equipment considered for the assessment and a comparison of their noise emissions to the applicable NPC-115 and NPC-118 noise limits. A detailed construction plan or equipment list is not currently available. Therefore, the construction equipment list in Table 8 represents typical equipment expected to be used for this type of construction. The listed construction equipment noise emissions are based on Stantec's database of field measurements of construction equipment.

Table 8 Construction Equipment Sound Level Assessment

Type of Equipment	Typical Range of Maximum Sound Levels at 15 m (dBA)	NPC-115/118 Sound Level at 15 m (dBA)	Meets NPC-115/118 Sound Level? (Y/N)
Front-End Loaders	77 – 85	85	Y
Backhoe	66 – 80	85	Y
Auger	76 – 84	85	Y
Dump Trucks	76 – 88	95[b]	Y
Concrete Trucks	77 – 85	85	Y
Concrete Pump and Boom	77 – 82	85	Y
Vibratory Compactors	79 – 83	85	Y
Paving Machines [a]	77 – 89	85	N
Cranes	73 – 83	85	Y
Grader	79 – 85	85	Y

Notes:

[a] These equipment units have potential to exceed the applicable MECP limits and precautions/noise control feasibility should be investigated if they are used near sensitive receptors

[b] Refers to the NPC-118 Sound Level at 15 m

Once the construction equipment and schedules are finalized, the equipment sound levels should be reviewed to confirm that noise emissions are within the permissible limits. If they are higher than the limits, noise control options should be explored for the construction equipment exceeding the limits.

5.5 Construction Code of Practice

The following best practices should be considered for the Project construction:

- All construction equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order.
- There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract and local noise by-laws. Enforcement of noise control by-laws is the responsibility of the Municipality for all work done by Contractors.
- The Contract documents should contain a provision that any initial noise complaint will trigger verification of construction noise and typical noise control measures.
- In the presence of persistent noise complaints, all construction equipment should be verified to comply with MECP NPC-115 and NPC-118 guidelines
- In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measures may be required, where reasonably available. In selecting appropriate noise control and mitigation measures, consideration should be given to the technical, administrative, and economic feasibility of the various alternatives.

Reference: Bramalea Road Corridor Improvements, City of Brampton, Schedule C Municipal Class Environmental Assessment Study – Noise Impact Assessment

6 Conclusions and Closure

The noise impacts of the preferred design alternative for the Bramalea Corridor Improvements were assessed for the 2041 horizon year. Both road traffic (operational) and construction noise impacts were considered in the assessment.

The preferred design is not expected to change road traffic of the Bramalea Corridor to cause a net difference in road traffic noise levels. Therefore, 2041 road traffic noise levels with (Future Build) and without the Project (Future No-build) are expected to be same.

The results of the Future Build scenario indicate that twenty-two (22) of the twenty-five (25) modelled receptors have an overall road traffic noise level exceeding the 60 dBA limit which warrants mitigation investigation under the City of Brampton Noise Wall Policy. Out of those twenty-two (22) receptors, nine (9) receptors have an overall sound level of at least 65 dBA which warrants mitigation investigation under the MTO Guide.

The mitigation investigation showed that noise walls identified in Section 4.3 can meet a minimum noise reduction of 5 dB or reduce road traffic noise levels to 60 dBA or less at receptors that warranted noise mitigation consideration. A map showing the noise wall extents and locations is provided in Attachment B – Figure B.1.

Most of the construction equipment expected for the Project can be operated in compliance with MECP limits. However, there is a potential for higher sound levels from some equipment (e.g., paving machines). Once equipment and construction schedules are finalized, construction equipment sound levels should be reviewed to confirm that the nose emissions are within permissible limits. If they are higher than the limits, noise control options should be explored for the construction equipment exceeding the limits. Methods to minimize construction noise impacts should be included in the Construction Code of Practice, as outlined in Section 5.5.

Sincerely,

STANTEC CONSULTING LTD.

Digitally signed by Alvarado, Fabian
Date: 2023.05.12 15:59:05 -04'00'

Digitally signed by Mohammed Salim
Date: 2023.05.12 16:21:42 -04'00'

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Attachments: Attachment A: Road Traffic Data
Attachment B: Figures

7 References

City of Brampton. 2023. Accessed January 2023. https://www.brampton.ca/EN/residents/Roads-and-Traffic/Resident-Info-Centre/Pages/Noise-Walls.aspx.

—. 2019. *City of Brampton GeoHub.* Accessed February 2023. https://geohub.brampton.ca/.

Ontario Ministry of the Environment . 1989. "ORNAMENT Ontario Road Analysis Method for Environment and Transportation."

Ontario Ministry of the Environment, Conservation and Parks. 2020. "Draft NPC-306 - Methods to Determine Sound Levels dur to Road and Rail Traffic."

Ontario Ministry of the Environment, Conservation and Parks. 1977. "Model Municipal Noise Control Bylaw - Publication NPC - 115, Construction Equipment."

Ontario Ministry of the Environment, Conservation and Parks. 1982. "Publication NPC-118 for Motorized Conveyances."

Ontario Ministry of Transportation. 2022. "Environmental Guide for Noise, Version 2.0."

Regional Municipality of Peel. 2020. *Traffic Count Stations.* Accessed 2023. https://data.peelregion.ca/datasets/RegionofPeel::traffic-count-stations/about.

Stantec Consulting Ltd. 2020. "Bramalea Road Environmental Assessment Study, Transportation and Traffic Study – Existing Conditions Transportation Assessment Report."

The City of Brampton . 2019. *City of Brampton Traffic Volumes.* Accessed 2023. https://geohub.brampton.ca/datasets/brampton::city-of-brampton-traffic-volumes/about.

The City of Brampton. 2020. *BramPlanOnline.* Accessed February 2023.

The City of Brampton. 2004. "Zoning By-Law 270 - 2004."

The Coporation of the City of Brampton. 1984. "Office Consolidation Noise By-law 93-84."

The Corporation of the City of Brampton. 2018. "RFP2018-022 Environmental Assessment Study for Improvements to Bramalea Road from Queen Street to South City Limit."

Attachment A Road Traffic Data

Bramalea Road & Clark Boulevard

Morning Peak Diagram

Specified Period
From: 6:30:00
To: 9:30:00

One Hour Peak
From: 7:45:00
To: 8:45:00

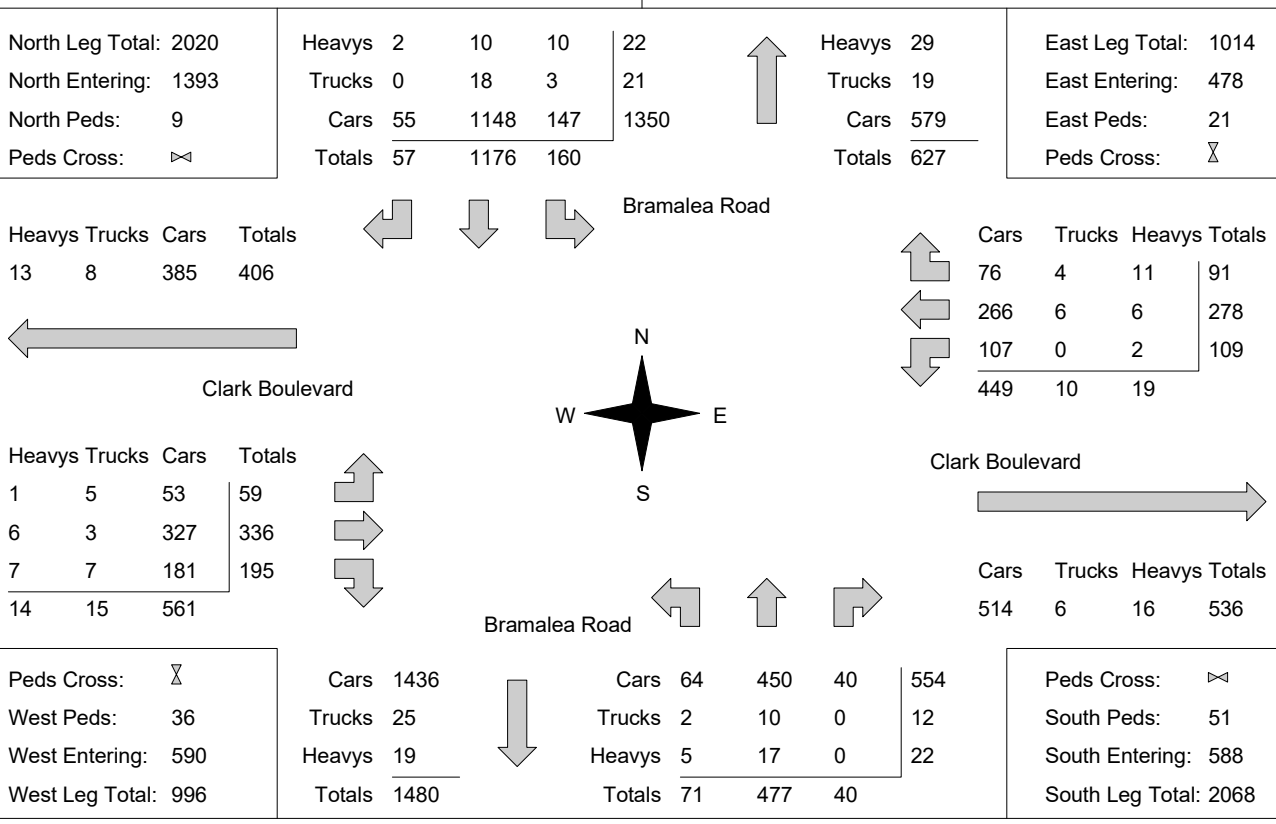
Municipality: Brampton
Site #: 0000005505
Intersection: Bramalea Road & Clark Boulevard
TFR File #: 1
Count date: 18-Sep-2018

Weather conditions:
Cloudy

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Bramalea Road runs N/S



Comments

Bramalea Road & Clark Boulevard

Mid-day Peak Diagram

Specified Period
From: 11:30:00
To: 13:30:00

One Hour Peak
From: 12:15:00
To: 13:15:00

Municipality: Brampton
Site #: 0000005505
Intersection: Bramalea Road & Clark Boulevard
TFR File #: 1
Count date: 18-Sep-2018

Weather conditions:
Cloudy

Person(s) who counted:

**** Signalized Intersection ****

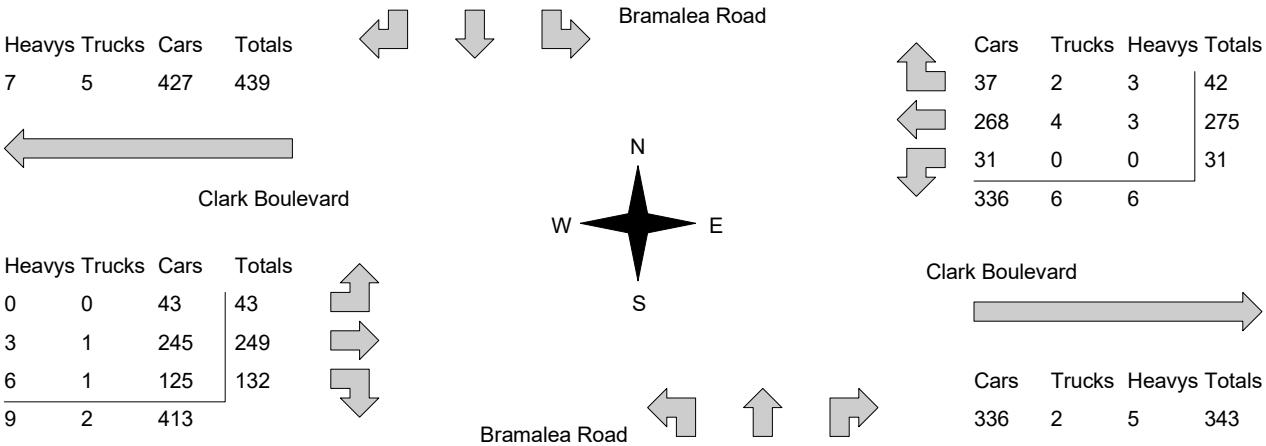
Major Road: Bramalea Road runs N/S

North Leg Total: 1009
North Entering: 545
North Peds: 8
Peds Cross: ⋈

Heavys	0	4	2	6
Trucks	0	10	1	11
Cars	35	436	57	528
Totals	35	450	60	

Heavys	6
Trucks	10
Cars	448
Totals	464

East Leg Total: 691
East Entering: 348
East Peds: 7
Peds Cross: ⧖



Heavys	Trucks	Cars	Totals
7	5	427	439

Cars	37	2	3	42
	268	4	3	275
	31	0	0	31
	336	6	6	

Heavys	Trucks	Cars	Totals
0	0	43	43
3	1	245	249
6	1	125	132
9	2	413	

Cars	Trucks	Heavys	Totals
336	2	5	343

Peds Cross: ⧖
West Peds: 7
West Entering: 424
West Leg Total: 863

Cars	592
Trucks	11
Heavys	10
Totals	613

Cars	124	368	34	526
Trucks	1	8	0	9
Heavys	4	3	0	7
Totals	129	379	34	

Peds Cross: ⋈
South Peds: 5
South Entering: 542
South Leg Total: 1155

Comments

Bramalea Road & Clark Boulevard

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 19:00:00

One Hour Peak
From: 17:00:00
To: 18:00:00

Municipality: Brampton
Site #: 0000005505
Intersection: Bramalea Road & Clark Boulevard
TFR File #: 1
Count date: 18-Sep-2018

Weather conditions:
Cloudy

Person(s) who counted:

**** Signalized Intersection ****

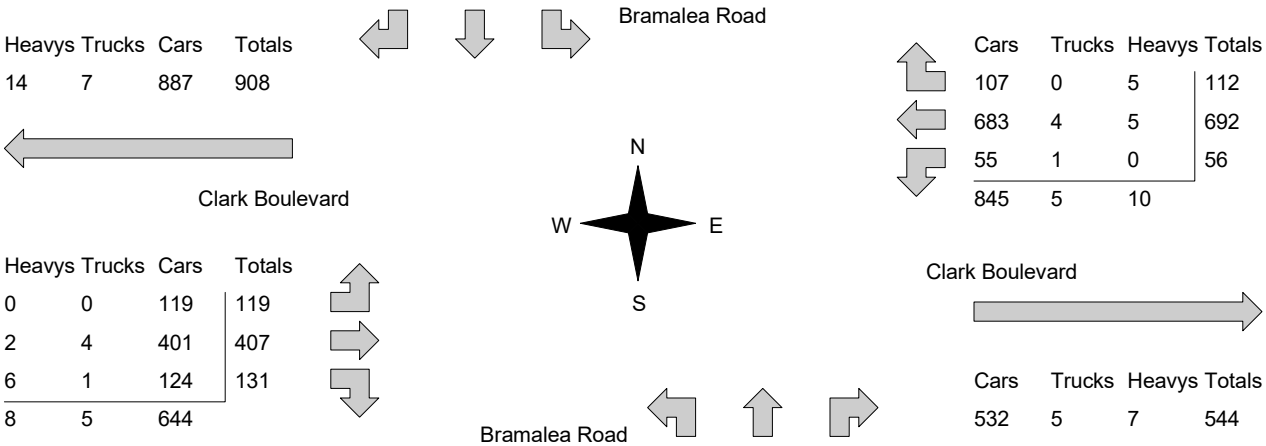
Major Road: Bramalea Road runs N/S

North Leg Total: 1719
North Entering: 648
North Peds: 4
Peds Cross: ⋈

Heavys	2	8	5	15
Trucks	2	14	1	17
Cars	60	476	80	616
Totals	64	498	86	

Heavys	13
Trucks	9
Cars	1049
Totals	1071

East Leg Total: 1404
East Entering: 860
East Peds: 15
Peds Cross: ⧖



Heavys	Trucks	Cars	Totals
14	7	887	908

Cars	Trucks	Heavys	Totals
107	0	5	112
683	4	5	692
55	1	0	56
845	5	10	

Heavys	Trucks	Cars	Totals
0	0	119	119
2	4	401	407
6	1	124	131
8	5	644	

Cars	Trucks	Heavys	Totals
532	5	7	544

Peds Cross: ⧖
West Peds: 9
West Entering: 657
West Leg Total: 1565

Cars	655			
Trucks	16			
Heavys	14			
Totals	685			

Cars	144	823	51	1018
Trucks	1	9	0	10
Heavys	7	8	0	15
Totals	152	840	51	

Peds Cross: ⋈
South Peds: 7
South Entering: 1043
South Leg Total: 1728

Comments

Bramalea Road & Clark Boulevard

Total Count Diagram

Municipality: Brampton
Site #: 0000005505
Intersection: Bramalea Road & Clark Boulevard
TFR File #: 1
Count date: 18-Sep-2018

Weather conditions:
Cloudy

Person(s) who counted:

**** Signalized Intersection ****

Major Road: Bramalea Road runs N/S

North Leg Total:	11893			
North Entering:	6591			
North Peds:	60			
Peds Cross:	⋈			
Heavys	6	66	38	110
Trucks	4	81	9	94
Cars	383	5397	607	6387
Totals	393	5544	654	
Heavys	127			
Trucks	94			
Cars	5081			
Totals	5302			
East Leg Total:	7698			
East Entering:	4271			
East Peds:	109			
Peds Cross:	⧖			

Bramalea Road

Heavys	Trucks	Cars	Totals
91	49	4386	4526

Clark Boulevard

Heavys	Trucks	Cars	Totals
3	6	495	504
32	24	2444	2500
52	16	1003	1071
87	46	3942	

Cars	Trucks	Heavys	Totals
584	12	43	639
3129	32	40	3201
422	3	6	431
4135	47	89	

N
W E
S

Clark Boulevard

Cars	Trucks	Heavys	Totals
3319	36	72	3427

Bramalea Road

Peds Cross:	⧖			
West Peds:	108			
West Entering:	4075			
West Leg Total:	8601			
Cars	6822			
Trucks	100			
Heavys	124			
Totals	7046			
Cars	874	4002	268	5144
Trucks	13	76	3	92
Heavys	45	81	2	128
Totals	932	4159	273	
Peds Cross:	⋈			
South Peds:	124			
South Entering:	5364			
South Leg Total:	12410			

Comments

Bramalea Road & Clark Boulevard
Traffic Count Summary

Intersection: Bramalea Road & Clark Boulevard | **Count Date:** 18-Sep-2018 | **Municipality:** Brampton

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	26	562	8	596	0	757
8:00:00	87	1153	56	1296	6	1812
9:00:00	147	1176	57	1380	7	1949
12:00:00	58	582	41	681	10	1214
13:00:00	59	442	38	539	9	1075
16:00:00	34	207	12	253	2	525
17:00:00	75	468	72	615	6	1383
18:00:00	86	498	64	648	4	1691
19:00:00	82	456	45	583	16	1549
Totals:	654	5544	393	6591	60	11955

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds
7:00:00	20	134	7	161	5
8:00:00	65	419	32	516	25
9:00:00	77	459	33	569	50
12:00:00	118	393	22	533	9
13:00:00	144	361	31	536	5
16:00:00	56	203	13	272	2
17:00:00	133	597	38	768	8
18:00:00	152	840	51	1043	7
19:00:00	167	753	46	966	13
Totals:	932	4159	273	5364	124

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	35	116	9	160	3	381
8:00:00	74	268	58	400	15	882
9:00:00	96	288	97	481	27	1039
12:00:00	39	238	63	340	13	739
13:00:00	28	270	51	349	8	738
16:00:00	13	134	19	166	3	398
17:00:00	41	721	113	875	16	1446
18:00:00	56	692	112	860	15	1517
19:00:00	49	474	117	640	9	1206
Totals:	431	3201	639	4271	109	8346

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Heavys: Left	Thru	Right	Grand Total	Total Peds
7:00:00	16	149	56	221	1
8:00:00	50	300	132	482	13
9:00:00	50	317	191	558	41
12:00:00	39	232	128	399	16
13:00:00	45	233	111	389	10
16:00:00	19	136	77	232	1
17:00:00	77	374	120	571	7
18:00:00	119	407	131	657	9
19:00:00	89	352	125	566	10
Totals:	504	2500	1071	4075	108

Calculated Values for Traffic Crossing Major Street

Hours Ending:	7:00	8:00	9:00	12:00	13:00	17:00	18:00	19:00
Crossing Values:	205	455	520	335	357	853	878	641

Attachment B Figures