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1795 Montreal Road

Transportation Impact Assessment Report

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1795 Montreal Road

Transportation Impact Assessment Report

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

March 2018

Novatech File: 116151
Ref: R-2018-001

NOVATECH
Engineers, Planners & Landscape Architects

March 22, 2018

BY HAND

City of Ottawa
Planning and Growth Management Department
110 Laurier Ave. W., 4th Floor,
Ottawa, Ontario K1P 1J1

Attention: **Asad Yousfani**
Project Manager, Infrastructure Approvals

Dear Sir:

Reference: **1795 Montreal Road**
Transportation Impact Assessment Report
Novatech File No.116151

We are pleased to submit the following Transportation Impact Assessment (TIA) Report in support of Zoning and Site Plan Applications for 1795 Montreal Road.

The structure and format of this report is in accordance with the City of Ottawa Transportation Impact Assessment Guidelines (June 2017).

Yours truly,

NOVATECH

Lisa Bowley, P.Eng.
Project Manager | Land Development Engineering

Encl.

TABLE OF CONTENTS

Figures

Tables

Appendices

Enclosed Disk (1 City copy, only)

PDF of Transportation Impact Assessment Report
Synchro Files

1.0 INTRODUCTION

The Transportation Impact Assessment (TIA) report has been prepared in support of Zoning By-Law Amendment and Site Plan Control applications for 1795 Montreal Road.

As required by the City of Ottawa Transportation Impact Assessment Guidelines (June 2017), a copy of the signed credentials form is included in Appendix B.

The subject site has an area of 0.42 hectares and is currently undeveloped. The site is bound by Montreal Road to the south, the Ottawa Withdrawal Management Centre to the west, and existing residential to the north and east. An aerial photo of the subject site is provided in **Figure 1**.

Figure 1: Aerial Photo of Subject Site

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2.0 PROPOSED DEVELOPMENT

The development consists of a 2-storey office building (approximately 611m^2) and a single storey auxiliary storage building (approximately 849m^2) at the rear of the site. The ancillary building will be used for material storage.

The proposed access is a right-in, right-out (RIRO) driveway to Montreal Road.

The proposed site development is anticipated to be constructed in a single phase with occupancy in 2019.

A copy of the proposed Site Plan is included in **Appendix A**.

3.0 SCREENING

3.1 Screening Form

The City of Ottawa Transportation Impact Assessment (TIA) Guidelines identify three triggers for completing a TIA report, including trip generation, location, and safety. The criteria for each trigger is outlined in the City's TIA Screening Form.

Trip Generation Trigger: Based on the size of the office, the development will generate substantially less than the Trip Generation Trigger of 60 person trips/peak hour; further assessment is not required based on this trigger.

Location Triggers: The development is located along a Spine cycling route and in a Design Priority Area; further assessment is required based on this trigger.

Safety Triggers: A review of the boundary street conditions indicates that no further assessment is required based on this trigger.

Our review of the development and the screening form indicate that the Location trigger is met. A Transportation Impact Assessment including the Design Review component is required based on this trigger.

A copy of the TIA Screening Form is included in **Appendix B**.

4.0 SCOPING

4.1 Existing Conditions

4.1.1 Roadways

Montreal Road is an arterial roadway that runs on an east-west alignment between Highway 174 to the Rideau River. Within the study area, Montreal Road has a four-lane divided urban cross section. Montreal Road is a designated truck route with a posted speed limit of 60km/h. For the subject section of Montreal Road, the City of Ottawa's Official Plan identifies a requirement to protect a right-of-way width of 37.5m.

The nearest signalized intersections include Elmsmere Road, approximately 250m to the east and Elwood Street, approximately 295m to the west of the proposed site access.

4.1.2 Intersections

Montreal Road and Elmsmere Road

- *Signalized intersection*
- *Westbound: two through lanes and one left turn lane*
- *Eastbound: two through lanes, one right turn lane, and one left turn pocket (not currently used; no north leg)*
- *Northbound: one shared right/left turn lane*

Montreal Road and Elwood Street

- *Signalized intersection*
- *Westbound/Eastbound: one through lane, one shared through/right turn lane and one left turn lane*
- *Northbound/Southbound: one shared through/right turn/left turn lane*

4.1.3 Pedestrian and Cycling Facilities

Concrete sidewalks are provided on both sides of Montreal Road.

Montreal Road is classified as a spine cycling route with shared use travel lanes.

4.1.4 Transit

The nearest bus stops include OC Transpo bus stops #2572 westbound and #2568 eastbound on Montreal Road which serve route 12. OC Transpo Bus stop locations are shown in **Figure 2**.

OC Transpo route 12 is a regular route that travels between the Blair transit station at Gloucester Centre to the Rideau centre downtown. This route operates every 15 minutes on weekdays between 6:00am and 9:00pm. This bus route operates seven days a week.

Figure 2: OC Transpo Bus Stop Locations

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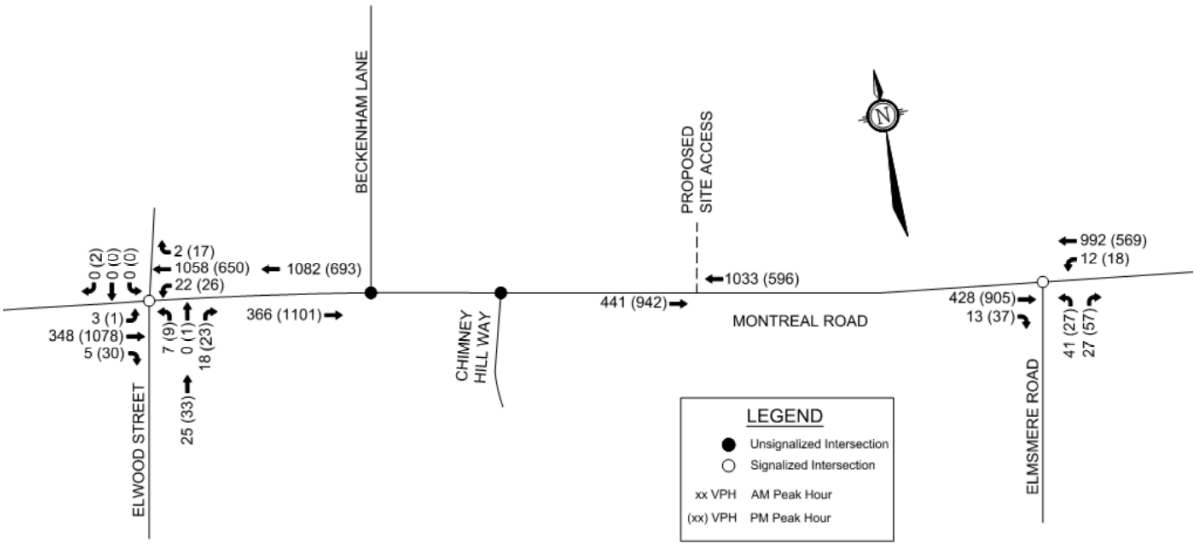
4.1.5 Existing Traffic Volumes

Weekday traffic counts completed by the City of Ottawa were used to determine the existing vehicular traffic volumes at the adjacent intersections and at the site access. The traffic counts were completed on the following dates:

- Montreal Road/Elmsmere Road July 10, 2014
- Montreal Road/Elwood Street July 10, 2014

The above noted turning movement counts are included in **Appendix C**. Existing weekday AM and PM peak hour traffic volumes at the study area intersections are shown in **Figure 3**.

Figure 3: Existing Traffic Volumes



4.1.6 Collision Records

Historical collision data from the last five years was obtained from the City's Traffic Services Branch and Traffic Management Unit Public Works and Environmental Services Department for the study area intersections. Copies of the collision summary reports are included in **Appendix D**.

The collision data has been evaluated to determine if there are any identifiable collision patterns. The following table summarizes the number of collisions between January 1, 2012 to January 1, 2017.

Table 1: Reported Collisions

Intersection	Number of Reported Collisions
Montreal Road and Elmsmere Road	9
Montreal Road and Elwood Street	4

A total of 9 collisions were reported at the Montreal Road/Elmsmere Road intersection over the last five years. Six of the reported collisions were rear-end impacts, one was angle impact, and two were single vehicle/other impacts. Three of the collisions caused personal injuries, but none caused fatalities. No patterns of six or more collision types were noted in any one movement.

A total of 4 collisions were reported at the Montreal Road/Elwood Street intersection over the last five years. One of the collisions caused personal injuries, but none caused fatalities. No pattern of six or more collision types were noted in any one movement.

4.2 Planned Conditions

The City of Ottawa's 2013 Transportation Master Plan does not identify any roadway or transit projects along the boundary street within its Affordable Road Network and Affordable Rapid Transit and Transit Priority Network. The 2031 Network Concept Rapid Transit and Transit Priority identifies Montreal Road as a Transit Priority Corridor with continuous lanes. As part of the 2031 Network Concepts, road widening is planned to provide exclusive bus lanes and transit signals priority between Blair Road and Ogilvie Road.

There are no other developments under construction, approved, or in the approval process within the study area.

4.3 Study Area and Time Periods

The study area for this report will include the boundary street of Montreal Road, and the proposed site access. The site access is a right-in, right-out driveway to Montreal Road.

The selected time periods for the analysis are the weekday AM and PM peak hours, as they represent the 'worst case' combination of site generated traffic and adjacent street traffic. The proposed site is anticipated to be constructed with full occupancy in 2019.

4.4 Exemptions Review

As the trip generation trigger was not met, the Transportation Demand Management (Module 4.5), Neighbourhood Traffic Management (Module 4.6), Transit (Module 4.7), Network Concept (Module 4.8) and Network Intersections (Module 4.9) are not required for analysis.

The following modules are included in the TIA report:

- Module 4.1 – Development Design
- Module 4.2 – Parking
- Module 4.3 – Boundary Street Design
- Module 4.4 – Access Intersections Design

5.0 DEVELOPMENT GENERATED TRAFFIC

5.1 Trip Generation

5.1.1 Trip Generation Rates

Site generated traffic has been estimated using the vehicle trip rates identified in the ITE Trip Generation Manual (9th Edition) for a General Office Building (Land Use Code 710).

The ancillary building will be used for material storage and is not intended as a distribution warehouse. It is our understanding that employees using this building will be accounted for as primary users of the office building.

The number of vehicle trips generated by the proposed development during the weekday AM and PM peak hours is summarized in **Table 2**.

Table 2: Trip Generation

Land Use	Land Use Code	AM Peak			PM Peak		
		IN	OUT	TOTAL	IN	OUT	TOTAL
General Office Building	710	10	1	11	2	8	10

The ITE vehicle trips have been converted to person trips using a factor of 1.28, consistent with the TIA guidelines. Person trips generated by the proposed site are shown in **Table 3**.

Table 3: Projected Site-Generated Person Trips

Land Use	AM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL
General Office Building	13	1	14	3	10	13

5.1.2 Mode Shares

The number of auto and non-auto trips that the site will generate has been estimated by categorizing the person trips by modal share. The modal shares are based on observed percentages in the 2011 TRANS O-D Survey Report that are specific to the region referred to as the Beacon Hill district. The modal share values applied to the trips generated by the proposed development are based on those with an origin or destination beyond that area. A full breakdown of the projected person trips by modal share and arrival/departure is shown **Table 4**.

Table 4: Site-Generated Trips by Modal Share

Travel Mode	Modal Share	AM Peak			PM Peak		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Total Person Trips		13	1	14	3	10	13
Auto Driver	65%	8	1	9	2	7	9
Auto Passenger	10%	1	0	1	0	1	1
Transit	20%	3	0	3	1	1	2
Non-Auto	5%	1	0	1	0	1	1

5.2 Trip Distribution

The distribution of site generated traffic is based on the existing traffic patterns and the location of the subject site with respect to major area roadways.

The trip distribution assumptions are summarized as follows:

40% to/from the east via Montreal Road
60% to/from the west via Montreal Road

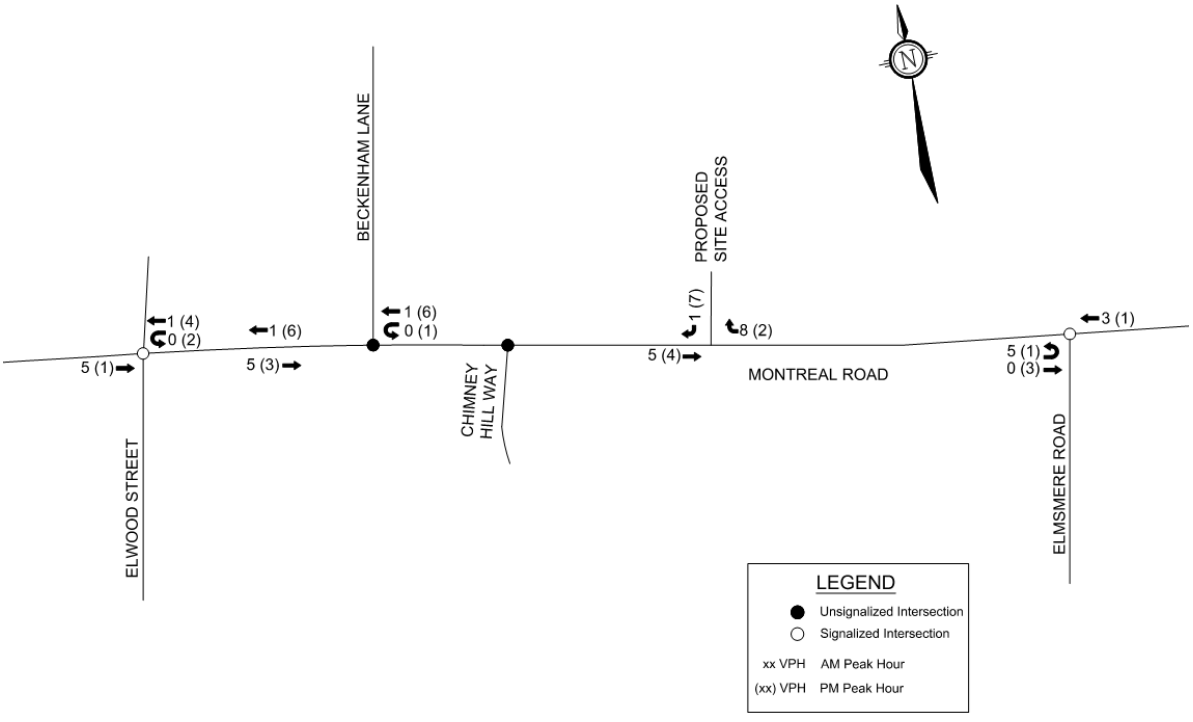
5.3 Trip Assignment

The proposed Site Plan, included in **Appendix A**, indicates the layout of the proposed site. The site is accessed westbound on Montreal Road via a right-in, right-out access. Vehicles approaching from the eastbound direction would be required to make u-turn movements at the intersection of Montreal Road/Elmsmere Road. The existing left-turn pocket lane could accommodate the u-turn vehicles, however, line panting may need to be adjusted. The u-turns would be permitted during the all green phase similar to the westbound left-turning vehicles.

Vehicles departing from the proposed site to an eastbound destination could make a u-turn at the median break at 1765,1770,1777 Montreal Road approximately 50m west of the site, at the unsignalized intersection of Beckenham Lane and Montreal Road, approximately 190m west of the site, or during the all green phase at the signalized intersection of Elwood Street/Montreal Road.

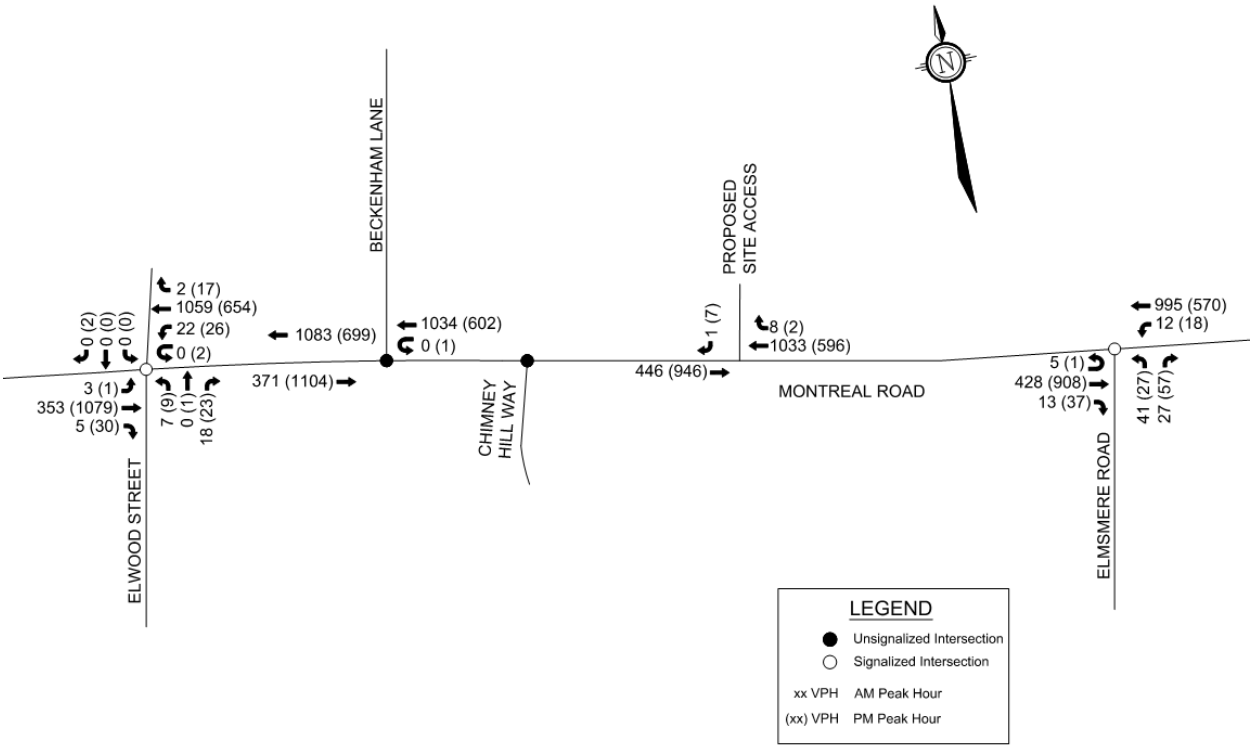
Site generated traffic volumes are shown in **Figure 4** for the weekday AM and PM peak hours.

Figure 4: Site Generated Traffic Volumes



Total traffic volumes have been calculated by adding the site generated traffic to existing traffic as shown in **Figure 5** for the weekday AM and PM peak hours.

Figure 5: Total Traffic Volumes



6.0 ANALYSIS

6.1 Development Design

6.1.1. Design for Sustainable Modes

The proposed Site Plan, included in **Appendix A**, indicates the layout of the proposed site.

A walkway is proposed connecting the building entrances to the existing sidewalk along Montreal Road. Sidewalk locations and bus stop locations adjacent to the subject site were previously described in Section 4.1, Existing Conditions. Walking distances to the adjacent bus stops are approximately 25m and 250m. A depressed sidewalk would be constructed across the proposed site access.

A review of the Transportation Demand Management (TDM) – Supportive Development Design and Infrastructure Checklist has been conducted. A copy of the TDM checklist is included in **Appendix E**. All applicable and required TDM-supportive design and infrastructure measures in the TDM checklist are met.

6.1.2 Circulation and Access

The garbage enclosure is located at the northeast corner of the site.

6.2 Parking

6.2.1 Parking Supply

The City of Ottawa Zoning By-law identifies a minimum requirement of vehicle and bicycle parking spaces. The site is located in Area C of Schedule 1A to the City's Zoning By-law. **Table 5** summarizes these requirements:

Table 5: Parking Supply

Use	Zoning by-law (minimum requirement)		Parking Provided	
	Vehicle Parking	Bicycle Parking	Vehicle Parking	Bicycle Parking
Office	2.4/100m^{2}GFA; 15	1/250m^{2}GFA; 2	15	2
Light Industrial Use[1]	0.8/100m^2; 7	1/1000m^{2}GFA; 1	1	1
Total	**22**	**3**	**16**	**3**

[1] Light Industrial Use - closest comparison in the City's Zoning by-law for the ancillary building

A total of 16 on-site vehicle parking spaces will be provided. The ancillary building will be used for material storage and is not intended as a distribution warehouse. It is our understanding that employees using this building will be accounted for as primary users of the office building. Therefore, parking spaces will not be provided for the ancillary building. The reduction in parking provided will be addresses as special zoning provision. The rationale for removing the requirement for parking is provided in the Planning Rationale prepared by Novatech.

The proposed bike parking would meet the minimum requirement of the by-law, with 1 bike rack (3 spaces) as shown on the Site Plan drawing.

The City of Ottawa Traffic and Parking By-law identifies that no accessible vehicle parking space are required for any public parking area with 1-19 spaces. One accessible spaces will be provided. Therefore, the number of accessible parking spaces exceeds the by-law requirement.

6.3 Boundary Street Design

6.3.1 Existing MMLOS Analysis

The MMLOS guidelines produced by IBI Group in October 2015 were used to evaluate the LOS of the roadway segment for each mode of transportation. Schedule B of the City of Ottawa's Official Plan indicates the roadway segment is located along an Arterial Mainstreet.

Figure 6 show the existing pedestrian, bicycle and transit measures along the boundary street, Montreal Road.

Figure 6: Existing Boundary Street – Montreal Road

Google Streetview

Pedestrian Level of Service

The intent of the PLOS tool, as described in the MMLOS Guidelines, is to evaluate the level of pedestrian comfort, safety and convenience. Exhibit 4 of the MMLOS Guidelines was used to evaluate the existing segment PLOS along the boundary street.

Exhibit 22 of the MMLOS Guidelines suggests that the minimum desirable PLOS target for the an Arterial Mainstreet is LOS C.

The results of the segment PLOS analysis are shown in the following table:

Table 6: PLOS Segment Analysis

Segment	Vehicular Operation Speed	Sidewalk Width	Boulevard Width	Motor Vehicle Voume (AADT)	Presence of on-street Parking	Segment PLOS
Montreal Rd	60km/h	1.5	0.5 to 2	>3000	No	**E**

The existing conditions along this segment of Montreal Road fails to meet the target PLOS. If the City wishes to address the deficiency, options that they could consider to improve the PLOS include, increasing the boulevard width on Montreal Road to greater that 2m (currently 1.6m) and widening the sidewalk to 2m.

Bicycle Level of Service

The intent of the BLOS tool, as described in the MMLOS Guidelines, is to evaluate roadway segments for the level of traffic stress experienced by cyclists using the corridor. Exhibit 11 of the MMLOS Guidelines has been used to evaluate the existing segment BLOS within the boundary limits.

Exhibit 22 of the MMLOS Guidelines suggests that the minimum desirable BLOS target for a spine route is LOS C.

The results of the segment BLOS analysis are shown in the following table:

Table 7: BLOS Segment Analysis

Segment	Road Class/ Route Type	Type of Bikeway	Vehicular Operation Speed	Segment BLOS
Montreal Rd	Arterial; Spine Route	Mixed Traffic	60km/h	**F**

The existing conditions along this segment of Montreal Road fails to meet the target BLOS. If the City wishes to improve the deficiency, options that they could considered include adding a separated bike facility on Montreal Road. This approach would be consistent with the Desirable Cycling Facility Pre-selection Nomograph found in OTM Book 18.

Transit Level of Service

The intent of TLOS, as described in the MMLOS Guidelines, is to evaluate the relative attractiveness of transit to support the City's aim to ultimately increase transit modal share. Exhibit 15 has been used to evaluate the Montreal Road segment TLOS.

Exhibit 22 of the MMLOS Guidelines suggests a target TLOS C for transit priority corridor with continuous lanes (planned in the case of Montreal Road).

Table 8: TLOS Segment Analysis

Facility Type	Level/Exposure to Congestion Delay, Friction and Incidents			Quantitative Measurement	LOS
	Congestion	Friction	Incident Potential		
Montreal Road - Mixed Traffic - Limited parking/driveway friction	Yes	Low	Medium	Vt / Vp ≥ 0.8	**D**

The existing conditions along this segment of Montreal Road fails to meet the target TLOS.

The 2031 Network Concept Rapid Transit and Transit Priority identifies Montreal Road as a Transit Priority Corridor with continuous lanes. As part of the 2031 Network Concept, road widening is planned to provide exclusive bus lanes and transit signal priority between Blair Road and Ogilvie Road, which would improve TLOS.

Truck Level of Service

The intent of the TkLOS, as described in the MMLOS Guidelines, is to review the physical space available for trucks to negotiate corners quickly and easily, and to operate safely within travel lanes. Exhibits 20 of the MMLOS Guidelines have been used to evaluate the existing segment TkLOS along Montreal Road.

Montreal Road is a truck route with a target TkLOS D for an Arterial Mainstreet, as defined in Exhibit 22 of the MMLOS Guidelines.

Table 9: TkLOS Segment Analysis

Curb Lane Width (m)	Number of Travel Lanes	LOS
Montreal Road		
> 3.7	>2	A

The existing conditions along Montreal Road for this segment meet the desirable TkLOS.

Vehicular Level of Service

Exhibit 22 of the MMLOS Guidelines suggests that the minimum desirable Auto-LOS target is LOS D for an Arterial Mainstreet.

Lane capacity of a two-way arterial roadway with frequent signals, at-grade intersections and a raised median is estimated at 1000 vph per lane per the City's guidelines for long-range strategic planning model. The existing traffic counts shown in **Figure 3** were used to compare volume to capacity along this roadway segment.

Results of the segment Auto-LOS analysis are summarized in **Table 10**.

Table 10: Auto-LOS Segment Analysis - Existing Conditions

Road Segment	AM Peak				PM Peak			
	Volume (vph)	Capacity (vph)	v/c	LOS	Volume (vph)	Capacity (vph)	v/c	LOS
Montreal Road								
Eastbound	441	2000	0.22	A	942	2000	0.47	A
Westbound	1033	2000	0.52	A	596	2000	0.30	A

The existing conditions along Montreal Road for this segment meet the desirable Auto-LOS.

6.4 Access Intersection Design

6.4.1 Location and Design of Access

In the vicinity of the site, Montreal Road is divided by a concrete median between Beckenham Lane to the west and Elmsmere Road to the east.

The west edge of the site entrance is 22m from the west property line. The RIRO access will have a width of 6.7m and a clear throat length of approximately 8m. The site access meets the City of Ottawa's Private Approach By-law requirement which identifies a maximum driveway width of 9.0m and a minimum requirement of 3.0m between any access and the nearest property line.

6.4.2 Sight Distance

A review of Stopping Sight Distance and Intersection Sight Distance has been completed at the proposed site access.

Stopping Sight Distance

Stopping Sight Distance (SSD) at this site is described as the distance required for a vehicle to stop safely behind a vehicle queued turning right into the site from Montreal Road. The SSD at the proposed access is the sum of the distance traveled during the perception and reaction time and the braking distance. The required SSD at the access has been calculated using Transportation Association of Canada (TAC) Equations 2.5.1 to 2.5.3, a design speed of 70km/h and a 3% westbound upgrade along Montreal Road. Based on the foregoing, a minimum westbound SSD of 100m is required at the proposed access. The minimum required SSD at the proposed access is shown in **Figure 7**, no concerns are noted with the sight distance available. Relevant excerpts from the TAC guidelines are included in **Appendix F**.

Figure 7: Minimum Stopping Sight Distance

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Intersection Sight Distance

Intersection Sight Distance (ISD) is described as the required distance along the major road for a vehicle to turn either left or right from a stopped position, without being overtaken by a vehicle approaching from the left or right. Based on a design speed of 70km/h, the time gaps provided in table 9.9.5 and TAC Equation 9.9.1, the required ISD is approximately 130m for a passenger vehicle to turn right (provided in Table 9.9.6). The minimum required ISD at the proposed RIRO access is shown in **Figure 8**. Relevant excerpts from the TAC guidelines are included in **Appendix F**. The available sight distance is sufficient to meet the TAC guidelines.

Figure 8: Minimum Intersection Sight Distance

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6.4.3 Intersection Control

The site access will be stop/yield controlled with free flow conditions on Montreal Road.

6.4.4 Intersection Design

Intersection capacity analysis has been completed for the 2019 total traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines. The results of the Synchro analysis are summarized in the following table for the weekday AM and PM peak hours. Detailed synchro reports are included in **Appendix G**.

Table 11: Synchro Analysis - Total Traffic

Intersection	AM Peak			PM Peak		
	Delay	LOS	Movement	Delay	LOS	Movement
RIRO Access at Montreal Road	12.9s	B	SBR	10.5s	B	SBR

The outbound movement at the study area access is anticipated to operate with a LOS B or better during the weekday AM and PM peak hours, meeting the target for an Arterial Mainstreet. No roadway modifications are proposed on Montreal Road to accommodate this development.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing, the conclusions and recommendations of this TIA can be summarized as follows:

- The Transportation Impact Assessment report has been prepared in support of Zoning By-Law Amendment and Site Plan Control applications for 1795 Montreal Road.

- The proposed access is a right-in, right-out driveway to Montreal Road. The access will be stop/yield controlled with free flow conditions Montreal Road.

- Our review of the development and the screening form indicate that the Location trigger is met as Montreal Road is a spine cycling route and in a Design Priority Area.

- All applicable and required TDM-supportive design and infrastructure measures in the TDM checklist are met.

- The MMLOS guidelines were used to evaluate the LOS of the roadway segment for each mode of transportation. The existing conditions along Montreal Road exceed the desirable PLOS, BLOS and TLOS. The existing conditions along Montreal Road for this segment meet the desirable TkLOS and Auto-LOS.

    - If the City wishes to address these deficiencies they could consider increasing the boulevard width on Montreal Road to greater that 2m (currently 1.6m) and widening the sidewalk to 2m which would improve PLOS.

    - The City could consider adding a separated bike facility to Montreal Road which would improve the BLOS.

    - The 2031 Network Concept Rapid Transit and Transit Priority identifies Montreal Road as a Transit Priority Corridor with continuous lanes. As part of the 2031 Network Concept, road widening is planned to provide exclusive bus lanes and transit signal priority between Blair Road and Ogilvie Road, which would improve TLOS.

- The minimum required Stopping Sight Distance and Intersection Sight Distance at the site entrance were reviewed. The available sight distances are sufficient to meet the TAC guidelines.

- The outbound auto movements at the proposed access is anticipated to operate with a LOS B or better during the weekday AM and PM peak hours, meeting the target for an Arterial Mainstreet.

- No roadway modifications are proposed for Montreal Road to accommodate the development of 1795 Montreal Road.

Prepared by:

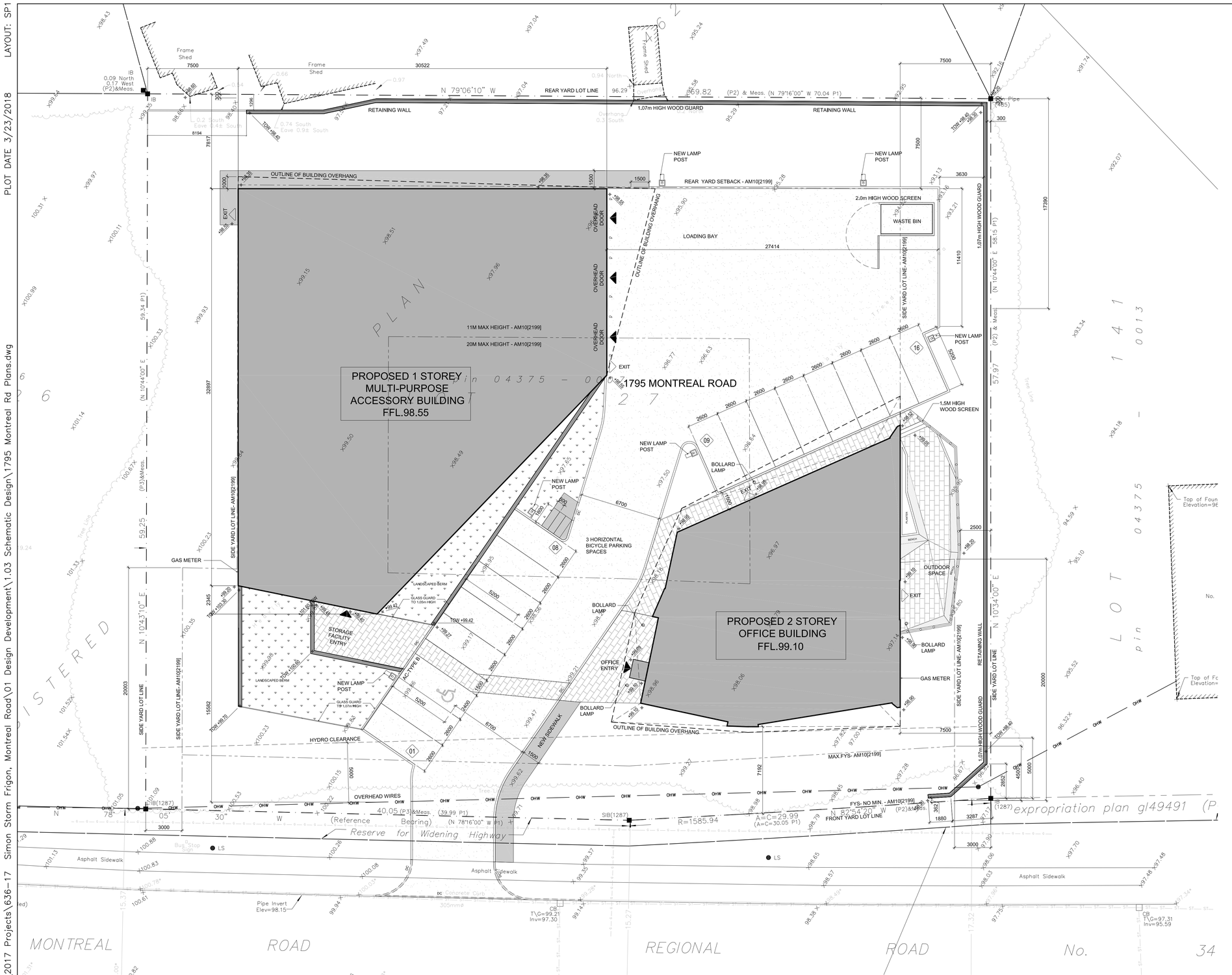
NOVATECH

Lisa Bowley, P.Eng.
Project Manager
Land Development Engineering

APPENDIX A

Proposed Site Plan

S:\CSA Jobs\2017 Projects\636-17 Simon Storm Frigon, Montreal Road\01 Design Development\1.03 Schematic Design\1795 Montreal Rd Plans.dwg PLOT DATE 3/23/2018 LAYOUT: SP1



1 SITE PLAN A000 — 1:150

SCALE = 1:150

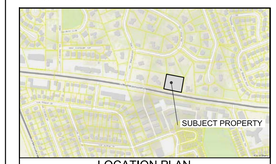
GENERAL NOTES

A THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON SITE AND REPORT ALL DISCREPANCIES TO THE ARCHITECT.

B DO NOT SCALE DRAWINGS.

C ALL WORK SHALL COMPLY WITH THE ONTARIO BUILDING CODE AND THE REQUIREMENTS OF ALL AUTHORITIES HAVING JURISDICTION.

D THIS DRAWING IS THE EXCLUSIVE PROPERTY OF CHRISTOPHER SIMMONDS ARCHITECT INC. COPYRIGHT RESERVED.



LOCATION PLAN

Legal Description:
Lot 27
Registered Plan 462
City of Ottawa

Lot Area : 4148 m²

PROPOSED USE

Office	611 m2
Multi-Purpose Access. Bldg	849 m2

Building Area/coverage: 1414.4 m²

PROPOSED GLAZING ALONG FRONT FACADE AT GROUND FLOOR

Office Bldg:	76%
Multi-Purpose Acess. Bldg:	73%

BUILDING HEIGHT

Proposed Office Bldg :	8.01m
Proposed Multi-Purpose Access. Bldg.:	5.81m

GROSS FLOOR AREA

Office GFA:	611 m²
Multi-Purpose Access. Bldg, GFA:	849 m²
Total Building GFA:	1460 m²

PARKING

Required:
Total parking spaces required:

Office:	2.4 per 100m2 GFA=	2.4 x 6.11 = 14.66
Multi-Purpose Access.:	0.8 per 100m2 GFA=	0.8 x 8.49 = 6.79
Total:		21.45

Proposed:

Parking spaces:	10
Visitor spaces (V):	6
Total:	16
Small car spaces (SM):	0% (0)
Accessible (HC,a, HC,b):	1 HC,b
Electric car spaces (EX)	0

BICYCLE PARKING

Office :	1 per 250m2 GFA=	1 x 611/250 =	2.4
Multi-Purp. Access. ;	1 per 1000m2 GFA=	1 x 849/1000 =	0.85
Total Bikes Req'd:			3
Bike Spaces Provided:			3

LEGEND

- PROPERTY LINE
- SETBACK
- NEW BUILDING FOOTPRINT
- BUILDING FACE ABOVE
- OVERHEAD WIRES
- BUILDING ENTRY
- BUILDING EXIT
- EXISTING UTILITY POLE
- FIRE HYDRANT
- PROPOSED GRADE
- STAIR DIRECTION
- PARKING SPACE NUMBER
- BARRIER-FREE PARKING SPACE
- CATCH BASIN
- MANHOLE
- BOLLARD
- BOLLARD LAMP
- FENCE
- RETAINING WALL
- DEPRESSED CURB
- NEW CONCRETE SIDEWALK
- UNIT PAVERS
- ASPHALT
- NEW LANDSCAPED AREA

REV.	ISSUED FOR	MM/DD/YYY
01	SITE PLAN CONTROL	03/23/2018

ARCHITECT'S SEAL:

PROJECT NORTH:

Christopher Simmonds Architect
THE ANNEX / 45 ECCLES ST. OTTAWA ON K1R 6S3
613.567.7888 PHONE / 613.567.7528 FAX
csarchitect.com

PROJECT:
1795 MONTREAL RD
OFFICES AND MULTI-PURPOSE ACCESSORY BUILDING

DRAWING TITLE:
SITE PLAN

DATE:	23/11/2017
SCALE:	AS INDICATED
DRAWN BY:	SS
JOB No:	636-17

DRAWING No: SP-1

APPENDIX B

TIA Screening Form and Letter of Certification

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	**1795 Montreal Road**
Description of Location	**The 0.42 hectare property is bound by Montreal Road to the south, the Ottawa Withdrawal Management Centre to the west and existing residential to the north and east.**
Land Use Classification	**Office**
Development Size (units)	**N/A**
Development Size (m^2)	**Office Building (611 m^2)** **Auxiliary Storage Building (874m^2)**
Number of Accesses and Locations	**The subject site has one proposed access a right-in right-out driveway (westbound) on Montreal Road.**
Phase of Development	**N/A**
Buildout Year	**2019**

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m^2
Industrial	5,000 m^2
Fast-food restaurant or coffee shop	100 m^2
Destination retail	1,000 m^2
Gas station or convenience market	75 m^2

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	✓	
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*	✓	

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?		✓
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		✓
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?		✓
Is the proposed driveway within auxiliary lanes of an intersection?		✓
Does the proposed driveway make use of an existing median break that serves an existing site?		✓
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		✓
Does the development include a drive-thru facility?		✓

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?		✓
Does the development satisfy the Location Trigger?	✓	
Does the development satisfy the Safety Trigger?		✓

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering ☑ or transportation planning ☐.

[1,2] **License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.**

City Of Ottawa
Infrastructure Services and Community Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
Tel. : 613-580-2424
Fax: 613-560-6006

Ville d'Ottawa
Services d 'infrastructure et Viabilité des collectivités
Urbanisme et Gestion de la croissance
110, avenue Laurier Ouest
Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
Télécopieur: 613-560-6006

Dated at Ottawa this 8 day of January, 2018.
(City)

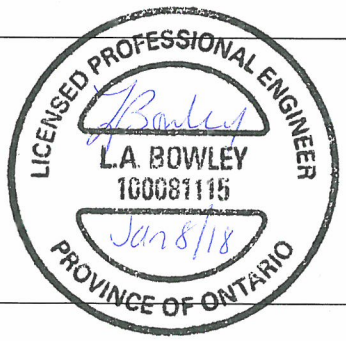
Name: Lisa Bowley
(Please Print)

Professional Title: Project Manager

L Bowley
Signature of Individual certifier that s/he meets the above four criteria

Office Contact Information (Please Print)
Address: 240 Michael Cowpland Drive Suite 200
City / Postal Code: Ottawa ON K2M 1P6
Telephone / Extension: 613-254-9643 x 246
E-Mail Address: l.bowley@novatech-eng.com

Stamp



APPENDIX C

Traffic Count Data

Transportation Services - Traffic Services

W.O. 1174

Turning Movement Count - 15 Minute Summary Report

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 0 Westbound: 1

		ELMSMERE RD									MONTREAL RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	6	0	7	**13**	0	0	0	**0**	**13**	0	72	2	**74**	1	204	0	**205**	**279**	**292**
07:15	07:30	7	0	6	**13**	0	0	0	**0**	**13**	0	68	4	**72**	1	201	0	**202**	**274**	**287**
07:30	07:45	5	0	6	**11**	0	0	0	**0**	**11**	0	84	4	**88**	4	221	0	**225**	**313**	**324**
07:45	08:00	8	0	3	**11**	0	0	0	**0**	**11**	0	95	3	**98**	1	276	0	**277**	**375**	**386**
08:00	08:15	9	0	7	**16**	0	0	0	**0**	**16**	0	111	4	**115**	4	260	0	**264**	**379**	**395**
08:15	08:30	12	0	6	**18**	0	0	0	**0**	**18**	0	97	4	**101**	2	242	0	**244**	**345**	**363**
08:30	08:45	12	0	11	**23**	0	0	0	**0**	**23**	0	125	2	**127**	5	214	0	**219**	**346**	**369**
08:45	09:00	10	0	7	**17**	0	0	0	**0**	**17**	0	104	5	**109**	9	204	0	**213**	**322**	**339**
09:00	09:15	9	0	12	**21**	0	0	0	**0**	**21**	0	109	4	**113**	10	183	0	**193**	**306**	**327**
09:15	09:30	12	0	10	**22**	0	0	0	**0**	**22**	0	139	3	**142**	4	155	0	**159**	**301**	**323**
09:30	09:45	11	0	8	**19**	0	0	0	**0**	**19**	0	113	4	**117**	4	142	0	**146**	**263**	**282**
09:45	10:00	6	0	13	**19**	0	0	0	**0**	**19**	0	104	7	**111**	6	170	0	**176**	**287**	**306**
11:30	11:45	4	0	10	**14**	0	0	0	**0**	**14**	0	83	6	**89**	9	151	0	**160**	**249**	**263**
11:45	12:00	5	0	3	**8**	0	0	0	**0**	**8**	0	129	5	**134**	6	160	0	**166**	**300**	**308**
12:00	12:15	2	0	5	**7**	0	0	0	**0**	**7**	0	161	7	**168**	10	139	0	**149**	**317**	**324**
12:15	12:30	9	0	5	**14**	0	0	0	**0**	**14**	0	133	8	**141**	10	149	0	**159**	**300**	**314**
12:30	12:45	11	0	15	**26**	0	0	0	**0**	**26**	0	113	5	**118**	7	166	0	**173**	**291**	**317**
12:45	13:00	10	0	2	**12**	0	0	0	**0**	**12**	0	80	3	**83**	6	150	0	**156**	**239**	**251**
13:00	13:15	7	0	10	**17**	0	0	0	**0**	**17**	0	121	14	**135**	4	154	0	**158**	**293**	**310**
13:15	13:30	7	0	12	**19**	0	0	0	**0**	**19**	0	129	3	**132**	3	143	0	**146**	**278**	**297**
15:00	15:15	4	0	10	**14**	0	0	0	**0**	**14**	0	167	6	**173**	5	156	0	**161**	**334**	**348**
15:15	15:30	10	0	18	**28**	0	0	0	**0**	**28**	0	182	8	**190**	8	157	0	**165**	**355**	**383**
15:30	15:45	8	0	13	**21**	0	0	0	**0**	**21**	0	212	7	**219**	3	137	0	**140**	**359**	**380**
15:45	16:00	11	0	11	**22**	0	0	0	**0**	**22**	0	168	6	**174**	6	132	0	**138**	**312**	**334**
16:00	16:15	6	0	9	**15**	0	0	0	**0**	**15**	0	220	9	**229**	7	155	0	**162**	**391**	**406**
16:15	16:30	3	0	15	**18**	0	0	0	**0**	**18**	0	240	11	**251**	2	118	0	**120**	**371**	**389**
16:30	16:45	10	0	23	**33**	0	0	0	**0**	**33**	0	213	8	**221**	7	151	0	**158**	**379**	**412**
16:45	17:00	8	0	10	**18**	0	0	0	**0**	**18**	0	232	9	**241**	2	145	0	**147**	**388**	**406**
17:00	17:15	8	0	18	**26**	0	0	0	**0**	**26**	0	161	6	**167**	10	142	0	**152**	**319**	**345**
17:15	17:30	6	0	16	**22**	0	0	0	**0**	**22**	0	189	5	**194**	8	120	0	**128**	**322**	**344**
17:30	17:45	5	0	11	**16**	0	0	0	**0**	**16**	0	197	10	**207**	3	137	0	**140**	**347**	**363**
17:45	18:00	5	0	9	**14**	0	0	0	**0**	**14**	0	147	7	**154**	5	121	0	**127**	**281**	**295**
TOTAL:		246	0	321	**567**	0	0	0	**0**	**567**	0	4498	189	**4687**	172	5355	0	**5528**	**10215**	**10782**

Note: U-Turns are included in Totals.

Comment:

Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
1174

ELMSMERE RD @ MONTREAL RD

Count Date: Thursday, July 10, 2014 **Start Time:** 07:00

	ELMSMERE RD			MONTREAL RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	1	0	**1**	4	4	**8**	**9**
08:00 09:00	1	0	**1**	1	6	**7**	**8**
09:00 10:00	0	0	**0**	0	2	**2**	**2**
11:30 12:30	2	0	**2**	1	0	**1**	**3**
12:30 13:30	3	0	**3**	2	2	**4**	**7**
15:00 16:00	1	0	**1**	0	4	**4**	**5**
16:00 17:00	4	0	**4**	1	3	**4**	**8**
17:00 18:00	2	0	**2**	4	3	**7**	**9**
Total	14	0	**14**	13	24	**37**	**51**

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.

Transportation Services - Traffic Services

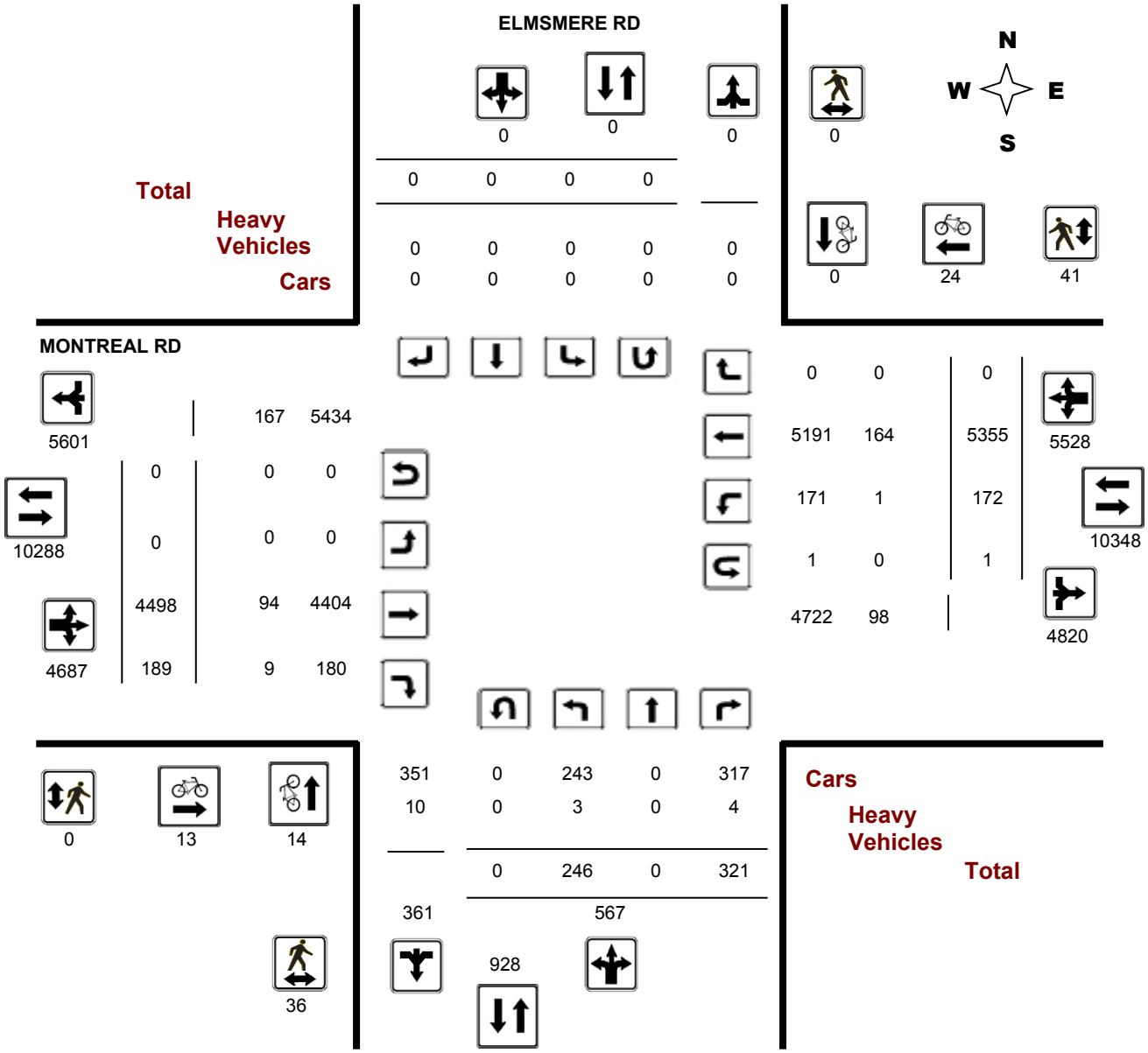
Turning Movement Count - Full Study Diagram

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

WO#: 1174

Device: Jamar Technologies, Inc



Comments

Transportation Services - Traffic Services

W.O. 1174

Turning Movement Count - Heavy Vehicle Report

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

		ELMSMERE RD									MONTREAL RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	08:00	0	0	1	**1**	0	0	0	**0**	**1**	0	8	2	**10**	0	18	0	**18**	**28**	**29**
08:00	09:00	2	0	0	**2**	0	0	0	**0**	**2**	0	12	1	**13**	0	33	0	**33**	**46**	**48**
09:00	10:00	0	0	1	**1**	0	0	0	**0**	**1**	0	21	1	**22**	0	27	0	**27**	**49**	**50**
11:30	12:30	0	0	0	**0**	0	0	0	**0**	**0**	0	11	1	**12**	0	17	0	**17**	**29**	**29**
12:30	13:30	0	0	1	**1**	0	0	0	**0**	**1**	0	8	2	**10**	1	23	0	**24**	**34**	**35**
15:00	16:00	1	0	1	**2**	0	0	0	**0**	**2**	0	10	2	**12**	0	17	0	**17**	**29**	**31**
16:00	17:00	0	0	0	**0**	0	0	0	**0**	**0**	0	16	0	**16**	0	14	0	**14**	**30**	**30**
17:00	18:00	0	0	0	**0**	0	0	0	**0**	**0**	0	8	0	**8**	0	15	0	**15**	**23**	**23**
Sub Total		3	0	4	**7**	0	0	0	**0**	**7**	0	94	9	**103**	1	164	0	**165**	**268**	**275**
U-Turns (Heavy Vehicles)					**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total		3	0	4	**0**	0	0	0	**0**	**7**	0	94	9	**103**	1	164	0	**165**	**268**	**275**

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.

Transportation Services - Traffic Services

Work Order
1174

Turning Movement Count - Pedestrian Volume Report

ELMSMERE RD @ MONTREAL RD

Count Date: Thursday, July 10, 2014 **Start Time:** 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	**0**	0	2	**2**	**2**
07:15 07:30	2	0	**2**	0	5	**5**	**7**
07:30 07:45	1	0	**1**	0	1	**1**	**2**
07:45 08:00	1	0	**1**	0	2	**2**	**3**
07:00 08:00	4	0	**4**	0	10	**10**	**14**
08:00 08:15	2	0	**2**	0	0	**0**	**2**
08:15 08:30	1	0	**1**	0	0	**0**	**1**
08:30 08:45	0	0	**0**	0	1	**1**	**1**
08:45 09:00	0	0	**0**	0	0	**0**	**0**
08:00 09:00	3	0	**3**	0	1	**1**	**4**
09:00 09:15	0	0	**0**	0	1	**1**	**1**
09:15 09:30	2	0	**2**	0	2	**2**	**4**
09:30 09:45	0	0	**0**	0	0	**0**	**0**
09:45 10:00	1	0	**1**	0	0	**0**	**1**
09:00 10:00	3	0	**3**	0	3	**3**	**6**
11:30 11:45	1	0	**1**	0	5	**5**	**6**
11:45 12:00	1	0	**1**	0	1	**1**	**2**
12:00 12:15	2	0	**2**	0	1	**1**	**3**
12:15 12:30	1	0	**1**	0	0	**0**	**1**
11:30 12:30	5	0	**5**	0	7	**7**	**12**
12:30 12:45	1	0	**1**	0	2	**2**	**3**
12:45 13:00	2	0	**2**	0	2	**2**	**4**
13:00 13:15	0	0	**0**	0	0	**0**	**0**
13:15 13:30	0	0	**0**	0	6	**6**	**6**
12:30 13:30	3	0	**3**	0	10	**10**	**13**
15:00 15:15	0	0	**0**	0	0	**0**	**0**
15:15 15:30	0	0	**0**	0	0	**0**	**0**
15:30 15:45	1	0	**1**	0	3	**3**	**4**
15:45 16:00	3	0	**3**	0	2	**2**	**5**
15:00 16:00	4	0	**4**	0	5	**5**	**9**
16:00 16:15	1	0	**1**	0	0	**0**	**1**
16:15 16:30	2	0	**2**	0	1	**1**	**3**
16:30 16:45	0	0	**0**	0	1	**1**	**1**
16:45 17:00	2	0	**2**	0	0	**0**	**2**
16:00 17:00	5	0	**5**	0	2	**2**	**7**
17:00 17:15	0	0	**0**	0	0	**0**	**0**
17:15 17:30	1	0	**1**	0	0	**0**	**1**
17:30 17:45	2	0	**2**	0	0	**0**	**2**
17:45 18:00	6	0	**6**	0	3	**3**	**9**
17:00 18:00	9	0	**9**	0	3	**3**	**12**
Total	36	0	**36**	0	41	**41**	**77**

Comment:

Transportation Services - Traffic Services

Work Order
1174

Turning Movement Count - Full Study Summary Report

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 0 Westbound: 1

AADT Factor
.90

Full Study

	ELMSMERE RD									MONTREAL RD									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	**NB TOT**	LT	ST	RT	**SB TOT**	**STR TOT**	LT	ST	RT	**EB TOT**	LT	ST	RT	**WB TOT**	**STR TOT**	**Grand Total**
07:00 08:00	26	0	22	**48**	0	0	0	**0**	**48**	0	319	13	**332**	7	902	0	**909**	**1241**	**1289**
08:00 09:00	43	0	31	**74**	0	0	0	**0**	**74**	0	437	15	**452**	20	920	0	**940**	**1392**	**1466**
09:00 10:00	38	0	43	**81**	0	0	0	**0**	**81**	0	465	18	**483**	24	650	0	**674**	**1157**	**1238**
11:30 12:30	20	0	23	**43**	0	0	0	**0**	**43**	0	506	26	**532**	35	599	0	**634**	**1166**	**1209**
12:30 13:30	35	0	39	**74**	0	0	0	**0**	**74**	0	443	25	**468**	20	613	0	**633**	**1101**	**1175**
15:00 16:00	33	0	52	**85**	0	0	0	**0**	**85**	0	729	27	**756**	22	582	0	**604**	**1360**	**1445**
16:00 17:00	27	0	57	**84**	0	0	0	**0**	**84**	0	905	37	**942**	18	569	0	**587**	**1529**	**1613**
17:00 18:00	24	0	54	**78**	0	0	0	**0**	**78**	0	694	28	**722**	26	520	0	**546**	**1268**	**1346**
Sub Total	246	0	321	**567**	0	0	0	**0**	**567**	0	4498	189	**4687**	172	5355	0	**5527**	**10214**	**10781**
U Turns				**0**				**0**	**0**				**0**				**1**	**1**	**1**
Total	246	0	321	**567**	0	0	0	**0**	**567**	0	4498	189	**4687**	172	5355	0	**5528**	**10215**	**10782**
EQ 12Hr	342	0	446	**788**	0	0	0	**0**	**788**	0	6252	263	**6515**	239	7443	0	**7684**	**14199**	**14987**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	308	0	402	**709**	0	0	0	**0**	**709**	0	5627	236	**5863**	215	6699	0	**6916**	**12779**	**13488**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	403	0	526	**929**	0	0	0	**0**	**929**	0	7371	310	**7681**	282	8776	0	**9059**	**16740**	**17669**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

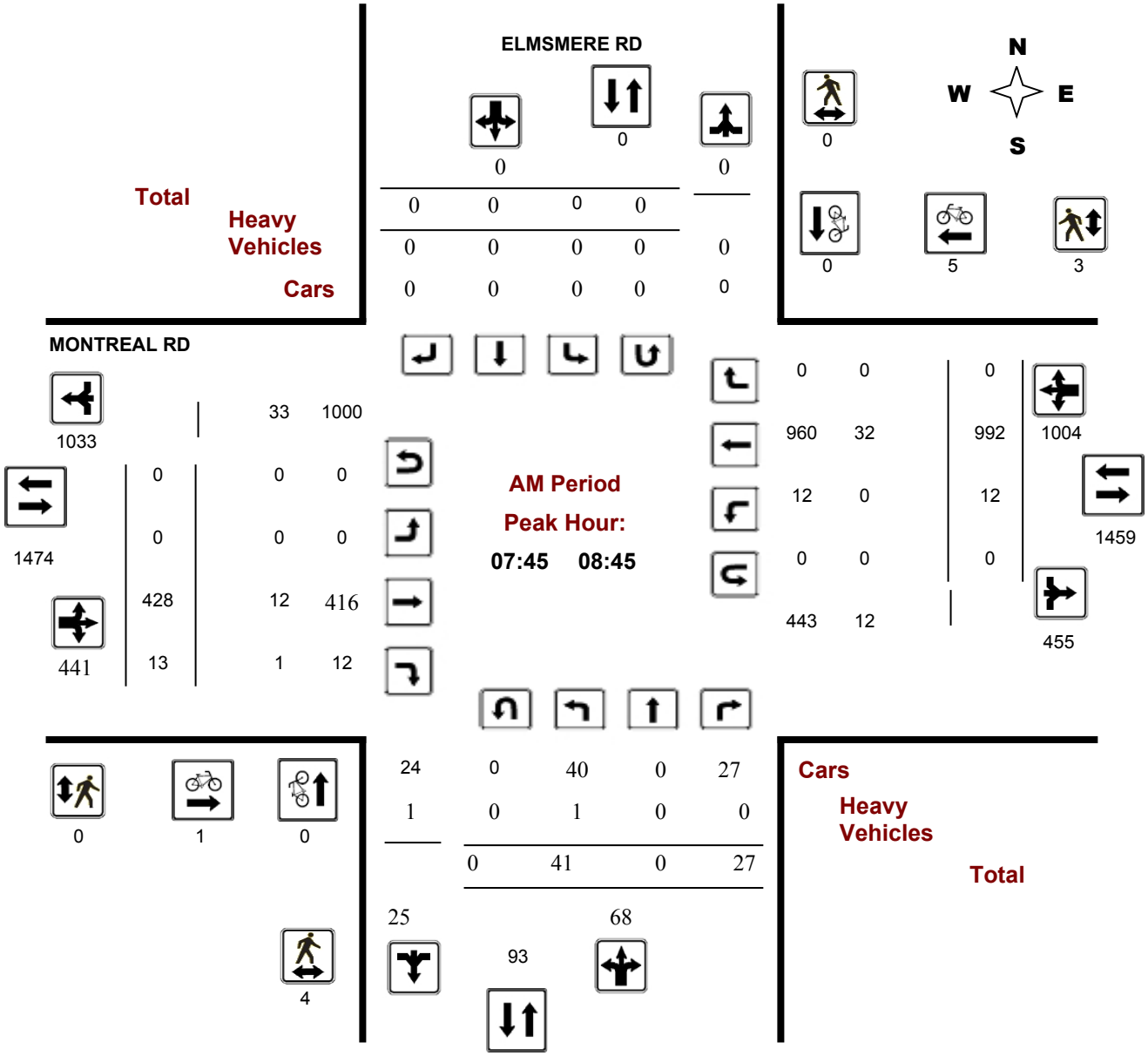
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1174
Device: Jamar Technologies, Inc



Comments

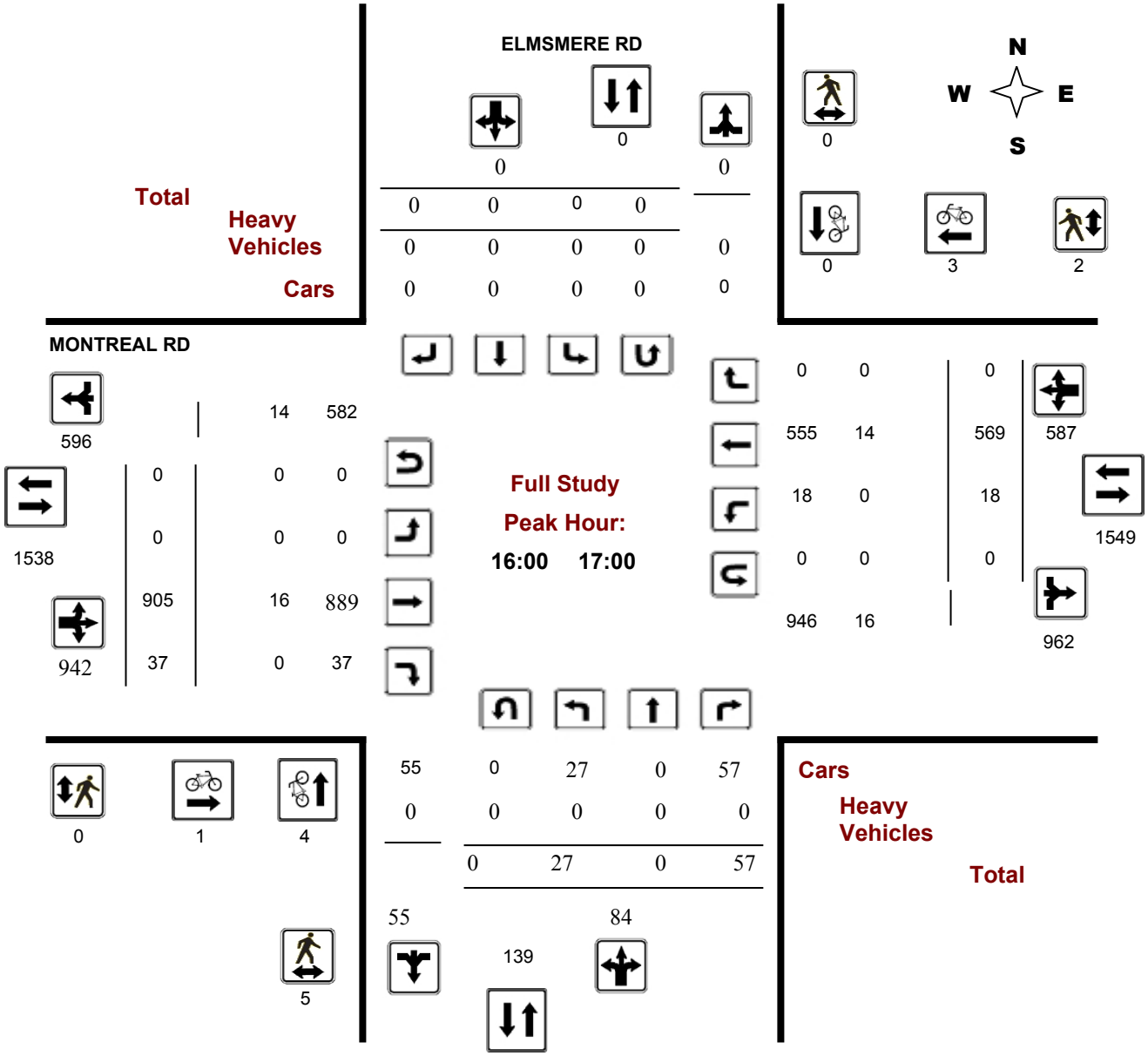
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1174
Device: Jamar Technologies, Inc



Comments

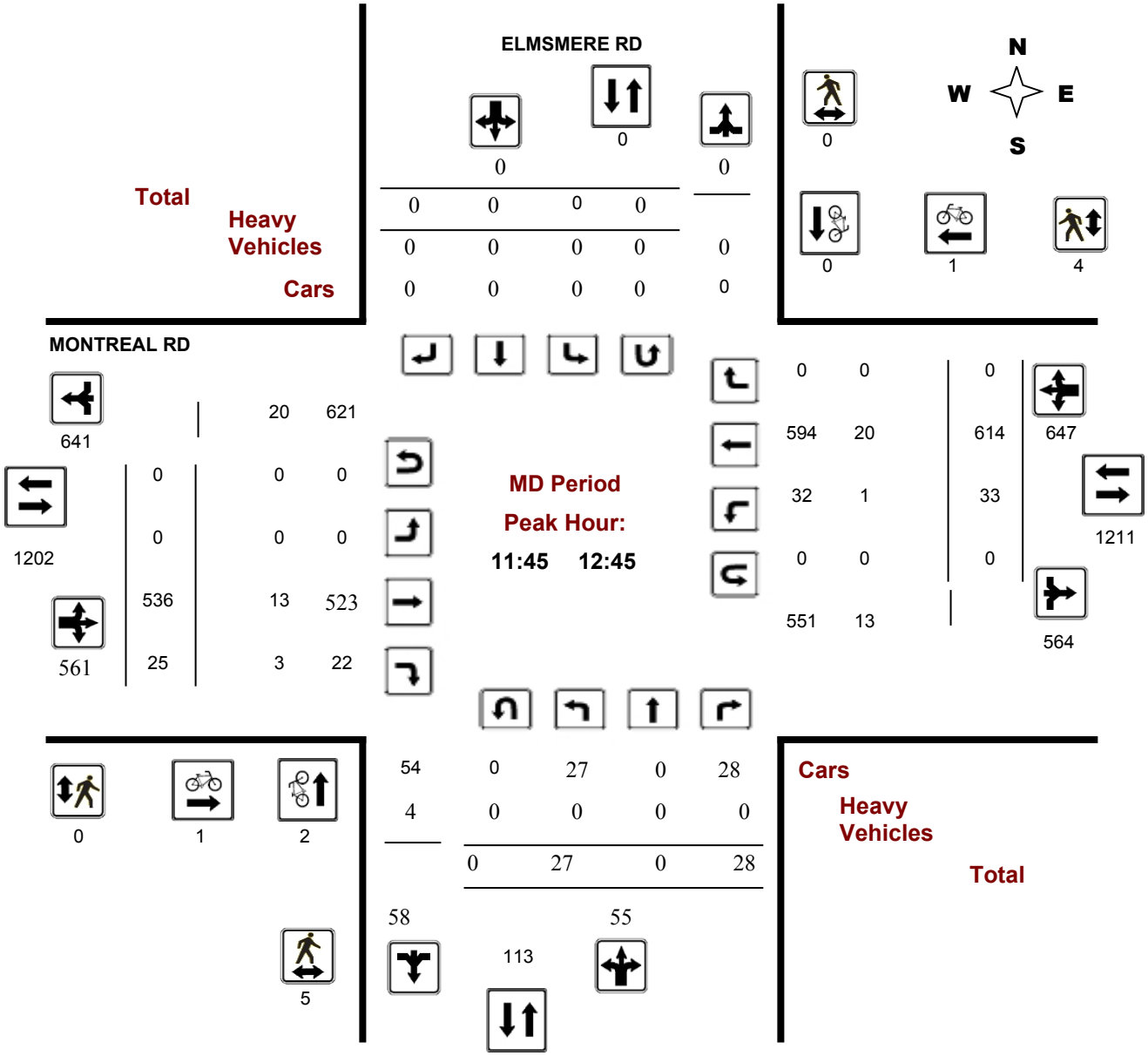
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1174
Device: Jamar Technologies, Inc



Comments

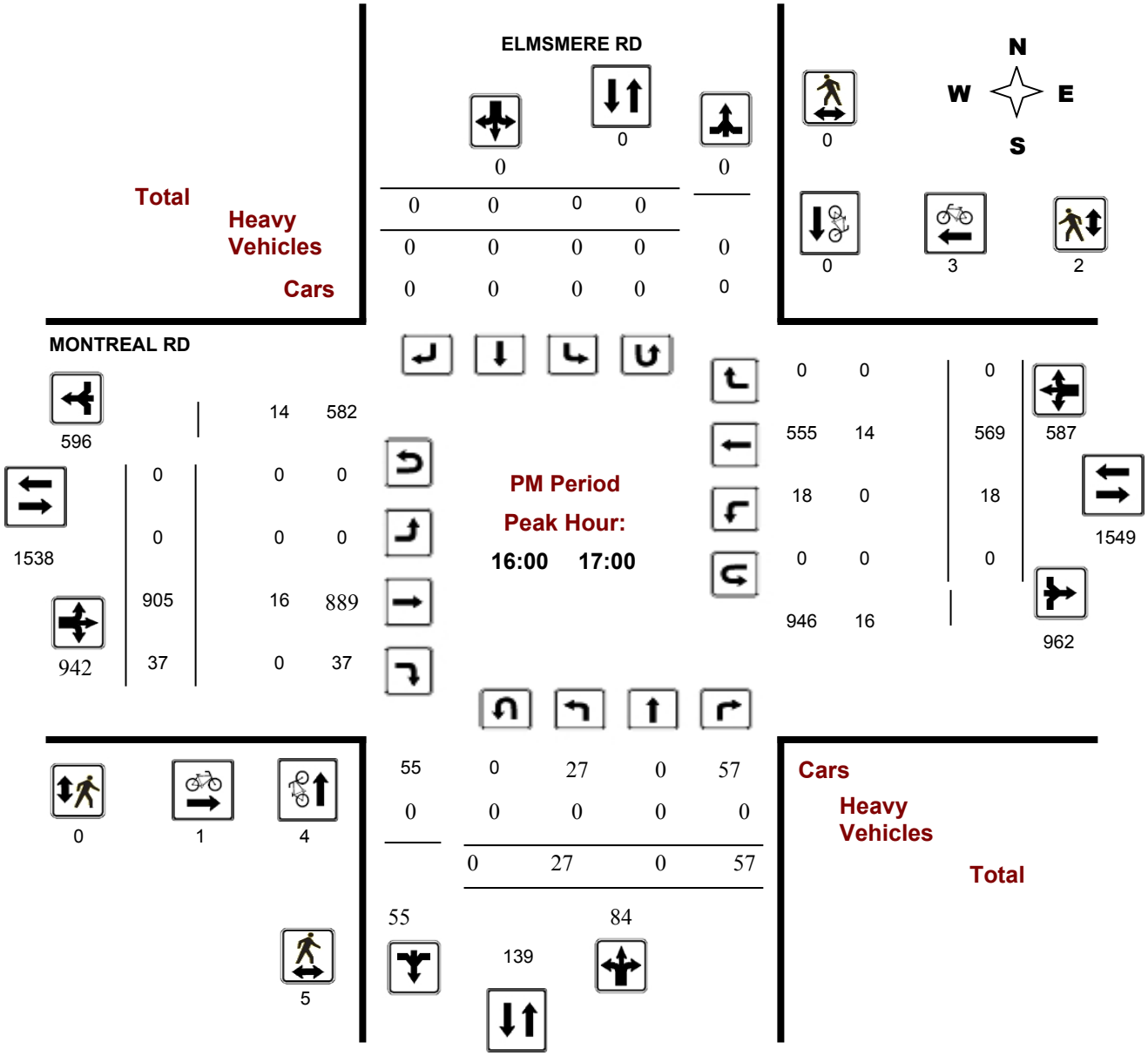
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1174
Device: Jamar Technologies, Inc



Comments

Transportation Services - Traffic Services

Work Order
1174

Turning Movement Count - 15 Min U-Turn Total Report

ELMSMERE RD @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	1	1
Total		0	0	0	1	1

Transportation Services - Traffic Services

W.O. 1181

Turning Movement Count - 15 Minute Summary Report

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 6 Westbound: 0

		ELWOOD ST									MONTREAL RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	07:15	1	0	6	**7**	0	0	0	**0**	**7**	0	90	1	**91**	1	199	7	**207**	**298**	**305**
07:15	07:30	2	0	3	**5**	0	0	0	**0**	**5**	1	77	2	**80**	5	243	1	**249**	**329**	**334**
07:30	07:45	2	0	5	**7**	0	0	0	**0**	**7**	0	77	1	**78**	7	258	1	**266**	**344**	**351**
07:45	08:00	3	0	5	**8**	0	0	0	**0**	**8**	1	95	2	**98**	7	281	0	**288**	**386**	**394**
08:00	08:15	0	0	5	**5**	0	0	0	**0**	**5**	1	99	0	**100**	3	276	0	**279**	**379**	**384**
08:15	08:30	1	0	5	**6**	0	0	0	**0**	**6**	0	130	1	**131**	3	155	3	**161**	**292**	**298**
08:30	08:45	0	0	8	**8**	0	0	0	**0**	**8**	0	126	3	**129**	3	153	5	**161**	**290**	**298**
08:45	09:00	2	0	8	**10**	0	0	1	**1**	**11**	0	122	1	**123**	5	226	1	**232**	**355**	**366**
09:00	09:15	0	0	3	**3**	0	0	0	**0**	**3**	1	107	4	**112**	7	156	1	**164**	**276**	**279**
09:15	09:30	1	0	2	**3**	0	0	1	**1**	**4**	1	143	1	**145**	1	62	2	**65**	**210**	**214**
09:30	09:45	2	0	4	**6**	0	0	0	**0**	**6**	0	101	4	**105**	1	172	1	**174**	**279**	**285**
09:45	10:00	1	0	3	**4**	0	0	1	**1**	**5**	0	118	2	**120**	2	152	0	**154**	**274**	**279**
11:30	11:45	2	0	6	**8**	0	0	0	**0**	**8**	0	126	7	**133**	6	162	1	**169**	**302**	**310**
11:45	12:00	3	0	5	**8**	0	0	0	**0**	**8**	1	157	6	**164**	3	187	0	**190**	**354**	**362**
12:00	12:15	3	0	3	**6**	0	0	0	**0**	**6**	1	183	1	**185**	5	150	1	**156**	**341**	**347**
12:15	12:30	4	0	8	**12**	0	0	0	**0**	**12**	0	165	5	**171**	9	151	11	**171**	**342**	**354**
12:30	12:45	2	0	7	**9**	0	0	0	**0**	**9**	0	152	5	**159**	2	176	0	**178**	**337**	**346**
12:45	13:00	3	0	6	**9**	0	0	0	**0**	**9**	1	130	5	**137**	3	176	0	**179**	**316**	**325**
13:00	13:15	1	0	6	**7**	0	0	0	**0**	**7**	1	151	7	**160**	2	167	16	**185**	**345**	**352**
13:15	13:30	3	0	4	**7**	2	0	2	**4**	**11**	2	140	2	**144**	4	158	2	**164**	**308**	**319**
15:00	15:15	4	0	1	**5**	0	0	0	**0**	**5**	1	165	6	**172**	4	158	0	**162**	**334**	**339**
15:15	15:30	0	0	3	**3**	0	0	0	**0**	**3**	8	201	6	**215**	0	181	0	**181**	**396**	**399**
15:30	15:45	2	0	5	**7**	1	0	0	**1**	**8**	3	230	4	**237**	5	149	2	**156**	**393**	**401**
15:45	16:00	3	0	7	**10**	0	0	1	**1**	**11**	0	237	8	**245**	0	152	0	**152**	**397**	**408**
16:00	16:15	2	0	7	**9**	2	0	0	**2**	**11**	0	261	6	**267**	2	134	5	**141**	**408**	**419**
16:15	16:30	0	1	4	**5**	0	0	2	**2**	**7**	1	309	4	**314**	6	126	14	**146**	**460**	**467**
16:30	16:45	3	0	5	**8**	0	0	0	**0**	**8**	0	272	8	**280**	4	181	1	**186**	**466**	**474**
16:45	17:00	2	0	7	**9**	0	0	0	**0**	**9**	0	267	12	**279**	8	177	1	**186**	**465**	**474**
17:00	17:15	4	0	7	**11**	0	0	0	**0**	**11**	0	230	6	**236**	8	166	1	**175**	**411**	**422**
17:15	17:30	4	0	5	**9**	0	0	0	**0**	**9**	0	282	4	**286**	5	153	1	**159**	**445**	**454**
17:30	17:45	0	0	7	**7**	0	0	0	**0**	**7**	0	212	5	**217**	7	146	2	**155**	**372**	**379**
17:45	18:00	5	0	5	**10**	0	0	1	**1**	**11**	1	207	7	**216**	6	181	0	**187**	**403**	**414**
TOTAL:		65	1	165	**231**	5	0	9	**14**	**245**	25	5362	136	**5529**	134	5564	80	**5778**	**11307**	**11552**

Note: U-Turns are included in Totals.

Comment:

Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
1181

ELWOOD ST @ MONTREAL RD

Count Date: Thursday, July 10, 2014 **Start Time:** 07:00

	ELWOOD ST			MONTREAL RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	0	0	**0**	4	8	**12**	**12**
08:00 09:00	0	0	**0**	5	9	**14**	**14**
09:00 10:00	0	0	**0**	1	4	**5**	**5**
11:30 12:30	5	0	**5**	0	2	**2**	**7**
12:30 13:30	0	0	**0**	2	7	**9**	**9**
15:00 16:00	0	0	**0**	3	3	**6**	**6**
16:00 17:00	0	0	**0**	5	3	**8**	**8**
17:00 18:00	0	0	**0**	9	4	**13**	**13**
Total	5	0	**5**	29	40	**69**	**74**

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.

Transportation Services - Traffic Services

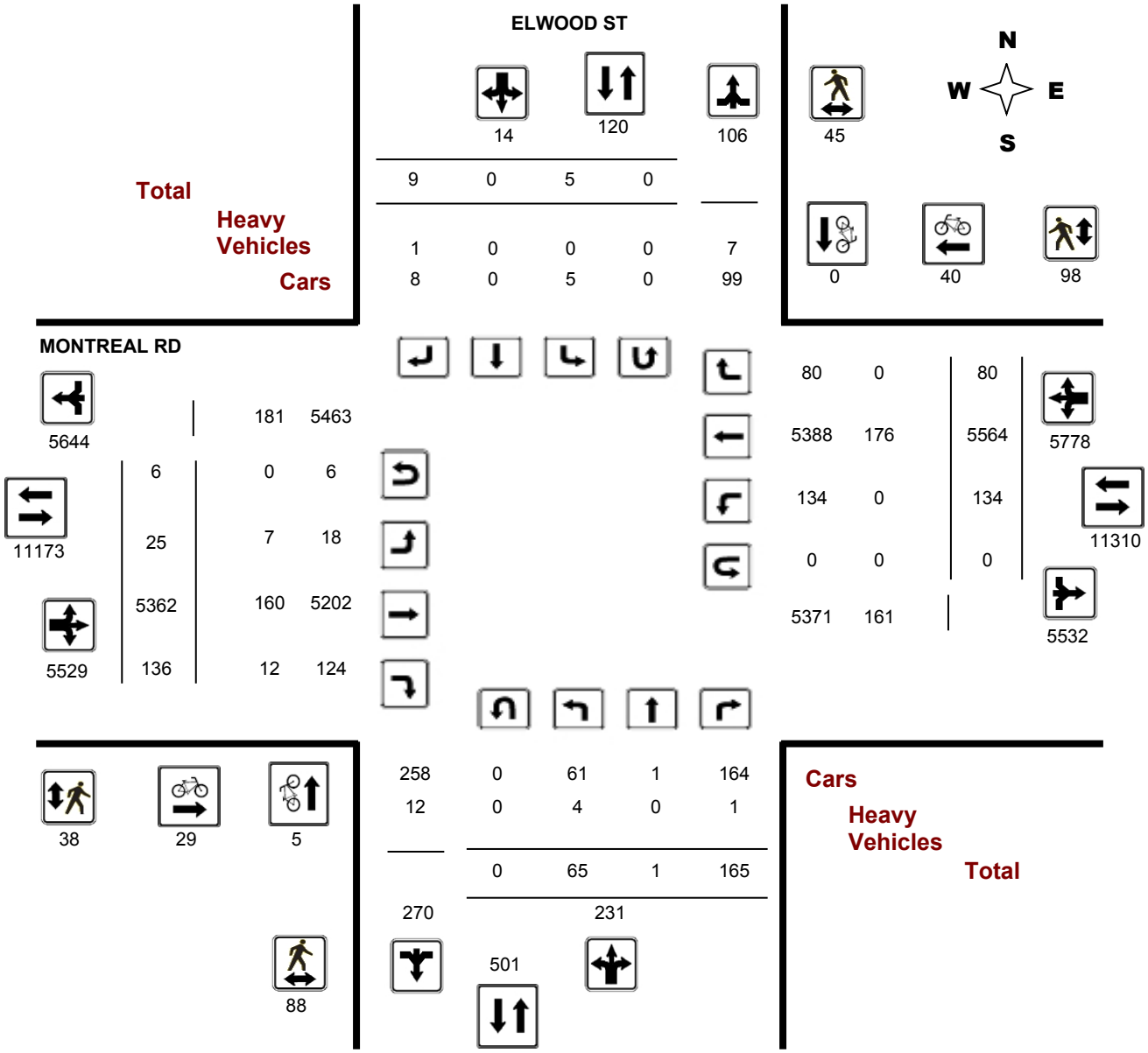
Turning Movement Count - Full Study Diagram

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

WO#: 1181

Device: Jamar Technologies, Inc



Comments

Transportation Services - Traffic Services

W.O. 1181

Turning Movement Count - Heavy Vehicle Report

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

		ELWOOD ST									MONTREAL RD									
		Northbound				Southbound					Eastbound				Westbound					
Time Period		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	08:00	0	0	0	**0**	0	0	0	**0**	**0**	0	15	1	**16**	0	18	0	**18**	**34**	**34**
08:00	09:00	1	0	0	**1**	0	0	0	**0**	**1**	0	22	2	**24**	0	34	0	**34**	**58**	**59**
09:00	10:00	1	0	0	**1**	0	0	1	**1**	**2**	1	27	2	**30**	0	25	0	**25**	**55**	**57**
11:30	12:30	0	0	0	**0**	0	0	0	**0**	**0**	1	19	1	**21**	0	21	0	**21**	**42**	**42**
12:30	13:30	1	0	1	**2**	0	0	0	**0**	**2**	2	17	0	**19**	0	22	0	**22**	**41**	**43**
15:00	16:00	1	0	0	**1**	0	0	0	**0**	**1**	2	17	2	**21**	0	21	0	**21**	**42**	**43**
16:00	17:00	0	0	0	**0**	0	0	0	**0**	**0**	1	27	2	**30**	0	13	0	**13**	**43**	**43**
17:00	18:00	0	0	0	**0**	0	0	0	**0**	**0**	0	16	2	**18**	0	22	0	**22**	**40**	**40**
Sub Total		4	0	1	**5**	0	0	1	**1**	**6**	7	160	12	**179**	0	176	0	**176**	**355**	**361**
U-Turns (Heavy Vehicles)					**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total		4	0	1	**0**	0	0	1	**1**	**6**	7	160	12	**179**	0	176	0	**176**	**355**	**361**

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.

Transportation Services - Traffic Services

Work Order
1181

Turning Movement Count - Pedestrian Volume Report

ELWOOD ST @ MONTREAL RD

Count Date: Thursday, July 10, 2014 **Start Time:** 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	**0**	0	0	**0**	**0**
07:15 07:30	0	0	**0**	0	0	**0**	**0**
07:30 07:45	0	1	**1**	0	0	**0**	**1**
07:45 08:00	4	0	**4**	0	3	**3**	**7**
07:00 08:00	4	1	**5**	0	3	**3**	**8**
08:00 08:15	5	0	**5**	2	5	**7**	**12**
08:15 08:30	4	2	**6**	1	4	**5**	**11**
08:30 08:45	3	0	**3**	3	7	**10**	**13**
08:45 09:00	1	0	**1**	3	5	**8**	**9**
08:00 09:00	13	2	**15**	9	21	**30**	**45**
09:00 09:15	2	1	**3**	2	0	**2**	**5**
09:15 09:30	1	1	**2**	1	1	**2**	**4**
09:30 09:45	4	0	**4**	2	3	**5**	**9**
09:45 10:00	4	3	**7**	0	7	**7**	**14**
09:00 10:00	11	5	**16**	5	11	**16**	**32**
11:30 11:45	3	6	**9**	1	6	**7**	**16**
11:45 12:00	2	2	**4**	0	1	**1**	**5**
12:00 12:15	2	0	**2**	0	2	**2**	**4**
12:15 12:30	3	6	**9**	0	4	**4**	**13**
11:30 12:30	10	14	**24**	1	13	**14**	**38**
12:30 12:45	2	5	**7**	3	4	**7**	**14**
12:45 13:00	6	2	**8**	3	0	**3**	**11**
13:00 13:15	1	2	**3**	3	2	**5**	**8**
13:15 13:30	0	2	**2**	0	4	**4**	**6**
12:30 13:30	9	11	**20**	9	10	**19**	**39**
15:00 15:15	6	0	**6**	1	2	**3**	**9**
15:15 15:30	1	0	**1**	0	0	**0**	**1**
15:30 15:45	3	0	**3**	0	3	**3**	**6**
15:45 16:00	1	2	**3**	2	2	**4**	**7**
15:00 16:00	11	2	**13**	3	7	**10**	**23**
16:00 16:15	12	2	**14**	2	7	**9**	**23**
16:15 16:30	1	0	**1**	0	8	**8**	**9**
16:30 16:45	3	1	**4**	2	4	**6**	**10**
16:45 17:00	6	0	**6**	2	1	**3**	**9**
16:00 17:00	22	3	**25**	6	20	**26**	**51**
17:00 17:15	4	2	**6**	2	2	**4**	**10**
17:15 17:30	3	1	**4**	2	6	**8**	**12**
17:30 17:45	1	3	**4**	0	0	**0**	**4**
17:45 18:00	0	1	**1**	1	5	**6**	**7**
17:00 18:00	8	7	**15**	5	13	**18**	**33**
Total	88	45	**133**	38	98	**136**	**269**

Comment:

Transportation Services - Traffic Services

Work Order 1181

Turning Movement Count - Full Study Summary Report

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 6 Westbound: 0

AADT Factor .90

Full Study

	ELWOOD ST									MONTREAL RD									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	**NB TOT**	LT	ST	RT	**SB TOT**	**STR TOT**	LT	ST	RT	**EB TOT**	LT	ST	RT	**WB TOT**	**STR TOT**	**Grand Total**
07:00 08:00	8	0	19	**27**	0	0	0	**0**	**27**	2	339	6	**347**	20	981	9	**1010**	**1357**	**1384**
08:00 09:00	3	0	26	**29**	0	0	1	**1**	**30**	1	477	5	**483**	14	810	9	**833**	**1316**	**1346**
09:00 10:00	4	0	12	**16**	0	0	2	**2**	**18**	2	469	11	**482**	11	542	4	**557**	**1039**	**1057**
11:30 12:30	12	0	22	**34**	0	0	0	**0**	**34**	2	631	19	**652**	23	650	13	**686**	**1338**	**1372**
12:30 13:30	9	0	23	**32**	2	0	2	**4**	**36**	4	573	19	**596**	11	677	18	**706**	**1302**	**1338**
15:00 16:00	9	0	16	**25**	1	0	1	**2**	**27**	12	833	24	**869**	9	640	2	**651**	**1520**	**1547**
16:00 17:00	7	1	23	**31**	2	0	2	**4**	**35**	1	1109	30	**1140**	20	618	21	**659**	**1799**	**1834**
17:00 18:00	13	0	24	**37**	0	0	1	**1**	**38**	1	931	22	**954**	26	646	4	**676**	**1630**	**1668**
Sub Total	65	1	165	**231**	5	0	9	**14**	**245**	25	5362	136	**5523**	134	5564	80	**5778**	**11301**	**11546**
U Turns				**0**				**0**	**0**				**6**				**0**	**6**	**6**
Total	65	1	165	**231**	5	0	9	**14**	**245**	25	5362	136	**5529**	134	5564	80	**5778**	**11307**	**11552**
EQ 12Hr	90	1	229	**321**	7	0	13	**19**	**340**	35	7453	189	**7685**	186	7734	111	**8031**	**15716**	**16056**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	81	1	206	**289**	6	0	11	**18**	**307**	31	6708	170	**6917**	168	6961	100	**7228**	**14145**	**14452**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	107	2	270	**379**	8	0	15	**23**	**402**	41	8787	223	**9061**	220	9118	131	**9469**	**18530**	**18932**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

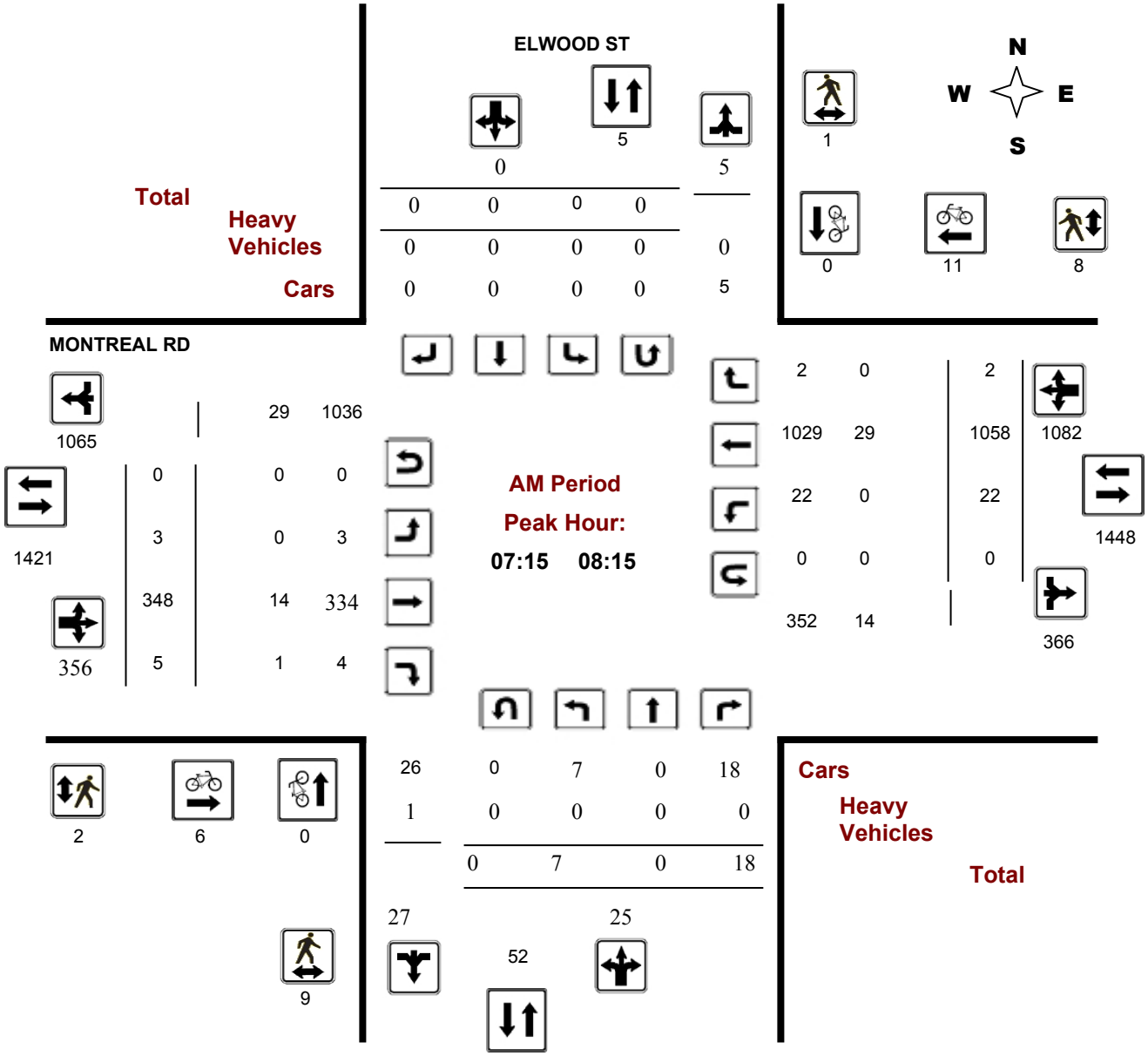
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1181
Device: Jamar Technologies, Inc



Comments

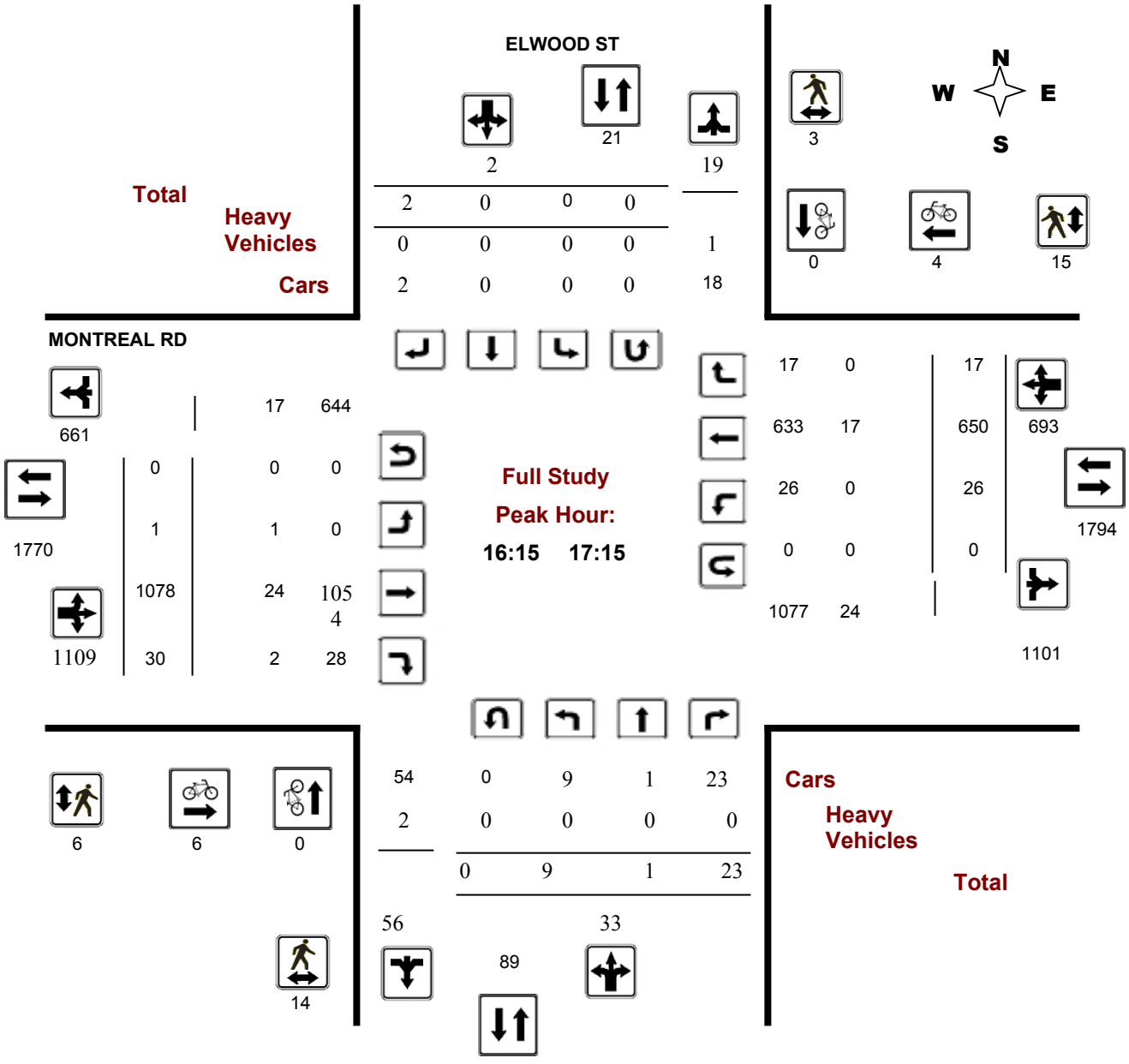
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1181
Device: Jamar Technologies, Inc



Comments

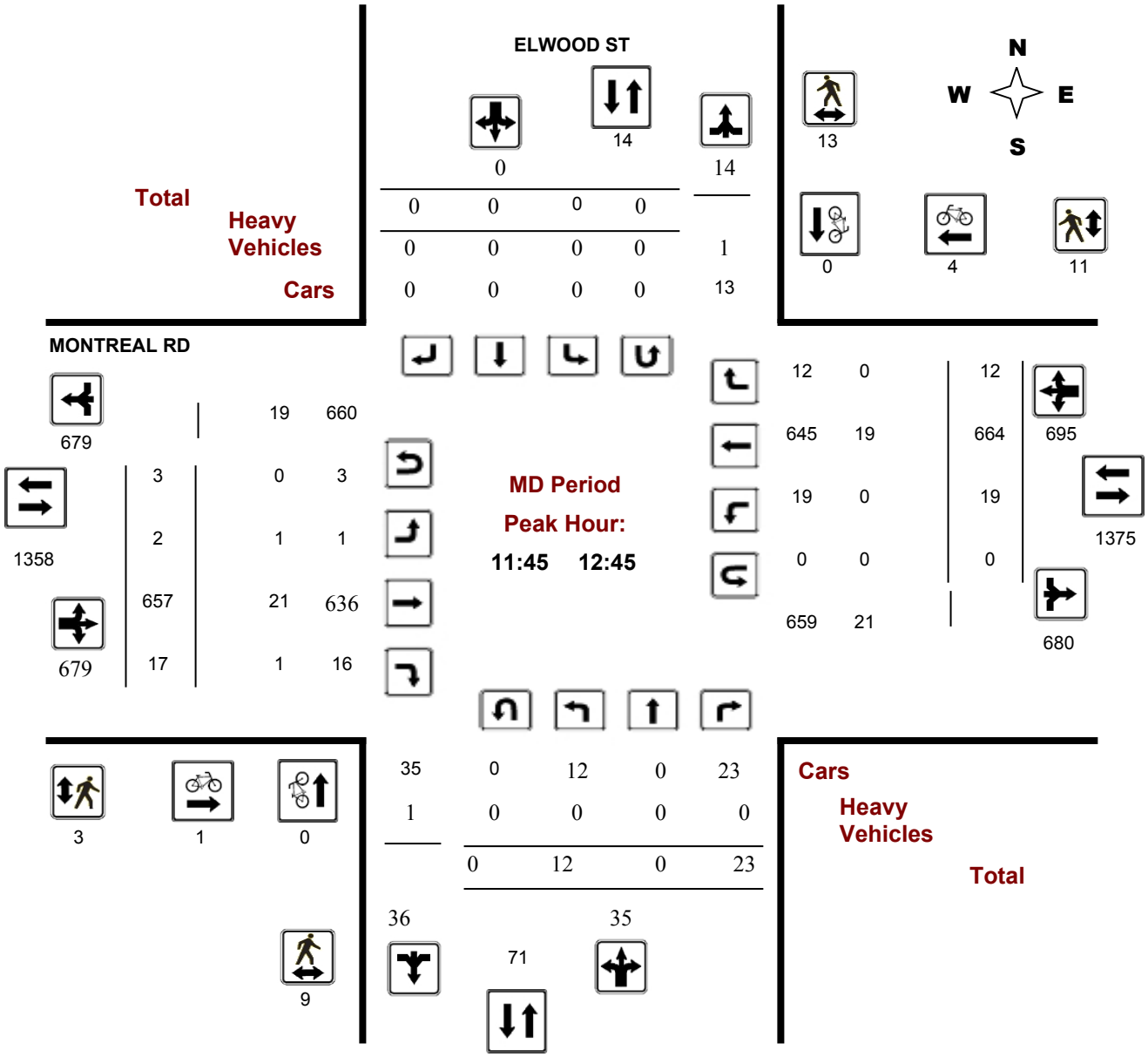
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1181
Device: Jamar Technologies, Inc



Comments

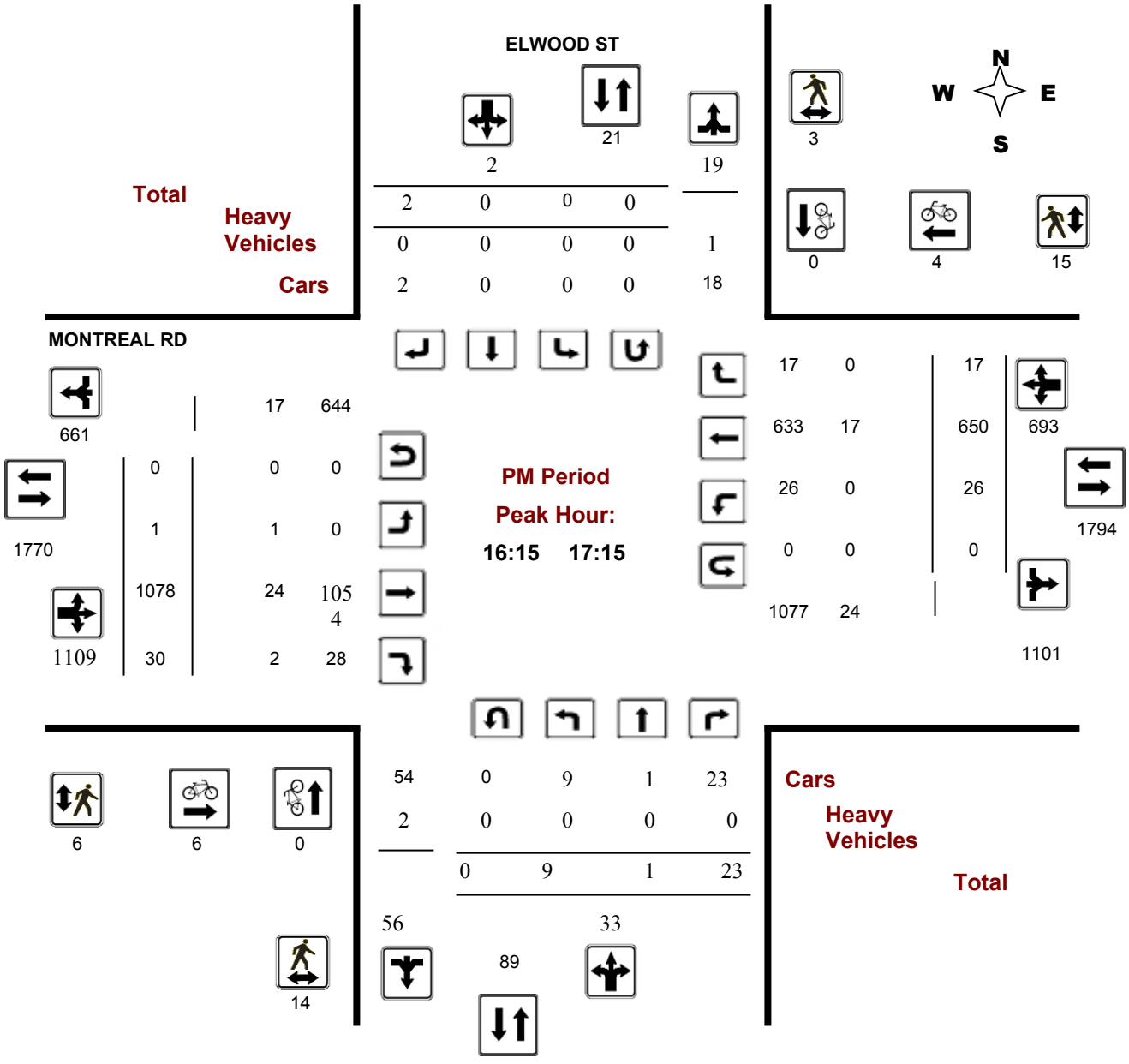
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014
Start Time: 07:00

WO No: 1181
Device: Jamar Technologies, Inc



Comments

Transportation Services - Traffic Services

Work Order
1181

Turning Movement Count - 15 Min U-Turn Total Report

ELWOOD ST @ MONTREAL RD

Survey Date: Thursday, July 10, 2014

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	1	0	1
12:30	12:45	0	0	2	0	2
12:45	13:00	0	0	1	0	1
13:00	13:15	0	0	1	0	1
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	1	0	1
Total		0	0	6	0	6

APPENDIX D

Collision Records

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** December 31, 2016

Location: BLAIR RD @ MONTREAL RD

Traffic Control: Traffic signal

Total Collisions: 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Mar-10, Tue,08:51	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Pick-up truck	Other motor vehicle	

Location: ELMSMERE RD @ MONTREAL RD

Traffic Control: Traffic signal

Total Collisions: 6

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jan-25, Sat,18:38	Clear	Other	P.D. only	Loose snow	East	Going ahead	Automobile, station wagon	Skidding/sliding	
					East	Stopped	Passenger van	Skidding/sliding	
2015-Feb-04, Wed,15:30	Snow	Rear end	P.D. only	Loose snow	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2015-Nov-16, Mon,08:38	Clear	SMV other	Non-fatal injury	Dry	North	Turning right	Automobile, station wagon	Pedestrian	1
2016-May-02, Mon,11:36	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	

2016-Jul-15, Fri,23:28	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Nov-30, Wed,18:11	Rain	Rear end	Non-fatal injury	Wet	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Tow truck	Other motor vehicle	

Location: ELWOOD ST @ MONTREAL RD

Traffic Control: Traffic signal **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jul-31, Fri,08:59	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Aug-04, Tue,00:39	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Pole (utility, power)	

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2012-01-01 TO: 2014-01-01

ELMSMERE RD & MONTREAL RD

Former Municipality: **Gloucester** Traffic Control: **Traffic signal** Number of Collisions: **3**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2012-06-24	Sun	20:37	Clear	Dusk	Single vehicle	Non-fatal	V1 U	Dry	Unknown	Unknown	Pedestrian	1
2	2013-03-21	Thu	11:20	Clear	Daylight	Rear end	P.D. only	V1 E	Dry	Slowing or	Pick-up truck	Other motor vehicle	0
								V2 E	Dry	Stopped	Pick-up truck	Other motor vehicle	
3	2013-11-23	Sat	14:20	Snow	Daylight	Rear end	P.D. only	V1 W	Loose snow	Slowing or	Automobile, station	Other motor vehicle	0
								V2 W	Loose snow	Stopped	Passenger van	Other motor vehicle	

ELWOOD ST & MONTREAL RD

Former Municipality: **Gloucester** Traffic Control: **Traffic signal** Number of Collisions: **2**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
4	2012-12-21	Fri	03:42	Snow	Dark	Angle	P.D. only	V1 E	Loose snow	Slowing or	Pick-up truck	Skidding/Sliding	0
								V2 N	Loose snow	Turning left	Automobile, station	Other motor vehicle	
5	2013-02-27	We	14:39	Snow	Daylight	Rear end	P.D. only	V1 E	Loose snow	Slowing or	Automobile, station	Other motor vehicle	0
								V2 E	Loose snow	Slowing or	Automobile, station	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

APPENDIX E

TDM – Supportive Development Design and Infrastructure Checklist

Introduction

The City of Ottawa's *Transportation Impact Assessment (TIA) Guidelines* (specifically Module 4.1—Development Design) requires proponents of qualifying developments to use the City's **TDM-Supportive Development Design and Infrastructure Checklist** to assess the opportunity to implement design elements that are supportive of sustainable modes. The goal of this assessment is to ensure that the development provides safe and efficient access for all users, while creating an environment that encourages walking, cycling and transit use.

The remaining sections of this document are:

- Using the Checklist
- Glossary
- TDM-Supportive Development Design and Infrastructure Checklist: Non-Residential Developments
- TDM-Supportive Development Design and Infrastructure Checklist: Residential Developments

Readers are encouraged to contact the City of Ottawa's TDM Officer for any guidance and assistance they require to complete this checklist.

Using the Checklist

This **TDM-Supportive Development Design and Infrastructure Checklist** document includes two actual checklists, one for non-residential developments (office, institutional, retail or industrial) and one for residential developments (multi-family or condominium only; subdivisions are exempt). Readers may download the applicable checklist in electronic format and complete it electronically, or print it out and complete it by hand. As an alternative, they may create a freestanding document that lists the design and infrastructure measures being proposed and provides additional detail on them.

Each measure in the checklist is numbered for easy reference. Each measure is also flagged as:

- REQUIRED —The Official Plan or Zoning By-law provides related guidance that must be followed.
- BASIC —The measure is generally feasible and effective, and in most cases would benefit the development and its users.
- BETTER —The measure could maximize support for users of sustainable modes, and optimize development performance.

Glossary

This glossary defines and describes the following measures that are identified in the **TDM-Supportive Development Design and Infrastructure Checklist**:

Walking & cycling: Routes
- Building location & access points
- Facilities for walking & cycling
- Amenities for walking & cycling

Walking & cycling: End-of-trip facilities
- Bicycle parking
- Secure bicycle parking
- Shower & change facilities
- Bicycle repair station

Transit
- Walking routes to transit
- Customer amenities

Ridesharing
- Pick-up & drop-off facilities
- Carpool parking

Carsharing & bikesharing
- Carshare parking spaces
- Bikeshare station location

Parking
- Number of parking spaces
- Separate long-term & short-term parking areas

Other
- On-site amenities to minimize off-site trips

In addition to specific references made in this glossary, readers should consult the City of Ottawa's design and planning guidelines for a variety of different land uses and contexts, available on the City's website at www.ottawa.ca. Readers may also find the following resources to be helpful:

- *Promoting Sustainable Transportation through Site Design*, Institute of Transportation Engineers, 2004 (www.cite7.org/wpdm-package/iterp-promoting-sustainable-transportation)
- *Bicycle End-of-Trip Facilities: A Guide for Canadian Municipalities and Employers*, Transport Canada, 2010 (www.fcm.ca/Documents/tools/GMF/Transport_Canada/BikeEndofTrip_EN.pdf)

▶ *Walking & cycling: Routes*

Building location & access points. Correctly positioning buildings and their entrances can help make walking convenient, comfortable and safe. Minimizing travel distances and maximizing visibility are key.

Facilities for walking & cycling. The Official Plan gives clear direction on the provision and design of walking and cycling facilities for both access and circulation. On larger, busier sites (e.g. multi-building campuses) the inclusion of sidewalks, pathways, marked crossings, stop signs and traffic calming features can create a safer and more supportive environment for active transportation.

Amenities for walking & cycling. Lighting, landscaping, benches and wayfinding can make walking and cycling safer and more secure, comfortable and accessible.

▶ *Walking & cycling: End-of-trip facilities*

Bicycle parking. The Official Plan and Zoning By-law both address the need for adequate bicycle parking at developments. Weather protection and theft prevention are major concerns for commuters who spend hundreds or thousands of dollars on a quality bicycle. Bicycle racks should have a design that enables secure locking while preventing damage to wheels. They should be located within sight of busy areas such as main building entrances or staffed parking kiosks.

Secure bicycle parking. Ottawa's Zoning By-law requires a secure area for bicycles at office or residential developments having more than 50 bicycle parking spaces. Lockable outdoor bike cages or indoor storage rooms that limit access to registered users are ideal.

Shower & change facilities. Longer-distance cyclists, joggers and even pedestrians can need a place to shower and change at work; the lack of such facilities is a major barrier to active commuting. Lockers and drying racks provide a place to store gear away from workspaces, and showers and grooming stations allow commuters to make themselves presentable for the office.

Bicycle repair station. Cycling commuters can experience maintenance issues that make the homeward trip difficult or impossible. A small supply of tools (e.g. air pump, Allen keys, wrenches) and supplies (e.g. inner tube patches, chain lubricant) in the workplace can help.

▶ *Transit*

Customer amenities. Larger developments that feature an on-site transit stop can make transit use more attractive by providing shelters, lighting and benches. Even better, they could integrate the passenger waiting area into a building entrance.

▶ *Ridesharing*

Pick-up & drop-off facilities. Having a safe place to load or unload passengers (for carpools as well as taxis and ride-hailing services) without obstructing pedestrians, cyclists or other vehicles can help make carpooling work.

Carpool parking. At destinations with large parking lots (or lots that regularly fill to capacity), signed priority carpool parking spaces can be an effective ridesharing incentive. Priority spaces are frequently abused by non-carpoolers, so a system to provide registered users with vehicle identification tags is recommended.

▶ *Carsharing & bikesharing*

Carshare parking spaces. For developments where carsharing could be an attractive option for employees, visitors or residents, ensuring an attractive location for future carshare parking spaces can avoid challenges associated with future retrofits.

Bikeshare station location. For developments where bikesharing could be an attractive option for employees, visitor or residents, ensuring an attractive location for a future bikeshare station can avoid challenges associated with future retrofits.

▶ *Parking*

Number of parking spaces. Parking capacity is an important variable in development design, as it can either support or subvert the mode share targets set during the transportation impact analysis (TIA). While the Zoning By-law establishes any minimum and/or maximum requirements for parking capacity, it also allows a reduction in any minimum to reflect the existence of on-site shower, change and locker rooms provided for cyclists.

Separate long-term & short-term parking areas. Because access to unused parking spaces can be a powerful incentive to drive, developments can better manage their parking supply and travel behaviours by separating long-term from short-term parking through the use of landscaping, gated controls or signs. Doing so makes it difficult for long-term parkers (e.g. commuters) to park in short-term areas (e.g. for visitors) as long as enforcement occurs; it also protects long-term parking capacity for its intended users.

▶ *Other*

On-site amenities to minimize off-site trips. Developments that offer facilities to limit employees' need for a car during their commute (e.g. to drop off children at daycare) or during their workday (e.g. to hit the gym) can free employees to make the commuting decision that otherwise works best for them.

TDM-Supportive Development Design and Infrastructure Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☒
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☒
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☒
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☐ **N/A**
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☒

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☐ **N/A**
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☒
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☐
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☐
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☒
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☒
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☒
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	☐
BETTER	2.1.5	Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single office building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☐**N/A**
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met)	☐
	2.3	**Shower & change facilities**	
BASIC	2.3.1	Provide shower and change facilities for the use of active commuters	☐
BETTER	2.3.2	In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	☐
	2.4	**Bicycle repair station**	
BETTER	2.4.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
	4.2	**Carpool parking**	
BASIC	4.2.1	Provide signed parking spaces for carpools in a priority location close to a major building entrance, sufficient in number to accommodate the mode share target for carpools	☐
BETTER	4.2.2	At large developments, provide spaces for carpools in a separate, access-controlled parking area to simplify enforcement	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide carshare parking spaces in permitted non-residential zones, occupying either required or provided parking spaces *(see Zoning By-law Section 94)*	☐
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐

	TDM-supportive design & infrastructure measures: *Non-residential developments*		Check if completed & add descriptions, explanations or plan/drawing references
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☒
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	☐
	7.	**OTHER**	
	7.1	**On-site amenities to minimize off-site trips**	
BETTER	7.1.1	Provide on-site amenities to minimize mid-day or mid-commute errands	☐

TDM-Supportive Development Design and Infrastructure Checklist:
Residential Developments (multi-family or condominium)

N/A

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☐
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☐
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☐
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☐
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☐
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☐
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☐
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☐
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☐
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☐
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☐
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☐
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☐
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☐
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☐
	2.3	**Bicycle repair station**	
BETTER	2.3.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses *(see Zoning By-law Section 94)*	☐
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☐
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	☐

APPENDIX F

TAC Excerpts

- The frequency of collisions occurring as a result of vehicles striking objects less than 0.15 m in height has been shown to be very low.[52]
- As discussed above, a driver's ability to discern small objects at a distance is limited.
- In general, a driver must see at least the top 0.15 m of an object in order to detect its presence.
- If such an object is of limited lateral size (e.g., a rock) a driver may well be able to take evasive action rather than stop, particularly on a roadway with low traffic volumes.
- Evasion might not be possible if the object were a fallen tree, but in many parts of the country this is an unlikely hazard since trees are not present or because local jurisdictions do not allow trees to remain close to the roadway. In areas where logging trucks are present, the designer should consider the possibility of a log falling onto the roadway from a truck.

The designer should adopt an object height based on the probability of a particular object occurring on the roadway, as shown on **Table 2.5.1**. If fallen trees or rocks are a real risk, an object height of 0.15 m is recommended. Otherwise, for stopping sight distance, a tail light height of 0.60 m is recommended. For passing sight distance, an object height of 1.30 m will allow the driver to discern the top of an oncoming typical car. A zero object height is recommended where road washouts are a serious risk, for example on approaches to bridges and culverts in mountainous areas. It is only recommended for pavement markings in critical situations such as at intersections or interchanges, as the driver's ability to discern the markings cannot be relied upon, and traffic signs should be used instead.

2.5.2.2 Deceleration Rate

Approximately 90 percent of all drivers decelerate at rates greater than 3.4 m/s^2. Such deceleration is within a driver's capability to stay within their lane and maintain steering control during the braking maneuver on wet surfaces. Therefore 3.4 m/s^2 is a comfortable deceleration for most drivers and is recommended as the deceleration threshold for determining stopping sight distance.[53]

Most vehicle braking systems and the tire-pavement friction levels of most roadways are capable of providing a deceleration rate of at least 3.4 m/s^2. Also, the friction available on most wet pavement surfaces and the capabilities of most vehicle braking systems can provide braking friction that exceeds this deceleration rate.

2.5.3 STOPPING SIGHT DISTANCE

Braking distance is the distance that it takes to stop a vehicle once the brakes have been applied. On a level roadway this distance can be determined using the following formula:

$$d_b = 0.039 \frac{V^2}{a} \qquad (2.5.1)$$

Where:

d_b = Braking distance (m)
V = Design speed (km/h)
a = Deceleration rate (m/s^2)

Stopping sight distance is the sum of the distance travelled during the perception and reaction time and the braking distance.

$$SSD = 0.278Vt + 0.039 \frac{V^2}{a} \quad (2.5.2)$$

Where:

SSD = Stopping sight distance (m)
t = Brake reaction time, 2.5 s
V = Design speed (km/h)
a = Deceleration rate (m/s^2)

Table 2.5.2 gives the minimum stopping sight distances on level grade, on wet pavement, for a range of design speeds. These values are used for vertical curve design, intersection geometry and the placement of traffic control devices. The stopping sight distances quoted in **Table 2.5.2** may need to be increased for a variety of reasons related to grade and vehicle type as noted below.

Table 2.5.2: Stopping Sight Distance on level roadways for Automobiles[54]

Design speed (km/h)	Brake reaction distance (m)	Braking distance on level (m)	Stopping sight distance	
			Calculated (m)	Design (m)
20	13.9	4.6	18.5	20
30	20.9	10.3	31.2	35
40	27.8	18.4	46.2	50
50	34.8	28.7	63.5	65
60	41.7	41.3	83.0	85
70	48.7	56.2	104.9	105
80	55.6	73.4	129.0	130
90	62.6	92.9	155.5	160
100	69.5	114.7	184.2	185
110	76.5	138.8	215.3	220
120	83.4	165.2	248.6	250
130	90.4	193.8	284.2	285

Note: Brake reaction distance predicated on a time of 2.5 s; deceleration rate of 3.4 m/s^2 used to determine calculated sight distance.

The Effect of Grade

Braking distances will increase on downgrades and decrease on upgrades. When the roadway is on a grade, formula 2.5.1 for braking distance is modified as follows:

$$d_b = \frac{V^2}{254\,[(a/9.81) + G]} \qquad (2.5.3)$$

Where:

d_b = Braking distance (m)
V = Design speed (km/h)
a = Deceleration rate (m/s^2)
G = Grade (m/m) (G is positive if vehicles uphill and negative if downhill)

It has been noted that many drivers, particularly those in automobiles, do not compensate completely (i.e., by acceleration or deceleration) for the changes in speed caused by grade. It should also be noted that in many cases the sight distance available on downgrades is greater than on upgrades, which can help to provide the necessary corrections for grade. The following **Table 2.5.3** summarizes the stopping sight distances on grades for a variety of design speeds.

Table 2.5.3: Stopping Sight Distance on Grades[55]

Design Speed (km/h)	Stopping Sight Distance (m)					
	Downgrades (%)			Upgrades (%)		
	3	6	9	3	6	9
20	20	20	20	19	18	18
30	32	35	35	31	30	29
40	50	50	53	45	44	43
50	66	70	74	61	59	58
60	87	92	97	80	77	75
70	110	116	124	100	97	93
80	136	144	154	123	118	114
90	164	174	187	148	141	136
100	194	207	223	174	167	160
110	227	243	262	203	194	186
120	263	281	304	234	223	214
130	302	323	350	267	254	243

This clear triangular area will allow the vehicles on either road to stop, if needed, before reaching the intersection. If the design speed of any approach is not known, it can be estimated by using the 85th percentile of the mid-block running speeds for that approach.

The distances shown in **Table 9.9.1** are generally less than the corresponding values of stopping sight distance for the same design speed. This relationship is illustrated in **Figure 9.9.3**. Where a clear sight triangle has legs that correspond to the stopping sight distances on their respective approaches, an even greater margin of efficient operation is provided. However, since field observations show that motorists slow down to some extent on approaches to uncontrolled intersections, it is not essential to provide a clear sight triangle with legs equal to the full stopping sight distance.

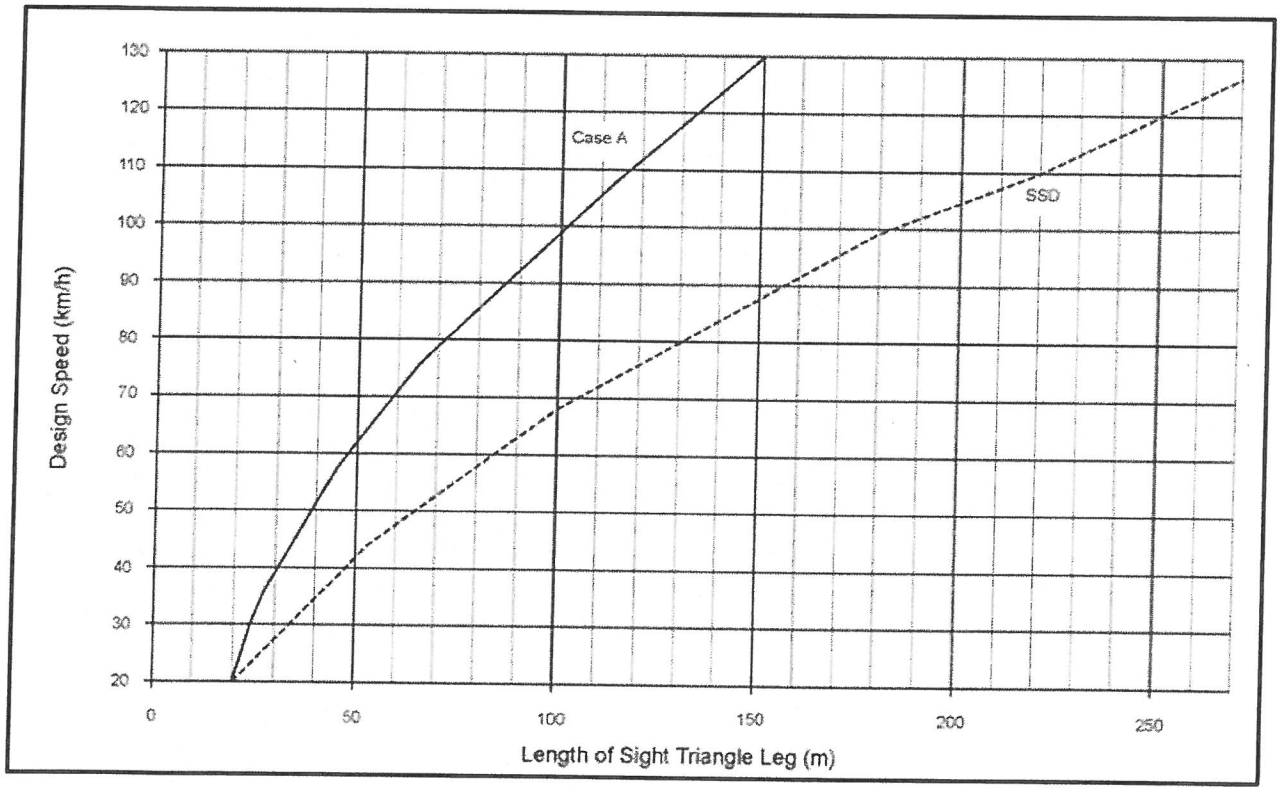


Figure 9.9.3: Length of Sight Triangle Leg – Case A, No Traffic Control

Case B – Intersections with Stop Control on the Minor Road

Departure sight triangles for intersections with stop control on the minor road should be considered for three situations:

- Case B1 – Left turns from the minor road
- Case B2 – Right turns from the minor road
- Case B3 – Crossing the major road from a minor-road approach

Intersection sight distance criteria for stop-controlled intersections are longer than the minimum stopping sight distance to allow the intersection to operate smoothly. Minor-road vehicle operators can wait until they can proceed safely without forcing a major-road vehicle to slow to less than 70% of their initial speed.

Case B1 – Left Turn from the Minor Road

Departure sight triangles for traffic approaching from either the right or the left, like those shown in **Figure 9.9.2**, should be provided for left turns from the minor road onto the major road for all stop-controlled approaches. The length of the leg of the departure sight triangle along the major road in both directions, shown as distance b in **Figure 9.9.2**, is the recommended intersection sight distance for Case B1.

The vertex (decision point) of the departure sight triangle on the minor road should be 4.4 m from the edge of the major-road traveled way. This represents the typical position of the minor-road driver's eye when a vehicle is stopped relatively close to the major road. Field observations of vehicle stopping positions found that, where needed, drivers will stop with the front of their vehicle 2.0 m or less from the edge of the major-road traveled way. Measurements of passenger cars indicate that the distance from the front of the vehicle to the driver's eye for the current North American passenger car population is nearly always 2.4 m or less.[68] Where practical, it is desirable to increase the distance from the edge of the major-road traveled way to the vertex of the clear sight triangle from 4.4 m to 5.4 m. This increase allows 3.0 m from the edge of the major-road traveled way to the front of the stopped vehicle, providing a larger sight triangle. The length of the sight triangle along the minor road (distance a in **Figure 9.9.2**) is the sum of the distance from the major road plus ½ lane width for vehicles approaching from the left, or 1½ lane widths for vehicles approaching from the right.

Field observations of the gaps in major-road traffic actually accepted by drivers turning onto the major road have shown that the values in **Table 9.9.3** provide sufficient time for the minor-road vehicle to accelerate from a stop and complete a left turn without unduly interfering with major-road traffic operations. The time gap acceptance time does not vary with approach speed on the major road. A constant value of time gap, independent of approach speed, can be used as a basis for intersection sight distance determinations. Observations have also shown that major-road drivers will reduce their speed to some extent when minor-road vehicles turn onto the major road. Where the time gap acceptance values in **Table 9.9.3** are used to determine the length of the leg of the departure sight triangle, most major-road drivers should not need to reduce speed to less than 70% of their initial speed.[69]

The intersection sight distance in both directions should be equal to the distance traveled at the design speed of the major road during a period of time equal to the time gap. In applying **Table 9.9.3**, it can usually be assumed that the minor-road vehicle is a passenger car; however, road authorities may provide more precise guidance on selection of the required design vehicle. Where substantial volumes of heavy vehicles enter the major road (e.g., from a ramp terminal), the use of tabulated values for single-unit or combination trucks should be considered.

Table 9.9.3 includes appropriate adjustments to the gap times for the number of lanes on the major road and for the approach grade of the minor road. The adjustment for the grade of the minor-road approach is needed only if the rear wheels of the design vehicle would be on an upgrade that exceeds 3% when the vehicle is at the stop line of the minor-road approach.

Table 9.9.3: Time Gap for Case B1, Left Turn from Stop

Design Vehicle	Time Gap (t_g)(s) at Design Speed of Major Road
Passenger car	7.5
Single-unit truck	9.5
Combination truck (WB 19 and WB 20)	11.5
Longer truck	To be established by road authority

Notes: Time gaps are for a stopped vehicle to turn left onto a two-lane highway with no median and with grades of 3% or less. The table values should be adjusted as follows:

- For multi-lane highways: For left turns onto two-lane highways with more than two lanes, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.
- For minor approach grades: If the approach grade is an upgrade that exceeds 3%, add 0.2 s for each percent grade for left turns.
- Some road authorities use higher values for certain specialized vehicles (e.g., Alberta uses 22 s for very long log trucks).

The intersection sight distance along the major road (distance b in **Figure 9.9.2**) is determined by:

$$ISD = 0.278\, V_{major}\, t_g \qquad (9.9.1)$$

Where:

ISD = intersection sight distance (length of the leg of sight triangle along the major road) (m)
V_{major} = design speed of the major road (km/h)
t_g = time gap for minor road vehicle to enter the major road (s)

For example, a passenger car turning left onto a two-lane major road should be provided sight distance equivalent to a time gap of 7.5 s in major-road traffic. If the design speed of the major road is 100 km/h, this corresponds to a sight distance of 0.278(100)(7.5) = 208.5 or 210 m, rounded for design.

A passenger car turning left onto a four-lane undivided roadway will need to cross two near lanes, rather than one. This increases the recommended gap in major-road traffic from 7.5 to 8.0 s. The corresponding value of sight distance for this example would be 223 m. If the minor-road approach to such an intersection is located on a 4% upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in **Table 9.9.4**. **Figure 9.9.4** includes design values, based on the time gaps for the design vehicles included in **Table 9.9.3**.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3%, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

Table 9.9.4: Design Intersection Sight Distance – Case B1, Left Turn From Stop

Design Speed (km/h)	Stopping Sight Distance (m)	Intersection Sight Distance for Passenger Cars	
		Calculated (m)	Design (m)
20	20	41.7	45
30	35	62.6	65
40	50	83.4	85
50	65	104.3	105
60	85	125.1	130
70	105	146.0	150
80	130	166.8	170
90	160	187.7	190
100	185	208.5	210
110	220	229.4	230
120	250	250.2	255
130	285	271.1	275

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right turns (case B2) will provide sufficient sight distance for a passenger car to cross the near roadway to reach the median. Possible exceptions are addressed in the discussion of case B3.

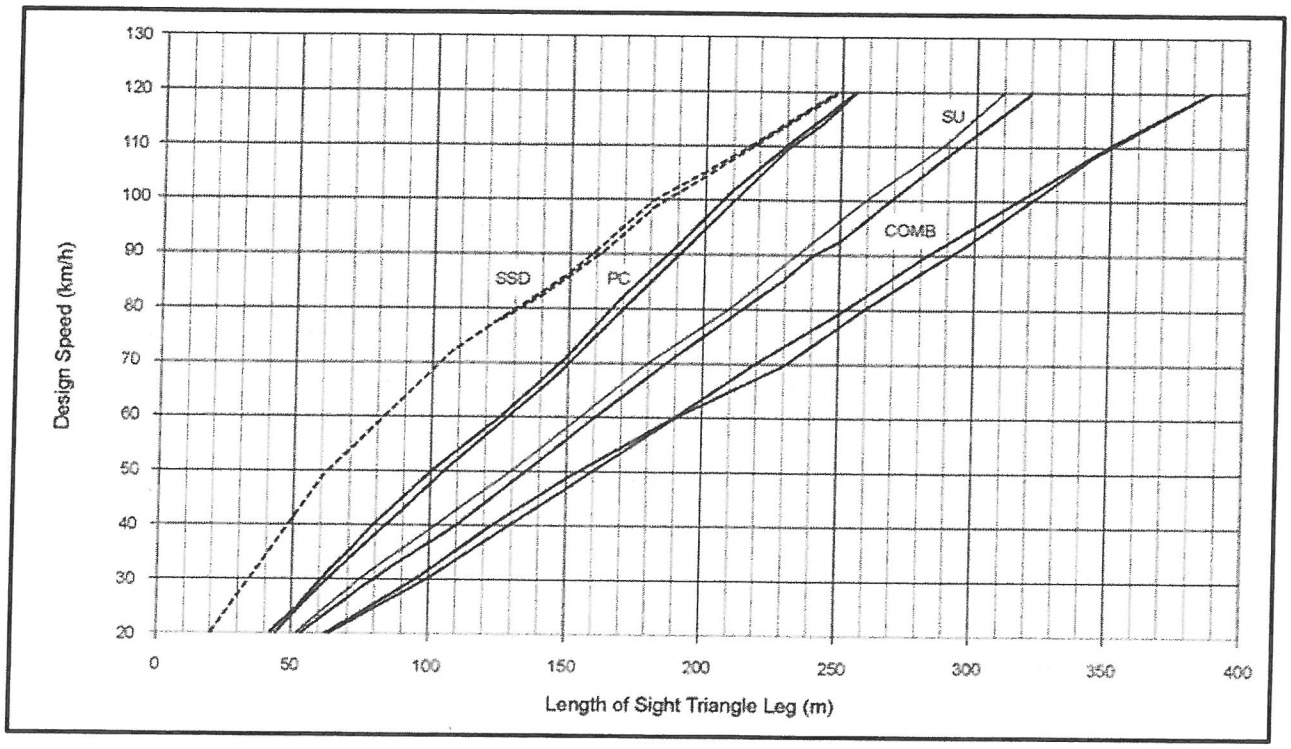


Figure 9.9.4: Intersection Sight Distance – Case B1, Left Turn from Stop (Calculated and Design Values Plotted)

If the design vehicle can be stored in the median with adequate clearance to the through lanes, a departure sight triangle to the right for left turns should be provided for that design vehicle turning left from the median roadway. Where the median is not wide enough to store the design vehicle, a departure sight triangle should be provided for that design vehicle to turn left from the minor-road approach.

The median width should be considered in determining the number of lanes to be crossed. The median width should be converted to equivalent lanes. For example, a 7.2-m median should be considered as two additional lanes to be crossed in applying the multilane highway adjustment for time gaps in **Table 9.9.3**. Furthermore, a departure sight triangle for left turns from the median roadway should be provided for the largest design vehicle that can be stored on the median roadway with adequate clearance to the through lanes. If a divided highway intersection has a 12 m median width and the design vehicle for sight distance is a 22 m combination truck, departure sight triangles should be provided for the combination truck turning left from the minor-road approach and through the median. In addition, a departure sight triangle should also be provided to the right for a 9 m single unit truck turning left from a stopped position in the median.

Case B2 – Right Turn from the Minor Road

A departure sight triangle for traffic approaching from the left like that shown in **Figure 9.9.2** should be provided for right turns from the minor road onto the major road. The intersection sight distance for right turns is determined in the same manner as for case B1, except that the time gaps (t_g) in **Table 9.9.3** should be adjusted. Field observations indicate that, in making right turns, drivers generally accept gaps that are slightly shorter than those accepted in making left turns.[70]

The time gaps in **Table 9.9.3** can be decreased by 1.0 s for right-turn maneuvers without undue interference with major-road traffic. These adjusted time gaps for the right turn from the minor road are shown in **Table 9.9.5**. Design values based on these adjusted time gaps are shown in **Table 9.9.6** for passenger cars. **Figure 9.9.5** includes the design values for the design vehicles for each of the time gaps in **Table 9.9.5**.

Table 9.9.5: Time Gap for Case B2—Right Turn from Stop and Case B3—Crossing Maneuver

Design Vehicle	Time Gap (t_g)(s) at Design Speed of Major Road
Passenger car	6.5
Single-unit truck	8.5
Combination truck (WB 19 and WB 20)	10.5

Note: Time gaps are for a stopped vehicle to turn left onto a two-lane highway with no median and with grades of 3% or less. The table values should be adjusted as follows:

- For multi-lane highways: For left turns onto two-lane highways with more than two lanes, add 0.5 s for passenger cars and 0.7 s for trucks for each additional lane, from the left, in excess of one, to be crossed by the turning vehicle.
- For minor approach grades: If the approach grade is an upgrade that exceeds 3%, add 0.1 s for each percent grade for left turns.

Table 9.9.6: Design Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver

Design Speed (km/h)	Stopping Sight Distance (m)	Intersection Sight Distance for Passenger Cars	
		Calculated (m)	Design (m)
20	20	36.1	40
30	35	54.2	55
40	50	72.3	75
50	65	90.4	95
60	85	108.4	110
70	105	126.5	130
80	130	144.6	145
90	160	162.6	165
100	185	180.7	185
110	220	198.8	200
120	250	216.8	220
130	285	234.9	235

Note: Intersection sight distance shown is for a stopped passenger car to turn right onto or to cross a two-lane highway with no median and with grades of 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

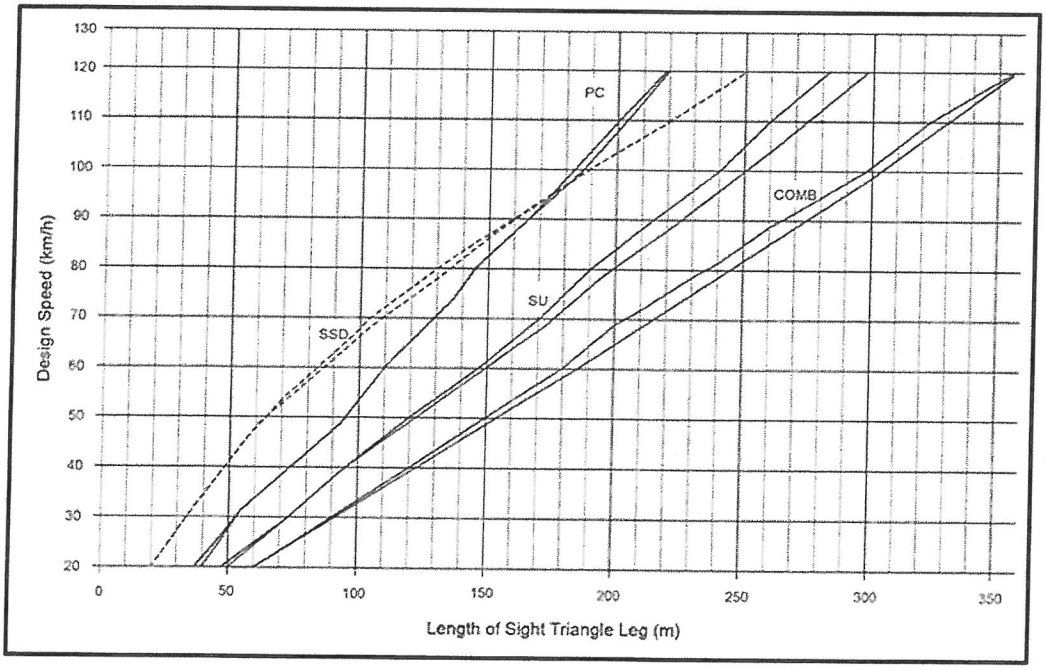


Figure 9.9.5: Intersection Sight Distance – Case B2, Right Turn from Stop, and Case B3, Crossing Maneuver (Calculated and Design Values Plotted)

APPENDIX G

Synchro Analysis

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↱			↱
Traffic Volume (veh/h)	0	446	1033	8	0	1
Future Volume (Veh/h)	0	446	1033	8	0	1
Sign Control		Free	Free		Stop	
Grade		-3%	3%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	496	1148	9	0	1
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1157				1400	578
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1157				1400	578
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	600				131	459

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	248	248	765	392	1
Volume Left	0	0	0	0	0
Volume Right	0	0	0	9	1
cSH	1700	1700	1700	1700	459
Volume to Capacity	0.15	0.15	0.45	0.23	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	12.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		12.9
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑↱			↱
Traffic Volume (veh/h)	0	946	596	2	0	7
Future Volume (Veh/h)	0	946	596	2	0	7
Sign Control		Free	Free		Stop	
Grade		-3%	3%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	1051	662	2	0	8
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	664				1188	332
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	664				1188	332
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	921				181	664

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	526	526	441	223	8
Volume Left	0	0	0	0	0
Volume Right	0	0	0	2	8
cSH	1700	1700	1700	1700	664
Volume to Capacity	0.31	0.31	0.26	0.13	0.01
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	0.0	0.0	10.5
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.5
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		