Transportation Impact Assessment – Step 4: Analysis

232 Donald B. Munro Drive

Prepared for Tartan Homes
by IBI Group
October 6, 2021

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TIA Plan Reports - Certification

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 associate 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[1] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering □ or transportation planning □.

[1] **License or 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.**

Dated at Ottawa this 6th day of October 2021.
(City)

Name: David Hook, P.Eng.

Professional Title: Project Engineer

Signature of Individual certifier that she/he meets the above four criteria

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Stamp

Executive Summary

IBI Group (IBI) was retained by Tartan Homes to undertake a Transportation Impact Assessment (TIA) in support of a Draft Plan of Subdivision application for a proposed residential development located at 232 Donald B. Munro Drive in Carp. The proposed development will consist of a mix of single-family homes, semi-detached homes and townhomes with a total of 117 units. Access to the site will be provided via a new fourth leg at both the Donald B. Munro Drive & Farmridge Avenue intersection and Donald B. Munro Drive & Meadowridge Circle intersection.

Based on the trip generation rates from the 2020 TRANS Trip Generation Manual, it is anticipated that the proposed development will generate a total of 97 and 104 two-way person-trips during the weekday morning and afternoon peak hour, respectively. As a result of limited transit service and minimal pedestrian and cycling linkages, it is anticipated that the site will have a high automobile mode share due to the lack of alternative options. As a result, it is estimated that the site will generate 73 and 80 two-way vehicle-trips during the weekday morning and afternoon peak hour, respectively. Site-generated traffic was subsequently distributed and assigned to the road network based on the morning peak period commuter flows from the 2011 TRANS Origin-Destination Survey as well as existing travel patterns.

Within the proposed development, concrete sidewalks will be provided on one side of Street 1 and Street 2. Property has also been set aside along the western boundary of the site to accommodate a future pathway, consistent with the Carp CDP. A conceptual traffic calming plan has also been developed for the site in accordance with the City's 30 km/h Design Guidelines for Local Residential Streets. A Multi-Modal Information Package will be provided to new homeowners to provide them with information on local walking trails, available bicycle infrastructure, nearby amenities and services, nearby bus stops/routes/schedules, etc. In order to ensure adequate transit coverage for the proposed development, it is recommended that an additional bus stop be provided at the corner of Donald B. Munro Drive & Farmridge Avenue / Street 2. In addition to this, providing weekday peak direction service would help reduce automobile demand during the peak commuter periods and should be considered by the City, if warranted based on passenger demand for the community as a whole.

A multi-modal analysis was conducted for the segment of Donald B. Munro Drive adjacent to the site. The results indicated that both the Pedestrian and Bicycle Level of Service (PLOS and BLOS) targets were not being met. In order to meet the PLOS and BLOS targets, the following potential modifications were identified:

- PLOS: Provide a 2.0m-wide sidewalk on the north side of the roadway and reduce speed limit to 50 km/h or less, or provide 2.0m-wide sidewalks with 0.5m-wide boulevards.
- BLOS: Provide on-street bike lanes and reduce operating speeds to 50 km/h or less, or provide physically separated cycling facilities (i.e. cycle tracks).

Bicycle facilities on Donald B. Munro Drive were found to be unfeasible, however, due to the limited right-of-way and pavement width. As such, it was recommended that the speed transition zone be relocated from Farmridge Avenue to east of Meadowridge Circle to address the poor BLOS along the site frontage. It was also recommended that the existing sidewalk network along Donald B. Munro Drive be extended up to at least Farmridge Avenue to establish connectivity with the existing community. It should be noted, however, that the recommendations are solely for the consideration of the City of Ottawa to address existing deficiencies in user comfort and are not a direct requirement or consequence of the proposed development.

None of the study area intersections are expected to be signalized in the future and there is no MMLOS methodology for unsignalized intersection, therefore MMLOS analysis was limited to just the roadway segment discussed above.

As the proposed development depends on Donald B. Munro Drive, a collector road, for access the neighbourhood traffic impacts of the site were reviewed. The review indicated that the roadway is currently operating at its maximum livability threshold and will therefore exceed this threshold after the addition of adjacent development and site-generated traffic. These high volumes will only impact a small number of residences, however, which will limit the overall impact. Additionally, all residential units will be oriented towards local roads, which will reduce the number of residences impacted by high traffic volumes on Donald B. Munro Drive.

Intersection capacity analysis was completed for all study area intersections under existing, background and total traffic conditions. All study area intersections were shown to operate at an acceptable Level of Service (i.e. LOS 'D' or better) under their existing configuration within the timeframe of this study. A potential collision trend was identified at the March Road & Donald B. Munro Drive / Old Carp Road intersection, although no apparent causes or patterns were identified. It was recommended that the City of Ottawa consider mitigation measures such as a flashing overhead beacon at this location (if warranted) to address this documented safety issue.

Geometric requirements at the study area intersections were also reviewed. Sightlines from the two site accesses were found to be adequate and provide sufficient sight distance for a single-unit truck to turn left out of either access. Auxiliary lane analysis also indicates that no additional auxiliary lanes are required at any of the study area intersections.

Based on the findings of this study, it is the overall opinion of IBI Group that the proposed development will integrate well with and can be safely accommodated by the adjacent transportation network. Consideration should be given by the City of Ottawa of the recommendations provided in order to address the existing issues identified.

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1 Introduction

IBI Group (IBI) was retained by Tartan Homes to undertake a Transportation Impact Assessment (TIA) in support of a Draft Plan of Subdivision application for the proposed residential development to be located at 232 Donald B. Munro Drive in Carp.

In accordance with the City of Ottawa's Transportation Impact Assessment Guidelines, published in June 2017, the following report is divided into four major components:

- **Screening** – Prior to the commencement of a TIA, an initial assessment of the proposed development is undertaken to establish the need for a comprehensive review of the site based on three triggers: Trip Generation, Location and Safety.
- **Scoping** – This component of the TIA report describes both the existing and planned conditions in the vicinity of the development and defines study parameters such as the study area, analysis periods and analysis years of the development. It also provides an opportunity to identify any scope exemptions that would eliminate elements of scope described in the TIA Guidelines but not relevant to the development proposal, based on consultation with City staff.
- **Forecasting** – The Forecasting component of the TIA is intended to review both the development-generated travel demand and the background network travel demand. It also provides an opportunity to rationalize this demand to ensure projections are within the capacity constraints of the transportation network.
- **Analysis** – This component documents the results of any analyses undertaken to ensure that the transportation related features of the proposed development are in conformance with prescribed technical standards and that its impacts on the transportation network are both sustainable and effectively managed. It also identifies a development strategy to ensure that what is being proposed is aligned with the City of Ottawa's policies and city-building objectives.

Throughout the development of a TIA report, each of the four study components above are submitted in draft form to the City of Ottawa and undergo a review by a designated Transportation Project Manager. Any comments received are addressed to the satisfaction of the City's Transportation Project Manager before proceeding with subsequent components of the study. All technical comments and responses are included in **Appendix A**.

Dependent on the findings of this report, the complete submission of this Transportation Impact Assessment may also require Functional Design Drawings of recommended roadway improvements to support a Roadway Modification Application (RMA). The submission may also require a post-development Monitoring Plan to track performance of the planned TIA Strategy. The need for these two elements will be confirmed through the analysis undertaken for this report.

2 TIA Screening

An initial screening was completed to confirm the need for a Transportation Impact Assessment by reviewing the following three triggers:

- **Trip Generation**: Based on the proposed number of residential dwelling units, the minimum development size threshold has been exceeded and therefore the Trip Generation trigger is satisfied.
- **Location**: The proposed development will be accessed from Donald B. Munro Drive which is not designated as a transit priority, rapid transit or spine route. The site is also not located in a Design Priority Area (DPA) or Transit-Oriented Development (TOD) zone. As such, the Location trigger is not satisfied.
- **Safety**: Boundary street conditions were reviewed to determine if there is an elevated potential for safety concerns adjacent the site. Given the horizontal curve present on Donald B. Munro Drive, there may be a potential for safety concerns and therefore the Safety trigger is satisfied.

As the proposed development meets the Trip Generation and Safety triggers, the need to undertake a Transportation Impact Assessment is confirmed.

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

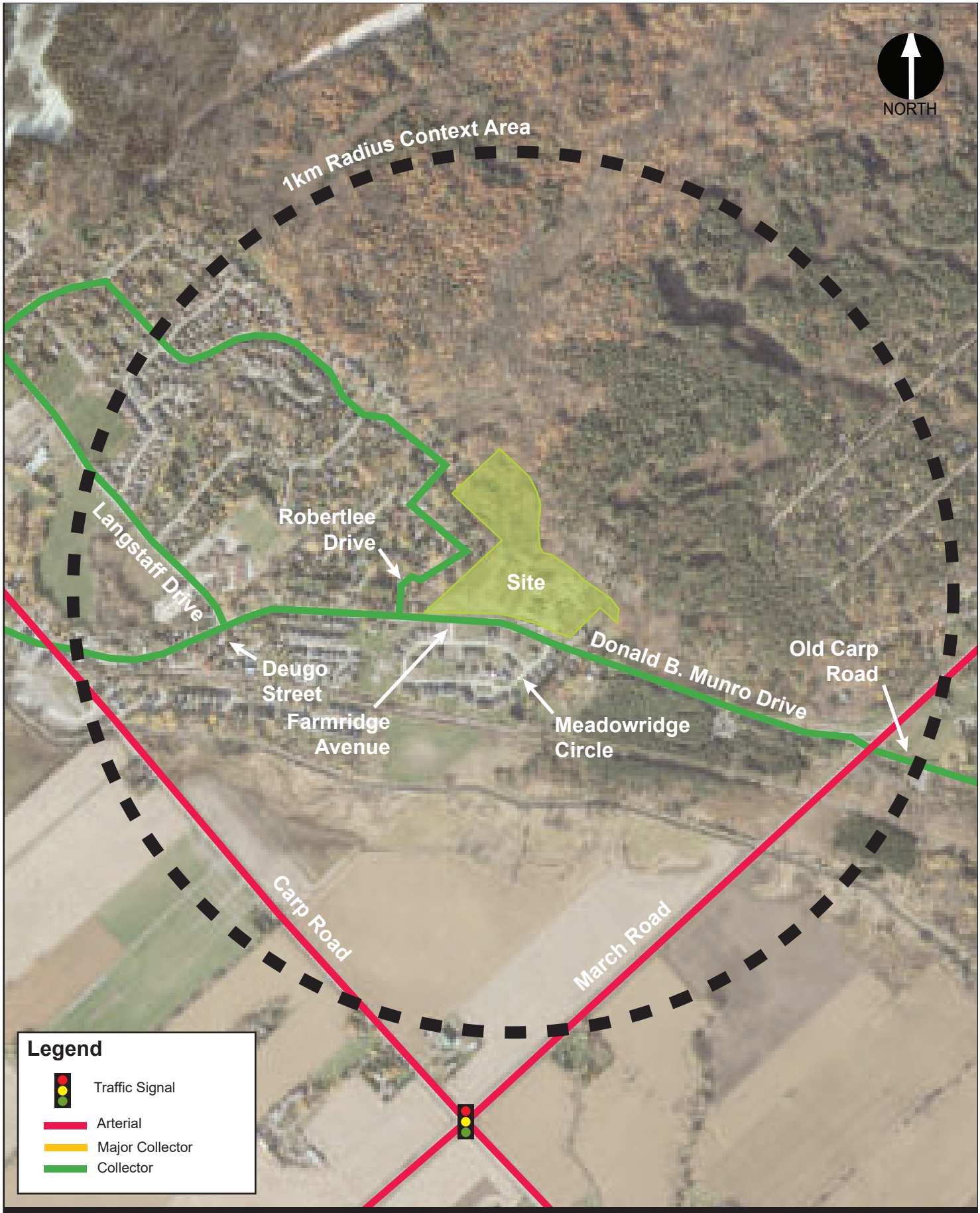
3 Project Scoping

3.1 Description of Proposed Development

3.1.1 Site Location

The proposed development is located at 232 Donald B. Munro Drive in the community of Carp and is within the boundaries of the Carp Community Design Plan (CDP). The site occupies only a portion of the property and is bound by Donald B. Munro Drive to the south, residential land uses to the west, a single-family home to the east and undeveloped greenfield land to the north.

The site location and its surrounding context is illustrated in **Exhibit 1**.



IBI

232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 1:
Site Location

PROJECT No. 131947

SCALE: 100m 0m 200m

3.1.2 Land Use Details

Table 1 below summarizes the proposed land uses included in this development.

Table 1 - Land Use Statistics

LAND USE	SIZE (APPROX. # OF UNITS)
Single-Family Homes	57
Townhomes / Semi-Detached Homes	60

The Draft Plan of Subdivision for the proposed development is illustrated in **Exhibit 2**. Direct access to the site will be provided via two all-movement access intersections on Donald B. Munro Drive.

The subject site is currently an undeveloped greenfield site and, according to GeoOttawa, the portion which will be developed is zoned DR3 – Development Reserve.

3.1.3 Development Phasing & Date of Occupancy

The proposed development is anticipated to be constructed in a single phase with full occupancy of the development by the end of 2024.

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232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 2:
Proposed Development

PROJECT No. 131947

SCALE: 10m 0m 20m

3.2 Existing Conditions

3.2.1 Existing Road Network

3.2.1.1 Roadways

Table 2 below summarizes the details of the boundary roadways as well as other streets within the context area of the proposed development.

Table 2 - Existing Roadways

NAME	CLASS	JURISDICTION	ORIENTATION & EXTENTS	CROSS-SECTION	ROW (m)	SPEED LIMIT (km/h)
Carp Road	Arterial	City of Ottawa	North-South, Galetta Side Road to Stittsville Main Street	2-Lane, Urban, Undivided	23	50
March Road	Arterial	City of Ottawa	East-West, Ramsay Concession 11A to Campeau Drive	2-Lane, Rural, Undivided	32	70
Donald B. Munro Drive	Collector	City of Ottawa	Northwest-Southeast, Kinburn Side Road to March Road	2-Lane, Urban/Rural, Undivided	16, 23 & 26[1]	40 & 60[2]
Old Carp Road	Collector	City of Ottawa	Northwest-Southeast, March Road to Halton Terrace	2-Lane, Rural, Undivided	13	60
Langstaff Drive	Collector	City of Ottawa	North-South, Juanita Avenue to Donald B. Munro Drive	2-Lane, Urban, Undivided	20	40
Robertlee Drive	Collector	City of Ottawa	North-South, Cavanagh Drive to Donald B. Munro Drive	2-Lane, Urban, Undivided	20	40
Deugo Street	Local	City of Ottawa	North-South, Donald B. Munro Drive to Salisbury Street	2-Lane, Urban, Undivided	12	50
Farmridge Avenue	Local	City of Ottawa	North-South, Donald B. Munro Drive to Meadowridge Circle	2-Lane, Urban, Undivided	18	50

NAME	CLASS	JURISDICTION	ORIENTATION & EXTENTS	CROSS-SECTION	ROW (m)	SPEED LIMIT (km/h)
Meadow-ridge Circle	Local	City of Ottawa	North-South at Donald B. Munro Drive, forms loop with itself	2-Lane, Urban, Undivided	18	50

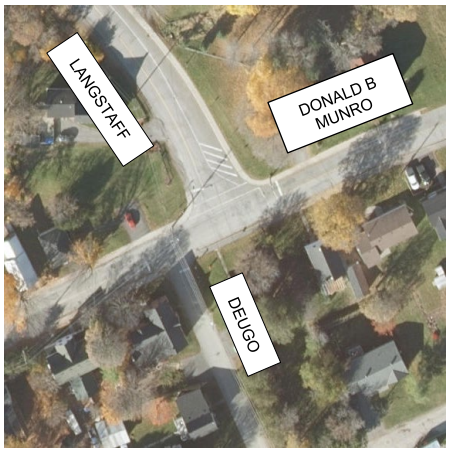
[1] *16m from Falldown Ln to Langstaff Dr, 23m from Langstaff Dr to Farmridge Ave, 26m from Farmridge Ave to March Rd*

[2] *Posted speed limit is reduced from 60 km/h to 40 km/h approximately 80m west of Farmridge Avenue*

3.2.1.2 Intersections

The following existing intersections have the greatest potential to be impacted by the proposed development:

- **Carp Road & Donald B. Munro Drive** is a skewed four-legged unsignalized intersection with stop-control on all approaches.

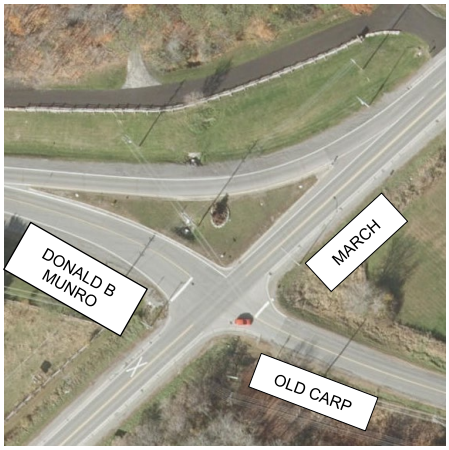


- **Donald B. Munro Drive & Langstaff Drive / Deugo Street** is an offset four-legged unsignalized intersection with stop-control on all approaches. Langstaff Drive and Deugo Street are offset by approximately 20m.

- **Donald B. Munro Drive & Robertlee Drive** is a three-legged unsignalized intersection with stop-control on Robertlee Drive.

- **Donald B. Munro Drive & Farmridge Avenue** is a three-legged unsignalized intersection with stop-control on Farmridge Avenue.

- **Donald B. Munro Drive & Meadowridge Circle** is a three-legged unsignalized intersection with stop-control on Meadowridge Circle.



- **March Road & Donald B. Munro Drive / Old Carp Road** is a four-legged unsignalized intersection with stop-control on Donald B. Munro Drive and Old Carp Road and a channelized right-turn lane on the westbound approach.

3.2.1.3 Driveways Adjacent to Development Access

Within 200m of the proposed approaches are a number of private approaches serving single-family homes.

3.2.1.4 Traffic Management Measures

Flexible centreline speed limit signs have been implemented along Langstaff Drive and a speed display device has been implemented on Donald B. Munro Drive approximately 60m west of Farmridge Avenue. No other traffic management or traffic calming measures have been implemented in the vicinity of the proposed development.

3.2.2 Existing Bicycle and Pedestrian Facilities

The following cycling and pedestrian facilities exist within the context area:

- Concrete sidewalks on both sides of Carp Road;
- Concrete sidewalks on both sides of Donald B. Munro Drive west of 50m east of Langstaff Drive;
- Concrete sidewalk on the south side of Donald B. Munro Drive between 50m east of Langstaff Drive and Meadowridge Circle;
- Concrete sidewalk on the east side of Langstaff Drive; and
- Paved shoulders on Carp Road south of Donald B. Munro Drive.

3.2.3 Existing Transit Facilities and Service

The following transit route, operated by OC Transpo, exist within the vicinity of the site:

- **Route #303** provides Wednesday-only service between Dunrobin / Carp / Stittsville and Bayshore / Carlingwood. There is a single trip in the morning towards Bayshore / Carlingwood and a single return trip in the afternoon towards Dunrobin / Carp / Stittsville.

The nearest bus stops to the proposed development are presently located at the intersection of Donald B. Munro Drive & Robertlee Drive, approximately 200m west of the site. The transit service map for the Route #303 is provided in **Appendix C**.

3.2.4 Collision History

A review of historical collision data has been conducted for the road network surrounding the proposed development. The TIA Guidelines require a safety review if at least six collisions for any one movement or of a discernible pattern, over a five-year period have occurred. **Table 3** summarizes all reported collisions between January 1, 2015 and December 31, 2019.

Table 3 – Reported Collisions within Vicinity of Proposed Development

LOCATION	# OF REPORTED COLLISIONS
INTERSECTIONS	
Carp Road & Donald B. Munro Drive	5
Donald B. Munro Drive & Langstaff Drive / Deugo Street	0
Donald B. Munro Drive & Robertlee Drive	1
Donald B. Munro Drive & Farmridge Avenue	0
Donald B. Munro Drive & Meadowridge Circle	1
March Road & Donald B. Munro Drive / Old Carp Road	9
SEGMENTS	
Donald B. Munro Drive – Carp Road to Salisbury Street	0
Donald B. Munro Drive – Salisbury Street to Langstaff Drive / Deugo Street	1
Donald B. Munro Drive – Langstaff Drive / Deugo Street to Robertlee Drive	1
Donald B. Munro Drive – Robertlee Drive to March Road	3

Based on the collision history noted above, the intersection of March Road & Donald B. Munro Drive / Old Carp Road may require further review.

Another method of evaluating the relative magnitude of collision frequency at one intersection compared to another is to quantify the average historical number of collisions against the daily volume of traffic entering the intersection. This is commonly expressed in terms of average collisions per year per Million Vehicles Entering (MVE) and a rate of greater than 1.0 is considered significant. The March Road & Donald B. Munro Drive / Old Carp Road intersection currently experiences 0.75 collisions per MVE which is not considered significant.

Detailed collision records are provided in **Appendix D**.

3.3 Planned Conditions

3.3.1 Transportation Network

3.3.1.1 Future Road Network Projects

The 2013 Transportation Master Plan (TMP) outlines future road network modifications required in the 2031 'Affordable Network'. Based on the TMP there are no planned future road network modifications in the vicinity of the site. The Carp CDP also does not identify any planned future road network modifications.

3.3.1.2 Future Transit Facilities and Services

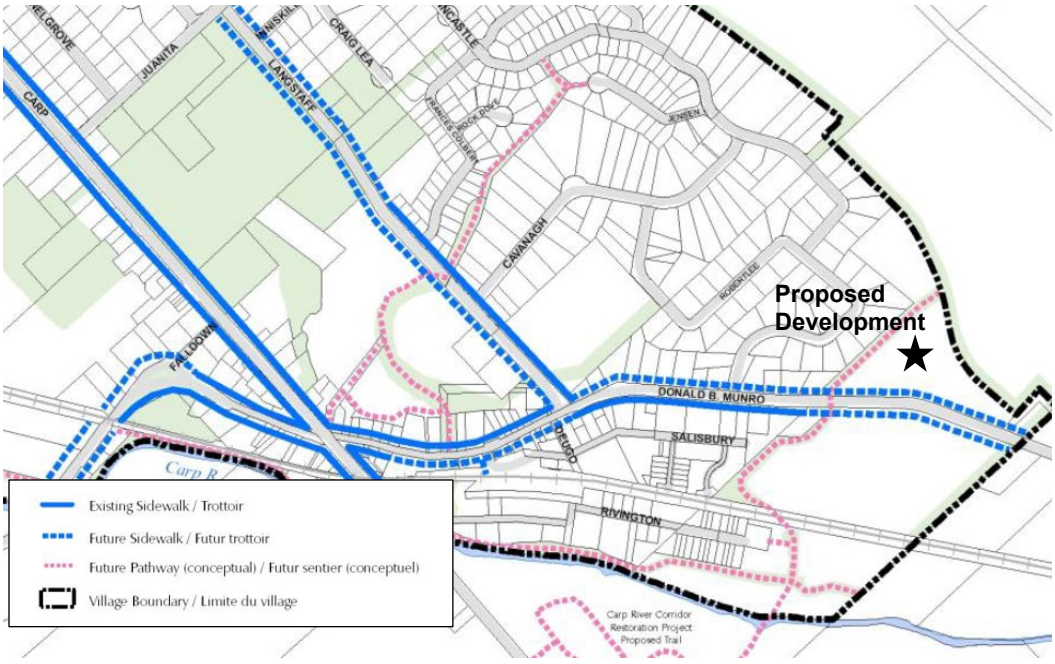
The 2013 TMP outlines the future rapid transit and transit priority (RTTP) network. Based on the TMP there are no planned future RTTP network improvements planned within the vicinity of the site.

3.3.1.3 Future Cycling and Pedestrian Facilities

The Transportation Master Plan (TMP) designates Carp Road (south of Donald B. Munro Drive) and March Road as 'Spine' Routes, which forms part of a system linking the commercial, employment, institutional, residential and educational nodes throughout the City of Ottawa. It also identifies Donald B. Munro Drive (east of Carp Road) and Old Carp Road as 'Local' Routes and indicates that the rail corridor south of the site will become a multi-use path.

The Carp CDP (May 2012) indicates that concrete sidewalks will be provided on both sides of Donald B. Munro Drive up to the eastern boundary of the proposed development and on both sides of Langstaff Drive. A pedestrian pathway is also planned on the west side of the proposed development with a connection to the existing pathways south of Donald B. Munro Drive, as shown in **Figure 1** below.

Figure 1 – Pedestrian Pathway System (Carp CDP)



Source: The Carp Community Design Plan (May 2012) – Schedule C

3.3.2 Future Adjacent Developments

The City of Ottawa Transportation Impact Assessment (TIA) Guidelines specify that all significant developments proposed within the surrounding area which are likely to occur within the study's horizon year must be identified and taken into consideration in the development of future background traffic projections.

There is currently only one development application of significance in the vicinity of the proposed development, as shown in **Table 4** and **Figure 2** below.

Table 4 - Future Adjacent Developments

DEVELOPMENT	LAND USE	EXPECTED BUILD-OUT YEAR
147 Langstaff Drive	• 128 apartment units and 66 townhome units	2023

Figure 2 – Adjacent Developments

3.3.3 Network Concept Screenline

A screenline is a predetermined boundary between areas of major traffic generation that captures all significant points of entry from one area to another to compare crossing demand with the available roadway capacity. Screenlines are typically located along geographical barriers such as rivers, rail lines or within the greenbelt. To capture existing flow and model future demand, count stations are established at each crossing point along the screenline.

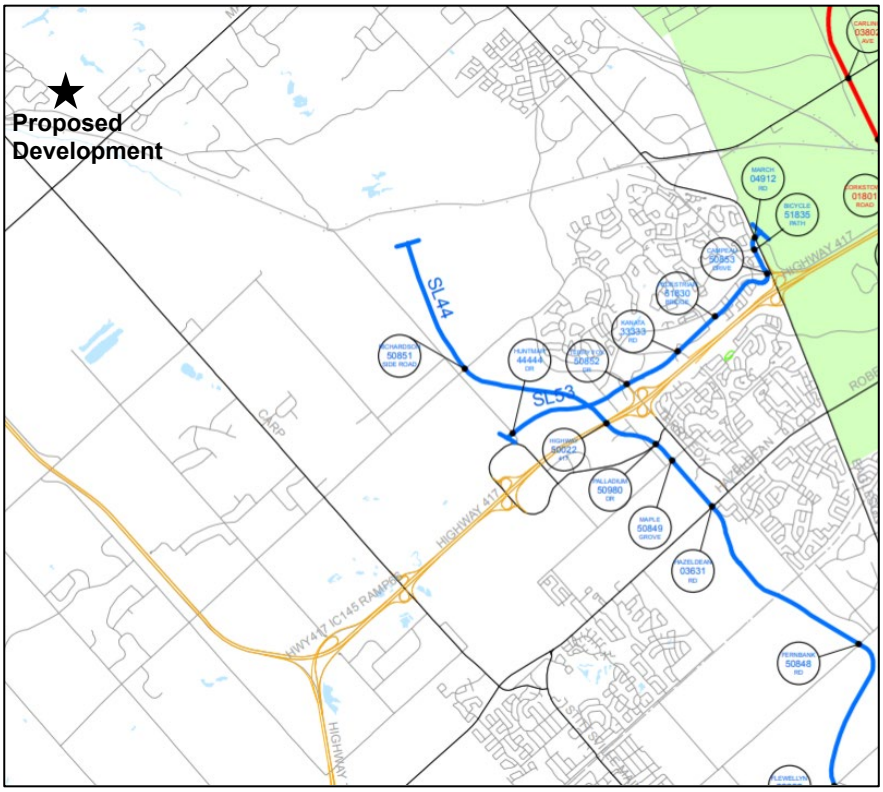
The nearest strategic planning screenlines adjacent to the development have been considered in the screenline analysis:

- **SL44 – Terry Fox** – This is the nearest north/south screenline to the study area and generally follows the alignment of Terry Fox Drive. This screenline has seven crossing points: Richardson Side Road, Highway 417, Palladium Drive, Maple Grove, Hazeldean Road, Fernbank Road and Flewellyn Road.

- **SL53 – Campeau** – This is the nearest east/west screenline to the study area and follows the south side of Campeau Drive. This screenline has seven crossing points: Huntmar Drive, Terry Fox Drive, Kanata Road, Pedestrian Bridge, Campeau Drive, Bicycle Path and March Road.

SL44 and SL53 are shown in **Figure 3** below, as determined from the City of Ottawa's Road Network Development Report (2013), a supporting document to the 2013 Transportation Master Plan (TMP).

Figure 3 - Screenlines



3.4 Study Area

With consideration of the information presented thus far, a study area bound by Carp Road to the west, March Road to the east, Donald B. Munro Drive to the south and the northern boundary of the site will provide a sufficient assessment of the development's impact on the adjacent transportation network.

The following intersections have been identified as being most impacted by the proposed development and will be assessed for vehicular capacity as part of this study:

- Carp Road & Donald B. Munro Drive
- Donald B. Munro Drive & Langstaff Drive/Deugo Street
- Donald B. Munro Drive & Robertlee Drive
- Donald B. Munro Drive & Farmridge Avenue/Street 2
- Donald B. Munro Drive & Meadowridge Circle/Street 1
- March Road & Donald B. Munro Drive/Old Carp Road

An intersection Multi-Modal Level of Service (MMLOS) analysis is only required for signalized intersections. All of the existing study area intersections noted above are presently stop-controlled and therefore no intersection MMLOS is required under existing conditions. The need for intersection MMLOS under future conditions will be determined through a review of intersection capacity analyses and intersection control warrants, which will be undertaken in subsequent components of this study. Segment-based MMLOS analysis will only be conducted for the segment of Donald B. Munro Drive that is adjacent to the proposed development.

3.5 Time Periods

As the proposed development will consist of residential land uses, traffic generated during the weekday morning and afternoon peak hours is expected to result in the most significant impact to traffic operations on the adjacent network.

3.6 Existing Lane Configurations & Traffic Volumes

The following weekday morning and afternoon peak hour turning movement counts were obtained from the City of Ottawa:

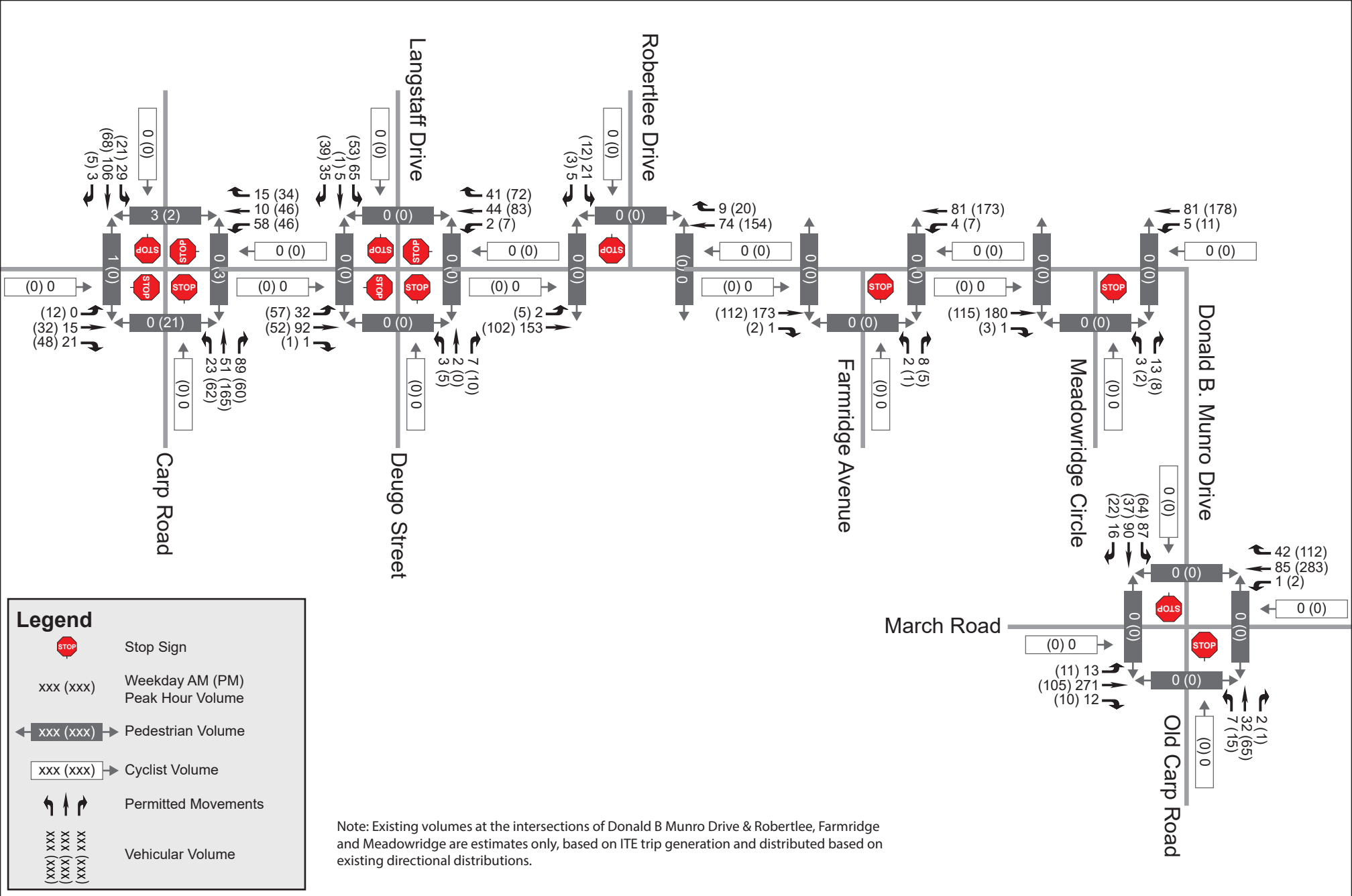
- Carp Road & Donald B. Munro Drive (City of Ottawa, April 2019)
- March Road & Donald B. Munro Drive/Old Carp Road (City of Ottawa, February 2019)

The above traffic counts were supplemented by a traffic count conducted by McIntosh Perry in August 2019 for the Donald B. Munro Drive & Langstaff Drive/Deugo Street intersection.

It should be noted that, due the ongoing COVID-19 pandemic, it is not possible to undertake reliable, updated traffic counts at the study intersections. As such, using GeoOttawa 2019 aerial imagery and the 2020 TRANS Trip Generation Manual, the number of trips generated by residential land uses north and south of Donald B. Munro Drive was estimated and used to approximate the intersection volumes at the Donald B. Munro Drive & Robertlee Drive intersection, Donald B. Munro Drive & Farmridge Avenue intersection and Donald B. Munro Drive & Meadowridge Circle intersection.

A growth rate was applied to the above noted turning movement count data to approximate existing (2021) traffic volumes. Justification of background growth rates is discussed further in the Forecasting section of this TIA.

Peak hour traffic volumes representative of existing conditions are shown in **Exhibit 3**. The traffic count data is provided in **Appendix E**. The lane configurations and intersection controls for the study area intersections are illustrated in **Exhibit 4**.



Note: Existing volumes at the intersections of Donald B Munro Drive & Robertlee, Farmridge and Meadowridge are estimates only, based on ITE trip generation and distributed based on existing directional distributions.

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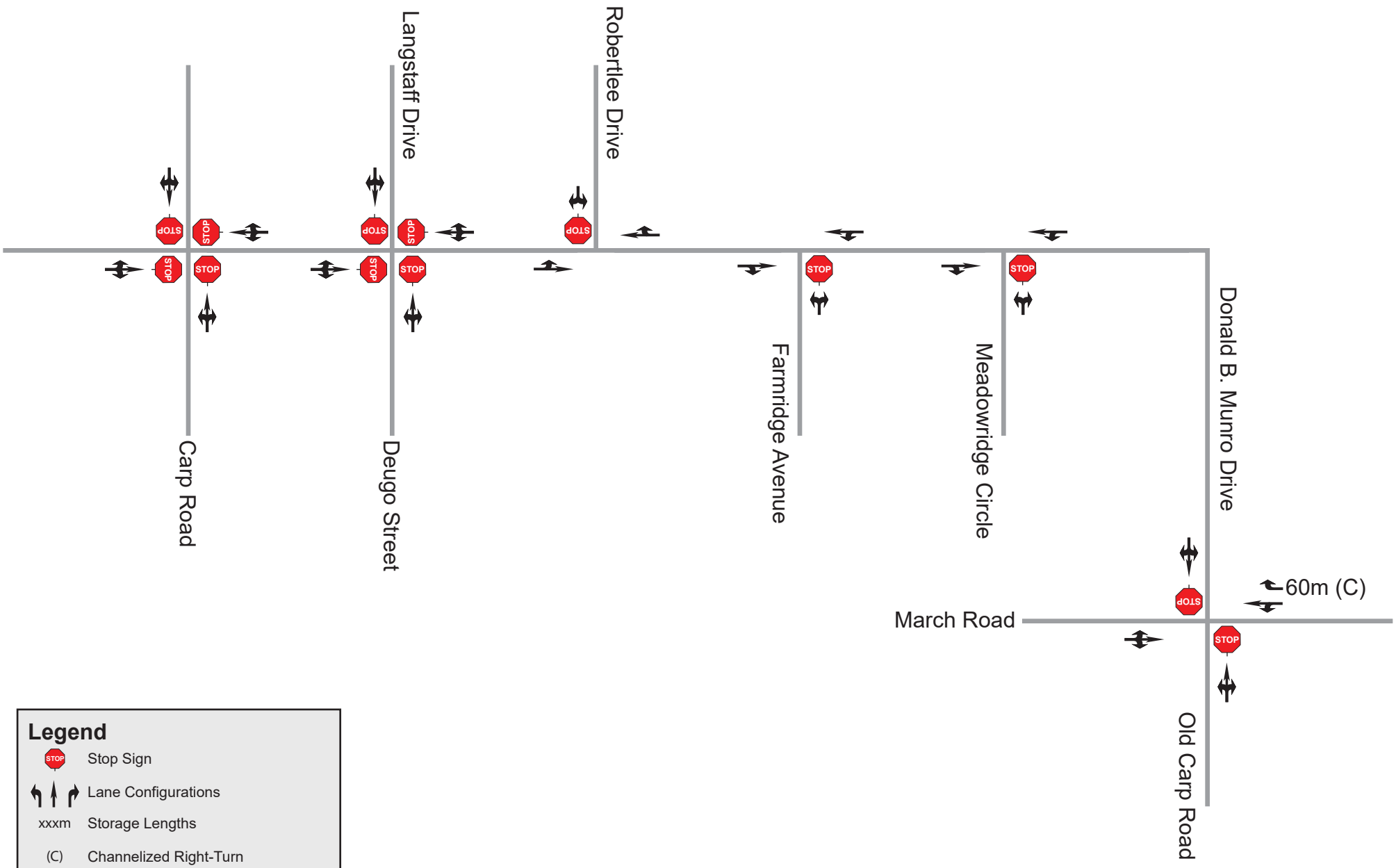
232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 3:
Existing (2021)
Traffic

PROJECT No. 131947

SCALE: N.T.S.



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232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 4:
Existing (2021)
Lane Configurations
and Traffic Controls

PROJECT No. 131947

SCALE: N.T.S.

3.7 Study Horizon Year

The following future analysis years will be assessed in this study:

- Year 2024 – Full Build-out / Occupancy of Proposed Development
- Year 2029 – 5 Years Beyond Full Build-out/ Occupancy

3.8 Exemptions Review

The TIA Guidelines provide exemption considerations for elements of the Design Review and Network Impact components. **Table 5** summarizes the TIA modules that are not applicable to this study.

Table 5 - Exemptions Review

TIA MODULE	ELEMENT	EXEMPTION CONISDERATIONS	REQUIRED
DESIGN REVIEW COMPONENT			
4.1 Development Design	4.1.2 Circulation and Access	• Only required for site plans	✗
	4.1.3 New Street Networks	• Only required for plans of subdivision	✓
4.2 Parking	4.2.1 Parking Supply	• Only required for site plans	✗
	4.2.2 Spillover Parking	• Only required for site plans where parking supply is 15% below unconstrained demand	✗
NETWORK IMPACT COMPONENT			
4.5 Transportation Demand Management	All Elements	• Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	✓
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	• Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	✓
4.8 Network Concept	n/a	• Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning	✗

4 Forecasting

4.1 Development Generated Traffic

4.1.1 Trip Generation Methodology

Peak hour residential site-generated traffic volumes were developed using the 2020 TRANS Trip Generation Manual. The TRANS trip generation rates are based on blended rates derived from the 49 trip generation studies undertaken between 2008 and 2012, the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) and the 2011 TRANS O-D Travel Survey. Separate peak period person-trip generation rates were developed for single-detached housing, low-rise multifamily housing (i.e. two storeys or less) and high-rise multifamily housing (i.e. three storeys or more). Site-generated peak period person-trips were estimated using these rates and subsequently subdivided based on representative mode share percentages applicable to the study area. Mode-specific adjustment factors were then applied to these peak period person-trips to determine the number of peak hour vehicle, passenger, transit, cycling and pedestrian trips.

Local mode share targets were based on the 2020 TRANS Trip Generation Manual which provides blended mode shares based on the 2011 TRANS Origin-Destination (O-D) Survey for select land uses for each of the Traffic Assessment Zones (TAZs) in the O-D Survey. The proposed development is located within the Rural West TAZ which the 2020 TRANS Trip Generation Manual groups together with the other rural TAZs.

4.1.2 Trip Generation Results

4.1.2.1 Residential Trip Generation Results

Peak period person-trips associated with the proposed development were determined using the trip generation rates from the 2020 TRANS Trip Generation Manual. The peak period person-trip generation results for the proposed development have been summarized in **Table 6** below.

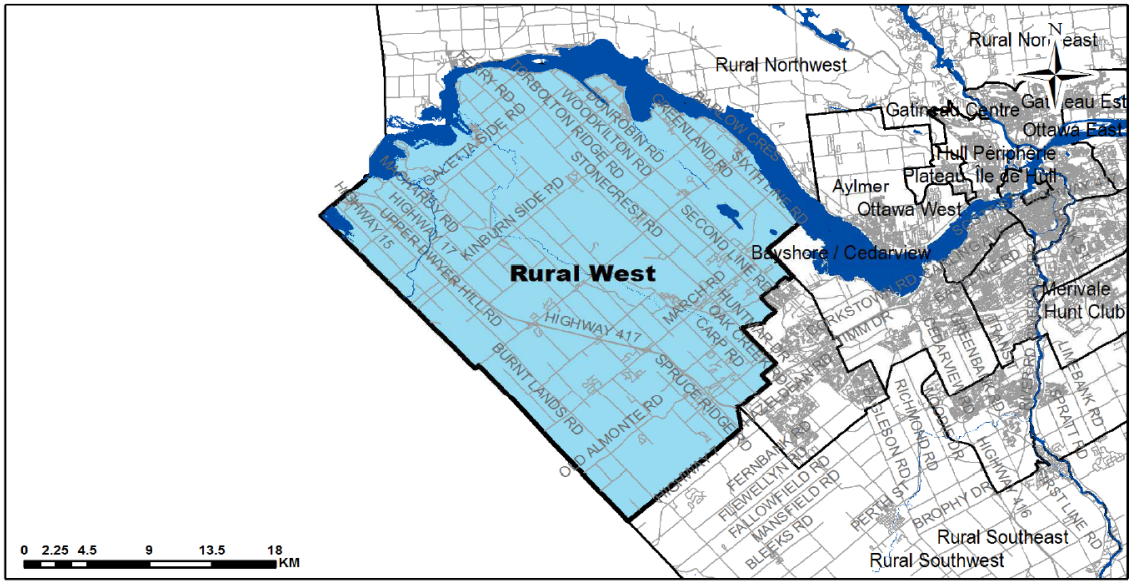
Table 6 - Residential Peak Period Person-Trip Generation

BUILD-OUT	LAND USE	SIZE (UNITS)	PERIOD	PEAK PERIOD PERSON-TRIPS		
				IN	OUT	TOTAL
2024	Single Family Homes	57	AM	35	82	117
			PM	88	54	142
	Townhomes / Semi-Detached	60	AM	24	57	81
			PM	53	42	95

4.1.2.2 Mode Share Proportions

The TRANS Trip Generation Manual (October 2020) provides blended mode shares based on the 2011 TRANS Origin-Destination (O-D) Survey for select land uses for each of the Traffic Assessment Zones (TAZs) in the O-D Survey. The proposed development is located within the Rural West TAZ, as illustrated in **Figure 6** below. Given the land uses proposed, the mode share distribution for the single-family home and townhome / semi-detached land uses are based on the 'single-detached housing' and 'low-rise multifamily housing' mode share distributions from Table 6 and 7, respectively. Relevant extracts from the TRANS Trip Generation Manual are provided in **Appendix F**.

Figure 4 – Rural West TAZ



Source: 2011 O-D Survey

The village of Carp is highly isolated in terms of transit, pedestrian and cyclist access, with transit service provided only once a week and limited pedestrian or cycling linkages outside of the village. Furthermore, as discussed in Section 3.3, there are currently no planned improvements in transit infrastructure in the vicinity of the proposed development. As such, it is expected that the majority of site-generated trips will occur via private vehicle. The target mode share distribution therefore considers a 0% transit mode share target. The proposed development will be designed with good quality pedestrian infrastructure which will provide residents with access to amenities within the community. As such, a 2% pedestrian mode share target is considered achievable. The auto driver, auto passenger and cycling mode share targets were subsequently established by calculating the weighted average of the existing mode share and adjusting the results to account for the targets established for transit and pedestrians.

The existing mode shares for the TAZ and the proposed mode share targets for the proposed development are identified in **Table 7** below.

Table 7 - Existing and Target Mode Share Distributions

MODE	EXISTING MODE SHARE WITHIN TAZ				MODE SHARE TARGETS
	SINGLE-DETACHED		LOW-RISE MULTIFAMILY		
	AM	PM	AM	PM	
Auto Driver	60%	67%	66%	62%	77%
Auto Passenger	14%	17%	13%	19%	19%
Transit	24%	14%	21%	16%	0%
Cycling	2%	2%	1%	3%	2%
Walking	0%	0%	0%	0%	2%

4.1.2.3 Trip Reduction Factors

Deduction of Existing Development Trips

Not Applicable: The proposed development lands are currently undeveloped, and do not generate any traffic volumes.

Pass-by Traffic

Not Applicable: The proposed development will not generate pass-by traffic.

Synergy/ Internalization

Not Applicable: The proposed development will include only residential uses, therefore internalization reduction factors are not required for this study.

4.1.2.4 Trip Generation by Mode

The mode share targets from **Table 7** were applied to the number of development generated peak period person-trips to determine the number of trips per travel mode. The peak period to peak hour adjustment factors from Table 4 of the 2020 TRANS Trip Generation Manual were subsequently applied in order to convert to peak hour trips.

The results after applying the mode share targets and adjustment factors are summarized in **Table 8** below.

Table 8 – Development-Generated Peak Hour Person Trips by Mode

MODE	AM			PM		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Auto Driver	22	51	73	48	32	80
Auto Passenger	5	13	18	12	8	20
Transit	0	0	0	0	0	0
Cycling	1	2	3	1	1	2
Walking	1	2	3	1	1	2
Total Person Trips	**29**	**68**	**97**	**62**	**42**	**104**

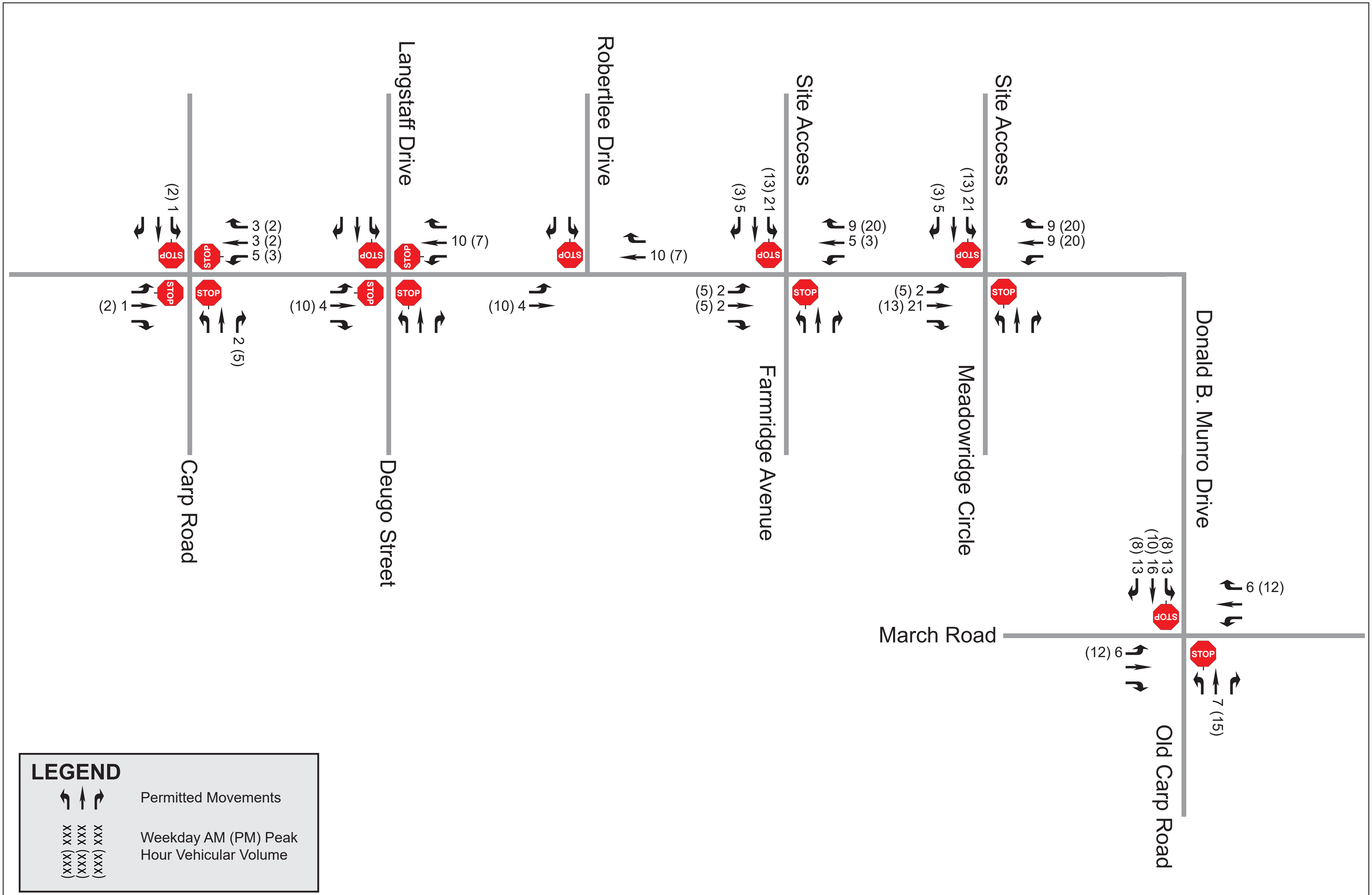
4.1.3 Trip Distribution and Assignment

With consideration that the proposed development will consist solely of residential land uses, it is anticipated that the distribution of site-generated traffic in each of the four cardinal directions will align with the AM Peak commuter flow patterns identified in the 2011 O-D Survey. Based on the 2011 O-D Survey, approximately 38% of traffic will remain within the TAZ while the remainder will go to/from the east towards other areas of Ottawa. The assignment of traffic staying within the TAZ was based on existing travel patterns derived from the turning movement counts while traffic to/from other areas of Ottawa were assigned to logical routes based on engineering judgement and Google Maps travel times during weekday peak hour conditions:

- 5% to/from the North via Carp Road
- 10% to/from the South via Carp Road
- 80% to/from the East

  - 30% via Old Carp Road
  - 25% via March Road
  - 25% via March Road & Carp Road
- 5% to/from the West via Carp Road

Applying the estimated number of new auto trips to the above distribution, future site-generated traffic volumes from **Table 8** are illustrated in **Exhibit 5** below at each of the study area intersections.



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232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 5:
Site-Generated Traffic

PROJECT No. 131947

SCALE: N.T.S.

4.2 Background Network Traffic

4.2.1 Changes to the Background Transportation Network

To properly assess future traffic conditions, planned modifications to the transportation network that may impact travel patterns or demand within the study area have been considered. The Scoping section of this TIA reviewed the anticipated changes to the study area transportation network based on the Transportation Master Plan (TMP) and the Carp CDP. Based on a review of these planning policy documents, no significant transportation network modifications are anticipated within the timeframe of this study.

4.2.2 General Background Growth Rates

The background growth rate is intended to represent regional growth from outside the study area that will travel along the adjacent road network. Consistent with approved TIAs completed in the study area, a linear growth rate of 1% per annum is proposed for the calculation of future background traffic estimates. This growth rate has been applied to all through movements on Donald B. Munro Drive and to all movements at the Carp Road & Donald B. Munro Drive intersection and at the March Road & Donald B. Munro Drive / Old Carp Road intersection.

4.2.3 Other Area Development

All current adjacent development applications and future potential developments of significance within the study area were previously identified in **Table 4**. All of these developments have been accounted for in the estimation of future background volume projections. The developments represent specific areas of growth within the study area and are therefore considered in addition to the general background growth rate discussed previously.

4.3 Demand Rationalization

The purpose of this section is to rationalize future travel demands within the study area to account for potential capacity limitations in the transportation network and its ability to effectively absorb the additional demand generated by a new development.

4.3.1 Description of Capacity Issues

Based on a review of other TIAs recently conducted for adjacent developments, no capacity issues are expected at any of the study area intersections. The Analysis section of this TIA will confirm any additional traffic operational issues at study area intersections under both background and total traffic conditions and suggest mitigation measures where applicable.

4.3.2 Adjustment to Development Generated Demands

Development generated demand and mode share can vary over time to reflect changes to the transportation network. Within the study area, however, there are no planned improvements to transit infrastructure by the City therefore local mode share is not expected to change by the horizon year of this study. Some localized improvements to the pedestrian and cycling networks are identified in the Carp CDP. A nominal 2% has been applied to the pedestrian mode share. Future enhancements to the pedestrian network per the CDP will further promote walking as an alternative means of community mobility, however as there is no indication of timing with respect to planned sidewalks on Donald B Munro Drive, no further increase in the pedestrian mode share has been considered.

4.3.3 Adjustment to Background Network Demands

The application of a 1% background growth rate within the study area is consistent with the rate used in TIAs in support of adjacent developments.

4.4 Traffic Volume Summary

4.4.1 Future Background Traffic Volumes

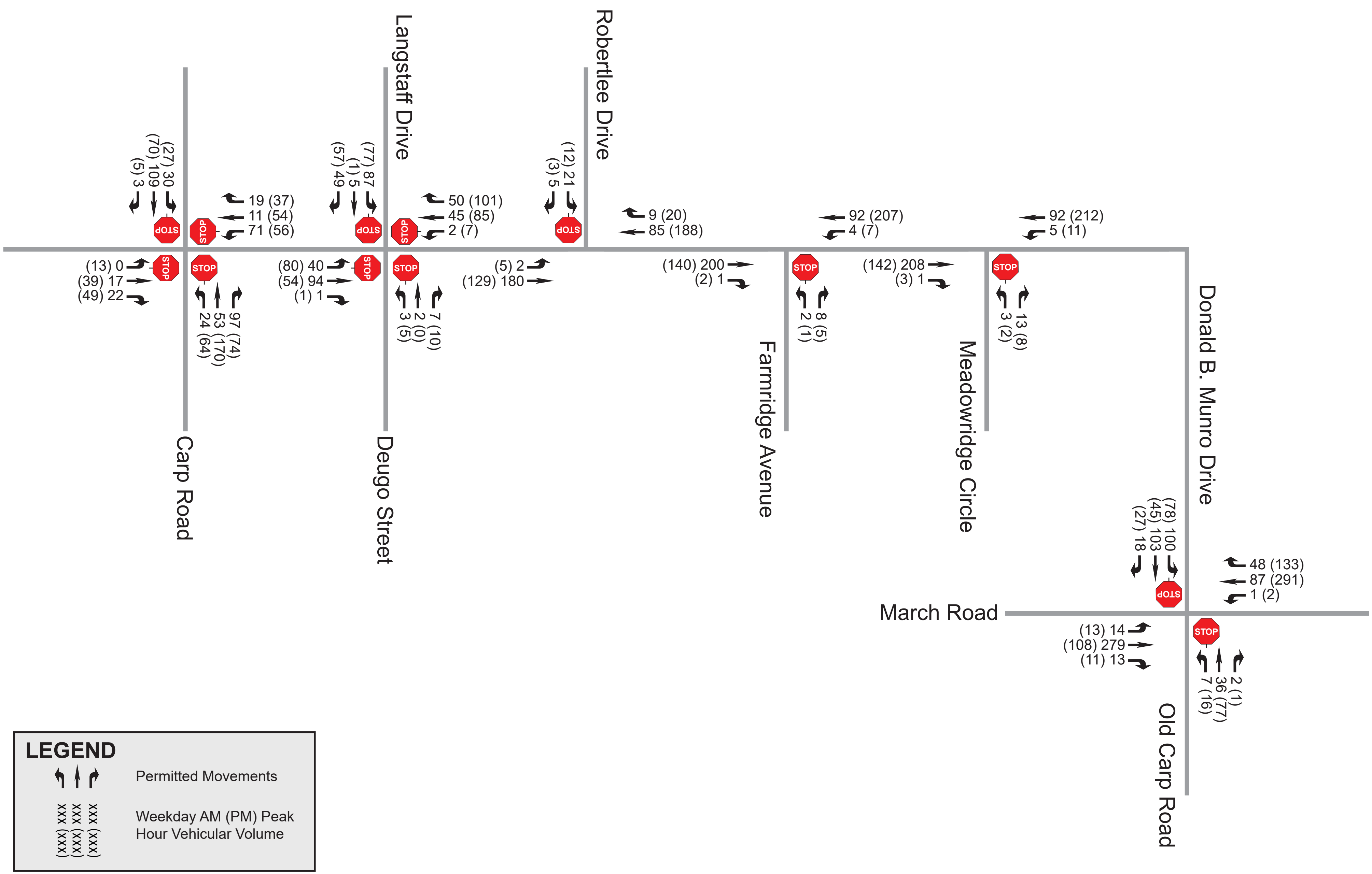
Future background traffic volumes projections have been established by combining the adjacent development traffic and background traffic derived through the application of a growth rate, as discussed previously.

Exhibit 6 and **Exhibit 7** present the future background traffic volumes anticipated for the 2024 and 2029 analysis years, respectively.

4.4.2 Future Total Traffic Volumes

Future total volumes have been derived by combining the site-generated traffic volumes with future background volumes.

Exhibit 8 and **Exhibit 9** present the future total traffic volumes anticipated for the 2024 and 2029 analysis years, respectively.



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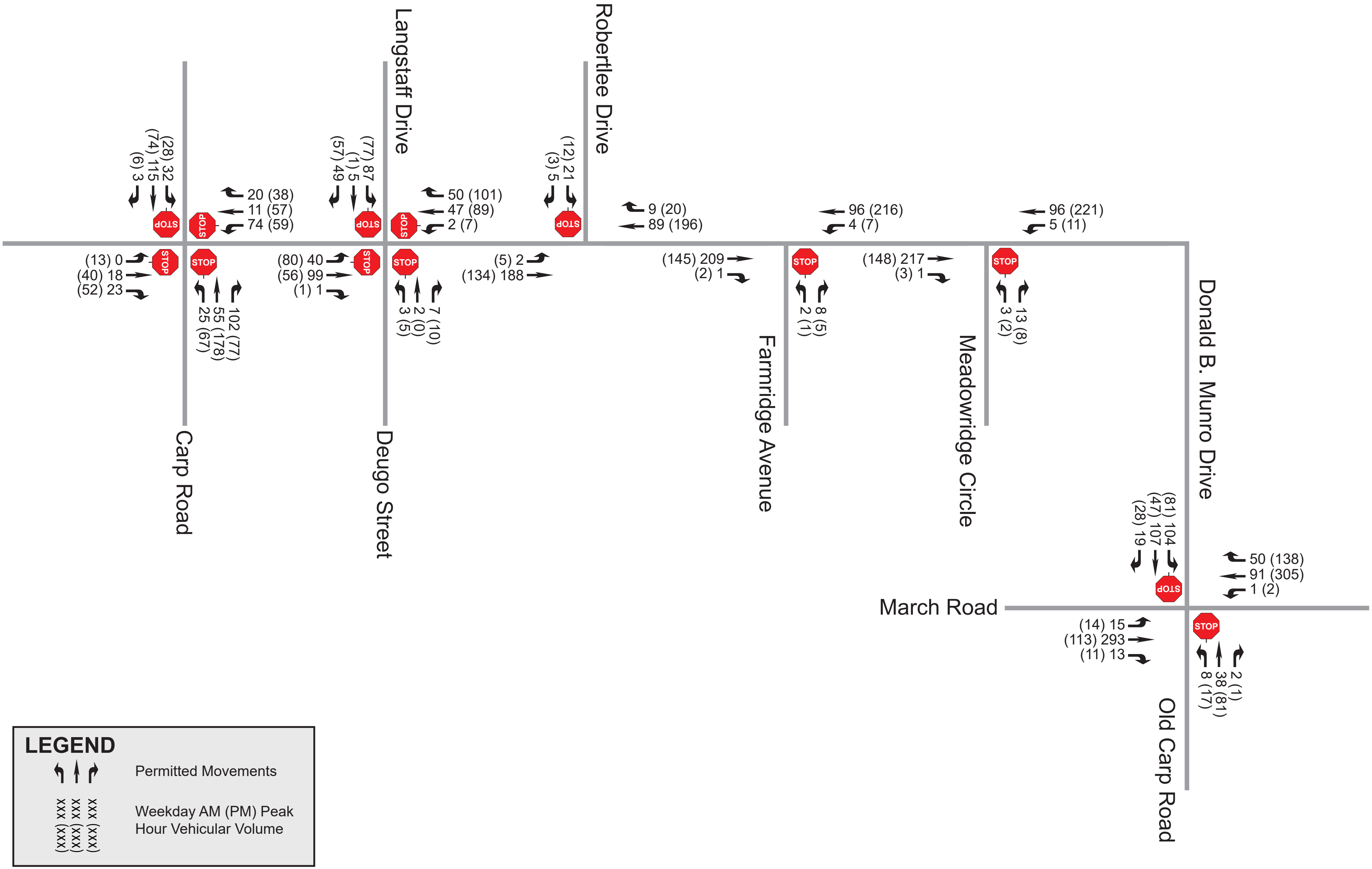
232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 6:
Future (2024)
Background Traffic

PROJECT No. 131947

SCALE: N.T.S.



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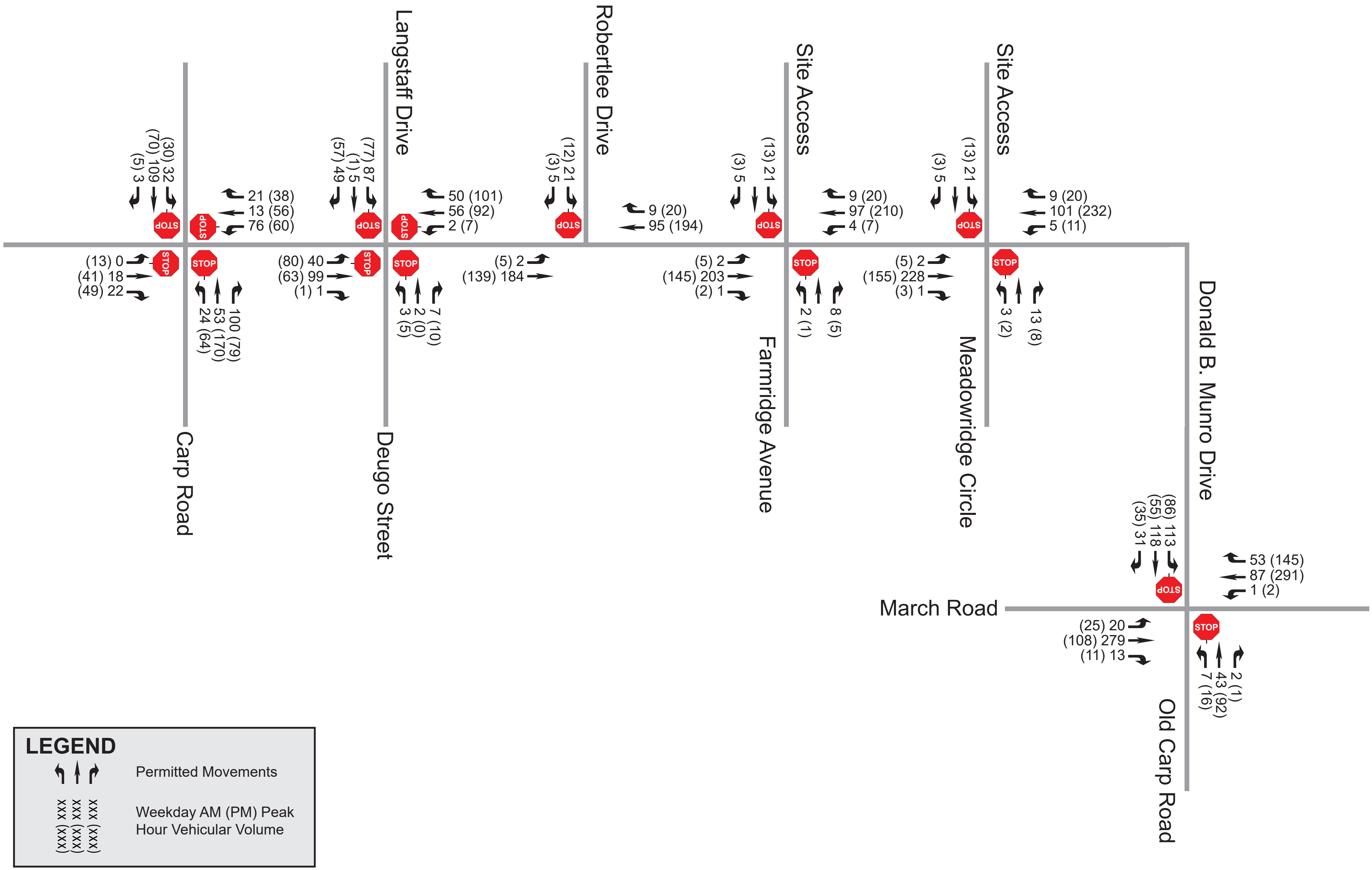
232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 7:
Future (2029)
Background Traffic

PROJECT No. 131947

SCALE: N.T.S.



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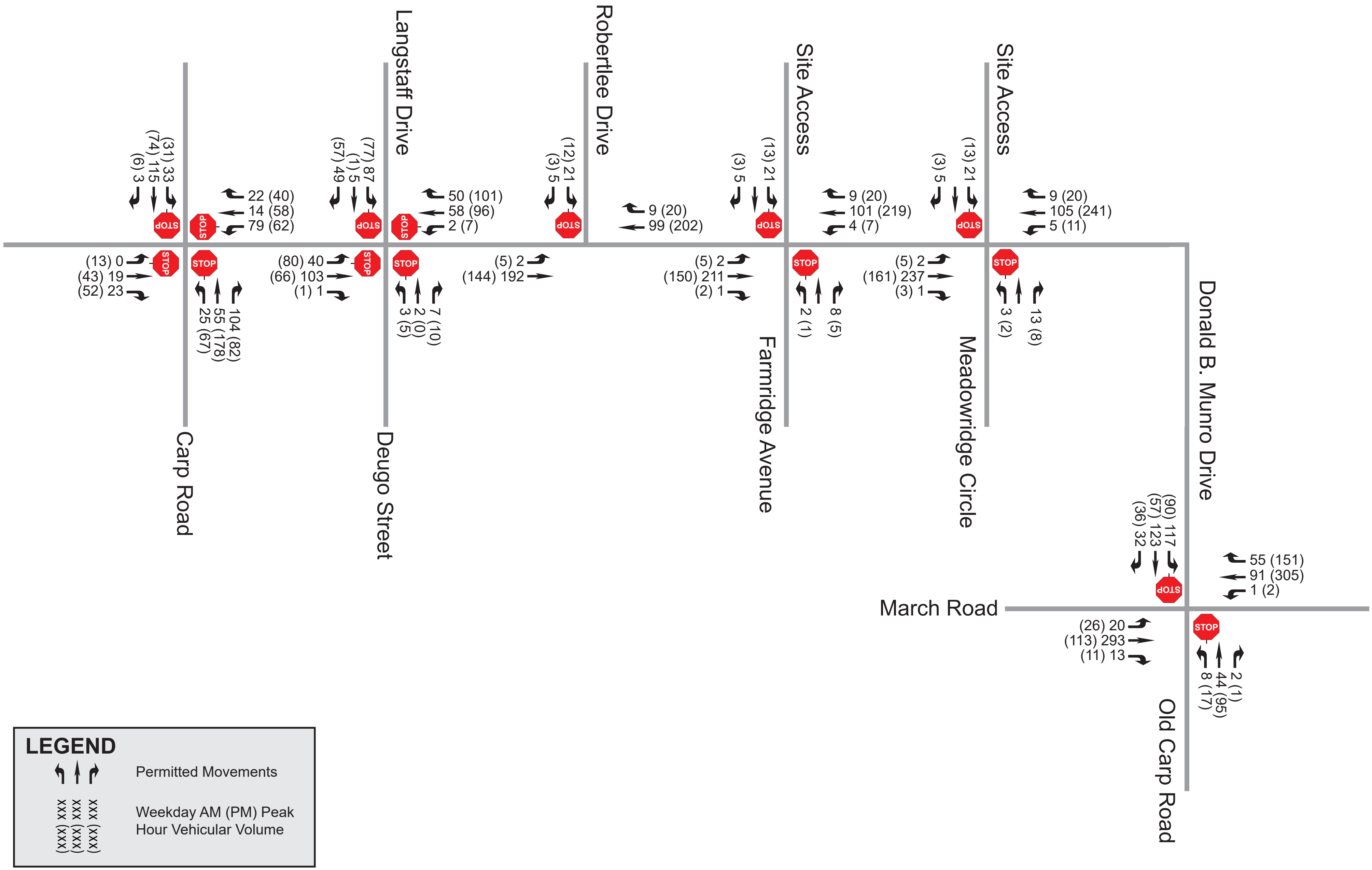
232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 8:
Future (2024)
Total Traffic

PROJECT No. 131947

SCALE: N.T.S.



232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 9:
Future (2029)
Total Traffic

PROJECT No. 131947

SCALE: N.T.S.

5 Analysis

5.1 Development Design

5.1.1 Design for Sustainable Modes

The City of Ottawa transit coverage target is for 95% of units to be within 5-minute (400m) walking distance of transit. Currently, the nearest bus stop to the proposed development is located at the intersection of Donald B. Munro Drive & Robertlee Drive. Approximately 35 dwellings are within 400m walking distance from this stop, representing 30% of dwellings within the proposed development. As such, an additional transit stop at the corner of Donald B. Munro Drive & Farmridge Avenue / Street 2 will be required to increase transit coverage to 95%. In addition to this, providing weekday peak direction service would help reduce automobile demand during the peak commuter periods and should be considered by the City, if warranted based on passenger demand for the community as a whole.

Within the proposed development, concrete sidewalks are proposed along the south side of Street 1 and the east side of Street 2. Land along the west side of the site has also been set aside for a future pathway, consistent with the Carp CDP. The internal road network has been designed using a modified grid pattern with short curvilinear block lengths to provide permeability for active transportation modes while encouraging slower vehicular speeds. The proposed mobility plan for the subject site is illustrated in **Exhibit 10** below.

The TDM-Supportive Development Design and Infrastructure Checklist is only applicable to multi-family or residential condominium developments and as such was not completed for this development.

5.1.2 Circulation and Access

Not Applicable: The Circulation and Access element is exempt from this TIA, as defined in the study scope. This element is not required for Draft Plan of Subdivision applications.

5.1.3 New Street Networks

The road network within the proposed development is organized in a modified grid pattern with relatively short road segments to create a more porous, walkable community in accordance with the Building Better and Smarter Suburbs framework. The overall road network design will promote driver behaviour that is consistent with the roadway classifications. **Table 9** summarizes the designation and right-of-way for each new roadway within the proposed development.

Table 9 - Proposed Roadways

ROADWAY	DESIGNATION	RIGHT-OF-WAY (m)
Street 1	Local	18.0
Street 2	Local	18.0
Street 3	Local	18.0

In accordance with the City's 30km/h Design Guidelines for Local Residential Streets, specific design elements such as bulb-outs, speed humps, chicanes and reduced curb radii will be considered within the site's internal road network following Draft Approval and prior to Registration of the subdivision lands.

A conceptual traffic calming plan for the proposed development is provided in **Exhibit 11** below.

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232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 10:
Proposed Mobility Plan

PROJECT No. 131947

SCALE: 10m 0m 20m

IBI

232 Donald B. Munro Drive
Transportation Impact Assessment

Exhibit 11:
Proposed Traffic
Calming Plan

PROJECT No. 131947

SCALE: 10m 0m 20m

5.2 Parking

Not Applicable: The Parking Supply and Spillover Parking elements are exempt from this TIA, as previously defined in the Scoping section. These elements are not required for a Draft Plan of Subdivision application.

5.3 Boundary Streets

The proposed development is accessed via two access intersections on Donald B. Munro Drive. Segment-based Multi-Modal Level of Service (MMLOS) analysis has been completed for this roadway.

5.3.1 Mobility

The MMLOS targets for each road vary based on a variety of factors such as the Official Plan designation/ policy area, as well as road classification, cycling network and transit network classification and whether the road is on a truck route.

Segment-based MMLOS results for the segment of Donald B. Munro Drive adjacent to the proposed development are provided in **Table 10** below.

Details of the MMLOS analysis are provided in **Appendix G**.

Table 10 - Segment MMLOS

LOCATION	LEVEL OF SERVICE BY MODE			
	PEDESTRIAN (PLOS)	BICYCLE (BLOS)	TRANSIT (TLOS)	TRUCK (TkLOS)
SEGMENTS				
Donald B. Munro Drive	**F** (Target: C)	**F** (Target: B)	D (Target: N/A)	B (Target: N/A)

The results of the segment-based MMLOS presented above indicate that Donald B. Munro Drive is not currently meeting its PLOS or BLOS targets.

In order to achieve these targets, the following modifications have been identified that could improve conditions for each mode:

- **Pedestrian Level of Service (PLOS):** Analysis indicates that providing a 2-metre wide sidewalk on the north side of the roadway similar to what is provided on the south side, as well as reducing the speed limit to 50 km/h or lower along the frontage of the site, would be sufficient in order to meet the PLOS target of 'C'. Without speed limit reductions, both sides of Donald B. Munro Drive would require 2-metre wide sidewalks with minimum 0.5-metre wide boulevards.
- **Bicycle Level of Service (BLOS):** The BLOS target of 'B' could be achieved be either providing bike lanes and reducing operating speeds to less than 50 km/h or by providing a physically separated cycling facility (e.g. cycle track). It should be noted, however, that Donald B. Munro Drive is considered a Local Cycling Route with only 8 metres of curb-to-curb width and a 20-metre right-of-way and therefore neither bike lanes nor cycle tracks are feasible.

It should be noted that these deficiencies in the segment-based MMLOS along the boundary streets represent existing conditions and are not expected to be exacerbated by the proposed development. To improve both pedestrian and bicycle LOS, it is recommended that the City relocate the speed transition zone further from Farmridge Avenue/Street 2 to east of Meadowridge

Circle/Street 1, particularly in recognition of the increased urbanization of this segment of Donald B. Munro Drive, and implement a pedestrian sidewalk along the north side of the road per the CDP.

5.3.2 Road Safety

A summary of all reported collisions within the study period over the past five years was presented in Section 3.2.4. The City requires a safety review if at least six collisions for any one movement or of a discernible pattern have occurred over the study period. Based on this criterion, the March Road & Donald B. Munro Drive / Old Carp Road intersection warrants further analysis.

Collision records for this intersection identified that one rear end collision and seven angle collisions occurred between January 2015 and December 2019. The angle collisions typically were the result of a northbound or southbound through vehicle failing to yield the right-of-way to an eastbound or westbound vehicle. This may be an indication of sightline deficiencies or long delays on the northbound and southbound approach resulting in driver impatience and greater risk taking.

A desktop review of the sightlines from the north and south approach indicate that sightlines towards the east may be slightly restricted by a vertical curve. There is approximately 275m of sight distance available towards the east which, based on the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads, is sufficient for a design speed of up to 130 km/h. As the speed limit on March Road is only 70 km/h, the sightlines are more than adequate.

Based on the intersection capacity analysis, the average delay on the northbound and southbound approaches under Existing (2021) Traffic conditions ranges from 13.2 seconds to 17.0 seconds and therefore operates at LOS ‘B’ or ‘C’. As such, average delays on these approaches are relatively short and are therefore unlikely to be contributing to the collision pattern observed.

Based on the collision records, the majority of angle collisions occurred during the weekday afternoon peak period. One occurred under nighttime conditions, two occurred under dusk conditions and three occurred under adverse weather conditions (rain/snow). During the sunset, sun glare may impact visibility for northbound vehicles which may be contributing to collisions at this location.

It should be emphasized that while the above collision pattern may be considered noteworthy, it is likely not significant given the variation in contributing factors identified (i.e. there was no significant reoccurring set of contributing factors). Furthermore, as stated in Section 3.2.4, a collision rate of 0.75 collisions per MEV is not considered significant. It is recommended that the City give consideration to mitigation measures, as justified.

5.4 Access Intersections

5.4.1 Location and Design of Access

The proposed development will provide direct access to the arterial road network at these locations:

- **Donald B. Munro Drive & Farmridge Avenue/Street 2** – This intersection is currently a three-legged, unsignalized intersection with stop-control on the northbound approach. A new stop-controlled leg is proposed to provide access to the proposed development. Due to the physical constraints of the site, Street 2 cannot be aligned at 90-degrees from Donald B. Munro Drive without being offset from Farmridge Avenue. From a safety perspective, aligning Street 2 at 90-degrees from Donald B. Munro Drive is more important than aligning Street 2 with Farmridge Avenue, especially given the low traffic volumes

projected along both roadways. As such, there will be an offset between Street 2 and Farmridge Avenue in order to align Street 2 at 90-degrees from Donald B. Munro Drive.

- **Donald B. Munro Drive & Meadowridge Circle/Street 1** – This intersection is also currently a three-legged, unsignalized intersection with stop-control on the northbound approach. A new stop-controlled leg is also proposed at this location to provide access to the proposed development. Street 1 has been designed to align with the existing Meadowridge Circle and intersect Donald B. Munro Drive at a 90-degree angle.

5.4.2 Intersection Control

5.4.2.1 Traffic Signal Warrants

Based on the projected traffic volumes presented in this study, neither of the site access intersections warrant traffic signals under Future (2029) Total Traffic conditions.

The results of the traffic signal warrants are provided in **Appendix H**.

5.4.2.2 Roundabout Analysis

As per the City's Roundabout Implementation Policy, intersections that satisfy any of the following criteria should be screened utilizing the Roundabout Initial Feasibility Screening Tool:

- At any new City intersection
- Where traffic signals are warranted
- At intersections where capacity or safety problems are being experienced

Both site accesses are new legs to existing intersections and therefore do not qualify as a new City intersection. As discussed in Sections 5.4.2.1 and 5.9.3, these intersections do not warrant signalization nor are anticipated to experience capacity or safety issues. As such, the Roundabout Initial Feasibility Screening Tool was not completed for these intersections.

5.4.3 Intersection Design (MMLOS)

There is currently no methodology for evaluating Multi-Modal Level of Service (MMLOS) at unsignalized intersections. Neither of the site access intersections are expected to require traffic signals, therefore MMLOS analysis is not provided for either location.

5.5 Transportation Demand Management (TDM)

The City of Ottawa is committed to implementing Transportation Demand Management (TDM) measures on a City-wide basis in an effort to reduce automobile dependence, particularly during the weekday peak travel periods.

5.5.1 Context for TDM

As described in the Forecasting section of this report, the mode share targets used to estimate future development traffic were based on the blended mode shares from the 2020 TRANS Trip Generation Manual for the Rural West Traffic Assessment Zone (TAZ).

The proposed development aligns with the objectives of the Building Better and Smarter Suburbs (BBSS) policy document, which promotes sustainable and compact growth. Approximately 51% of dwelling units are either semi-detached homes or street townhomes, an appropriate level of density given the rural village context of this development. It should be noted that this development is not located within close proximity to a Transit-Oriented Development (TOD) zone and is not within the Carp Village Core Design Priority Area (DPA).

5.5.2 Need and Opportunity

To promote sustainable transportation for local trips, sidewalks and appropriate pedestrian connections will be provided throughout the subdivision to facilitate access to local amenities, recreational pathways and the adjacent road network.

Existing transit service is very limited within the vicinity of the proposed development and as such it is anticipated that the transit mode share will be negligible. Despite the low transit use anticipated, consideration should be given to providing an additional transit stop at the corner of Donald B. Munro Drive & Farmridge Avenue / Street 2 in order to ensure adequate transit access to the proposed development. Consideration should also be given to providing weekday peak direction service as it would help reduce automobile demand during the peak commuter periods.

It is expected that given the context of the proposed development that the primary mode of transportation will be private automobile until such time as transit service becomes more regular. The lack of access to alternative modes of transportation presents a barrier to reducing automobile dependence for the site, particularly during the weekday commuter peak periods.

5.5.3 TDM Program

The proposed development conforms to the City's TDM principles by providing convenient and direct connections to adjacent pedestrian, cycling and transit facilities where available.

The City of Ottawa's TDM Measures Checklist was completed for the proposed development and is provided in **Appendix I**. A Multi-Modal Information Package will provided to new homeowners and will include information about how to get around the area by modes other than private automobile. This package may include information about local walking trails, available bicycle infrastructure, nearby services or amenities, nearby bus stops/routes/schedules, schools, local taxi companies, etc. The intent of this package is to provide new residents with options to get around their new community without reliance on a private automobile for at least some of their daily needs.

5.6 Neighbourhood Traffic Management

5.6.1 Adjacent Neighbourhoods

The proposed development is dependent on Donald B. Munro Drive, a collector road, for access. Based on the TIA Guidelines, collector roads have a maximum threshold of 300 vehicles per hour during the peak hour. Volumes in excess of this threshold may impact resident comfort but do not necessarily indicate that the roadway cannot accommodate this level of traffic.

Based on the Existing (2021) Traffic volumes, Donald B. Munro Drive is already at its maximum threshold and is anticipated to exceed the maximum threshold with the addition of site-generated and adjacent development traffic. It should be noted that west of Langstaff Drive / Deugo Street, traffic on Donald B. Munro Drive is expected to remain below or near the maximum threshold under Future (2029) Total Traffic. As such, the high volumes will only impact a small number of residences on Donald B. Munro Drive.

As Donald B. Munro Drive is the only roadway from which the development can access the arterial road network it is not possible to reduce the neighbourhood traffic impact of the proposed development. The impact of the proposed development is minimized as much as possible by orienting all new residential units towards local roads, thereby reducing the number of residences impacted by high traffic volumes on Donald B. Munro Drive.

5.7 Transit

5.7.1 Route Capacity

Given the limited transit service available in the vicinity of the proposed development, it is anticipated that the proposed development will generate a negligible number of transit trips. As such, the impact on the existing transit route is expected to be minimal.

5.7.2 Transit Priority Measures

The negligible increase in transit ridership associated with the proposed development is not expected to trigger the need for any isolated transit priority measures to offset any transit delays.

5.8 Review of Network Concept

Not Applicable: The Network Concept elements are exempt from this TIA, as previously defined in the Scoping section. These elements are not required for developments that generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by established zoning.

5.9 Intersection Design

The following sections summarize the methodology and results of the Multi-Modal Level of Service (MMLOS) analysis conducted within the study area.

5.9.1 Intersection Control

The results of the intersection control warrants discussed below are provided in **Appendix H**.

5.9.1.1 Traffic Signal Warrants

Traffic signal warrants for site access intersections were discussed previously in Section 5.4.2. Traffic signal warrant analysis was completed for the remaining study area intersections. The results of the analysis found that traffic signals are warranted at the March Road & Donald B. Munro Drive / Old Carp Road intersection under Future (2029) Total Traffic conditions. None of the other study area intersections warranted traffic signals.

Sensitivity analysis indicates that a 1.2% increase to eastbound and westbound traffic on March Road under Future (2029) Background Traffic conditions is sufficient to warrant signalization. This indicates that the need for traffic signals is primarily driven by background traffic volumes rather than site-generated traffic.

Although traffic signals are warranted based on projected traffic volumes, the intersection capacity analysis indicates that the intersection will operate at an acceptable Level of Service (i.e. LOS ‘D’ or better) under its existing configuration. As such, signalization of the intersection is not recommended. Given the collision history noted previously, an overhead flashing beacon could be considered by the City (if warranted based on collision frequency) to address the recurring collisions as no apparent cause has been identified through an analysis of the records.

5.9.1.2 Roundabout Analysis

Roundabout analysis for site access intersections was discussed previously in Section 5.4. Given that the March Road & Donald B. Munro Drive / Old Carp Road intersection meets two of the criteria for roundabout screening (i.e. traffic signals are warranted and there is a documented safety issue at this location), the Roundabout Initial Feasibility Screening Tool has been completed

for this intersection. None of the other study area intersections meet the criteria requirements for roundabout screening.

The results of the roundabout screening indicate that a roundabout should be considered at the March Road & Donald B. Munro Drive / Old Carp Road intersection due to the high frequency of historical collisions and because it warrants signalization under Future (2029) Total Traffic conditions. As such, roundabout capacity analysis has been conducted for this location under Future (2029) Total Traffic conditions to inform the City on the resulting impacts on vehicular delay.

5.9.2 Intersection Analysis Criteria (Automobile)

The following section outlines the City of Ottawa's methodology for determining motor vehicle Level of Service (LOS) at signalized and unsignalized intersections.

5.9.2.1 Signalized Intersections

In qualitative terms, the Level of Service (LOS) defines operational conditions within a traffic stream and their perception by motorists. A LOS definition generally describes these conditions in terms of such factors as delay, speed and travel time, freedom to manoeuvre, traffic interruptions, safety, comfort and convenience. LOS can also be related to the ratio of the volume to capacity (v/c) which is simply the relationship of the traffic volume (either measured or forecast) to the capability of the intersection or road section to accommodate a given traffic volume. This capability varies depending on the factors described above. LOS are given letter designations from 'A' to 'F'. LOS 'A' represents the best operating conditions and LOS 'E' represents the level at which the intersection or an approach to the intersection is carrying the maximum traffic volume that can, practicably, be accommodated. LOS 'F' indicates that the intersection is operating beyond its theoretical capacity.

The City of Ottawa has developed criteria as part of the Transportation Impact Assessment Guidelines, which directly relate the volume to capacity (v/c) ratio of a signalized intersection to a LOS designation. These criteria are presented in **Table 11** below:

Table 11 - LOS Criteria for Signalized Intersections

LOS	VOLUME TO CAPACITY RATIO (v/c)
A	0 to 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.91 to 1.00
F	> 1.00

The intersection capacity analysis technique provides an indication of the LOS for each movement at the intersection under consideration and for the intersection as a whole. The overall v/c ratio for an intersection is defined as the sum of equivalent volumes for all critical movements at the intersection divided by the sum of capacities for all critical movements.

The Level of Service calculation is based on locally-specific parameters as described in the TIA Guidelines and incorporates existing signal timing plans obtained from the City of Ottawa. The analysis existing conditions utilized a Peak Hour Factor (PHF) of 0.90, while future conditions

considers optimized signal timing plans and use of a Peak Hour Factor (PHF) of 1.0 to recognize peak spreading beyond a 15-minute period in congested conditions.

5.9.2.2 Unsignalized Intersections

The capacity of an unsignalized intersection can also be expressed in terms of the LOS it provides. For an unsignalized intersection, the Level of Service is defined in terms of the average movement delays at the intersection. This is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line; this includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. The average delay for any particular minor movement at the un-signalized intersection is a function of the capacity of the approach and the degree of saturation.

The Highway Capacity Manual 2010 (HCM), prepared by the Transportation Research Board, includes the following Levels of Service criteria for un-signalized intersections, related to average movement delays at the intersection, as indicated in **Table 12** below.

Table 12 - LOS Criteria for Unsignalized Intersections

LOS	DELAY (seconds)
A	<10
B	>10 and <15
C	>15 and <25
D	>25 and <35
E	>35 and <50
F	>50

The unsignalized intersection capacity analysis technique included in the HCM and used in the current study provides an indication of the Level of Service for each movement of the intersection under consideration. By this technique, the performance of the unsignalized intersection can be compared under varying traffic scenarios, using the Level of Service concept in a qualitative sense. One unsignalized intersection can be compared with another unsignalized intersection using this concept. Level of Service 'E' represents the capacity of the movement under consideration and generally, in large urban areas, Level of Service 'D' is considered to represent an acceptable operating condition. Level of Service 'E' is considered an acceptable operating condition for planning purposes for intersections located within Ottawa's Urban Core the downtown and its vicinity). Level of Service 'F' indicates that the movement is operating beyond its design capacity.

Roundabout capacity analysis has been carried out using the HCM 2010 methodology.

5.9.3 Intersection Capacity Analysis

Following the established intersection capacity analysis criteria described above, the existing and future conditions are analysed using the weekday peak hour traffic volumes derived in this study.

The subsequent section presents the results of the intersection capacity analysis. All tables summarize study area intersection LOS results during the weekday morning and afternoon peak hour periods.

The intersection capacity analysis reports have been provided in **Appendix J**.

5.9.3.1 Existing Traffic

An intersection capacity analysis has been undertaken using the Existing (2021) Traffic volumes presented previously in **Exhibit 3**.

The results of the intersection capacity analysis are summarized in **Table 13** below.

Table 13 - Intersection Capacity Analysis: Existing (2021) Traffic

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Carp Road & Donald B. Munro Drive	Unsignalized	A (8.7s)	SBTRL (8.7s)	B (10.6s)	NBTRL (10.6s)
Donald B. Munro Drive & Deugo Street / Langstaff Drive	Unsignalized	A (8.2s)	EBTRL (8.2s)	A (8.3s)	EBTRL (8.3s)
Donald B. Munro Drive & Robertlee Drive	Unsignalized	A (9.9s)	SBRL (9.9s)	B (10.1s)	SBRL (10.1s)
Donald B. Munro Drive & Farmridge Avenue / Street 2	Unsignalized	A (9.5s)	NBTRL (9.5s)	A (9.2s)	NBTRL (9.2s)
Donald B. Munro Drive & Meadowridge Circle / Street 1	Unsignalized	A (9.6s)	NBTRL (9.6s)	A (9.4s)	NBTRL (9.4s)
March Road & Old Carp Road / Donald B. Munro Drive	Unsignalized	C (17.0s)	SBTRL (17.0s)	C (15.6s)	SBTRL (15.6s)

The results of the analysis indicate that the study area intersections above are operating at acceptable Levels of Service (i.e. LOS ‘D’ or better) under existing traffic conditions during both the weekday morning and afternoon peak hours.

5.9.3.2 Future (2024) Background Traffic

An intersection capacity analysis has been undertaken using the Future (2024) Background Traffic volumes presented previously in **Exhibit 6**.

The results of the intersection capacity analysis are summarized in **Table 14** below.

Table 14 - Intersection Capacity Analysis: Future (2024) Background Traffic

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Carp Road & Donald B. Munro Drive	Unsignalized	A (8.6s)	WBTRL (8.6s)	B (10.4s)	NBTRL (10.4s)
Donald B. Munro Drive & Deugo Street / Langstaff Drive	Unsignalized	A (8.3s)	EBTRL (8.3s)	A (8.5s)	EBTRL (8.5s)
Donald B. Munro Drive & Robertlee Drive	Unsignalized	A (9.9s)	SBRL (9.9s)	B (10.3s)	SBRL (10.3s)
Donald B. Munro Drive & Farmridge Avenue / Street 2	Unsignalized	A (9.6s)	NBTRL (9.6s)	A (9.3s)	NBTRL (9.3s)
Donald B. Munro Drive & Meadowridge Circle / Street 1	Unsignalized	A (9.6s)	NBTRL (9.6s)	A (9.5s)	NBTRL (9.5s)
March Road & Old Carp Road / Donald B. Munro Drive	Unsignalized	C (16.5s)	SBTRL (16.5s)	C (15.4s)	SBTRL (15.4s)

The results of the intersection capacity analysis presented in above indicate that the study area intersections are operating at acceptable Levels of Service (i.e. LOS ‘D’ or better) under Future (2024) Background Traffic conditions during both the weekday morning and afternoon peak hours. Overall, delays are expected to improve slightly relative to Existing (2021) Traffic conditions due to the effects of peak spreading (i.e. peak hour factor of 1.0 vs 0.9).

5.9.3.3 Future (2029) Background Traffic

An intersection capacity analysis has been undertaken using the Future (2029) Background Traffic volumes presented previously in Exhibit 7.

The results of the intersection capacity analysis are summarized in **Table 15** below.

Table 15 - Intersection Capacity Analysis: Future (2029) Background Traffic

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Carp Road & Donald B. Munro Drive	Unsignalized	A (8.7s)	WBTRL (8.7s)	B (10.8s)	NBTRL (10.8s)
Donald B. Munro Drive & Deugo Street / Langstaff Drive	Unsignalized	A (8.3s)	EBTRL (8.3s)	A (8.5s)	EBTRL (8.5s)
Donald B. Munro Drive & Robertlee Drive	Unsignalized	A (10.0s)	SBRL (10.0s)	B (10.4s)	SBRL (10.4s)
Donald B. Munro Drive & Farmridge Avenue / Street 2	Unsignalized	A (9.6s)	NBTRL (9.6s)	A (9.4s)	NBTRL (9.4s)
Donald B. Munro Drive & Meadowridge Circle / Street 1	Unsignalized	A (9.7s)	NBTRL (9.7s)	A (9.5s)	NBTRL (9.5s)
March Road & Old Carp Road / Donald B. Munro Drive	Unsignalized	C (17.4s)	SBTRL (17.4s)	C (16.2s)	SBTRL (16.2s)

The results of the intersection capacity analysis presented above indicate that the study area intersections are expected to operate at acceptable levels of service (i.e. LOS 'D' or better) under Future (2029) Background Traffic conditions.

5.9.3.4 Future (2024) Total Traffic

An intersection capacity analysis has been undertaken using the Future (2024) Total Traffic volumes presented previously in Exhibit 8.

The results of the intersection capacity analysis are summarized in **Table 16** below.

Table 16 - Intersection Capacity Analysis: Future (2024) Total Traffic

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Carp Road & Donald B. Munro Drive	Unsignalized	A (8.7s)	WBTRL (8.7s)	B (10.6s)	NBTRL (10.6s)
Donald B. Munro Drive & Deugo Street / Langstaff Drive	Unsignalized	A (8.3s)	EBTRL (8.3s)	A (8.6s)	EBTRL (8.6s)
Donald B. Munro Drive & Robertlee Drive	Unsignalized	A (10.0s)	SBRL (10.0s)	B (10.4s)	SBRL (10.4s)
Donald B. Munro Drive & Farmridge Avenue / Street 2	Unsignalized	B (10.6s)	SBTRL (10.6s)	B (11.2s)	SBTRL (11.2s)
Donald B. Munro Drive & Meadowridge Circle / Street 1	Unsignalized	B (10.9s)	SBTRL (10.9s)	B (11.6s)	SBTRL (11.6s)
March Road & Old Carp Road / Donald B. Munro Drive	Unsignalized	C (18.3s)	SBTRL (18.3s)	C (17.2s)	SBTRL (17.2s)

Based on the intersection capacity analysis shown above, all study area intersections are expected to operate at acceptable levels of service (i.e. LOS 'D' or better) under Future (2024) Total Traffic conditions.

5.9.3.5 Future (2029) Total Traffic

An intersection capacity analysis has been undertaken using the Future (2029) Total Traffic volumes presented previously in Exhibit 9.

The results of the intersection capacity analysis are summarized in **Table 17** below.

Table 17 - Intersection Capacity Analysis: Future (2029) Total Traffic

INTERSECTION	TRAFFIC CONTROL	AM PEAK HOUR		PM PEAK HOUR	
		OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)	OVERALL LOS (V/C OR DELAY)	CRITICAL MOVEMENTS (V/C OR DELAY)
Carp Road & Donald B. Munro Drive	Unsignalized	A (8.8s)	WBTRL (8.8s)	B (10.9s)	NBTRL (10.9s)
Donald B. Munro Drive & Deugo Street / Langstaff Drive	Unsignalized	A (8.4s)	EBTRL (8.4s)	A (8.6s)	EBTRL (8.6s)
Donald B. Munro Drive & Robertlee Drive	Unsignalized	B (10.1s)	SBRL (10.1s)	B (10.5s)	SBRL (10.5s)
Donald B. Munro Drive & Farmridge Avenue / Street 2	Unsignalized	B (10.7s)	SBTRL (10.7s)	B (11.3s)	SBTRL (11.3s)
Donald B. Munro Drive & Meadowridge Circle / Street 1	Unsignalized	B (11.0s)	SBTRL (11.0s)	B (11.8s)	SBTRL (11.8s)
March Road & Old Carp Road / Donald B. Munro Drive	Unsignalized	C (19.6s)	SBTRL (19.6s)	C (18.3s)	SBTRL (18.3s)
	Roundabout	A (9.8s)	EBTRL (9.8s)	B (10.6s)	WBTRL (10.6s)

Based on the intersection capacity analysis shown above, all study area intersections are anticipated to operate at acceptable levels of service (i.e. LOS 'D' or better) under Future (2029) Total Traffic conditions under their existing configuration.

Conversion of the March Road & Old Carp Road / Donald B. Munro Drive intersection to a single-lane roundabout is shown to improve the Level of Service at the intersection to LOS 'A' or 'B'. It should be noted, however, that the intersection is also expected to operate at an acceptable Level of Service under its existing configuration.

Converting the intersection to a roundabout would reduce operating speeds on March Road which may help address the safety issues at the intersection. Implementing a flashing beacon at the intersection, however, may be an easier mitigation measure that could be considered by the City and, if it is not effective, the City could then give consider implementing a roundabout. It should

be noted that these measures are intended to address an existing safety issue and are not required as a direct consequence of this development.

5.9.4 Intersection Design (MMLOS)

There is currently no methodology for evaluating Multi-Modal Level of Service (MMLOS) at unsignalized intersections. None of the study area intersections are anticipated to be signalized in the future, therefore MMLOS analysis has not completed for any of these intersections.

5.10 Geometric Review

The following section provides a review of all geometric requirements for the study area intersections.

5.10.1 Sight Distance

Between the two site access intersections is a horizontal curve which may restrict sightlines for vehicles exiting the site. Assuming a design speed of 70 km/h (posted speed limit plus 10 km/h), a minimum sight distance of 185m is required for a single-unit truck to safely complete a left-turn movement. Based on a desktop analysis of the proposed site accesses, the minimum sight distance requirement of 185m is met in both directions.

5.10.2 Auxiliary Lane Analysis

Auxiliary turning lane requirements for all intersections within the study area are described as below. The minimum storage requirements do not include deceleration or taper.

5.10.2.1 Auxiliary Left-Turn Lane Requirements (Unsignalized Intersections)

Left-turn lane warrants were completed under Future (2029) Total Traffic conditions for all study area intersections, with the exception of the two all-way stop-controlled intersections. The design speed for each intersection were assumed as follows, representing 10 km/h above the posted speed limits:

- Donald B. Munro Drive & Robertlee Drive: 50 km/h
- Donald B. Munro Drive & Farmridge Avenue/Street 2: 70 km/h
- Donald B. Munro Drive & Meadowridge Circle/Street 1: 70 km/h
- March Road & Donald B. Munro Drive/Old Carp Road: 80 km/h

The results of the left-turn lane warrant analyses indicate that none of the study area intersections warrant an auxiliary left-turn lane. Relevant extracts from the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads have been provided in **Appendix K**.

5.10.2.2 Auxiliary Right-Turn Lane Requirements (Unsignalized Intersections)

The Transportation Association of Canada (TAC) suggests that auxiliary right-turn lanes be considered “when the volume of decelerating or accelerating vehicles compared with through vehicles causes undue hazard.” Consideration for auxiliary right-turn lanes is typically given when the right-turning traffic exceeds 10% of the approach volume and is at least 60 vehicles per hour, particularly on high-speed arterial roads.

Future (2029) Total Traffic volumes were reviewed for all study area intersections, with the exception of the two all-way stop-controlled intersection. **Table 18** summarizes the results of the right-turn warrant analysis.

Table 18 - Right-Turn Warrant Results

INTERSECTION	MOVEMENT	VOLUME (AM/PM)	% RIGHT-TURNS (AM/PM)	RIGHT-TURN WARRANTED?
Donald B. Munro Drive & Robertlee Drive	WBR	9 / 20	8% / 9%	-
Donald B. Munro Drive & Farmridge Avenue/Street 2	EBR	1 / 2	0% / 1%	-
	WBR	10 / 21	8% / 9%	-
Donald B. Munro Drive & Meadowridge Circle/Street 1	EBR	1 / 3	1% / 2%	-
	WBR	10 / 21	8% / 8%	-
March Road & Donald B. Munro Drive/Old Carp Road	EBR	13 / 11	4% / 7%	-
	WBR	56 / 152	0% / 33%	Yes

As the above results indicate, only the westbound right-turn movement at the March Road & Donald B. Munro Drive / Old Carp Road warrants a right-turn lane. This movement already has channelized auxiliary right-turn lane with 160m of storage. The intersection capacity analysis indicates that no queuing is anticipated in this lane therefore the existing storage capacity is adequate to accommodate the demands of the proposed development.

5.11 Summary of Recommended Improvements

The historical collision analysis identified a notable frequency of angle collisions at the March Road & Donald B. Munro Drive / Old Carp Road intersection. It is recommended that the City review the historical collision records at this intersection and consider mitigation measures, such as the installation of an overhead flashing beacon, if justified. A signal warrants analysis indicates that a traffic signal would be warranted at this location despite the intersection capacity analysis results projecting an acceptable Level of Service at the horizon year of this study under the existing configuration. A single-lane roundabout was also analysed and would provide improvements to sidestreet delay while potentially mitigating the historical safety concerns at this location by calming traffic along March Road. A roundabout configuration should therefore be considered by the City as a secondary mitigation measure if collision patterns persist.

It should be noted that this recommendation is provided to address an existing safety concern and is not a consequence of the proposed development.

Within the vicinity of the proposed development, it is recommended that the City implement concrete sidewalks along the north side of Donald B. Munro Drive from 50 metre east of Langstaff Drive to at least Street 2/Farmridge Avenue, per the recommendations of the Community Design Plan, to establish pedestrian connectivity to the existing community. It is also recommended that the City relocate the existing speed transition zone to east of Street 1/Meadowridge Circle in recognition of the expansion to the urbanized area along this roadway.

6 Conclusion

The proposed 232 Donald B. Munro Drive development is expected to generate up to 97 and 104 two-way person-trips during the weekday morning and afternoon peak hours, respectively. These person-trips were assigned mode share targets and trip distributions, consistent with the Kanata/ Stittsville Traffic Assessment Zone (TAZ) in the 2020 TRANS Trip Generation Manual and the 2011 O-D Survey. The resulting two-way vehicular trip generation is, therefore, 73 and 80 vehicles during the weekday morning and afternoon peak hours, respectively. Site-generated traffic will access the adjacent roadway network via two access intersections on Donald B. Munro Drive.

As indicated by the analysis conducted for this study, all study area intersections are expected to operate at an acceptable level of service (i.e. LOS 'D' or better) during weekday peak hours within the timeframe of this study. It was identified that there may be a collision trend at the March Road & Donald B. Munro Drive / Old Carp Road intersection with no apparent cause or pattern. It is recommended that the City give consideration to the implementation of an overhead flashing beacon at this location to address this safety issue.

Multi-Modal Level of Service analysis was conducted for the segment of Donald B. Munro Drive adjacent to the proposed development and potential remediation measures have been suggested which the City could consider in order to meet the prescribed targets such as:

- Either reducing the speed limit to 50 km/h or less along the site frontage and providing a 2-metre wide sidewalk on the north side of Donald B. Munro Drive, or providing 2-metre wide sidewalks on both sides of the roadway with minimum 0.5-metre wide boulevards; and
- Either reducing operating speeds on Donald B. Munro Drive to 50 km/h or less and providing on-street bike lanes, or providing cycle tracks.

Bicycle facilities on Donald B. Munro Drive were found to be unfeasible due to limited right-of-way and pavement width. As such, relocating the existing speed transition zone from Farmridge Avenue to east of Street 1/Meadowridge Circle is recommended due to the increased urbanization of this area and to address the poor bicycle and pedestrian Level of Service along the site frontage. It is also recommended that the City implement concrete sidewalks along the north side of Donald B. Munro Drive from 50 metre east of Langstaff Drive to at least Street 2/Farmridge Avenue, per the recommendations of the Community Design Plan, to establish pedestrian connectivity to the existing community. Within the proposed development, concrete sidewalks will be provided along one side of Street 1 and Street 2 and land has been set aside along the western boundary of the site to provision for a future pathway, consistent with the Carp CDP.

Although there is very limited transit service in the vicinity of the proposed development, it is recommended that OC Transpo consider providing addition bus stops at the corner of Donald B. Munro Drive & Farmridge Avenue / Street 2 to ensure adequate transit coverage for the proposed development and also consider adding weekday, daily peak direction service.

All intersections were shown to operate well under their theoretical capacities within the timeframe of this study and no operational issues were identified from the queuing analysis. A post-development monitoring plan is therefore not a requirement of this study. Further, the analysis conducted indicated that no off-site intersection improvements are necessary to accommodate the projected travel demands of the proposed development, and as such an RMA will not be required.

Based on the findings of this study, it is the overall opinion of IBI Group that the proposed development will integrate well with and can be safely accommodated by the adjacent transportation network. Consideration should be given by the City of Ottawa of the recommendations provided in order to address the existing issues identified.

Appendix A – City Circulation Comments

File Number PC2020-0332

1 February 2021

Tartan Land Consultants Inc.
Melissa Cote
237 Somerset St. W
Ottawa, ON
K2P 0J3

Dear Ms Cote

Re: 232 Donald B. Munro Drive, Village of Carp Pre-Consultation Results

Date of Meeting December 16, 2020

In attendance and/or provided comments:

Ostafichuk, Jeffrey Jeffrey.Ostafichuk@ottawa.ca
Brown, Adam Adam.Brown@ottawa.ca
Whittaker, Damien Damien.Whittaker@ottawa.ca
Melissa Cote mcote@tartanland.on.ca
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Young, Mark Mark.Young@ottawa.ca
Erica Ogden eogden@mvc.on.ca
Joseph Zagorski Joseph.Zagorski@ottawa.ca

Please find below the results of our meeting with respect to your proposal to develop a “multi residential” dwellings on a private street.

Comments

Jeff Ostafichuk Planning

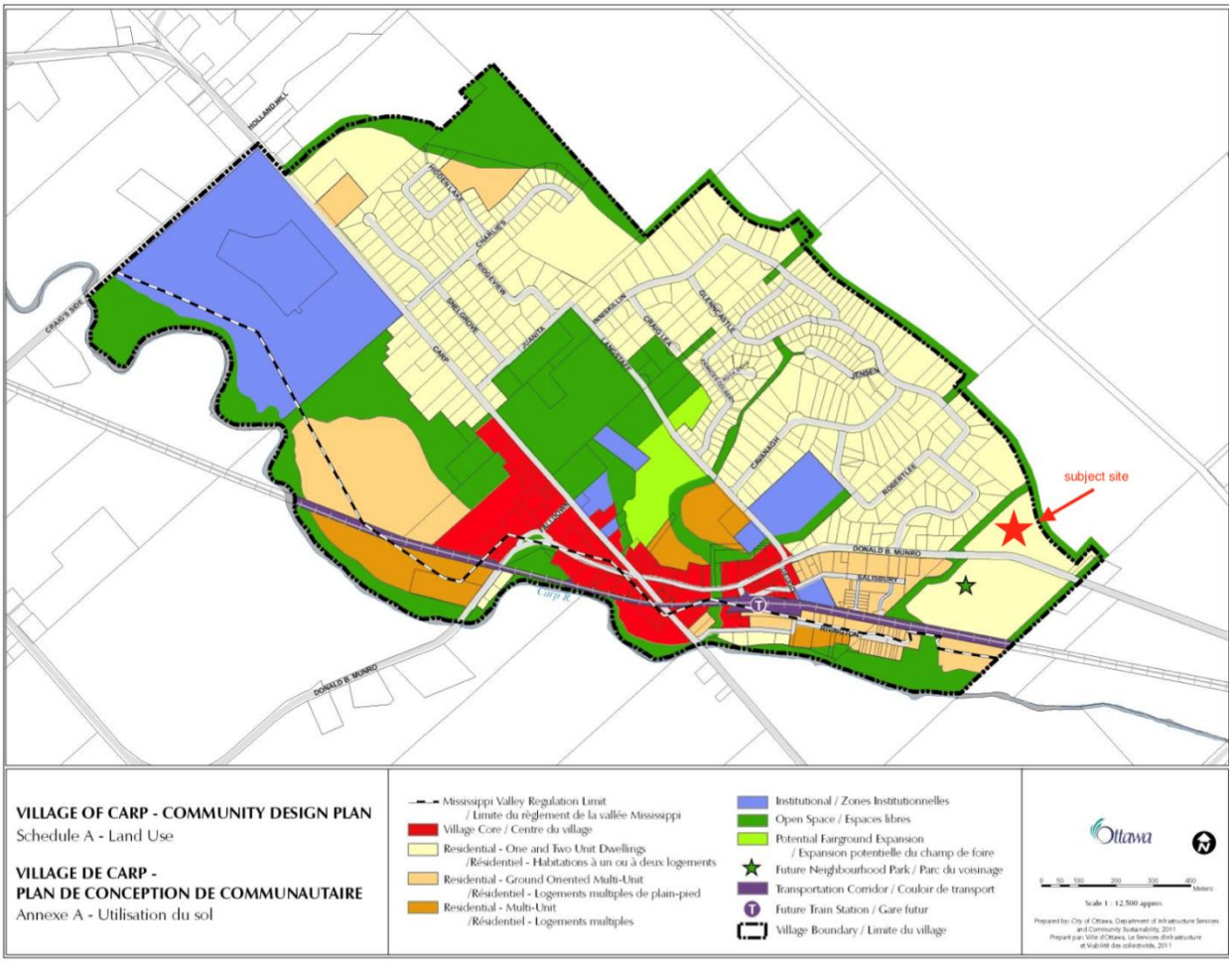
In our discussions you have suggested that you will be filing a plan of subdivision and zoning by-law amendment. Policies that need to be considered as per the Official

Plan and Village of Carp CDP (changing to Secondary Plan through the new Official Plan) are as follows.

Land Use

The proposed plan of subdivision is located in the Village of Carp. The lands front onto the north side of Donald B. Munro, the main northwest/southwest entrance to the Village. The site, approximately 7.2 ha in size, proposes 64 single family lots and 65 townhouse/semi detached units. Access to the site is provided by two intersections to the north side of Donald B. Munro Drive which service the development via an internal loop road system (18 metre right-of -way). The applicant proposes municipal servicing via an extension to the existing local water and sanitary systems.

The subject lands are within the “Village” designation as identified on Schedule ‘A’, Rural Policy Plan of the City Official Plan. Further land uses within the Village of Carp are determined in the context of the Carp CDP (New OP Secondary Plan). The CDP provides guidelines for land use planning, such as subdivision, zoning applications. The CDP sets aside these lands for residential use.



2. Managing Growth

2.3 Environmental Protection

Policies are addressed by:

Sami Rehman, Environmental Planner, Planning
Damien Whittaker, Senior Engineer Infrastructure
Erica Ogden, Environmental Planner, MVCA Mississippi Valley Conservation Authority

2.3.1 The Natural Heritage System

Policies are addressed by:
Sami Rehman, Environmental Planner, Planning
Erica Ogden, Environmental Planner, MVCA Mississippi Valley Conservation Authority

2.3.2 Source Water Protection

Land uses that are determined to constitute a significant threat to municipal drinking water (as defined in the Source Water Protection Act and its regulations) may be restricted. The basis and policy mechanism for restrictions will be in accordance with the Mississippi Rideau Source Water Protection Plan and the Official Plan.

Statement in rationale required.

3. Land Use

3.3.2 Design Guidelines for new Residential Development

Policies

1. To maintain the character of traditional village streets, and ensure the buildings define the streetscape, the building face to building face distance should be in the range of 24 to 25 metres for smaller singles, semi, duplexes, town houses, and not greater that 30 meters for larger singles, or low rise apartments.

2. Zoning and subdivision plans will address the following aspects:

- Residential streets will be 18.0m wide
- The length of the driveway to accommodate cars can be measured from the curb, or back of sidewalk rather than from the ROW, provided pedestrian access is not blocked. The result will be parking within the public ROW
- Building setbacks may be reduced to as low as 3.0 meters from the ROW or 6.0 metres from the sidewalk if it is provided for.
- The front of garages should not extend beyond the front façade of the house, either as attached buildings or separate structures.
- The tree lined village streets will be created through the provision of one tree per lot and two on corner lots as part of subdivision development agreements.

3.3.4 Residential – One and Two Unit Dwellings

The uses permitted in the area designated Residential - One and Two Unit Dwellings on Schedule A will be detached, semi-detached and duplex dwelling units including secondary dwelling units.

The proposed draft plan of subdivision provides for a full range of ground oriented dwelling types including single family, semi detached and townhouse units. It is the introduction of townhouse units (ground oriented multi-unit) that goes beyond the site objectives. Some rationale needs to provided to support multiple units; perhaps a discussion is warranted with the Policy team (contact John Lunney) currently updating the OP team because Carp CDP will be amended to become a Secondary Plan.

3.7 Open Space

Policies are addressed by:
Mark Young, Urban Design Planner
Reid Shepherd, Parks

4.10 Create Prominent Approaches to the Village

Policies are addressed by:
Mark Young, Urban Design Planner

Key initiatives

1. At the four approaches to the Village identified on Figure 2:

    a) Erect a Carp Village sign using common and well-designed graphics and materials at the four main entrances to the village;

    b) Reconfigure the road from a rural cross-section to a village cross-section (by providing sidewalks, landscaping etc.); and

    c) Add specific design elements as visual accents that give the impression that travelers are entering a unique village with character.

2. When undertaking road works or as a special community improvement the following will be considered:

    - Plant an avenue of trees along Donald B. Munro Drive from the southern village limit to the Village Core as part of roadway improvements and development of any subdivisions.

5. Road Network and Right-of-Way Protection

Policies are addressed by:
Josiane Gervais, P.Eng. Project Manager

7. Recreation and Open Space

Policies are addressed by:
Mark Young, Urban Design Planner
Reid Shepherd, Parks

7.4 Pedestrian Pathways

Policies

1. The pedestrian pathway system is shown on Schedule C.

2. The City will ensure that new developments are linked to the existing or planned network of public sidewalks, recreational pathways and on-road cycle routes, which connect parks and other open spaces, and community services and facilities.

The proposed plan does not provide for pathways as identified on Schedule 'C'- Pedestrian Pathway System ,CDP.

Damien Whittaker, Senior Engineer Infrastructure

Surveying:

Survey monument to be shown and annotated, and sufficient information to enable a layperson to locate.

Water pipes:

There is a municipal water pipe near the application, though presently there is no capacity in the Carp water treatment plant for the application. When capacity is made available, a looped system may be needed. A 203 mm PVC stub exists in the property. A boundary codition request was submitted and the response to that request is as copied herein "It is to our understanding that there is limited/no more capacity in the Village of Carp Water facility to support further developments. With the understanding that any remaining residual capacity has already been allocated we can not provide the Water Boundary Condition for further site applications at this stage."

Sanitary Sewers:

There is a municipal sanitary sewer adjacent the proposed development, though, presently, there is no capacity in the Carp sanitary pump station for the development.a 200 mm dia sani pipe stub exists in the proposed development. Please check the capacity of the downstream pipes to accept the proposed flows.

The Carp sanitary pump station forcemain is in the ROW and needs to be cautioned against.

Geotechnical:

Please note that sensitive marine clays are anticipated in the area of the proposal and, if so, enhanced geotechnical investigation and analysis will be necessary. Investigation of clays should be undertaken with vane shear, Atterberg limits, shrinkage, size, grade raise restriction, consolidation, sensitivity, and liquefaction analysis- amongst others. Further, to maintain the desired result of the trees in clay soils policy all of the conditions of the policy need to be met. Please note that the 2.1 m of cover in the vicinity of the footings is sometimes a challenge as is the necessary comprehensive linkages between geotechnical, grading, parks, utilities, and trees.
Organic soils exist in the area and enhanced geotechnical investigation and analysis will be necessary. Thin soils, and possibly bedrock outcrops exist in the area and enhanced geotechnical investigation and analysis will be necessary.

Hydrogeological:

A hydrogeological report will be required if a SWM pond, or similar stormwater management infrastructure, is proposed.

Storm Sewers:

There is a municipal storm sewer adjacent the proposed development. And a 1050 mm stub in the lands. Please review the downstream system for capacity.

Groundwater:

Groundwater is anticipated to be high and the level is to be derived from long-term analysis (12 months, or more). With the high groundwater anticipated, the City advises against basements for the development. An (annual) groundwater elevation, from a long-term study will be required.

Noise and vibration:

A noise feasibility study is required showing a number of layouts to minimize noise barriers (if required). In due course a noise report will be required for the traffic from Donald B. Munro Drive, recorded on Official Plan Schedule G as an existing collector, and for the rail corridor located 210 m away (less than the threshold). Rail safety should be reviewed against the document Guidelines for New Development in Proximity to Rail Operations.

Integrated Environmental Review:

An integrated environmental review is required being adjacent to an EP3 zoned area.

Storm Water Management:

Stormwater management quality criteria shall follow the MVCA's requirements of 80% TSS removal. The quantity criteria for the development is that 100-year

post-development shall match 5-year pre-development. LID is required as per the memo from the former MOECC (now MECP). A water budget will need to be developed for the proposal and resulting in a 15% reduction in the change. Any existing stormwater runoff from adjacent site(s) that crosses the property must be accommodated by the proposed stormwater management design. All stormwater management determinations shall have supporting rationale. The stormwater management shall itemize concurrence with the content of the update Carp River wateshed/subwatershed study.
In the pre-consultation it was suggested that that quantity control for the lands being applied for currently was provided by the lands already developed to the south of Donald B Munro known as the Rivington lands. Based on a review of the Rivington report, and existing development, quantity control does not appear to be provided.

Roads:

Please refer to the City of Ottawa Private Approach By-Law 2003-447 for the entrance design. Some of the driveways might be a challenge at curves.
As per the Safer Roads initiative (adopted by Coucil, late 2019), roads must be designed to limit vehicle speeds to 30 km/h (by design; not merely by signage). Additional ROW will be required if sidewalks and/or sensitive marine clay is found. Please note that additional width is required for SMC and additional width for sidewalks (if required)

Energy conservation is required to be demonstrated throughout design as per section 4.9 of the Official Plan.

Permits and Approvals:

Please contact the Mississippi Valley Conservation Authority (MVCA), amongst other federal and provincial departments/agencies, to identify all the necessary permits and approvals required to facilitate the development: responsibility rests with the developer and their consultant for determining which approvals are needed and for obtaining all external agency approvals. The address shall be in good standing with all approval agencies, for example MVCA, prior to approval. Copies of confirmation of correspondence will be required by the City of Ottawa from all approval agencies that a form of assent is given. Please note that a stormwater program for multiple lots is understood to be the expanded type of Environmental Compliance Approval (ECA) application with the MECP; please speak with your engineering consultant to understand the impact this has on the application. An MECP ECA application is not submitted until after City of Ottawa engineering is satisfied that components directly or indirectly aligned with the ECA process concur with standards, directives and guidelines of the MECP. No construction shall commence until after a commence work notification is given by Development Review. Please also note that by the time the ECA is applied for with this application that a different type of process may be underway.

Ministry of the Environment, Conservation and Parks	Mississippi Valley Conservation Authority

Contact Information:
Christina Des Rochers
Water Inspector
613-521-3450 ext. 231
Chstina.Desrochers@ontario.ca

Contact Information:
Erica Ogden
eogden@mvc.on.ca

Plan Submission Requirements for engineering:

Site Servicing Plan*
Grading and Drainage Area Plan*
Erosion and Sediment Control Plan*

*All identified required plans are to be submitted on standard A1 size sheets as per City of Ottawa Servicing and Grading Plan Requirements and shall note the survey monument used to establish datum on the plans with sufficient information to enable a layperson to locate the monument.

Report Submission Requirements:

-Site Servicing Report
To be prepared as per requirements.
-Storm Water Management Report
-Noise Feasibility Report
-Erosion and Sediment Control Measures
-Geotechnical Investigation Study
The geotechnical consultant will need to provide full copies of any published and peer reviewed papers relied on to determine results and conclusions
Earthquake analysis is now required to be provided in the report.

-Phase 1 Environmental Site Assessment (ESA)

The Phase 1 Environmental Site Assessment (ESA) shall be as per O.Reg. 153/04. Phase 1 ESA documents performed to CSA standards are not acceptable. Documents older than 18 months from the time of draft approval will not be accepted

Guide to preparing City of Ottawa Studies and Plans:

http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

To request City of Ottawa plan(s) or report information please contact the ISD Information Centre:

Information Centre
(613) 580-2424 ext. 44455

Joseph Zagorski, P.Eng. Senior Project Manager Asset Management Branch – Infrastructure Planning

Additional comments provided in lieu of pre-consult meeting on state of water servicing for the Village of Carp provided to applicant's consultant:

- Currently peak wet weather flows to the Carp PS are approaching (exceeded) its rated capacity of 57.7 L/s pumping ability, limiting available capacity for the new residential and commercial development in the village. The station is 25 years old with some mechanical and electrical components quickly reaching the end of their design life. In addition, no overflow is provided to protect the station and houses located close to the Carp River during equipment failure or extreme I/I event. The preferred **long-term** *(to accommodate projected wastewater flows from the Carp build-out development inside village boundary)* solutions to the Carp wastewater system includes emergency overflows at both sewage pumping stations, twinning existing forcemain, upgrading pumps and back-up power. Implementing long term solutions to the Carp water and wastewater systems as proposed in the 2009 Class EA is a time-consuming process, required extensive design and construction work including significant capital budget allocation.

- The City has hired a consultant to investigate the possibility of **short-term** options to increase the Carp PS interim capacity (such as installation of new pumps which would deliver more flow but still be below design operating pressures of the existing forcemain) to provide capacity for the new development. This assignment will also confirm if Carp water facility has presently enough capacity to accommodate additional village and Carp Airport development.

Reid Shepherd, Parks

We understand that during the pre-consultation it was suggested there was a clause in the Green Meadows Subdivision (Former Rivington lands opposite Donald B. Munro Dr.) that spoke to an over-dedication of parkland. More specifically, clause 8b page 31 of the Green Meadows subdivision agreement states:

> "In recognition of the over-dedication of parkland by the Owner, the City agrees to transfer the parkland dedication in excess of 5% to the future development of other lands owned by the Owner described as Part of Lot 17, Concession 2, Geographic Township of Huntley, City of Ottawa being Part 1 on Plan 4R-7027". (Agreement attached).

This matter was forwarded to Legal Services for an opinion on the agreement. We understand that the over dedication is applicable to the one who signed the agreement and developed the Rivington subdivision only. Such a clause is not transferable to a new Owner of the lands in question.

As such the following is required with your submission:

Park and Facility Planning Comments:

- The density of this proposal is above 18 units per net hectare and therefore a parkland dedication of 0.43 ha is required based on the current unit numbers.
- Based on the above requirement of 0.43 ha, a parkette located within the development would be feasible. Please revise the concept to include a parkette centrally located within the development. Parkette requirements (location, amenities, etc) and further details can be found within the Park Development Manual, 2nd Edition.
- The Carp CDP proposes a north-south pathway connection to link up with the existing pathway across Donald B Munro, and a second east-west pathway along the northern edge of the development. Please revise the concept to show improved pathway connections within the site and to adjacent subdivisions in line with the vision of the CDP.

Mark Young, Urban Design Planner

Please accept the following comments on behalf of PRUD for the proposed plan of subdivision and zoning by-law amendment in the Village of Carp. A Design Brief will be required. The terms of reference is attached.

Plan of Subdivision:

1. Please review for compliance with the Village of Carp CDP which is being converted into a Secondary Plan as part of the New Official Plan.
2. The CDP identifies an open space corridor across the subject lands linking the park lands to the west with the Carp Ridge to the east. Open space connection blocks are identified as having a width of 10 m and should include tree retention and a publicly accessible path.
3. The CDP does not identify street townhomes as a permitted use in the subject land use designation.
4. Efforts should be taken to minimize the need for noise walls on Donald B. Munro Drive. Options include a window street, rear lane product or fronting lots and driveways directly onto the existing roadway as-is the case in most of the Village.
5. Connectivity to the Carp Ridge is a significant asset for the site. A minimum of two connection points to the natural area to the east should be provided and should be of an adequate width to allow for some views and vistas of this feature.

Zoning By-law Amendment:

1. The Zoning By-law amendment should reflect the need for adequate setbacks and buffering from existing low-density residential uses.
2. The zoning should be reflective of soil conditions, if clay soil tree setbacks are required in front and corner side yards.
3. The zoning should be reflective of the product types proposed. An R1 zone should be utilized abutting the existing dwellings and a minimum lot width and lot coverage should be reflective of the desire to locate the most compatible dwellings adjacent to the existing dwellings.

Sami Rehman, Environmental Planner Planning

The proposed development will require an Integrated Environmental Review (IER) and Environmental Impact Statement (EIS).

- The EIS will review the:
    - NEA boundary,
    - ANSI boundary
    - PSW & wetlands associated with Sign Woodlands
    - SAR, throughout the area
    - Significant Woodlands
    - Sign Wildlife Habitat
    - Results from the RMOC's NESS
    - The surface water feature and the appropriate setbacks from OP 4.7.3.

Plan of Subdivision will require a Tree Conservation Report (TCR), which can be combined with an EIS to avoid duplication.

NEA (and EP3) boundary will need to be verified during the growing season.

Site Visit December 18, 2020

Thank you for inviting me to join your site visit. It was helpful to explore the property, understand the boundaries of your potential purchase and to have the current zoning boundary (as illustrated in GeoOttawa) staked out on the subject property. While it was also useful to explore the geological features when much of the vegetation was in dormancy, it is difficult to identify the boundary of the Natural Environment Area (NEA) until we can examine the vegetation communities during the growing season. As discussed with my colleagues, we would anticipate re-visiting the site after May 2021 to assess the flora and better determine the boundary of the NEA. It is acknowledged that the final NEA boundary will also be the zoning boundary.

Josiane Gervais, P.Eng. Project Manager, Infrastructure Approvals

Follow Traffic Impact Assessment Guidelines:

- Traffic Impact Assessment will be required.
- Screening and Scoping can be submitted together. Start this process asap.
- The application will not be deemed complete until the submission of the draft step 1-4, including the functional draft RMA package (if applicable), draft functional plans (if applicable) and/or monitoring report (if applicable).
- Request base mapping asap if RMA is required. Contact Engineering Services (https://ottawa.ca/en/city-hall/planning-and-development/engineering-services)

Local and collector roadways are to be designed for a 30km/hr posted speed, as per the approved Road Safety Action Plan. Further information on design elements to achieve the 30 km/hr design speed can be provided upon request.

If any collector roads are considered, you must follow collector road guidelines for subdivisions, desired 26m ROW for collector Roads.

Geometric Road Design (GRD) drawings will be required with the first submission of underground infrastructure and grading drawings. These drawings should include such items as, but are not limited to:

- Road signage and pavement markings;
- Location of depressed curbs and tactile walking surface indicators (TWSI);
- Traffic calming measures aimed at reducing vehicle speed and enhancing pedestrian safety. Measures may include either vertical or horizontal features, however such measures shall not interfere with stormwater management and overland flow routing. Traffic calming measures shall reference best management practices from the Canadian Guide to Neighbourhood Traffic Calming, published by the Transportation Association of Canada, and/or Ontario Traffic Manual, and/or the City of Ottawa's Traffic Calming Design Guidelines;
- Intersection control measures at new internal intersections; and
- ROW protection on Donald B. Munro between Langstaff and Farm Ridge is 23m even, and between Farm Ridge and March Road is 26m even.
- Requesting to change the speed limit on Donald B. Munro as part of the application is not supported.
- Corner triangles as per OP Annex 1 - Road Classification and Rights-of-Way at the following locations on the final plan will be required:
    - Local Road to Local Road: 3 m x 3 m
    - Local Road to Arterial Road: 5 m x 5 m
- Ensure to pair driveways where possible.
- Noise Impact Studies are required. Both studies must assess:
    - Road, site is within 100m of Donald B. Munro, which is a collector roadway.
    - Rail, site is within the buffer zone Renfrew Rail Corridor, which is an active rail corridor.

It is highly recommended to review noise conditions as soon as possible so that noise effects can be avoided or mitigated as part of the subdivision design. The Noise Feasibility Study is required at the time of application. A detailed Noise Study will be required prior to registration.

Erica Ogden. Environmental Planner MVCA

Please find below a summary of the Conservation Authority's comments.

- The property contains a watercourse and unevaluated wetlands. The Environmental Impact Statement should assess each of these features in regards to their significant under Ontario Regulation 153/06. These features

should be taken into consideration when determining the area for development on the property.

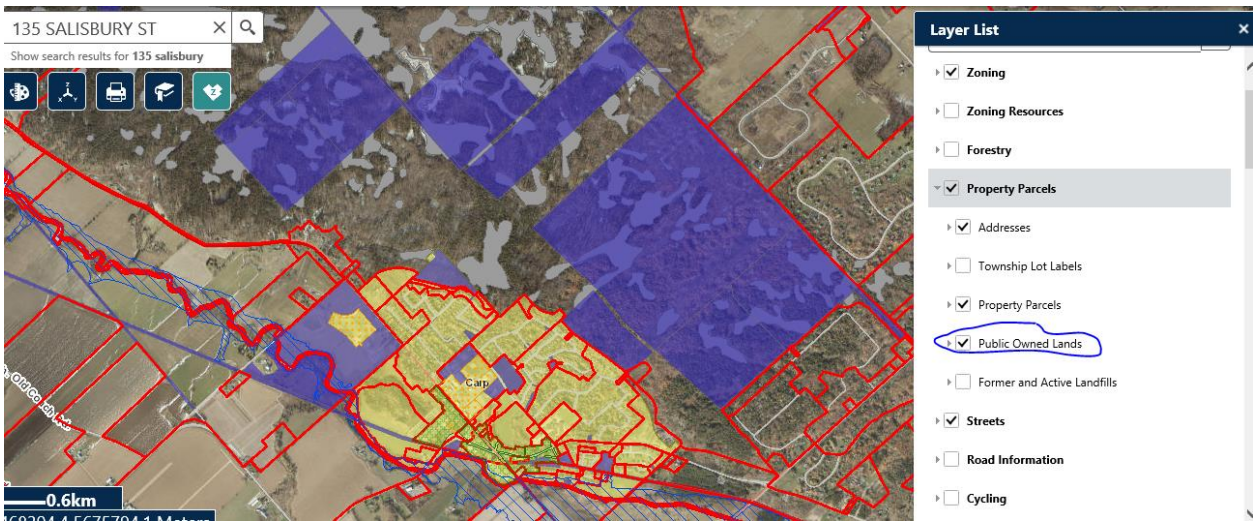
- A headwater feature assessment will be required for the watercourse on the property to provide an understanding of the feature's seasonal functions and develop a mitigation plan. Any hydraulic connection between the wetlands and watercourse should be assessed.
- MVCA will review the stormwater management for the proposed development. The water quality requirement for the Carp River is a normal level of protection which requires 70% total suspended solids removal.
- There is the potential for organic soils on the property, which must be appropriately assessed.

Adam Brown, Manager Development Review

Some information about the Carp Hills.

https://carphills.com/
https://ottawa.ca/en/living-ottawa/environment-conservation-and-climate/conservation-areas#carp-hills

To see what land the City owns in the area, you can go on geoOttawa and turn on the "Property Parcels – Public Owned Lands" box and you will see the City-owned lands in blue.



Step 2 Submission (Scoping) – Circulation Comments & Response

Report Submitted: August 23, 2021
Comments Received: September 8, 2021
Transportation Project Manager: Josiane Gervais

- No comments on the Scoping report, please proceed to Step 3: Forecasting. An update to the TRANS Trip Generation Manual has been completed (October 2020). This manual is to be utilized for this TIA. A copy of this document can be provided upon request.

  - **IBI Response:** Noted. The 2020 TRANS Trip Generation Manual will be used for this TIA as directed.

Step 3 Submission (Forecasting) – Circulation Comments & Response

Report Submitted: September 9, 2021
Comments Received: September 22, 2021
Transportation Project Manager: Josiane Gervais

- I have no comments on the Forecasting Report for 232 Donald B. Munro Dr. Please proceed to Step 4: Strategy.

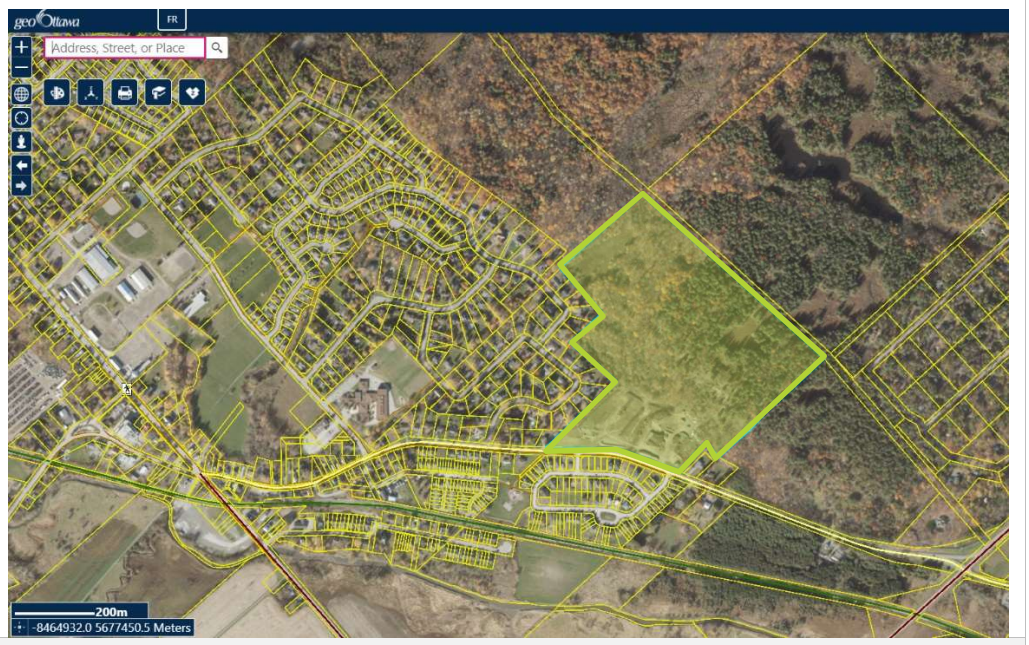
- While preparing the Draft Plan and TIA Strategy Report, note that:
    a. All new collector streets within the subdivision should be designed following the City's Designing Neighborhood Collector Streets (2019) document; and
    b. All new local residential streets should be designed with a target operating speed of 30km/h per the new Strategic Road Safety Action Plan Update. Please follow the City's Local Residential Streets 30 km/h Design Toolbox (2021) document.

    - **IBI Response:** No new collector roads are proposed within the proposed development. All new roads will be designed as local roads with 18.0m right-of-way and will be designed in accordance with the above guideline.

Appendix B – Screening Form

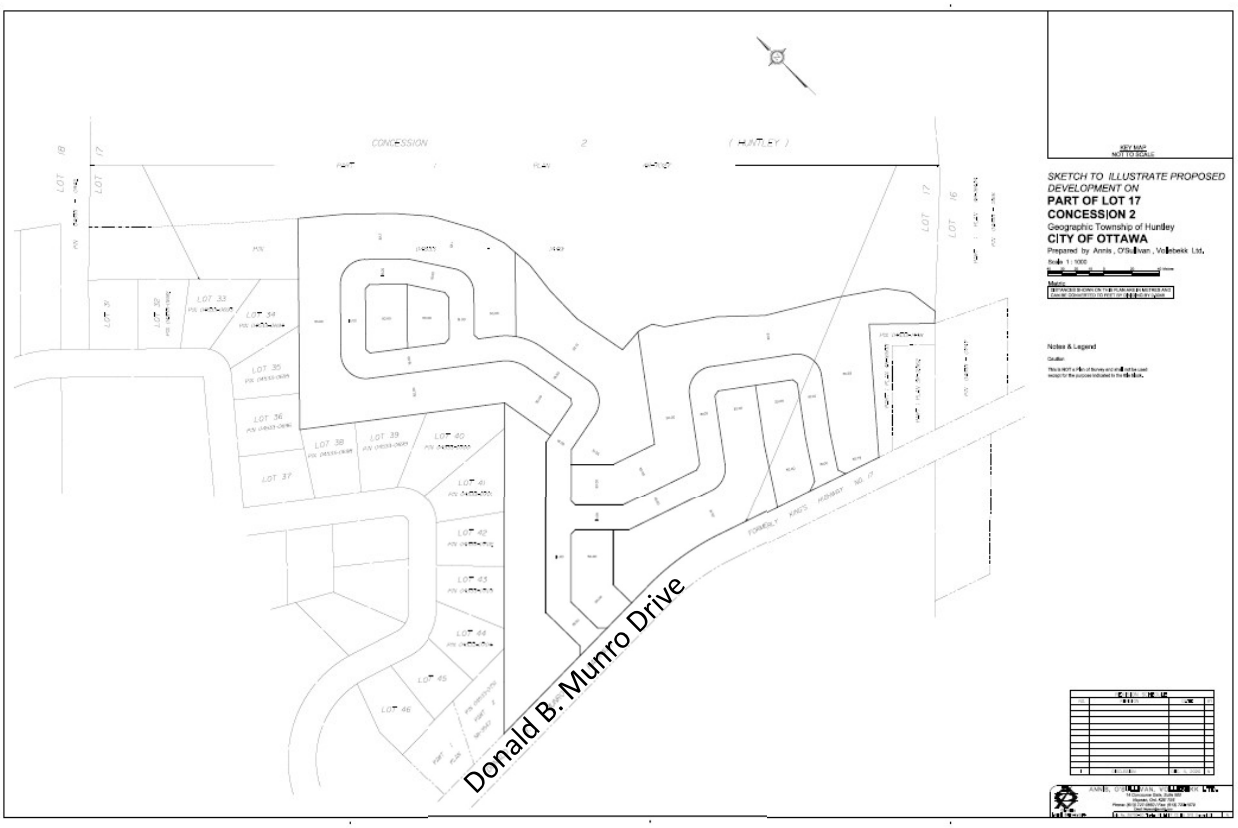
City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	Part of Lot 17, Concession 2 (Donald B. Munro Drive, approx. 900 metres east of Carp Road)
Description of Location	Carp – Donald B. Munro Drive, approx. 900 metres east of Carp Road 
Land Use Classification	Residential
Development Size (units)	100-150 residential units
Development Size (m^2)	18.4 acres
Number of Accesses and Locations	Two all-movement access intersections on Donald B. Munro Drive
Phase of Development	Single Phase
Build-out Year	TBD

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

Proposed Development:



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.*

Based on the results 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).*

Based on the results above, the Location Trigger is not 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?		✓

Based on the results above, 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?	✓	

CONCLUSION: As one or more of the above triggers has been satisfied, a TIA will be required.

Appendix C – OC Transpo Routes

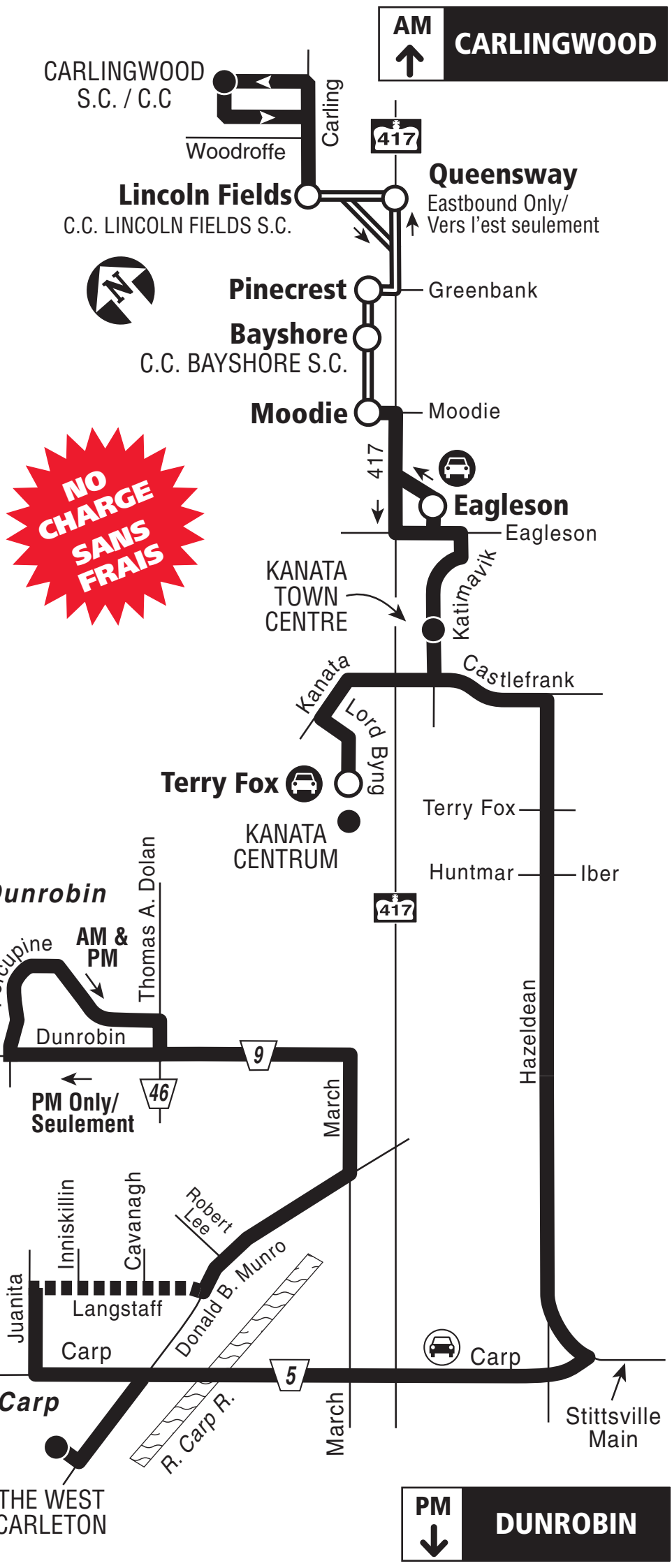
303

CARLINGWOOD
DUNROBIN, CARP

Local

Wednesday only / Mercredi seulement

Selected time periods
Périodes sélectionnées



Transitway & Station

Request stop zone
Zone d'arrêt sur demande

Park & Ride / Parc-o-bus

2019.08

Schedule / Horaire.....613-560-1000
Text / Texto 560560

plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Relations
Service à la clientèle **613-842-3600**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective December 24, 2017
En vigueur 24 décembre 2017

OC Transpo

INFO 613-741-4390
octranspo.com

Appendix D – Collision Data

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2015 **To:** December 31, 2019

Location: CARP RD @ DONALD B. MUNRO DR

Traffic Control: Stop sign **Total Collisions:** 5

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Feb-27, Fri,16:39	Clear	Turning movement	P.D. only	Dry	West	Turning left	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2015-Aug-14, Fri,17:26	Clear	Turning movement	Non-fatal injury	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					South	Turning left	Automobile, station wagon	Other motor vehicle	
2016-Jan-13, Wed,14:18	Clear	Angle	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle	0
					East	Turning right	Automobile, station wagon	Other motor vehicle	
2016-Sep-03, Sat,13:36	Clear	Rear end	P.D. only	Dry	South	Going ahead	Pick-up truck	Other motor vehicle	0
					South	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Mar-01, Wed,11:50	Rain	Angle	Non-fatal injury	Wet	West	Going ahead	Automobile, station wagon	Other motor vehicle	0
					South	Going ahead	Pick-up truck	Other motor vehicle	

Location: DONALD B. MUNRO DR @ MEADOWRIDGE CIR

Traffic Control: Stop sign **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Jun-29, Wed,17:50	Clear	SMV other	P.D. only	Dry	North	Turning left	Truck and trailer	Other	0

Location: DONALD B. MUNRO DR @ ROBERTLEE DR

Traffic Control: Stop sign **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Nov-17, Tue,15:39	Freezing Rain	Angle	P.D. only	Wet	South	Turning right	Unknown	Other motor vehicle	0
					East	Going ahead	Truck - tractor	Other motor vehicle	

Location: DONALD B. MUNRO DR btwn LANGSTAFF DR & ROBERTLEE DR

Traffic Control: No control **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2015 **To:** December 31, 2019

Location: DONALD B. MUNRO DR btwn LANGSTAFF DR & ROBERTLEE DR

Traffic Control: No control **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2019-Oct-09, Wed,07:50	Clear	SMV unattended vehicle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Unattended vehicle	0

Location: DONALD B. MUNRO DR btwn MARCH RD & ROBERTLEE DR

Traffic Control: No control **Total Collisions:** 3

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jan-19, Mon,17:25	Clear	SMV other	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Animal - wild	0
2015-Jun-15, Mon,17:48	Clear	SMV other	P.D. only	Dry	North	Going ahead	Passenger van	Pole (utility, power)	0
2016-Feb-05, Fri,08:05	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Stopped	Pick-up truck	Other motor vehicle	

Location: DONALD B. MUNRO DR btwn SALISBURY ST & DEUGO ST

Traffic Control: No control **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2018-Jul-08, Sun,04:30	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Ran off road	0

Location: DONALD B. MUNRO DR/OLD CARP RD W @ MARCH RD

Traffic Control: Stop sign **Total Collisions:** 9

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Feb-04, Wed,12:30	Snow	Angle	P.D. only	Loose snow	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Feb-20, Fri,15:04	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	0
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Feb-23, Mon,15:58	Clear	Rear end	Non-fatal injury	Dry	North	Going ahead	Passenger van	Other motor vehicle	0
					North	Turning left	Pick-up truck	Other motor vehicle	

Transportation Services - Traffic Services

Collision Details Report - Public Version

From: January 1, 2015 **To:** December 31, 2019

Location: DONALD B. MUNRO DR/OLD CARP RD W @ MARCH RD

Traffic Control: Stop sign **Total Collisions:** 9

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Sep-23, Fri,18:20	Clear	Angle	Non-fatal injury	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Jan-15, Sun,17:05	Clear	Angle	P.D. only	Dry	North	Going ahead	Unknown	Other motor vehicle	0
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-May-30, Tue,17:19	Rain	Angle	P.D. only	Wet	West	Going ahead	Pick-up truck	Other motor vehicle	0
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2018-Mar-05, Mon,17:55	Clear	Angle	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2018-Oct-17, Wed,15:08	Clear	Angle	P.D. only	Dry	South	Going ahead	School bus	Other motor vehicle	0
					West	Going ahead	Pick-up truck	Other motor vehicle	
2019-Nov-22, Fri,03:24	Rain	Angle	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					West	Going ahead	Passenger van	Other motor vehicle	

Appendix E – Traffic Data

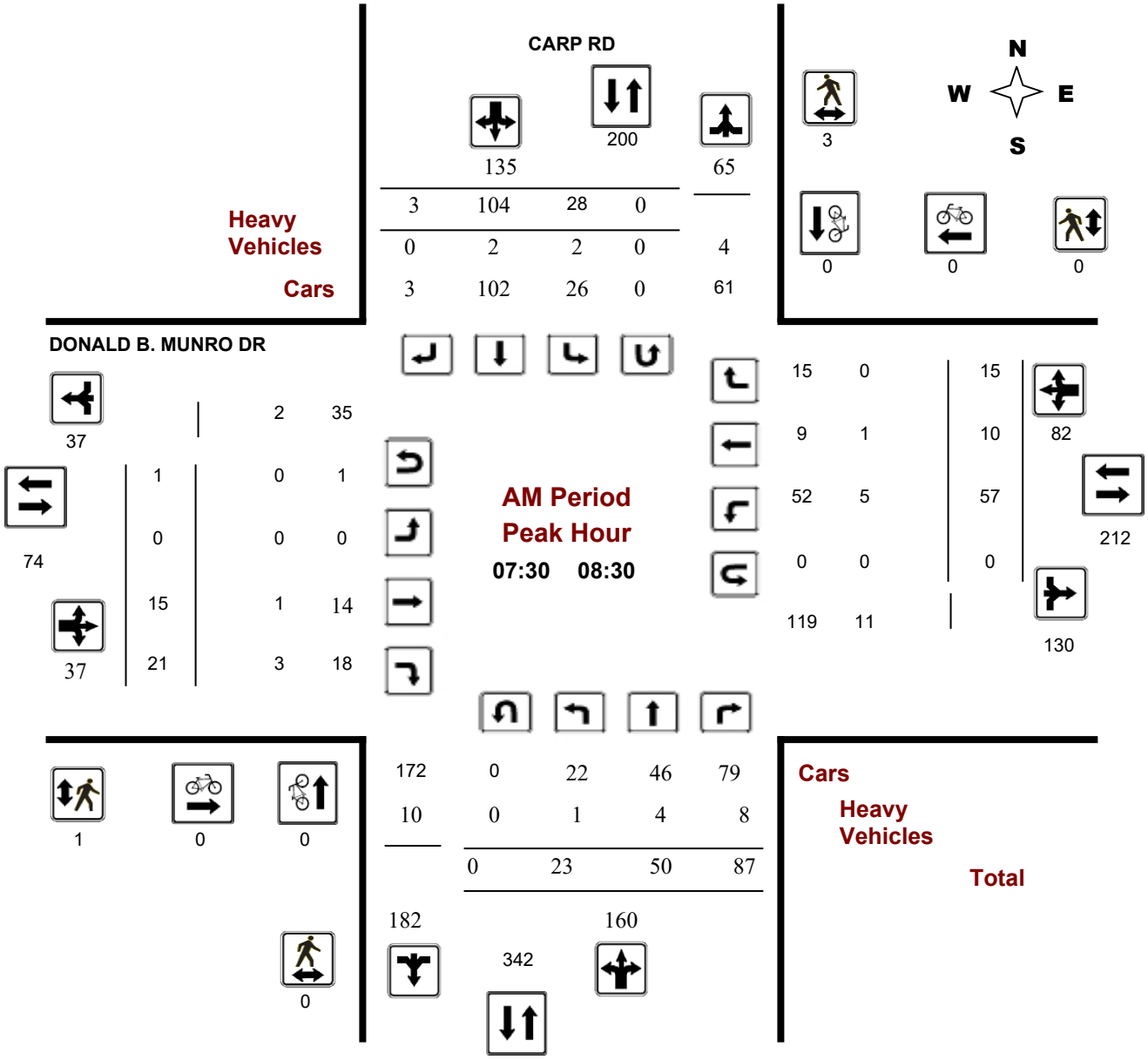
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CARP RD @ DONALD B. MUNRO DR

Survey Date: Tuesday, April 02, 2019 **WO No:** 38471

Start Time: 07:00 **Device:** Miovision



Comments

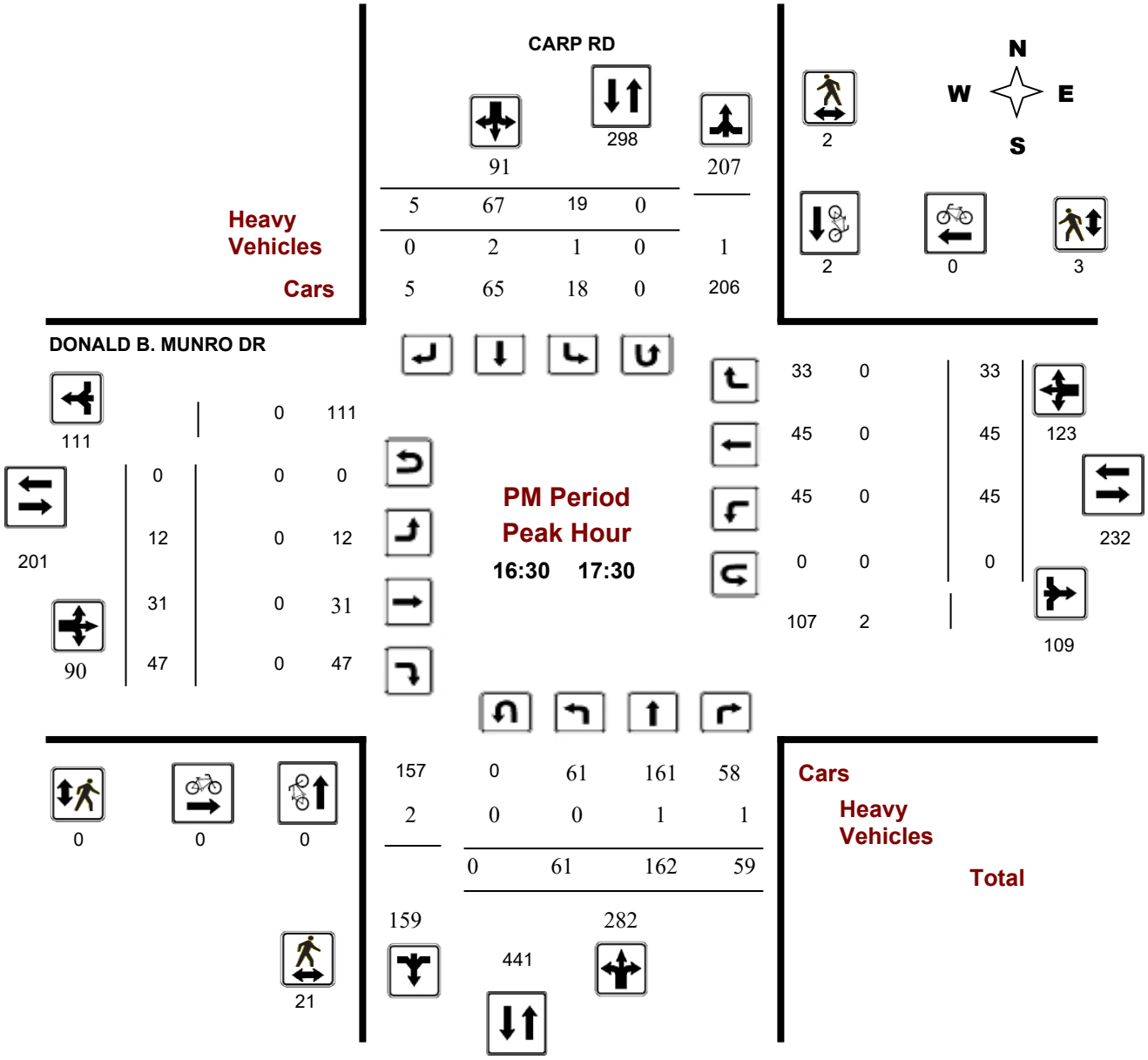
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CARP RD @ DONALD B. MUNRO DR

Survey Date: Tuesday, April 02, 2019 **WO No:** 38471

Start Time: 07:00 **Device:** Miovision



Comments

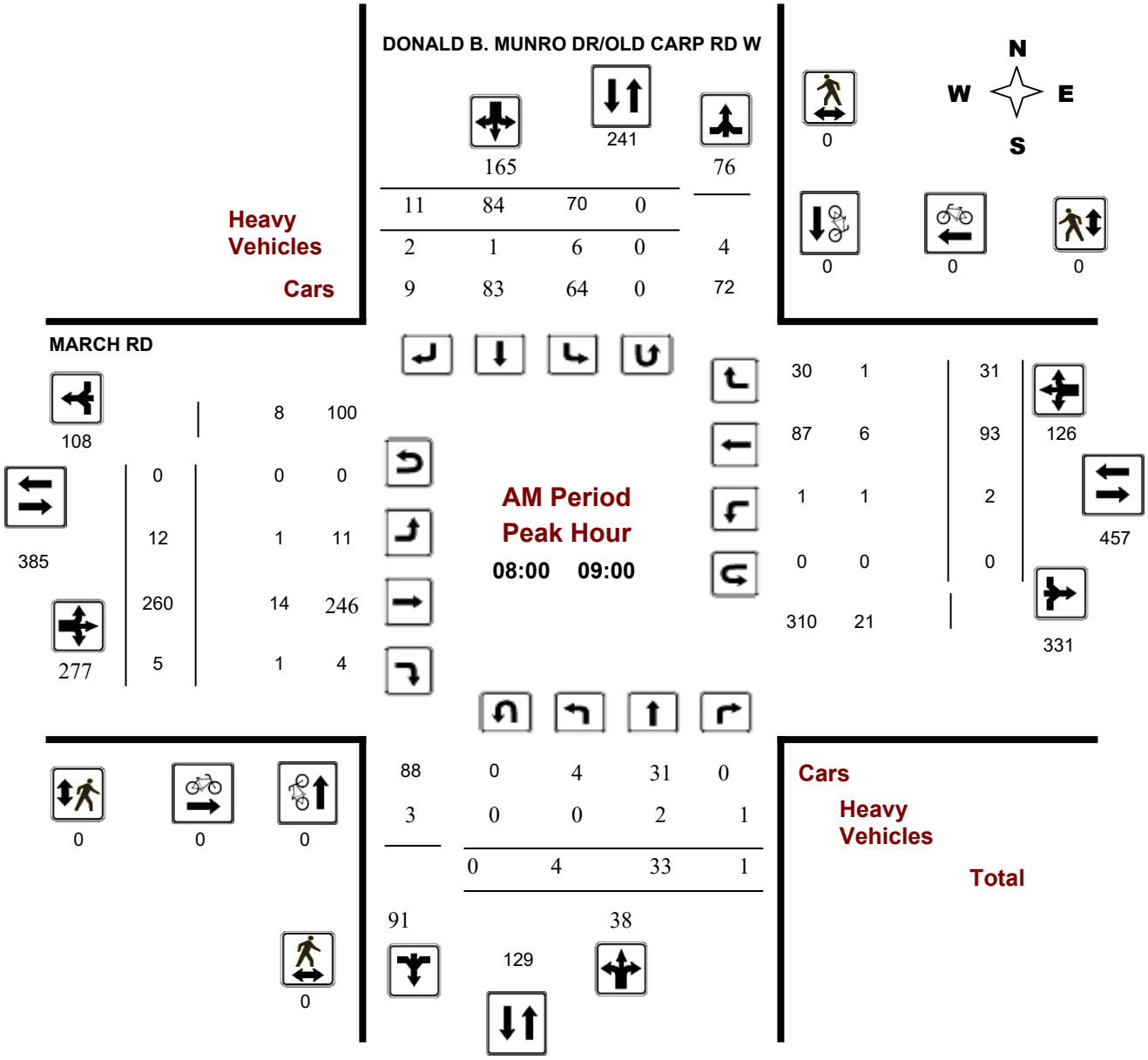
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

DONALD B. MUNRO DR/OLD CARP RD W @ MARCH RD

Survey Date: Thursday, February 21, 2019 **WO No:** 38304

Start Time: 07:00 **Device:** Miovision



Comments

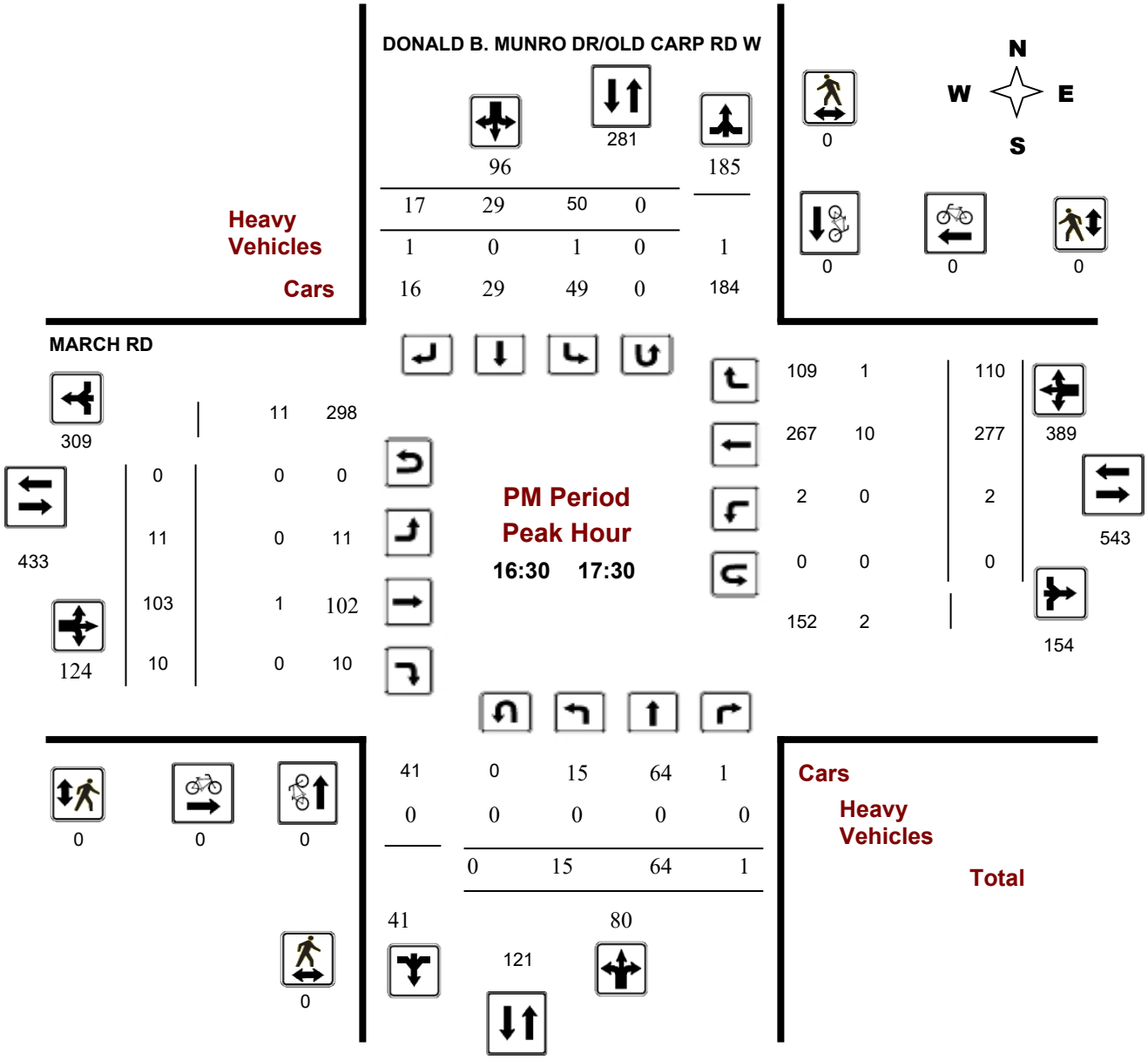
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

DONALD B. MUNRO DR/OLD CARP RD W @ MARCH RD

Survey Date: Thursday, February 21, 2019 **WO No:** 38304

Start Time: 07:00 **Device:** Miovision



Comments

Turning Movement Count Conducted in August 2019 by McIntosh Perry

Source: Traffic Impact Assessment Report: Residential Development at
147 Langstaff Drive (McIntosh Perry, April 2021)

East/West Street Donald B. Munro Dr
Municipality: City of Ottawa
North/South Street Langstaff Dr

Time	NB Approach											SB Approach											EB Approach											WB Approach											Total
	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	Cars			Trucks			Heavies			Ped	Cyclist	
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right			
07:00-07:15	0	0	1	0	0	0	0	0	0	0	0	3	0	10	0	0	0	0	0	0	3	0	4	11	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	31
07:15-07:30	1	0	1	0	0	0	0	0	0	0	0	7	0	2	0	0	1	0	0	0	1	0	7	11	1	0	0	0	0	0	0	0	0	2	2	3	0	0	0	0	0	0	0	38
07:30-07:45	2	1	2	0	0	0	0	0	0	0	0	12	0	7	1	0	0	0	0	0	0	0	13	11	2	1	0	0	0	0	0	0	0	0	9	6	0	0	0	0	0	1	0	67
07:45-08:00	1	0	2	0	0	0	0	0	0	0	0	16	0	8	2	0	1	0	0	0	1	0	10	9	0	0	1	0	0	0	0	0	0	0	10	6	0	0	4	0	0	0	1	0	70
08:00-08:15	0	1	3	0	0	0	0	0	0	0	0	18	1	5	1	0	0	0	0	0	0	0	5	15	0	1	1	0	0	0	0	0	0	0	8	5	0	0	2	0	0	0	0	0	66
08:15-08:30	2	0	1	0	0	0	0	0	0	0	0	14	0	5	2	0	0	0	0	0	0	0	10	2	0	0	0	0	0	0	0	0	0	0	12	11	0	0	1	0	0	0	0	0	60
08:30-08:45	1	1	1	0	0	0	0	0	0	1	0	17	3	11	0	0	0	0	0	0	1	0	5	13	1	0	0	0	0	0	0	1	0	1	11	14	0	0	1	0	0	0	0	0	80
08:45-09:00	0	0	2	0	0	0	0	0	0	1	0	11	1	13	2	0	1	0	0	0	1	0	11	16	0	0	0	0	0	0	0	0	0	1	11	5	0	1	2	0	0	0	1	0	77
16:00-16:15	1	0	3	0	0	0	0	0	0	2	0	11	0	14	2	0	0	0	0	0	0	0	10	17	1	0	0	0	0	0	0	0	0	2	19	11	0	0	1	0	0	0	0	0	92
16:15-16:30	4	0	2	0	0	1	0	0	0	0	0	14	0	10	1	0	0	0	0	0	0	0	13	6	0	0	0	0	0	0	0	0	0	2	16	18	0	0	2	0	0	0	2	0	89
16:30-16:45	0	0	3	0	0	0	0	0	0	0	0	11	1	9	2	0	0	0	0	0	1	0	14	15	0	1	0	0	0	0	0	0	0	2	18	21	0	0	2	0	0	0	0	0	99
16:45-17:00	0	0	1	0	0	0	0	0	0	4	0	11	0	5	1	0	1	0	0	0	0	0	17	13	0	2	0	0	0	0	0	0	0	1	25	16	0	3	1	0	0	0	0	0	97
17:00-17:15	2	0	3	0	0	0	0	0	0	0	0	15	1	7	0	0	0	0	0	0	0	0	12	7	0	0	1	0	0	0	0	0	0	3	20	17	0	0	0	0	0	0	0	0	88
17:15-17:30	1	1	2	0	0	0	0	0	0	1	0	13	0	6	0	0	1	0	0	0	0	0	15	5	1	0	3	0	0	0	0	0	0	1	18	22	0	2	0	0	0	0	0	0	91
17:30-17:45	0	1	1	0	0	0	0	0	0	0	0	7	0	8	0	0	0	0	0	0	0	0	11	20	0	0	0	0	0	0	0	0	0	1	19	17	0	0	1	0	0	0	2	0	86
17:45-18:00	0	0	0	0	0	0	0	0	0	1	0	9	1	9	2	0	0	0	0	0	0	0	12	9	1	0	0	0	0	0	0	1	0	1	20	27	0	0	1	0	0	0	3	0	92

Appendix F – Trip Generation Data

3.2 Recommended Residential Trip Generation Rates

A blended trip rate was developed from the three data sources through application of a rank-sum weighting process, considering the strengths and weaknesses of each dataset for the dwelling type in question. The recommended blended **residential person-trip rates** are presented in **Table 3**. All rates represent person-trips per dwelling unit and are to be applied to the **AM or PM peak period.**

Table 3: Recommended Residential Person-trip Rates

ITE Land Use Code	Dwelling Unit Type	Period	Person-Trip Rate
210	Single-detached	AM	2.05
		PM	2.48
220	Multi-Unit (Low-Rise)	AM	1.35
		PM	1.58
221 & 222	Multi-Unit (High-Rise)	AM	0.80
		PM	0.90

3.3 Adjustment Factors – Peak Period to Peak Hour

The various trip generation data sources require some adjustment to standardize the data for developing robust blended trip rates. The peak period conversion factor in **Table 4** may be used where applicable to develop trip generation rate estimates in the desired format.

Table 4: Adjustment Factors for Residential Trip Generation Rates

Factor	Application	Apply To	Period	Value
Peak Period Conversion Factor	**Peak period to peak hour conversion.** Because the 2020 TRANS Trip Generation Study reports trip generation rates by peak period, factors must be applied if the practitioner requires peak hour rates. In practice, the conversion to peak hour trip rates should occur **after** the application of modal shares.	Person-trip rates per peak period	AM	0.50
			PM	0.44
		Vehicle trip rates per peak period	AM	0.48
			PM	0.44
		Transit trip rates per peak period	AM	0.55
			PM	0.47
		Cycling trip rates per peak period	AM	0.58
			PM	0.48
		Walking trip rates per peak period	AM	0.58
			PM	0.52

Table 6: Residential Mode Share for Single-Detached Housing

District	Period	Mode				
		Auto Driver	Auto Pass.	Transit	Cycling	Walking
Ottawa Centre	AM	37%	13%	17%	9%	25%
	PM	36%	12%	13%	8%	30%
Ottawa Inner Area	AM	36%	13%	17%	9%	25%
	PM	35%	12%	13%	9%	30%
Île de Hull	AM	46%	13%	13%	0%	28%
	PM	53%	12%	11%	0%	24%
Ottawa East	AM	45%	15%	20%	9%	11%
	PM	48%	15%	17%	9%	12%
Beacon Hill	AM	51%	15%	20%	2%	12%
	PM	52%	21%	16%	4%	8%
Alta Vista	AM	49%	15%	21%	4%	11%
	PM	52%	18%	16%	3%	12%
Hunt Club	AM	48%	15%	29%	1%	7%
	PM	51%	19%	23%	1%	7%
Merivale	AM	52%	16%	21%	3%	8%
	PM	54%	18%	17%	3%	9%
Ottawa West	AM	43%	15%	19%	6%	16%
	PM	43%	13%	15%	6%	23%
Bayshore/Cedarview	AM	49%	15%	27%	2%	7%
	PM	52%	18%	21%	2%	7%
Hull Périphérie	AM	49%	17%	22%	4%	8%
	PM	51%	18%	18%	4%	9%
Orleans	AM	48%	14%	27%	1%	9%
	PM	54%	17%	22%	1%	6%
South Gloucester / Leitrim	AM	54%	24%	12%	1%	9%
	PM	55%	25%	9%	1%	10%
South Nepean	AM	51%	14%	25%	1%	9%
	PM	53%	19%	18%	1%	10%
Kanata - Stittsville	AM	52%	15%	20%	1%	12%
	PM	56%	19%	14%	1%	9%
Plateau	AM	47%	17%	24%	4%	7%
	PM	49%	19%	21%	3%	9%
Aylmer	AM	53%	17%	23%	2%	6%
	PM	55%	21%	17%	2%	5%
Pointe Gatineau	AM	55%	15%	22%	2%	7%
	PM	55%	17%	19%	2%	7%
Gatineau Est	AM	54%	16%	20%	0%	10%
	PM	60%	18%	14%	1%	7%
Masson-Angers	AM	62%	13%	13%	11%	1%
	PM	62%	18%	12%	8%	1%
Other Rural Districts	AM	60%	14%	24%	2%	0%
	PM	67%	17%	14%	2%	0%

Table 7: Residential Mode Share for Low-Rise Multifamily Housing

District	Period	Mode				
		Auto Driver	Auto Pass.	Transit	Cycling	Walking
Ottawa Centre	AM	27%	9%	25%	9%	30%
	PM	31%	10%	20%	9%	30%
Ottawa Inner Area	AM	27%	8%	26%	9%	30%
	PM	31%	9%	20%	9%	31%
Île de Hull	AM	27%	9%	25%	9%	30%
	PM	34%	22%	16%	5%	22%
Ottawa East	AM	36%	11%	38%	7%	8%
	PM	39%	16%	29%	5%	11%
Beacon Hill	AM	45%	9%	35%	1%	10%
	PM	48%	16%	24%	1%	11%
Alta Vista	AM	38%	15%	35%	1%	10%
	PM	38%	19%	31%	2%	10%
Hunt Club	AM	44%	11%	38%	1%	6%
	PM	47%	15%	29%	1%	8%
Merivale	AM	44%	11%	32%	6%	7%
	PM	44%	12%	29%	4%	11%
Ottawa West	AM	36%	12%	24%	10%	19%
	PM	35%	12%	16%	10%	27%
Bayshore/Cedarview	AM	43%	11%	31%	1%	13%
	PM	44%	14%	25%	1%	15%
Hull Périphérie	AM	46%	22%	22%	4%	6%
	PM	46%	17%	22%	3%	11%
Orleans	AM	47%	15%	29%	1%	9%
	PM	51%	19%	24%	1%	6%
South Gloucester / Leitrim	AM	59%	20%	16%	1%	4%
	PM	62%	18%	17%	1%	3%
South Nepean	AM	49%	13%	26%	2%	9%
	PM	49%	13%	24%	2%	12%
Kanata - Stittsville	AM	52%	14%	22%	0%	11%
	PM	58%	17%	17%	0%	8%
Plateau	AM	44%	18%	28%	4%	6%
	PM	47%	17%	26%	2%	8%
Aylmer	AM	52%	18%	23%	0%	7%
	PM	52%	16%	20%	1%	12%
Pointe Gatineau	AM	46%	17%	23%	0%	14%
	PM	52%	16%	19%	1%	12%
Gatineau Est	AM	54%	17%	20%	1%	8%
	PM	56%	21%	16%	0%	7%
Masson-Angers	AM	60%	15%	21%	4%	1%
	PM	63%	15%	17%	3%	1%
Other Rural Districts	AM	66%	13%	21%	1%	0%
	PM	62%	19%	16%	3%	0%

5 RESIDENTIAL DIRECTIONAL SPLITS

After calculating the total person trips generated by the development and applying the appropriate modal shares, directional factors can be applied to estimate the number of inbound and outbound trips by vehicle. The vehicle trip directional splits were developed for both the AM and PM peak periods[2]. The vehicle trip directional splits, as shown in **Table 9**, have been developed for the NCR based on a review of the local trip generator surveys as well as the latest published data in the ITE *Trip Generation Manual* (10th Edition).

Table 9: Recommended Vehicle Trip Directional Splits (Peak Period)

ITE Land Use Code	Dwelling Unit Type	Period	Inbound	Outbound
210	Single-detached	AM	30%	70%
		PM	62%	38%
220	Multi-Unit (Low-Rise)	AM	30%	70%
		PM	56%	44%
221 & 222	Multi-Unit (High-Rise)	AM	31%	69%
		PM	58%	42%

6 NON-RESIDENTIAL MODE SHARE

Mode shares were developed for three types of non-residential development: schools (elementary and high school); employment generators; and commercial (retail) generators. These mode shares were developed through data provided by the Ville de Gatineau from local school surveys as well as the TRANS Origin-Destination Survey. The non-residential mode shares presented below are limited and do not capture all development types. For data on the travel characteristics associated with colleges and universities, transportation terminals, and sports and entertainment venues in the National Capital Region, practitioners should refer to the various reports for the TRANS *Special Generators Survey* (2013), which are posted on the TRANS website. For other development types, practitioners may need to carry out their own local generator data collection where necessary.

[2] A directional split for active transportation was calculated based on the local generator surveys for low-rise and mid-rise land uses. The splits are mostly in-line with the vehicle directional splits, which could be used as a rough assumption for areas with lower vehicle mode share.

Rural West

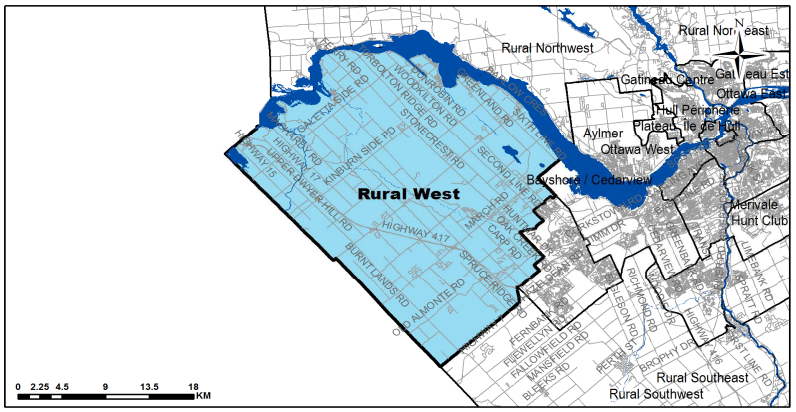
Demographic Characteristics

Population	24,960	Actively Travelled	19,280
Employed Population	12,280	Number of Vehicles	18,930
Households	8,750	Area (km^2)	744.4

Occupation Status (age 5+)	Male	Female	Total
Full Time Employed	6,190	4,610	10,800
Part Time Employed	480	990	1,470
Student	2,720	2,970	5,680
Retiree	1,920	1,900	3,820
Unemployed	300	150	450
Homemaker	60	970	1,030
Other	260	140	390
Total:	11,920	11,730	23,660

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	620	550	1,170
Licensed Drivers	9,590	9,180	18,770
Telecommuters	90	100	190
Trips made by residents	28,240	31,610	59,850

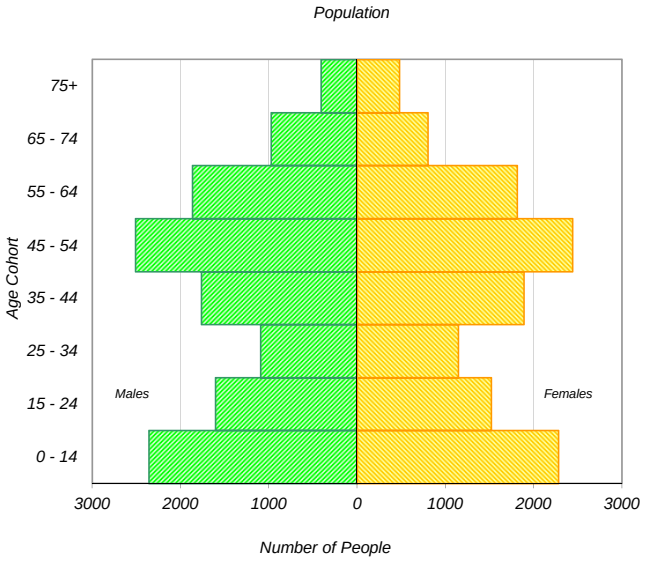
Selected Indicators	
Daily Trips per Person (age 5+)	2.53
Vehicles per Person	0.76
Number of Persons per Household	2.85
Daily Trips per Household	6.84
Vehicles per Household	2.16
Workers per Household	1.40
Population Density (Pop/km2)	30

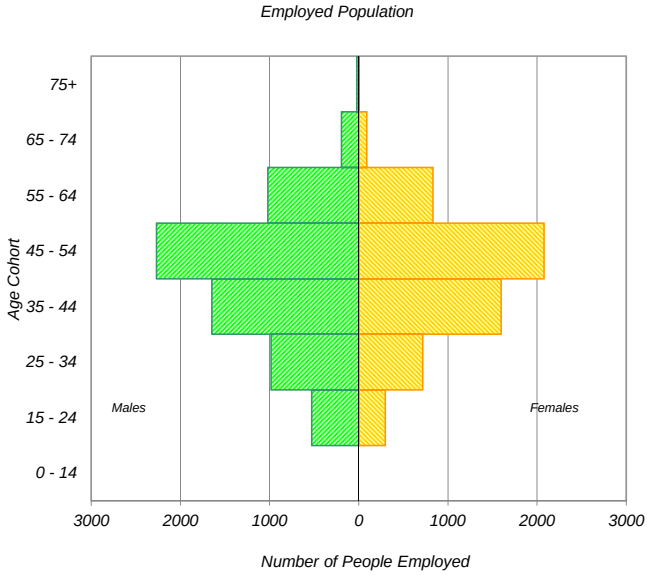


Household Size		
1 person	1,280	15%
2 persons	3,330	38%
3 persons	1,520	17%
4 persons	1,800	21%
5+ persons	820	9%
Total:	8,750	100%

Households by Vehicle Availability		
0 vehicles	90	1%
1 vehicle	1,820	21%
2 vehicles	4,540	52%
3 vehicles	1,530	17%
4+ vehicles	770	9%
Total:	8,750	100%

Households by Dwelling Type		
Single-detached	8,330	95%
Semi-detached	160	2%
Townhouse	170	2%
Apartment/Condo	90	1%
Total:	8,750	100%



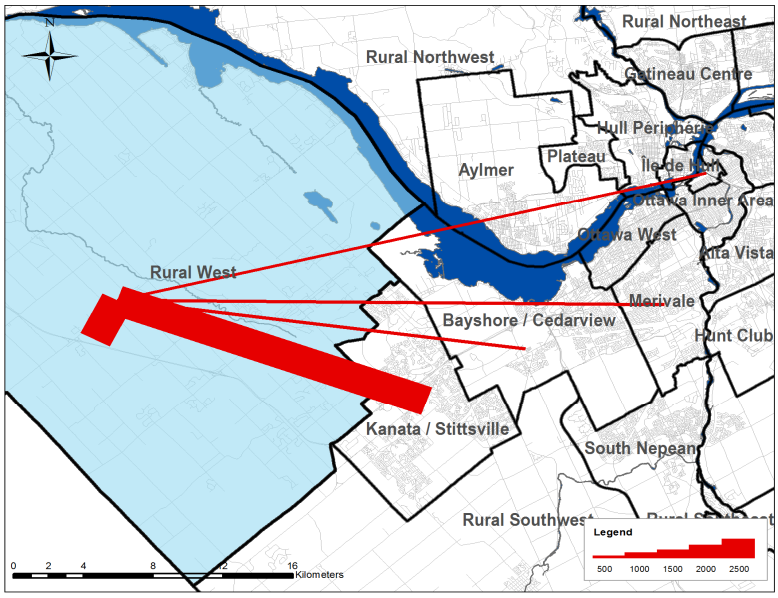


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Destinations of Trips from Rural West

AM Peak Period



Summary of Trips to and from Rural West

AM Peak Period (6:30 - 8:59)	Destinations of Trips From District	% Total	Origins of Trips To District	% Total
Districts				
Ottawa Centre	430	4%	0	0%
Ottawa Inner Area	380	4%	20	0%
Ottawa East	80	1%	90	1%
Beacon Hill	70	1%	40	1%
Alta Vista	180	2%	20	0%
Hunt Club	80	1%	60	1%
Merivale	720	7%	70	1%
Ottawa West	170	2%	70	1%
Bayshore / Cedarview	760	7%	380	6%
Orléans	0	0%	70	1%
Rural East	0	0%	0	0%
Rural Southeast	20	0%	0	0%
South Gloucester / Leitrim	60	1%	40	1%
South Nepean	30	0%	80	1%
Rural Southwest	160	2%	80	1%
Kanata / Stittsvile	3,250	31%	1,050	17%
Rural West	4,020	38%	4,020	65%
Île de Hull	140	1%	0	0%
Hull Périphérie	50	0%	0	0%
Plateau	0	0%	0	0%
Aylmer	0	0%	50	1%
Rural Northwest	10	0%	0	0%
Pointe Gatineau	20	0%	10	0%
Gatineau Est	0	0%	20	0%
Rural Northeast	0	0%	0	0%
Buckingham / Masson-Angers	0	0%	0	0%
Ontario Sub-Total:	10,410	98%	6,090	99%
Québec Sub-Total:	220	2%	80	1%
Total:	10,630	100%	6,170	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	6,640	32%	2,300	11%	1,860	12%
School	1,930	9%	460	2%	2,220	14%
Shopping	2,930	14%	220	1%	750	5%
Leisure	2,240	11%	1,440	7%	1,310	8%
Medical	680	3%	150	1%	420	3%
Pick-up / drive passenger	1,610	8%	800	4%	1,400	9%
Return Home	3,570	17%	14,860	72%	6,720	43%
Other	1,080	5%	370	2%	880	6%
Total:	20,680	100%	20,600	100%	15,560	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	4,090	62%	1,410	65%	1,140	28%
School	1,480	22%	420	19%	2,010	50%
Shopping	130	2%	0	0%	90	2%
Leisure	110	2%	40	2%	40	1%
Medical	120	2%	30	1%	0	0%
Pick-up / drive passenger	460	7%	50	2%	430	11%
Return Home	0	0%	150	7%	170	4%
Other	230	3%	60	3%	140	3%
Total:	6,620	100%	2,160	100%	4,020	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	40	1%	30	0%	50	1%
School	40	1%	0	0%	0	0%
Shopping	550	17%	30	0%	140	4%
Leisure	510	16%	290	4%	510	14%
Medical	170	5%	40	1%	0	0%
Pick-up / drive passenger	360	11%	360	5%	430	12%
Return Home	1,380	42%	5,950	88%	2,310	63%
Other	200	6%	40	1%	230	6%
Total:	3,250	100%	6,740	100%	3,670	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	56,840		27%
AM Peak Period	12,800	23%	31%
PM Peak Period	13,660	24%	27%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	15,110	73%	15,000	73%	8,640	55%
Auto Passenger	3,170	15%	3,310	16%	2,320	15%
Transit	790	4%	680	3%	0	0%
Bicycle	190	1%	180	1%	50	0%
Walk	0	0%	0	0%	720	5%
Other	1,430	7%	1,430	7%	3,840	25%
Total:	20,690	100%	20,600	100%	15,570	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	4,400	67%	1,570	73%	1,670	42%
Auto Passenger	610	9%	180	8%	490	12%
Transit	650	10%	0	0%	0	0%
Bicycle	0	0%	0	0%	0	0%
Walk	0	0%	0	0%	140	3%
Other	950	14%	400	19%	1,720	43%
Total:	6,610	100%	2,150	100%	4,020	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	2,590	80%	5,070	75%	1,960	54%
Auto Passenger	540	17%	850	13%	870	24%
Transit	0	0%	450	7%	0	0%
Bicycle	10	0%	0	0%	20	1%
Walk	0	0%	0	0%	180	5%
Other	100	3%	370	5%	630	17%
Total:	3,240	100%	6,740	100%	3,660	100%

Avg Vehicle Occupancy	From District	To District	Within District
24 Hours	1.21	1.22	1.27
AM Peak Period	1.14	1.11	1.29
PM Peak Period	1.21	1.17	1.44

Transit Modal Split	From District	To District	Within District
24 Hours	4%	4%	0%
AM Peak Period	11%	0%	0%
PM Peak Period	0%	7%	0%

Appendix G – MMLOS Analyses

Multi-Modal Level of Service - Segments Form

Consultant	**IBI Group**	**Project**	**232 Donald B Munro Dr**
Scenario	**Existing (2021) Conditions**	**Date**	**September 27, 2021**
Comments			

SEGMENTS		**Donald B Munro Drive**	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	**-**	no sidewalk n/a								
	Avg Daily Curb Lane Traffic Volume		≤ 3000								
	Operating Speed On-Street Parking		> 60 km/h no								
	Exposure to Traffic PLoS		**F**	-	-	-	-	-	-	-	-
	Effective Sidewalk Width										
	Pedestrian Volume										
	Crowding PLoS		-	-	-	-	-	-	-	-	-
	Level of Service		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Bicycle	Type of Cycling Facility	**-**	Mixed Traffic								
	Number of Travel Lanes		2-3 lanes total								
	Operating Speed		≥ 60 km/h								
	# of Lanes & Operating Speed LoS		**F**	-	-	-	-	-	-	-	-
	Bike Lane (+ Parking Lane) Width										
	Bike Lane Width LoS		-	-	-	-	-	-	-	-	-
	Bike Lane Blockages										
	Blockage LoS		-	-	-	-	-	-	-	-	-
	Median Refuge Width (no median = < 1.8 m)										
	No. of Lanes at Unsignalized Crossing										
	Sidestreet Operating Speed										
	Unsignalized Crossing - Lowest LoS		-	-	-	-	-	-	-	-	-
	Level of Service		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Transit	Facility Type	**D**	Mixed Traffic								
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8								
	Level of Service		**D**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Truck	Truck Lane Width	**B**	> 3.7 m								
	Travel Lanes per Direction		1								
	Level of Service		**B**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix H – Intersection Control Warrants

IBI

OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: Carp Road *(Major Roadway)* at Donald B. Munro Drive *(Minor Roadway)*

Orientation: North/South East/West

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	480	720	603 100%	301 63%	301 63%	301 63%	934 100%	467 97%	467 97%	467 97%	85%
B. Vehicle volume along minor roads	120	170	120	170	268 100%	134 100%	134 100%	134 100%	498 100%	249 100%	249 100%	249 100%	100%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	480	720	335 70%	167 35%	167 35%	167 35%	436 91%	218 45%	218 45%	218 45%	50%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	50	70	163 100%	81 100%	81 100%	81 100%	261 100%	130 100%	130 100%	130 100%	100%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	YES	NO
Justification 2 - Delay to Cross Traffic	NO	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	384	67%	67%
	B. Vehicle volume along minor roads (Average Hour)	120	170	144	204	191	100%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	193	34%	34%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	106	100%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	66	
3	115	33	←	81	
↙	↓	↘	↙	78	
	0	↗	↖	↑	↗
	18	→	25	55	104
	23	↘			

PM Peak Hour Volumes

			↖	166	
6	74	30	←	163	
↙	↓	↘	↙	61	
	13	↗	↖	↑	↗
	42	→	67	178	81
	52	↘			

Average Hourly Volumes (AHV)

			↖	58	
2	47	16	←	61	
↙	↓	↘	↙	35	
	3	↗	↖	↑	↗
	15	→	23	58	46
	19	↘			

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	
7:00 AM	25	55	104	33	115	3	0	18	23	78	81	66	3
8:00 AM	13	28	52	16	57	2	0	9	12	39	41	33	2
9:00 AM	13	28	52	16	57	2	0	9	12	39	41	33	2
10:00 AM	13	28	52	16	57	2	0	9	12	39	41	33	2
3:00 PM	67	178	81	30	74	6	13	42	52	61	163	166	23
4:00 PM	34	89	41	15	37	3	7	21	26	31	82	83	12
5:00 PM	34	89	41	15	37	3	7	21	26	31	82	83	12
6:00 PM	34	89	41	15	37	3	7	21	26	31	82	83	12

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

Existing Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: The intersection does NOT meet the minimum warrants for traffic control signals.

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

IBI

OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: Donald B. Munro Drive (Major Roadway) at Langstaff Drive / Deugo Street (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	480	720	518 100%	259 54%	259 54%	259 54%	730 100%	365 76%	365 76%	365 76%	74%
B. Vehicle volume along minor roads	120	170	120	170	153 100%	77 64%	77 64%	77 64%	150 100%	75 63%	75 63%	75 63%	72%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	480	720	365 76%	183 38%	183 38%	183 38%	580 100%	290 60%	290 60%	290 60%	59%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	50	70	95 100%	48 95%	48 95%	48 95%	83 100%	42 83%	42 83%	42 83%	92%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	NO	NO
Justification 2 - Delay to Cross Traffic	NO	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	312	54%	53%
	B. Vehicle volume along minor roads (Average Hour)	120	170	144	204	76	53%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	236	41%	41%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	45	75%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	95				
49	5	87	←	125				
↙	↓	↘	↙	2				
	40	↗	↖	↑	↗			
	103	→	3	2	7			
	1	↘						

PM Peak Hour Volumes

			↖	227				
57	1	77	←	200				
↙	↓	↘	↙	7				
	80	↗	↖	↑	↗			
	65	→	5	0	10			
	1	↘						

Average Hourly Volumes (AHV)

			↖	81				
27	2	41	←	81				
↙	↓	↘	↙	2				
	30	↗	↖	↑	↗			
	42	→	2	1	4			
	1	↘						

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	40	103	1	2	125	95	3	2	7	87	5	49	0
8:00 AM	20	51	1	1	62	47	2	1	4	44	3	25	0
9:00 AM	20	51	1	1	62	47	2	1	4	44	3	25	0
10:00 AM	20	51	1	1	62	47	2	1	4	44	3	25	0
3:00 PM	80	65	1	7	200	227	5	0	10	77	1	57	0
4:00 PM	40	32	1	4	100	114	3	0	5	39	1	29	0
5:00 PM	40	32	1	4	100	114	3	0	5	39	1	29	0
6:00 PM	40	32	1	4	100	114	3	0	5	39	1	29	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

Existing Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: **The intersection does NOT meet the minimum warrants for traffic control signals.**

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

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OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: Donald B. Munro Drive (Major Roadway) at Robertlee Drive (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	480	720	439 91%	219 46%	219 46%	219 46%	615 100%	308 64%	308 64%	308 64%	65%
B. Vehicle volume along minor roads	120	170	180	255	26 14%	13 7%	13 7%	13 7%	15 8%	8 4%	8 4%	8 4%	7%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	480	720	413 86%	207 43%	207 43%	207 43%	600 100%	300 63%	300 63%	300 63%	63%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	50	70	21 41%	10 21%	10 21%	10 21%	12 24%	6 12%	6 12%	6 12%	20%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	NO	NO
Justification 2 - Delay to Cross Traffic	NO	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	263	46%	5%
	B. Vehicle volume along minor roads (Average Hour)	120	170	216	306	10	5%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	253	44%	13%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	8	13%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	54				
5	0	21	←	166				
↙	↓	↘	↙	0				
	2	↗	↖	↑	↗			
	192	→	0	0	0			
	0	↘						

PM Peak Hour Volumes

			↖	146				
3	0	12	←	306				
↙	↓	↘	↙	0				
	5	↗	↖	↑	↗			
	143	→	0	0	0			
	0	↘						

Average Hourly Volumes (AHV)

			↖	50				
2	0	8	←	118				
↙	↓	↘	↙	0				
	2	↗	↖	↑	↗			
	84	→	0	0	0			
	0	↘						

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	2	192	0	0	166	54	0	0	0	21	0	5	0
8:00 AM	1	96	0	0	83	27	0	0	0	10	0	3	0
9:00 AM	1	96	0	0	83	27	0	0	0	10	0	3	0
10:00 AM	1	96	0	0	83	27	0	0	0	10	0	3	0
3:00 PM	5	143	0	0	306	146	0	0	0	12	0	3	0
4:00 PM	2	71	0	0	153	73	0	0	0	6	0	2	0
5:00 PM	2	71	0	0	153	73	0	0	0	6	0	2	0
6:00 PM	2	71	0	0	153	73	0	0	0	6	0	2	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

3-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

Existing Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: **The intersection does NOT meet the minimum warrants for traffic control signals.**

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

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OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: Donald B. Munro Drive (Major Roadway) at Farmridge Avenue / Street 2 (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	576	864	472 82%	236 41%	236 41%	236 41%	650 100%	325 56%	325 56%	325 56%	59%
B. Vehicle volume along minor roads	120	170	144	204	33 23%	17 12%	17 12%	17 12%	21 14%	10 7%	10 7%	10 7%	12%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	576	864	438 76%	219 38%	219 38%	219 38%	629 100%	315 55%	315 55%	315 55%	57%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	60	84	20 34%	10 17%	10 17%	10 17%	13 21%	6 11%	6 11%	6 11%	17%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	N/A	N/A
Justification 2 - Delay to Cross Traffic	N/A	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	720	1080	280	39%	7%
	B. Vehicle volume along minor roads (Average Hour)	120	170	180	255	13	7%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	720	1080	267	37%	11%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	75	113	8	11%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	52				
5	0	18	←	169				
↙	↓	↘	↙	4				
	2	↗	↖	↑	↗			
	211	→	2	0	8			
	1	↘						

PM Peak Hour Volumes

			↖	143				
3	0	11	←	324				
↙	↓	↘	↙	7				
	4	↗	↖	↑	↗			
	150	→	1	0	5			
	2	↘						

Average Hourly Volumes (AHV)

			↖	49				
2	0	7	←	123				
↙	↓	↘	↙	3				
	2	↗	↖	↑	↗			
	90	→	1	0	3			
	1	↘						

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	2	211	1	4	169	52	2	0	8	18	0	5	0
8:00 AM	1	105	0	2	84	26	1	0	4	9	0	2	0
9:00 AM	1	105	0	2	84	26	1	0	4	9	0	2	0
10:00 AM	1	105	0	2	84	26	1	0	4	9	0	2	0
3:00 PM	4	150	2	7	324	143	1	0	5	11	0	3	0
4:00 PM	2	75	1	4	162	72	1	0	3	6	0	1	0
5:00 PM	2	75	1	4	162	72	1	0	3	6	0	1	0
6:00 PM	2	75	1	4	162	72	1	0	3	6	0	1	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

New Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: **The intersection does NOT meet the minimum warrants for traffic control signals.**

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

IBI

OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: Donald B. Munro Drive (Major Roadway) at Meadowridge Circle / Street 1 (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	576	864	507 88%	253 44%	253 44%	253 44%	687 100%	344 60%	344 60%	344 60%	62%
B. Vehicle volume along minor roads	120	170	144	204	38 27%	19 13%	19 13%	19 13%	24 17%	12 8%	12 8%	12 8%	14%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	576	864	468 81%	234 41%	234 41%	234 41%	663 100%	332 58%	332 58%	332 58%	59%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	60	84	21 35%	11 18%	11 18%	11 18%	13 22%	7 11%	7 11%	7 11%	18%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	N/A	N/A
Justification 2 - Delay to Cross Traffic	N/A	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	720	1080	298	41%	8%
	B. Vehicle volume along minor roads (Average Hour)	120	170	180	255	15	8%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	720	1080	283	39%	11%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	75	113	8	11%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖		52			
5	0	18	←		172			
↙	↓	↘	↙		5			
	2	↗	↖	↑	↗			
	235	→	3	0	13			
	1	↘						

PM Peak Hour Volumes

			↖		143			
3	0	11	←		343			
↙	↓	↘	↙		11			
	4	↗	↖	↑	↗			
	160	→	2	0	8			
	3	↘						

Average Hourly Volumes (AHV)

			↖		49			
2	0	7	←		129			
↙	↓	↘	↙		4			
	2	↗	↖	↑	↗			
	99	→	1	0	5			
	1	↘						

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	2	235	1	5	172	52	3	0	13	18	0	5	0
8:00 AM	1	117	1	3	86	26	2	0	6	9	0	2	0
9:00 AM	1	117	1	3	86	26	2	0	6	9	0	2	0
10:00 AM	1	117	1	3	86	26	2	0	6	9	0	2	0
3:00 PM	4	160	3	11	343	143	2	0	8	11	0	3	0
4:00 PM	2	80	1	5	172	72	1	0	4	6	0	1	0
5:00 PM	2	80	1	5	172	72	1	0	4	6	0	1	0
6:00 PM	2	80	1	5	172	72	1	0	4	6	0	1	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

New Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: **The intersection does NOT meet the minimum warrants for traffic control signals.**

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

IBI

OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: March Road (Major Roadway) at Donald B. Munro Drive / Old Carp Road (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Background Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	480	720	854 100%	427 89%	427 89%	427 89%	1070 100%	535 100%	535 100%	535 100%	96%
B. Vehicle volume along minor roads	120	170	120	170	278 100%	139 100%	139 100%	139 100%	254 100%	127 100%	127 100%	127 100%	100%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	480	720	576 100%	288 60%	288 60%	288 60%	816 100%	408 85%	408 85%	408 85%	79%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	50	70	219 100%	110 100%	110 100%	110 100%	178 100%	89 100%	89 100%	89 100%	100%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	YES	NO
Justification 2 - Delay to Cross Traffic	NO	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	481	84%	84%
	B. Vehicle volume along minor roads (Average Hour)	120	170	144	204	133	92%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	348	60%	60%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	91	100%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	95			
19	107	104	←	160			
↙	↓	↘	↙	1			
	15	↗	↖	↑	↗		
	293	→	8	38	2		
	13	↘					

PM Peak Hour Volumes

			↖	265			
28	47	81	←	410			
↙	↓	↘	↙	2			
	14	↗	↖	↑	↗		
	113	→	17	81	1		
	11	↘					

Average Hourly Volumes (AHV)

			↖	90			
12	39	46	←	142			
↙	↓	↘	↙	1			
	7	↗	↖	↑	↗		
	102	→	6	30	1		
	6	↘					

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	15	293	13	1	160	95	8	38	2	104	107	19	0
8:00 AM	7	147	7	1	80	47	4	19	1	52	54	9	0
9:00 AM	7	147	7	1	80	47	4	19	1	52	54	9	0
10:00 AM	7	147	7	1	80	47	4	19	1	52	54	9	0
3:00 PM	14	113	11	2	410	265	17	81	1	81	47	28	0
4:00 PM	7	57	6	1	205	132	8	40	1	41	24	14	0
5:00 PM	7	57	6	1	205	132	8	40	1	41	24	14	0
6:00 PM	7	57	6	1	205	132	8	40	1	41	24	14	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

Existing Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: **The intersection does NOT meet the minimum warrants for traffic control signals.**

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

IBI

OTM BOOK 12* - TRAFFIC SIGNAL WARRANT

Project: 232 Donald B. Munro Drive **Date:** ###############

Project #: 131947

Location: March Road (Major Roadway) at Donald B. Munro Drive / Old Carp Road (Minor Roadway)

Orientation: East/West North/South

Municipality: City of Ottawa **Scenario:** Future (2029) Total Traffic

Justification 1 - Minimum Vehicle Volume

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, all approaches	480	720	480	720	906 100%	453 94%	453 94%	453 94%	1126 100%	563 100%	563 100%	563 100%	98%
B. Vehicle volume along minor roads	120	170	120	170	320 100%	160 100%	160 100%	160 100%	290 100%	145 100%	145 100%	145 100%	100%

Justification 2 - Delay to Cross Traffic

WARRANT	MINIMUM REQUIREMENT				COMPLIANCE								SECTIONAL PERCENT
	FREE FLOW	RESTR. FLOW	ADJUST. FREE FLOW	ADJUST. RESTR. FLOW	7:00 AM	8:00 AM	9:00 AM	10:00 AM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	
A. Vehicle volumes, along artery	480	720	480	720	586 100%	293 61%	293 61%	293 61%	837 100%	418 87%	418 87%	418 87%	81%
B. Combined vehicle and pedestrian volume crossing artery from minor roads	50	70	50	70	244 100%	122 100%	122 100%	122 100%	198 100%	99 100%	99 100%	99 100%	100%

Justification 3 - Volume/Delay Combination

JUSTIFICATION	SATISFIED TO 80% OR MORE?	BOTH SATISFIED TO 80% OR MORE?
Justification 1 - Minimum Vehicular Volume	YES	YES
Justification 2 - Delay to Cross Traffic	YES	

Justification 7 - Projected Volumes

WARRANT	DESCRIPTION	MINIMUM REQUIREMENT				COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	ADJUSTED FREE FLOW	ADJUSTED RESTRICTED FLOW	SECTIONAL AHV	SECTIONAL %	ENTIRE %
1. MINIMUM VEHICULAR VOLUME	A. Vehicle volumes, all approaches (Average Hour)	480	720	576	864	508	88%	88%
	B. Vehicle volume along minor roads (Average Hour)	120	170	144	204	152	100%	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volumes, along artery (Average Hour)	480	720	576	864	356	62%	62%
	B. Combined vehicle and pedestrian volume crossing artery from minor roads (Average Hour)	50	75	60	90	101	100%	

Projected Traffic Volumes:

Average Hourly Volume (AHV) Equation: AHV = (amPHV + pmPHV)/4

AM Peak Hour Volumes

			↖	99				
30	121	116	←	160				
↙	↓	↘	↙	1				
	20	↗	↖	↑	↗			
	293	→	8	44	2			
	13	↘						

PM Peak Hour Volumes

			↖	275				
35	56	89	←	410				
↙	↓	↘	↙	2				
	24	↗	↖	↑	↗			
	113	→	17	93	1			
	11	↘						

Average Hourly Volumes (AHV)

			↖	94				
16	44	51	←	142				
↙	↓	↘	↙	1				
	11	↗	↖	↑	↗			
	102	→	6	34	1			
	6	↘						

Eight Hour Traffic Volumes:

Hour	Major Road						Minor Road						Ped*
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
7:00 AM	20	293	13	1	160	99	8	44	2	116	121	30	0
8:00 AM	10	147	7	1	80	50	4	22	1	58	60	15	0
9:00 AM	10	147	7	1	80	50	4	22	1	58	60	15	0
10:00 AM	10	147	7	1	80	50	4	22	1	58	60	15	0
3:00 PM	24	113	11	2	410	275	17	93	1	89	56	35	0
4:00 PM	12	57	6	1	205	138	8	47	1	44	28	17	0
5:00 PM	12	57	6	1	205	138	8	47	1	44	28	17	0
6:00 PM	12	57	6	1	205	138	8	47	1	44	28	17	0

** Number of pedestrians crossing the major road*

Notes:

1. Vehicle volume warrant (1A) and (2A) for intersections of roadways having two or more moving lanes in one direction should be 25% higher than the values given above.

1 Lane per Direction

2. Warrant values for free flow apply when the 85th percentile speed of artery traffic equals or exceeds 70 km/h or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000. Warrant values for restricted flow apply to large urban communities when the 85th percentile speed of artery traffic does not exceed 70 km/h.

Free Flow

3. The lowest sectional percentage governs the entire warrant.

4. For "T" intersections the warrant values for the minor road should be increased by 50% (Warrant 1B only).

4-legged Intersection

5. All flow values for Justification 1 and 2 are to be increased by 20% in the case of new intersections, Justification 3 is to only be used for existing intersections and all flow values for Warrant 1 and Warrant 2 of Justification 7 are to be increased by 20% for existing intersections and by 50% in the case of new intersections.

Existing Intersection

6. The crossing volumes are defined as the sum of:
   - (a) Left-turns from both minor road approaches.
   - (b) The heaviest through volume from the minor road.
   - (c) 50% of the heavier left turn movement from major road when both of the following are met:
     - (i) the left-turn volume >120 vph
     - (ii) the left-turn volume plus the opposing volume >720 vph
   - (d) Pedestrians crossing the main road.

CONCLUSION: The intersection meets the minimum warrants for traffic control signals.

* "Ontario Traffic Manual, Book 12 (March 2012)", Ontario Ministry of Transportation.

City of Ottawa
Roundabout Initial Feasability Screening Tool

The intent of this screening tool is to provide a relatively quick assessment of the feasibility of a roundabout at a particular intersection in comparison to other appropriate forms of traffic control or road modifications including all-way stop control, traffic signals, auxiliary lanes, etc. The intended outcome of this tool is to provide enough information to assist staff in deciding whether or not to proceed with an Intersection Control Study to investigate the feasibility of a roundabout in more detail.

1	Project Name:	232 Donald B. Munro Drive
2	Intersection:	March Road & Donald B. Munro Drive / Old Carp Road
3	Location and Description of Intersection: Lane Configuration, total or approach AADT, distance to nearby intersection(s), etc. Attach or sketch a diagram and include existing and/or horizon-year turning movements. If an existing intersection then indicate type of control	The intersection is currently configured as a four-legged, unsignalized intersection with stop-control on the northbound and southbound approaches and a channelized westbound right-turn lane.
4	What traditional modifications are proposed? All-way stop control, traffic signals, auxiliary lanes, etc. Attach or sketch a diagram if necessary.	No modifications are proposed.
5	What size of roundabout is being considered? Describe, and attach a Roundabout Traffic Flow Worksheet	Single-lane roundabout
6	Why is a roundabout being considered?	To address historical collision issues

7 Are there contra-indications for

If "Yes" is indicated for one or more of the contra-indications then a roundabout may be problematic at the subject intersection. That is not to say that a roundabout is not possible, just that there may be difficulties or high

No.	Contra-Indication	Outcome
1	Is there insufficient property at the intersection (i.e. less than 44 metres diameter if considering a single-lane roundabout, and less than 60 metres if considering a two-lane roundabout) or property constraints that would require demolition of adjacent structures?	Yes ☐ No ☒
2	Are there any instances where stopping sight distance (SSD) of a roundabout yield line may not be attainable (i.e. the intersection is on a crest vertical curve)?	Yes ☐ No ☒
3	Is there an existing uncontrolled approach with a grade in excess of 4 percent?	Yes ☐ No ☒
4	Is the intersection located within a coordinated signal system?	Yes ☐ No ☒
5	Is there a closely-spaced traffic signal or railway crossing that could not be controlled with a nearby roundabout?	Yes ☐ No ☒
6	Are significant differences in directional flows or any situations of sudden high demand expected?	Yes ☒ No ☐
7	Are there known visually-impaired pedestrians that cross this intersection?	Yes ☐ No ☒

8 Are there suitability factors for a roundabout?

If "Yes" is indicated for two or more of the suitability factors then a roundabout should be technically feasible at the subject intersection..

No.	Suitability Factor	Outcome
1	Does the intersection currently experience an average collision frequency of more than 1.5 injury crashes per year, or a collision rate in excess of 1 injury crash per 1 million vehicles entering (MVE)?	Yes ☒ No ☐
2	Has there been a fatal crash at the intersection in the last 10 years?	Yes ☐ No ☒
3	Are capacity problems currently being experienced, or expected in the future?	Yes ☐ No ☒
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes ☒ No ☐
5	Does the intersection have more than 4 legs, or unusual geometry?	Yes ☐ No ☒
6	Will Planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes ☐ No ☒
7	Is the intersection located at a transition between rural and urban environments (i.e. an urban boundary) such that a roundabout could act as a means of speed transition?	Yes ☐ No ☒

9	Conclusions/recommendation whether to proceed with an Intersection Control Study:	Although traffic flows in the east/west direction are roughly double the traffic flows in the north/south direction, the intersection meets two of the suitability factors (high collision frequency and meets traffic signal warrants) and therefore a roundabout should be considered at this location.

City of Ottawa
Mini-Roundabout Screening Criteria

Mini roundabouts are best suited and most effective when they meet the following conditions;

No.	Criteria	Outcome
1	Located at minor collector road intersecting a minor collector road or a local residential road	Yes [ ] No [X]
2	ADT lesser than 15,000 (estimated ADT in case of new development area)	Yes [X] No [ ]
3	At least 10% of the total traffic has generated from minor road (estimated in case of new development area)	Yes [X] No [ ]
4	Operating speed <55km/hr or posted speed ≤ 50km/hr in a new development area	Yes [ ] No [X]
5	A right of way wide enough to accommodate a 13 m to 27 m Inscribed Circle Diameter roundabout and adjacent sidewalks	Yes [X] No [ ]
6	Situated on a non truck route or roads without heavy truck movements	Yes [ ] No [X]
7	Intersections with no more than four legs	Yes [X] No [ ]

Conclusion

Based on the roadway classification and posted speed of March Road, as well as its designation as a truck route, a mini-roundabout is not appropriate for this location.

Appendix I – Transportation Demand Management

TDM Measures Checklist:
Residential Developments (multi-family, condominium or subdivision)

Legend

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

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☐ Not Applicable to Subdivisions
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances *(multi-family, condominium)*	☐ Not Applicable to Subdivisions
	2.2	**Bicycle skills training**	
BETTER	2.2.1	Offer on-site cycling courses for residents, or subsidize off-site courses	☐

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances *(multi-family, condominium)*	☐ Not Applicable to Subdivisions
BETTER		3.1.2	Provide real-time arrival information display at entrances *(multi-family, condominium)*	☐ Not Applicable to Subdivisions
		3.2	**Transit fare incentives**	
BASIC	★	3.2.1	Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	☐
BETTER		3.2.2	Offer at least one year of free monthly transit passes on residence purchase/move-in	☐
		3.3	**Enhanced public transit service**	
BETTER	★	3.3.1	Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels *(subdivision)*	☐
		3.4	**Private transit service**	
BETTER		3.4.1	Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	☐ Not Applicable to Subdivisions
		4.	**CARSHARING & BIKESHARING**	
		4.1	**Bikeshare stations & memberships**	
BETTER		4.1.1	Contract with provider to install on-site bikeshare station (*multi-family)*	☐ Not Applicable to Subdivisions
BETTER		4.1.2	Provide residents with bikeshare memberships, either free or subsidized *(multi-family)*	☐ Not Applicable to Subdivisions
		4.2	**Carshare vehicles & memberships**	
BETTER		4.2.1	Contract with provider to install on-site carshare vehicles and promote their use by residents	☐ Not Applicable to Subdivisions
BETTER		4.2.2	Provide residents with carshare memberships, either free or subsidized	☐ Not Applicable to Subdivisions
		5.	**PARKING**	
		5.1	**Priced parking**	
BASIC	★	5.1.1	Unbundle parking cost from purchase price *(condominium)*	☐ Not Applicable to Subdivisions
BASIC	★	5.1.2	Unbundle parking cost from monthly rent *(multi-family)*	☐ Not Applicable to Subdivisions

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☑ A multi-modal travel package will be provided to new homeowners and will include information about local trails, bike infrastructure, nearby services/amenities, etc.
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☐

Appendix J – Intersection Capacity Analyses

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	15	21	58	10	15	23	51	89	29	106	3
Future Vol, veh/h	0	15	21	58	10	15	23	51	89	29	106	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	0	7	14	9	10	0	4	8	9	7	2	0
Mvmt Flow	0	17	23	64	11	17	26	57	99	32	118	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	8.6	8.3	8.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	70%	21%
Vol Thru, %	31%	42%	12%	77%
Vol Right, %	55%	58%	18%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	163	36	83	138
LT Vol	23	0	58	29
Through Vol	51	15	10	106
RT Vol	89	21	15	3
Lane Flow Rate	181	40	92	153
Geometry Grp	1	1	1	1
Degree of Util (X)	0.209	0.05	0.125	0.194
Departure Headway (Hd)	4.164	4.53	4.874	4.558
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	864	790	736	788
Service Time	2.184	2.56	2.9	2.579
HCM Lane V/C Ratio	0.209	0.051	0.125	0.194
HCM Control Delay	8.3	7.8	8.6	8.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.2	0.4	0.7

Intersection	
Intersection Delay, s/veh	8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	32	92	1	2	44	41	3	2	7	65	5	35
Future Vol, veh/h	32	92	1	2	44	41	3	2	7	65	5	35
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	36	102	1	2	49	46	3	2	8	72	6	39
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	7.6	7.3	8.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	26%	2%	62%
Vol Thru, %	17%	74%	51%	5%
Vol Right, %	58%	1%	47%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	125	87	105
LT Vol	3	32	2	65
Through Vol	2	92	44	5
RT Vol	7	1	41	35
Lane Flow Rate	13	139	97	117
Geometry Grp	1	1	1	1
Degree of Util (X)	0.016	0.168	0.109	0.141
Departure Headway (Hd)	4.248	4.351	4.065	4.355
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	844	829	885	826
Service Time	2.265	2.351	2.079	2.369
HCM Lane V/C Ratio	0.015	0.168	0.11	0.142
HCM Control Delay	7.3	8.2	7.6	8.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.6	0.4	0.5

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	153	74	9	21	5
Future Vol, veh/h	2	153	74	9	21	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	8	7	0	0	0
Mvmt Flow	2	170	82	10	23	6

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	92	0	-	0	261	87
Stage 1	-	-	-	-	87	-
Stage 2	-	-	-	-	174	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1515	-	-	-	732	977
Stage 1	-	-	-	-	941	-
Stage 2	-	-	-	-	861	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1515	-	-	-	731	977
Mov Cap-2 Maneuver	-	-	-	-	731	-
Stage 1	-	-	-	-	940	-
Stage 2	-	-	-	-	861	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1515	-	-	-	768
HCM Lane V/C Ratio	0.001	-	-	-	0.038
HCM Control Delay (s)	7.4	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	173	1	4	81	0	2	0	8	0	0	0
Future Vol, veh/h	0	173	1	4	81	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	192	1	4	90	0	2	0	9	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	90	0	0	193	0	0	291	291	193	295	291	90
Stage 1	-	-	-	-	-	-	193	193	-	98	98	-
Stage 2	-	-	-	-	-	-	98	98	-	197	193	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1518	-	-	1392	-	-	665	623	854	661	623	973
Stage 1	-	-	-	-	-	-	813	745	-	913	818	-
Stage 2	-	-	-	-	-	-	913	818	-	809	745	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1518	-	-	1392	-	-	664	621	854	652	621	973
Mov Cap-2 Maneuver	-	-	-	-	-	-	664	621	-	652	621	-
Stage 1	-	-	-	-	-	-	813	745	-	913	816	-
Stage 2	-	-	-	-	-	-	910	816	-	801	745	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	808	1518	-	-	1392	-	-	-
HCM Lane V/C Ratio	0.014	-	-	-	0.003	-	-	-
HCM Control Delay (s)	9.5	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	180	1	5	81	0	3	0	13	0	0	0
Future Vol, veh/h	0	180	1	5	81	0	3	0	13	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	200	1	6	90	0	3	0	14	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	90	0	0	201	0	0	303	303	201	310	303	90
Stage 1	-	-	-	-	-	-	201	201	-	102	102	-
Stage 2	-	-	-	-	-	-	102	102	-	208	201	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1518	-	-	1383	-	-	653	613	845	646	613	973
Stage 1	-	-	-	-	-	-	805	739	-	909	815	-
Stage 2	-	-	-	-	-	-	909	815	-	799	739	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1518	-	-	1383	-	-	650	610	845	632	610	973
Mov Cap-2 Maneuver	-	-	-	-	-	-	650	610	-	632	610	-
Stage 1	-	-	-	-	-	-	805	739	-	909	811	-
Stage 2	-	-	-	-	-	-	904	811	-	785	739	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.6	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	800	1518	-	-	1383	-	-	-
HCM Lane V/C Ratio	0.022	-	-	-	0.004	-	-	-
HCM Control Delay (s)	9.6	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	13	271	12	1	85	42	7	32	2	87	90	16
Future Vol, veh/h	13	271	12	1	85	42	7	32	2	87	90	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	9	4	17	0	1	3	14	4	50	7	1	8
Mvmt Flow	14	301	13	1	94	47	8	36	2	97	100	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	94	0	0	314	0	0	491	432	308	451	438	94
Stage 1	-	-	-	-	-	-	336	336	-	96	96	-
Stage 2	-	-	-	-	-	-	155	96	-	355	342	-
Critical Hdwy	4.19	-	-	4.1	-	-	7.24	6.54	6.7	7.17	6.51	6.28
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Follow-up Hdwy	2.281	-	-	2.2	-	-	3.626	4.036	3.75	3.563	4.009	3.372
Pot Cap-1 Maneuver	1457	-	-	1258	-	-	469	513	633	510	514	947
Stage 1	-	-	-	-	-	-	654	638	-	898	817	-
Stage 2	-	-	-	-	-	-	820	812	-	652	640	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1457	-	-	1258	-	-	386	506	633	476	507	947
Mov Cap-2 Maneuver	-	-	-	-	-	-	386	506	-	476	507	-
Stage 1	-	-	-	-	-	-	646	630	-	887	816	-
Stage 2	-	-	-	-	-	-	705	811	-	606	632	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.1	13.2	17
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	485	1457	-	-	1258	-	-	512
HCM Lane V/C Ratio	0.094	0.01	-	-	0.001	-	-	0.419
HCM Control Delay (s)	13.2	7.5	0	-	7.9	0	-	17
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	2

Intersection	
Intersection Delay, s/veh	9.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	32	48	46	46	34	62	165	60	21	68	5
Future Vol, veh/h	12	32	48	46	46	34	62	165	60	21	68	5
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	0	0	0	0	0	0	0	1	2	5	3	0
Mvmt Flow	13	36	53	51	51	38	69	183	67	23	76	6
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.6	9.2	10.6	8.9
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	22%	13%	37%	22%
Vol Thru, %	57%	35%	37%	72%
Vol Right, %	21%	52%	27%	5%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	287	92	126	94
LT Vol	62	12	46	21
Through Vol	165	32	46	68
RT Vol	60	48	34	5
Lane Flow Rate	319	102	140	104
Geometry Grp	1	1	1	1
Degree of Util (X)	0.402	0.136	0.192	0.144
Departure Headway (Hd)	4.538	4.789	4.93	4.962
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	791	743	722	718
Service Time	2.586	2.856	2.994	3.026
HCM Lane V/C Ratio	0.403	0.137	0.194	0.145
HCM Control Delay	10.6	8.6	9.2	8.9
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2	0.5	0.7	0.5

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	57	52	1	7	83	72	5	0	10	53	1	39
Future Vol, veh/h	57	52	1	7	83	72	5	0	10	53	1	39
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	63	58	1	8	92	80	6	0	11	59	1	43
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	8.1	7.5	8.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	33%	52%	4%	57%
Vol Thru, %	0%	47%	51%	1%
Vol Right, %	67%	1%	44%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	110	162	93
LT Vol	5	57	7	53
Through Vol	0	52	83	1
RT Vol	10	1	72	39
Lane Flow Rate	17	122	180	103
Geometry Grp	1	1	1	1
Degree of Util (X)	0.02	0.151	0.203	0.127
Departure Headway (Hd)	4.345	4.452	4.05	4.437
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	825	808	889	810
Service Time	2.366	2.467	2.063	2.454
HCM Lane V/C Ratio	0.021	0.151	0.202	0.127
HCM Control Delay	7.5	8.3	8.1	8.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.5	0.8	0.4

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	102	154	20	12	3
Future Vol, veh/h	5	102	154	20	12	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	0	2	1	0	0	0
Mvmt Flow	6	113	171	22	13	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	193	0	-	0	307	182
Stage 1	-	-	-	-	182	-
Stage 2	-	-	-	-	125	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1392	-	-	-	689	866
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	906	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1392	-	-	-	686	866
Mov Cap-2 Maneuver	-	-	-	-	686	-
Stage 1	-	-	-	-	850	-
Stage 2	-	-	-	-	906	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	10.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1392	-	-	-	716
HCM Lane V/C Ratio	0.004	-	-	-	0.023
HCM Control Delay (s)	7.6	0	-	-	10.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	112	2	7	173	0	1	0	5	0	0	0
Future Vol, veh/h	0	112	2	7	173	0	1	0	5	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	124	2	8	192	0	1	0	6	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	192	0	0	126	0	0	333	333	125	336	334	192
Stage 1	-	-	-	-	-	-	125	125	-	208	208	-
Stage 2	-	-	-	-	-	-	208	208	-	128	126	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1394	-	-	1473	-	-	624	590	931	622	589	855
Stage 1	-	-	-	-	-	-	884	796	-	799	734	-
Stage 2	-	-	-	-	-	-	799	734	-	881	796	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1394	-	-	1473	-	-	621	586	931	615	585	855
Mov Cap-2 Maneuver	-	-	-	-	-	-	621	586	-	615	585	-
Stage 1	-	-	-	-	-	-	884	796	-	799	730	-
Stage 2	-	-	-	-	-	-	794	730	-	876	796	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	9.2	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	859	1394	-	-	1473	-	-	-
HCM Lane V/C Ratio	0.008	-	-	-	0.005	-	-	-
HCM Control Delay (s)	9.2	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	115	3	11	178	0	2	0	8	0	0	0
Future Vol, veh/h	0	115	3	11	178	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	128	3	12	198	0	2	0	9	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	198	0	0	131	0	0	352	352	130	356	353	198
Stage 1	-	-	-	-	-	-	130	130	-	222	222	-
Stage 2	-	-	-	-	-	-	222	222	-	134	131	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1387	-	-	1467	-	-	607	576	925	603	575	848
Stage 1	-	-	-	-	-	-	878	792	-	785	723	-
Stage 2	-	-	-	-	-	-	785	723	-	874	792	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1387	-	-	1467	-	-	603	571	925	593	570	848
Mov Cap-2 Maneuver	-	-	-	-	-	-	603	571	-	593	570	-
Stage 1	-	-	-	-	-	-	878	792	-	785	716	-
Stage 2	-	-	-	-	-	-	778	716	-	866	792	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.4	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	836	1387	-	-	1467	-	-	-
HCM Lane V/C Ratio	0.013	-	-	-	0.008	-	-	-
HCM Control Delay (s)	9.4	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	4.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	11	105	10	2	283	112	15	65	1	64	37	22
Future Vol, veh/h	11	105	10	2	283	112	15	65	1	64	37	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	0	1	0	0	4	1	0	0	0	2	0	6
Mvmt Flow	12	117	11	2	314	124	17	72	1	71	41	24

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	314	0	0	128	0	0	498	465	123	501	470	314
Stage 1	-	-	-	-	-	-	147	147	-	318	318	-
Stage 2	-	-	-	-	-	-	351	318	-	183	152	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.12	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.518	4	3.354
Pot Cap-1 Maneuver	1258	-	-	1470	-	-	486	498	933	480	495	717
Stage 1	-	-	-	-	-	-	860	779	-	693	657	-
Stage 2	-	-	-	-	-	-	670	657	-	819	775	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1258	-	-	1470	-	-	435	492	933	421	489	717
Mov Cap-2 Maneuver	-	-	-	-	-	-	435	492	-	421	489	-
Stage 1	-	-	-	-	-	-	851	771	-	686	656	-
Stage 2	-	-	-	-	-	-	605	656	-	734	767	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	0	14.2	15.6
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	483	1258	-	-	1470	-	-	476
HCM Lane V/C Ratio	0.186	0.01	-	-	0.002	-	-	0.287
HCM Control Delay (s)	14.2	7.9	0	-	7.5	0	-	15.6
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	1.2

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	17	22	71	11	19	24	53	97	30	109	3
Future Vol, veh/h	0	17	22	71	11	19	24	53	97	30	109	3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	7	14	9	10	0	4	8	9	7	2	0
Mvmt Flow	0	17	22	71	11	19	24	53	97	30	109	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	8.6	8.2	8.6
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	70%	21%
Vol Thru, %	30%	44%	11%	77%
Vol Right, %	56%	56%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	174	39	101	142
LT Vol	24	0	71	30
Through Vol	53	17	11	109
RT Vol	97	22	19	3
Lane Flow Rate	174	39	101	142
Geometry Grp	1	1	1	1
Degree of Util (X)	0.201	0.049	0.136	0.18
Departure Headway (Hd)	4.165	4.513	4.83	4.572
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	863	793	743	787
Service Time	2.183	2.541	2.854	2.592
HCM Lane V/C Ratio	0.202	0.049	0.136	0.18
HCM Control Delay	8.2	7.8	8.6	8.6
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.7	0.2	0.5	0.7

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	94	1	2	45	50	3	2	7	87	5	49
Future Vol, veh/h	40	94	1	2	45	50	3	2	7	87	5	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	40	94	1	2	45	50	3	2	7	87	5	49
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	7.6	7.3	8.2
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	30%	2%	62%
Vol Thru, %	17%	70%	46%	4%
Vol Right, %	58%	1%	52%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	135	97	141
LT Vol	3	40	2	87
Through Vol	2	94	45	5
RT Vol	7	1	50	49
Lane Flow Rate	12	135	97	141
Geometry Grp	1	1	1	1
Degree of Util (X)	0.014	0.165	0.11	0.17
Departure Headway (Hd)	4.271	4.402	4.09	4.341
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	840	818	879	829
Service Time	2.289	2.415	2.103	2.355
HCM Lane V/C Ratio	0.014	0.165	0.11	0.17
HCM Control Delay	7.3	8.3	7.6	8.2
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.6	0.4	0.6

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	180	85	9	21	5
Future Vol, veh/h	2	180	85	9	21	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	8	7	0	0	0
Mvmt Flow	2	180	85	9	21	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	94	0	-	0	274	90
Stage 1	-	-	-	-	90	-
Stage 2	-	-	-	-	184	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1513	-	-	-	720	973
Stage 1	-	-	-	-	939	-
Stage 2	-	-	-	-	852	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1513	-	-	-	719	973
Mov Cap-2 Maneuver	-	-	-	-	719	-
Stage 1	-	-	-	-	938	-
Stage 2	-	-	-	-	852	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1513	-	-	-	757
HCM Lane V/C Ratio	0.001	-	-	-	0.034
HCM Control Delay (s)	7.4	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	200	1	4	92	0	2	0	8	0	0	0
Future Vol, veh/h	0	200	1	4	92	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	200	1	4	92	0	2	0	8	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	92	0	0	201	0	0	301	301	201	305	301	92
Stage 1	-	-	-	-	-	-	201	201	-	100	100	-
Stage 2	-	-	-	-	-	-	100	100	-	205	201	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1515	-	-	1383	-	-	655	615	845	651	615	971
Stage 1	-	-	-	-	-	-	805	739	-	911	816	-
Stage 2	-	-	-	-	-	-	911	816	-	802	739	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1515	-	-	1383	-	-	654	613	845	643	613	971
Mov Cap-2 Maneuver	-	-	-	-	-	-	654	613	-	643	613	-
Stage 1	-	-	-	-	-	-	805	739	-	911	814	-
Stage 2	-	-	-	-	-	-	908	814	-	794	739	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	9.6	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	798	1515	-	-	1383	-	-	-
HCM Lane V/C Ratio	0.013	-	-	-	0.003	-	-	-
HCM Control Delay (s)	9.6	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	208	1	5	92	0	3	0	13	0	0	0
Future Vol, veh/h	0	208	1	5	92	0	3	0	13	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	208	1	5	92	0	3	0	13	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	92	0	0	209	0	0	311	311	209	317	311	92
Stage 1	-	-	-	-	-	-	209	209	-	102	102	-
Stage 2	-	-	-	-	-	-	102	102	-	215	209	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1515	-	-	1374	-	-	645	607	836	640	607	971
Stage 1	-	-	-	-	-	-	798	733	-	909	815	-
Stage 2	-	-	-	-	-	-	909	815	-	792	733	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1515	-	-	1374	-	-	643	605	836	628	605	971
Mov Cap-2 Maneuver	-	-	-	-	-	-	643	605	-	628	605	-
Stage 1	-	-	-	-	-	-	798	733	-	909	812	-
Stage 2	-	-	-	-	-	-	905	812	-	780	733	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.6	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	791	1515	-	-	1374	-	-	-
HCM Lane V/C Ratio	0.02	-	-	-	0.004	-	-	-
HCM Control Delay (s)	9.6	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱		↕			↕	
Traffic Vol, veh/h	14	279	13	1	87	48	7	36	2	100	103	18
Future Vol, veh/h	14	279	13	1	87	48	7	36	2	100	103	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	9	4	17	0	1	3	14	4	50	7	1	8
Mvmt Flow	14	279	13	1	87	48	7	36	2	100	103	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	87	0	0	292	0	0	464	403	286	422	409	87
Stage 1	-	-	-	-	-	-	314	314	-	89	89	-
Stage 2	-	-	-	-	-	-	150	89	-	333	320	-
Critical Hdwy	4.19	-	-	4.1	-	-	7.24	6.54	6.7	7.17	6.51	6.28
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Follow-up Hdwy	2.281	-	-	2.2	-	-	3.626	4.036	3.75	3.563	4.009	3.372
Pot Cap-1 Maneuver	1466	-	-	1281	-	-	489	533	652	533	534	955
Stage 1	-	-	-	-	-	-	672	653	-	906	823	-
Stage 2	-	-	-	-	-	-	825	817	-	670	654	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1466	-	-	1281	-	-	404	527	652	499	528	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	404	527	-	499	528	-
Stage 1	-	-	-	-	-	-	665	646	-	896	822	-
Stage 2	-	-	-	-	-	-	707	816	-	624	647	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.1	12.8	16.5
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	507	1466	-	-	1281	-	-	533
HCM Lane V/C Ratio	0.089	0.01	-	-	0.001	-	-	0.415
HCM Control Delay (s)	12.8	7.5	0	-	7.8	0	-	16.5
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	2

Intersection	
Intersection Delay, s/veh	9.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	39	49	56	54	37	64	170	74	27	70	5
Future Vol, veh/h	13	39	49	56	54	37	64	170	74	27	70	5
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	1	2	5	3	0
Mvmt Flow	13	39	49	56	54	37	64	170	74	27	70	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.6	9.2	10.4	8.9
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	21%	13%	38%	26%
Vol Thru, %	55%	39%	37%	69%
Vol Right, %	24%	49%	25%	5%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	308	101	147	102
LT Vol	64	13	56	27
Through Vol	170	39	54	70
RT Vol	74	49	37	5
Lane Flow Rate	308	101	147	102
Geometry Grp	1	1	1	1
Degree of Util (X)	0.387	0.134	0.2	0.141
Departure Headway (Hd)	4.526	4.786	4.91	4.972
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	792	743	726	717
Service Time	2.574	2.852	2.971	3.034
HCM Lane V/C Ratio	0.389	0.136	0.202	0.142
HCM Control Delay	10.4	8.6	9.2	8.9
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.8	0.5	0.7	0.5

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	80	54	1	7	85	101	5	0	10	77	1	57
Future Vol, veh/h	80	54	1	7	85	101	5	0	10	77	1	57
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	80	54	1	7	85	101	5	0	10	77	1	57
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.5	8.3	7.6	8.4
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	33%	59%	4%	57%
Vol Thru, %	0%	40%	44%	1%
Vol Right, %	67%	1%	52%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	135	193	135
LT Vol	5	80	7	77
Through Vol	0	54	85	1
RT Vol	10	1	101	57
Lane Flow Rate	15	135	193	135
Geometry Grp	1	1	1	1
Degree of Util (X)	0.019	0.171	0.219	0.169
Departure Headway (Hd)	4.448	4.559	4.094	4.495
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	804	787	878	799
Service Time	2.478	2.582	2.115	2.518
HCM Lane V/C Ratio	0.019	0.172	0.22	0.169
HCM Control Delay	7.6	8.5	8.3	8.4
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.6	0.8	0.6

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	129	188	20	12	3
Future Vol, veh/h	5	129	188	20	12	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	1	0	0	0
Mvmt Flow	5	129	188	20	12	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	208	0	-	0	337	198
Stage 1	-	-	-	-	198	-
Stage 2	-	-	-	-	139	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1375	-	-	-	663	848
Stage 1	-	-	-	-	840	-
Stage 2	-	-	-	-	893	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1375	-	-	-	660	848
Mov Cap-2 Maneuver	-	-	-	-	660	-
Stage 1	-	-	-	-	837	-
Stage 2	-	-	-	-	893	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1375	-	-	-	691
HCM Lane V/C Ratio	0.004	-	-	-	0.022
HCM Control Delay (s)	7.6	0	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	140	2	7	207	0	1	0	5	0	0	0
Future Vol, veh/h	0	140	2	7	207	0	1	0	5	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	140	2	7	207	0	1	0	5	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	207	0	0	142	0	0	362	362	141	365	363	207
Stage 1	-	-	-	-	-	-	141	141	-	221	221	-
Stage 2	-	-	-	-	-	-	221	221	-	144	142	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1376	-	-	1453	-	-	598	569	912	595	568	839
Stage 1	-	-	-	-	-	-	867	784	-	786	724	-
Stage 2	-	-	-	-	-	-	786	724	-	864	783	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1376	-	-	1453	-	-	596	566	912	590	565	839
Mov Cap-2 Maneuver	-	-	-	-	-	-	596	566	-	590	565	-
Stage 1	-	-	-	-	-	-	867	784	-	786	720	-
Stage 2	-	-	-	-	-	-	782	720	-	859	783	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	9.3	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	838	1376	-	-	1453	-	-	-
HCM Lane V/C Ratio	0.007	-	-	-	0.005	-	-	-
HCM Control Delay (s)	9.3	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	142	3	11	212	0	2	0	8	0	0	0
Future Vol, veh/h	0	142	3	11	212	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	142	3	11	212	0	2	0	8	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	212	0	0	145	0	0	378	378	144	382	379	212
Stage 1	-	-	-	-	-	-	144	144	-	234	234	-
Stage 2	-	-	-	-	-	-	234	234	-	148	145	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1370	-	-	1450	-	-	583	557	909	580	556	833
Stage 1	-	-	-	-	-	-	864	782	-	774	715	-
Stage 2	-	-	-	-	-	-	774	715	-	859	781	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1370	-	-	1450	-	-	579	552	909	571	551	833
Mov Cap-2 Maneuver	-	-	-	-	-	-	579	552	-	571	551	-
Stage 1	-	-	-	-	-	-	864	782	-	774	709	-
Stage 2	-	-	-	-	-	-	767	709	-	851	781	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	816	1370	-	-	1450	-	-	-
HCM Lane V/C Ratio	0.012	-	-	-	0.008	-	-	-
HCM Control Delay (s)	9.5	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	4.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	13	108	11	2	291	133	16	77	1	78	45	27
Future Vol, veh/h	13	108	11	2	291	133	16	77	1	78	45	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	1	0	0	0	2	0	6
Mvmt Flow	13	108	11	2	291	133	16	77	1	78	45	27

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	291	0	0	119	0	0	471	435	114	474	440	291
Stage 1	-	-	-	-	-	-	140	140	-	295	295	-
Stage 2	-	-	-	-	-	-	331	295	-	179	145	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.12	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.518	4	3.354
Pot Cap-1 Maneuver	1282	-	-	1482	-	-	506	517	944	501	514	739
Stage 1	-	-	-	-	-	-	868	785	-	713	673	-
Stage 2	-	-	-	-	-	-	687	673	-	823	781	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1282	-	-	1482	-	-	450	510	944	438	507	739
Mov Cap-2 Maneuver	-	-	-	-	-	-	450	510	-	438	507	-
Stage 1	-	-	-	-	-	-	858	776	-	705	672	-
Stage 2	-	-	-	-	-	-	616	672	-	732	772	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	13.8	15.4
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	501	1282	-	-	1482	-	-	494
HCM Lane V/C Ratio	0.188	0.01	-	-	0.001	-	-	0.304
HCM Control Delay (s)	13.8	7.8	0	-	7.4	0	-	15.4
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.7	0	-	-	0	-	-	1.3

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	18	23	74	11	20	25	55	102	32	115	3
Future Vol, veh/h	0	18	23	74	11	20	25	55	102	32	115	3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	7	14	9	10	0	4	8	9	7	2	0
Mvmt Flow	0	18	23	74	11	20	25	55	102	32	115	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	8.7	8.3	8.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	70%	21%
Vol Thru, %	30%	44%	10%	77%
Vol Right, %	56%	56%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	182	41	105	150
LT Vol	25	0	74	32
Through Vol	55	18	11	115
RT Vol	102	23	20	3
Lane Flow Rate	182	41	105	150
Geometry Grp	1	1	1	1
Degree of Util (X)	0.212	0.052	0.142	0.192
Departure Headway (Hd)	4.186	4.558	4.868	4.596
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	857	784	736	782
Service Time	2.211	2.593	2.899	2.622
HCM Lane V/C Ratio	0.212	0.052	0.143	0.192
HCM Control Delay	8.3	7.8	8.7	8.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.2	0.5	0.7

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	99	1	2	47	50	3	2	7	87	5	49
Future Vol, veh/h	40	99	1	2	47	50	3	2	7	87	5	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	40	99	1	2	47	50	3	2	7	87	5	49
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	7.6	7.4	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	29%	2%	62%
Vol Thru, %	17%	71%	47%	4%
Vol Right, %	58%	1%	51%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	140	99	141
LT Vol	3	40	2	87
Through Vol	2	99	47	5
RT Vol	7	1	50	49
Lane Flow Rate	12	140	99	141
Geometry Grp	1	1	1	1
Degree of Util (X)	0.014	0.171	0.113	0.171
Departure Headway (Hd)	4.288	4.404	4.103	4.356
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	836	818	876	826
Service Time	2.308	2.417	2.117	2.371
HCM Lane V/C Ratio	0.014	0.171	0.113	0.171
HCM Control Delay	7.4	8.3	7.6	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.6	0.4	0.6

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	188	89	9	21	5
Future Vol, veh/h	2	188	89	9	21	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	8	7	0	0	0
Mvmt Flow	2	188	89	9	21	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	98	0	-	0	286	94
Stage 1	-	-	-	-	94	-
Stage 2	-	-	-	-	192	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1508	-	-	-	709	968
Stage 1	-	-	-	-	935	-
Stage 2	-	-	-	-	845	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1508	-	-	-	708	968
Mov Cap-2 Maneuver	-	-	-	-	708	-
Stage 1	-	-	-	-	934	-
Stage 2	-	-	-	-	845	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1508	-	-	-	747
HCM Lane V/C Ratio	0.001	-	-	-	0.035
HCM Control Delay (s)	7.4	0	-	-	10
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	209	1	4	96	0	2	0	8	0	0	0
Future Vol, veh/h	0	209	1	4	96	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	209	1	4	96	0	2	0	8	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	96	0	0	210	0	0	314	314	210	318	314	96
Stage 1	-	-	-	-	-	-	210	210	-	104	104	-
Stage 2	-	-	-	-	-	-	104	104	-	214	210	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1510	-	-	1373	-	-	643	605	835	639	605	966
Stage 1	-	-	-	-	-	-	797	732	-	907	813	-
Stage 2	-	-	-	-	-	-	907	813	-	793	732	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1510	-	-	1373	-	-	642	603	835	631	603	966
Mov Cap-2 Maneuver	-	-	-	-	-	-	642	603	-	631	603	-
Stage 1	-	-	-	-	-	-	797	732	-	907	811	-
Stage 2	-	-	-	-	-	-	904	811	-	785	732	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.3	9.6	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	788	1510	-	-	1373	-	-	-
HCM Lane V/C Ratio	0.013	-	-	-	0.003	-	-	-
HCM Control Delay (s)	9.6	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	217	1	5	96	0	3	0	13	0	0	0
Future Vol, veh/h	0	217	1	5	96	0	3	0	13	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	0	217	1	5	96	0	3	0	13	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	96	0	0	218	0	0	324	324	218	330	324	96
Stage 1	-	-	-	-	-	-	218	218	-	106	106	-
Stage 2	-	-	-	-	-	-	106	106	-	224	218	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1510	-	-	1364	-	-	633	597	827	627	597	966
Stage 1	-	-	-	-	-	-	789	726	-	905	811	-
Stage 2	-	-	-	-	-	-	905	811	-	783	726	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1510	-	-	1364	-	-	631	595	827	615	595	966
Mov Cap-2 Maneuver	-	-	-	-	-	-	631	595	-	615	595	-
Stage 1	-	-	-	-	-	-	789	726	-	905	808	-
Stage 2	-	-	-	-	-	-	901	808	-	771	726	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.7	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	781	1510	-	-	1364	-	-	-
HCM Lane V/C Ratio	0.02	-	-	-	0.004	-	-	-
HCM Control Delay (s)	9.7	0	-	-	7.6	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	6.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱		↕			↕	
Traffic Vol, veh/h	15	293	13	1	91	50	8	38	2	104	107	19
Future Vol, veh/h	15	293	13	1	91	50	8	38	2	104	107	19
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	9	4	17	0	1	3	14	4	50	7	1	8
Mvmt Flow	15	293	13	1	91	50	8	38	2	104	107	19

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	306	0	0	486	423	300	443	429	91
Stage 1	-	-	-	-	-	-	330	330	-	93	93	-
Stage 2	-	-	-	-	-	-	156	93	-	350	336	-
Critical Hdwy	4.19	-	-	4.1	-	-	7.24	6.54	6.7	7.17	6.51	6.28
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Follow-up Hdwy	2.281	-	-	2.2	-	-	3.626	4.036	3.75	3.563	4.009	3.372
Pot Cap-1 Maneuver	1461	-	-	1266	-	-	472	519	640	516	520	950
Stage 1	-	-	-	-	-	-	659	642	-	902	820	-
Stage 2	-	-	-	-	-	-	819	814	-	656	644	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1461	-	-	1266	-	-	385	512	640	480	513	950
Mov Cap-2 Maneuver	-	-	-	-	-	-	385	512	-	480	513	-
Stage 1	-	-	-	-	-	-	651	634	-	891	819	-
Stage 2	-	-	-	-	-	-	697	813	-	607	636	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.1	13.2	17.4
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	489	1461	-	-	1266	-	-	517
HCM Lane V/C Ratio	0.098	0.01	-	-	0.001	-	-	0.445
HCM Control Delay (s)	13.2	7.5	0	-	7.8	0	-	17.4
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0	-	-	2.3

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	40	52	59	57	38	67	178	77	28	74	6
Future Vol, veh/h	13	40	52	59	57	38	67	178	77	28	74	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	1	2	5	3	0
Mvmt Flow	13	40	52	59	57	38	67	178	77	28	74	6
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.7	9.4	10.8	9
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	21%	12%	38%	26%
Vol Thru, %	55%	38%	37%	69%
Vol Right, %	24%	50%	25%	6%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	322	105	154	108
LT Vol	67	13	59	28
Through Vol	178	40	57	74
RT Vol	77	52	38	6
Lane Flow Rate	322	105	154	108
Geometry Grp	1	1	1	1
Degree of Util (X)	0.409	0.141	0.213	0.151
Departure Headway (Hd)	4.568	4.846	4.973	5.021
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	782	733	716	708
Service Time	2.624	2.921	3.043	3.093
HCM Lane V/C Ratio	0.412	0.143	0.215	0.153
HCM Control Delay	10.8	8.7	9.4	9
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2	0.5	0.8	0.5

Intersection	
Intersection Delay, s/veh	8.4
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	80	56	1	7	89	101	5	0	10	77	1	57
Future Vol, veh/h	80	56	1	7	89	101	5	0	10	77	1	57
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	80	56	1	7	89	101	5	0	10	77	1	57
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.5	8.3	7.6	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	33%	58%	4%	57%
Vol Thru, %	0%	41%	45%	1%
Vol Right, %	67%	1%	51%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	137	197	135
LT Vol	5	80	7	77
Through Vol	0	56	89	1
RT Vol	10	1	101	57
Lane Flow Rate	15	137	197	135
Geometry Grp	1	1	1	1
Degree of Util (X)	0.019	0.174	0.225	0.169
Departure Headway (Hd)	4.464	4.564	4.105	4.51
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	801	786	877	797
Service Time	2.495	2.586	2.124	2.535
HCM Lane V/C Ratio	0.019	0.174	0.225	0.169
HCM Control Delay	7.6	8.5	8.3	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.6	0.9	0.6

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	134	196	20	12	3
Future Vol, veh/h	5	134	196	20	12	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	1	0	0	0
Mvmt Flow	5	134	196	20	12	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	216	0	-	0	350	206
Stage 1	-	-	-	-	206	-
Stage 2	-	-	-	-	144	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1366	-	-	-	651	840
Stage 1	-	-	-	-	833	-
Stage 2	-	-	-	-	888	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1366	-	-	-	648	840
Mov Cap-2 Maneuver	-	-	-	-	648	-
Stage 1	-	-	-	-	830	-
Stage 2	-	-	-	-	888	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1366	-	-	-	679
HCM Lane V/C Ratio	0.004	-	-	-	0.022
HCM Control Delay (s)	7.6	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	145	2	7	216	0	1	0	5	0	0	0
Future Vol, veh/h	0	145	2	7	216	0	1	0	5	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	145	2	7	216	0	1	0	5	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	216	0	0	147	0	0	376	376	146	379	377	216
Stage 1	-	-	-	-	-	-	146	146	-	230	230	-
Stage 2	-	-	-	-	-	-	230	230	-	149	147	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1366	-	-	1447	-	-	585	558	906	582	558	829
Stage 1	-	-	-	-	-	-	861	780	-	777	718	-
Stage 2	-	-	-	-	-	-	777	718	-	858	779	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1366	-	-	1447	-	-	583	555	906	577	555	829
Mov Cap-2 Maneuver	-	-	-	-	-	-	583	555	-	577	555	-
Stage 1	-	-	-	-	-	-	861	780	-	777	714	-
Stage 2	-	-	-	-	-	-	773	714	-	853	779	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.2	9.4	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	829	1366	-	-	1447	-	-	-
HCM Lane V/C Ratio	0.007	-	-	-	0.005	-	-	-
HCM Control Delay (s)	9.4	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		⇕			⇕			⇕			⇕	
Traffic Vol, veh/h	0	148	3	11	221	0	2	0	8	0	0	0
Future Vol, veh/h	0	148	3	11	221	0	2	0	8	0	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	0	148	3	11	221	0	2	0	8	0	0	0

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	221	0	0	151	0	0	393	393	150	397	394	221
Stage 1	-	-	-	-	-	-	150	150	-	243	243	-
Stage 2	-	-	-	-	-	-	243	243	-	154	151	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1360	-	-	1442	-	-	570	546	902	567	546	824
Stage 1	-	-	-	-	-	-	857	777	-	765	708	-
Stage 2	-	-	-	-	-	-	765	708	-	853	776	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1360	-	-	1442	-	-	566	541	902	558	541	824
Mov Cap-2 Maneuver	-	-	-	-	-	-	566	541	-	558	541	-
Stage 1	-	-	-	-	-	-	857	777	-	765	702	-
Stage 2	-	-	-	-	-	-	758	702	-	845	776	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0.4	9.5	0
HCM LOS			A	A

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	806	1360	-	-	1442	-	-	-
HCM Lane V/C Ratio	0.012	-	-	-	0.008	-	-	-
HCM Control Delay (s)	9.5	0	-	-	7.5	0	-	0
HCM Lane LOS	A	A	-	-	A	A	-	A
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↱		↕			↕	
Traffic Vol, veh/h	14	113	11	2	305	138	17	81	1	81	47	28
Future Vol, veh/h	14	113	11	2	305	138	17	81	1	81	47	28
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	1	0	0	0	2	0	6
Mvmt Flow	14	113	11	2	305	138	17	81	1	81	47	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	305	0	0	124	0	0	494	456	119	497	461	305
Stage 1	-	-	-	-	-	-	147	147	-	309	309	-
Stage 2	-	-	-	-	-	-	347	309	-	188	152	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.12	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.518	4	3.354
Pot Cap-1 Maneuver	1267	-	-	1475	-	-	489	504	938	483	500	726
Stage 1	-	-	-	-	-	-	860	779	-	701	663	-
Stage 2	-	-	-	-	-	-	673	663	-	814	775	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1267	-	-	1475	-	-	431	497	938	418	493	726
Mov Cap-2 Maneuver	-	-	-	-	-	-	431	497	-	418	493	-
Stage 1	-	-	-	-	-	-	850	770	-	693	662	-
Stage 2	-	-	-	-	-	-	600	662	-	719	766	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.8	0	14.3	16.2
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	487	1267	-	-	1475	-	-	476
HCM Lane V/C Ratio	0.203	0.011	-	-	0.001	-	-	0.328
HCM Control Delay (s)	14.3	7.9	0	-	7.4	0	-	16.2
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.8	0	-	-	0	-	-	1.4

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	18	22	76	13	21	24	53	100	32	109	3
Future Vol, veh/h	0	18	22	76	13	21	24	53	100	32	109	3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	7	14	9	10	0	4	8	9	7	2	0
Mvmt Flow	0	18	22	76	13	21	24	53	100	32	109	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.8	8.7	8.3	8.7
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	69%	22%
Vol Thru, %	30%	45%	12%	76%
Vol Right, %	56%	55%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	177	40	110	144
LT Vol	24	0	76	32
Through Vol	53	18	13	109
RT Vol	100	22	21	3
Lane Flow Rate	177	40	110	144
Geometry Grp	1	1	1	1
Degree of Util (X)	0.206	0.051	0.148	0.184
Departure Headway (Hd)	4.187	4.546	4.84	4.602
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	858	787	741	780
Service Time	2.21	2.579	2.869	2.627
HCM Lane V/C Ratio	0.206	0.051	0.148	0.185
HCM Control Delay	8.3	7.8	8.7	8.7
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.2	0.5	0.7

Intersection	
Intersection Delay, s/veh	8.1
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	99	1	2	56	50	3	2	7	87	5	49
Future Vol, veh/h	40	99	1	2	56	50	3	2	7	87	5	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	40	99	1	2	56	50	3	2	7	87	5	49
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.3	7.7	7.4	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	29%	2%	62%
Vol Thru, %	17%	71%	52%	4%
Vol Right, %	58%	1%	46%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	140	108	141
LT Vol	3	40	2	87
Through Vol	2	99	56	5
RT Vol	7	1	50	49
Lane Flow Rate	12	140	108	141
Geometry Grp	1	1	1	1
Degree of Util (X)	0.014	0.172	0.124	0.171
Departure Headway (Hd)	4.309	4.414	4.128	4.377
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	831	815	870	822
Service Time	2.331	2.428	2.143	2.394
HCM Lane V/C Ratio	0.014	0.172	0.124	0.172
HCM Control Delay	7.4	8.3	7.7	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.6	0.4	0.6

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	184	95	9	21	5
Future Vol, veh/h	2	184	95	9	21	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	8	7	0	0	0
Mvmt Flow	2	184	95	9	21	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	104	0	-	0	288	100
Stage 1	-	-	-	-	100	-
Stage 2	-	-	-	-	188	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1500	-	-	-	707	961
Stage 1	-	-	-	-	929	-
Stage 2	-	-	-	-	849	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1500	-	-	-	706	961
Mov Cap-2 Maneuver	-	-	-	-	706	-
Stage 1	-	-	-	-	928	-
Stage 2	-	-	-	-	849	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1500	-	-	-	744
HCM Lane V/C Ratio	0.001	-	-	-	0.035
HCM Control Delay (s)	7.4	0	-	-	10
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	203	1	4	97	9	2	0	8	21	0	5
Future Vol, veh/h	2	203	1	4	97	9	2	0	8	21	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	2	203	1	4	97	9	2	0	8	21	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	106	0	0	204	0	0	320	322	204	322	318	102
Stage 1	-	-	-	-	-	-	208	208	-	110	110	-
Stage 2	-	-	-	-	-	-	112	114	-	212	208	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1498	-	-	1380	-	-	637	599	842	635	602	959
Stage 1	-	-	-	-	-	-	799	734	-	900	808	-
Stage 2	-	-	-	-	-	-	898	805	-	795	734	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1498	-	-	1380	-	-	631	596	842	627	599	959
Mov Cap-2 Maneuver	-	-	-	-	-	-	631	596	-	627	599	-
Stage 1	-	-	-	-	-	-	797	733	-	898	806	-
Stage 2	-	-	-	-	-	-	891	803	-	786	733	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	9.6	10.6
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	789	1498	-	-	1380	-	-	672
HCM Lane V/C Ratio	0.013	0.001	-	-	0.003	-	-	0.039
HCM Control Delay (s)	9.6	7.4	0	-	7.6	0	-	10.6
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	228	1	5	101	9	3	0	13	21	0	5
Future Vol, veh/h	2	228	1	5	101	9	3	0	13	21	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	2	228	1	5	101	9	3	0	13	21	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	110	0	0	229	0	0	351	353	229	355	349	106
Stage 1	-	-	-	-	-	-	233	233	-	116	116	-
Stage 2	-	-	-	-	-	-	118	120	-	239	233	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1493	-	-	1351	-	-	608	575	815	604	578	954
Stage 1	-	-	-	-	-	-	775	716	-	894	803	-
Stage 2	-	-	-	-	-	-	891	800	-	769	716	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1493	-	-	1351	-	-	602	572	815	592	575	954
Mov Cap-2 Maneuver	-	-	-	-	-	-	602	572	-	592	575	-
Stage 1	-	-	-	-	-	-	773	715	-	892	800	-
Stage 2	-	-	-	-	-	-	883	797	-	755	715	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	9.8	10.9
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	764	1493	-	-	1351	-	-	639
HCM Lane V/C Ratio	0.021	0.001	-	-	0.004	-	-	0.041
HCM Control Delay (s)	9.8	7.4	0	-	7.7	0	-	10.9
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	7.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱		↕			↕	
Traffic Vol, veh/h	20	279	13	1	87	53	7	43	2	113	118	31
Future Vol, veh/h	20	279	13	1	87	53	7	43	2	113	118	31
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	9	4	17	0	1	3	14	4	50	7	1	8
Mvmt Flow	20	279	13	1	87	53	7	43	2	113	118	31

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	87	0	0	292	0	0	490	415	286	437	421	87
Stage 1	-	-	-	-	-	-	326	326	-	89	89	-
Stage 2	-	-	-	-	-	-	164	89	-	348	332	-
Critical Hdwy	4.19	-	-	4.1	-	-	7.24	6.54	6.7	7.17	6.51	6.28
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Follow-up Hdwy	2.281	-	-	2.2	-	-	3.626	4.036	3.75	3.563	4.009	3.372
Pot Cap-1 Maneuver	1466	-	-	1281	-	-	470	525	652	521	525	955
Stage 1	-	-	-	-	-	-	662	645	-	906	823	-
Stage 2	-	-	-	-	-	-	811	817	-	658	646	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1466	-	-	1281	-	-	370	516	652	480	516	955
Mov Cap-2 Maneuver	-	-	-	-	-	-	370	516	-	480	516	-
Stage 1	-	-	-	-	-	-	651	635	-	892	822	-
Stage 2	-	-	-	-	-	-	671	816	-	602	636	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	0.1	13.1	18.3
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	494	1466	-	-	1281	-	-	528
HCM Lane V/C Ratio	0.105	0.014	-	-	0.001	-	-	0.496
HCM Control Delay (s)	13.1	7.5	0	-	7.8	0	-	18.3
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	2.7

Intersection	
Intersection Delay, s/veh	9.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	41	49	60	56	38	64	170	79	30	70	5
Future Vol, veh/h	13	41	49	60	56	38	64	170	79	30	70	5
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	1	2	5	3	0
Mvmt Flow	13	41	49	60	56	38	64	170	79	30	70	5
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.7	9.3	10.6	8.9
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	20%	13%	39%	29%
Vol Thru, %	54%	40%	36%	67%
Vol Right, %	25%	48%	25%	5%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	313	103	154	105
LT Vol	64	13	60	30
Through Vol	170	41	56	70
RT Vol	79	49	38	5
Lane Flow Rate	313	103	154	105
Geometry Grp	1	1	1	1
Degree of Util (X)	0.395	0.138	0.211	0.146
Departure Headway (Hd)	4.548	4.826	4.94	5.011
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	789	737	722	711
Service Time	2.6	2.894	3.005	3.079
HCM Lane V/C Ratio	0.397	0.14	0.213	0.148
HCM Control Delay	10.6	8.7	9.3	8.9
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.9	0.5	0.8	0.5

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	80	63	1	7	92	101	5	0	10	77	1	57
Future Vol, veh/h	80	63	1	7	92	101	5	0	10	77	1	57
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	80	63	1	7	92	101	5	0	10	77	1	57
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.6	8.4	7.6	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	33%	56%	4%	57%
Vol Thru, %	0%	44%	46%	1%
Vol Right, %	67%	1%	51%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	144	200	135
LT Vol	5	80	7	77
Through Vol	0	63	92	1
RT Vol	10	1	101	57
Lane Flow Rate	15	144	200	135
Geometry Grp	1	1	1	1
Degree of Util (X)	0.019	0.182	0.229	0.17
Departure Headway (Hd)	4.487	4.562	4.117	4.532
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	797	788	872	792
Service Time	2.519	2.586	2.138	2.556
HCM Lane V/C Ratio	0.019	0.183	0.229	0.17
HCM Control Delay	7.6	8.6	8.4	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.7	0.9	0.6

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	139	194	20	12	3
Future Vol, veh/h	5	139	194	20	12	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	1	0	0	0
Mvmt Flow	5	139	194	20	12	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	214	0	-	0	353	204
Stage 1	-	-	-	-	204	-
Stage 2	-	-	-	-	149	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1368	-	-	-	649	842
Stage 1	-	-	-	-	835	-
Stage 2	-	-	-	-	884	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1368	-	-	-	646	842
Mov Cap-2 Maneuver	-	-	-	-	646	-
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	884	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1368	-	-	-	678
HCM Lane V/C Ratio	0.004	-	-	-	0.022
HCM Control Delay (s)	7.6	0	-	-	10.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	145	2	7	210	20	1	0	5	13	0	3
Future Vol, veh/h	5	145	2	7	210	20	1	0	5	13	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	145	2	7	210	20	1	0	5	13	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	230	0	0	147	0	0	392	400	146	393	391	220
Stage 1	-	-	-	-	-	-	156	156	-	234	234	-
Stage 2	-	-	-	-	-	-	236	244	-	159	157	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1350	-	-	1447	-	-	571	541	906	570	548	825
Stage 1	-	-	-	-	-	-	851	772	-	774	715	-
Stage 2	-	-	-	-	-	-	772	708	-	848	772	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1350	-	-	1447	-	-	565	536	906	563	543	825
Mov Cap-2 Maneuver	-	-	-	-	-	-	565	536	-	563	543	-
Stage 1	-	-	-	-	-	-	848	769	-	771	711	-
Stage 2	-	-	-	-	-	-	765	704	-	840	769	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	0.2	9.4	11.2
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	823	1350	-	-	1447	-	-	599
HCM Lane V/C Ratio	0.007	0.004	-	-	0.005	-	-	0.027
HCM Control Delay (s)	9.4	7.7	0	-	7.5	0	-	11.2
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	155	3	11	232	20	2	0	8	13	0	3
Future Vol, veh/h	5	155	3	11	232	20	2	0	8	13	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	155	3	11	232	20	2	0	8	13	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	252	0	0	158	0	0	433	441	157	435	432	242
Stage 1	-	-	-	-	-	-	167	167	-	264	264	-
Stage 2	-	-	-	-	-	-	266	274	-	171	168	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1325	-	-	1434	-	-	537	513	894	535	519	802
Stage 1	-	-	-	-	-	-	840	764	-	746	694	-
Stage 2	-	-	-	-	-	-	744	687	-	836	763	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1325	-	-	1434	-	-	529	506	894	525	512	802
Mov Cap-2 Maneuver	-	-	-	-	-	-	529	506	-	525	512	-
Stage 1	-	-	-	-	-	-	837	761	-	743	688	-
Stage 2	-	-	-	-	-	-	735	681	-	825	760	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	9.6	11.6
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	786	1325	-	-	1434	-	-	561
HCM Lane V/C Ratio	0.013	0.004	-	-	0.008	-	-	0.029
HCM Control Delay (s)	9.6	7.7	0	-	7.5	0	-	11.6
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕	↱		↕			↕	
Traffic Vol, veh/h	25	108	11	2	291	145	16	92	1	86	55	35
Future Vol, veh/h	25	108	11	2	291	145	16	92	1	86	55	35
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	1	0	0	0	2	0	6
Mvmt Flow	25	108	11	2	291	145	16	92	1	86	55	35

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	291	0	0	119	0	0	504	459	114	505	464	291
Stage 1	-	-	-	-	-	-	164	164	-	295	295	-
Stage 2	-	-	-	-	-	-	340	295	-	210	169	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.12	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.518	4	3.354
Pot Cap-1 Maneuver	1282	-	-	1482	-	-	482	502	944	478	498	739
Stage 1	-	-	-	-	-	-	843	766	-	713	673	-
Stage 2	-	-	-	-	-	-	679	673	-	792	763	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1282	-	-	1482	-	-	412	490	944	402	487	739
Mov Cap-2 Maneuver	-	-	-	-	-	-	412	490	-	402	487	-
Stage 1	-	-	-	-	-	-	825	750	-	698	672	-
Stage 2	-	-	-	-	-	-	593	672	-	680	747	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	0	14.7	17.2
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	479	1282	-	-	1482	-	-	470
HCM Lane V/C Ratio	0.228	0.02	-	-	0.001	-	-	0.374
HCM Control Delay (s)	14.7	7.9	0	-	7.4	0	-	17.2
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.9	0.1	-	-	0	-	-	1.7

Intersection	
Intersection Delay, s/veh	8.6
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	19	23	79	14	22	25	55	104	33	115	3
Future Vol, veh/h	0	19	23	79	14	22	25	55	104	33	115	3
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	7	14	9	10	0	4	8	9	7	2	0
Mvmt Flow	0	19	23	79	14	22	25	55	104	33	115	3
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	7.9	8.8	8.4	8.8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	14%	0%	69%	22%
Vol Thru, %	30%	45%	12%	76%
Vol Right, %	57%	55%	19%	2%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	184	42	115	151
LT Vol	25	0	79	33
Through Vol	55	19	14	115
RT Vol	104	23	22	3
Lane Flow Rate	184	42	115	151
Geometry Grp	1	1	1	1
Degree of Util (X)	0.216	0.054	0.156	0.194
Departure Headway (Hd)	4.217	4.59	4.876	4.632
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	852	779	735	775
Service Time	2.241	2.627	2.908	2.659
HCM Lane V/C Ratio	0.216	0.054	0.156	0.195
HCM Control Delay	8.4	7.9	8.8	8.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.8	0.2	0.6	0.7

Intersection	
Intersection Delay, s/veh	8.2
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	40	103	1	2	58	50	3	2	7	87	5	49
Future Vol, veh/h	40	103	1	2	58	50	3	2	7	87	5	49
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	40	103	1	2	58	50	3	2	7	87	5	49
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.4	7.8	7.4	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	28%	2%	62%
Vol Thru, %	17%	72%	53%	4%
Vol Right, %	58%	1%	45%	35%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	12	144	110	141
LT Vol	3	40	2	87
Through Vol	2	103	58	5
RT Vol	7	1	50	49
Lane Flow Rate	12	144	110	141
Geometry Grp	1	1	1	1
Degree of Util (X)	0.014	0.177	0.127	0.172
Departure Headway (Hd)	4.325	4.417	4.14	4.392
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	828	815	868	819
Service Time	2.348	2.431	2.155	2.409
HCM Lane V/C Ratio	0.014	0.177	0.127	0.172
HCM Control Delay	7.4	8.4	7.8	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0	0.6	0.4	0.6

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	2	192	99	9	21	5
Future Vol, veh/h	2	192	99	9	21	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	8	7	0	0	0
Mvmt Flow	2	192	99	9	21	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	108	0	-	0	300	104
Stage 1	-	-	-	-	104	-
Stage 2	-	-	-	-	196	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1495	-	-	-	696	956
Stage 1	-	-	-	-	925	-
Stage 2	-	-	-	-	842	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1495	-	-	-	695	956
Mov Cap-2 Maneuver	-	-	-	-	695	-
Stage 1	-	-	-	-	924	-
Stage 2	-	-	-	-	842	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1495	-	-	-	734
HCM Lane V/C Ratio	0.001	-	-	-	0.035
HCM Control Delay (s)	7.4	0	-	-	10.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	211	1	4	101	9	2	0	8	21	0	5
Future Vol, veh/h	2	211	1	4	101	9	2	0	8	21	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	2	211	1	4	101	9	2	0	8	21	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	110	0	0	212	0	0	332	334	212	334	330	106
Stage 1	-	-	-	-	-	-	216	216	-	114	114	-
Stage 2	-	-	-	-	-	-	116	118	-	220	216	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1493	-	-	1370	-	-	625	589	833	623	592	954
Stage 1	-	-	-	-	-	-	791	728	-	896	805	-
Stage 2	-	-	-	-	-	-	894	802	-	787	728	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1493	-	-	1370	-	-	619	586	833	615	589	954
Mov Cap-2 Maneuver	-	-	-	-	-	-	619	586	-	615	589	-
Stage 1	-	-	-	-	-	-	789	727	-	894	803	-
Stage 2	-	-	-	-	-	-	887	800	-	778	727	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	9.7	10.7
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	779	1493	-	-	1370	-	-	660
HCM Lane V/C Ratio	0.013	0.001	-	-	0.003	-	-	0.039
HCM Control Delay (s)	9.7	7.4	0	-	7.6	0	-	10.7
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	1.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	2	237	1	5	105	9	3	0	13	21	0	5
Future Vol, veh/h	2	237	1	5	105	9	3	0	13	21	0	5
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	8	0	0	7	0	0	0	0	0	0	0
Mvmt Flow	2	237	1	5	105	9	3	0	13	21	0	5

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	114	0	0	238	0	0	364	366	238	368	362	110
Stage 1	-	-	-	-	-	-	242	242	-	120	120	-
Stage 2	-	-	-	-	-	-	122	124	-	248	242	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1488	-	-	1341	-	-	596	566	806	592	569	949
Stage 1	-	-	-	-	-	-	766	709	-	889	800	-
Stage 2	-	-	-	-	-	-	887	797	-	760	709	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1488	-	-	1341	-	-	590	563	806	580	566	949
Mov Cap-2 Maneuver	-	-	-	-	-	-	590	563	-	580	566	-
Stage 1	-	-	-	-	-	-	764	708	-	887	797	-
Stage 2	-	-	-	-	-	-	879	794	-	746	708	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.3	9.9	11
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	754	1488	-	-	1341	-	-	627
HCM Lane V/C Ratio	0.021	0.001	-	-	0.004	-	-	0.041
HCM Control Delay (s)	9.9	7.4	0	-	7.7	0	-	11
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	7.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↱		↕			↕	
Traffic Vol, veh/h	20	293	13	1	91	55	8	44	2	117	123	32
Future Vol, veh/h	20	293	13	1	91	55	8	44	2	117	123	32
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	9	4	17	0	1	3	14	4	50	7	1	8
Mvmt Flow	20	293	13	1	91	55	8	44	2	117	123	32

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	91	0	0	306	0	0	511	433	300	456	439	91
Stage 1	-	-	-	-	-	-	340	340	-	93	93	-
Stage 2	-	-	-	-	-	-	171	93	-	363	346	-
Critical Hdwy	4.19	-	-	4.1	-	-	7.24	6.54	6.7	7.17	6.51	6.28
Critical Hdwy Stg 1	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.24	5.54	-	6.17	5.51	-
Follow-up Hdwy	2.281	-	-	2.2	-	-	3.626	4.036	3.75	3.563	4.009	3.372
Pot Cap-1 Maneuver	1461	-	-	1266	-	-	455	513	640	506	513	950
Stage 1	-	-	-	-	-	-	650	636	-	902	820	-
Stage 2	-	-	-	-	-	-	804	814	-	646	637	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1461	-	-	1266	-	-	352	504	640	465	504	950
Mov Cap-2 Maneuver	-	-	-	-	-	-	352	504	-	465	504	-
Stage 1	-	-	-	-	-	-	639	625	-	887	819	-
Stage 2	-	-	-	-	-	-	660	813	-	588	626	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.5	0.1	13.5	19.6
HCM LOS			B	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	477	1461	-	-	1266	-	-	514
HCM Lane V/C Ratio	0.113	0.014	-	-	0.001	-	-	0.529
HCM Control Delay (s)	13.5	7.5	0	-	7.8	0	-	19.6
HCM Lane LOS	B	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.4	0	-	-	0	-	-	3.1

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	13	43	52	62	58	40	67	178	82	31	74	6
Future Vol, veh/h	13	43	52	62	58	40	67	178	82	31	74	6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	0	0	0	0	0	0	1	2	5	3	0
Mvmt Flow	13	43	52	62	58	40	67	178	82	31	74	6
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.8	9.5	10.9	9.1
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	20%	12%	39%	28%
Vol Thru, %	54%	40%	36%	67%
Vol Right, %	25%	48%	25%	5%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	327	108	160	111
LT Vol	67	13	62	31
Through Vol	178	43	58	74
RT Vol	82	52	40	6
Lane Flow Rate	327	108	160	111
Geometry Grp	1	1	1	1
Degree of Util (X)	0.417	0.147	0.222	0.156
Departure Headway (Hd)	4.592	4.884	4.998	5.062
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	778	727	712	703
Service Time	2.65	2.964	3.073	3.138
HCM Lane V/C Ratio	0.42	0.149	0.225	0.158
HCM Control Delay	10.9	8.8	9.5	9.1
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	2.1	0.5	0.8	0.6

Intersection	
Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	80	66	1	7	96	101	5	0	10	77	1	57
Future Vol, veh/h	80	66	1	7	96	101	5	0	10	77	1	57
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	80	66	1	7	96	101	5	0	10	77	1	57
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.6	8.4	7.6	8.5
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	33%	54%	3%	57%
Vol Thru, %	0%	45%	47%	1%
Vol Right, %	67%	1%	50%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	15	147	204	135
LT Vol	5	80	7	77
Through Vol	0	66	96	1
RT Vol	10	1	101	57
Lane Flow Rate	15	147	204	135
Geometry Grp	1	1	1	1
Degree of Util (X)	0.019	0.186	0.234	0.171
Departure Headway (Hd)	4.505	4.567	4.129	4.548
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	793	786	871	790
Service Time	2.538	2.59	2.149	2.573
HCM Lane V/C Ratio	0.019	0.187	0.234	0.171
HCM Control Delay	7.6	8.6	8.4	8.5
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.1	0.7	0.9	0.6

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	5	144	202	20	12	3
Future Vol, veh/h	5	144	202	20	12	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	0	2	1	0	0	0
Mvmt Flow	5	144	202	20	12	3

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	222	0	-	0	366	212
Stage 1	-	-	-	-	212	-
Stage 2	-	-	-	-	154	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1359	-	-	-	638	833
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	879	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1359	-	-	-	635	833
Mov Cap-2 Maneuver	-	-	-	-	635	-
Stage 1	-	-	-	-	825	-
Stage 2	-	-	-	-	879	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	10.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1359	-	-	-	667
HCM Lane V/C Ratio	0.004	-	-	-	0.022
HCM Control Delay (s)	7.7	0	-	-	10.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	150	2	7	219	20	1	0	5	13	0	3
Future Vol, veh/h	5	150	2	7	219	20	1	0	5	13	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	150	2	7	219	20	1	0	5	13	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	239	0	0	152	0	0	406	414	151	407	405	229
Stage 1	-	-	-	-	-	-	161	161	-	243	243	-
Stage 2	-	-	-	-	-	-	245	253	-	164	162	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1340	-	-	1441	-	-	559	532	901	558	538	815
Stage 1	-	-	-	-	-	-	846	769	-	765	708	-
Stage 2	-	-	-	-	-	-	763	701	-	843	768	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1340	-	-	1441	-	-	553	527	901	551	533	815
Mov Cap-2 Maneuver	-	-	-	-	-	-	553	527	-	551	533	-
Stage 1	-	-	-	-	-	-	843	766	-	762	704	-
Stage 2	-	-	-	-	-	-	756	697	-	835	765	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	9.5	11.3
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	815	1340	-	-	1441	-	-	587
HCM Lane V/C Ratio	0.007	0.004	-	-	0.005	-	-	0.027
HCM Control Delay (s)	9.5	7.7	0	-	7.5	0	-	11.3
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	161	3	11	241	20	2	0	8	13	0	3
Future Vol, veh/h	5	161	3	11	241	20	2	0	8	13	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	2	0	0	1	0	0	0	0	0	0	0
Mvmt Flow	5	161	3	11	241	20	2	0	8	13	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	261	0	0	164	0	0	448	456	163	450	447	251
Stage 1	-	-	-	-	-	-	173	173	-	273	273	-
Stage 2	-	-	-	-	-	-	275	283	-	177	174	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1315	-	-	1427	-	-	524	504	887	523	509	793
Stage 1	-	-	-	-	-	-	834	760	-	737	688	-
Stage 2	-	-	-	-	-	-	736	681	-	829	759	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1315	-	-	1427	-	-	517	497	887	513	502	793
Mov Cap-2 Maneuver	-	-	-	-	-	-	517	497	-	513	502	-
Stage 1	-	-	-	-	-	-	831	757	-	734	682	-
Stage 2	-	-	-	-	-	-	727	675	-	818	756	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.3	9.7	11.8
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	776	1315	-	-	1427	-	-	549
HCM Lane V/C Ratio	0.013	0.004	-	-	0.008	-	-	0.029
HCM Control Delay (s)	9.7	7.7	0	-	7.5	0	-	11.8
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0	0	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	5.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↰	↗		↕			↕	
Traffic Vol, veh/h	26	113	11	2	305	151	17	95	1	90	57	36
Future Vol, veh/h	26	113	11	2	305	151	17	95	1	90	57	36
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Yield	-	-	None	-	-	None
Storage Length	-	-	-	-	-	600	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	0	1	0	0	4	1	0	0	0	2	0	6
Mvmt Flow	26	113	11	2	305	151	17	95	1	90	57	36

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	305	0	0	124	0	0	527	480	119	528	485	305
Stage 1	-	-	-	-	-	-	171	171	-	309	309	-
Stage 2	-	-	-	-	-	-	356	309	-	219	176	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.12	6.5	6.26
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.12	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.518	4	3.354
Pot Cap-1 Maneuver	1267	-	-	1475	-	-	465	488	938	461	485	726
Stage 1	-	-	-	-	-	-	836	761	-	701	663	-
Stage 2	-	-	-	-	-	-	666	663	-	783	757	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1267	-	-	1475	-	-	394	476	938	383	473	726
Mov Cap-2 Maneuver	-	-	-	-	-	-	394	476	-	383	473	-
Stage 1	-	-	-	-	-	-	818	744	-	686	662	-
Stage 2	-	-	-	-	-	-	577	662	-	667	740	-

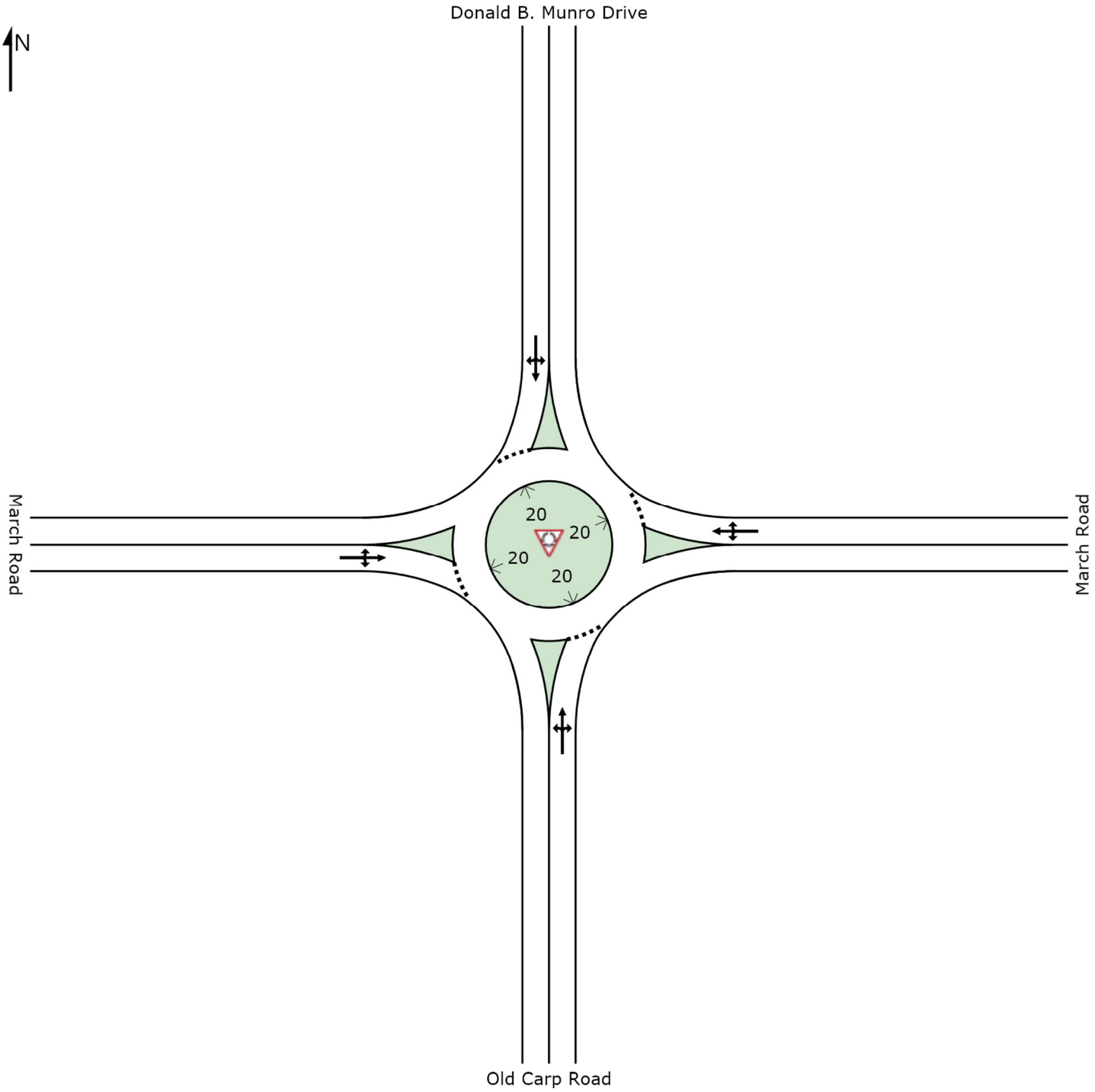
Approach	EB	WB	NB	SB
HCM Control Delay, s	1.4	0	15.2	18.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	464	1267	-	-	1475	-	-	452
HCM Lane V/C Ratio	0.244	0.021	-	-	0.001	-	-	0.405
HCM Control Delay (s)	15.2	7.9	0	-	7.4	0	-	18.3
HCM Lane LOS	C	A	A	-	A	A	-	C
HCM 95th %tile Q(veh)	0.9	0.1	-	-	0	-	-	1.9

SITE LAYOUT

Site: TT 2029 AM

March Road & Donald B. Munro Drive / Old Carp Road
Future (2029) Total Traffic
AM Peak Hour
Roundabout



MOVEMENT SUMMARY

Site: TT 2029 AM

March Road & Donald B. Munro Drive / Old Carp Road
Future (2029) Total Traffic
AM Peak Hour
Roundabout

Movement Performance - Vehicles

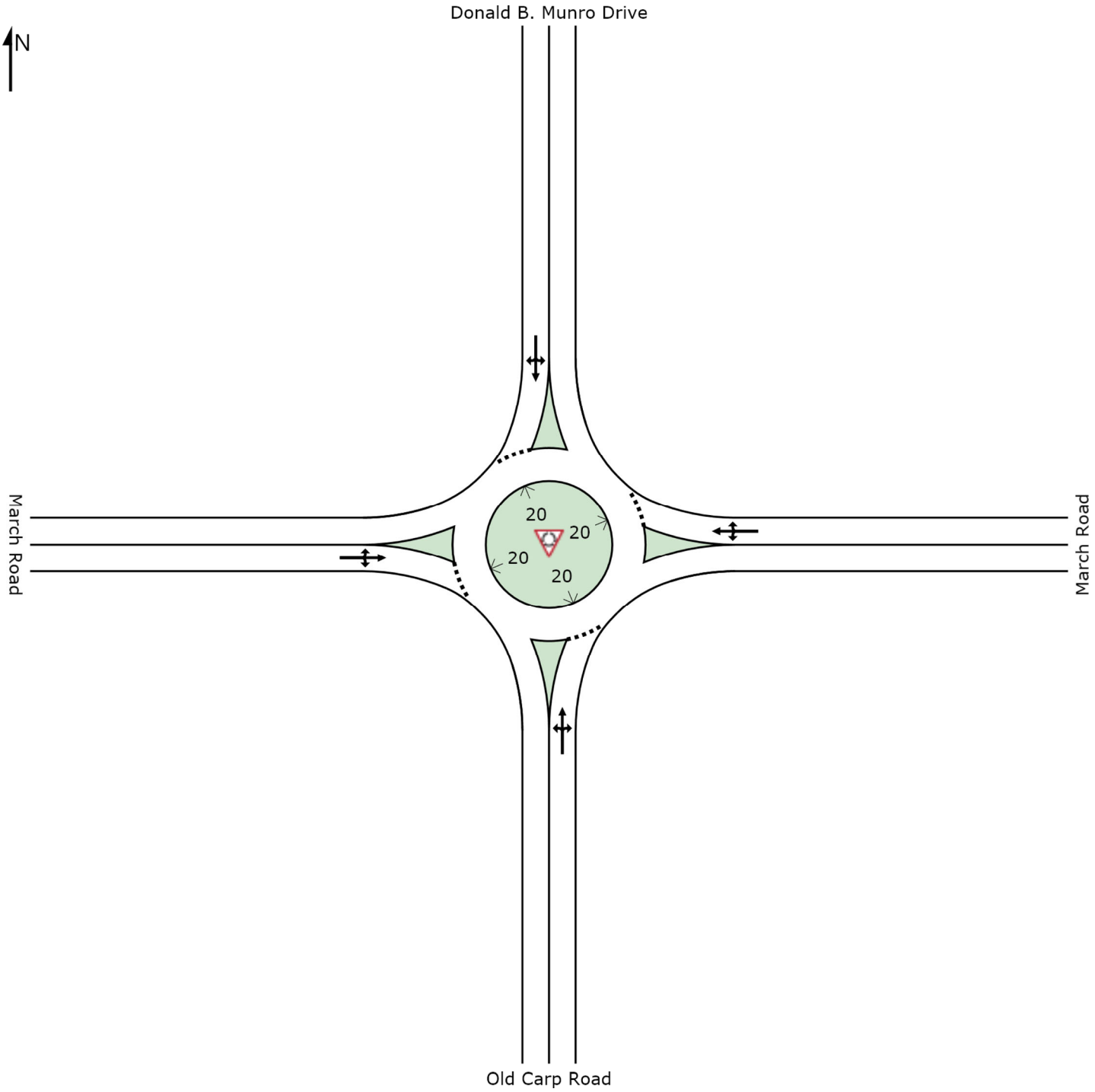
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Carp Road											
3	L2	9	14.0	0.091	6.6	LOS A	0.3	2.3	0.48	0.43	53.1
8	T1	48	4.0	0.091	6.6	LOS A	0.3	2.3	0.48	0.43	53.9
18	R2	2	50.0	0.091	6.6	LOS A	0.3	2.3	0.48	0.43	50.7
Approach		59	7.2	0.091	6.6	LOS A	0.3	2.3	0.48	0.43	53.6
East: March Road											
1	L2	1	0.0	0.156	5.0	LOS A	0.6	4.6	0.21	0.10	55.7
6	T1	99	1.0	0.156	5.0	LOS A	0.6	4.6	0.21	0.10	55.8
16	R2	60	3.0	0.156	5.0	LOS A	0.6	4.6	0.21	0.10	54.4
Approach		160	1.7	0.156	5.0	LOS A	0.6	4.6	0.21	0.10	55.3
North: Donald B. Munro Drive											
7	L2	127	7.0	0.305	6.9	LOS A	1.3	10.4	0.29	0.17	52.4
4	T1	134	1.0	0.305	6.9	LOS A	1.3	10.4	0.29	0.17	52.8
14	R2	35	8.0	0.305	6.9	LOS A	1.3	10.4	0.29	0.17	51.4
Approach		296	4.4	0.305	6.9	LOS A	1.3	10.4	0.29	0.17	52.5
West: March Road											
5	L2	22	9.0	0.432	9.8	LOS A	2.0	15.7	0.50	0.43	51.3
2	T1	318	4.0	0.432	9.8	LOS A	2.0	15.7	0.50	0.43	51.7
12	R2	14	17.0	0.432	9.8	LOS A	2.0	15.7	0.50	0.43	50.1
Approach		354	4.8	0.432	9.8	LOS A	2.0	15.7	0.50	0.43	51.6
All Vehicles		868	4.3	0.432	7.7	LOS A	2.0	15.7	0.37	0.28	52.7

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: TT 2029 PM

March Road & Donald B. Munro Drive / Old Carp Road
Future (2029) Total Traffic
PM Peak Hour
Roundabout



MOVEMENT SUMMARY

Site: TT 2029 PM

March Road & Donald B. Munro Drive / Old Carp Road
Future (2029) Total Traffic
PM Peak Hour
Roundabout

Movement Performance - Vehicles

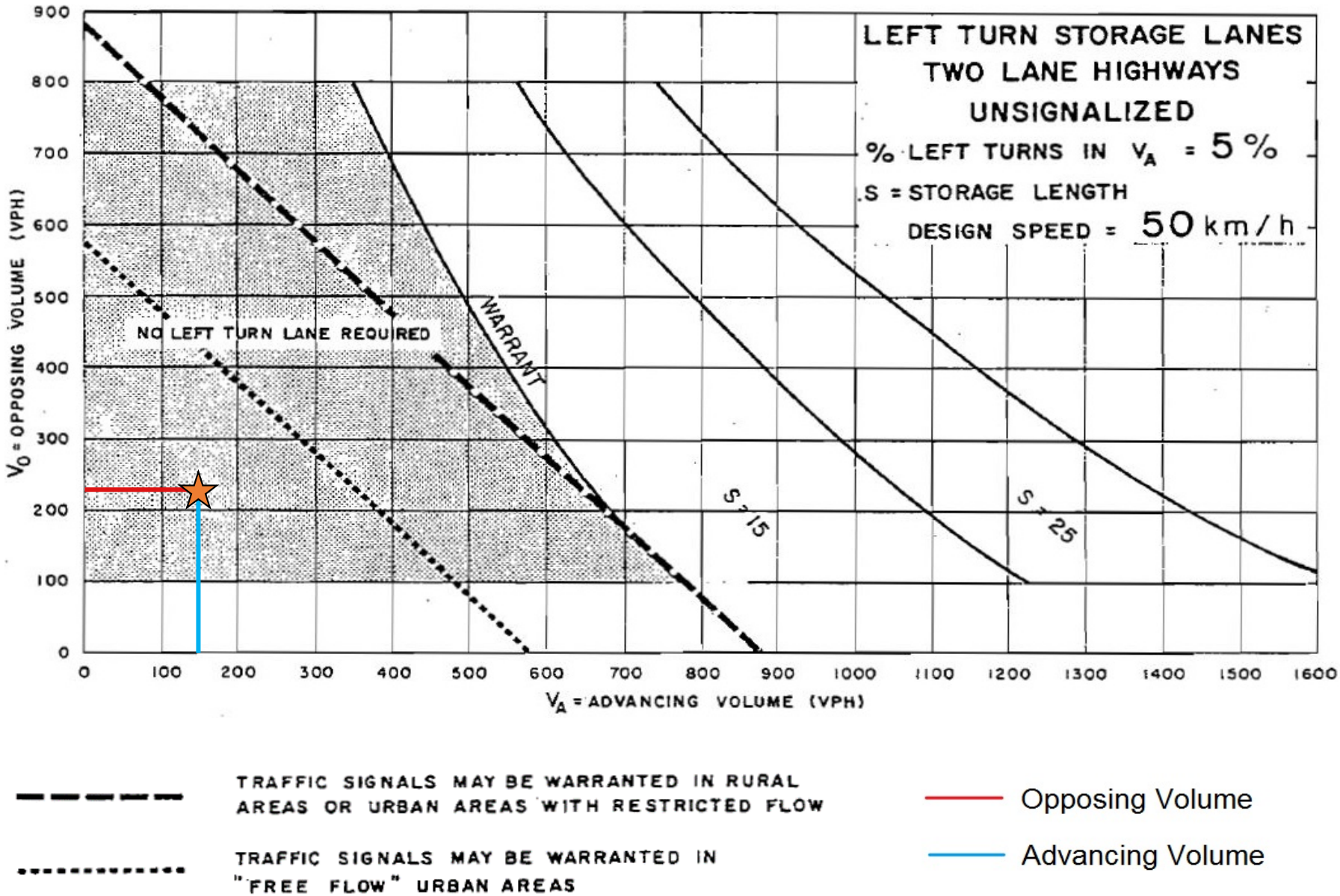
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Old Carp Road											
3	L2	18	0.0	0.140	5.5	LOS A	0.5	3.9	0.37	0.28	54.7
8	T1	103	0.0	0.140	5.5	LOS A	0.5	3.9	0.37	0.28	54.9
18	R2	1	0.0	0.140	5.5	LOS A	0.5	3.9	0.37	0.28	53.6
Approach		123	0.0	0.140	5.5	LOS A	0.5	3.9	0.37	0.28	54.9
East: March Road											
1	L2	2	0.0	0.527	10.6	LOS B	3.1	23.8	0.45	0.31	51.4
6	T1	332	4.0	0.527	10.6	LOS B	3.1	23.8	0.45	0.31	51.3
16	R2	164	1.0	0.527	10.6	LOS B	3.1	23.8	0.45	0.31	50.3
Approach		498	3.0	0.527	10.6	LOS B	3.1	23.8	0.45	0.31	51.0
North: Donald B. Munro Drive											
7	L2	98	2.0	0.259	7.6	LOS A	1.0	7.8	0.48	0.44	51.9
4	T1	62	0.0	0.259	7.6	LOS A	1.0	7.8	0.48	0.44	52.1
14	R2	39	6.0	0.259	7.6	LOS A	1.0	7.8	0.48	0.44	50.7
Approach		199	2.2	0.259	7.6	LOS A	1.0	7.8	0.48	0.44	51.7
West: March Road											
5	L2	28	0.0	0.171	5.4	LOS A	0.7	5.1	0.31	0.20	54.7
2	T1	123	1.0	0.171	5.4	LOS A	0.7	5.1	0.31	0.20	54.8
12	R2	12	0.0	0.171	5.4	LOS A	0.7	5.1	0.31	0.20	53.6
Approach		163	0.8	0.171	5.4	LOS A	0.7	5.1	0.31	0.20	54.7
All Vehicles		983	2.1	0.527	8.5	LOS A	3.1	23.8	0.42	0.31	52.2

Level of Service (LOS) Method: Delay & v/c (HCM 2010).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix K – Auxiliary Lane Analyses

Donald B. Munro Drive & Robertlee Drive - Eastbound Left-Turn - AM Peak Hour

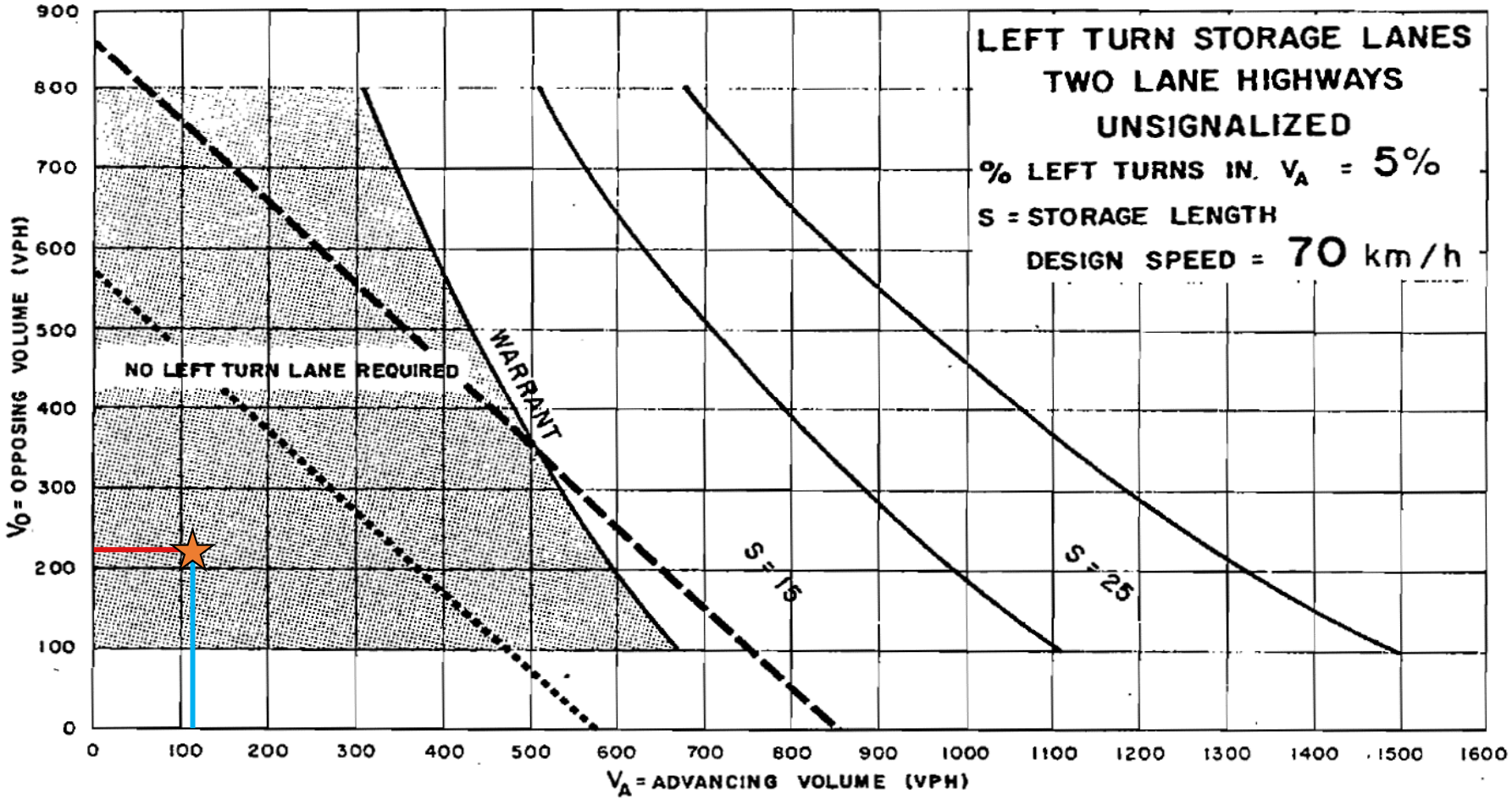
Left-turn volume represents less than 5% of approaching volumes. As such, left-turn warrant analysis can not be completed.



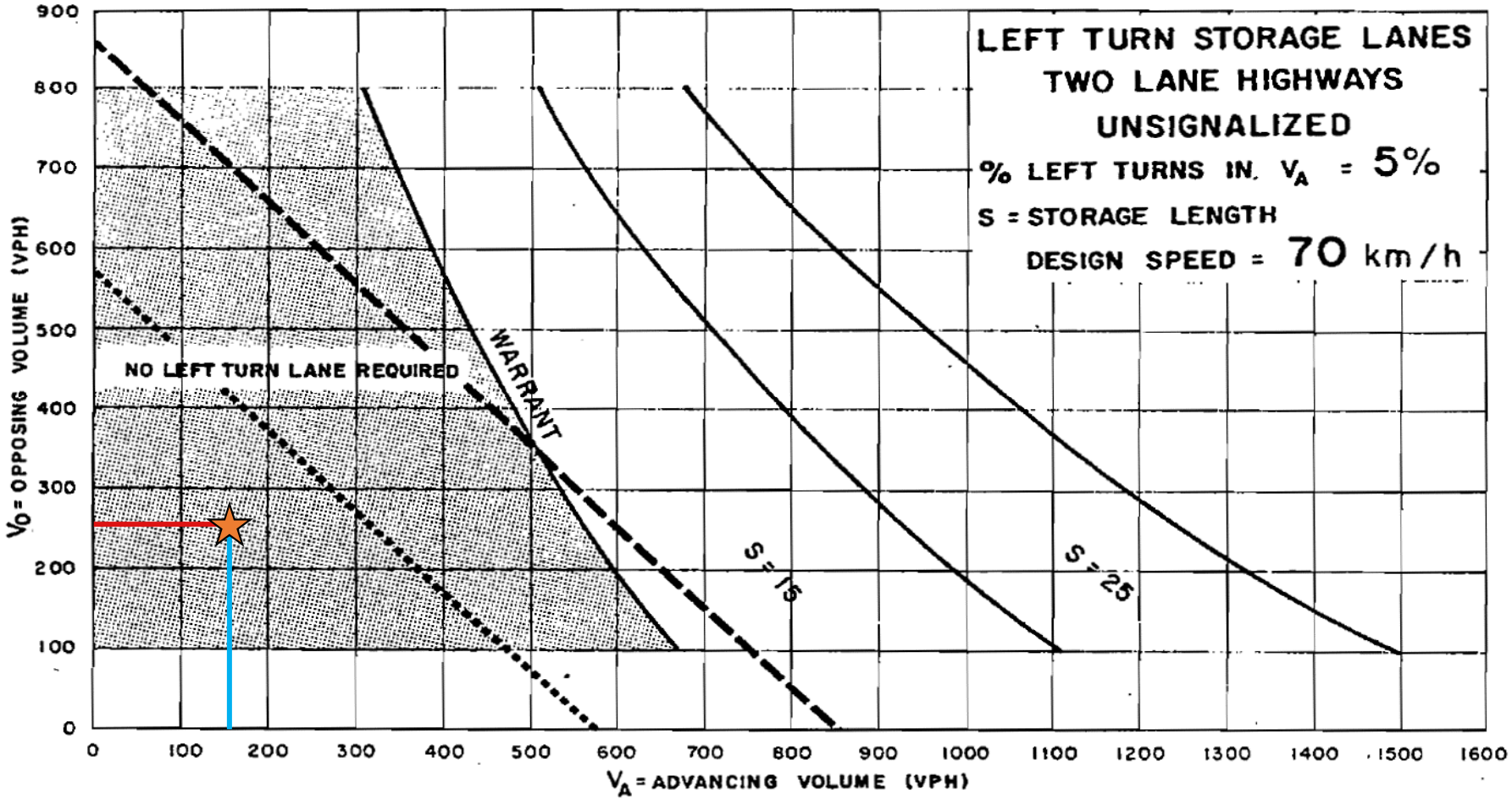
Donald B. Munro Drive & Robertlee Drive - Eastbound Left-Turn - PM Peak Hour

Donald B. Munro Drive & Farmridge Avenue/Street 2 - Eastbound Left-Turn - AM Peak Hour

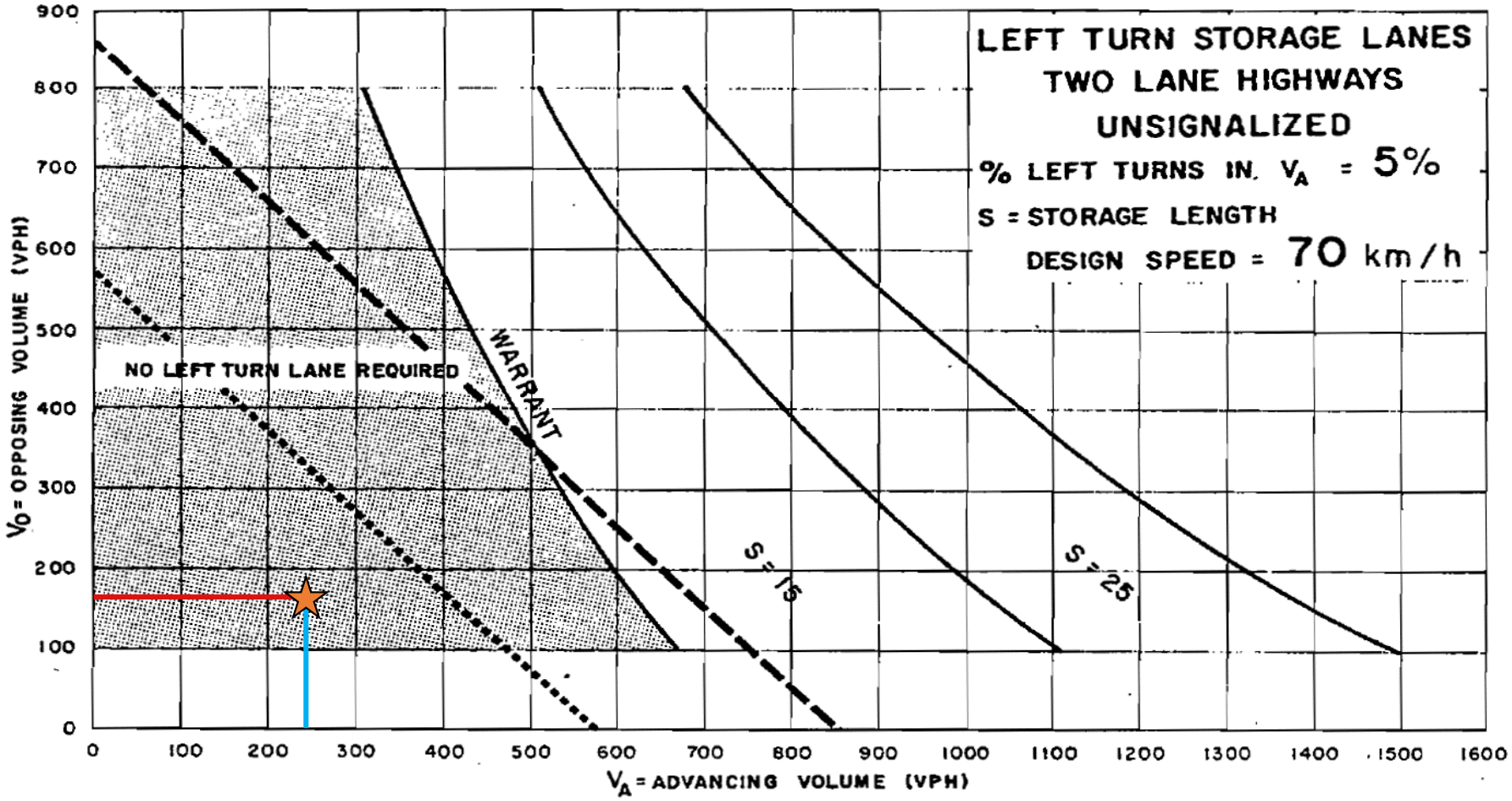
Left-turn volume represents less than 5% of approaching volumes. As such, left-turn warrant analysis can not be completed.



Donald B. Munro Drive & Farmridge Avenue/Street 2 - Westbound Left-Turn - AM Peak Hour



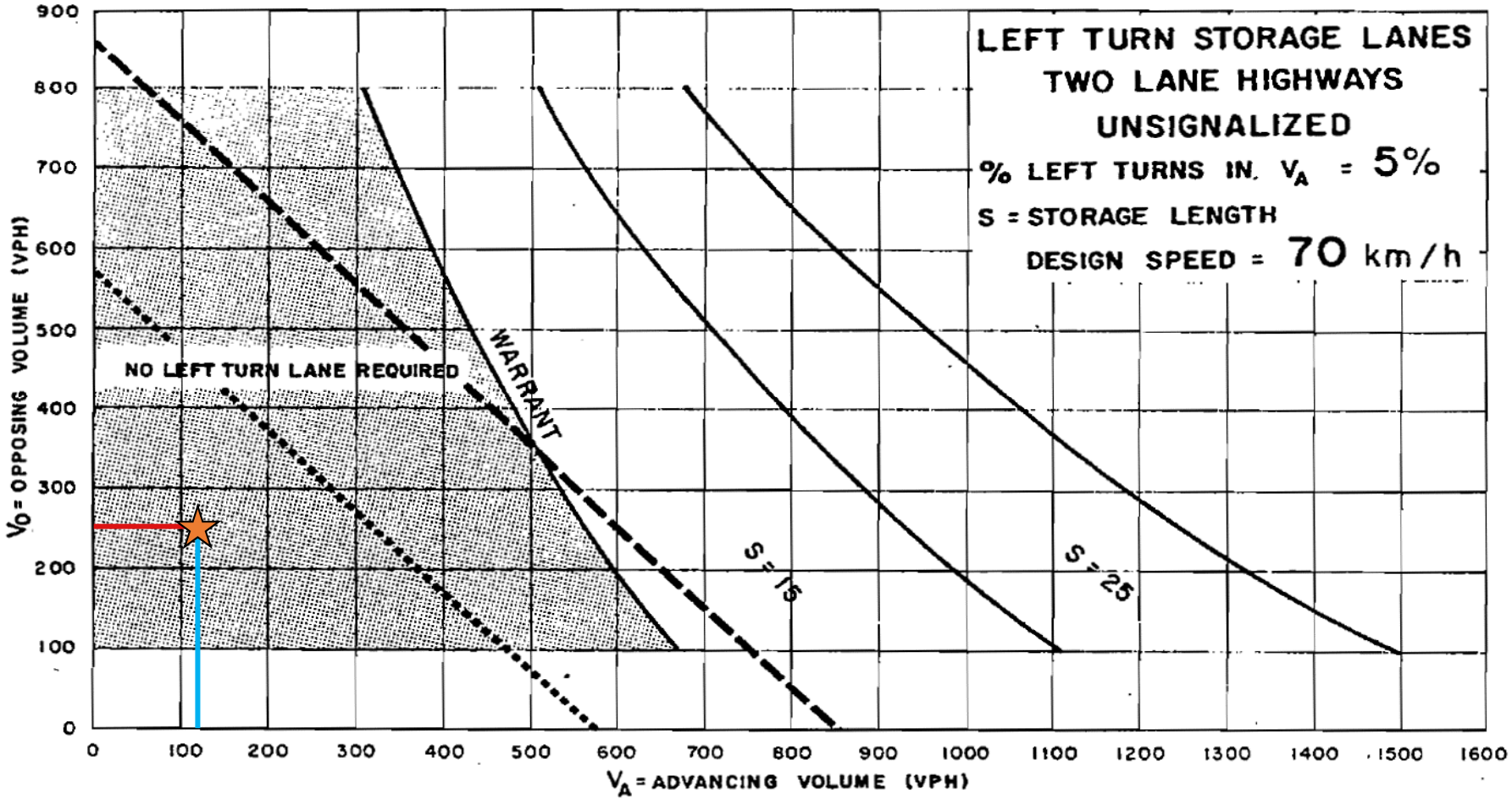
Donald B. Munro Drive & Farmridge Avenue/Street 2 - Eastbound Left-Turn - PM Peak Hour



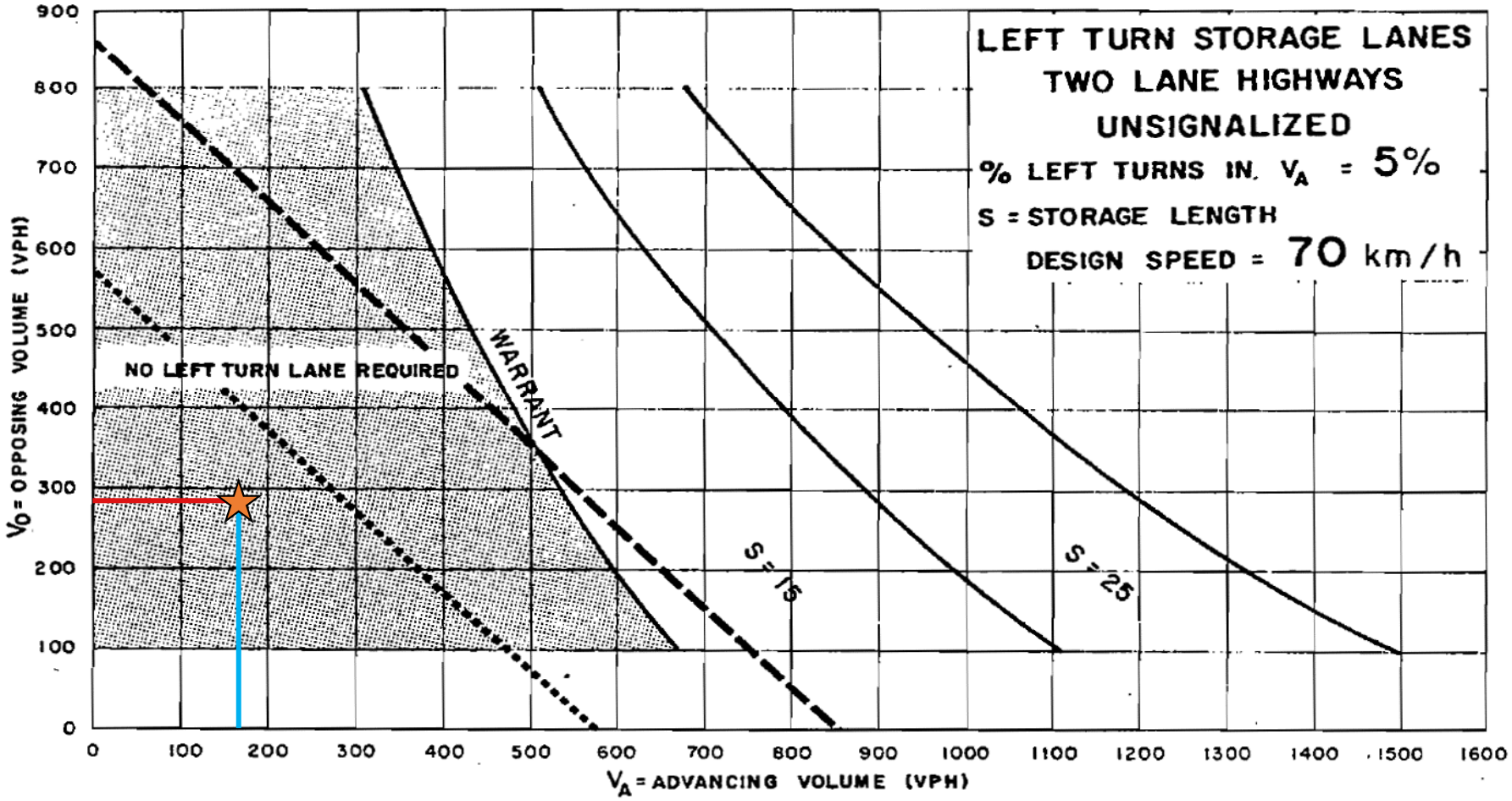
Donald B. Munro Drive & Farmridge Avenue/Street 2 - Westbound Left-Turn - PM Peak Hour

Donald B. Munro Drive & Meadowridge Circle/Street 1 - Eastbound Left-Turn - AM Peak Hour

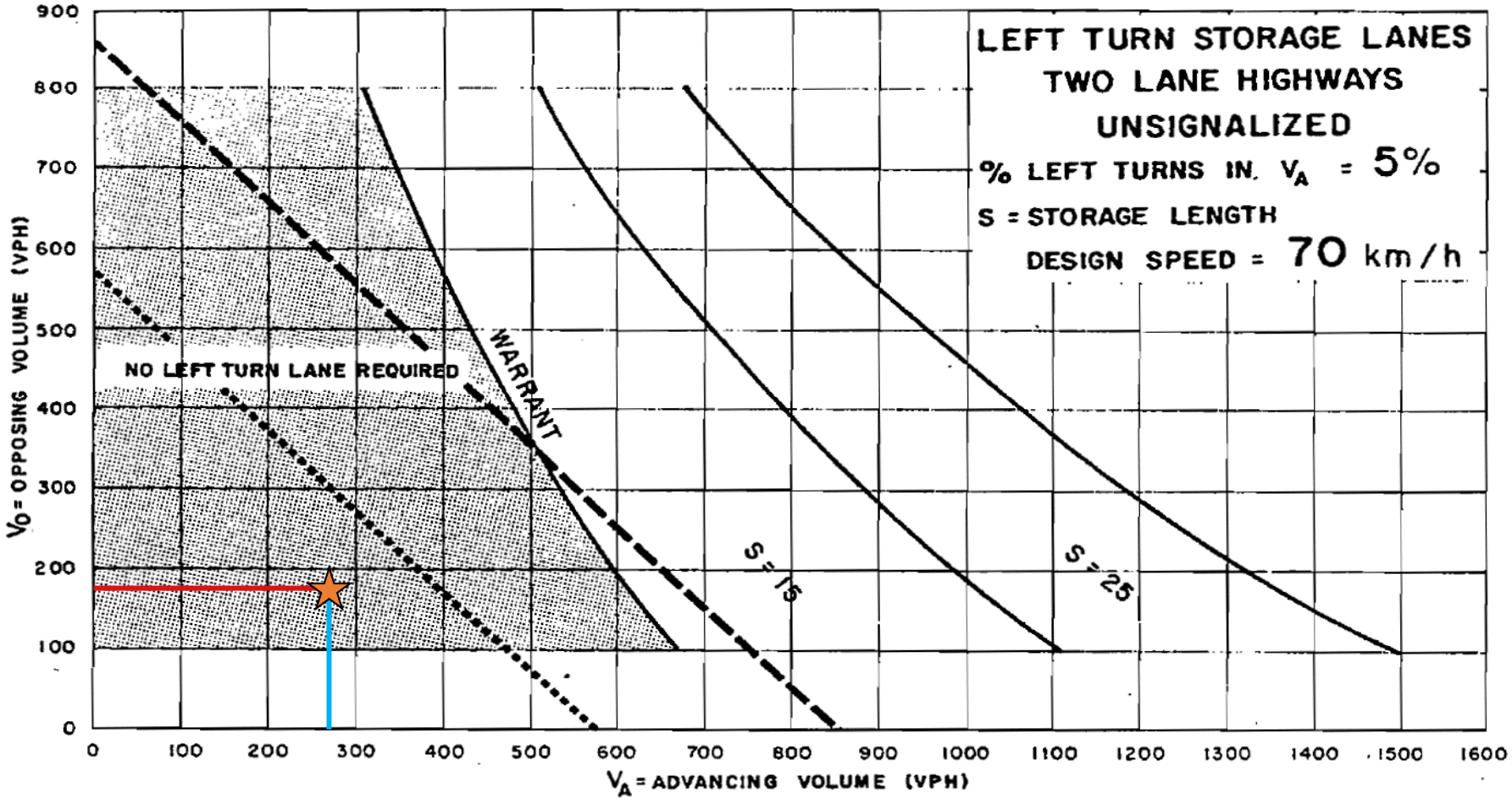
Left-turn volume represents less than 5% of approaching volumes. As such, left-turn warrant analysis can not be completed.



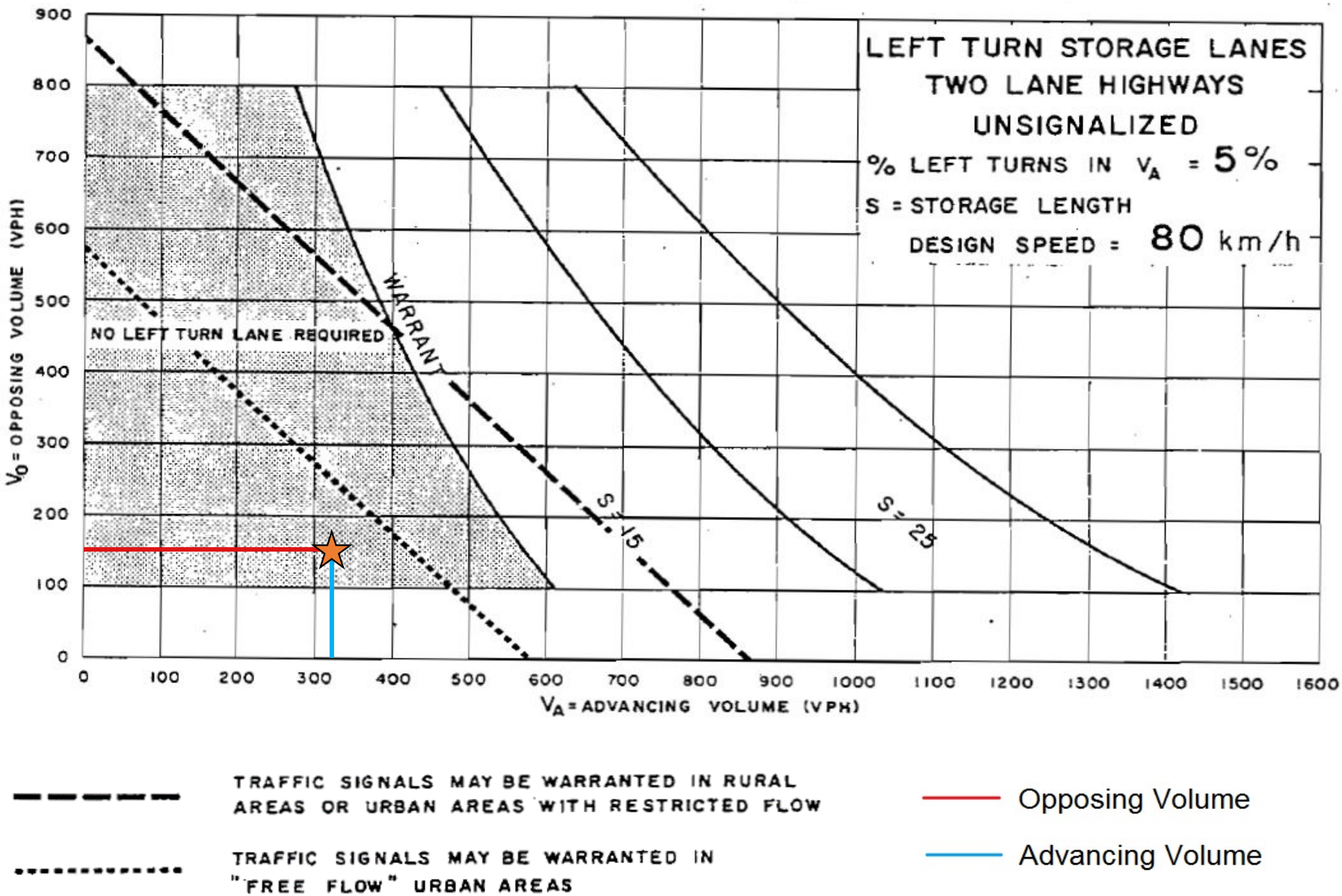
Donald B. Munro Drive & Meadowridge Circle/Street 1 - Westbound Left-Turn - AM Peak Hour



Donald B. Munro Drive & Meadowridge Circle/Street 1 - Eastbound Left-Turn - PM Peak Hour



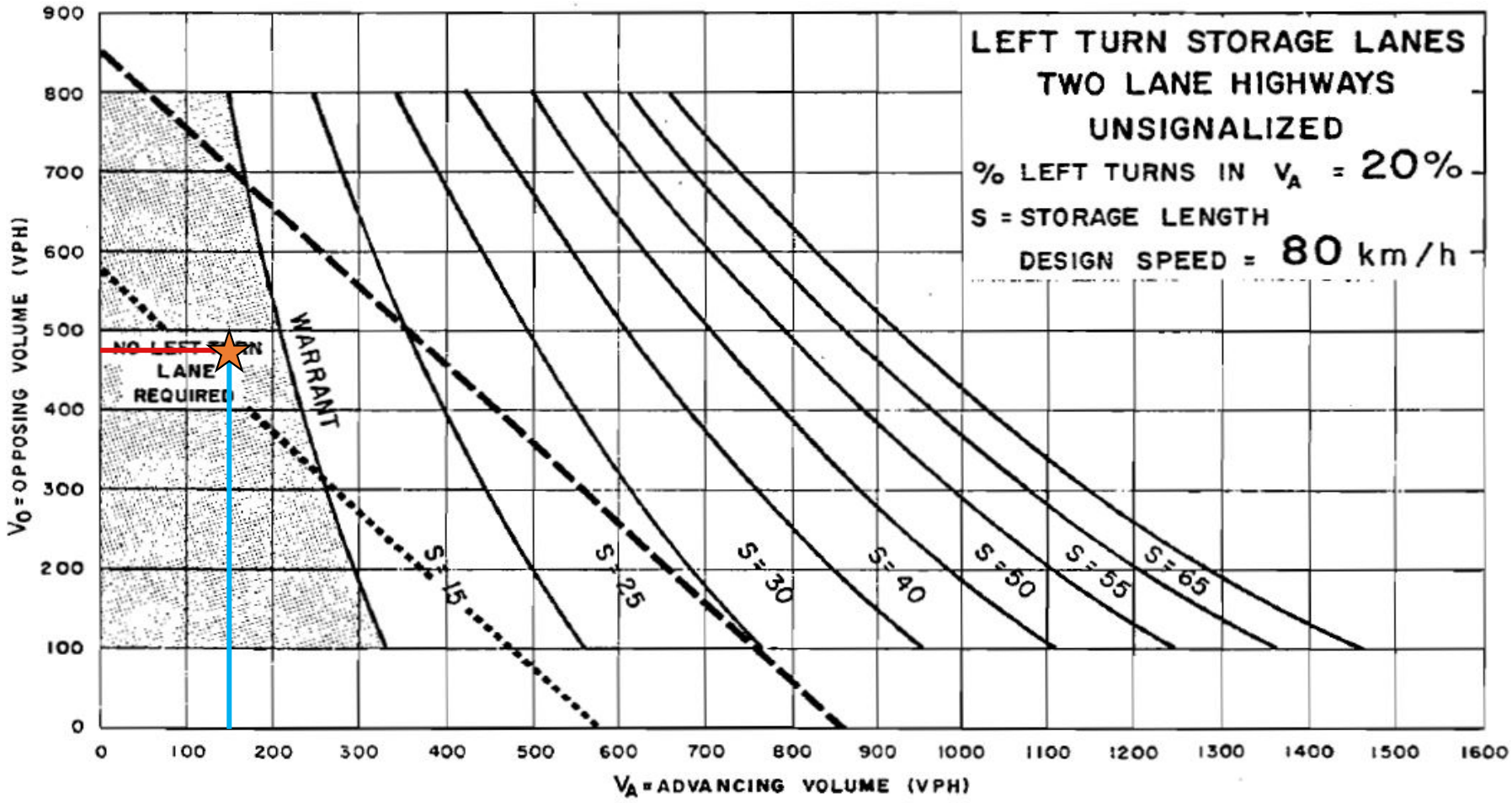
Donald B. Munro Drive & Meadowridge Circle/Street 1 - Westbound Left-Turn - PM Peak Hour



March Road & Donald B. Munro Drive/Old Carp Road - Eastbound Left-Turn - AM Peak Hour

March Road & Donald B. Munro Drive/Old Carp Road - Westbound Left-Turn - AM Peak Hour

Left-turn volume represents less than 5% of approaching volumes. As such, left-turn warrant analysis can not be completed.



March Road & Donald B. Munro Drive/Old Carp Road - Eastbound Left-Turn - PM Peak Hour

March Road & Donald B. Munro Drive/Old Carp Road - Westbound Left-Turn - PM Peak Hour

Left-turn volume represents less than 5% of approaching volumes. As such, left-turn warrant analysis can not be completed.