1919 MAPLE GROVE ROAD

TRANSPORTATION IMPACT ASSESSMENT (TIA) REPORT

Prepared for Formasian Development Corp.
by IBI Group

April 2019

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April 24, 2019

Ms. Rosanna Baggs, CET
Project Manager
Infrastructure Approvals, Development Review
City of Ottawa
110 Laurier Avenue West
Ottawa, ON
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Attention Rosanna Baggs:

RE: 1919 MAPLE GROVE ROAD RESUBMISSION

At your request, the enclosed TIA resubmission has been updated to include additional intersection capacity analysis for the Maple Grove/ Huntmar Road intersection with its existing configuration in all planning years to demonstrate the marginal impact of the proposed development in comparison to the overall growth in travel demand at this intersection.

If you have any questions regarding the contents of this submission, please do not hesitate to contact the undersigned at 613-225-1311 ext. 64029.

Sincerely,

David Hook, P.Eng.
Project Engineer

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 23rd day of April, 2019.
(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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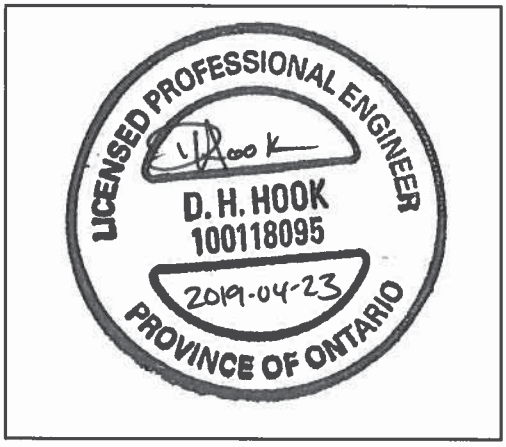

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EXECUTIVE SUMMARY

IBI Group (IBI) was retained by Formasian Development Corporation to complete a Transportation Impact Assessment (TIA) in support of the 1919 Maple Grove Road residential subdivision in the City of Ottawa. This subject property is approximately 15 acres in size, and is generally bounded to the south by Maple Grove Road, to the east by an existing residential development, and to the north and west by undeveloped lands.

Formasian Development Corporation intends to develop approximately 79 townhome units, 440 apartment units and a park at 1919 Maple Grove Road. The proposed development was assumed to be completed in two (2) phases.

The general methodology used in this study was based on the City of Ottawa Transportation Impact Assessment Guidelines (2017). The complete TIA was originally submitted on March 21, 2018. This resubmission is meant to address City comments.

195 Huntmar Drive

A Public Open House (POH) was held on January 10, 2018 to review the preliminary concept plan for 195 Huntmar Drive, and no target buildout date was given for the development. Since the concept plan has not been finalized and the buildout of the site is unknown, it was agreed to by City staff that the lands at 195 Huntmar Drive would not be built within the planning horizons proposed for this study. Traffic generated from the subject site would need to rely on the existing transportation network. A Transportation Impact Assessment (TIA) report will be prepared by Parsons in support of the 195 Huntmar Drive development, which will incorporate traffic generated from the subject site (1981 Maple Grove Road) as part of the background traffic. Parsons' future TIA will define characteristics for 195 Huntmar Drive such as the road alignment, unit count and general layout of the site.

Potential Shortcutting Issues

The surrounding community expressed concerns about the possibility of existing shortcutting issues within the Fairwinds and Bryanston Gate communities being exacerbated by the proposed development. In response to existing shortcutting concerns, the City of Ottawa has recently implemented a variety of traffic calming measures within the Bryanston Gate and Fairwinds communities to both increase driver awareness as well as discourage the use of these shortcut routes by increasing the amount of friction to motorists. In the short term, the extension of Maple Grove Road to Stittsville Main Street is expected to mitigate potential shortcutting issues within these communities by providing a less circuitous route with higher capacity and less 'friction' as a viable alternative to discourage traffic originating west of Johnwoods Street from shortcutting through the Fairwinds and Bryanston Gate communities.

In the longer term, when Stittsville Main Street is extended further north to provide direct connections to Palladium Drive and Highway 417, the permanent closure of Johnwoods Street is expected to significantly reduce the desire for shortcutting through the development by eliminating any direct connections between Hazeldean Road and the proposed Street 1 access north of Maple Grove Road.

The proposed development is not expected to exacerbate any potential shortcutting issues in the existing Bryanston Gate of Fairwinds communities. The circuitousness of any potential shortcut routes to Highway 417 through the proposed development is expected to discourage this activity by design.

The key conclusions from the TIA Analysis Report are as follows:

- The study area transportation network is expected to accommodate site-generated traffic volumes through to the 2026 horizon year with the appropriate actions modifications by the City of Ottawa to support growth in background and site-generated traffic. Formasian Development Corporation shall be responsible for constructing all required access intersections and internal transportation facilities as dictated by the proposed draft plan.

- There are existing shortcutting concerns that have been addressed through the recent implementation of traffic calming measures in the Bryanston Gate and Fairwinds communities. The extension of Maple Grove Road will alleviate shortcutting in the short term by providing greater connectivity of the arterial and collector road network. The ultimate road network will provide additional roadway capacity with more direct connections to Highway 417, and the closure of Johnwoods Street should discourage additional shortcutting with the elimination of the direct route from Hazeldean Road through the proposed development.
- There is no RMA required for the proposed development. The RMA process is currently ongoing for the extension of Maple Grove Road to Stittsville Main Street as part of the development application for 1981 Maple Grove Road.
- There is no requirement for a monitoring plan.

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The key findings and recommendations from this TIA are as follows:

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- The proposed rights-of-way for internal roads within the 1919 Maple Grove Road development will be as follows:
  - Single-loaded streets – 14.75m to 16.5m
  - Double-loaded streets – 18m
- Some local roadways will have sidewalks to provide connections to local parks and pathways. No dedicated cycling facilities have been proposed within the development lands.
- TDM and non-auto mode provisions will be reinforced. Appropriate connections, both internal and to the regional network, have been provided to accommodate active transportation.
- The proposed development is expected to be constructed in two (2) phases:
  - Phase 1 – Townhome units – full buildout/ occupancy expected by 2021
  - Phase 2 – Apartment units – full buildout/ occupancy expected by 2026

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- The study area included the following existing intersections:
  - Maple Grove Road and Huntmar Drive
  - Maple Grove Road and Santolina Street
  - Maple Grove Road and Alon Street
- A review of the reported collisions showed a pattern of rear-end collisions at the Maple Grove Road and Huntmar Drive intersection. The majority of the 8 rear-end collisions occurred during the AM and PM peak periods, or during adverse weather conditions, and were likely not the result of the intersection design
- There are two (2) existing transit service routes operating within the study area: 162 and 261. The 162 provides daily service: the 261 operates on weekdays only.

- Maple Grove Road is currently the only existing boundary street providing direct frontage to the proposed development. The section of Maple Grove Road fronting the subject property currently has a rural cross-section with gravel shoulders, and no formal cycling or pedestrian facilities.
- All existing study area intersections with the exception of the Maple Grove Road and Huntmar Drive intersection were shown to operate within City standards in 2018. These results coincided with previous traffic studies completed in the study area.

Future Background Traffic Demand

- Two future analysis horizons were established based on the expected development phases: 2021 and 2026.
- A 2.0% background traffic growth rate was applied to the following existing intersection within the study area:
    - Maple Grove Road and Huntmar Drive intersection, all movements
- Side street traffic from minor collector and local roadways within the study area was not factored into the background growth rate, since these roads provide access to local developments; all adjacent developments were accounted for separately in this analysis.
- Two (2) known adjacent developments were accounted for in the future background traffic volumes. The unit counts and characteristics for each development were based on traffic studies and draft plans of subdivision that supported the development applications.

1919 Maple Grove Road Generated Traffic Volumes

- Development generated traffic volumes were derived using 2009 TRANS Trip Generation Study and converted to person trips according to the TIA Guidelines. The City Origin Destination (OD) Survey mode share for the Kanata/ Stittsville Zone was applied to determine the trips by mode.
- The 1919 Maple Grove Road development is expected to generate the following peak hour trips at each future horizon:
    - 2021 & 2026 - Auto Driver: 223 morning peak hour trips; 284 afternoon peak hour trips
      Transit: 89 morning peak hour trips; 98 afternoon peak hour trips

Future Intersection Analysis

- <u>Maple Grove Road and Huntmar Drive:</u>

  The Maple Grove Road and Huntmar Drive intersection is presently approaching its theoretical capacity, operating at a LOS 'E' during the weekday afternoon peak period, and auxiliary lane modifications are required on the northbound and southbound approaches to alleviate existing capacity issues that will continue to worsen with or without development traffic.

  The TIA prepared for the Fairwinds development at 33 Johnwoods Street (December 2012) assumed that auxiliary left and right turn lanes would be constructed on all approaches at the intersection of Maple Grove Road and Huntmar Drive by 2017. Despite these recommendations, all approaches of the existing intersection have remained as shared through-turning lanes with the exception of the northbound approach, which has a 15m left-turn storage lane.

Operational results from queuing analysis based on the 2026 total traffic condition indicated that the eastbound left-turn lane should have 85m of storage, the westbound left-turn lane should have 40m of storage, the southbound left-turn lane should have 15m of storage, and the northbound left-turn lane storage length should be extended from 15m to 50m. A southbound right-turn lane of 30m is also warranted in the existing condition and projected future traffic demand.

- Maple Grove Road and Santolina Street

  The Maple Grove Road and Santolina Street intersection was shown to operate within City standards in the morning and afternoon peak periods through to the 2026 total traffic condition with the existing intersection control.

  The geometric assessment of Maple Grove Road and Santolina Street triggered a 15m westbound left-turn to accommodate the 2026 background and total traffic conditions; however, this auxiliary lane was determined to be unnecessary, as it was triggered under the worst case scenario in the ultimate planning horizon, 2026. This scenario assumed that infrastructure to the north of the subject property is not built out, and that the majority of commuter traffic is reliant on Maple Grove Road. The TMP indicates that the road network to the north of the subject development will be built out between 2026 and 2031, which will help relieve traffic congestion along Maple Grove Road, thereby eliminating the need for a westbound left-turn lane. The existing shared lanes on all approaches were considered acceptable.

- Maple Grove Road and Alon Street

  The Maple Grove Road and Alon Street intersection was shown to operate within City standards in the morning and afternoon peak periods through to the 2026 total traffic condition with the existing lane configurations and intersection control.

- Stittsville Main Street Extension and Maple Grove Road

  The proposed Stittsville Main Street Extension and Maple Grove Road intersection was shown to operate within City operational standards with shared through-turning lanes on all approaches, and a stop-controlled minor approach through to the 2026 total traffic condition.

- Proposed Accesses/ Egresses

  The proposed Street 1 access/ egress off of Maple Grove Road was shown to operate within City operational standards with shared through-turning lanes on all approaches, and a stop-controlled southbound approach through to the 2026 total traffic condition.

  The geometric requirements for all intersections should be reviewed and confirmed during detailed design.

Geometric Analysis Results

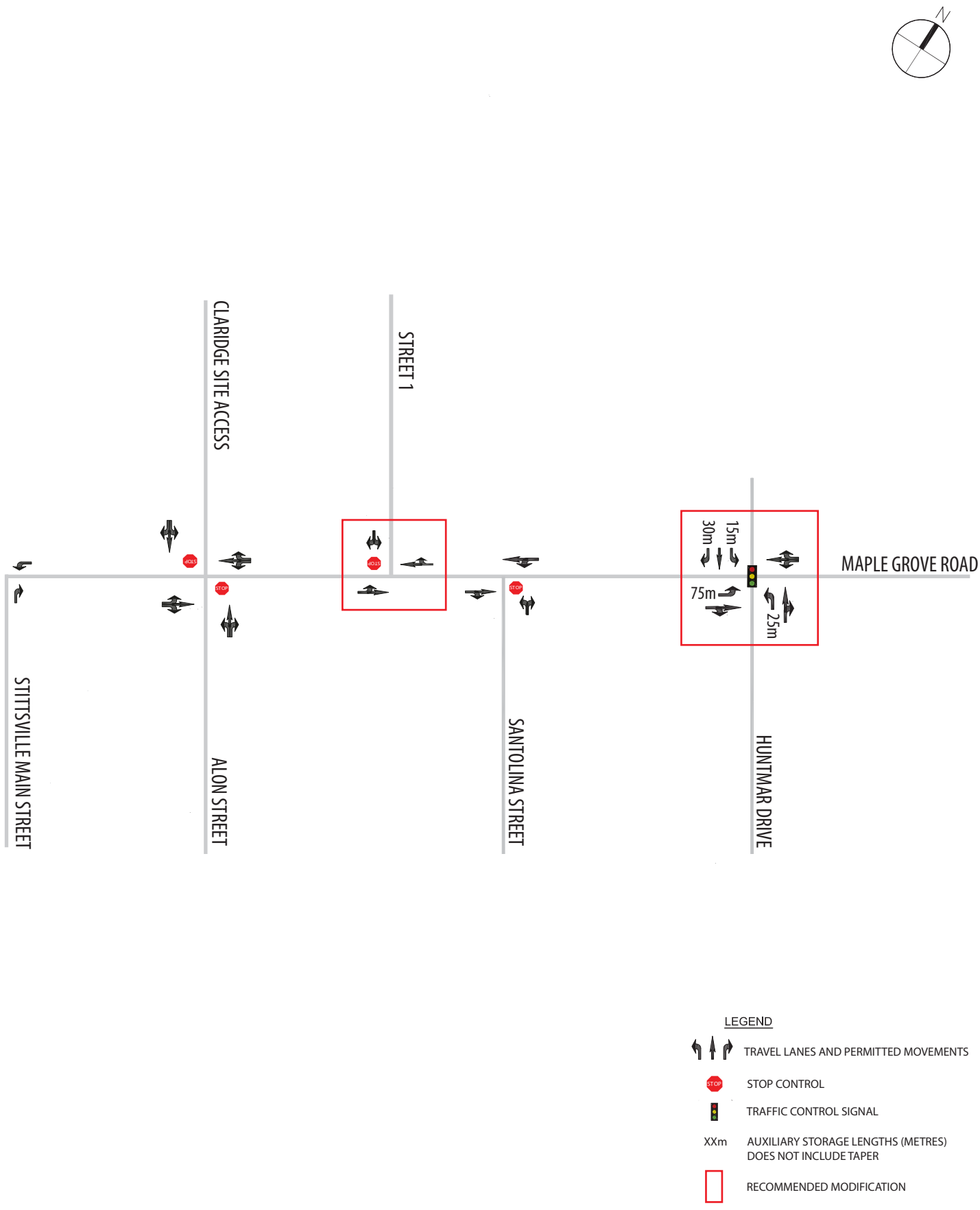
- Geometric evaluations revealed no sight distance or corner clearance issues. Proper care should be taken to ensure no obstructions are placed in the line-of-sight in the vicinity of the proposed access points. The future access locations to the commercial blocks are expected to follow these guidelines, and will be assessed during the site plan application when more details are available.

Summary of Recommendations

A summary of all recommended actions/ modifications has been provided in Table ES-1 and Exhibit ES-1.

TABLE ES-1 – Summary of Recommended Actions/ Modifications

HORIZON	RECOMMENDED ACTIONS/ MODIFICATIONS
Existing (2018)	Maple Grove Road and Huntmar Drive • Existing intersection configuration with signal optimization does not meet City intersection capacity requirements. • Construct southbound right-turn lane with 30m of storage • Construct left turn lanes with the following storage lengths: ◆ Extend northbound left-turn storage length by 10m (total recommended storage length is 25m) ◆ Southbound left-turn lane with 15m storage • Restrict parking on both side of eastbound approach for the first 75m to accommodate de-facto left-turn vehicle storage lane Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Alon Street • Meets City operational guidelines
Future (2021) Background – No Site Generated Traffic	Assume all actions and modifications from the Existing (2018) traffic conditions remain. Optimize all traffic signals. Maple Grove Road and Huntmar Drive • Meets City operational guidelines Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Alon Street / Claridge Site Access • Claridge Homes – Construct north leg • Two-way stop-controlled intersection • Shared through-turn lanes on all approaches • Meets City operational guidelines Maple Grove Road and Stittsville Main Street • City of Ottawa - Extend Maple Grove Road to Stittsville Main Street
Future (2021) Total – With Site Generated Traffic	Assume all actions and modifications from the Existing (2018) traffic conditions remain. Optimize all traffic signals. Maple Grove Road and Huntmar Drive • Meets City operational guidelines Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Street 1 • Formasian Development Corporation – Construct unsignalized access intersection • Southbound stop-controlled • Shared through-turn lanes on all approaches Maple Grove Road and Stittsville Main Street • City of Ottawa - Extend Maple Grove Road to Stittsville Main Street to create a bend in the road
Future (2026) Background – No Site Generated Traffic	Assume all modifications from the Future (2021) Background traffic conditions remain. Optimize all traffic signals.
Future (2026) Total – With Site Generated Traffic	Assume all modifications from the Future (2021) Total traffic conditions remain. Optimize all traffic signals.



IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT ES-1
2026 Intersection Control and
Lane Configurations

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

1 Introduction

The following Transportation Impact Assessment (TIA) Report has been prepared on behalf of Formasian Development Corporation in support of the 1919 Maple Grove Road draft plan of subdivision application. The format of the TIA Report is based on the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. The purpose of the TIA Report is to "identify on-site and off-site measures to be undertaken by a developer to align the transportation system's performance with the City's goals of creating an integrated land use and transportation system as expressed in the Official Plan and Transportation Master Plan" (Ottawa 2017 TIA Guidelines, page 27).

Responses to the City's comments received for the submission of the Screening, Scoping, Forecasting and Analysis Reports for the previously-submitted TIA are provided in Appendix A.

2 Screening and Scoping

Section 2 summarizes the Screening Form and Scoping Report previously submitted and approved by the City. The Screening Form (Section 2.1) established the need to complete the study. The Scoping Report established the existing/ planned conditions of the study, key parameters and a review of possible exemptions.

2.1 Screening Form

STEP 1 - City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	1919 Maple Grove Road, Kanata West
Description of Location	Site is bounded by Maple Grove Road to the south, residential developments to the east and undeveloped lands to the north & west
Land Use Classification	Residential
Development Size (units)	460 units (apartment units) 72 units (townhome units)
Development Size (acres)	15
Number of Accesses and Locations	There are three access/ egress locations proposed for this development to connect it to its boundary streets: (1) Maple Grove Road – 1 access/ egress to the south (2) East-West Road – 2 accesses/ egresses located to the north
Phase of Development	Phase 1 – 2021; Phase 2 – 2026
Buildout Year	2026

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.*

The proposed development size is greater than the sizes identified above, therefore 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).*

None of the above questions were answered with 'Yes'. Therefore, the Location Trigger is not satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/h 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?		✓

None of the above questions were answered with 'Yes'. Therefore, the Location Trigger is not 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?		✓

The subject development satisfied the trip generation trigger for a Transportation Impact Assessment (TIA).

2.2 Description of Proposed Development

2.2.1 Site Location

The proposed residential development at 1919 Maple Grove Road is shown in Exhibit 1. This property is approximately 15 acres in size, and it is currently a greenfield site. The subject site abuts Maple Grove Road to the south, an existing residential development to the east, and undeveloped lands to the west and north.

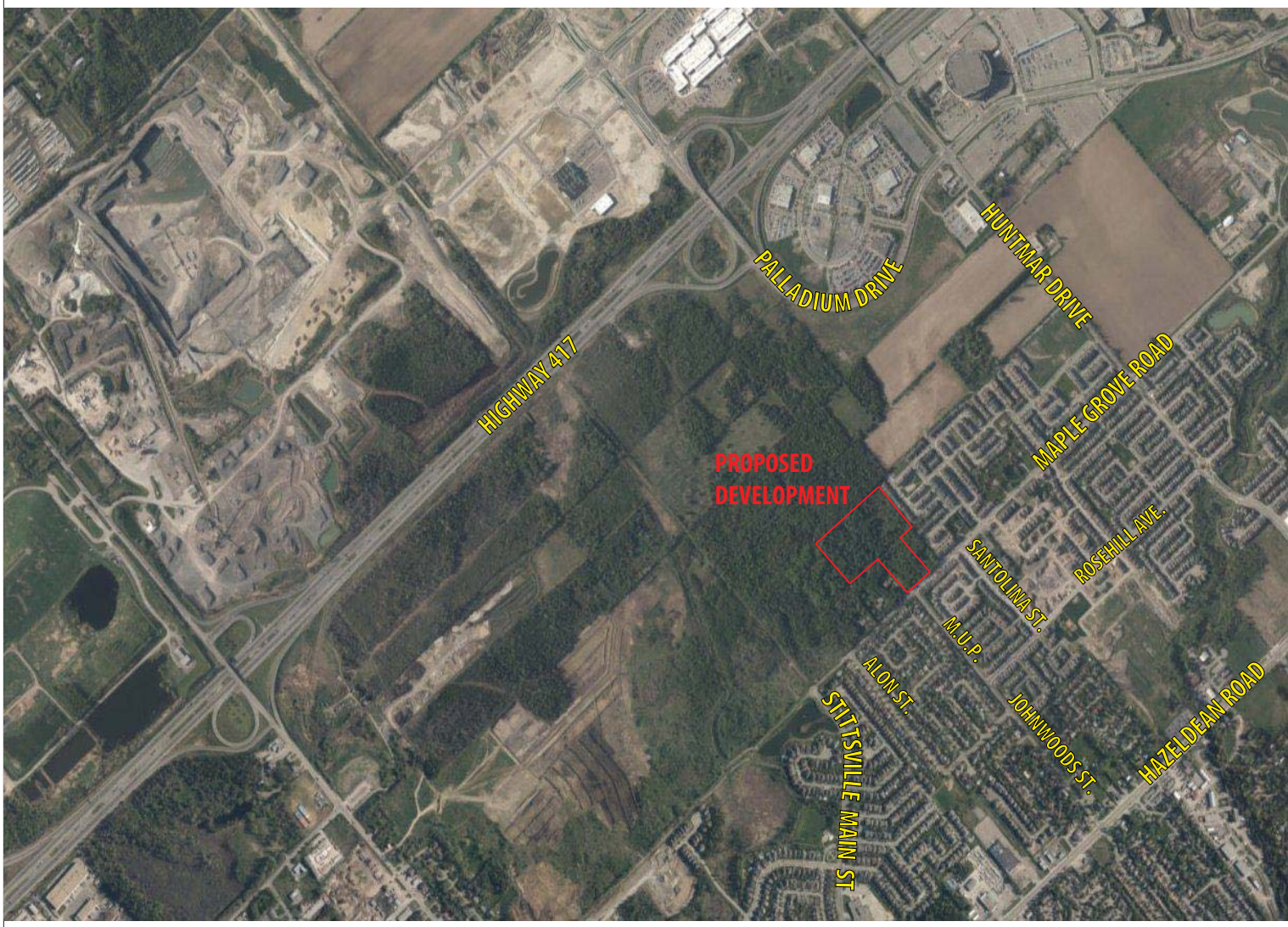
2.2.2 Land Use

The proposed draft plan for the subject site is shown in Exhibit 2. The land is currently undeveloped, and is zoned as development reserve. The proposed development will contain a mix of low and medium density residential land uses, as summarized in Table 1.

It is planned that the development will be constructed in two phases: full buildout/ occupancy of the townhome units is expected by 2021, and full buildout/ occupancy of the apartment units is expected by 2026.

Table 1 – Land Use Statistics

LAND USE	SIZE (# OF UNITS)
Townhome/ Semi-Detached Residential	79 units
Apartment	440 units



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1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 1
Site Location

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DATE
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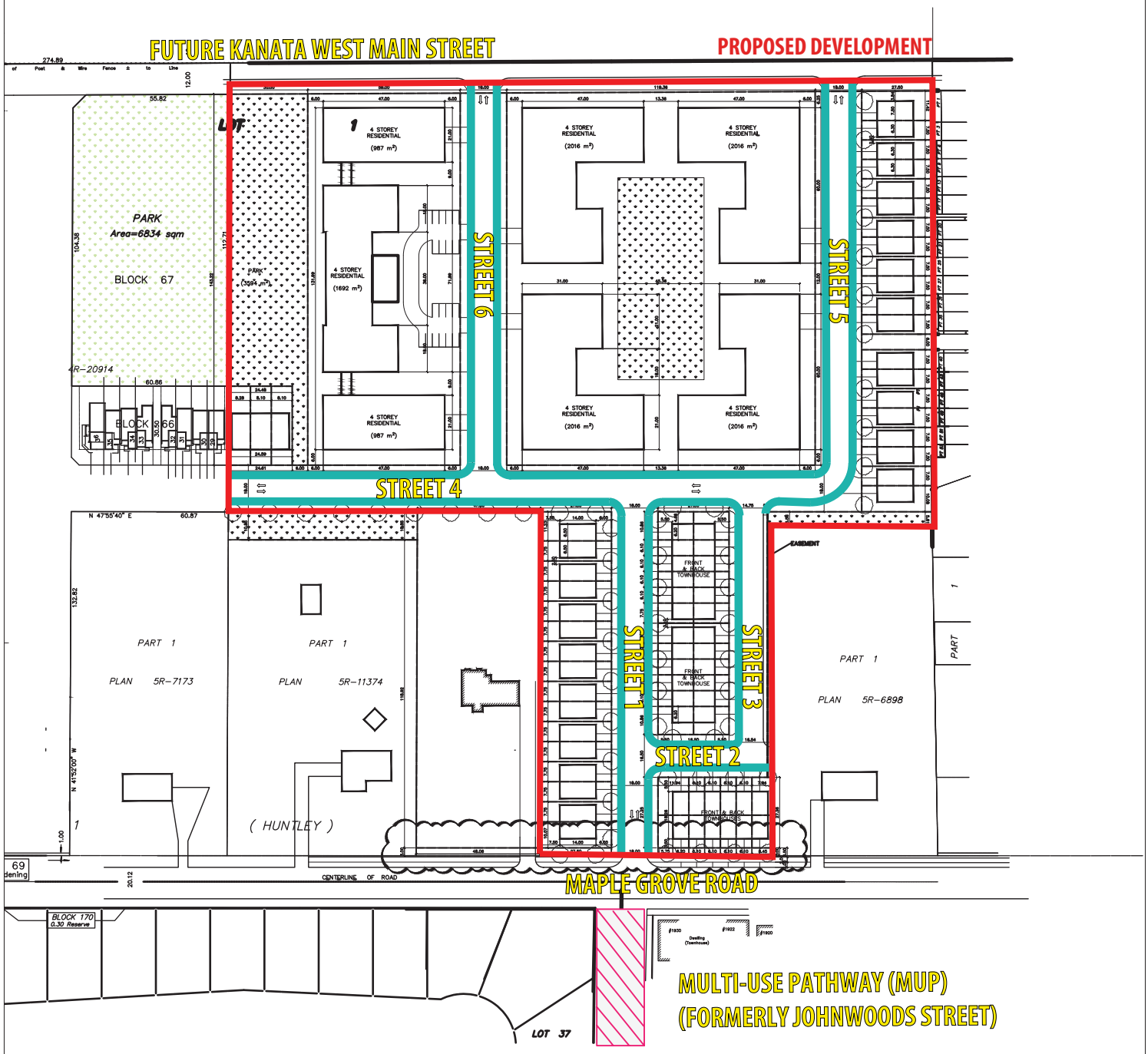

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Potential Sidewalk Location

Proposed Development Limit

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1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 2
Proposed Development

PROJECT NO.: 39124
DATE: APRIL 2019
SCALE: -20m 0 40m

2.2.3 Site Layout

The subject site proposes three new full movement access intersections connecting it to the adjacent road network, as shown in Exhibit 2, and described below:

- Maple Grove Road and Street 1
- Future Kanata West Main Street and Street 5
- Future Kanata West Main Street and Street 6

The Future Kanata West Main Street will be constructed in conjunction with the development of 195 Huntmar Drive, located immediately north of the subject site. At the time of this traffic study, the concept plan for 195 Huntmar Drive was in the early stages of the development application process, and may be subject to change.

2.2.4 Transit, Pedestrian and Cycling Facilities

The proposed development does not include any transit or cycling facilities. Sidewalks will be provided on select roadways to provide access to local amenities. The location and configuration of on-site pedestrian facilities will be established through the Draft Plan of subdivision.

2.3 Existing Conditions

2.3.1 Existing Road Network

2.3.1.1 Roadways

Stittsville Main Street is a two-lane urban roadway that extends from south of Fernbank Road in the south, and terminates with a cul-de-sac near Maple Grove Road. South of Hazeldean Road, Stittsville Main Street is classified as an arterial road, and north of Hazeldean Road, it is classified as a major collector road. The available right-of-way along Stittsville Main Street north of Hazeldean Road is 26m, and the speed limit is 50km/h.

Maple Grove Road is classified as an arterial roadway, between Huntmar Drive and Terry Fox Drive, a collector road between Huntmar Drive and the multi-use pathway (formerly Johnwoods Street), and a local road from the multi-use pathway to Alon Street. The portion of Maple Grove Road fronting the subject property has a two-lane, rural cross-section with a posted speed limit of 50km/h. From Stittsville Main Street to Huntmar Drive, Maple Grove Road has a 26m right-of-way, and east of Huntmar Drive, the right-of-way widens to 37.5m, as the road classification is upgraded to arterial.

Huntmar Drive is a two-lane north-south arterial road that extends from March Road in the north to Hazeldean Road in the south, where it continues as Iber Road. The road has a posted speed limit of 50 km/h within the study area.

Santolina Street is a two-lane north-south collector road that extends from Maple Grove Road in the north and terminates at Rosehill Avenue in the south, before transitioning to Eucalyptus Circle. The unposted speed limit is 50 km/h.

Alon Street is a two-lane north-south local street that extends from Maple Grove Road, before transitioning to an east-west alignment and terminating at its connection with Johnwoods Street. The posted speed limit is 40 km/h.

2.3.1.2 Study Area Intersections

The following existing intersections will be evaluated in this report:

- Huntmar Drive and Maple Grove Road
- Maple Grove Road and Santolina Street
- Maple Grove Road and Alon Street

The intersection control and lane configurations of each intersection are shown in Exhibit 3.

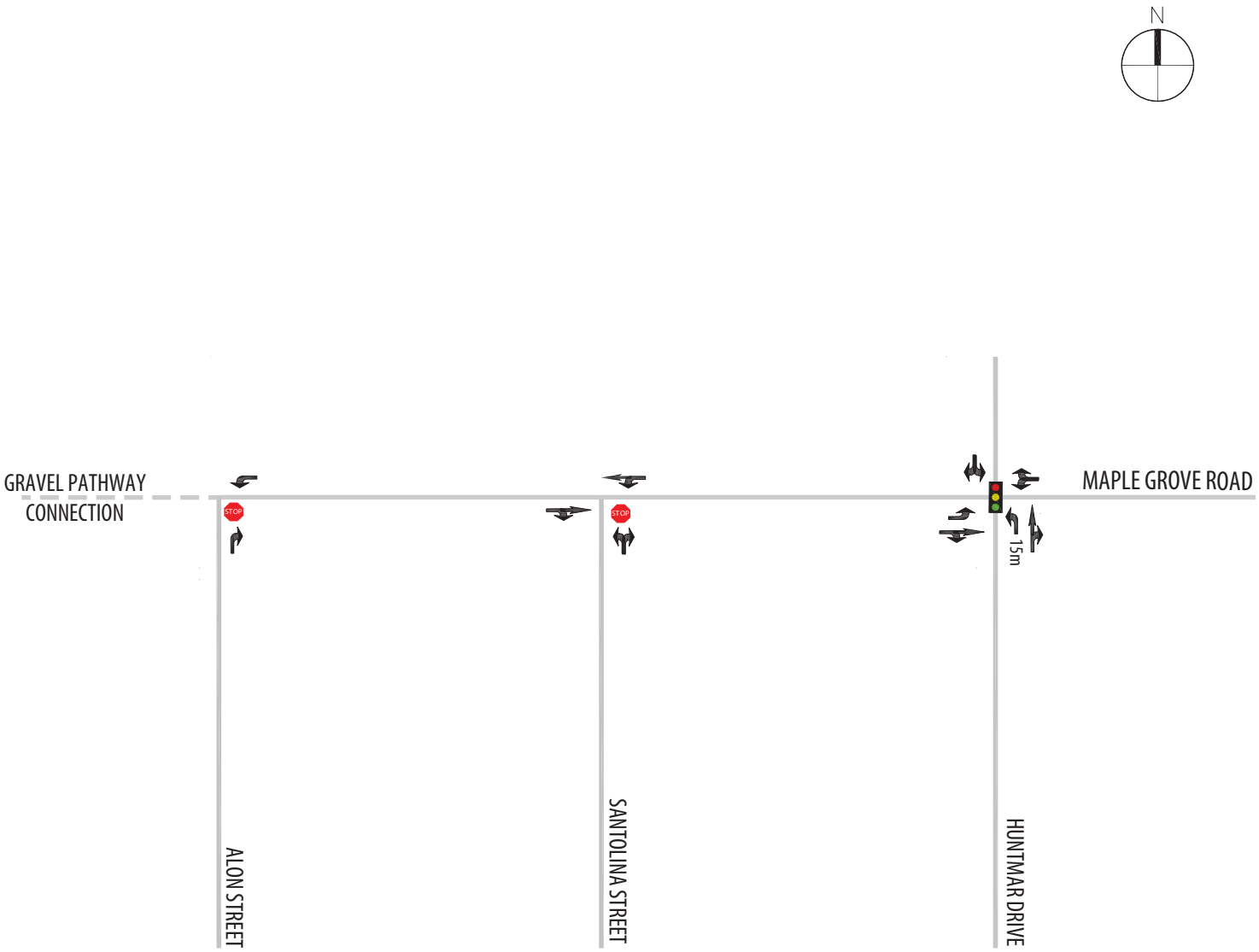
It was noted that there are four (4) private approaches serving single-family homes located on the north side of Maple Grove Road within the vicinity of the proposed development. Three private approaches are located to the west of the proposed Street 1 access off of Maple Grove Road, and one private approach is located to the east. These driveways currently permit all-turn access movements onto Maple Grove Road. Traffic volumes at both of all of these existing private approaches are assumed to be negligible, and are not expected to cause operational conflicts with the proposed Street 1 and Maple Grove Road intersection or vice versa.

2.3.1.3 Traffic Management Measures

There are a range of traffic management measures provided in the existing community south of the subject site.

The following measures were observed by IBI staff on a site visit conducted October 3, 2018:

- Information signage along Maple Grove Road west of Johnwoods Street indicates that this area has been designated as a 'traffic calmed neighborhood'.
- Permanent closure of Johnwoods Street from Rosehill Avenue to Maple Grove Road and conversion into a multi-use pathway (MUP).
- Vertical centreline treatments such as flexible stake bollards are provided west of Johnwoods Street on Maple Grove Road and along Alon Street. The speed limit along Alon Street has been reduced to 40km/h.
- Speed counters and display devices are located along Alon Street, Santolina Street and Rosehill Avenue.
- Speed humps are provided along Johnwoods Street with 30km/h warning signs.
- In response to the school priority along Stittsville Main Street near Bandelier Way, there are traffic calming measures such as school zone speed limit signage, school crossing signs and pavement markings. There are also curb bulbouts and pinch points located along Stittsville Main Street north of Hazeldean Road.



LEGEND

- TRAVEL LANES AND PERMITTED MOVEMENTS
- STOP CONTROL
- TRAFFIC CONTROL SIGNAL
- XXm AUXILIARY STORAGE LENGTH (in metres) DOES NOT INCLUDE TAPER LENGTH

IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 3
Existing (2018) Lane Configurations
and Intersection Controls

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

2.3.2 Existing Traffic Volumes

Weekday morning and afternoon peak hour turning movement counts were collected by IBI Group at the following study area intersections:

- Huntmar Drive and Maple Grove Road (IBI Group – October 2018)
- Maple Grove Road and Santolina Street (IBI Group – January 2018)
- Maple Grove Road and Alon Street (IBI Group – January 2018)

The existing (2018) peak hour traffic volumes are shown in Exhibit 4. Traffic count data is provided in Appendix B.

2.3.3 Existing Bicycle and Pedestrian Facilities

Maple Grove Road is located along the southern boundary of the subject site, and is the only existing boundary street providing direct frontage to the proposed development. The section of Maple Grove Road fronting the subject property currently has a 2.0m sidewalk on the north side with a 2.5m grassed boulevard separating the road and the sidewalk. West of the multi-use pathway (MUP), Maple Grove Road transitions to a rural cross-section with gravel shoulders.

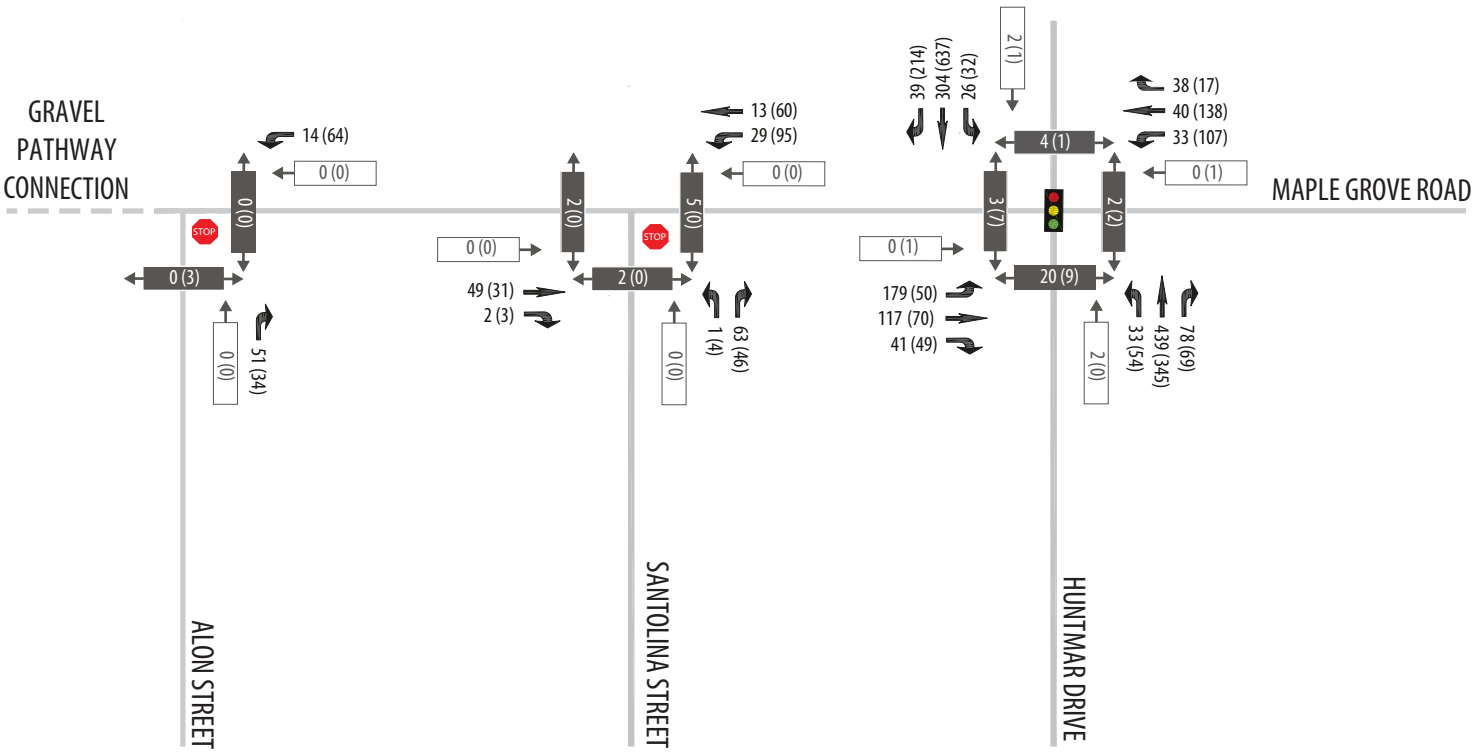
Johnwoods Street was permanently closed to vehicular traffic from Maple Grove Road to Rosehill Avenue on November 15, 2017, and converted into a linear park with a multi-use pathway (MUP). There are presently no formal cycling facilities along Maple Grove Road.

2.3.4 Existing Transit Facilities and Service

There are currently two OC Transpo routes that provides service within the study area:

- Route #162 operates from Fernbank Road in Stittsville to the Terry Fox Station (via the Tanger Outlet Mall). Week day bus services the study area only in off-peak times, and operates with approximately 60-minute headways. All-day service is offered on Saturdays with approximately 20-minute headways. Service is not offered on Sundays. Bus stops are located along Maple Grove Road from Santolina Street to Huntmar Drive.
- Route #261 is a weekday express bus that provides commuter service with 20 to 30-minute headways from Stittsville to the downtown core during the AM Peak, and the reverse in the PM Peak. This route does not provide weekend service.

Exhibit 5 shows the existing transit routes in the study area. Transit data is provided in Appendix C.



LEGEND

- STOP CONTROL
- TRAFFIC CONTROL SIGNAL
- PERMITTED MOVEMENTS
- xxx (xxx) xxx (xxx) xxx (xxx) — AM & PM PEAK HOUR VEHICULAR VOLUMES
- xxx (xxx) — AM & PM PEAK HOUR PEDESTRIAN VOLUMES
- xxx (xxx) — AM & PM PEAK HOUR CYCLING VOLUMES

IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 4
Existing (2018) Auto, Cycling and Pedestrian
AM & PM Peak Hour Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

Exhibit 5 – Existing Transit Routes

source: octranspo.com, Jan 19, 2018

2.3.5 Collision Analysis

A review of historical collision data has been provided. The City requires 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 2 summarizes all reported collisions between January 1, 2012 and January 1, 2017 that have a discernible pattern. A copy of the City collision records is available in Appendix D.

Table 2 – Reported Collisions within Study Area

LOCATION	# OF REPORTED COLLISIONS	# OF SIMILAR EVENTS
Huntmar Drive and Maple Grove Road	15	8 rear-end collisions
Alon Street and Maple Grove Road	1	1 single-vehicle collision
Leveche Way and Maple Grove Road	2	2 angle collisions
Johnwoods Street and Maple Grove Road [1]	2	1 angle collision 1 single-vehicle collision
Maple Grove Road (Huntmar Drive to MUP[1])	5	3 single-vehicle collisions

[1] On November 15, 2017, Johnwoods Street from Maple Grove Road to Rosehill Avenue was permanently closed to vehicular traffic, and was converted into a multi-use pathway (MUP)

Based on an initial review of the collision history as shown in Table 2, collisions at Huntmar Drive and Maple Grove Road requires further analysis in Section 4.3.2 to determine if there is a discernible collision pattern at the intersection.

2.4 Planned Conditions

2.4.1 Changes to the Study Area Transportation Network

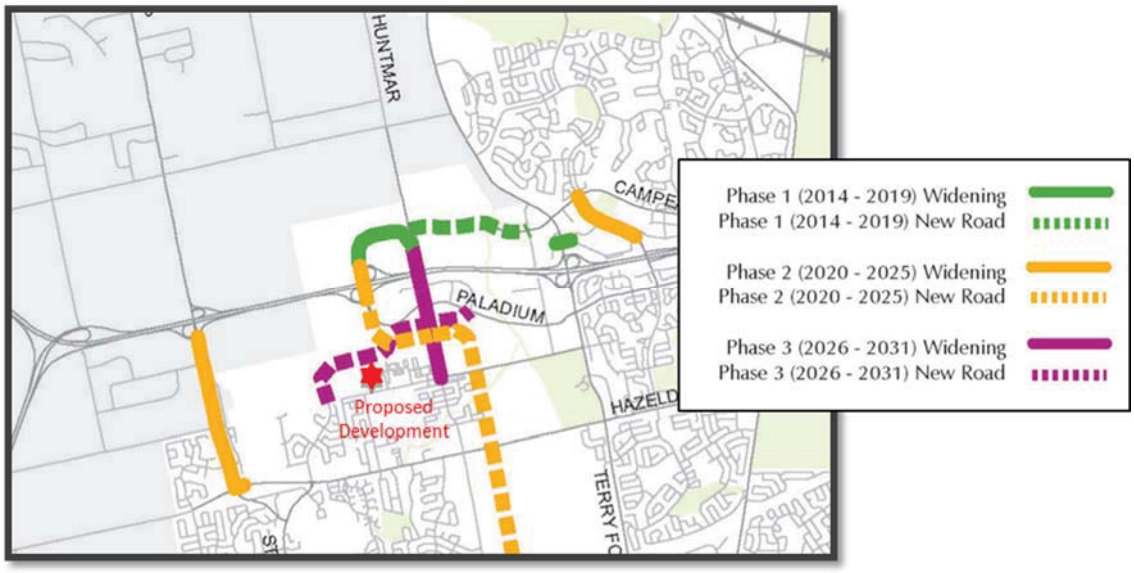
2.4.1.1 Future Road Network Projects

The 2013 Transportation Master Plan (TMP) outlines future road network modifications required in the 2031 'Affordable Road Network,' as shown in Exhibit 6. The following projects were noted that may have an impact on study area traffic:

- Palladium Road realignment in vicinity of Huntmar Drive to proposed North-South Arterial. Phase 2 (2020-2025)
- Stittsville N-S Arterial Road – Proposed North-South Arterial between Palladium Drive and Fernbank Road. Phase 2 (2020-2025)
- Stittsville Main Street Extension – Proposed Stittsville Main Street Extension to connect to the proposed North-South Arterial and continue to Palladium Drive. Phase 3 (2026-2031)
- Huntmar Drive – Widen Huntmar Drive from 2 lanes to 4 lanes between Campeau Drive and Maple Grove Road. Phase 3 (2026-2031)

The 2017 Development Charges Amendment Background Study: Transit and Roads and Related Services (March 24, 2017) identified funds set aside for the construction of the proposed Stittsville Main Street Extension. This study indicates that construction will be complete between 2026 and 2031, which is consistent with the timing described in the 2013 TMP.

Exhibit 6 – Future Road Network Projects



2.4.1.2 Maple Grove Road Extension

Maple Grove Road presently terminates in a cul-de-sac just west of Alon Street, approximately 110m shy of Stittsville Main Street with a gravel pathway continuing west to Stittsville Main Street. It is assumed Maple Grove Road will be extended to Stittsville Main Street by 2021, significantly improving connectivity of the local transportation network, particularly for transit service.

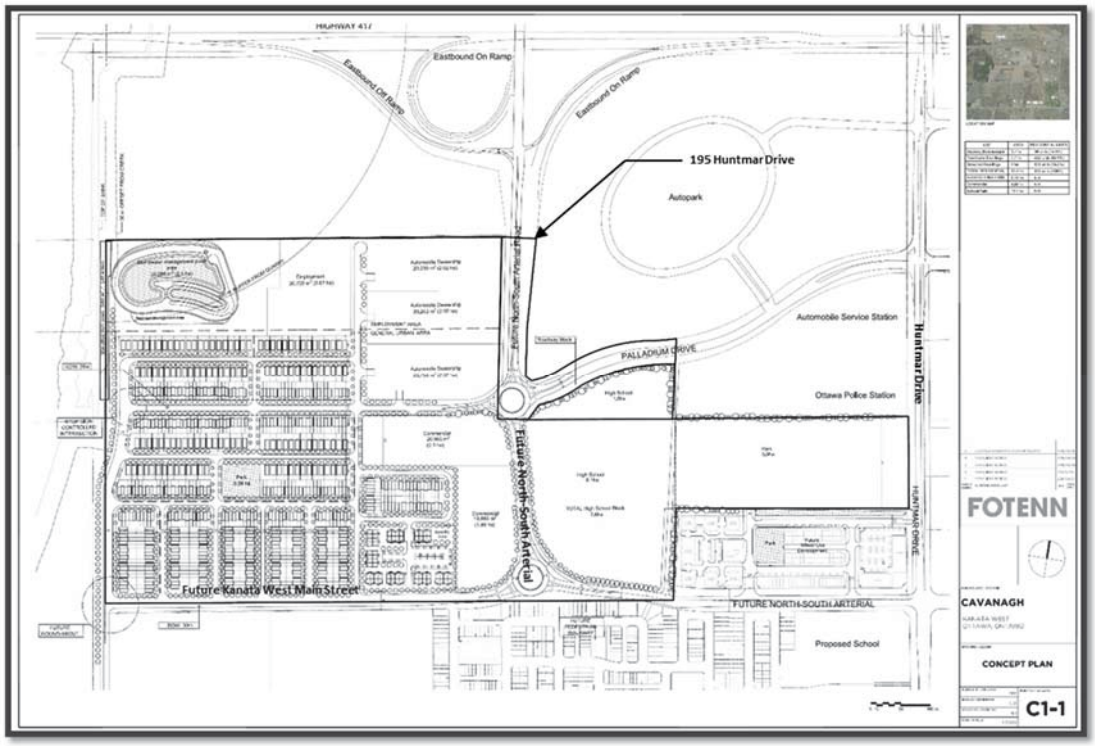
Traffic diversions associated with the extension of Maple Grove Road will be assessed in Section 3.3.1.2.

2.4.1.3 195 Huntmar Drive – Shenkman/ Cavanagh Development

The development of 195 Huntmar Drive is currently under review for Plan of Subdivision, Zoning Bylaw Amendment and Official Plan Amendment applications. The latest concept plan available from the City's Development Applications Search Tool at the time of this TIA is shown in Exhibit 7.

A Public Open House (POH) was held on January 10, 2018 to review the preliminary concept plan for 195 Huntmar Drive, and no target buildout date was given for the development. Since the concept plan has not been finalized and the buildout of the site is unknown, it was assumed that the lands at 195 Huntmar Drive would not be built within the planning horizons of this study. It has therefore been assumed that traffic generated by the development would rely on the existing transportation network.

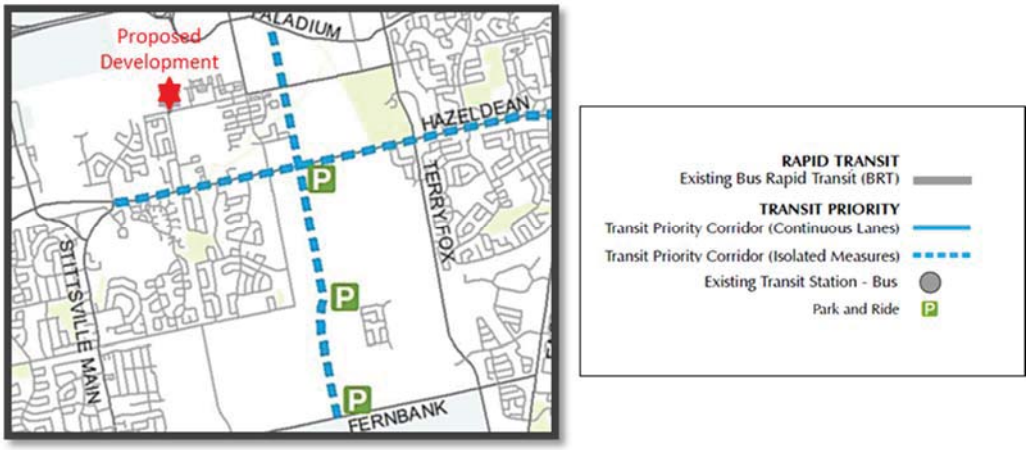
Exhibit 7 – Concept Plan for 195 Huntmar Drive Development (February 26, 2018)



2.4.1.4 Future Transit Facilities and Services

As illustrated in Exhibit 8 below, the 2013 TMP outlines the future rapid transit and transit priority (RTTP) network. The 'Affordable RTTP Network' notes that the future Stittsville North-South arterial road will include transit signal priority and queue jump lanes at select intersections between Palladium Drive and Fernbank Road. Along Hazeldean Road, transit signal priority and queue jump lanes will be implemented at select intersections east of Stittsville Main Street.

Exhibit 8 – Future 'Affordable RTTP Network Projects'



2.4.1.5 Future Cycling and Pedestrian Facilities.

The Ultimate Cycling Network in the Transportation Master Plan (TMP) designates Maple Grove Road as a "Local Route" east of Stittsville Main Street, and a "Major Pathway" west of Stittsville Main Street.

As illustrated in Exhibit 9, the Ottawa Cycling Plan (2013) does not note any future modifications local cycling infrastructure based on the 'Affordable Cycling Network Plan' recommendations.

In conjunction with the proposed development, continuous sidewalks will be provided along the entire frontage of Maple Grove Road. Roadway modifications associated with the extension of Maple Grove Road and will include both cycling and pedestrian facilities.

Exhibit 9 – Affordable Cycling Network

The Kanata West Transportation Master Plan shows pedestrian and cycling pathway linkages planned along Maple Grove Road and the proposed Stittsville Main Street extension that will link together the communities of Stittsville and Kanata West.

2.4.2 Future Adjacent Developments

The City of Ottawa Transportation Impact Assessment (TIA) Guidelines specifies all significant developments within the study area which are likely to occur within the horizon years must be identified and recognized in all TIA reports. Table 3 summarizes the developments adjacent to the study area, which are also shown in Exhibit 10.

The proposed development at 173 Huntmar Drive is located approximately 900m east along Maple Grove Road and 300m north along Huntmar Drive.

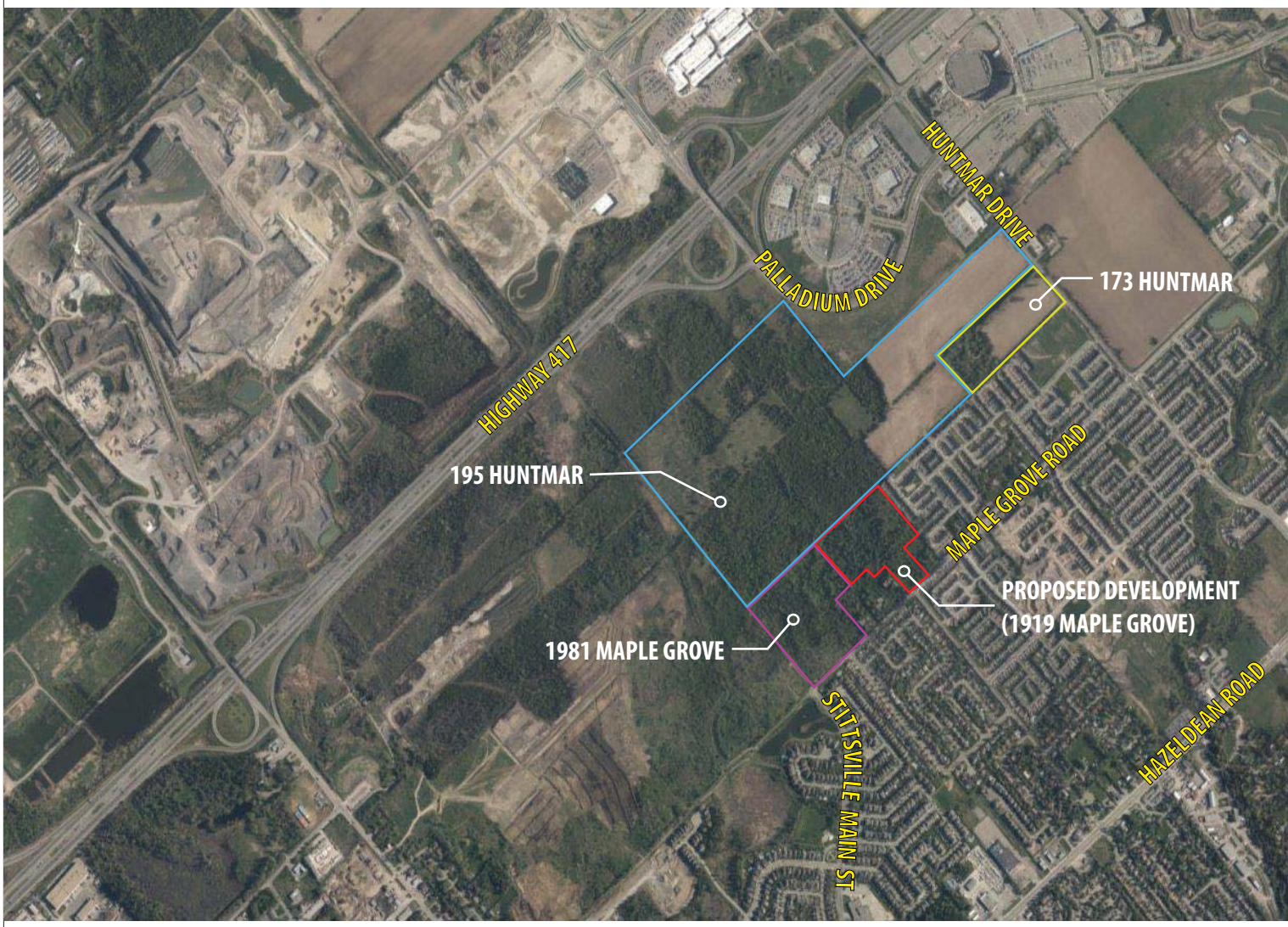
The proposed development at 1981 Maple Grove Road is located immediately to the west of the subject development. An estimate of the unit count is included, based on the latest site plan.

Table 3 – Developments Adjacent to Study Area

DEVELOPMENT LOCATION	DEVELOPER	TIA PREPARED BY (DATE)	SIZE/ NUMBER OF UNITS	EXPECTED BUILDOUT/ OCCUPANCY DATE	RECOMMENDED ROAD MODIFICATIONS
173 Huntmar Drive	Amazon Land Development Corp.	Parsons (2014)	345 townhome units	2021 [1]	Planned Road Modifications from TMP's 2031 Affordable Network will be sufficient to accommodate the development
			156 apartment units		
			65,930 ft^2 office space		
			21,690 ft^2 specialty retail		
1981 Maple Grove Road	Claridge	Not Complete Yet	51 single-detached housing	2021	Recommended auxiliary turning lanes at the Maple Grove Road and Huntmar Drive intersection
			105 townhome units		
			32 stacked townhome units		

[1] Full buildout/ occupancy date not noted in the Community Transportation Study (CTS). The buildout dates listed above should considered conservative estimates.

As previously noted in Section 2.4.1.3, the development of 195 Huntmar Drive will not be included in the analysis of this TIA report. The concept plan for the site has not yet been finalized, and buildout horizons for the site have not been established.



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1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 10
Adjacent Developments

PROJ
DATE
SCAL

2.4.3 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.

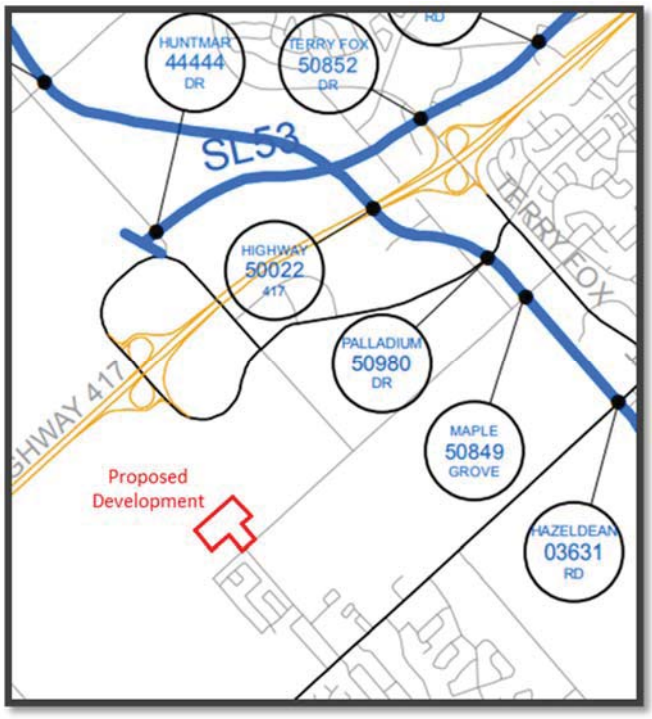
As specified in Module 4.8 of the 2017 TIA Guidelines, the latest Network Concept will be reviewed to ensure that the nearest strategic planning screenlines adjacent to the development are considered in the screenline analysis.

The nearest screenlines with respect to the proposed development are as follows:

- SL44 – Terry Fox – This is the nearest north/south screenline to the east of the study area. It is located west of Terry Fox Drive and starts 2 kilometres north of Richardson Side Road and continues south to Fernbank Road, and then south-west to Flewellyn Road. This screen line has seven crossing point at Richardson Side Road, Highway 417, Palladium Drive, Maple Grove Road, Hazeldean Road, Fernbank Road and Flewellyn Road.
- SL53 – Campeau – This is the nearest east/west screenline to the study area, and it is located to the north of Highway 417. It starts at Huntmar Drive and continues east to Campeau Drive and then north to March Road. This screenline has seven crossing points, including Huntmar Drive, Terry Fox Drive, Kanata Avenue, the Pedestrian Bridge across Highway 417, Campeau Drive, the Watts Creek Bicycle Pathway, and March Road.

SL44 and SL53 are shown in Exhibit 11, as determined from the City of Ottawa's *Road Network Development Report (2013)*, a supporting document to the 2013 Transportation Master Plan (TMP).

Exhibit 11 – Nearest Screenlines to Subject Site (Screenline System Map, 2010)



Detailed trip generation calculations will be provided in Section 3.1, as part of the Forecasting stage of the report.

2.5 Study Area

Based on the review of the nearest screenlines, transit routes and active transportation facilities, the proposed study area will be defined by Huntmar Drive to the east, the western property boundary of the site to the west, future development lands to the north and Maple Grove Road to the south.

The following existing intersections will be assessed as part of this TIA:

- Maple Grove Road and Huntmar Drive
- Maple Grove Road and Santolina Street
- Maple Grove Road and Alon Street

The following proposed intersection will be assessed as part of this TIA:

- Street 1 and Maple Grove Road

As mentioned in Section 2.4.1.1, Maple Grove Road will be extended west to Stittsville Main Street. This connection will inevitably result in the diversion of additional vehicular traffic to Maple Grove Road. It is therefore appropriate to evaluate the overall traffic impacts of these diversions at the Stittsville Main Street and Maple Grove Road intersection, as well as other affected intersections and roadway segments within the study area.

As previously discussed in Section 2.4.1.3, the development lands at 195 Huntmar Drive will not be included in the project study area. This study conservatively assumes that the subject lands will rely on existing roadway infrastructure. As a result, the proposed Street 5 and Street 6 intersections with the Future Kanata West Main Street will not be included in the TIA. The roadway network to the north of the site will be defined through the planning of the 195 Huntmar Drive development.

2.6 Time Periods

Traffic generated during the morning and afternoon week day peak hour is expected to result in the most significant impact to traffic operations on the adjacent network in terms of development-generated and background traffic. These two analysis periods will be considered for operational analysis.

2.7 Horizon Years

Two future horizons are proposed for analysis:

- Year 2021 – Full buildout and occupancy of townhome units (2021)
- Year 2026 – Full buildout and occupancy of apartment units (2026)

2.8 Exemptions Review

Table 4 of the Transportation Impact Assessment Guidelines provides exemption considerations for both the Design Review Component and Network Impact Component. Upon review of this list, the Circulation and Access, Parking Supply, Spillover Parking and Network Concept components are exempt. No other exemptions were considered for the TIA.

Table 4 – Exemption Considerations

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	✓

3 Forecasting

The purpose of the Forecasting section is to "generate the future transportation demand number required to analyze pre and post-development network performance to determine if a network modification is required to offset development impacts." [1]

3.1 Development Generated Traffic

3.1.1 Trip Generation Methodology

Peak hour development generated traffic volumes were developed using the 2009 TRANS Trip Generation Residential Trip Rates Study Report. The TRANS trip generation rates are based on a blended rate derived from the 17 trip generation studies undertaken in 2008, the Institute of Transportation Engineers (ITE) Trip Generation Manual and the 2005 TRANS OD Travel Survey. A separate trip generation rate exists for each of the four general geographic areas in Ottawa: Core, Urban (Inside the Greenbelt), Suburban (Outside the Greenbelt) and Rural. These trip generation rates reflect existing travel behavior by dwelling type and geographic area. Adjusted trip generation rates also exist to reflect increased transit usage for developments in close proximity to rapid transit stations.

The Transportation Impact Assessment (TIA) Guidelines recommends the TRANS trip generation rates be converted to person-trips based on the vehicular mode share proportions detailed in the TRANS Trip Generation study. The person-trips were then then split based on representative mode share percentages to determine the number of vehicle, transit, pedestrian, cycling and other trip types.

Local mode shares were based on the TRANS Committee: 2011 Origin-Destination (OD) Survey completed for the City of Ottawa. The OD Survey has mode share breakdowns for specific zones throughout the City; the Kanata/ Stittsville Zone contained the subject site and was applied in this analysis.

3.1.2 Trip Generation Results

3.1.2.1 Vehicle Trip Generation

The peak hour vehicular traffic volumes from the subject development were determined using peak hour trip generation rates from the TRANS Trip Generation Study. A summary of the vehicular trip generation results for the proposed development has been summarized in Table 5. The relevant extracts from the TRANS Trip Generation Study have been provided in Appendix E.

[1] Ottawa 2017 Transportation Impact Assessment Guidelines, p. 27

Table 5 – TRANS Development Trip Generation Results

LAND USE	SIZE (DU)	FORMULA RATE	SPLITS	PERIOD	GENERATED TRIPS (VPH)		
					IN	OUT	TOTAL
Apartment	440	T=0.29*(X)	IN: 24%; OUT: 77%	AM	31	98	129
		T=0.37*(X)	IN: 62%; OUT: 39%	PM	101	63	164
Townhouse	79	T=0.54*(X)	IN: 37%; OUT: 64%	AM	16	27	43
		T=0.71*(X)	IN: 53%; OUT: 47%	PM	30	26	56
Total				AM	47	125	172
				PM	131	89	220

Notes: DU = Dwelling Units; vph = vehicles per hour; DU = Dwelling Units; vph = vehicles per hour; DU = Dwelling Units

3.1.2.2 Person Trip Generation

The person-trip to vehicle-trip conversion factor for TRANS trip generation rates varies depending on the peak hour and geographic location considered. For townhome units in a suburban location the vehicular mode share is 55% and 61% for the AM and PM peak hours, respectively. The vehicular mode share for apartment units is 44% in both the AM and PM Peak hours. The vehicle-trip results in Table 5 were divided by these mode shares to determine the number of person-trips likely to be generated. The results after applying this conversion factor have been summarized in Table 6.

Table 6 – Development Person Trip Generation Results

LAND USE	FACTOR	PERIOD	GENERATED TRIPS (PPH)		
			IN	OUT	TOTAL
Apartment	1/55% = 1.82	AM	70	223	293
	1/64% = 1.56	PM	229	144	373
Townhouse	1/55% = 1.82	AM	29	50	79
	1/61% = 1.64	PM	49	43	92
Total		AM	98	273	365
		PM	278	188	466

Notes: pph = persons per hour; DU = dwelling units

3.1.2.3 Mode Share Proportions

The total person trips generated by the proposed development were stratified by mode, based on mode share proportions in the 2011 Origin-Destination (OD) Survey for the Kanata/ Stittsville Traffic Assessment Zone (TAZ). The relevant extracts from the 2011 OD Survey has been provided in Appendix F.

No adjustments were made to any sustainable modes of transportation such as transit, walking or cycling for future planning horizons. This approach should be considered conservative. The existing and proposed mode share targets for the Kanata/ Stittsville TAZ for each of the analysis horizons are outlined in Table 7.

Table 7 – Proposed Mode Shares for Kanata/ Stittsville (2011 OD Survey)

TRAVEL MODE	MODE SHARE (OD SURVEY)	
	AM	PM
Auto Driver	60%	61%
Transit	24%	21%
Auto Passenger	9%	15%
Cycling	0%	0%
Walking	0%	0%
Other	7%	3%
Total	100%	100%

3.1.2.4 Trip Reduction Factors

The proposed development will only be composed of residential land uses. Therefore, 'pass-by' or internalization trip reduction factors are not applicable to this study.

3.1.2.5 Trip Generation by Mode

The mode share target in Table 7 were applied to person trips results from Table 6 to estimate the number of development generated trips by mode, as shown in Table 8.

Table 8 – Development Generated Traffic by Mode

TRAVEL MODE	PEAK PERIOD TRIPS BY MODE					
	AM			PM		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Auto Driver	59	164	223	170	114	284
Transit	24	25	49	42	28	70
Auto Passenger	9	66	75	58	39	97
Cycling	0	0	0	0	0	0
Walking	0	0	0	0	0	0
Other	7	19	26	10	7	17

The proposed development is expected to generate approximately 223 morning and 284 afternoon peak hour vehicular trips at full buildout.

3.1.3 Trip Distribution and Assignment

Since the land use of the proposed development will be residential, it is anticipated that the distribution of site-generated traffic in each of the four cardinal directions will be consistent with the commuter traffic flow, based on logical routings for each direction, and existing turning movement counts:

- 40% to/from the North
    - 40% via Huntmar Drive
- 35% to/from the South
    - 15% via Stittsville Main Street
    - 10% via Santolina Street
    - 5% via Alon Street
    - 5% via Huntmar Drive
- 25% to/from the East
    - 25% via Maple Grove Road

No traffic is expected to be headed to/from the west, as there are no existing or proposed roads that continue west of Stittsville Main Street, the westerly limit of the study area. There are no plans to extend Maple Grove Road west of Stittsville Main Street, as the area to the west consists of protected wetlands. The resulting development generated morning and afternoon peak hour traffic volumes have been provided in Exhibit 12 for the 2021 horizon year, and Exhibit 13 for the 2026 horizon year.

3.2 Background Network Traffic

3.2.1 Changes to the Background Transportation Network

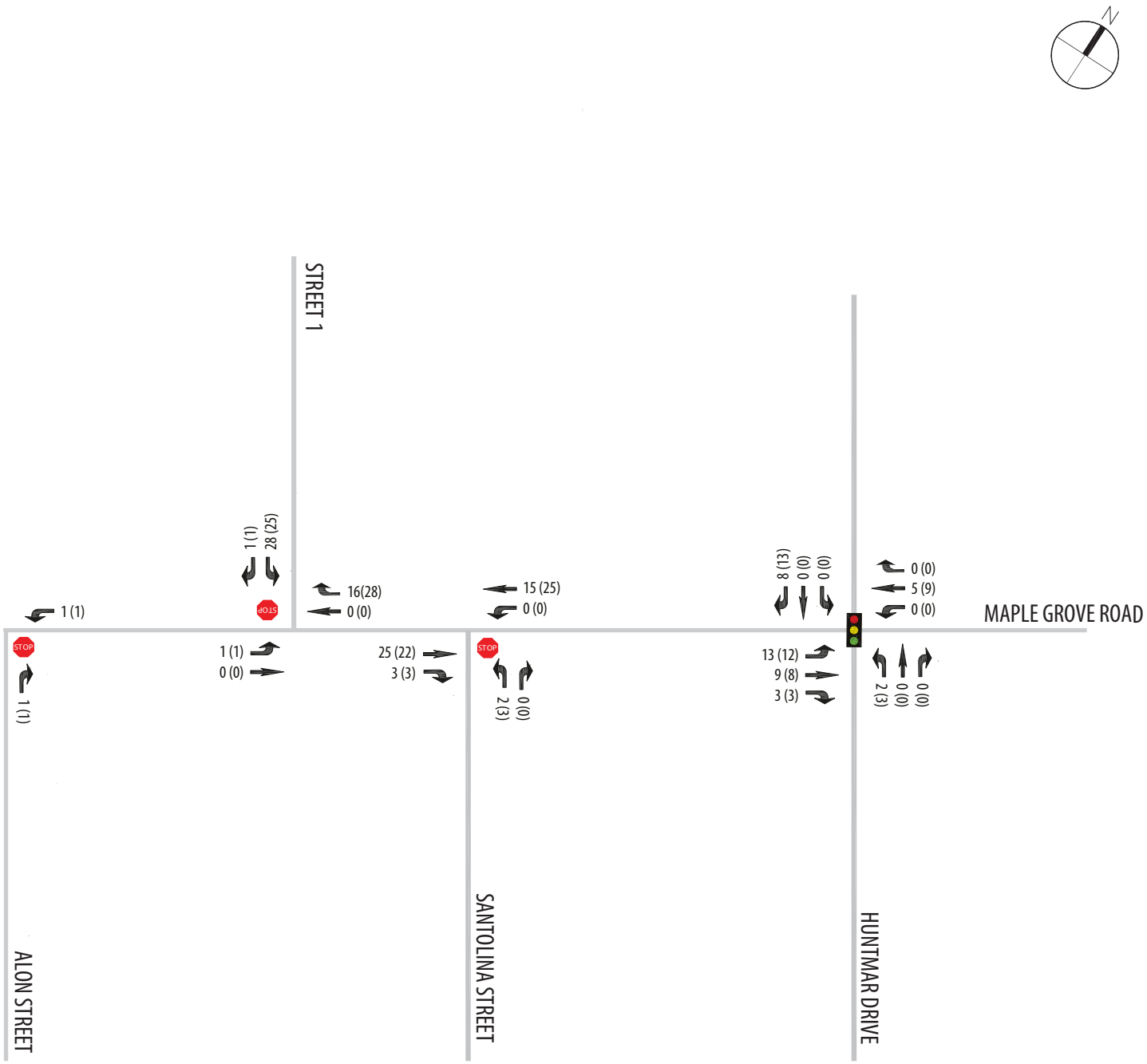
To properly assess future traffic conditions, that all anticipated changes to the transportation network have been accounted for and have been reflected in future background traffic volumes to establish an appropriate baseline for this study.

As noted in Section 2.4.1.3, it is expected that the development of the road network to the north of the subject site will be determined through the planning of 195 Huntmar Drive and is not expected to be built within the horizon year for this study.

The intersection of Maple Grove Road and Huntmar Drive presently operates with shared lanes on all approaches, except for the northbound approach, which consists of a separate left-turn lane and shared through-right lane. It is expected that the transportation network will be able to operate at an acceptable level of service condition beyond the 2026 total traffic scenario with the addition of auxiliary lanes on all approaches at the intersection of Maple Grove Road and Huntmar Drive. These modifications were previously recommended as part of the TIA for Fairwinds West (December 2012). The Fairwinds traffic study assumed that these modifications would be required by approximately 2017. These intersection modifications would support growth in both background and development traffic.

3.2.2 General Background Growth Rates

The background growth rate represents regional traffic growth from outside the study area, along the adjacent road network. The approved Traffic Impact Study (TIS) for the Fairwinds West development at 33 Johnwoods Street (December 2012), proposed a background growth rate of 2% on all arterial and collector roads within the study area.



LEGEND

STOP CONTROL

TRAFFIC CONTROL SIGNAL

PERMITTED MOVEMENTS

AM & PM PEAK HOUR VEHICULAR VOLUMES

xxx (xxx) xxx (xxx) xxx (xxx)

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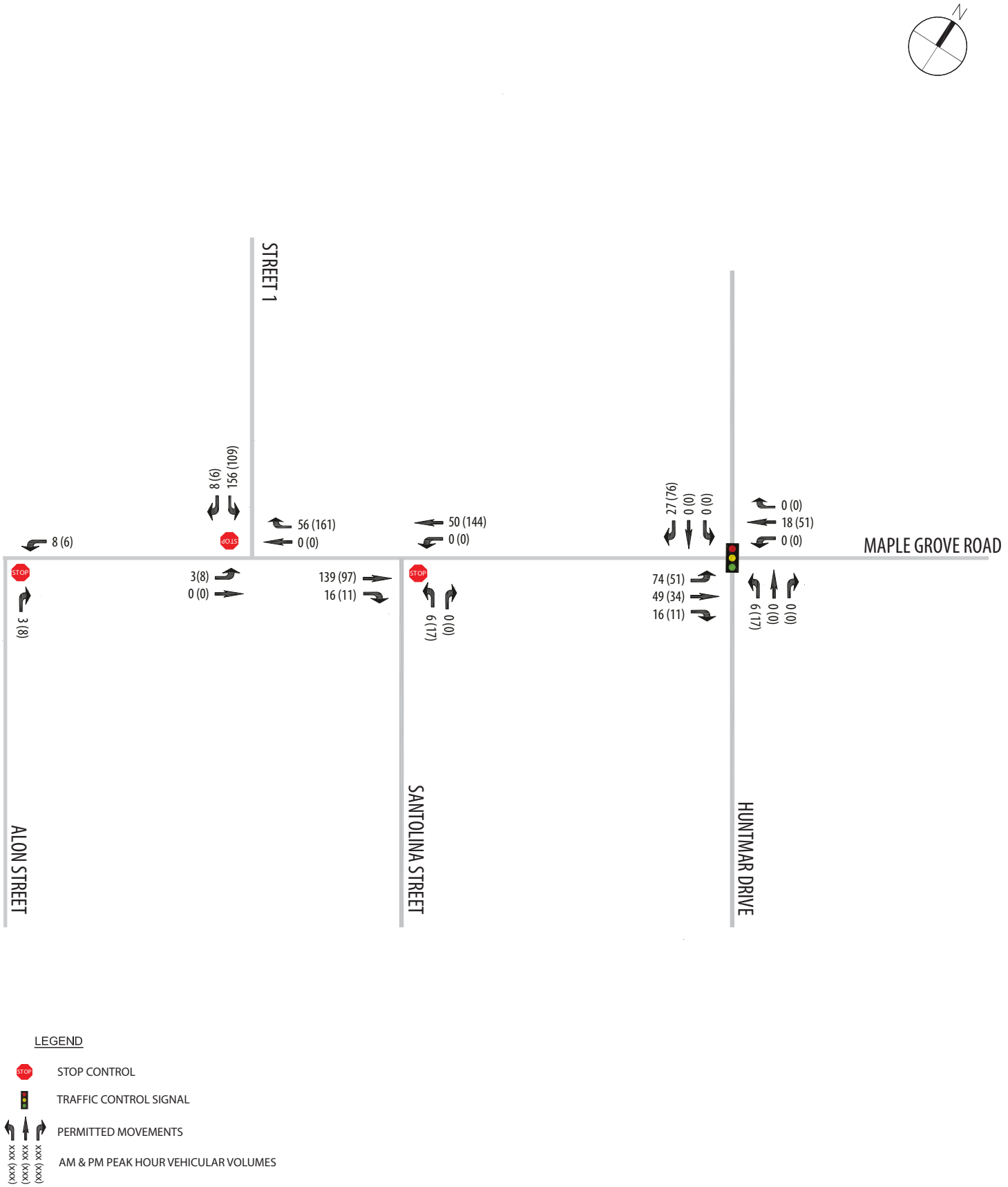
1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 12
Future (2021) Site Generated AM & PM
Peak Hour Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS



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1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 13
Future (2026) Site Generated AM & PM
Peak Hour Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

3.2.3 Other Area Development

The City of Ottawa TIA Guidelines specifies that the estimated traffic generation associated with any significant developments that are likely to occur within the horizon year must be identified and taken into consideration in the development of future background volumes.

There are two known developments expected to contribute traffic within the study area. These developments are currently in the development application approvals process. Construction has not begun for either of the developments; therefore, no units or retail space has been built or is currently occupied.

The adjacent developments have been summarized in Table 9, and their approximate locations in relation to subject site were shown in Exhibit 10.

Table 9 – Future Adjacent Developments

DEVELOPMENT NAME	LAND USE	UNITS or BUILDINGS NOT BUILT/ OCCUPIED
1981 Maple Grove Road	Single Family Homes	51
	Townhome Units	139
173 Huntmar Drive	Townhome Units	345
	Apartment Units	156
	Office Space	65,930 ft^2
	Specialty Retail	21,690 ft^2

Notes: sf = square feet

As previously discussed in Section 2.4.1.3, the development of 195 Huntmar Drive has been excluded from this TIA report.

3.3 Demand Rationalization

The following section summarizes any adjustments made to future travel demands in the study area to account for capacity limitations of the transportation network.

3.3.1 Description of Capacity Issues

3.3.1.1 Maple Grove Road and Huntmar Drive

A review of previous TIAs reveals existing capacity issues at the intersection of Maple Grove Road and Huntmar Drive in 'existing' and 'future' planning scenarios. The TIA prepared for 33 Johnwoods Street in December 2012 notes that auxiliary left and right turn lanes were assumed to be provided by 2017 on all approaches at this intersection to accommodate future development in the area. The addition of auxiliary lanes at the intersection of Huntmar Drive and Maple Grove Road is expected to be sufficient to accommodate traffic generated from the subject site (1919 Maple Grove Road). There is 37.5m of right-of-way protection on the north, south and east legs of this intersection, and Maple Grove Road to the west of Huntmar Drive has 26m right-of-way protection, with an existing pavement width of 11m; therefore, left-turn auxiliary lanes can be accommodated on all approaches. The heavy southbound right turn movement will require a right-turn lane to accommodate more than 200 vehicles that were recorded to have made this turn in the City's turning movement data during the PM Peak hour. The storage lengths required for the auxiliary lanes will be confirmed in the Analysis section of this report.

Some residents expressed concerns regarding congestion at the Maple Grove Road and Huntmar Drive intersection, and recommend that the 4-lane widening of Huntmar Drive from Campeau Drive to Maple Grove Road should be expedited. The timing currently provided for the widening, as part of Phase 3 of the TMP's Affordable Network from 2026 to 2031, is seen by these residents as insufficient to match development growth in the area.

There are potential conflicts associated with painting a formal eastbound left-turn lane due to existing townhomes with direct frontage onto Maple Grove Road and a lack of parking restrictions along the southern side of Maple Grove Road. Storage length requirements will be analysed for this intersection in Section 4.9.

3.3.1.2 Maple Grove Road Extension

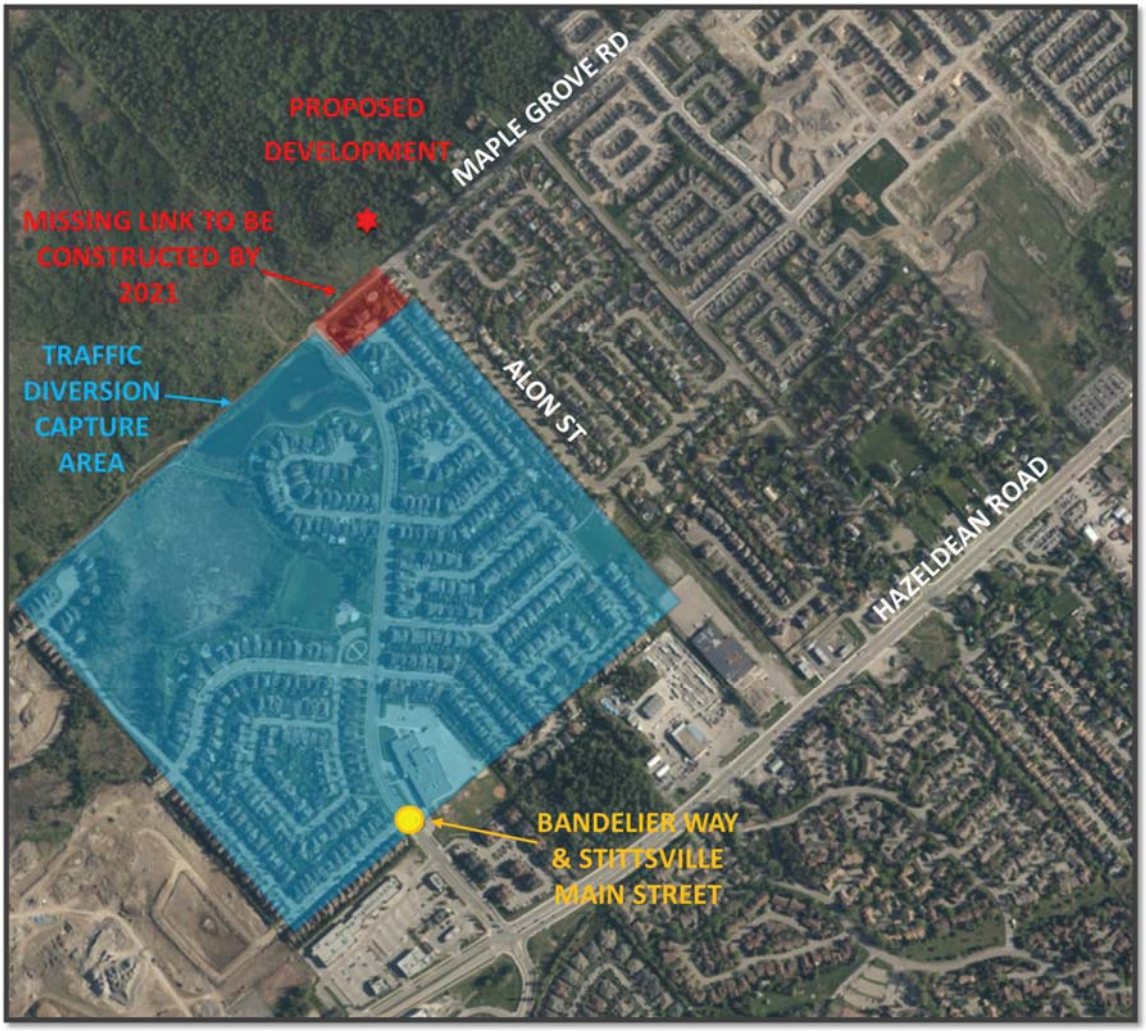
It is expected that existing traffic volumes will be redistributed, once Maple Grove Road is extended to Stittsville Main Street. Motorists in the Jackson Trails community are currently forced to access/ egress the subdivision via Stittsville Main Street and Hazeldean Road. A screenline traffic count was conducted by IBI staff on Thursday, January 25, 2018 at Bandelier Way and Stittsville Main Street to determine the number of trips that are currently heading north and south along Stittsville Main Street during the AM and PM Peak hours. With the extension of Maple Grove Road to Stittsville Main Street, it was assumed that 50% of this traffic would re-route through Maple Grove Road. The need to upgrade Maple Grove Road is discussed further in Section 4.6.1 with regards to Neighborhood Traffic Management provides a summary of results from the traffic count conducted at Bandelier Way and Stittsville Main Street, and the number of trips diverted to the Maple Grove Road extension. Exhibit 14 shows the community to the southwest of the subject development, referred to as the Traffic Diversion Capture Area, where most trips would originate or terminate.

Table 10 – Bandelier Way & Stittsville Main Street Diversion to Maple Grove Road Extension

INTERSECTION	TRAFFIC COUNT DATA			50% DIVERESION OF TRAFFIC TO MAPLE GROVE ROAD EXTENSION		
	DIRECTION	AM PEAK HR	PM PEAK HR	DIVERSION DIRECTION	AM PEAK HR	PM PEAK HR
Stittsville Main Street & Bandelier Way	NBT	92	272	SBT	46	136
	SBT	248	193	NBT	124	97

The 2013 Official Plan (OP) classifies Maple Grove Road as a collector road from Huntmar Drive to the Johnwoods multi-use pathway, and a local road further west towards Stittsville Main Street. The OP indicates that 26m of right-of-way has been protected along the entire corridor from Huntmar Drive to Stittsville Main Street, which provides sufficient width to accommodate higher order roadway classifications, including collector and major collector roadways. The need to upgrade Maple Grove Road is discussed further in Section 4.6.1 with regards to Neighbourhood Traffic Management.

Exhibit 14 – Traffic Diversion Capture Area for Maple Grove Road Extension



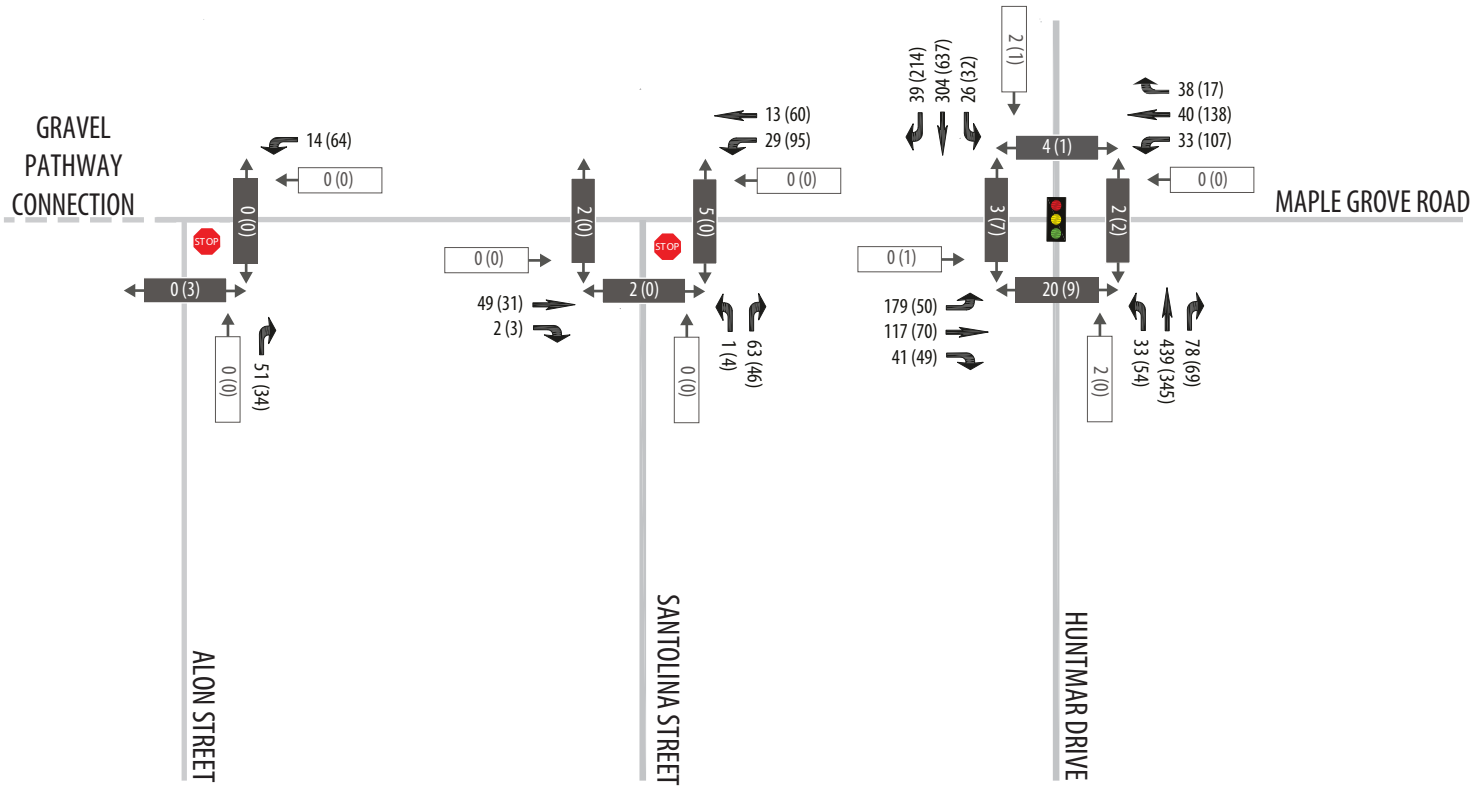
3.4 Traffic Volume Summary

3.4.1 Future Background Traffic Volumes

The existing 2018 peak hour traffic volumes from the Scoping section are provided in Exhibit 15. The future background traffic volumes developed in Section 3.2 for the 2021 and 2026 horizons are provided in Exhibit 16 and Exhibit 17, respectively.

3.4.2 Future Total Traffic Volumes

The site generated peak hour traffic volumes from Exhibit 12 and Exhibit 13 were added to corresponding background traffic volumes to establish background plus site generated or total peak hour traffic volumes for the 2021 and 2026 horizon years, as shown in Exhibit 18 and Exhibit 19, respectively.



LEGEND

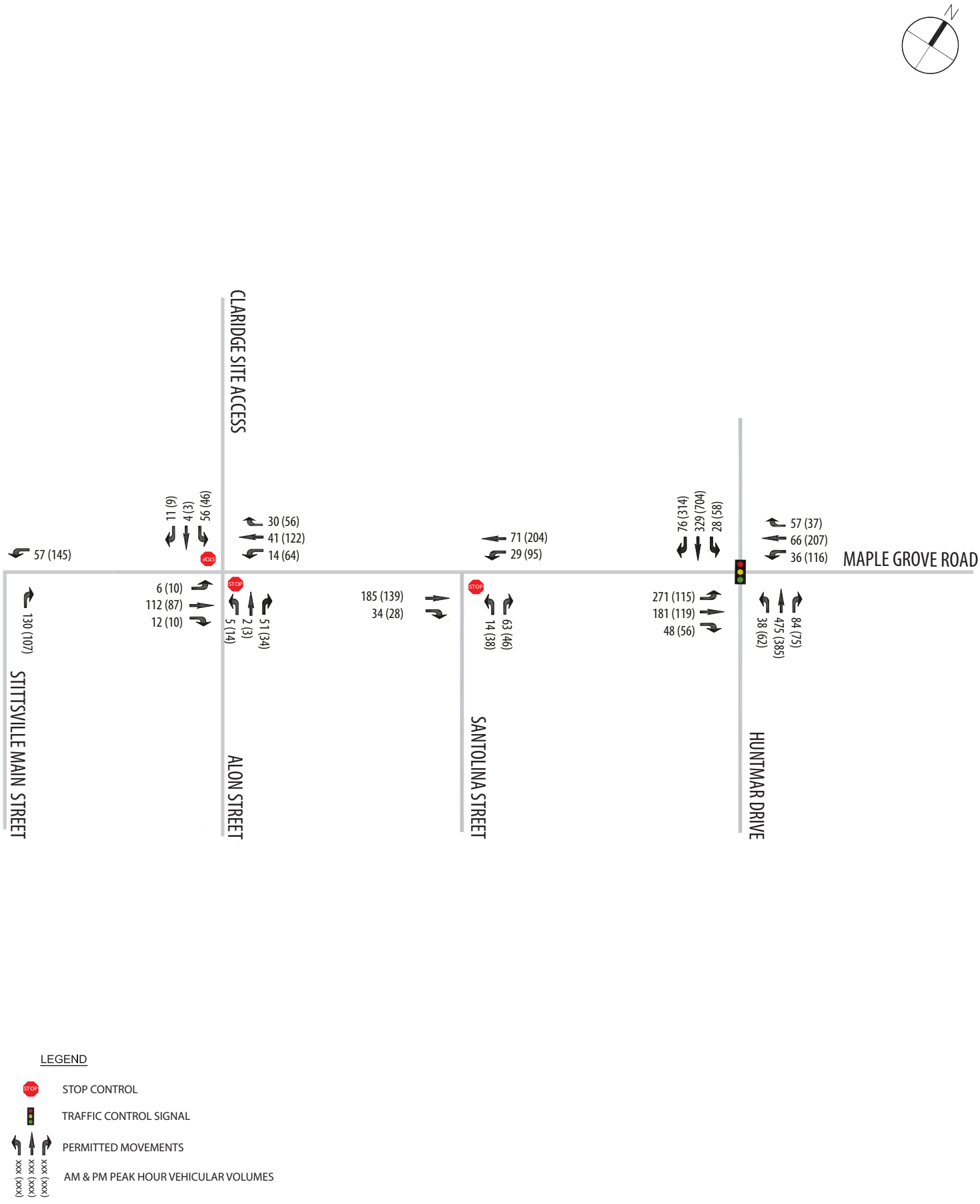
- STOP CONTROL
- TRAFFIC CONTROL SIGNAL
- PERMITTED MOVEMENTS
- xxx (xxx) — AM & PM PEAK HOUR VEHICULAR VOLUMES
- xxx (xxx) — AM & PM PEAK HOUR PEDESTRIAN VOLUMES
- xxx (xxx) — AM & PM PEAK HOUR CYCLING VOLUMES

IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 15
Existing (2018) Auto, Cycling and Pedestrian
AM & PM Peak Hour Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

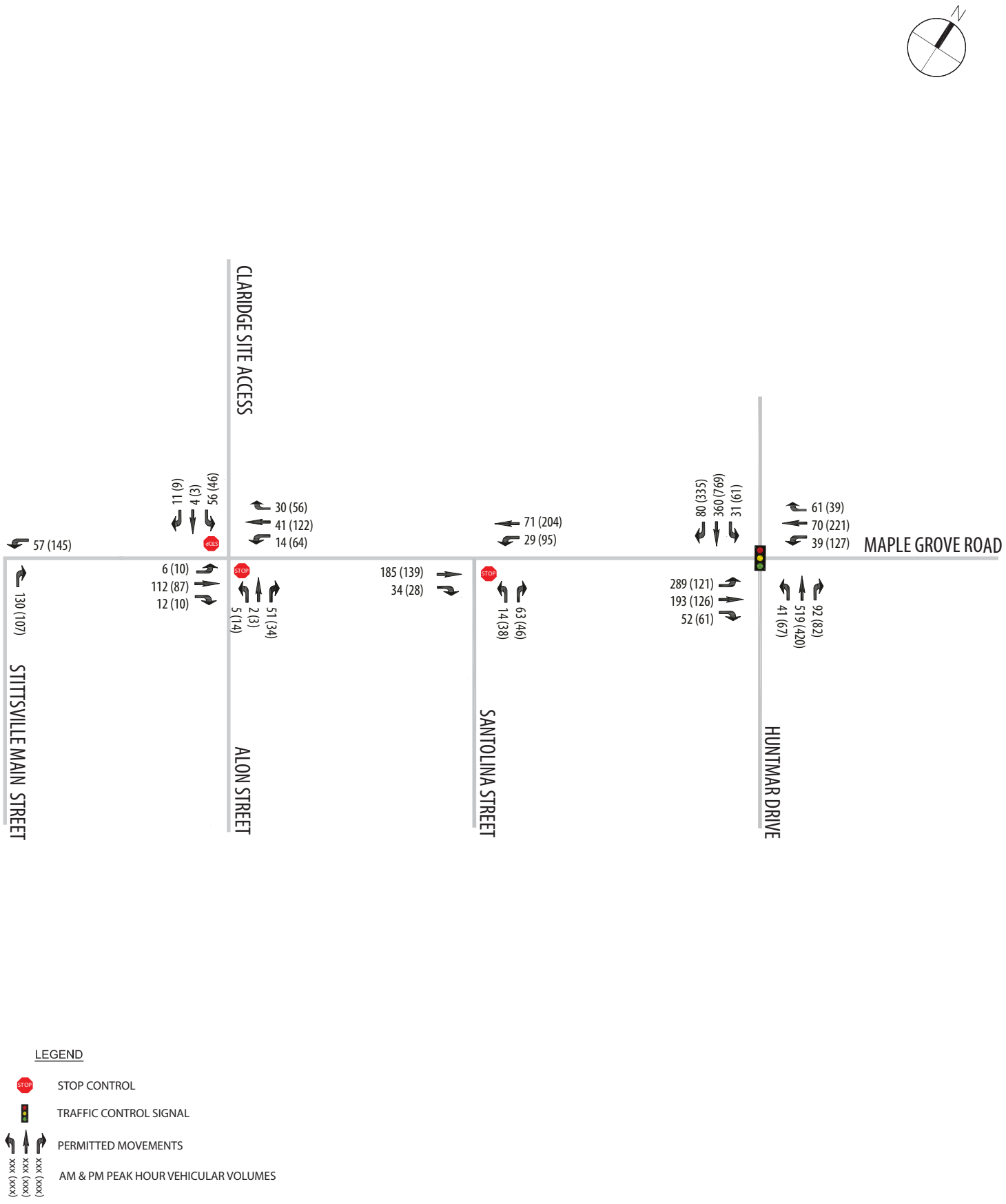


IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 16
Future (2021) Peak Hour
Background Traffic Volumes

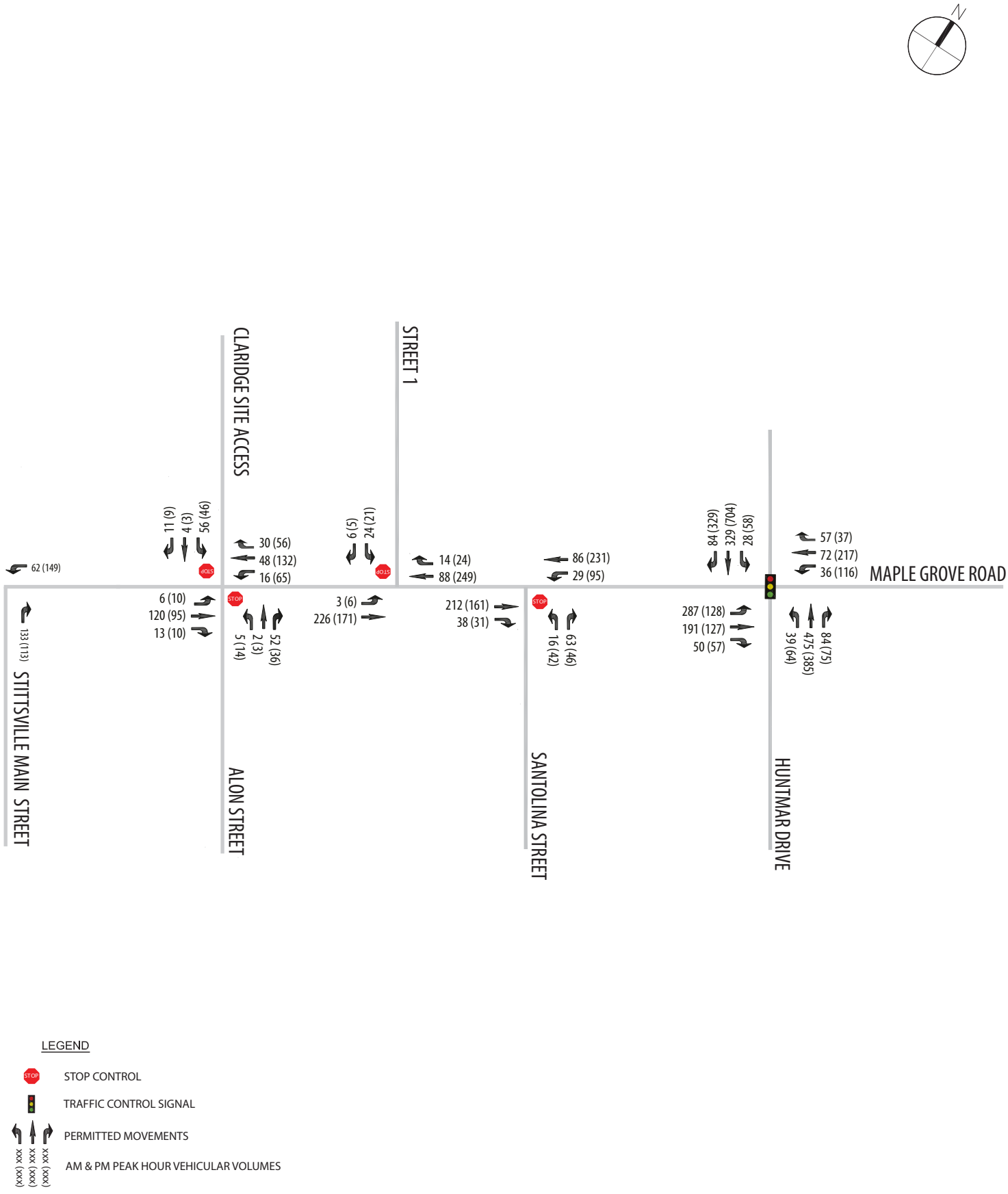
PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS



1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 17
Future (2026) Peak Hour
Background Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

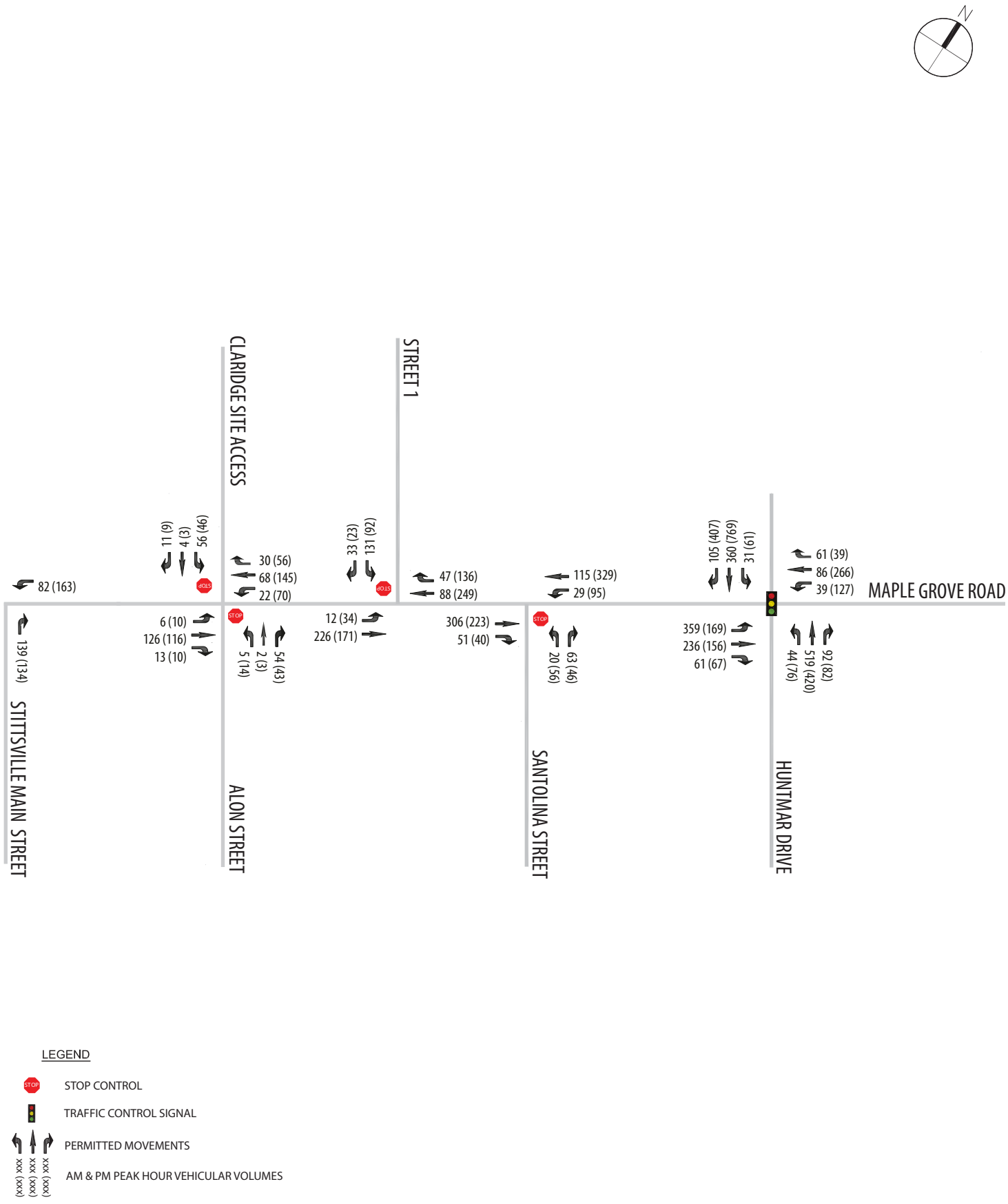


IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 18
Future (2021) Peak Hour Background and Site Generated Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS



IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 19
Future (2026) Peak Hour Background and
Site Generated Traffic Volumes

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

4 Analysis

The purpose of the TIA Analysis is to "assess the alignment between the transportation elements of the proposed development and the City of Ottawa's city-building objectives and identify any opportunities to improve alignment. It also evaluates the post-development performance of the planned transportation network based on the City's established performance measures and targets and identifies potential mitigation measures to off-set development impacts." [2]

4.1 Development Design

4.1.1 Design for Sustainable Modes

The nearest existing bus stops to the subject development are located north of Santolina Street on Maple Grove Road, which provides transit service to approximately 60% of the proposed development within the maximum 400m walking distance required by the City.

Providing a transit stop along Maple Grove Road at the Street 1 access would increase transit coverage to approximately 100%. Existing and planned transit stop coverage within the City's 400m walking distance is presented in Exhibit 20. It was confirmed by City staff that bus Route 261 is expected to travel along the extension of Maple Grove Road providing direct transit service along the site frontage until such time that Stittsville Main Street is extended further north.

There are no cycling facilities planned within the proposed development. Sidewalks are strategically placed to ensure adequate accessibility to the adjacent road network and local amenities.

4.1.2 New Street Networks

The proposed development connects to the adjacent roadway network via three access intersections:

- Maple Grove Road and Street 1
- Future Kanata West Main Street and Street 5
- Future Kanata West Main Street and Street 5

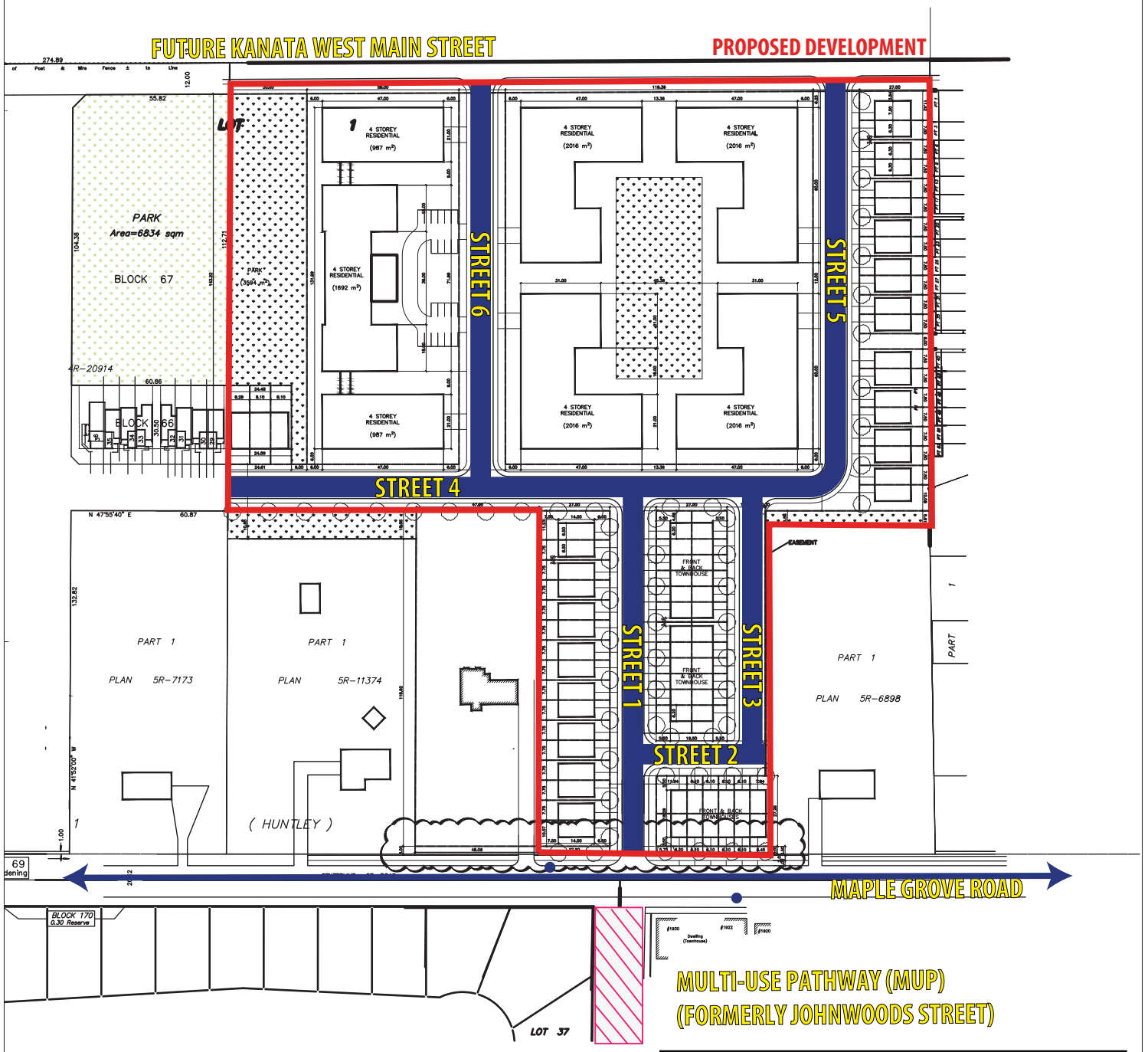
The internal road network of the site consists of local roads with the following right-of-way widths:

- Single-loaded streets – 14.75m to 16.5m right-of-way
- Double-loaded streets – 18m right-of-way

4.2 Parking

The Parking Supply and Spillover Parking elements are exempt from this TIA, as indicated in Section 2.8. These elements are only required for site plan applications and not for draft plans of subdivision.

[2] Ottawa 2017 Transportation Impact Assessment (TIA) Guidelines, p. 35



IBI

1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 20
Planned Transit Routes

PROJECT NO.: 39124
DATE: APRIL 2019
SCALE: -20m 0 40m

4.3 Boundary Streets

4.3.1 Mobility

Maple Grove Road is only existing boundary street to the proposed development. Segment multi-modal level of service (MMLOS) was undertaken for Maple Grove Road, and was dependent on the roadway geometry. Changes to the cross-section elements triggered changes to the Segment MMLOS. West of the Johnwoods multi-use pathway, Maple Grove Road is currently classified as a local road with a rural cross-section and no formal pedestrian facilities.

The development of the subject site and other adjacent lands fronting Maple Grove Road have triggered the need to extend Maple Grove Road to Stittsville Main Street, and urbanize the roadway west of the Johnwoods multi-use pathway. Once Maple Grove Road is reconstructed, it is expected that the corridor will facilitate transit, as well as provide infrastructure to accommodate pedestrians and cyclists. It was assumed that the existing urban cross-section elements of Maple Grove Road east of the multi-use pathway would be incorporated into future cross-section west towards Stittsville Main Street.

The Future Kanata West Main Street will eventually be a boundary street to the north of the subject development; however, the cross-section elements of this roadway were unknown at the time of this study, and will be defined during the development approvals process for the lands at 195 Huntmar Drive.

The results of the Segment Multi-modal Level of Service (MMLOS) for the Existing (2018) conditions are shown in Table 11, and Future Background and Total Traffic (2021 and 2026) results are shown in Table 12. Appendix G provides all detailed Segment MMLOS results.

Table 11 – Segment MMLOS – Existing (2018) Results

SEGMENT	LEVEL OF SERVICE			
	2018			
	P	B	T	TK
Maple Grove Road (Alon Street to M.U.P. [1])	F [2]	D	D	B
Maple Grove Road (M.U.P.[1] to Santolina Street)	B	D	D	B

[1] Formerly Johnwoods Street; M.U.P. = multi-use pathway
[2] This section of Maple Grove Road has a rural cross-section with gravel shoulders, and no formal pedestrian facilities

Table 12 – Segment MMLOS – Background and Total (2021 & 2026) Results

SEGMENT	LEVEL OF SERVICE			
	2021, 2026			
	P	B	T	TK
Maple Grove Road (Stittsville Main Street to Alon)	B	D	D	B
Maple Grove Road (Alon to M.U.P. [1])	B	D	D	B
Maple Grove Road (M.U.P.[1] to Santolina Street)	B	D	D	B

[1] Formerly Johnwoods Street; M.U.P. = multi-use pathway

4.3.2 Road Safety

A summary of all reported collisions within the study period over the past five years was presented in Section 2.3.5 in Table 2. The City requires a safety review if at least six collisions for any one movement or of a discernible pattern occur. Based on this collision summary, collisions at Huntmar Drive and Maple Grove Road required further analysis to determine if there is a discernible collision pattern at the intersection.

Huntmar Drive and Maple Grove Road

- 8 of the collisions were described as 'rear-end' collisions
    - 5 of the collisions occurred during AM or PM peak periods and in the peak direction
    - 5 of the collisions occurred in adverse driving conditions (i.e. rain, freezing rain, snow-packed roads)

The majority of rear-end collisions were recorded in the peak direction during the AM and PM peak periods due to the higher volume of traffic travelling in the peak direction. It should also be noted that the most of these collisions occurred during adverse weather conditions, and were likely not a result of the intersection design.

4.4 Access Intersections

4.4.1 Location and Design of Access

The proposed vehicular accesses/ egresses for the subject site will be located to the south of the subject property via Maple Grove Road/ Street 1, as well as to the north of the subject property with the connection of Streets 5 and 6 to the Future Kanata West Main Street.

According to TAC Section 9.2.4, the minimum spacing for successive local-to-local T-intersections is 40m. The proposed accesses/ egresses for the subject development satisfy this requirement. The two proposed accesses along the northern property boundary of the subject site are proposed to connect to the Future Kanata West Main Street, with a spacing of approximately 140m centre-to-centre.

According to the *Private Approach By-Law*, Section 26a, the minimum distance between a private approach and the nearest intersecting street line for a single dwelling unit is 6m. All of the existing or proposed private approaches within the vicinity of the proposed Street 1 access satisfy this requirement. There are existing private approaches serving single-family homes located approximately 40m to the west and 60m to the east of the proposed Street 1 access along Maple Grove Road. Along Street 1, the nearest private approach for a single dwelling unit is approximately 11 metres north of the Maple Grove Road street line.

4.4.2 Intersection Control

4.4.2.1 Roundabout Analysis

The Roundabout Screening Tool was completed for the following access intersection:

- Maple Grove Road and Street 1

Based on the results of the analysis from the Roundabout Screening Tool, a roundabout was not warranted at this intersection. The results of the Roundabout Screening Tool are shown in Appendix H.

4.4.2.2 Traffic Signal Warrants

The use of traffic signals was investigated at the following access intersections:

- Maple Grove Road and Street 1
- Maple Grove and Santolina
- Maple Grove and Alon/ Claridge Site Access

Traffic signal warrants specified in the Ontario Traffic Manual (OTM) Book 12 were completed for the above noted intersections in the 2026 total traffic condition, and the conclusion of the analysis indicated that signalization at these intersections would be unnecessary.

The results of the traffic signal warrants analyses are shown in Appendix I.

4.4.3 Intersection Design

The Multi-Modal Level of Service (MMLOS) Guidelines provide guidance on how to assess the various LOS for the different modes of transportation and specify target service levels for each mode, given the location and context of the transportation project. This all-in-one evaluation tool allows for comparisons using similar performance metrics for each non-auto mode.

The MMLOS procedure is only applied to signalized intersections and the worst-performing approach at the intersection for any mode represents the overall intersection MMLOS for that mode. As indicated in Section 4.4.2.2, none of the above proposed access intersections will require signalization in the 2026 total traffic condition; therefore, no MMLOS analysis is required for any of these intersections.

4.5 Transportation Demand Management

The City of Ottawa is committed to implementing Transportation Demand Management (TDM) measures on a City-wide basis in an effort to reduce the automobile dependence of Ottawa residents, particularly during the weekday peak travel periods. TDM initiatives are aimed at encouraging individuals to use non-auto modes of travel during the peak periods.

Mode shares used to estimate future development traffic were based on the 2011 TRANS OD Survey for the Traffic Assessment Zone where the proposed development is located. The non-auto transportation mode shares were left constant in the future, which was a conservative assumption.

There are no employment uses proposed onsite. However, the development will still conform to the City's TDM principles by providing direct connections to adjacent pedestrian, cycling and transit facilities where applicable.

4.6 Neighbourhood Traffic Management

4.6.1 Adjacent Neighbourhoods

Neighbourhood Traffic Management (NTM) future volume thresholds outlined in the TIA Guidelines were assessed, based on the criteria for local and collector roads. Internal roads within the subdivision and boundary roads fronting the subject lands were evaluated. The contributions traffic to the proposed Street 1 access, as well as the section of Maple Grove Road fronting the site are shown in Table 13 with traffic volumes from the 2026 total traffic condition.

Table 13 – Neighbourhood Traffic Management Road Classification Capacity

STREET	SEGMENT	ROAD CLASSIFICATION	CAPACITY (VPHPL)	PEAK HOUR DEMAND IN PEAK DIRECTION (VPHPL)	
				AM	PM
Maple Grove Road	Stittsville Main Street to Johnwoods Multi-Use Pathway (MUP)	Collector	300	238	272
	Johnwoods Multi-Use Pathway (MUP) to Santolina Street	Major Collector	600	369	424
Street 1	North of Maple Grove Road	Local	120	164	170

It should be noted that these results represent a temporary worst case scenario with all site-generated traffic utilizing Street 1 and Maple Grove Road. Once key portions of the transportation network are developed to the north of the subject site, traffic bottlenecks will be alleviated along Maple Grove Road and the proposed Street 1 access.

As previously discussed in Section 3.3.1.2, the 2013 Official Plan (OP) classifies Maple Grove Road as a collector road from Huntmar Drive to the Johnwoods multi-use pathway, and a local road further west towards Stittsville Main Street. The OP indicates that 26m of right-of-way has been protected along the entire corridor from Huntmar Drive to Stittsville Main Street. According to the Official Plan - Annex 1: Road Classifications and Rights-of-Way, roads with 26m right-of-way protection tend to have major collector status. Therefore, it is feasible to increase the capacity threshold along Maple Grove Road to 600 vehicles per hour per lane (vphpl), as specified for in the TIA Guidelines for major collector roads, until Streets 5 and 6 are connected to the Future Kanata West Main Street to the north of the subject property.

Street 1 is expected to exceed the threshold of 120 vehicles per hour per lane (vphpl) for local roads, as all site-generated traffic will be required to utilize this access temporarily until the Future Kanata West Main Street to the north of the site is constructed.

4.6.1.1 Potential short cutting Issues

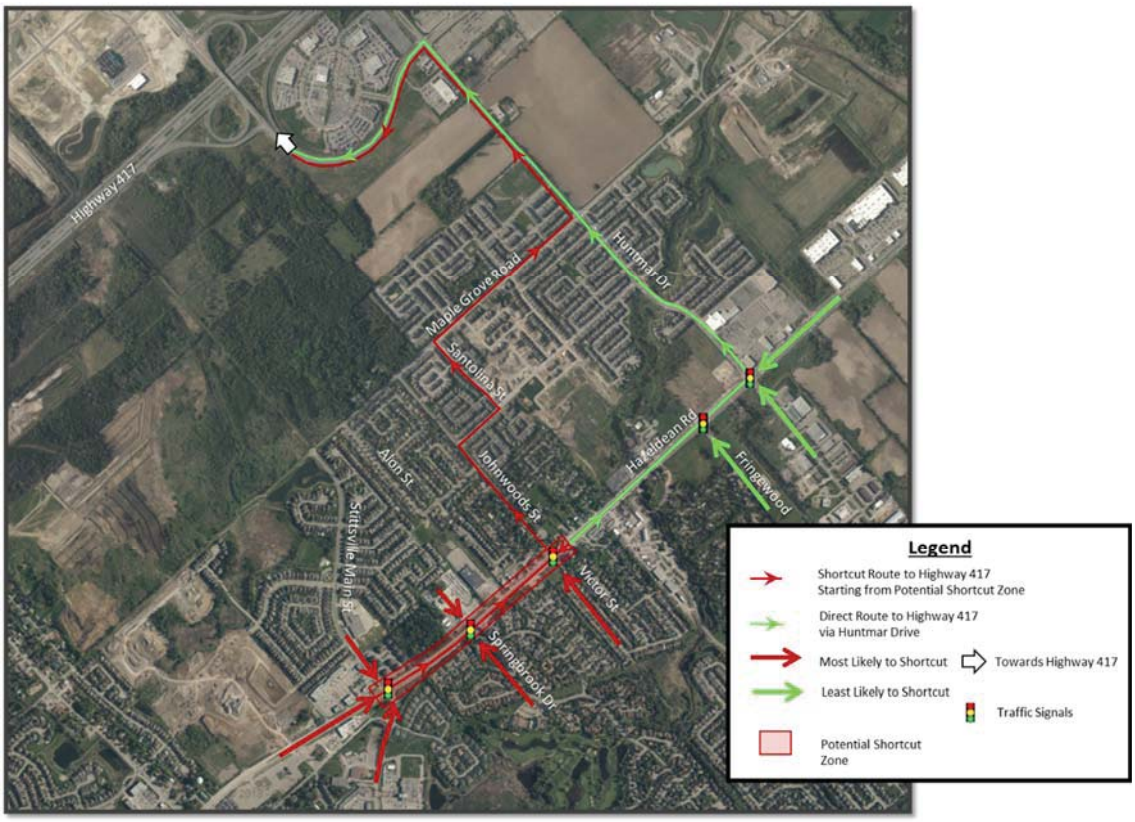
Shortcutting typically occurs as a result of congestion on the arterial road network, prompting motorists to consider alternative routing, often opting to travel on local neighbourhood-scale roads to bypass problem areas. As local roads are not designed or intended to accommodate through-traffic, this can have adverse effects for a community.

Within the study area, residents of the Bryanston Gate and Fairwinds communities to the south of Maple Grove Road have long expressed concerns with respect to shortcutting and have concerns this condition will be exacerbated with increased development to the north.

Existing Shortcutting Issues

Based on analysis of the existing road network, it is apparent that Johnwoods-Santolina-Maple Grove is likely the most impacted shortcut route through these communities at present to avoid congestion on segments of Hazeldean Road and Huntmar Drive, although other shortcut routes through this community also exist. A portion of this traffic infiltration may originate from further to the south, however the majority of this traffic is geographically-limited to the Amberwood Village community south of Hazeldean Road between Stittsville Main Street and Johnwoods Street. As other communities beyond this area would require a significant amount of back-tracking and already have more direct access to the regional transportation network (Highway 417) those areas are less likely to contribute to the shortcutting concerns. The area has been described as a 'Potential Shortcut Zone'. This zone, as well as the primary existing shortcut route, are illustrated in Exhibit 21 as follows.

Exhibit 21 – 'Potential Shortcut Zone' for Existing Conditions



Existing Traffic Calming Measures

In response to existing shortcutting concerns, the City of Ottawa has recently implemented a variety of traffic calming measures within the Bryanston Gate and Fairwinds communities to both increase driver awareness as well as discourage use of these shortcut routes by increasing the amount of friction to motorists.

The traffic calming measures currently in place are listed below and shown in Exhibit 22 below.

- Permanent closure of Johnwoods Street from Rosehill Avenue to Maple Grove Road and the conversion to a linear park with multi-use pathway (MUP) has been executed to improve pedestrian/cyclist connectivity as well as eliminate a direct shortcut route between Hazeldean Road and Maple Grove Road.
- Information signage along Maple Grove Road west of Johnwoods Street has been introduced to increase driver-awareness that the area has been designated as a 'traffic calmed neighborhood'.
- Vertical centreline treatments such as flexible stake bollards have been provided west of Johnwoods Street on Maple Grove Road and along Alon Street to increase driver-awareness and slow traffic
- The speed limit along Alon Street has been reduced to 40km/h to reduce the travel time savings of the shortcut route while mitigating safety concerns associated with traffic in the residential neighbourhood
- Speed counters and display devices have been located along Alon Street, Santolina Street and Rosehill Avenue.
- Speed humps have been introduced along Johnwoods Street with 30km/h warning signs to slow traffic and reduce the travel time savings of the shortcut route

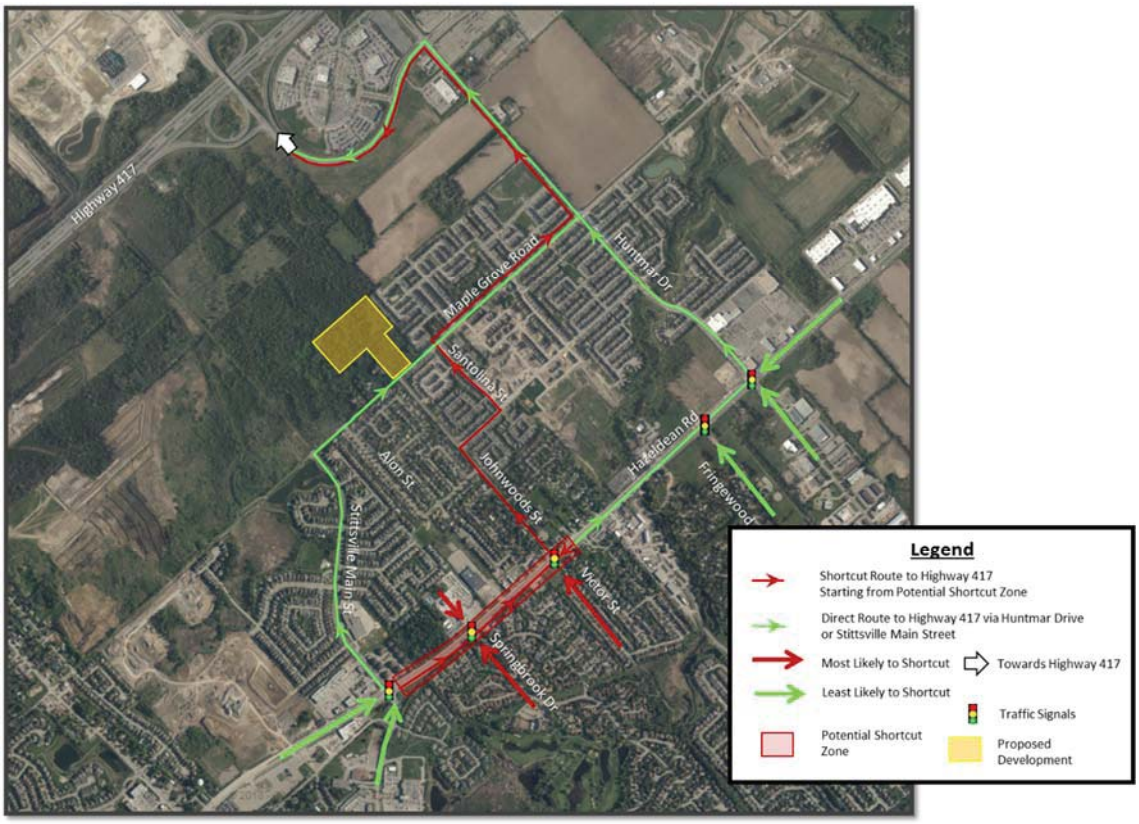
Exhibit 22 - Existing Traffic Calming Features in the Surrounding Community

Interim Shortcut Issues – Maple Grove Road Extension

As indicated by the Official Plan, right-of-way has been protected for the future extension of Maple Grove Road to Stittsville Main Street to provide connectivity of the arterial and collector road network as development in the community progresses. This link is expected to be provided along Maple Grove Road within the planning horizons for this study, and will result in the local redistribution of traffic and will enhance mobility within the area.

As indicated in Exhibit 23, this link will provide a more direct route between the area of Stittsville Main Street and Hazeldean Road, thereby reducing the viability of the existing 'shortcut' route via Johnwoods Street from this area.

Exhibit 23 – 'Potential Shortcut Zone' with the Maple Grove Road Extension



As seen in Exhibit 23, the 'Potential Shortcut Zone', would be reduced and no longer include the Hazeldean Road and Stittsville Main Street intersection following the extension of Maple Grove Road to Stittsville Main Street.

Ultimate Road Network

As stated previously, the local community is concerned that the proposed development will exacerbate shortcutting through the community, particularly when Stittsville Main Street is extended further to the north and ultimately provides connections to Palladium Drive and Highway 417 in conjunction with the development of 195 Huntmar Drive.

In response to these concerns, the City pre-emptively closed the northern section of Johnwoods Street to eliminate the potential direct connection from Hazeldean Road through the proposed Street 1 access north of Maple Grove Road. With the closure of Johnwoods Street, the nearest existing intersections south of Maple Grove Road are located 200m to the east at Santolina Street and 275m to the west at Alon Street, with respect to the Street 1 access. These significant offsets create a more circuitous route for motorists to travel to/from the north via the proposed development.

Summary of Evaluation

A variety of traffic calming measures were implemented along Johnwoods Street and Alon Street in response to concerns from the Bryanston Gate and Fairwinds Communities to discourage shortcutting. These measures include flexible stake bollards, speed humps, reduced speed limits and speed counters, as well as the permanent closure of Johnwoods Street from Maple Grove Road to Rosehill Avenue.

In the short term, the extension of Maple Grove Road to Stittsville Main Street is expected to mitigate potential shortcutting issues within these communities by providing a less circuitous route with higher capacity and less 'friction' as an alternative route to discourage traffic originating west of Stittsville Main Street from shortcutting through the Fairwinds and Bryanston Gate Communities.

Once the ultimate road network in the area has been established, the closure of Johnwoods Street to the north is expected to significantly reduce the desirability for shortcut traffic through the proposed development. Further to this, the availability of a secondary route between Highway 417 and the Stittsville Main Street/Hazeldean area will distribute traffic throughout the region and alleviate the very congestion that is triggering the desire to shortcut through the local communities.

The proposed development is not expected to exacerbate any potential shortcutting issues in the existing Bryanston Gate of Fairwinds communities. The circuitousness of any potential shortcut routes to Highway 417 through the proposed development is expected to discourage this activity by design.

4.6.2 Local Intersection Requirements

Local road intersections are expected to be unsignalized (stop-controlled) on the side street movement. These requirements will be reviewed and confirmed during the detailed design of the subdivision.

4.7 Transit

4.7.1 Route Capacity

The estimated future total transit passenger demand within the study area was provided in Section 3.1.2.4: Trip Generation by Mode. The results have been summarized in Table 14.

Table 14 – 2031 Development Generated Transit Demand

PERIOD	PEAK PERIOD DEMAND	
	IN	OUT
AM	24	66
PM	58	39

The proposed development will generate a marginal amount of transit demand. It is anticipated that increased transit demand will be accommodated by recommended modifications to transit routes, as discussed in Section 4.1.1. Additional capacity and service improvements via transit priority measures were not deemed necessary.

4.8 Review of Network Concept

Section 2.4.3 outlined the nearby screenlines to the subject site, SL 44 – Terry Fox; and SL 53 – Campeau, shown in Exhibit 11; obtained from the *Road Network Development Report (December 2013)*, an update to the 2013 Transportation Master Plan (TMP). A summary of 2031 Base and 2031 Network Concept demand and capacity scenarios have been provided in Table 15. The results of the 2031 Network Concept reflect the increase in roadway capacity associated with planned capital projects noted in the Transportation Master Plan (TMP), as compared with the 2031 Base scenario.

Table 15 – 2031 Development Generated Transit Demand

SCREENLINE	AM 2031 INBOUND (BASE)			AM 2031 INBOUND (NETWORK CONCEPT)		
	DEMAND	CAPACITY	V/C RATIO	DEMAND	CAPACITY	V/C RATIO
SL 44 – Terry Fox	7,001	10,400	0.67	7,902	18,200	0.43
SL 53 – Campeau	4,261	7,000	0.61	4,028	8,000	0.50

Notes: Table results from TMP – Final Report: Road Network Development Report

Proposed development traffic does not trigger any capacity deficiencies along nearby screenlines in either the 2031 Base Scenario or 2031 Network Concept. However, future road projects such as the Stittsville Main Street Extension, the widening of Huntmar Drive, the extension and widening of Campeau Drive, and the re-alignment of Palladium Drive should be completed on schedule to reduce or spread traffic demand along nearby screenlines and help mitigate local traffic bottlenecks.

4.9 Intersection Design

The study area intersections were evaluated in the morning and afternoon peak hour traffic conditions at the following horizons:

- Existing Traffic (2018)
- Future (2021) Background Traffic
- Future (2026) Background Traffic
- Future (2021) Total Traffic
- Future (2026) Total Traffic

The following intersections were included in this analysis:

- Maple Grove Road and Huntmar Drive
- Santolina Street and Maple Grove Road
- Alon Street and Maple Grove Road
- Street 1 and Maple Grove Road (new intersection)

4.9.1 Base Road Network

The base road network configuration for existing intersections in each horizon year was based on the existing road network, as shown in Exhibit 3. There were no future roadway modifications noted in the Transportation Master Plan (TMP) "Affordable Network," DC Background Study or Capital Budget Forecasts within the study area.

Further discussion on the geometric requirements for auxiliary turn lanes and storage lengths at proposed access intersections has been provided in Section 4.10.2.

4.9.2 Intersection Analysis Criteria

4.9.2.1 Roundabout Analysis

A roundabout was not considered at the intersection of Huntmar Drive and Maple Grove Road due to existing right-of-way restrictions. At the time of this TIA, the City indicated that a detailed design was being prepared for Maple Grove

Road and Huntmar Drive, and that this intersection would remain signalized, with auxiliary lane upgrades at each approach to increase capacity and mitigate existing congestion issues.

The Roundabout Initial Feasibility Screening Tool was not completed for Maple Grove Road and Santolina Street or Maple Grove and Alon, since the intersections do not meet any of the conditions that require the completion of the screening form, which was verified through the Synchro analysis results shown in Section 4.9.4. The conditions are described below:

- Neither Maple Grove and Santolina nor Maple Grove and Alon are new City intersections;
- Traffic signals are not warranted at either intersection up to the 2026 total traffic condition;
- There are no safety/ capacity issues being experienced at the either intersection

The results of the Roundabout Screening Tool for the proposed Street 1 and Maple Grove Road intersection are shown in Appendix H.

4.9.2.2 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 shown in Table 16.

Table 16 – 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.

4.9.2.3 Unsignalized Intersections

The capacity of an unsignalized intersection can also be expressed in terms of the LOS it provides. For an un-signalized 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 17.

Table 17 – 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 conditions, 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.

4.9.3 Intersection Control

4.9.3.1 Traffic Signal Warrant Methodology

Traffic control signal warrants were completed for all unsignalized stop or yield controlled intersections. The City has requested that traffic signal warrant procedures for future conditions follow the methodology outlined in Justifications 1 to 3 of the Ontario Traffic Manual (OTM), Book 12, Ministry of Transportation Ontario (MTO), 2012, as opposed to following Justification 7. Traffic signal warrants for existing conditions continue to follow Justifications 1 to 6, as per the OTM.

Both the existing and future signal warrants were evaluated utilizing the 8-hour method. The 8-hour traffic volumes for the future conditions were approximated as follows:

- *Hour 1* – AM Peak Hour Traffic Volumes
- *Hours 2 to 4* – Each hour is assigned 50% of AM Peak Hour Volumes
- *Hour 5* – PM Peak Hour Traffic Volumes

- *Hours 6 to 8* - Each hour is assigned 50% of PM Peak Hour Volumes

4.9.3.2 Traffic Signal Warrant Results

The traffic signal warrants were not triggered in the 2026 total traffic condition at either of the existing unsignalized intersections within the study area: Santolina Street and Maple Grove Road, Alon Street and Maple Grove Road.

As previously mentioned in Section 4.4.2.2, traffic signal warrant analysis did not trigger the need for signals at the proposed Street 1 and Maple Grove Road intersection.

Details of the traffic signal warrant analyses described above are included in Appendix I.

4.9.4 Intersection Design (Operations)

4.9.4.1 Intersection Analysis Methodology

Using the established intersection capacity analysis criteria described above, the existing and future conditions were analyzed during the weekday peak hour traffic volumes derived in the previous sections of this report.

The worst/ critical observed Level of Service (LOS) movement at each study area intersection was recorded; if the LOS was 'E' or lower, it was compared to the intersection LOS. If the intersection LOS was also indicated to be below City standards, potential roadway modifications or measures were considered and the intersection was re-evaluated. Any recommended modifications would be carried forward to the following horizon.

The following section presents the results of the intersection capacity analysis and roundabout capacity analysis. All tables summarize study area intersection LOS results during the morning and afternoon peak hour periods. The Synchro analysis output files have been provided in Appendix J.

4.9.4.2 Existing (2018) Traffic Results

The existing (2018) intersection capacity analysis was based on morning and afternoon peak hour traffic volumes. The existing signal timing plan provided by the City for the Maple Grove Road and Huntmar Drive intersection is included in Appendix K. A summary of the results has been provided in Table 18.

.

Table 18 – Intersection Capacity Analysis: Existing (2018) Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Huntmar Drive and Maple Grove Road	Traffic Signals	AM	0.76	-	C	-
		PM	0.96	0.94	E	E
	Traffic Signals [1]	AM	0.83	-	D	-
		PM	0.78	-	C	-
Maple Grove Road and Santolina Street	NB stop	AM	0.07	-	A	-
		PM	0.07	-	A	-
Maple Grove Road and Alon Street	NB stop	AM	0.05	-	A	-
		PM	0.04	-	A	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[1] Construct the following auxiliary lanes at the Maple Grove Road and Huntmar Drive intersection:

a. 15m SBL storage lane
b. De facto 75m EBL storage lane. It is recommended to restrict parking on both sides of Maple Grove Road for first 75m west of Huntmar Drive.
c. Extend NBL storage lane by 10m (proposed storage length = 25m)
d. 30m SBR storage lane

4.9.4.3 2021 Background Traffic Results

The 2021 background traffic condition intersection capacity analysis for total background traffic was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the existing (2018) traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 19.

Table 19 – Intersection Capacity Analysis: 2021 Background Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Huntmar Drive and Maple Grove Road	Traffic Signals	AM	0.83	-	D	-
		PM	1.08	1.06	F	F
	Traffic Signals [1]	AM	0.83	-	D	-
		PM	0.80	-	C	-
Maple Grove Road and Santolina Street	NB stop	AM	0.10	-	B	-
		PM	0.13	-	B	-
Maple Grove Road and Alon Street	NB stop	AM	0.10	-	B	-
		PM	0.11	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[1] Construct the following auxiliary lanes at the Maple Grove Road and Huntmar Drive intersection:

a. 15m SBL storage lane
b. De facto 75m EBL storage lane. It is recommended to restrict parking along both sides of Maple Grove Road for first 75m west of Huntmar Drive.
c. Extend NBL storage lane by 10m (proposed storage length = 25m)
d. 30m SBR storage lane

4.9.4.4 2026 Background Traffic Results

The 2026 background traffic condition intersection capacity for total background traffic analysis was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the 2021 background traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 20.

Table 20 – Intersection Capacity Analysis: 2026 Background Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Huntmar Drive and Maple Grove Road	Traffic Signals	AM	0.86	-	D	-
		PM	1.16	1.15	F	F
	Traffic Signals [1]	AM	0.86	-	D	-
		PM	0.85	-	D	-
Maple Grove Road and Santolina Street	NB stop	AM	0.10	-	B	-
		PM	0.15	-	B	-
Maple Grove Road and Alon Street	NB stop	AM	0.10	-	B	-
		PM	0.10	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

4.9.4.5 2021 Total Traffic Results

The 2021 total traffic condition intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the existing (2018) traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 21.

Table 21 – Intersection Capacity Analysis: 2021 Total Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Huntmar Drive and Maple Grove Road	Traffic Signals	AM	0.86	-	D	-
		PM	1.09	1.08	F	F
	Traffic Signals [1]	AM	0.84	-	D	-
		PM	0.80	-	D	-
Maple Grove Road and Santolina Street	NB stop	AM	0.10	-	B	-
		PM	0.15	-	B	-
Maple Grove Road and Alon Street	NB stop	AM	0.10	-	B	-
		PM	0.11	-	B	-
Maple Grove Road and Street 1	SB stop	AM	0.04	-	B	-
		PM	0.04	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

The following intersections are expected to be constructed by 2021: Maple Grove Road and Street 1

[1] Construct the following auxiliary lanes at the Maple Grove Road and Huntmar Drive intersection:

a. 15m SBL storage lane
b. De facto 75m EBL storage lane. It is recommended to restrict parking along both sides of Maple Grove Road for first 75m west of Huntmar Drive.
c. Extend NBL storage lane by 10m (proposed storage length = 25m)
d. 30m SBR storage lane

4.9.4.6 2026 Total Traffic Results

The 2026 total traffic condition intersection capacity analysis was completed using morning and afternoon peak hour traffic volumes. All recommended modifications from the 2021 total traffic condition have been carried forward to this horizon. A summary of the results has been provided in Table 22.

Table 22 – Intersection Capacity Analysis: 2026 Total Traffic

INTERSECTION	CONTROL	PEAK HOUR	V/C RATIO		LEVEL OF SERVICE	
			CRITICAL MOVEMENT	INTERSECTION	CRITICAL MOVEMENT	INTERSECTION
Huntmar Drive and Maple Grove Road	Traffic Signals	AM	0.89	-	D	
		PM	1.28	1.26	F	F
	Traffic Signals [1]	AM	0.84	-	D	-
		PM	0.88	-	D	-
Maple Grove Road and Santolina Street	NB stop	AM	0.13	-	B	-
		PM	0.22	-	C	-
Maple Grove Road and Alon Street	NB stop	AM	0.11	-	B	-
		PM	0.12	-	B	-
Maple Grove Road and Street 1	SB stop	AM	0.25	-	B	-
		PM	0.23	-	B	-

Notes: EB = eastbound; WB = westbound; NB = northbound; SB = southbound

[1] Construct the following auxiliary lanes at the Maple Grove Road and Huntmar Drive intersection:

a. 15m SBL storage lane
b. De facto 75m EBL storage lane. It is recommended to restrict parking along both sides of Maple Grove Road for first 75m west of Huntmar Drive.
c. Extend NBL storage lane by 10m (proposed storage length = 25m)
d. 30m SBR storage lane

Based on the analysis above, there is only a marginal variation in traffic operations with the existing configuration of Huntmar Drive and Maple Grove Road in the 2026 background and 2026 total traffic scenarios, and regardless of whether the development is constructed, this intersection will operate well above its theoretical capacity by 2026.

4.9.5 Intersection Design (MMLOS)

The Multi-modal level of service (MMLOS) Guidelines provide guidance on how to assess the various LOS for the different modes of transportation and what the specific target service levels for each mode should be given the location and context of the transportation project. This all-in-one evaluation tool will allow comparisons using similar performance metrics for each non-auto mode. The MMLOS procedure is only applied to signalized intersections, and the worst-performing approach at the intersection for any mode represents the overall intersection MMLOS for that mode.

The Intersection MMLOS results for the Existing (2018) condition are shown in Table 23 and the Intersection MMLOS results for the Future (2021 and 2026) Background and Total Traffic condition are shown in Table 24. Detailed MMLOS results are provided in Appendix G.

Table 23 – Intersection MMLOS – Existing Conditions (2018)

INTERSECTION	SCENARIO	LEVEL OF SERVICE			
		PLOS	BLOS	TLOS	TKLOS
Maple Grove Road and Huntmar Drive	Existing (2018) Base	E	F	F	F
	Existing (2018) Modifications [1]	D	D	E	F

Notes: PLOS = Pedestrian LOS; BLOS = Bicycle LOS; TLOS = Transit LOS; TKLOS = Truck LOS

[1] Construct/ Modify the following auxiliary lanes:

a. SBL with 15m of storage
b. De facto 75m EBL storage lane. It is recommended to restrict parking along both sides of Maple Grove Road for first 75m west of Huntmar Drive.
c. Extend NBL storage lane by 10m (proposed storage length = 25m)
d. SBR with 30m of storage

Table 24 – Intersection MMLOS – Future Background and Total Results

INTERSECTION	SCENARIO	LEVEL OF SERVICE			
		P	B	T	TK
Maple Grove Road and Huntmar Drive	Future (2021) BG	D	D	E	F
	Future (2026) BG	D	D	F	F
	Future (2021) BGSG	D	D	E	F
	Future (2026) BGSG	D	D	F	F

Notes:
LOS = Level of Service; P = Pedestrian LOS; B = Bicycle LOS; T = Transit LOS; TK = Truck LOS
Future BG = Future Background Traffic; Future BGSG = Future Background and Site-Generated Traffic

4.9.5.1 Intersection Pedestrian Level of Service (PLOS)

The PLOS at intersections is based on several factors including the number of traffic lanes that pedestrians must cross, corner radii, and whether the crossing allows for permissive or protective right or left turns, among others. The City of Ottawa target for PLOS is C.

The intersection of Maple Grove Road and Huntmar Drive was tested in the Existing (2018), as well as the 2021 and 2026 background and total traffic conditions. The 2021 and 2026 background and total traffic conditions resulted in PLOS values of 'D' at each approach, which just marginally exceed the City's PLOS target value.

4.9.5.2 Intersection Bicycle Level of Service (BLOS)

The BLOS at intersections is dependent on the number of lanes that the cyclist is required to cross to make a left-turn, the presence of a dedicated right-turn lane on the approach, as well as the operating speed of each approach. The City target for BLOS is 'C'.

The BLOS analysis indicates that the Existing (2018), 2021 and 2026 background and total traffic conditions result in a BLOS of 'D' at the intersection of Maple Grove Road and Huntmar Drive Road, marginally exceeding the City's target. In this situation, cyclists are required to cross one lane of traffic with an operating speed of 50 km/hr.

4.9.5.3 Intersection Transit Level of Service (TLOS)

Intersection TLOS is based on the average signal delay experienced by transit vehicles at each intersection. The City Target TLOS is 'C'.

The results of the analysis indicate that the 2021 background and total traffic condition resulted in a TLOS of 'D' for the City of Ottawa's vehicular capacity target caused by delays on all approaches. The 2026 background and 2026 total traffic conditions experienced a TLOS of 'F', resulting from higher delays experienced on the westbound approach. It is recommended that the City consider the inclusion of a westbound left-turn lane at this approach as part of the intersection upgrades meant to alleviate congestion at this intersection. All other approaches meet or marginally exceeded the City's TLOS target value and maintained the TLOS of 'D' through to the 2026 total traffic condition.

4.9.5.4 Intersection Truck Level of Service (TKLOS)

The TKLOS is based on the right-turn radii, as well as the number of receiving lanes for vehicles making a right-turn from the traffic lane being analyzed. The City of Ottawa target for TKLOS is 'D'.

The intersection of the existing Maple Grove Road and Huntmar Drive intersection has a TKLOS of 'F', which is attributed to the tighter turning radii and single-receiving lanes on all approaches. The Transportation Master Plan (TMP) proposes to widen the section of Huntmar Drive north of the intersection from 2 to 4 lanes, as part of Phase 3 (2026-2031) of the Affordable Network, which would satisfy the City target for TkLOS along Huntmar Drive.

4.10 Geometric Review

The following section reviews all geometric requirements for the study area intersections. All relevant excerpts from referenced technical standards have been provided in Appendix L.

4.10.1 Sight Distance and Corner Clearances

The proposed development access intersections are located along sections with no significant horizontal or vertical alignment constraints. Sight distance and corner clearances are not expected to be a concern. All geometric design requirements should be reviewed and confirmed during detailed design.

4.10.2 Auxiliary Lane Analysis

Auxiliary turning lane lengths for all study area intersections were evaluated for all intersections within the study area.

4.10.2.1 Auxiliary Left-Turn Lane Requirements (Unsignalized)

Left-turn warrants from the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads (June 2017) was applied to main-street approaches at all unsignalized intersections using the highest left-turn volume from either the morning or afternoon peak hour in the 2026 total traffic condition.

The results have been summarized in Table 25.

Table 25 – Auxiliary Left-Turn Lane Analysis at Unsignalized Intersections

INTERSECTION	SCENARIO	MOVEMENT	POSTED/ DESIGN SPEED (KM/H)	LEFT-TURN VOLUME (VPH)	APPROACH VOLUME (VPH)	OPPOSING VOLUME (VPH)	LEFT-TURN STORAGE (M)
Maple Grove Road and Santolina Street	2026 BGSG	WBL	50/ 60	95	424	263	15 [1]
Maple Grove Road and Alon Street	2026 BGSG	WBL	50/ 60	70	270	136	Not Required
Maple Grove Road and Street 1	2026 BGSG	EBL	50/ 60	34	205	385	Not Required

Notes:

Recommended storage lengths do not account for deceleration lane and taper lane lengths.
[1] Triggered by MTO left-turn warrants, but not recommended, as cross-commuter volumes are inflated and expected to normalize once alternative routes are made available to commuters.

The geometric assessment of Maple Grove Road and Santolina Street triggered a 15m westbound left-turn lane to accommodate the 2026 total traffic conditions. However, the auxiliary lane was determined to be unnecessary, as it was triggered under the worst case scenario in the future (2026) planning horizon. It was assumed that there will be a temporary influx of traffic on Maple Grove Road, some of which will divert to alternative routes, once key infrastructure for 195 Huntmar Drive is built. The worst case assumed that infrastructure to the north of the subject site was not built, and that the majority of commuter traffic was reliant on Maple Grove Road. The development of the lands to the north of the subject site is expected to coincide with the timings in the TMP Affordable Network, which indicates that the road network will be constructed between 2026 and 2031. There is expected to be at most a five-year delay between triggering the left-turn lane and buildout of key infrastructure to the north that will divert traffic from Maple Grove Road and eliminate the need for a left-turn lane. Therefore, it is not recommended to redesign the intersection to resolve a temporary potential congestion issue that is expected to have no negative impact on intersection safety.

Left-turn storage lengths should be reviewed and confirmed during detailed design.

4.10.2.2 Signalized Auxiliary Left-Turn Lane Requirements

A review of auxiliary left-turn lane storage requirements was completed at the intersection of Maple Grove Road and Huntmar Drive, the only intersection within the study area expected to be signalized in the 2026 total traffic condition. The review compared the projected 95th percentile queue lengths from Synchro operational results, and the City of Ottawa queue length calculation based on the following equation:

$$Storage\ Length, S = \frac{NL}{C} \times 1.5$$

Where:
N = number of vehicles per hour
L = Length occupied by a vehicle in the queue = 7 m
C= number of traffic signal cycles per hour (3600 seconds per hour/cycle length)

The results of the auxiliary left-turn lane analysis storage lengths are summarized in Table 26.

Table 26 – Recommended Auxiliary Left-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	95TH %ILE QUEUE LENGTH (M)	CITY QUEUE LENGTH (M)	EXISTING STORAGE LENGTH (M)	RECOMMENDED ADDITIONAL STORAGE LENGTH (M)
Maple Grove Road and Huntmar Drive	NB	25	20	15	10
	SB	15	15	-	15
	EB	#65	75	-	70

Recommended storage lengths do not include deceleration lane and taper lengths. Units rounded to nearest 5m.
- Synchro extrapolated queue lengths at congested intersections. From Synchro 9 User Guide, "In practice, 95th percentile queue lengths will rarely be exceeded and the queues shown with the # footnote are acceptable in the design of storage bays."

As noted in Section 3.3.1.1, the Transportation Impact Assessment (TIA) prepared for the Fairwinds development at 33 Johnwoods Street (December 2012) assumed that auxiliary left and right turn lanes would be constructed on all approaches at the intersection of Maple Grove Road and Huntmar Drive by 2017. Despite these recommendations, all approaches of the existing intersection remain as shared through-turning lanes with the exception of the 15m northbound left turning lane. The auxiliary left-turn lane analysis indicated that additional storage may be required on the northbound approach to accommodate future traffic demand. Should the northbound left-turn lane length require additional storage to accommodate future travel demand, the median along Huntmar Drive could be reconstructed to increase the capacity of the storage bay.

Even though an eastbound left-turn 'permissive-protected' signal head was installed at Maple Grove Road and Huntmar Drive, an eastbound left-turn storage bay had not been painted at the time of IBI's field investigation on October 3, 2018. Motorists were observed to queue in separate travel lanes for vehicles for the eastbound left and eastbound through-right movements, despite the lack of pavement markings on the eastbound approach.

The existing pavement along the eastbound approach maintains an 11-metre width to Leveche Way, the nearest intersecting street to the west along Maple Grove Road and allows for a theoretical eastbound left-turn storage lane of approximately 135 metres. However, direct frontage from existing townhomes along this section of Maple Grove Road and an absence of peak period parking restrictions on the south side of Maple Grove Road could result in the eastbound approach effectively being reduced to a single shared lane. It is recommended that the City consider implementing parking restrictions along both sides of Maple Grove Road on the eastbound approach to reduce potential conflicts between parking and queuing vehicles, in lieu of introducing a formal left-turn lane. Synchro results and the City's queue length calculation show 75m of storage is required to satisfy the future traffic demand at the Maple Grove Road and Huntmar Drive intersection, well below the 135m distance to the nearest intersecting street. Once key portions of the road network for 195 Huntmar Drive are constructed to the north of the subject site, this will alleviate traffic congestion and reduce queuing along Maple Grove Road.

According to Section 9.1.2.3 of TAC, the southbound left-turn should be aligned with the existing northbound left-turn to ensure symmetry between corresponding approach and departure lanes, thereby, reducing the risk of collisions between left-turns and opposing through traffic.

The Maple Grove Road and Huntmar Drive intersection operated within City standards through to the 2026 total traffic condition with a shared westbound configuration. It is recommended that the City explore options to implement a westbound left-turn lane to improve the symmetry with the eastbound approach and mitigate safety concerns resulting from any geometrical deficiencies.

The recommended left-turn storage lengths at Maple Grove Road and Huntmar Drive should be reviewed and confirmed during detailed design.

4.10.2.3 Auxiliary Right-Turn Lane Requirements (Unsignalized)

At this time, there is no formal City or MTO warrant procedure governing the application of auxiliary right-turn lanes at unsignalized intersections. Referring to TAC standards, Section 9.14.2 suggests an auxiliary right-turn lane be considered "when the volume of decelerating or accelerating vehicles compared with the through traffic volume causes undue hazard."

Synchro analysis does not indicate that right-turn lanes are necessary, as all intersections are currently operating within City operational standards through to the 2026 total traffic condition.

The requirement for auxiliary right-turn lanes at proposed development access intersections should be reviewed and confirmed during detailed design.

4.10.2.4 Signalized Auxiliary Right-Turn Lane Requirements

A southbound right-turn lane is warranted at the Maple Grove Road and Huntmar Drive intersection. According to Section 9.14 of TAC, a right-turn lane is recommended when more than 20% of vehicles on an approach are turning right, and the peak hour demand exceeds 60 vehicles. In the existing (2018) condition through to the 2026 total traffic condition, the southbound right-turn volume triggers this requirement. Synchro results for the existing (2018) condition indicate that queue lengths on the southbound approach in exceed 300 metres in the afternoon peak hour without the implementation of a right-turn lane.

Right-turn lanes may also be warranted on the remaining approaches of the Maple Grove Road and Huntmar Drive intersection; between 10-20% of vehicles are expected to turn right on the eastbound, westbound and northbound approaches under the 2026 total traffic condition, and the right-turn volumes are expected to marginally exceed the 60 vehicles per hour threshold on these approaches as well. However, Synchro results indicate that right-turn lanes on the eastbound, westbound and northbound approaches are not necessary for the intersection to operate within City standards.

Right-turn lane requirements should be reviewed and confirmed during detailed design. The results of the auxiliary right-turn lane analysis are summarized in Table 27.

Table 27 – Recommended Auxiliary Right-Turn Storage Lengths at Signalized Intersections

INTERSECTION	APPROACH	RIGHT TURN VOLUME	APPROACH VEHICLES TURNING RIGHT (%)	95TH %ILE QUEUE LENGTH (M)	EXISTING STORAGE LENGTH (M)	RECOMMENDED ADDITIONAL STORAGE LENGTH (M)
Maple Grove Road and Huntmar Drive	EB	67	18%	<10	-	Not warranted at this time [1]
	WB	61	34%	<10	-	Not warranted at this time [1]
	NB	92	14%	<10	-	Not warranted at this time [1]
	SB	407	32%	40	-	30 [1, 2]

[1] Right-turn lanes requirements will be reviewed during detailed design stage.

[2] Recommended storage lengths do not include deceleration lane and taper lengths. Units rounded to nearest 5m.

4.11 Summary of Improvements Indicated and Modification Options

4.11.1 Maple Grove Road and Santolina Street

The intersection of Maple Grove Road and Santolina Street was shown to operate within City standards through to the 2026 total traffic condition with the existing lane configurations and intersection control. This intersection is expected to remain as stop-controlled on the minor approach until at least 2026 with shared single lanes on each approach.

The geometric assessment of Maple Grove Road and Santolina Street triggered a 15m westbound left-turn to accommodate the 2026 background and total traffic conditions; however, this auxiliary lane was determined to be unnecessary, as discussed in Section 4.10.2.1.

4.11.2 Maple Grove Road and Alon Street

The intersection of Maple Grove Road and Alon Street was shown to operate within City standards through to the 2026 total traffic condition with the existing lane configurations and intersection control. This intersection is expected to remain as stop-controlled on the minor approaches until at least 2026 with shared single lanes on each approach.

The geometric assessment of Maple Grove Road and Alon Street intersection did not trigger any auxiliary turning lane requirements to accommodate the 2026 total traffic condition. The existing shared lanes on all approaches were considered acceptable.

4.11.3 Maple Grove Road and Huntmar Drive

The intersection of Maple Grove Road and Huntmar Drive is presently approaching its theoretical capacity, operating at LOS 'E' during the weekday afternoon peak hour, and auxiliary lane modifications are required to alleviate existing capacity issues that will continue to worsen under future conditions, operating well above its theoretical capacity by 2026 with and without development traffic.

The TIA prepared for the Fairwinds development at 33 Johnwoods Street (December 2012) assumed that auxiliary left and right turn lanes would be constructed on all approaches at the intersection of Maple Grove Road and Huntmar Drive by 2017. Despite these recommendations, all approaches of the existing intersection have remained as shared through-turning lanes with the exception of the northbound approach, which has a 15m left-turn storage lane.

Operational results from Synchro 95th percentile queue length analysis and City of Ottawa queuing analysis based on the 2026 total traffic condition indicated that the westbound left-turn lane should have 30m of storage, the southbound left-turn lane should have 15m of storage, and the northbound left-turn lane storage lane should be extended from 15m to 25m. A southbound right-turn lane of 30m is also warranted in the existing conditions, based on the heavy right turn volume exceeding 200 vehicles, and operates within City standards through to the 2026 total traffic condition.

Based on capacity analysis, the recommended eastbound left-turn storage length is 75m. It is recommended to restrict parking for the first 75m of frontage along both sides of Maple Grove Road to create a de facto eastbound left-turn lane, and the mitigate the risk of lane blockages along Maple Grove Road. Field observations conducted by IBI at the time of the study showed that parking restrictions only existed on the north side of the approach.

Drive, there were concerns raised by the public that the timing for the widening of Huntmar Drive did not align with the traffic growth being experienced in the area, and that the project should be expedited. The analysis undertaken in this study conservatively assumed that the widening would not be in place by the 2026 study horizon.

4.11.4 Proposed Accesses/ Egresses

The proposed Street 1 access/ egress off of Maple Grove Road was shown to operate within City operational standards with shared through-turning lanes on all approaches, and stop-controlled minor approaches through to the 2026 total traffic condition.

The geometric assessment of the proposed access intersections did not trigger any auxiliary turning lanes to accommodate the 2026 total traffic condition. The existing shared lanes on all approaches were considered acceptable.

4.11.5 Summary of Recommendations

The key conclusions from the TIA Analysis Report are as follows:

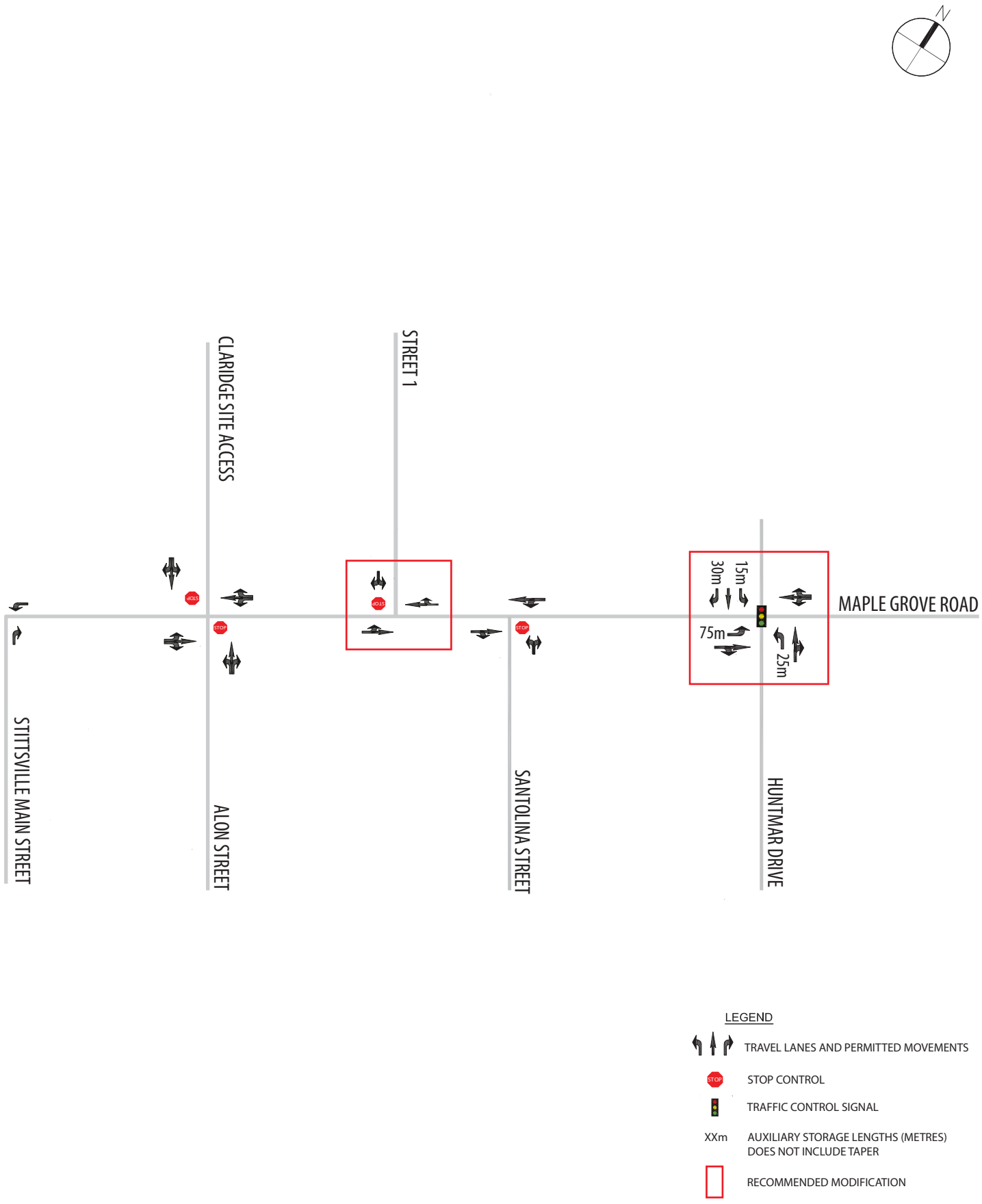
- The study area transportation network is expected to accommodate site-generated traffic volumes through to the 2026 horizon year.
- There are existing shortcutting concerns that have been addressed through the recent implementation of traffic calming measures in the Bryanston Gate and Fairwinds communities. The extension of Maple Grove Road will alleviate shortcutting in the short term by providing greater connectivity of the arterial and collector road network. The ultimate road network will provide additional roadway capacity with more direct connections to Highway 417, and the closure of Johnwoods Street should discourage additional shortcutting with the elimination of the direct route from Hazeldean Road through the proposed development.
- There is no RMA required for the proposed development. The RMA process is currently ongoing for the extension of Maple Grove Road to Stittsville Main Street as part of the development application for 1981 Maple Grove Road.
- There is no requirement for a monitoring plan.

The overall conclusion of this TIA is that the traffic generated by the 1919 Maple Grove Road Development can be accommodated on the adjacent transportation network with the recommended actions and modifications in place by the City of Ottawa to support growth in background and site-generated traffic. Formasian Development Corporation shall be responsible for constructing all required access intersections and internal transportation facilities as dictated by the proposed draft plan.

A summary of all recommended actions/ modifications has been provided in Table 28. The recommended design for all off-site roadway modifications in the 2026 total traffic condition has been provided in Exhibit 2 .

Table 28 – Summary of Recommended Actions/ Modifications

HORIZON	RECOMMENDED ACTIONS/ MODIFICATIONS
Existing (2018)	Maple Grove Road and Huntmar Drive • Existing intersection configuration with signal optimization does not meet City intersection capacity requirements. • Construct southbound right-turn lane with 30m of storage • Construct left turn lanes with the following storage lengths: ◆ Extend northbound left-turn storage length by 10m (total recommended storage length is 25m) ◆ Southbound left-turn lane with 15m storage • Restrict parking on both side of eastbound approach for the first 75m to accommodate de facto left-turn vehicle storage lane Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Alon Street • Meets City operational guidelines
Future (2021) Background – No Site Generated Traffic	Assume all actions and modifications from the Existing (2018) traffic conditions remain. Optimize all traffic signals. Maple Grove Road and Huntmar Drive • Meets City operational guidelines Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Alon Street / Claridge Site Access • Claridge Homes – Construct north leg • Two-way stop-controlled intersection • Shared through-turn lanes on all approaches • Meets City operational guidelines Maple Grove Road and Stittsville Main Street • City of Ottawa - Extend Maple Grove Road to Stittsville Main Street
Future (2021) Total – With Site Generated Traffic	Assume all actions and modifications from the Existing (2018) traffic conditions remain. Optimize all traffic signals. Maple Grove Road and Huntmar Drive • Meets City operational guidelines Maple Grove Road and Santolina Street • Meets City operational guidelines Maple Grove Road and Street 1 • Formasian Development Corporation – Construct unsignalized access intersection • Southbound stop-controlled • Shared through-turn lanes on all approaches Maple Grove Road and Stittsville Main Street • City of Ottawa - Extend Maple Grove Road to Stittsville Main Street to create a bend in the road
Future (2026) Background – No Site Generated Traffic	Assume all modifications from the Future (2021) Background traffic conditions remain. Optimize all traffic signals.
Future (2026) Total – With Site Generated Traffic	Assume all modifications from the Future (2021) Total traffic conditions remain. Optimize all traffic signals.



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1919 Maple Grove Road
Transportation Impact Assessment

EXHIBIT 24
2026 Intersection Control and
Lane Configurations

PROJECT No.: 39124
DATE: APRIL 2019
SCALE: NTS

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix A: City Comments

April 2019

IBI

1919 Maple Grove Road (Formasian) – October 24, 2018

Responses are provided in red, following each comment.

Traffic Signals

1) No comments to this TIA for this circulation. Traffic Signal Design and Specification reserves the right to make future comments based on subsequent submissions. Acknowledged.

2) Future considerations:
a) If there are any future proposed changes in the existing roadway geometry for the purpose of construction of a new TCS(s) or modifications to existing TCS(s) as recommended in Existing Horizon, pg 59, then the City of Ottawa Traffic Signal Design and Specification Unit is required to complete a review for traffic signal plant re-design and provide the actual re-design. Acknowledged.
b) If the proposed traffic signals are warranted/approved for installation or modifications to existing TCS are approved, and RMA approved, please forward an approved geometry detail design drawings (dwg digital format in NAD 83 coordinates) including base mapping, existing and new underground utilities/sewers, new/existing catch basins locations, Turn-Radius Modeling and approved pavement markings drawings in separate files for detail traffic plant design lay out. Acknowledged.
c) Please send all digital (CADD) design files to Peter.Grajcar@ottawa.ca 613-580-2424 extension 23035. Acknowledged.

Traffic Engineering

1) Huntmar Drive and Maple Grove Road intersection had a permitted-protected eastbound left-turn arrow installed on February 2, 2018. Future TIA submissions should reflect the new intersection phasing with regards to Synchro analysis.
   Acknowledged. The TIA has been revised to reflect the updated signal timing plan with the protected-permitted eastbound left-turn.

2) Minimum left-turn storage lane length is 35 metres. Acknowledged. The westbound left-turn lane and southbound left-turn lane storage lengths were based on the highest 95th% queue length in the ultimate 2026 total planning horizon, and thus were recorded as being less than 35m to show the minimum storage lengths required to accommodate future traffic demand in 2026.

Street Lighting

1) No comments with initial TIS for this circulation. Street Lighting reserves the right to make future comments based on subsequent submissions. Acknowledged.
2) Future considerations are as follows:
   a. If there are any proposed changes to the existing roadway geometry, the City of Ottawa Street Light Asset Management Group is required to provide a full street light design. Upon completion of proposed roadway geometry design changes, please submit digital Micro Station drawings with proposed roadway geometry changes to the Street Lighting Department, so that we may proceed with the detailed street light design and coordination with the Street Light maintenance provider and all necessary parties. Be advised that the applicant will be 100% responsible for all costs associated with any Street Light design as a result of the roadway geometry change. Acknowledged.

b. Alterations and/or repairs are required where the existing street light plant is directly, indirectly or adversely affected by the scope of work under this circulation, due to the proposed road reconstruction process. All street light plant alterations and/or repairs must be performed by the City of Ottawa's Street Light maintenance provider. Acknowledged.
c. Be advised that the applicant will be 100% responsible for all costs associated with any relocations/modifications to the existing street light plant. Acknowledged.
d. If conflict arises, please contact Isak Wall (City of Ottawa) 613-580-2424 ext. 32593. Acknowledged.

Transportation Engineering Services

1) IBI indicated in a memo on Feb 20th regarding the 1981 Maple Grove Road TIA Forecasting that they would use the TRANS model for residential developments. They have again neglected to use the TRANS model. Please keep this in mind for future submissions. Both the 1981 Maple Grove Road and 1919 Maple Grove Road TIA reports have been updated with the TRANS model for the development of trip generation volumes.

2) The intersection design at Huntmar Drive and Maple Grove Road was completed by Traffic Services. Contact Steve Lyon at 613-580-2424 extension 21721 for implementation/funding. Acknowledged.

   According to an email from Kunjan Ghimire from the City's Traffic Services Department on May 3, 2018, a functional design study was completed in 2015, which recommended upgrades including signalization (already complete), left-turn auxiliary lanes on all approaches, right-turn lanes along the northbound and southbound approaches directions and bike lane pockets on Huntmar Drive. There is a potential that the west side of Huntmar Drive north of Maple Grove Road will be urbanized. A preliminary design is currently being carried out, which is expected to be completed by the end of the year.

3) The bicycle LOS target for a General Urban Area collector street is BLOS B. Maple Grove Road has an existing BLOS of D. Cycling facilities are required to meet the target. A complete street design recommendation is required for Maple Grove Road.
   In order to achieve a Segment BLOS of 'B', bike lanes a width of 1.5m to 1.8m would need to be provided along the both sides of the roadway, according to the MMLOS Guidelines. The right-of-way protection along Maple Grove Road from Stittsville Main Street to the proposed MUP (formerly Johnwoods Street) is 26m. Alternatively, if parking is also planned along Maple Grove Road between Alon Street and Stittsville Main Street, then a 4.25m wide bike lane plus parking lane with a marked buffer separating both, could also be provided to achieve a Segment BLOS of 'B'.
   An RMA has been initiated to extend Maple Grove Road to Stittsville Main Street, and urbanize the roadway west of the MUP. The newly constructed section of road will include adequate pedestrian and cycling facilities.

4) Further consideration should be given to the intersection design at Maple Grove Road and Stittsville Main Street. The roundabout screening tool indicated that there is insufficient property; can this be modified at this point to allow the flexibility for this option? Has a mini roundabout been considered?
   An email from Rosanna Baggs from June 27, 2018 indicates that the City will be pursuing a bend in the road at the proposed intersection of Maple Grove Road and Stittsville Main Street, and that it is not necessary to consider a mini-roundabout at this location.

5) Identify the street connected to Street 1 and Street 3 as shown in Exhibit 20.
Acknowledged. This street has been labelled as Street 2 in Exhibit 20 (please see attached).

6) Provide details on pedestrian and cycling needs at Street 1 and Maple Grove Road to access the MUP (Johnwoods Street) on the south side. Ensure that both pedestrians and cyclists are accommodated on Street 1 especially given the interim conditions until a connection is made to the north.
Formal pedestrian and cycling infrastructure such as a cross-rides and pedestrian cross-walks could be provided at Street 1 and Maple Grove Road from the MUP (formerly Johnwoods Street) to the subject lands to the north, in order to provide connectivity crossing Maple Grove Road.
Street 1 is classified as a local road with a right-of-way of 18m. Therefore, there is insufficient right-of-way to accommodate formal cycling facilities, and it is typically unnecessary due to the lower traffic volumes experienced on local roads, when compared with collector or higher order roadway classifications. On-road sharrows may be considered as a viable option on Street 1 to encourage motorists to drive more cautiously, and be prepared to share the road with cyclists.
Sidewalks shall be placed strategically on internal streets within the proposed development, as shown in Exhibit 2, to provide connectivity to the MUP.

7) The intersection of Maple Grove Road and Santolina Street will be monitored by our unit for WB left turn lane warrant (post 2025). If the east-west collector to the north (Kanata West Main Street) is not constructed as identified in the TMP Phase 3 a left turn lane maybe warranted. Acknowledged.

8) As recommended in the report, a review of the road classification is required as this portion of Maple Grove Road is defined as a local road and should be considered in the next TMP update as a collector. This recommendation will be forwarded to Transportation Policy & Networks Branch for review in the next Transportation Master Plan update. Acknowledged.

Development Review – Transportation Engineering Services

1) The strategy section of the report is to include a review of the impact of the development on the study area/intersections and what would be required if Maple Grove is not extended to the Stittsville Main Extension.
If Maple Grove Road is not extended to Stittsville Main Street, there would likely be lower traffic volumes experienced along Maple Grove Road. It was assumed that 50% of trips from the residential community to the south of this proposed intersection would redirect to Maple Grove Road, once it is extended, as discussed on Section 3.3.1.2 of the TIA Report.

Ben Pascolo-Neveu

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: Wednesday, March 21, 2018 8:44 AM
To: Ben Pascolo-Neveu
Cc: Austin Shih
Subject: FW: 1919 Maple Grove TIA (Step 1-3) TPM Comments
Attachments: 1919 Maple Gr TIA (Forecasting) - March 1, 2018.pdf

Hi Ben,

Please see the comments for the submission the 1919 Maple Grove Rd Traffic Impact Assessment Step 1-3:

Transportation Engineering Services

The trip generation rates in table 5 are accepted, however, the City recommends the use of 2009 Trans Trip Generation Manual for residential development.

Please proceed with the submission of Step 1-4:

- Copies to have a “draft” water mark
- Provide 7 hard copies (sorry I forgot about the Planner’s copy when I originally thought we only needed 6)
- Provide an electronic copy of relevant Synchro file (on USB or CD)
- Provide electronic copy of TIA (send via e-mail)
- Please note (in the e-mail with the electronic copy of the TIA) if you/your client wish for this version of submission to be deemed complete.

Please let me know if you have any questions or concerns.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Ben Pascolo-Neveu [mailto:Ben.Pascolo-Neveu@ibigroup.com]
Sent: Thursday, March 01, 2018 5:07 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: Austin Shih <austin.shih@IBIGroup.com>
Subject: RE: 1919 Maple Grove TIA - Screening & Scoping

Hi Rosanna,

Please find attached the Screening, Scoping and Forecasting steps for 1919 Maple Grove Road (Formasian) for your review and circulation. I have addressed your comments for the Screening and Scoping.

Regards,
Ben

Ben Pascolo-Neveu, EIT

IBI GROUP
Suite 400, 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 520 fax +1 613 225 9868

From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Wednesday, February 28, 2018 3:57 PM
To: Ben Pascolo-Neveu
Subject: RE: 1919 Maple Grove TIA - Screening & Scoping

Hi Ben,

Please see my comments below:

1) Section 2.2.2 – Will the development be constructed in phases?
2) Section 2.3.1.1 – spelling error, its Eucalyptus
3) Section 2.3.1.2 – Make sure to evaluate the intersections with consideration for how the road network will work when Maple Grove and Stittsville Main are connected as this will most likely happened very soon and before the Stittsville main is extended north.
4) Section 2.3:
    a. List the road's jurisdiction

If the above can be incorporated into the next submission please proceed with Step 3. Otherwise please discuss responses prior to proceeding.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Ben Pascolo-Neveu [mailto:Ben.Pascolo-Neveu@ibigroup.com]
Sent: Wednesday, February 28, 2018 3:02 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Subject: 1919 Maple Grove TIA - Screening & Scoping

Good Afternoon Rosanna,

Please find attached the Scoping and Scoping for 1919 Maple Grove Road, prepared for Formasian Development Corporation, for your review.

Regards,
Ben

Ben Pascolo-Neveu, EIT

IBI GROUP
Suite 400, 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel +1 613 225 1311 ext 520 fax +1 613 225 9868

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'

Ben Pascolo-Neveu

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: Wednesday, February 28, 2018 3:57 PM
To: Ben Pascolo-Neveu
Subject: RE: 1919 Maple Grove TIA - Screening & Scoping
Attachments: 1919 Maple Gr TIA - Formasian - Screening & Scoping - 02-28-2018.pdf

Hi Ben,

Please see my comments below:

1) Section 2.2.2 – Will the development be constructed in phases?
2) Section 2.3.1.1 – spelling error, its Eucalyptus
3) Section 2.3.1.2 – Make sure to evaluate the intersections with consideration for how the road network will work when Maple Grove and Stittsville Main are connected as this will most likely happened very soon and before the Stittsville main is extended north.
4) Section 2.3:
    a. List the road's jurisdiction

If the above can be incorporated into the next submission please proceed with Step 3. Otherwise please discuss responses prior to proceeding.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Ben Pascolo-Neveu [mailto:Ben.Pascolo-Neveu@ibigroup.com]
Sent: Wednesday, February 28, 2018 3:02 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Subject: 1919 Maple Grove TIA - Screening & Scoping

Good Afternoon Rosanna,

Please find attached the Scoping and Scoping for 1919 Maple Grove Road, prepared for Formasian Development Corporation, for your review.

Regards,
Ben

Ben Pascolo-Neveu, EIT

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1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix B: Traffic Data

April 2019

IBI

UNT SUMMARY - ALL MODES

AADT FACTOR: 0.9

tudy Summary Report (Vehicles)

I/S REET TAL	Maple Grove Road Eastbound					Maple Grove Road Westbound					E/W STREET TOTAL	Grand TOTAL
	LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
754	214	111	37	0	**362**	14	25	22	0	**61**	**423**	**1177**
847	179	114	44	0	**337**	35	35	38	0	**108**	**445**	**1292**
720	98	79	40	0	**217**	23	33	19	0	**75**	**292**	**1012**
774	164	101	40	0	**305**	24	31	26	0	**81**	**387**	**1160**
984	70	63	27	0	**160**	82	69	17	0	**168**	**328**	**1312**
911	58	46	21	0	**125**	46	57	14	0	**117**	**242**	**1153**
948	64	55	24	0	**143**	64	63	16	0	**143**	**285**	**1233**
262	49	58	25	0	**132**	101	72	42	0	**215**	**347**	**1609**
273	43	59	43	0	**145**	120	125	21	0	**266**	**411**	**1684**
327	47	70	49	0	**166**	107	138	17	0	**262**	**428**	**1755**
287	46	62	39	0	**148**	109	112	27	0	**248**	**395**	**1683**
078	758	600	286	0	1,644	528	554	190	0	1,272	2,916	10,994
1228	1054	834	398	0	2285	734	770	264	0	1768	4053	15282
9106	948	751	358	0	2057	661	693	238	0	1591	3648	13753
3238	1242	983	469	0	2694	865	908	311	0	2085	4779	18017
	1.31											

dy Summary Report (Pedestrians)

I/S REET TAL	Maple Grove Road EB Approach (North or South Crossing)	Maple Grove Road WB Approach (North or South Crossing)	E/W STREET TOTAL	Grand TOTAL
36	2	4	**6**	**42**
9	1	1	**2**	**11**
3	0	23	**23**	**26**
4	1	0	**1**	**5**
8	0	2	**2**	**10**
9	2	1	**3**	**12**
31	7	1	**8**	**39**
10	7	2	**9**	**19**
110	20	34	**54**	**164**

tudy Summary Report (Cyclists)

N/S STREET TOTAL	Maple Grove Road Eastbound	Maple Grove Road Westbound	E/W STREET TOTAL	Grand TOTAL
1	1	2	**3**	**4**
1	0	0	**0**	**1**
0	0	0	**0**	**0**
1	0	0	**0**	**1**
0	0	2	**2**	**2**
0	2	0	**2**	**2**
0	0	0	**0**	**0**
1	1	0	**1**	**2**
4	4	4	**8**	**12**

y Summary Report (Heavy Vehicles)

N/S STREET TOTAL	Maple Grove Road Eastbound					Maple Grove Road Westbound					E/W STREET TOTAL	Grand TOTAL
	LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
19	0	3	0	0	**3**	0	3	0	0	**3**	**6**	**25**
18	3	7	2	0	**12**	3	7	2	0	**12**	**24**	**42**
17	0	11	2	0	**13**	0	11	2	0	**13**	**26**	**43**
14	1	4	1	0	**6**	2	4	0	0	**6**	**12**	**26**
13	2	2	0	0	**4**	2	3	0	0	**5**	**9**	**22**
33	2	2	3	0	**7**	2	5	1	0	**8**	**15**	**48**
19	1	2	1	0	**4**	1	2	0	0	**3**	**7**	**26**
11	3	0	0	0	**3**	0	0	0	0	**0**	**3**	**14**
144	12	31	9	0	**52**	10	35	5	0	**50**	**102**	**246**

& ALON SREET - ALL MODES

AADT FACTOR: 1.1

ull Study Summary Report (Vehicles)

	N/S STREET TOTAL	Maple Grove Cul-de-Sac Eastbound					Maple Grove Road Westbound					E/W STREET TOTAL	Grand TOTAL
		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
	38	0	0	0	0	**0**	14	0	0	0	**14**	**14**	**52**
	35	0	0	0	0	**0**	8	0	0	0	**8**	**8**	**43**
	20	0	0	0	0	**0**	14	0	0	1	**15**	**15**	**35**
	31	0	0	0	0	**0**	12	0	0	0	**12**	**12**	**43**
	25	0	1	0	0	**1**	16	0	0	0	**16**	**17**	**42**
	20	0	0	0	0	**0**	22	0	0	0	**22**	**22**	**42**
	23	0	1	0	0	**1**	19	0	0	0	**19**	**20**	**42**
	26	0	0	0	0	**0**	41	0	0	0	**41**	**41**	**67**
	27	0	0	0	0	**0**	29	0	0	0	**29**	**29**	**56**
	24	0	0	0	0	**0**	44	0	0	0	**44**	**44**	**68**
	26	0	0	0	0	**0**	38	0	0	0	**38**	**38**	**64**
	269	0	2	0	0	**2**	219	0	0	1	**220**	**222**	**490**
	373	0	2	0	0	2	304	0	0	2	306	308	682
	411	0	2	0	0	2	335	0	0	2	337	339	750
	538	0	3	0	0	3	439	0	0	3	441	444	982
		1.31											

Study Summary Report (Pedestrians)

	N/S STREET TOTAL	Maple Grove Cul-de-Sac	Maple Grove Road	E/W STREET TOTAL	Grand TOTAL
		EB Approach (North or South Crossing)	WB Approach (North or South Crossing)		
	1	0	0	**0**	**1**
	0	0	0	**0**	**0**
	1	0	14	**14**	**15**
	1	0	0	**0**	**1**
	1	0	1	**1**	**2**
	3	0	0	**0**	**3**
	4	0	0	**0**	**4**
	1	0	0	**0**	**1**
	12	0	15	**15**	**27**

ull Study Summary Report (Cyclists)

	N/S STREET TOTAL	Maple Grove Cul-de-Sac	Maple Grove Road	E/W STREET TOTAL	Grand TOTAL
		Eastbound	Westbound		
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**

tudy Summary Report (Heavy Vehicles)

	N/S STREET TOTAL	Maple Grove Cul-de-Sac					Maple Grove Road					E/W STREET TOTAL	Grand TOTAL
		Eastbound					Westbound						
		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
	3	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**3**
	2	0	0	0	0	**0**	1	0	0	0	**1**	**1**	**3**
	0	0	0	0	0	**0**	1	0	0	0	**1**	**1**	**1**
	0	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**0**
	0	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**0**
	1	0	0	0	0	**0**	1	0	0	0	**1**	**1**	**2**
	0	0	0	0	0	**0**	1	0	0	0	**1**	**1**	**1**
	1	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**1**
	7	0	0	0	0	**0**	4	0	0	0	**4**	**4**	**11**

SANTOLINA STREET - ALL MODES

AADT FACTOR: 1.0

ull Study Summary Report (Vehicles)

	N/S STREET TOTAL	Maple Grove Road Eastbound					Maple Grove Road Westbound					E/W STREET TOTAL	Grand TOTAL
		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
	63	0	49	2	0	**51**	29	13	0	0	**42**	**93**	**156**
	54	0	36	2	0	**38**	29	22	0	0	**51**	**89**	**143**
	43	0	17	1	0	**18**	23	12	0	1	**36**	**54**	**97**
	53	0	34	2	0	**36**	27	16	0	0	**43**	**79**	**132**
	66	0	20	2	0	**22**	31	18	0	0	**49**	**71**	**137**
	53	0	22	1	0	**23**	30	21	0	0	**51**	**74**	**127**
	60	0	21	2	0	**23**	31	20	0	0	**50**	**73**	**132**
	61	0	15	2	0	**17**	46	51	0	0	**97**	**114**	**175**
	50	0	28	1	0	**29**	77	54	0	0	**131**	**160**	**210**
	50	0	31	3	0	**34**	95	60	0	0	**155**	**189**	**239**
	54	0	25	2	0	**27**	73	55	0	0	**128**	**154**	**208**
	553	0	273	17	0	**290**	418	286	0	1	**705**	**995**	**1,548**
	768	0	379	24	0	403	580	398	0	2	980	1383	2152
	768	0	379	24	0	403	580	398	0	2	980	1383	2152
	1007	0	497	31	0	528	760	521	0	2	1284	1812	2819
		1.31											

Study Summary Report (Pedestrians)

	N/S STREET TOTAL	Maple Grove Road	Maple Grove Road	E/W STREET TOTAL	Grand TOTAL
		EB Approach (North or South Crossing)	WB Approach (North or South Crossing)		
	4	0	5	**5**	**9**
	0	0	0	**0**	**0**
	0	0	23	**23**	**23**
	1	0	1	**1**	**2**
	0	0	1	**1**	**1**
	1	0	0	**0**	**1**
	0	0	3	**3**	**3**
	0	0	2	**2**	**2**
	6	0	35	**35**	**41**

ull Study Summary Report (Cyclists)

	N/S STREET TOTAL	Maple Grove Road	Maple Grove Road	E/W STREET TOTAL	Grand TOTAL
		Eastbound	Westbound		
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**
	0	0	0	**0**	**0**

tudy Summary Report (Heavy Vehicles)

	N/S STREET TOTAL	Maple Grove Road					Maple Grove Road					E/W STREET TOTAL	Grand TOTAL
		Eastbound					Westbound						
		LT	ST	RT	U-Turns	EB TOTAL	LT	ST	RT	U-Turns	WB TOTAL		
	1	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**1**
	0	0	0	1	0	**1**	1	1	0	0	**2**	**3**	**3**
	1	0	0	1	0	**1**	0	1	0	0	**1**	**2**	**3**
	0	0	0	0	0	**0**	1	0	0	0	**1**	**1**	**1**
	3	0	0	1	0	**1**	2	0	0	0	**2**	**3**	**6**
	2	0	0	0	0	**0**	2	1	0	0	**3**	**3**	**5**
	0	0	1	0	0	**1**	0	0	0	0	**0**	**1**	**1**
	0	0	0	0	0	**0**	0	0	0	0	**0**	**0**	**0**
	7	0	1	3	0	**4**	6	3	0	0	**9**	**13**	**20**

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix C: OC Transpo Maps

April 2019

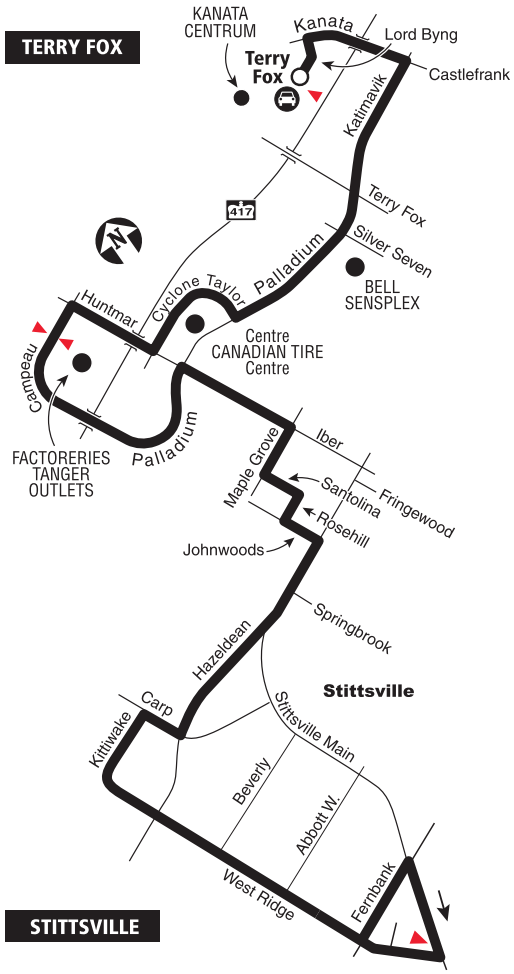
IBI

162 TERRY FOX / STITTSVILLE

Local

Monday to Friday/ Lundi au vendredi

Selected trips Mon. to Fri. All day Saturday. No Sunday service / Service limité du lun. au ven. Toute la journée le samedi. Aucun service le dimanche.



Transitway Station / Station du Transitway

Park & Ride / Parc-o-bus

Timepoint / Heures de passage

2017.11

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 November 15, 2017
En vigueur 15 novembre 2017

OC Transpo

INFO 613-741-4390
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MACKENZIE KING / STITTSVILLE MAIN

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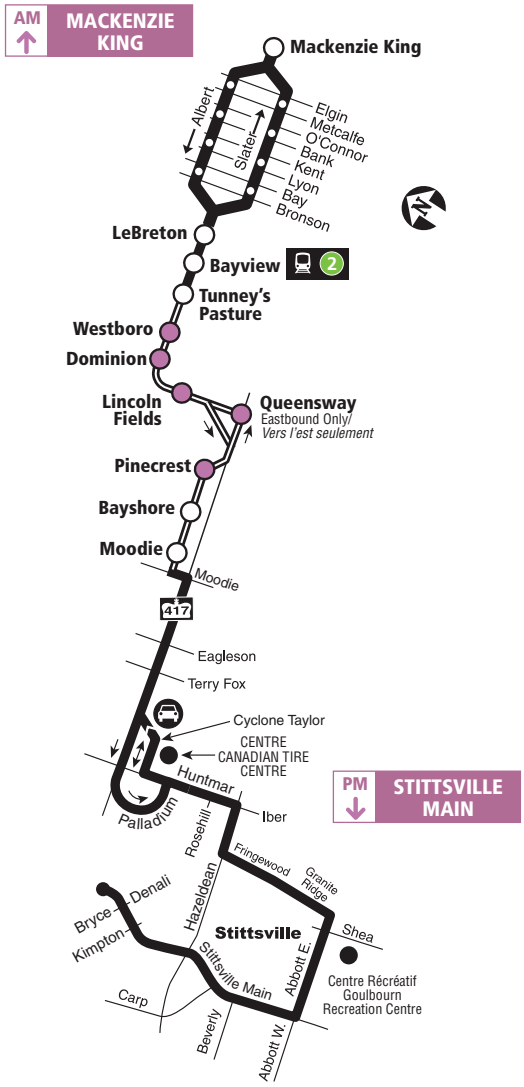
Peak periods only
Périodes de pointe seulement



Transitway & Station

Limited stops: Off only in AM / No stop in PM
Arrêts limités : Débarquement en AM seulement / Aucun arrêt en PM

Park & Ride / Parc-o-bus

2017.12

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

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix D: Collision Data

April 2019

IBI

ALON ST & MAPLE GROVE RD

Former Municipality: **Goulbourn** Traffic Control: **Stop sign** Number of Collisions: **1**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRS
1	2012-06-07	Thu	20:28	Clear	Dusk	Single vehicle	P.D. only	V1 W	Dry	Going ahead	Automobile, station	Conc

HUNTMAR DR & MAPLE GROVE RD

Former Municipality: **Goulbourn** Traffic Control: **Stop sign** Number of Collisions: **3**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRS
2	2012-05-16	We	05:17	Clear	Dark	Rear end	P.D. only	V1 N	Dry	Slowing or	Tow truck	Othe
								V2 N	Dry	Slowing or	Truck and trailer	Othe
3	2013-02-12	Tue	23:40	Snow	Dark	Single vehicle	P.D. only	V1 N	Wet	Going ahead	Automobile, station	Curb
4	2013-10-08	Tue	07:20	Clear	Daylight	Angle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Othe
								V2 E	Dry	Going ahead	Automobile, station	Othe

MAPLE GROVE RD, ALON ST to JOHNWOODS ST

Former Municipality: **West Carleton** Traffic Control: **No control** Number of Collisions: **1**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRS
5	2013-12-17	Tue	20:20	Snow	Dark	Single vehicle	P.D. only	V1 W	Loose snow	Going ahead	Automobile, station	Ran

MAPLE GROVE RD, HUNTMAR DR to JOHNWOODS ST

Former Municipality: **West Carleton** Traffic Control: **No control** Number of Collisions: **5**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRS
6	2012-07-29	Sun	12:05	Clear	Daylight	Other	P.D. only	V1 U	Dry	Reversing	Automobile, station	Othe
								V2 U	Dry	Going ahead	Pick-up truck	Othe

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

Thursday, December 28, 2017

7	2012-08-26	Sun	14:44	Clear	Daylight	Turning	P.D. only	V1	W	Dry	Overtaking	Automobile, station	Other
								V2	W	Dry	Making U-Turn	Automobile, station	Other
8	2012-10-16	Tue	11:00	Clear	Daylight	Approaching	P.D. only	V1	W	Dry	Going ahead	Construction	Other
								V2	E	Dry	Going ahead	Truck - dump	Other
9	2013-03-26	Tue	16:43	Clear	Daylight	Rear end	P.D. only	V1	E	Dry	Going ahead	Pick-up truck	Other
								V2	E	Dry	Going ahead	Automobile, station	Other
10	2013-12-01	Sun	18:11	Snow	Dark	Single vehicle	P.D. only	V1	E	Loose snow	Going ahead	Automobile, station	Unatt

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

Thursday, December 28, 2017

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2

Location: HUNTMAR DR @ MAPLE GROVE RD

Traffic Control: Stop sign

Total Collision

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Ev
2015-Jan-29, Thu,22:30	Snow	Rear end	P.D. only	Packed snow	East	Slowing or stopping	Automobile, station wagon	Other m vehicle
					East	Stopped	Automobile, station wagon	Other m vehicle
					East	Stopped	Passenger van	Other m vehicle
2015-Apr-29, Wed,16:23	Clear	Rear end	P.D. only	Dry	South	Going ahead	Pick-up truck	Other m vehicle
					South	Stopped	Police vehicle	Other m vehicle
2015-Feb-24, Tue,18:00	Clear	Rear end	P.D. only	Ice	East	Slowing or stopping	Pick-up truck	Other m vehicle
					East	Stopped	Pick-up truck	Other m vehicle
2015-Aug-14, Fri,08:48	Clear	Angle	P.D. only	Wet	West	Going ahead	Automobile, station wagon	Other m vehicle
					South	Going ahead	Passenger van	Other m vehicle
2016-Feb-25, Thu,15:30	Rain	Turning movement	P.D. only	Wet	North	Making "U" turn	Automobile, station wagon	Other m vehicle
					North	Going ahead	Pick-up truck	Other m vehicle

Thursday, December 28, 2017

2016-Oct-19, Wed,13:50	Clear	Rear end	P.D. only	Dry	South	Going ahead	Pick-up truck	Other m vehicle
					South	Stopped	Automobile, station wagon	Other m vehicle
2016-May-11, Wed,16:53	Clear	Rear end	P.D. only	Dry	South	Slowing or stopping	Automobile, station wagon	Other m vehicle
					South	Slowing or stopping	Automobile, station wagon	Other m vehicle
2016-Jul-03, Sun,14:52	Clear	Turning movement	Non-fatal injury	Dry	North	Turning left	Automobile, station wagon	Cyclist
					South	Going ahead	Bicycle	Other m vehicle
2016-Oct-02, Sun,11:05	Rain	Rear end	P.D. only	Wet	West	Slowing or stopping	Automobile, station wagon	Other m vehicle
					West	Stopped	Automobile, station wagon	Other m vehicle
2016-Dec-16, Fri,09:19	Clear	Rear end	P.D. only	Ice	North	Going ahead	Passenger van	Other m vehicle
					North	Stopped	Pick-up truck	Other m vehicle
					South	Going ahead	Pick-up truck	Other m vehicle
2016-Dec-26, Mon,10:17	Freezing Rain	Rear end	P.D. only	Wet	West	Slowing or stopping	Automobile, station wagon	Other m vehicle
					West	Stopped	Automobile, station wagon	Other m vehicle
					West	Stopped	Automobile, station wagon	Other m vehicle
2016-Dec-30, Fri,16:38	Clear	SMV other	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Curb

Thursday, December 28, 2017

Location: JOHNWOODS ST @ MAPLE GROVE RD

Traffic Control: Stop sign **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2014-Jan-14, Tue,11:46	Clear	Angle	P.D. only	Wet	West	Turning left	Automobile, station wagon	Other v vehicle
					North	Turning right	Automobile, station wagon	Other v vehicle
2015-Aug-19, Wed,22:50	Clear	SMV other	P.D. only	Dry	West	Unknown	Automobile, station wagon	Pole (s parking

Location: LEVECHE WAY @ MAPLE GROVE RD

Traffic Control: Stop sign **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2014-Jan-06, Mon,16:36	Clear	Angle	P.D. only	Wet	South	Turning left	Automobile, station wagon	Other v vehicle
					West	Going ahead	Automobile, station wagon	Other v vehicle
2016-Sep-17, Sat,23:30	Rain	Angle	P.D. only	Wet	South	Going ahead	Automobile, station wagon	Other v vehicle
					East	Going ahead	Automobile, station wagon	Other v vehicle

Location: MAPLE GROVE RD @ GESNER CRT/JARLAN TER

Traffic Control: Stop sign **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2014-Mar-21, Fri,16:22	Clear	Turning movement	P.D. only	Dry	East	Making "U" turn	Pick-up truck	Other v vehicle
					East	Going ahead	Automobile, station wagon	Other v vehicle

Thursday, December 28, 2017

Location: MAPLE GROVE RD btwn JOHNWOODS ST & MONTSERRAT ST

Traffic Control: No control **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2014-Aug-25, Mon,13:20	Clear	SMV unattended vehicle	P.D. only	Dry	South	Reversing	Pick-up truck	Unatte vehicle
2016-Oct-05, Wed,00:00	Clear	SMV unattended vehicle	P.D. only	Dry	Unknown	Unknown	Unknown	Unatte vehicle

Location: MAPLE GROVE RD btwn LEVECHE WAY & HUNTMAR DR

Traffic Control: No control **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2016-Aug-19, Fri,07:15	Clear	Sideswipe	P.D. only	Dry	East	Overtaking	Automobile, station wagon	Other r vehicle
					East	Stopped	Truck and trailer	Other r vehicle

Location: MAPLE GROVE RD btwn MONTSERRAT ST & LEVECHE WAY

Traffic Control: No control **Total Collisio**

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First E
2016-Feb-18, Thu,00:00	Clear	SMV unattended vehicle	P.D. only	Wet	East	Unknown	Unknown	Unatte vehicle

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix E: TRANS Trip Generation Study

April 2019

Table 3.12: Person Trip Generation Rates – (all households with residents not older than 55 years of age)

Person Trip Generation Rates

All Households with persons 55 years of age or less
AM and PM Peak Hours

Dwelling Unit Types \ Geographic Areas		Core Area Person Trip Rate	Core Area %▽	Urban Area (Inside the greenbelt) Person Trip Rate	Urban Area %▽	Suburban (Outside the greenbelt) Person Trip Rate	Suburban %▽	Rural Person Trip Rate	Rural %▽	All Areas Person Trip Rate
Single detached:	AM	0.85	- 7%	0.99	+ 9%	0.94	+ 3%	0.78	- 14%	0.91
	PM	0.74	- 3%	0.75	- 1%	0.79	+ 4%	0.71	- 7%	0.76
Semi-detached:	AM	0.79	- 10%	0.97	10%	0.89	+ 1%	0.64	- 27%	0.88
	PM	0.74	- 1%	0.68	- 9%	0.82	+ 9%	0.60	- 20%	0.75
Row Townhouse:	AM	0.71	- 3%	0.78	+ 7%	0.67	- 8%	0.74	+ 1%	0.73
	PM	0.62	- 3%	0.60	- 6%	0.69	+ 8%	0.56	- 13%	0.64
Apartment:	AM	0.48	- 4%	0.51	+ 2%	0.53	+ 6%	0.36	- 28%	0.50
	PM	0.45	0%	0.42	- 7%	0.52	+ 16%	0.52	+ 16%	0.45
All Types:	AM	0.62	- 23%	0.82	+ 2%	0.86	+ 8%	0.76	- 5%	0.80
	PM	0.57	- 16%	0.63	- 7%	0.75	+ 10%	0.69	+ 1%	0.68

Note: 5 % (+ or -) represents the percentage delta change in trip rate when compared against the average trip rate across all geographic areas

Table 3.13: Mode Shares - (all households with residents not older than 55 years of age)

Reported Mode Shares

All Households with persons 55 years of age or less
AM and PM Peak Hours

Dwelling Unit Types \ Geographic Areas		Core Area Vehicle Trips	Core Area Transit Share	Core Area Non-Motorised	Urban Area (Inside the greenbelt) Vehicle Trips	Urban Area Transit Share	Urban Area Non-Motorised	Suburban (Outside the greenbelt) Vehicle Trips	Suburban Transit Share	Suburban Non-Motorised	Rural * Vehicle Trips	Rural * Transit Share	Rural * Non-Motorised	All Areas Vehicle Trips	All Areas Transit Share	All Areas Non-Motorised
Single - Detached:	AM	35%	20%	33%	51%	26%	11%	55%	25%	9%	60%	27%	4%	54%	25%	10%
	PM	45%	11%	32%	58%	19%	13%	64%	19%	6%	73%	13%	2%	63%	17%	8%
Semi-Detached:	AM	38%	30%	26%	44%	35%	10%	52%	24%	12%	64%	27%	5%	49%	28%	12%
	PM	36%	20%	34%	51%	27%	13%	62%	17%	7%	77%	12%	1%	58%	20%	10%
Row / Townhouse:	AM	33%	22%	40%	45%	34%	10%	55%	27%	8%	73%	15%	3%	49%	30%	11%
	PM	39%	15%	42%	53%	28%	8%	61%	22%	6%	74%	15%	1%	57%	24%	9%
Apartment:	AM	27%	27%	43%	37%	41%	14%	44%	34%	13%	76%	8%	16%	36%	35%	23%
	PM	23%	29%	42%	40%	37%	14%	44%	33%	9%	48%	4%	17%	35%	33%	23%
All Types:	AM	32%	24%	38%	47%	31%	11%	54%	26%	9%	61%	26%	4%	51%	27%	11%
	PM	34%	21%	38%	53%	24%	12%	62%	20%	6%	73%	13%	2%	59%	20%	10%

Note: Percentages do not necessarily sum to 100% as the proportion of automobile passengers have not been tabulated. Vehicle trips reflect the percentage of vehicle drivers.
* - Rural area sample size is extremely low and mode shares are highly influenced by school types where public transportation levels are high during the AM versus the PM peaks.

Table 3.17: Blended Vehicle Trip Rate Directional Splits

Comparison of Directional Splits (Inbound/Outbound) AM and PM Peak Hours								
ITE Land Use Code	Area / Dwelling Unit Type / Data Source		2008 Count Data		ITE		Blended Rate	
			Inbound	Outbound	Inbound	Outbound	Inbound	Outbound
210	Single-detached dwellings	AM	33%	67%	25%	75%	29%	71%
		PM	60%	40%	63%	37%	62%	39%
224	Semi-detached dwellings, townhouses, rowhouses	AM	40%	60%	33%	67%	37%	64%
		PM	55%	45%	51%	49%	53%	47%
231	Low-rise condominiums (1 or 2 floors)	AM	36%	64%	25%	75%	31%	70%
		PM	54%	46%	58%	42%	56%	44%
232	High-rise condominiums (3+ floors)	AM	36%	64%	19%	81%	28%	73%
		PM	54%	46%	62%	38%	58%	42%
233	Luxury condominiums	AM	36%	64%	23%	77%	30%	71%
		PM	54%	46%	63%	37%	59%	42%
221	Low-rise apartments (2 floors)	AM	22%	78%	21%	79%	22%	79%
		PM	62%	38%	65%	35%	64%	37%
223	Mid-rise apartments (3-10 floors)	AM	22%	78%	25%	75%	24%	77%
		PM	62%	38%	61%	39%	62%	39%
222	High-rise apartments (10+ floors)	AM	22%	78%	25%	75%	24%	77%
		PM	62%	38%	61%	39%	62%	39%

The analysis of the OD Survey results confirmed that lower vehicle trip rates were reported in the core areas and higher vehicle trip rates in the suburban and rural areas. To account for the change in vehicle trip rates between geographic areas, the blended rates have been adjusted using information contained in Table 3.14. The resulting vehicle trip rates are highlighted in Table 3.18: Recommended Vehicle Trip Generation Rates without Transit Bonus.

Table 3.18: Recommended Vehicle Trip Generation Rates without Transit Bonus

Recommended Vehicle Trip Generation Rates AM and PM Peak Hours							
ITE Land Use Code	Dwelling Unit Type / Geographic Area		Vehicle Trip Rates				
			Core	Urban (Inside the Greenbelt)	Suburban (Outside the Greenbelt)	Rural	All Areas
210	Single-detached dwellings	AM	0.40	0.67	0.70	0.62	0.66
		PM	0.60	0.76	0.90	0.92	0.81
224	Semi-detached dwellings, townhouses, rowhouses	AM	0.34	0.51	0.54	0.62	0.52
		PM	0.39	0.51	0.71	0.67	0.61
231	Low-rise condominiums (1 or 2 floors)	AM	0.34	0.50	0.60	0.71	0.47
		PM	0.29	0.49	0.66	0.72	0.46
232	High-rise condominiums (3+ floors)	AM	0.26	0.38	0.46	0.54	0.36
		PM	0.20	0.34	0.46	0.50	0.32
233	Luxury condominiums	AM	0.31	0.45	0.55	0.65	0.43
		PM	0.24	0.40	0.55	0.59	0.38
221	Low-rise apartments (2 floors)	AM	0.21	0.31	0.37	0.44	0.29
		PM	0.20	0.34	0.46	0.50	0.32
223	Mid-rise apartments (3-10 floors)	AM	0.17	0.24	0.29	0.35	0.23
		PM	0.16	0.28	0.37	0.41	0.26
222	High-rise apartments (10+ floors)	AM	0.17	0.24	0.29	0.35	0.23
		PM	0.16	0.27	0.36	0.39	0.25

Note: See Table 6.3 for recommended vehicle trip rates with transit bonus

Table 6.3: Recommended Vehicle Trip Generation Rates for Residential Land Uses with Transit Bonus

Recommended Vehicle Trip Generation Rates with Transit Bonus AM and PM Peak Hours									
ITE Land Use Code	Dwelling Unit Type / Geographic Area		Vehicle Trip Rate						
			Core		Urban (Inside the Greenbelt)		Suburban (Outside the Greenbelt)		Rural
			Base Rate	< 600m to Rapid Transit	Base Rate	< 600m to Rapid Transit	Base Rate	< 600m to Rapid Transit	Base Rate
210	Single-detached dwellings	AM	0.40	0.31	0.67	0.50	0.70	0.49	0.62
		PM	0.60	0.33	0.76	0.57	0.90	0.63	0.92
224	Semi-detached dwellings, townhouses, rowhouses	AM	0.34	0.34	0.51	0.50	0.54	0.39	0.62
		PM	0.39	0.38	0.51	0.51	0.71	0.51	0.67
231	Low-rise condominiums (1 or 2 floors)	AM	0.34	0.34	0.50	0.50	0.60	0.60	0.71
		PM	0.29	0.29	0.49	0.49	0.66	0.66	0.72
232	High-rise condominiums (3+ floors)	AM	0.26	0.26	0.38	0.38	0.46	0.46	0.54
		PM	0.20	0.20	0.34	0.34	0.46	0.46	0.50
233	Luxury condominiums	AM	0.31	0.31	0.45	0.45	0.55	0.55	0.65
		PM	0.24	0.24	0.40	0.40	0.55	0.55	0.59
221	Low-rise apartments (2 floors)	AM	0.21	0.21	0.31	0.31	0.37	0.37	0.44
		PM	0.20	0.20	0.34	0.34	0.46	0.46	0.50
223	Mid-rise apartments (3-10 floors)	AM	0.17	0.17	0.24	0.24	0.29	0.29	0.35
		PM	0.16	0.16	0.28	0.28	0.37	0.37	0.41
222	High-rise apartments (10+ floors)	AM	0.17	0.17	0.24	0.24	0.29	0.29	0.35
		PM	0.16	0.16	0.27	0.27	0.36	0.36	0.39

Note: The transit bonus was only applied to geographic areas and dwelling unit types where the reported transit mode shares were less than the transit mode share reported for residential development located within the 600m proximity to a rapid transit station. It is noted that condominium and apartment housing categories reported similar levels of transit mode shares independent of location to rapid transit stations.

6.5 Future Data Collection

While the rates presented in were prepared by blending the vehicle trip rates from ITE, the OD Survey and the 2008 local trip generation studies, it is important to stress the importance and need for ongoing local trip generation surveys to monitor changes in travel behaviour. The 2008 trip generation studies undertaken to support this study provide insight into local travel patterns and a well organized ongoing annual data collection program aimed at trip generation surveys of key land uses or requirement for data collection by local developers will continue to provide recent and accurate local trip generation rates. For example the high-rise apartment category of dwelling units reported the lowest peak hour vehicle trip rates.

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix F: 2011 OD Survey Data – Kanata & Stittsville

April 2019

IBI

Kanata - Stittsville

Demographic Characteristics

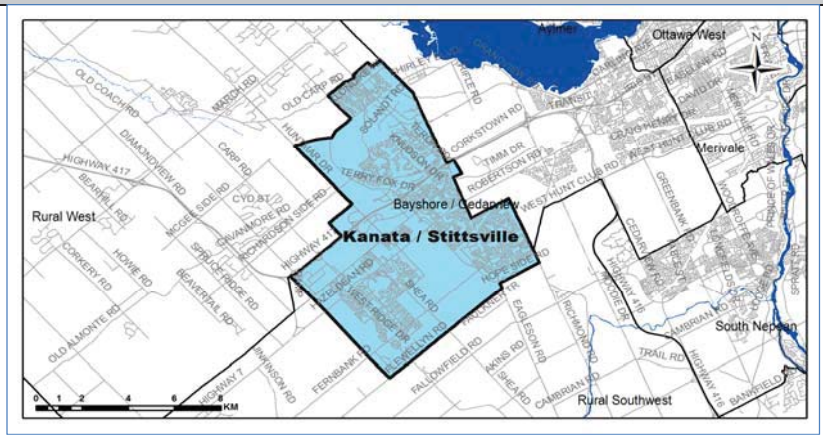
Population	105,210	Actively Travelled	83,460
Employed Population	49,640	Number of Vehicles	64,540
Households	38,010	Area (km^2)	82.6

Occupation

Status (age 5+)	Male	Female	Total
Full Time Employed	24,670	19,590	44,260
Part Time Employed	1,540	3,840	5,380
Student	13,630	13,410	27,040
Retiree	6,480	8,350	14,820
Unemployed	850	940	1,790
Homemaker	160	3,310	3,470
Other	350	1,010	1,360
Total:	47,690	50,440	98,120

Traveller Characteristics	Male	Female	Total
Transit Pass Holders	5,940	6,920	12,860
Licensed Drivers	36,280	36,790	73,070
Telecommuters	200	380	580
Trips made by residents	135,300	143,330	278,630

Selected Indicators	
Daily Trips per Person (age 5+)	2.84
Vehicles per Person	0.61
Number of Persons per Household	2.77
Daily Trips per Household	7.33
Vehicles per Household	1.70
Workers per Household	1.31
Population Density (Pop/km2)	1270

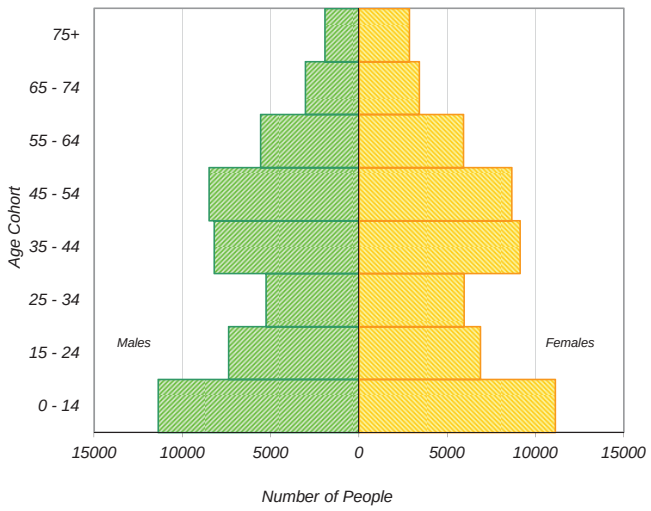


Household Size		
1 person	5,810	15%
2 persons	11,660	31%
3 persons	7,490	20%
4 persons	8,890	23%
5+ persons	4,160	11%
Total:	38,010	100%

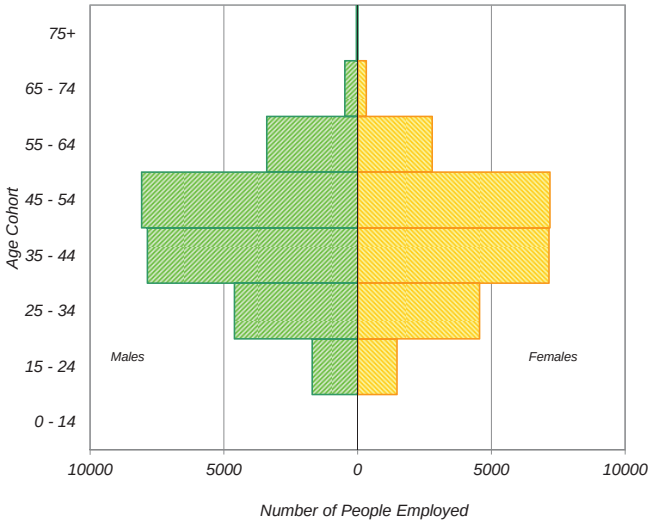
Households by Vehicle Availability		
0 vehicles	1,050	3%
1 vehicle	14,090	37%
2 vehicles	19,110	50%
3 vehicles	3,000	8%
4+ vehicles	770	2%
Total:	38,010	100%

Households by Dwelling Type		
Single-detached	21,610	57%
Semi-detached	3,890	10%
Townhouse	10,550	28%
Apartment/Condo	1,960	5%
Total:	38,010	100%

Population



Employed Population

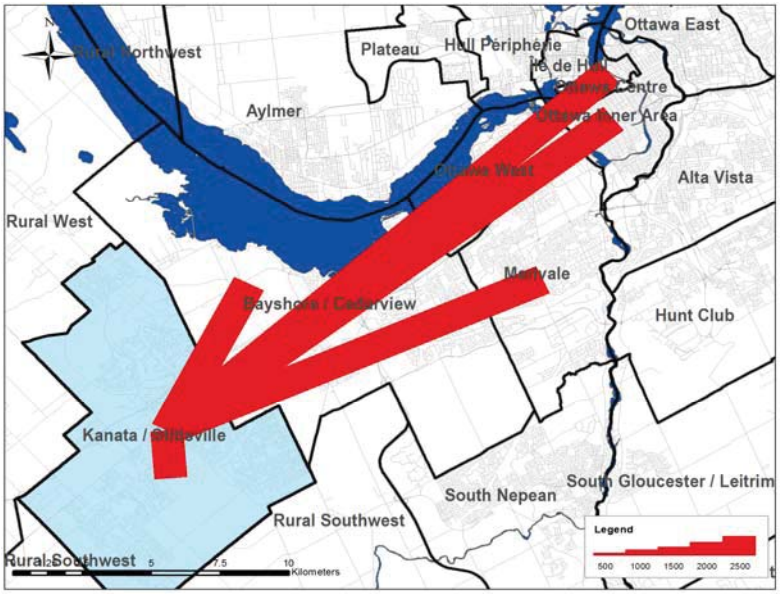


* In 2005 data was only collected for household members aged 11+ therefore these results cannot be compared to the 2011 data.

Travel Patterns

Top Five Destinations of Trips from Kanata - Stittsville

AM Peak Period



Summary of Trips to and from Kanata - Stittsville

AM Peak Period (6:30 - 8:59)	Destinations of Trips From		Origins of Trips To	
Districts	District	% Total	District	% Total
Ottawa Centre	4,560	8%	140	0%
Ottawa Inner Area	3,350	6%	970	2%
Ottawa East	660	1%	260	1%
Beacon Hill	280	0%	170	0%
Alta Vista	1,810	3%	660	1%
Hunt Club	490	1%	420	1%
Merivale	3,410	6%	1,200	3%
Ottawa West	2,020	4%	840	2%
Bayshore / Cedarview	5,010	9%	2,420	5%
Orléans	290	1%	500	1%
Rural East	100	0%	30	0%
Rural Southeast	50	0%	260	1%
South Gloucester / Leitrim	60	0%	140	0%
South Nepean	690	1%	1,800	4%
Rural Southwest	1,130	2%	1,850	4%
Kanata / Stittsvile	30,360	54%	30,360	66%
Rural West	1,050	2%	3,250	7%
Île de Hull	670	1%	30	0%
Hull Périphérie	160	0%	30	0%
Plateau	100	0%	230	0%
Aylmer	0	0%	190	0%
Rural Northwest	20	0%	60	0%
Pointe Gatineau	20	0%	80	0%
Gatineau Est	0	0%	60	0%
Rural Northeast	30	0%	50	0%
Buckingham / Masson-Angers	30	0%	10	0%
Ontario Sub-Total:	55,320	98%	45,270	98%
Québec Sub-Total:	1,030	2%	740	2%
Total:	56,350	100%	46,010	100%

Trips by Trip Purpose

24 Hours	From District		To District		Within District	
Work or related	27,180	29%	17,020	18%	14,550	9%
School	7,070	7%	2,500	3%	15,110	9%
Shopping	6,070	6%	9,150	10%	22,480	14%
Leisure	8,450	9%	10,590	11%	17,090	11%
Medical	2,520	3%	1,170	1%	2,660	2%
Pick-up / drive passenger	6,570	7%	5,470	6%	15,190	9%
Return Home	33,610	35%	45,620	48%	65,770	41%
Other	3,560	4%	3,590	4%	8,440	5%
Total:	95,030	100%	95,110	100%	161,290	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Work or related	18,030	69%	11,020	70%	7,430	24%
School	4,890	19%	2,280	15%	11,740	39%
Shopping	170	1%	320	2%	760	3%
Leisure	340	1%	400	3%	780	3%
Medical	330	1%	230	1%	350	1%
Pick-up / drive passenger	1,260	5%	580	4%	4,760	16%
Return Home	290	1%	380	2%	1,980	7%
Other	670	3%	430	3%	2,560	8%
Total:	25,980	100%	15,640	100%	30,360	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Work or related	390	2%	350	1%	930	2%
School	370	2%	0	0%	90	0%
Shopping	1,030	5%	1,910	7%	5,100	14%
Leisure	2,140	11%	3,080	11%	4,130	11%
Medical	230	1%	180	1%	400	1%
Pick-up / drive passenger	1,980	10%	1,980	7%	3,410	9%
Return Home	12,130	64%	20,550	71%	21,560	58%
Other	680	4%	860	3%	1,850	5%
Total:	18,950	100%	28,910	100%	37,470	100%

Peak Period (%)	Total:	% of 24 Hours	Within District (%)
24 Hours	351,430		46%
AM Peak Period	71,980	20%	42%
PM Peak Period	85,330	24%	44%

Trips by Primary Travel Mode

24 Hours	From District		To District		Within District	
Auto Driver	63,470	67%	63,830	67%	92,190	57%
Auto Passenger	15,220	16%	14,920	16%	31,880	20%
Transit	12,200	13%	12,270	13%	4,050	3%
Bicycle	360	0%	410	0%	960	1%
Walk	40	0%	50	0%	21,080	13%
Other	3,730	4%	3,660	4%	11,130	7%
Total:	95,020	100%	95,140	100%	161,290	100%

AM Peak (06:30 - 08:59)	From District		To District		Within District	
Auto Driver	15,360	59%	11,530	74%	13,630	45%
Auto Passenger	2,450	9%	1,160	7%	5,050	17%
Transit	6,230	24%	1,290	8%	1,210	4%
Bicycle	30	0%	80	1%	220	1%
Walk	0	0%	40	0%	5,730	19%
Other	1,900	7%	1,560	10%	4,510	15%
Total:	25,970	100%	15,660	100%	30,350	100%

PM Peak (15:30 - 17:59)	From District		To District		Within District	
Auto Driver	13,850	73%	17,660	61%	21,240	57%
Auto Passenger	3,240	17%	4,270	15%	8,570	23%
Transit	1,270	7%	5,980	21%	670	2%
Bicycle	40	0%	100	0%	260	1%
Walk	40	0%	0	0%	4,570	12%
Other	520	3%	910	3%	2,160	6%
Total:	18,960	100%	28,920	100%	37,470	100%

Avg Vehicle Occupancy	From District	To District	Within District
24 Hours	1.24	1.23	1.35
AM Peak Period	1.16	1.10	1.37
PM Peak Period	1.23	1.24	1.40

Transit Modal Split	From District	To District	Within District
24 Hours	13%	13%	3%
AM Peak Period	26%	9%	6%
PM Peak Period	7%	21%	2%

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix G: Multi-Modal Level of Service (MMLOS)

April 2019

IBI

October 22, 2018

IBI

treet [1]	Maple Grove Road & Huntmar Drive			
WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
	2	3	2	3
	No Median	No Median	No Median	No Median
	Permissive	Permissive	Permissive	Permissive
	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	No	No	No	No
	> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
	No right turn channel	No right turn channel	No right turn channel	No right turn channel
	Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
	86 **B**	**71** **C**	**86** **B**	**71** **C**
	125	125	125	125
	7	7	7	7
	55.7 **E**	**55.7** **E**	**55.7** **E**	**55.7** **E**
	E			
	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Slow	Slow	Slow	Slow
	No	No	No	No
	Yes	Yes	Yes	Yes
	No	No	No	No
	No Lanes Crossed	1 Lane Crossed	No Lanes Crossed	No Lanes Crossed
	50km/h	50km/h	50km/h	50km/h
	No	No	No	No
	D	**D**	**D**	**D**
	D			
	>40 sec	≤30 sec	>40 sec	≤30 sec
	F	**D**	**F**	**D**
	F			
	< 10m	< 10m	< 10m	< 10m
	1	1	1	1
	F	**F**	**F**	**F**
	F			
	C (AM) / E (PM)			

3	Maple Grove Road & Santolina Street
2.0 or more	
> 2	
> 3000	
Yes	
51 to 60 km/h	
B	
ction	
friction	
>3.7	
2	
B	

October 22, 2018

IBI

treet [1]	Maple Grove Road & Huntmar Drive			
WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
	4	3	2	3
	No Median	No Median	No Median	No Median
	Permissive	Permissive	Permissive	Permissive
	Protected/permissive	Protected/permissive	Protected/permissive	Protected/permissive
	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
	No	No	No	No
	> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
	No right turn channel	No right turn channel	No right turn channel	No right turn channel
	Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
	54 D	**71 C**	**86 B**	**71 C**
	70	70	70	70
	7	7	7	7
	28.4 C	**28.4 C**	**28.4 C**	**28.4 C**
	D			
	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Slow	Slow	Slow	Slow
	No	No	No	No
	No	Yes	Yes	Yes
	No	No	No	No
	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed
	50km/h	50km/h	50km/h	50km/h
	No	No	No	No
	D	**D**	**D**	**D**
	D			
	≤20 sec	≤30 sec	≤40 sec	≤20 sec
	C	**D**	**E**	**C**
	E			
	< 10m	< 10m	< 10m	< 10m
	1	1	1	1
	F	**F**	**F**	**F**
	F			
	C (AM) / D (PM)			

	Maple Grove Road & Santolina Street	
3		
2.0 or more		
> 2		
> 3000		
Yes		
51 to 60 km/h		
B		
ction		
friction		
>3.7		
2		
B		

October 22, 2018

IBI

reet [1]	Maple Grove Road & Santolina Street [1]				Maple Grove Road & Huntmar Drive			
WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
					4	3	2	3
					No Median	No Median	No Median	No Median
					Permissive	Permissive	Permissive	Permissive
					Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
					RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
					No	No	No	No
					> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
					No right turn channel	No right turn channel	No right turn channel	No right turn channel
					Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
					54	**71**	**86**	**71**
					D	**C**	**B**	**C**
					70	70	70	70
					7	7	7	7
					28.4	**28.4**	**28.4**	**28.4**
					C	**C**	**C**	**C**
					D			
					Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
					Fast	Fast	Fast	Fast
					≤ 50m	≤ 50m	≤ 50m	≤ 50m
					No	No	No	No
					No	Yes	Yes	Yes
					No	No	No	No
					1 Lane Crossed	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed
					50km/h	50km/h	50km/h	50km/h
					No	No	No	No
					D	**D**	**D**	**D**
					D			
					≤30 sec	≤30 sec	≤40 sec	≤20 sec
					D	**D**	**E**	**C**
					E			
					< 10m	< 10m	< 10m	< 10m
					1	1	1	1
					F	**F**	**F**	**F**
					F			
	B (AM) / B (PM)				**C (AM) / D (PM)**			

	Maple Grove Road & Proposed MUP	Section			Maple Grove Road & Santolina Street			
3		1	2	3				
2.0 or more		2.0 or more	2.0 or more	2.0 or more				
> 2		> 2	> 2	> 2				
> 3000		> 3000	> 3000	> 3000				
Yes		Yes	Yes	Yes				
51 to 60 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h				
B		**B**	**B**	**B**				
		B						
		Mixed Traffic						
rection		1 Travel Lane Per Direction						
		No						
		N/A						
		50 km/h						
		Rare						
ge		No Median Refuge						
d		2 Lanes Crossed						
		50 km/h						
		D						
		Mixed Traffic						
y friction		Limited parking/driveway friction						
		D						
>3.7		>3.7	>3.7	>3.7				
2		2	2	2				
B		**B**	**B**	**B**				
		B						

October 22, 2018

IBI

	Maple Grove Road & Santolina Street [1]				Maple Grove Road & Huntmar Drive			
T leg	NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
					4	3	2	3
					No Median	No Median	No Median	No Median
					Permissive	Permissive	Permissive	Permissive
					Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
					RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
					No	No	No	No
					> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
					No right turn channel	No right turn channel	No right turn channel	No right turn channel
					Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
					54 D	71 C	86 B	71 C
					80	80	80	80
					7	7	7	7
					33.3 D	33.3 D	33.3 D	33.3 D
					D			
					Mixed Traffic	Bike Lanes/Cycle Track	Mixed Traffic	Mixed Traffic
					Fast	Fast	Fast	Fast
					≤ 50m	≤ 50m	≤ 50m	> 50m
					No	No	No	No
					No	Yes	Yes	Yes
					No	No	No	No
					1 Lane Crossed	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed
					50km/h	50km/h	50km/h	50km/h
					No	No	No	No
					D	D	D	D
					D			
					≤30 sec	≤30 sec	>40 sec	≤30 sec
					D	D	F	D
					F			
					< 10m	< 10m	< 10m	< 10m
					1	1	1	1
					F	F	F	F
					F			
	B (AM) / B (PM)				D (AM) / D (PM)			

	Maple Grove Road & Proposed MUP	Section			Maple Grove Road & Santolina Street			
		1	2	3				
more		2.0 or more	2.0 or more	2.0 or more				
2		> 2	> 2	> 2				
00		> 3000	> 3000	> 3000				
s		Yes	Yes	Yes				
0 km/h		51 to 60 km/h	51 to 60 km/h	51 to 60 km/h				
		B	B	B				
		B						
		Mixed Traffic						
		1 Travel Lane Per Direction						
		No						
		N/A						
		50 km/h						
		Rare						
		No Median Refuge						
		2 Lanes Crossed						
		50 km/h						
		D						
		Mixed Traffic						
		Limited parking/driveway friction						
		D						
.7		>3.7	>3.7	>3.7				
		2	2	2				
		B	B	B				
		B						

October 22, 2018

IBI

Maple Grove Road & Street 1 [1]				Maple Grove Road & Santolina Street [1]				Maple Grove Road & Huntmar Drive			
NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
								4	3	2	3
								No Median	No Median	No Median	No Median
								Permissive	Permissive	Permissive	Permissive
								Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
								RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
								No	No	No	No
								> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
								No right turn channel	No right turn channel	No right turn channel	No right turn channel
								Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
								54	**71**	**86**	**71**
								D	**C**	**B**	**C**
								70	70	70	70
								7	7	7	7
								28.4	**28.4**	**28.4**	**28.4**
								C	**C**	**C**	**C**
								D			
								Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
								Fast	Fast	Fast	Fast
								> 50m	≤ 50m	≤ 50m	≤ 50m
								No	No	No	No
								No	Yes	Yes	Yes
								No	No	No	No
								1 Lane Crossed	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed
								50km/h	50km/h	50km/h	50km/h
								No	No	No	No
								D	**D**	**D**	**D**
								D			
								≤30 sec	≤30 sec	≤40 sec	≤30 sec
								D	**D**	**E**	**D**
								E			
								< 10m	< 10m	< 10m	< 10m
								1	1	1	1
								F	**F**	**F**	**F**
								F			
B (AM) / B (PM)				**B (AM) / B (PM)**				**C (AM) / D (PM)**			

Maple Grove Road & Street 1	Section			Maple Grove Road & Santolina Street							
	1	2	3								
	2.0 or more	2.0 or more	2.0 or more								
	> 2	> 2	> 2								
	> 3000	> 3000	> 3000								
	Yes	Yes	Yes								
	51 to 60 km/h	51 to 60 km/h	51 to 60 km/h								
	B	**B**	**B**								
	B										
	Mixed Traffic										
	1 Travel Lane Per Direction										
	No										
	N/A										
	50 km/h										
	Rare										
	No Median Refuge										
	2 Lanes Crossed										
	50 km/h										
	D										
	Mixed Traffic										
	Limited parking/driveway friction										
	D										
	>3.7	>3.7	>3.7								
	2	2	2								
	B	**B**	**B**								
	B										

October 22, 2018

IBI

Maple Grove Road & Street 1[1]				Maple Grove Road & Santolina Street [1]				Maple Grove Road & Huntmar Drive			
NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg	NORTH leg	SOUTH leg	EAST leg	WEST leg
								4	3	2	3
								No Median	No Median	No Median	No Median
								Permissive	Permissive	Permissive	Permissive
								Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control
								RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed
								No	No	No	No
								> 5m to 10m	> 5m to 10m	> 5m to 10m	> 5m to 10m
								No right turn channel	No right turn channel	No right turn channel	No right turn channel
								Standard transverse markings	Standard transverse markings	Standard transverse markings	Standard transverse markings
								54	**71**	**86**	**71**
								D	**C**	**B**	**C**
								80	80	80	80
								7	7	7	7
								33.3	**33.3**	**33.3**	**33.3**
								D	**D**	**D**	**D**
								D			
								Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
								Fast	Fast	Fast	Fast
								> 50m	≤ 50m	≤ 50m	≤ 50m
								No	No	No	No
								No	Yes	Yes	Yes
								No	No	No	No
								1 Lane Crossed	1 Lane Crossed	1 Lane Crossed	1 Lane Crossed
								50km/h	50km/h	50km/h	50km/h
								No	No	No	No
								D	**D**	**D**	**D**
								D			
								≤30 sec	≤30 sec	>40 sec	≤30 sec
								D	**D**	**F**	**D**
								F			
								< 10m	< 10m	< 10m	< 10m
								1	1	1	1
								F	**F**	**F**	**F**
								F			
B (AM) / B (PM)				**B (AM) / C (PM)**				**D (AM) / D (PM)**			

Maple Grove Road & Street 1	Section			Maple Grove Road & Santolina Street							
	1	2	3								
	2.0 or more	2.0 or more	2.0 or more								
	> 2	> 2	> 2								
	> 3000	> 3000	> 3000								
	Yes	Yes	Yes								
	51 to 60 km/h	51 to 60 km/h	51 to 60 km/h								
	B	**B**	**B**								
	B										
	Mixed Traffic										
	1 Travel Lane Per Direction										
	No										
	N/A										
	50 km/h										
	Rare										
	No Median Refuge										
	2 Lanes Crossed										
	50 km/h										
	D										
	Mixed Traffic										
	Limited parking/driveway friction										
	D										
	>3.7	>3.7	>3.7								
	2	2	2								
	B	**B**	**B**								
	B										

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix H: Roundabout Screening Tool

April 2019

IBI

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:	1919 Maple Grove Road (TIA)
2	Intersection:	Maple Grove & Street 1
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	Proposed 3-legged intersection to be located approximately 190m west of Santolina Street Shared through turning lanes on all approaches AADT: SB: 1150 EB: 2020 WB: 3850
4	What traditional modifications are proposed? All-way stop control, traffic signals, auxiliary lanes, etc. Attach or sketch a diagram if necessary.	SB Stop Control Shared through-turnign lanes on all three (3) approaches
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?	This is a 'new city intersection'

7 Are there contra-indications for a roundabout?

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

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 [x] 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 [x]
3	Is there an existing uncontrolled approach with a grade in excess of 4 percent?	Yes [ ] No [x]
4	Is the intersection located within a coordinated signal system?	Yes [ ] No [x]
5	Is there a closely-spaced traffic signal or railway crossing that could not be controlled with a nearby roundabout?	Yes [ ] No [x]
6	Are significant differences in directional flows or any situations of sudden high demand expected?	Yes [ ] No [x]
7	Are there known visually-impaired pedestrians that cross this intersection?	Yes [ ] No [x]

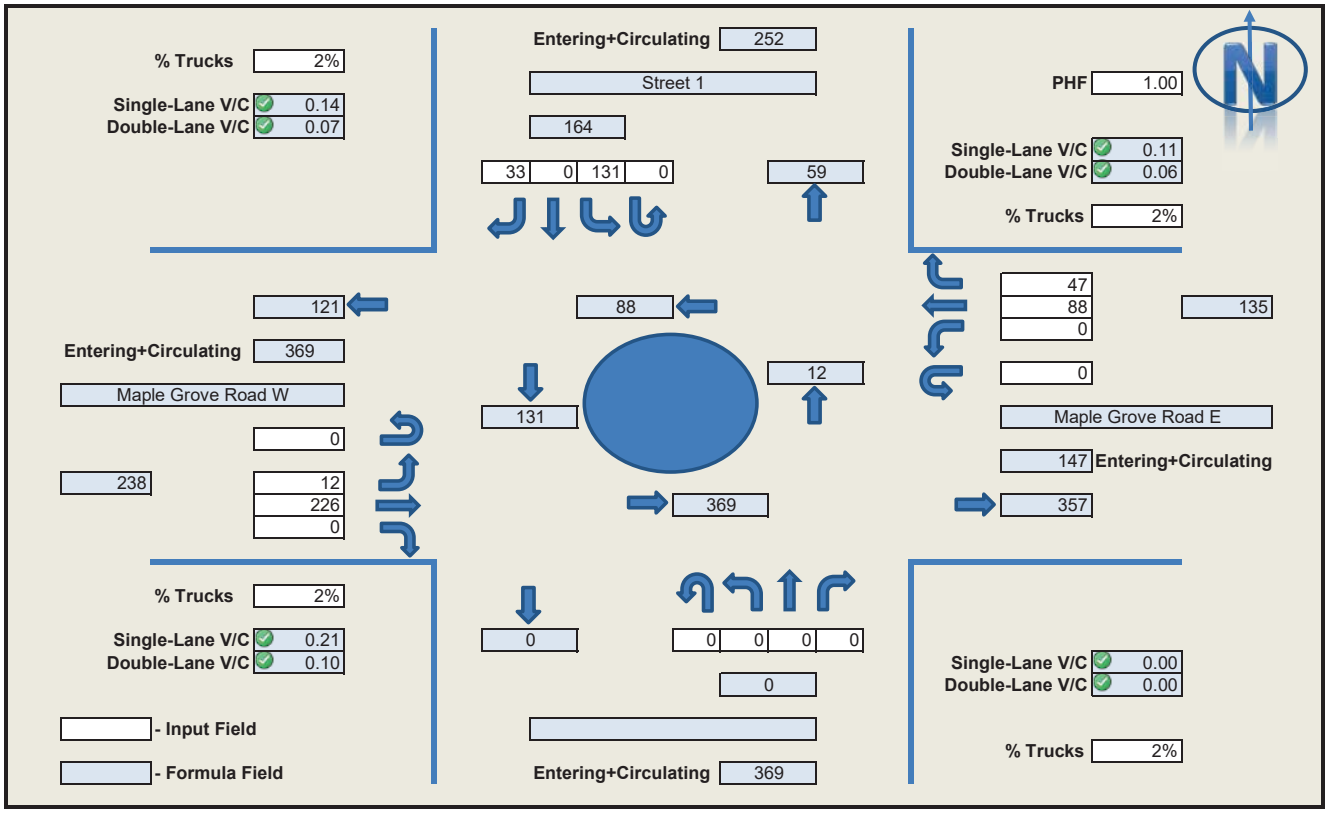
8 Are there suitability factors for a roundabout?

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 [x] Does not exist
2	Has there been a fatal crash at the intersection in the last 10 years?	Yes [ ] No [x] Does not exist
3	Are capacity problems currently being experienced, or expected in the future?	Yes [ ] No [x]
4	Are traffic signals warranted, or expected to be warranted in the future?	Yes [ ] No [x]
5	Does the intersection have more than 4 legs, or unusual geometry?	Yes [ ] No [x]
6	Will Planned modifications to the intersection require that nearby structures be widened (i.e. to accommodate left-turn lanes)?	Yes [ ] No [x]
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 [x]

9	Conclusions/recommendation whether to proceed with an Intersection Control Study:	The overall conclusion of the roundabout screening form for the proposed intersection of Maple Grove Road is that there is insufficient propety to accommodate a roundabout and that a roundabout is not suitable at the location based on the suitability factors

Project No.:	113480			**Horizon Year:**	2026
Intersection:	Maple Grove Road	at	Street 1	**Time Period:**	AM Peak

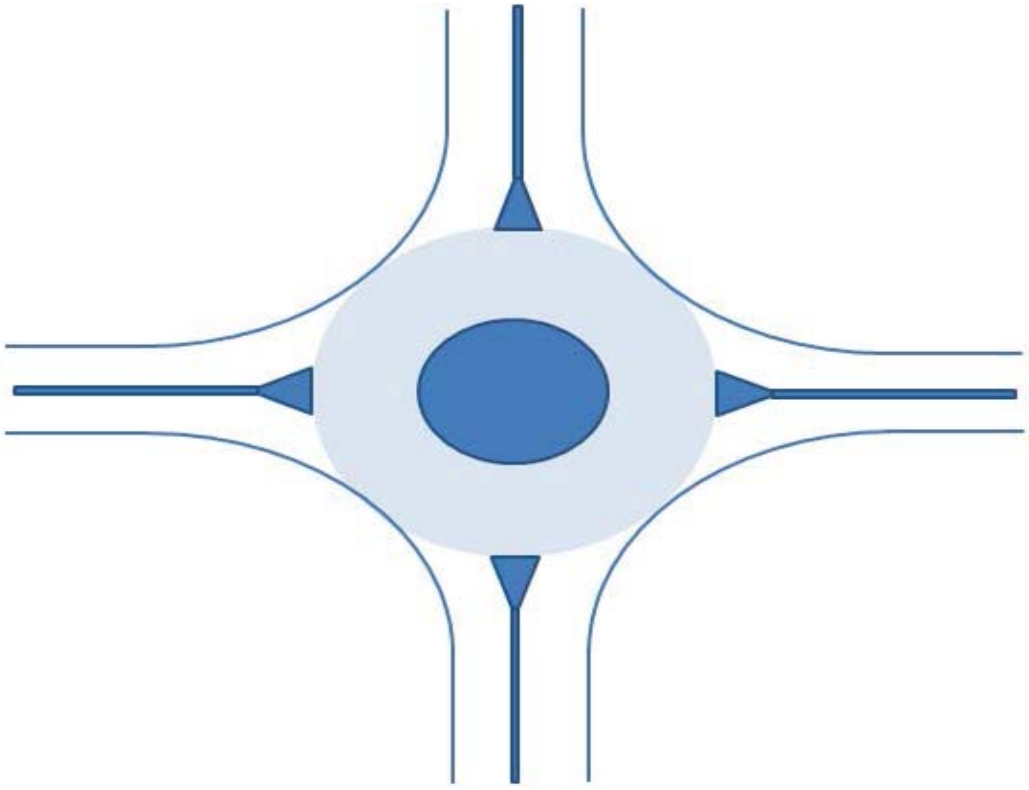


Capacity Guidelines for Single-Lane Roundabouts

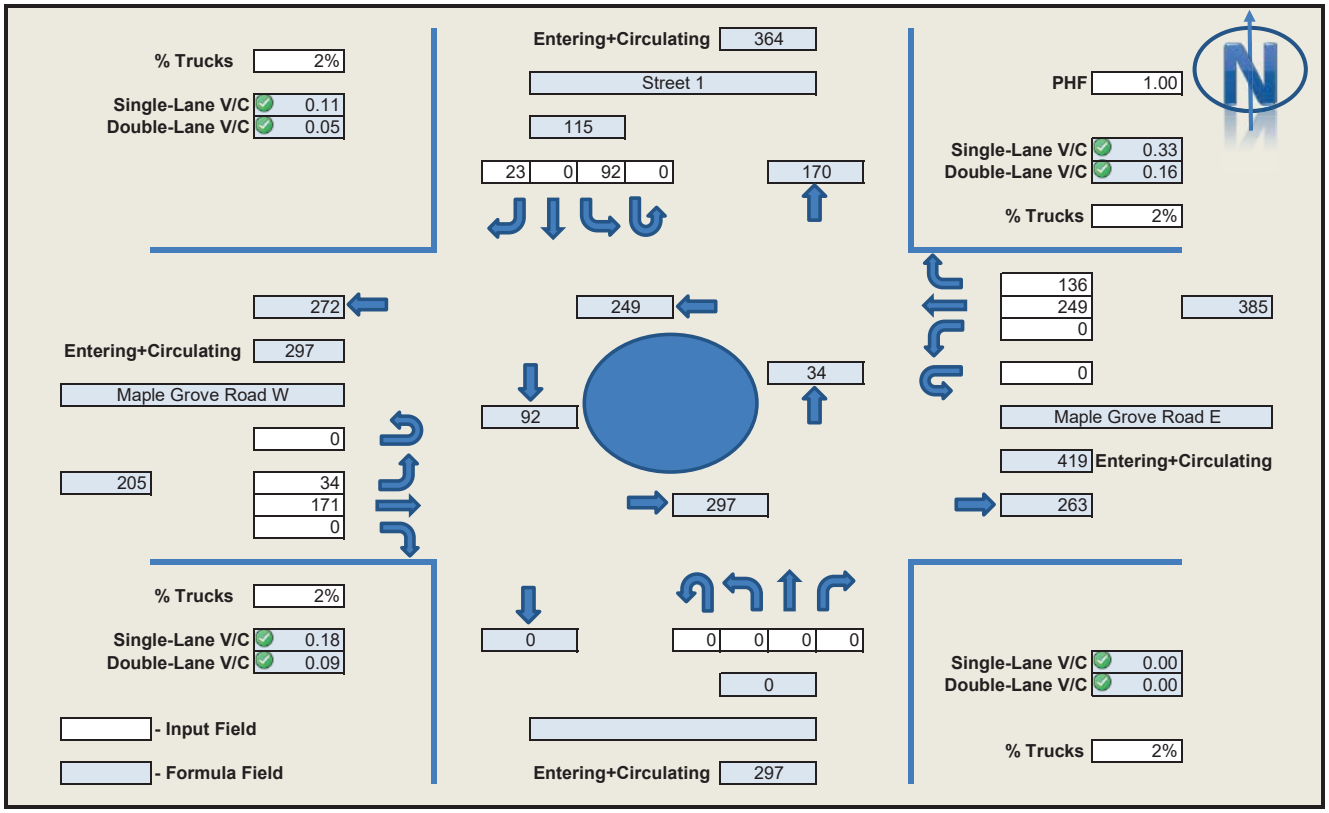
1. Single-lane service volumes < 900 vph - 1200 vph
2. Exit flow < 900 vph - 1200 vph
3. Entry flow + circulating flow < 1400 vph - 1800 vph
4. Circulating flow downstream of any entry 1400 vph - 1800 vph
5. V/C > 0.85

RODEL Inputs					
Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-Turn
Street 1	1.02	33	0	131	0
Maple Grove Road W	1.02	0	226	12	0
0	1.02	0	0	0	0
Maple Grove Road E	1.02	47	88	0	0

Proposed Lane Arrangement



Project No.:	113480			**Horizon Year:**	2026
Intersection:	Maple Grove Road	at	Street 1	**Time Period:**	PM Peak

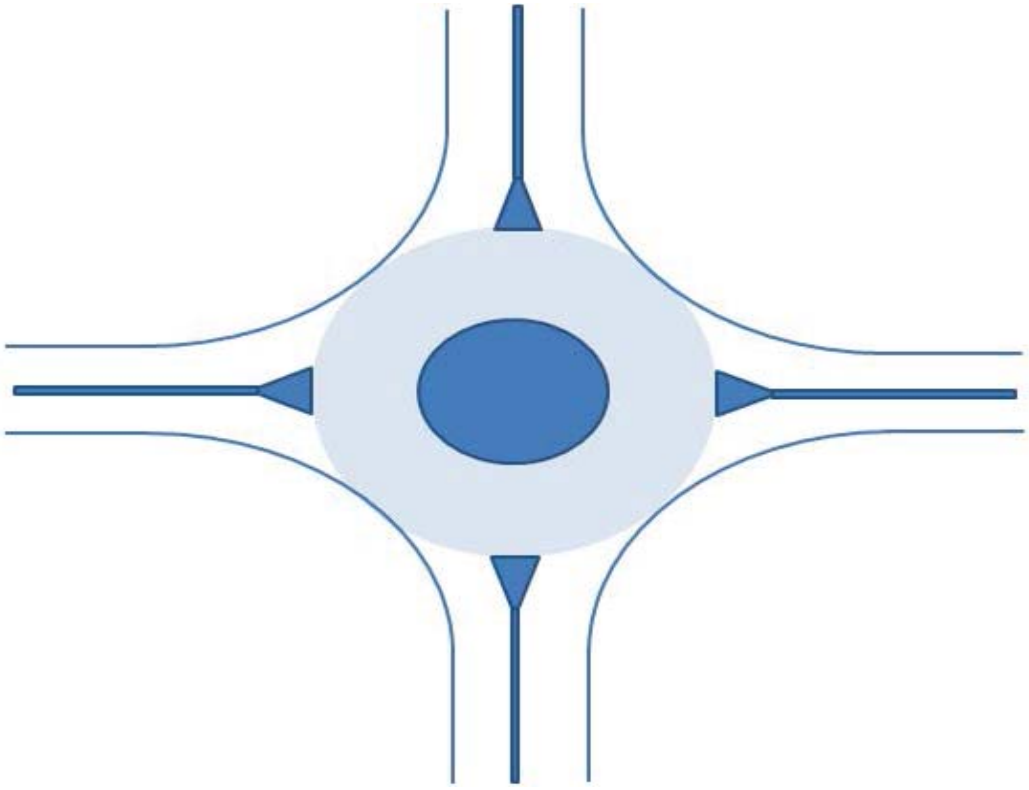


Capacity Guidelines for Single-Lane Roundabouts

1. Single-lane service volumes < 900 vph - 1200 vph
2. Exit flow < 900 vph - 1200 vph
3. Entry flow + circulating flow < 1400 vph - 1800 vph
4. Circulating flow downstream of any entry 1400 vph - 1800 vph
5. V/C > 0.85

RODEL Inputs					
Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-Turn
Street 1	1.02	23	0	92	0
Maple Grove Road W	1.02	0	171	34	0
0	1.02	0	0	0	0
Maple Grove Road E	1.02	136	249	0	0

Proposed Lane Arrangement



1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix I: Traffic Signal Warrants

April 2019

IBI

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? Alon Street & Maple Grove Road

What is the direction of the Main Road street? East-West

Scenario: Future (2026) BGSG

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 1

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 4

d.- What is the operating environment? Urban **Population >= 10,000 AND Speed < 70 km/hr**

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00	6	126	13	5	2	54	22	68	30	56	4	11	1
9:00	3	63	7	3	1	27	11	34	15	28	2	6	0
10:00	3	63	7	3	1	27	11	34	15	28	2	6	15
12:30	3	63	7	3	1	27	11	34	15	28	2	6	1
13:30	10	116	10	14	3	43	70	145	56	46	3	9	2
16:00	5	58	5	7	2	22	35	73	28	23	2	5	3
17:00	5	58	5	7	2	22	35	73	28	23	2	5	4
18:00	5	58	5	7	2	22	35	73	28	23	2	5	1
Total	**40**	**605**	**59**	**49**	**14**	**244**	**230**	**534**	**215**	**255**	**19**	**53**	**27**

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: Alon Street & Maple Grove Road

Scenario: Future (2026) BGSG

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	40	%	☐	☑
	B	Crossing Volume	47	%		
2. Delay to Cross Traffic	A	Main Road	29	%	☐	☑
	B	Crossing Road	58	%		
3. Combination	A	Justificaton 1	40	%	☐	☑
	B	Justification 2	29	%		
4. 4-Hr Volume			13	%	☐	☑

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? Street 1 & Maple Grove Road

What is the direction of the Main Road street? East-West

Scenario: Future (2026) BGSG

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 1

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 3

d.- What is the operating environment? Urban **Population >= 10,000 AND Speed < 70 km/hr**

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00	12	226	0	0	0	0	0	88	47	33	0	131	
9:00	6	113	0	0	0	0	0	44	24	17	0	66	
10:00	6	113	0	0	0	0	0	44	24	17	0	66	
12:30	6	113	0	0	0	0	0	44	24	17	0	66	
13:30	34	171	0	0	0	0	0	249	136	92	0	23	
16:00	17	86	0	0	0	0	0	125	68	46	0	12	
17:00	17	86	0	0	0	0	0	125	68	46	0	12	
18:00	17	86	0	0	0	0	0	125	68	46	0	12	
Total	**115**	**994**	**0**	**0**	**0**	**0**	**0**	**844**	**459**	**314**	**0**	**388**	**0**

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: Street 1 & Maple Grove Road

Scenario: Future (2026) BGSG

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	54	%	☐	☑
	B	Crossing Volume	34	%		
2. Delay to Cross Traffic	A	Main Road	42	%	☐	☑
	B	Crossing Road	50	%		
3. Combination	A	Justificaton 1	34	%	☐	☑
	B	Justification 2	42	%		
4. 4-Hr Volume			25	%	☐	☑

Input Data Sheet

Analysis Sheet | Results Sheet | Proposed Collision

GO TO Justification:

What are the intersecting roadways? Santolina Street & Maple Grove Road

What is the direction of the Main Road street? East-West

Scenario: Future (2026) BGSG

Justification 1 - 4: Volume Warrants

a.- Number of lanes on the Main Road? 1

b.- Number of lanes on the Minor Road? 1

c.- How many approaches? 3

d.- What is the operating environment? Urban **Population >= 10,000 AND Speed < 70 km/hr**

e.- What is the eight hour vehicle volume at the intersection? (Please fill in table below)

Hour Ending	Main Eastbound Approach			Minor Northbound Approach			Main Westbound Approach			Minor Southbound Approach			Pedestrians Crossing Main Road
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT	
8:00	0	306	51	20	0	63	29	115	0	0	0	0	9
9:00	0	153	26	10	0	32	15	58	0	0	0	0	0
10:00	0	153	26	10	0	32	15	58	0	0	0	0	23
12:30	0	153	26	10	0	32	15	58	0	0	0	0	2
13:30	0	223	40	56	0	46	95	329	0	0	0	0	1
16:00	0	112	20	28	0	23	48	165	0	0	0	0	1
17:00	0	112	20	28	0	23	48	165	0	0	0	0	3
18:00	0	112	20	28	0	23	48	165	0	0	0	0	2
Total	**0**	**1,324**	**229**	**190**	**0**	**274**	**313**	**1,113**	**0**	**0**	**0**	**0**	**41**

Results Sheet

Input Sheet | Analysis Sheet | Proposed Collision

GO TO Justification:

Intersection: Santolina Street & Maple Grove Road

Scenario: Future (2026) BGSG

Summary Results

Justification			Compliance		Signal Justified? YES	Signal Justified? NO
1. Minimum Vehicular Volume	A	Total Volume	59	%	☐	☑
	B	Crossing Volume	23	%		
2. Delay to Cross Traffic	A	Main Road	52	%	☐	☑
	B	Crossing Road	39	%		
3. Combination	A	Justificaton 1	23	%	☐	☑
	B	Justification 2	39	%		
4. 4-Hr Volume			19	%	☐	☑

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix J: Synchro Output Files

April 2019

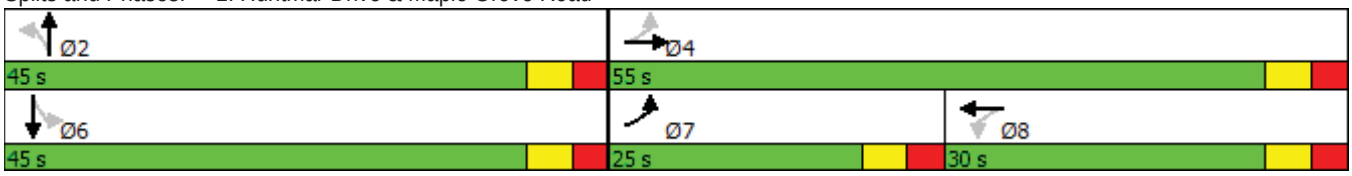
IBI

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	183	119	42	34	41	39	34	448	80	27	310	40
Future Volume (vph)	183	119	42	34	41	39	34	448	80	27	310	40
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.961			0.954			0.977			0.986	
Flt Protected	0.950				0.985		0.950				0.996	
Satd. Flow (prot)	1658	1677	0	0	1640	0	1658	1705	0	0	1714	0
Flt Permitted	0.493				0.835		0.463				0.865	
Satd. Flow (perm)	860	1677	0	0	1390	0	808	1705	0	0	1488	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25			24			11			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	203	132	47	38	46	43	38	498	89	30	344	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	203	179	0	0	127	0	38	587	0	0	418	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	11.2	29.2		29.2	29.2		21.1	21.1		21.1	21.1	
Total Split (s)	25.0	55.0		30.0	30.0		45.0	45.0		45.0	45.0	
Total Split (%)	25.0%	55.0%		30.0%	30.0%		45.0%	45.0%		45.0%	45.0%	
Maximum Green (s)	18.8	48.8		23.8	23.8		38.9	38.9		38.9	38.9	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		16.0		16.0	16.0		8.0	8.0		8.0	8.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	29.0	29.0			12.7		34.8	34.8			34.8	
Actuated g/C Ratio	0.38	0.38			0.16		0.45	0.45			0.45	
v/c Ratio	0.42	0.28			0.51		0.10	0.76			0.62	
Control Delay	19.5	15.0			36.2		16.3	27.5			23.1	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	19.5	15.0			36.2		16.3	27.5			23.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B			D		B	C			C	
Approach Delay		17.4			36.2			26.8			23.1	
Approach LOS		B			D			C			C	
Queue Length 50th (m)	20.0	14.7			14.3		3.0	66.4			43.3	
Queue Length 95th (m)	33.9	27.1			31.1		9.7	#136.6			84.8	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0					
Base Capacity (vph)	565	1123			474		436	925			806	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.36	0.16			0.27		0.09	0.63			0.52	

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 77			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.76			
Intersection Signal Delay: 24.3		Intersection LOS: C	
Intersection Capacity Utilization 78.1%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



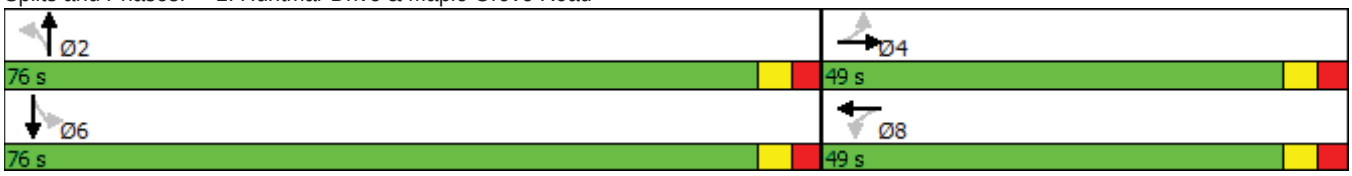
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	71	50	109	141	17	55	352	70	33	650	218
Future Volume (vph)	51	71	50	109	141	17	55	352	70	33	650	218
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	15.0		0.0	0.0		0.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.938			0.991			0.975			0.967	
Flt Protected	0.950				0.980		0.950				0.998	
Satd. Flow (prot)	1658	1637	0	0	1695	0	1658	1701	0	0	1684	0
Flt Permitted	0.505				0.793		0.260				0.970	
Satd. Flow (perm)	881	1637	0	0	1371	0	454	1701	0	0	1637	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31			3			13			21	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	57	79	56	121	157	19	61	391	78	37	722	242
Shared Lane Traffic (%)												
Lane Group Flow (vph)	57	135	0	0	297	0	61	469	0	0	1001	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	29.2	29.2		29.2	29.2		21.1	21.1		21.1	21.1	
Total Split (s)	49.0	49.0		49.0	49.0		76.0	76.0		76.0	76.0	
Total Split (%)	39.2%	39.2%		39.2%	39.2%		60.8%	60.8%		60.8%	60.8%	
Maximum Green (s)	42.8	42.8		42.8	42.8		69.9	69.9		69.9	69.9	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		8.0	8.0		8.0	8.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	28.6	28.6			28.6		70.3	70.3			70.3	
Actuated g/C Ratio	0.26	0.26			0.26		0.63	0.63			0.63	
v/c Ratio	0.25	0.30			0.84		0.21	0.43			0.96	
Control Delay	34.6	26.2			59.0		13.5	13.0			41.4	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	34.6	26.2			59.0		13.5	13.0			41.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			E		B	B			D	
Approach Delay		28.7			59.0			13.1			41.4	
Approach LOS		C			E			B			D	
Queue Length 50th (m)	9.0	16.5			55.6		4.8	42.3			169.9	
Queue Length 95th (m)	19.0	30.8			84.5		14.7	83.4			#320.3	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0					
Base Capacity (vph)	340	652			532		286	1079			1041	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.17	0.21			0.56		0.21	0.43			0.96	

Intersection Summary			
Area Type:	Other		
Cycle Length: 125			
Actuated Cycle Length: 111.2			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.96			
Intersection Signal Delay: 35.4		Intersection LOS: D	
Intersection Capacity Utilization 118.3%		ICU Level of Service H	
Analysis Period (min) 15			

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	183	119	42	34	41	39	34	448	80	27	310	40
Future Volume (vph)	183	119	42	34	41	39	34	448	80	27	310	40
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	15.0		0.0	15.0		40.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.961			0.954			0.977				0.850
Flt Protected	0.950				0.985		0.950			0.950		
Satd. Flow (prot)	1658	1677	0	0	1640	0	1658	1705	0	1658	1745	1483
Flt Permitted	0.545				0.835		0.476			0.226		
Satd. Flow (perm)	951	1677	0	0	1390	0	831	1705	0	394	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			19			11				85
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	203	132	47	38	46	43	38	498	89	30	344	44
Shared Lane Traffic (%)												
Lane Group Flow (vph)	203	179	0	0	127	0	38	587	0	30	344	44
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.2	29.2		29.2	29.2		21.1	21.1		21.1	21.1	21.1
Total Split (s)	21.0	51.0		30.0	30.0		69.0	69.0		69.0	69.0	69.0
Total Split (%)	17.5%	42.5%		25.0%	25.0%		57.5%	57.5%		57.5%	57.5%	57.5%
Maximum Green (s)	14.8	44.8		23.8	23.8		62.9	62.9		62.9	62.9	62.9
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1		6.1	6.1	6.1
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)		16.0		16.0	16.0		8.0	8.0		8.0	8.0	8.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	0
Act Effct Green (s)	32.7	32.7			13.0		32.0	32.0		32.0	32.0	32.0
Actuated g/C Ratio	0.42	0.42			0.17		0.41	0.41		0.41	0.41	0.41
v/c Ratio	0.39	0.25			0.51		0.11	0.83		0.19	0.48	0.07
Control Delay	20.0	16.8			36.9		14.8	30.8		17.7	18.9	0.7
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	20.0	16.8			36.9		14.8	30.8		17.7	18.9	0.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	B			D		B	C		B	B	A
Approach Delay		18.5			36.9			29.8			16.9	
Approach LOS		B			D			C			B	
Queue Length 50th (m)	16.6	12.9			13.2		3.0	65.8		2.4	32.1	0.0
Queue Length 95th (m)	43.2	35.4			35.3		8.9	116.5		8.4	58.5	1.1
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0			15.0		40.0
Base Capacity (vph)	542	1024			461		684	1406		324	1437	1236
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.37	0.17			0.28		0.06	0.42		0.09	0.24	0.04

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 77.7
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 24.1 Intersection LOS: C
Intersection Capacity Utilization 64.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	51	71	50	109	141	17	55	352	70	33	650	218
Future Volume (vph)	51	71	50	109	141	17	55	352	70	33	650	218
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	15.0		0.0	15.0		40.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.938			0.991			0.975				0.850
Flt Protected	0.950				0.980		0.950			0.950		
Satd. Flow (prot)	1658	1637	0	0	1695	0	1658	1701	0	1658	1745	1483
Flt Permitted	0.543				0.807		0.224			0.417		
Satd. Flow (perm)	948	1637	0	0	1396	0	391	1701	0	728	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		32			3			14				157
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	57	79	56	121	157	19	61	391	78	37	722	242
Shared Lane Traffic (%)												
Lane Group Flow (vph)	57	135	0	0	297	0	61	469	0	37	722	242
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	29.1	29.1		29.1	29.1		21.1	21.1		21.1	21.1	21.1
Total Split (s)	45.5	45.5		45.5	45.5		74.5	74.5		74.5	74.5	74.5
Total Split (%)	37.9%	37.9%		37.9%	37.9%		62.1%	62.1%		62.1%	62.1%	62.1%
Maximum Green (s)	39.4	39.4		39.4	39.4		68.4	68.4		68.4	68.4	68.4
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.8	2.8		2.8	2.8		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1			6.1		6.1	6.1		6.1	6.1	6.1
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	16.0	16.0		16.0	16.0		8.0	8.0		8.0	8.0	8.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	0
Act Effct Green (s)	23.5	23.5			23.5		41.6	41.6		41.6	41.6	41.6
Actuated g/C Ratio	0.30	0.30			0.30		0.53	0.53		0.53	0.53	0.53
v/c Ratio	0.20	0.26			0.71		0.30	0.52		0.10	0.78	0.28
Control Delay	26.5	20.6			37.2		16.2	14.4		11.1	22.6	5.1
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	26.5	20.6			37.2		16.2	14.4		11.1	22.6	5.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		B	B		B	C	A
Approach Delay		22.3			37.2			14.6			17.9	
Approach LOS		C			D			B			B	
Queue Length 50th (m)	5.4	9.8			33.2		4.0	34.7		2.2	68.6	5.0
Queue Length 95th (m)	18.6	30.3			82.8		15.0	79.7		8.3	153.4	19.2
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0			15.0		40.0
Base Capacity (vph)	530	929			781		330	1439		615	1474	1277
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.11	0.15			0.38		0.18	0.33		0.06	0.49	0.19

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 78.7			
Natural Cycle: 65			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 20.3		Intersection LOS: C	
Intersection Capacity Utilization 87.1%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

Intersection	
Int Delay, s/veh	5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	49	2	29	13	1	63
Future Vol, veh/h	49	2	29	13	1	63
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, %	2	2	2	2	2	2
Mvmt Flow	54	2	32	14	1	70

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	57	0	135	56
Stage 1	-	-	-	-	56	-
Stage 2	-	-	-	-	79	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1547	-	859	1011
Stage 1	-	-	-	-	967	-
Stage 2	-	-	-	-	944	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1547	-	841	1011
Mov Cap-2 Maneuver	-	-	-	-	841	-
Stage 1	-	-	-	-	967	-
Stage 2	-	-	-	-	924	-

Approach	EB	WB	NB
HCM Control Delay, s	0	5.1	8.8
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1008	-	-	1547	-
HCM Lane V/C Ratio	0.071	-	-	0.021	-
HCM Control Delay (s)	8.8	-	-	7.4	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	31	3	95	60	4	46
Future Vol, veh/h	31	3	95	60	4	46
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, %	2	2	2	2	2	2
Mvmt Flow	34	3	106	67	4	51

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	38	0	314	36
Stage 1	-	-	-	-	36	-
Stage 2	-	-	-	-	278	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1572	-	679	1037
Stage 1	-	-	-	-	986	-
Stage 2	-	-	-	-	769	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1572	-	631	1037
Mov Cap-2 Maneuver	-	-	-	-	631	-
Stage 1	-	-	-	-	986	-
Stage 2	-	-	-	-	715	-

Approach	EB	WB	NB
HCM Control Delay, s	0	4.6	8.9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	986	-	-	1572	-
HCM Lane V/C Ratio	0.056	-	-	0.067	-
HCM Control Delay (s)	8.9	-	-	7.5	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0.2	-

Intersection	
Int Delay, s/veh	8.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	0	14	0	0	51
Future Vol, veh/h	0	0	14	0	0	51
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, %	2	2	2	2	2	2
Mvmt Flow	0	0	16	0	0	57

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	32	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	31	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1622	-	982	1084
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	992	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	972	1084
Mov Cap-2 Maneuver	-	-	-	-	972	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	982	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.2	8.5
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1084	-	-	1622	-
HCM Lane V/C Ratio	0.052	-	-	0.01	-
HCM Control Delay (s)	8.5	-	-	7.2	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.2	-	-	0	-

Intersection	
Int Delay, s/veh	7.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	0	0	64	0	0	34
Future Vol, veh/h	0	0	64	0	0	34
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, %	2	2	2	2	2	2
Mvmt Flow	0	0	71	0	0	38

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1	0	143	1
Stage 1	-	-	-	-	1	-
Stage 2	-	-	-	-	142	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1622	-	850	1084
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	885	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1622	-	813	1084
Mov Cap-2 Maneuver	-	-	-	-	813	-
Stage 1	-	-	-	-	1022	-
Stage 2	-	-	-	-	846	-

Approach	EB	WB	NB
HCM Control Delay, s	0	7.3	8.4
HCM LOS			A

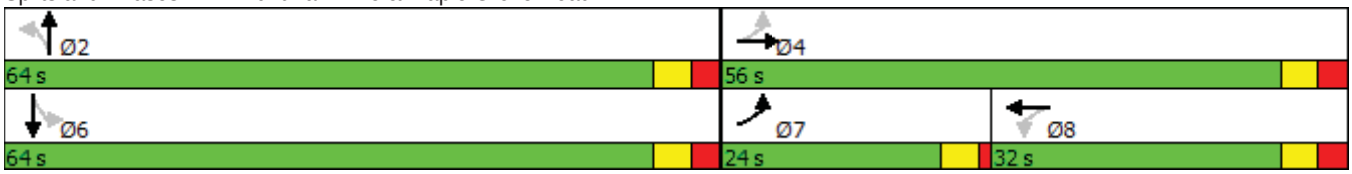
Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	1084	-	-	1622	-
HCM Lane V/C Ratio	0.035	-	-	0.044	-
HCM Control Delay (s)	8.4	-	-	7.3	0
HCM Lane LOS	A	-	-	A	A
HCM 95th %tile Q(veh)	0.1	-	-	0.1	-

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Future Volume (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.952			0.977			0.976	
Flt Protected	0.950				0.989		0.950				0.997	
Satd. Flow (prot)	1658	1691	0	0	1643	0	1658	1705	0	0	1698	0
Flt Permitted	0.509				0.864		0.419				0.797	
Satd. Flow (perm)	888	1691	0	0	1435	0	731	1705	0	0	1357	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			21			10			12	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	271	229	0	0	159	0	38	559	0	0	433	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	9.5	31.1		31.1	31.1		24.1	24.1		24.1	24.1	
Total Split (s)	24.0	56.0		32.0	32.0		64.0	64.0		64.0	64.0	
Total Split (%)	20.0%	46.7%		26.7%	26.7%		53.3%	53.3%		53.3%	53.3%	
Maximum Green (s)	19.5	49.9		25.9	25.9		57.9	57.9		57.9	57.9	
Yellow Time (s)	3.5	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	1.0	2.8		2.8	2.8		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	4.5	6.1			6.1		6.1	6.1			6.1	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	37.9	36.2			14.5		31.7	31.7			31.7	
Actuated g/C Ratio	0.47	0.45			0.18		0.39	0.39			0.39	
v/c Ratio	0.47	0.30			0.58		0.13	0.83			0.80	
Control Delay	19.1	16.9			39.2		17.6	33.5			33.9	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	19.1	16.9			39.2		17.6	33.5			33.9	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B			D		B	C			C	
Approach Delay		18.1			39.2			32.5			33.9	
Approach LOS		B			D			C			C	
Queue Length 50th (m)	22.0	17.5			17.9		3.4	68.0			51.4	
Queue Length 95th (m)	56.5	46.1			44.6		10.1	121.4			97.6	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0					
Base Capacity (vph)	613	1118			504		547	1279			1019	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.44	0.20			0.32		0.07	0.44			0.42	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 81			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 29.2		Intersection LOS: C	
Intersection Capacity Utilization 88.6%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Future Volume (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.952			0.986			0.976			0.961	
Flt Protected	0.950				0.984		0.950				0.997	
Satd. Flow (prot)	1658	1661	0	0	1693	0	1658	1703	0	0	1672	0
Flt Permitted	0.425				0.735		0.241				0.951	
Satd. Flow (perm)	742	1661	0	0	1265	0	421	1703	0	0	1595	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19			5			16			34	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Shared Lane Traffic (%)												
Lane Group Flow (vph)	115	175	0	0	360	0	62	460	0	0	1076	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	31.1	31.1		31.1	31.1		24.1	24.1		24.1	24.1	
Total Split (s)	37.4	37.4		37.4	37.4		82.6	82.6		82.6	82.6	
Total Split (%)	31.2%	31.2%		31.2%	31.2%		68.8%	68.8%		68.8%	68.8%	
Maximum Green (s)	31.3	31.3		31.3	31.3		76.5	76.5		76.5	76.5	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.1	6.1			6.1		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	31.3	31.3			31.3		76.5	76.5			76.5	
Actuated g/C Ratio	0.26	0.26			0.26		0.64	0.64			0.64	
v/c Ratio	0.60	0.39			1.08		0.23	0.42			1.05	
Control Delay	53.3	35.5			114.5		12.0	11.8			63.0	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	53.3	35.5			114.5		12.0	11.8			63.0	

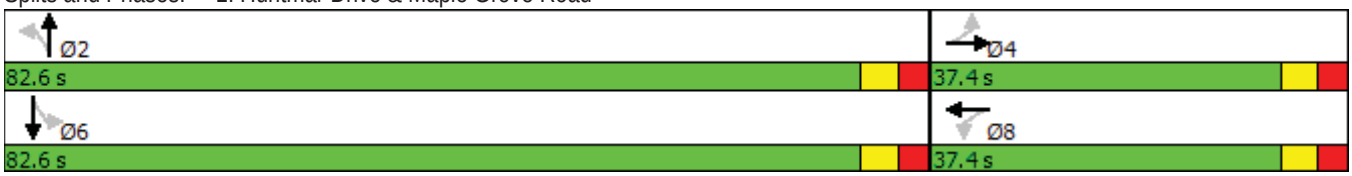
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	D			F		B	B			E	
Approach Delay		42.5			114.5			11.8			63.0	
Approach LOS		D			F			B			E	
Queue Length 50th (m)	21.9	27.8			~86.5		5.3	44.1			~250.9	
Queue Length 95th (m)	41.4	46.8			#140.7		12.2	63.5			#323.9	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0					
Base Capacity (vph)	193	447			333		268	1091			1029	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.60	0.39			1.08		0.23	0.42			1.05	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Natural Cycle: 100			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.08			
Intersection Signal Delay: 56.7		Intersection LOS: E	
Intersection Capacity Utilization 140.1%		ICU Level of Service H	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

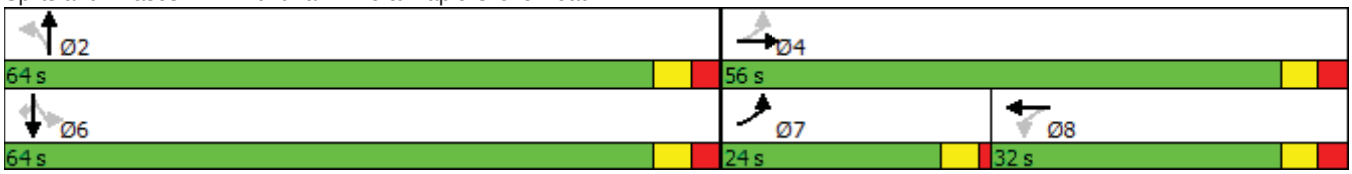


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Future Volume (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.952			0.977				0.850
Flt Protected	0.950				0.989		0.950			0.950		
Satd. Flow (prot)	1658	1691	0	0	1643	0	1658	1705	0	1658	1745	1483
Flt Permitted	0.509				0.864		0.478			0.229		
Satd. Flow (perm)	888	1691	0	0	1435	0	834	1705	0	400	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			21			10				71
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	271	181	48	36	66	57	38	475	84	28	329	76
Shared Lane Traffic (%)												
Lane Group Flow (vph)	271	229	0	0	159	0	38	559	0	28	329	76
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	9.5	31.1		31.1	31.1		24.1	24.1		24.1	24.1	24.1
Total Split (s)	24.0	56.0		32.0	32.0		64.0	64.0		64.0	64.0	64.0
Total Split (%)	20.0%	46.7%		26.7%	26.7%		53.3%	53.3%		53.3%	53.3%	53.3%
Maximum Green (s)	19.5	49.9		25.9	25.9		57.9	57.9		57.9	57.9	57.9
Yellow Time (s)	3.5	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	1.0	2.8		2.8	2.8		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	6.1			6.1		6.1	6.1		6.1	6.1	6.1
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	0
Act Effct Green (s)	37.9	36.2			14.5		31.7	31.7		31.7	31.7	31.7
Actuated g/C Ratio	0.47	0.45			0.18		0.39	0.39		0.39	0.39	0.39
v/c Ratio	0.47	0.30			0.58		0.12	0.83		0.18	0.48	0.12
Control Delay	19.1	16.9			39.2		17.1	33.5		19.9	21.1	5.1
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	19.1	16.9			39.2		17.1	33.5		19.9	21.1	5.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	B	B			D		B	C		B	C	A
Approach Delay		18.1			39.2			32.5			18.2	
Approach LOS		B			D			C			B	
Queue Length 50th (m)	22.0	17.5			17.9		3.3	68.0		2.5	33.8	0.4
Queue Length 95th (m)	56.5	46.1			44.6		10.0	121.4		8.7	62.5	7.6
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0			15.0		30.0
Base Capacity (vph)	613	1118			504		624	1279		299	1306	1128
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.44	0.20			0.32		0.06	0.44		0.09	0.25	0.07

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 81			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 25.2		Intersection LOS: C	
Intersection Capacity Utilization 73.9%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

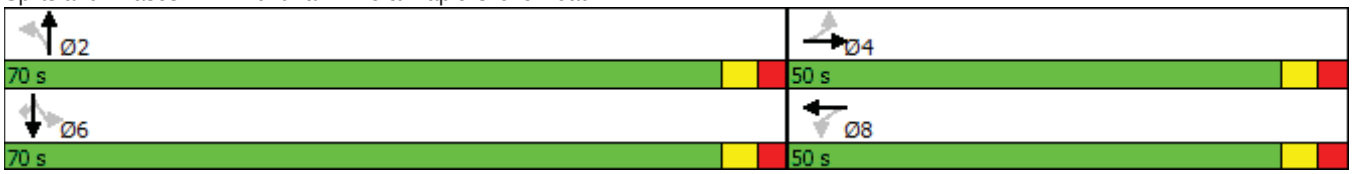


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Future Volume (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	0.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.952			0.986			0.976				0.850
Flt Protected	0.950				0.984		0.950			0.950		
Satd. Flow (prot)	1658	1661	0	0	1693	0	1658	1703	0	1658	1745	1483
Flt Permitted	0.487				0.826		0.211			0.406		
Satd. Flow (perm)	850	1661	0	0	1421	0	368	1703	0	709	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			5			13				151
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	115	119	56	116	207	37	62	385	75	58	704	314
Shared Lane Traffic (%)												
Lane Group Flow (vph)	115	175	0	0	360	0	62	460	0	58	704	314
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	31.1	31.1		31.1	31.1		24.1	24.1		24.1	24.1	24.1
Total Split (s)	50.0	50.0		50.0	50.0		70.0	70.0		70.0	70.0	70.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%		58.3%	58.3%		58.3%	58.3%	58.3%
Maximum Green (s)	43.9	43.9		43.9	43.9		63.9	63.9		63.9	63.9	63.9
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.8	2.8		2.8	2.8		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1			6.1		6.1	6.1		6.1	6.1	6.1
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	0
Act Effct Green (s)	28.8	28.8			28.8		43.2	43.2		43.2	43.2	43.2
Actuated g/C Ratio	0.34	0.34			0.34		0.51	0.51		0.51	0.51	0.51
v/c Ratio	0.40	0.31			0.75		0.34	0.53		0.16	0.80	0.38
Control Delay	29.9	21.9			37.6		20.3	17.1		14.2	26.4	8.5
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	29.9	21.9			37.6		20.3	17.1		14.2	26.4	8.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		C	B		B	C	A
Approach Delay		25.1			37.6			17.5			20.5	
Approach LOS		C			D			B			C	
Queue Length 50th (m)	12.8	16.1			45.6		5.0	41.2		4.3	79.9	12.4
Queue Length 95th (m)	33.6	39.1			97.1		17.4	85.4		13.2	161.2	35.3
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0			15.0		30.0
Base Capacity (vph)	482	952			809		282	1310		544	1340	1173
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.24	0.18			0.44		0.22	0.35		0.11	0.53	0.27

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 85.5			
Natural Cycle: 70			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.80			
Intersection Signal Delay: 23.1		Intersection LOS: C	
Intersection Capacity Utilization 98.6%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	185	34	29	71	14	63
Future Vol, veh/h	185	34	29	71	14	63
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, %	2	2	2	2	2	2
Mvmt Flow	185	34	29	71	14	63

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	219	0	331	202
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	129	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1350	-	664	839
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	897	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1350	-	649	839
Mov Cap-2 Maneuver	-	-	-	-	649	-
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	877	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	797	-	-	1350	-
HCM Lane V/C Ratio	0.097	-	-	0.021	-
HCM Control Delay (s)	10	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	139	28	95	204	38	46
Future Vol, veh/h	139	28	95	204	38	46
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, %	2	2	2	2	2	2
Mvmt Flow	139	28	95	204	38	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	167	0	547	153
Stage 1	-	-	-	-	153	-
Stage 2	-	-	-	-	394	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1411	-	498	893
Stage 1	-	-	-	-	875	-
Stage 2	-	-	-	-	681	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1411	-	460	893
Mov Cap-2 Maneuver	-	-	-	-	460	-
Stage 1	-	-	-	-	875	-
Stage 2	-	-	-	-	629	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.5	11.6
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	626	-	-	1411	-
HCM Lane V/C Ratio	0.134	-	-	0.067	-
HCM Control Delay (s)	11.6	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	112	12	14	41	30	5	2	51	56	4	11
Future Vol, veh/h	6	112	12	14	41	30	5	2	51	56	4	11
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	112	12	14	41	30	5	2	51	56	4	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	71	0	0	124	0	0	222	229	118	241	220	56
Stage 1	-	-	-	-	-	-	130	130	-	84	84	-
Stage 2	-	-	-	-	-	-	92	99	-	157	136	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1529	-	-	1463	-	-	734	671	934	713	678	1011
Stage 1	-	-	-	-	-	-	874	789	-	924	825	-
Stage 2	-	-	-	-	-	-	915	813	-	845	784	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1529	-	-	1463	-	-	715	662	934	665	669	1011
Mov Cap-2 Maneuver	-	-	-	-	-	-	715	662	-	665	669	-
Stage 1	-	-	-	-	-	-	871	786	-	920	817	-
Stage 2	-	-	-	-	-	-	892	805	-	794	781	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.2	9.3	10.7
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	898	1529	-	-	1463	-	-	702
HCM Lane V/C Ratio	0.065	0.004	-	-	0.01	-	-	0.101
HCM Control Delay (s)	9.3	7.4	0	-	7.5	0	-	10.7
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	87	10	64	122	56	14	3	34	46	3	9
Future Vol, veh/h	10	87	10	64	122	56	14	3	34	46	3	9
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	87	10	64	122	56	14	3	34	46	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	178	0	0	97	0	0	396	418	92	409	395	150
Stage 1	-	-	-	-	-	-	112	112	-	278	278	-
Stage 2	-	-	-	-	-	-	284	306	-	131	117	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1398	-	-	1496	-	-	564	526	965	553	542	896
Stage 1	-	-	-	-	-	-	893	803	-	728	680	-
Stage 2	-	-	-	-	-	-	723	662	-	873	799	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1398	-	-	1496	-	-	532	497	965	509	512	896
Mov Cap-2 Maneuver	-	-	-	-	-	-	532	497	-	509	512	-
Stage 1	-	-	-	-	-	-	886	797	-	722	647	-
Stage 2	-	-	-	-	-	-	678	630	-	832	793	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	2	10.1	12.4
HCM LOS			B	B

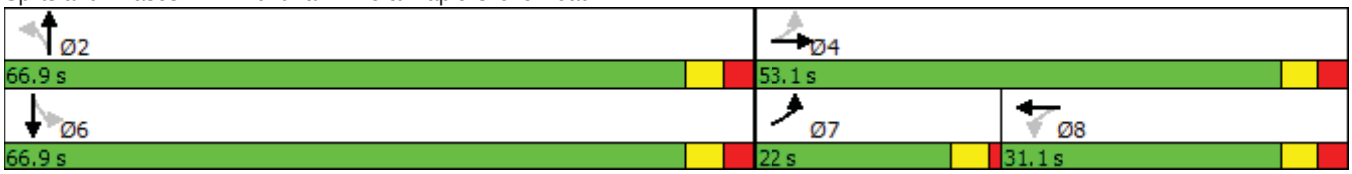
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	755	1398	-	-	1496	-	-	546
HCM Lane V/C Ratio	0.068	0.007	-	-	0.043	-	-	0.106
HCM Control Delay (s)	10.1	7.6	0	-	7.5	0	-	12.4
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1	-	-	0.4

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Future Volume (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	85.0		0.0	40.0		0.0	50.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.968			0.952			0.977			0.977	
Flt Protected	0.950				0.989		0.950				0.997	
Satd. Flow (prot)	1658	1689	0	0	1643	0	1658	1705	0	0	1700	0
Flt Permitted	0.488				0.857		0.405				0.751	
Satd. Flow (perm)	852	1689	0	0	1424	0	707	1705	0	0	1280	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			21			11			12	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	289	245	0	0	170	0	41	611	0	0	471	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	9.5	31.1		31.1	31.1		24.1	24.1		24.1	24.1	
Total Split (s)	22.0	53.1		31.1	31.1		66.9	66.9		66.9	66.9	
Total Split (%)	18.3%	44.3%		25.9%	25.9%		55.8%	55.8%		55.8%	55.8%	
Maximum Green (s)	17.5	47.0		25.0	25.0		60.8	60.8		60.8	60.8	
Yellow Time (s)	3.5	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	1.0	2.8		2.8	2.8		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	4.5	6.1			6.1		6.1	6.1			6.1	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	38.5	36.8			15.5		36.2	36.2			36.2	
Actuated g/C Ratio	0.45	0.43			0.18		0.42	0.42			0.42	
v/c Ratio	0.54	0.34			0.62		0.14	0.85			0.86	
Control Delay	23.1	19.7			42.5		16.7	33.7			39.1	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	23.1	19.7			42.5		16.7	33.7			39.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	B			D		B	C			D	
Approach Delay		21.6			42.5			32.7			39.1	
Approach LOS		C			D			C			D	
Queue Length 50th (m)	27.8	22.2			20.9		3.6	77.6			60.1	
Queue Length 95th (m)	66.2	54.3			49.9		10.5	136.7			114.3	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	85.0						50.0					
Base Capacity (vph)	556	990			456		523	1264			950	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.52	0.25			0.37		0.08	0.48			0.50	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 86			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 32.0		Intersection LOS: C	
Intersection Capacity Utilization 94.9%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Future Volume (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	85.0		0.0	40.0		0.0	50.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.951			0.986			0.975			0.961	
Flt Protected	0.950				0.984		0.950				0.997	
Satd. Flow (prot)	1658	1660	0	0	1693	0	1658	1701	0	0	1672	0
Flt Permitted	0.422				0.719		0.215				0.948	
Satd. Flow (perm)	736	1660	0	0	1237	0	375	1701	0	0	1590	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			5			16			32	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Shared Lane Traffic (%)												
Lane Group Flow (vph)	121	187	0	0	387	0	67	502	0	0	1165	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	31.1	31.1		31.1	31.1		24.1	24.1		24.1	24.1	
Total Split (s)	39.0	39.0		39.0	39.0		81.0	81.0		81.0	81.0	
Total Split (%)	32.5%	32.5%		32.5%	32.5%		67.5%	67.5%		67.5%	67.5%	
Maximum Green (s)	32.9	32.9		32.9	32.9		74.9	74.9		74.9	74.9	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.1	6.1			6.1		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	32.9	32.9			32.9		74.9	74.9			74.9	
Actuated g/C Ratio	0.27	0.27			0.27		0.62	0.62			0.62	
v/c Ratio	0.60	0.40			1.13		0.29	0.47			1.16	
Control Delay	52.2	34.6			129.1		14.3	13.3			106.8	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	52.2	34.6			129.1		14.3	13.3			106.8	

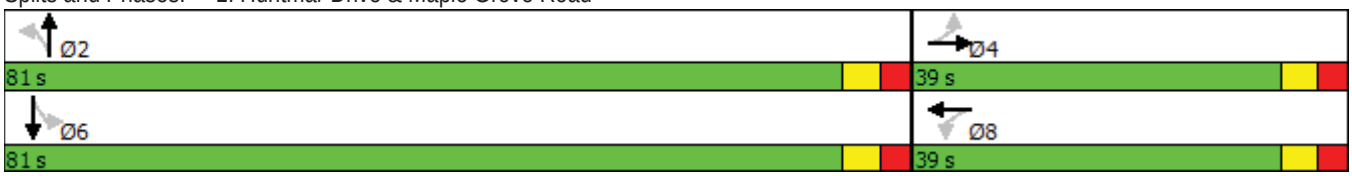
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	C			F		B	B			F	
Approach Delay		41.5			129.1			13.5			106.8	
Approach LOS		D			F			B			F	
Queue Length 50th (m)	22.8	29.4			~96.8		6.2	52.1			~297.5	
Queue Length 95th (m)	42.7	48.8			#152.3		14.6	74.7			#371.5	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	85.0						50.0					
Base Capacity (vph)	201	469			342		234	1067			1004	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.60	0.40			1.13		0.29	0.47			1.16	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Natural Cycle: 110			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.16			
Intersection Signal Delay: 80.2		Intersection LOS: F	
Intersection Capacity Utilization 149.9%		ICU Level of Service H	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

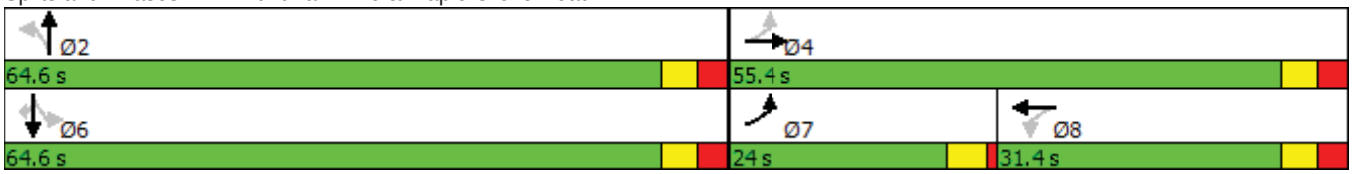


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Future Volume (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	85.0		0.0	40.0		0.0	50.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.968			0.952			0.977				0.850
Flt Protected	0.950				0.989		0.950			0.950		
Satd. Flow (prot)	1658	1689	0	0	1643	0	1658	1705	0	1658	1745	1483
Flt Permitted	0.485				0.857		0.448			0.196		
Satd. Flow (perm)	846	1689	0	0	1424	0	782	1705	0	342	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			21			10				69
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	289	193	52	39	70	61	41	519	92	31	360	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	289	245	0	0	170	0	41	611	0	31	360	80
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	9.5	31.1		31.1	31.1		24.1	24.1		24.1	24.1	24.1
Total Split (s)	24.0	55.4		31.4	31.4		64.6	64.6		64.6	64.6	64.6
Total Split (%)	20.0%	46.2%		26.2%	26.2%		53.8%	53.8%		53.8%	53.8%	53.8%
Maximum Green (s)	19.5	49.3		25.3	25.3		58.5	58.5		58.5	58.5	58.5
Yellow Time (s)	3.5	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	1.0	2.8		2.8	2.8		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	4.5	6.1			6.1		6.1	6.1		6.1	6.1	6.1
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	0
Act Effct Green (s)	39.9	38.2			15.7		36.2	36.2		36.2	36.2	36.2
Actuated g/C Ratio	0.46	0.44			0.18		0.41	0.41		0.41	0.41	0.41
v/c Ratio	0.53	0.33			0.62		0.13	0.86		0.22	0.50	0.12
Control Delay	22.2	19.1			43.2		17.3	36.1		21.6	21.5	5.7
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	22.2	19.1			43.2		17.3	36.1		21.6	21.5	5.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	B			D		B	D		C	C	A
Approach Delay		20.8			43.2			34.9			18.8	
Approach LOS		C			D			C			B	
Queue Length 50th (m)	28.0	22.2			21.7		3.8	81.6		3.0	39.7	1.0
Queue Length 95th (m)	64.3	52.6			49.6		10.8	142.7		10.0	71.2	8.6
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	85.0						50.0			15.0		30.0
Base Capacity (vph)	579	1024			455		554	1212		242	1237	1072
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.50	0.24			0.37		0.07	0.50		0.13	0.29	0.07

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 87.4			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 27.4		Intersection LOS: C	
Intersection Capacity Utilization 78.2%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



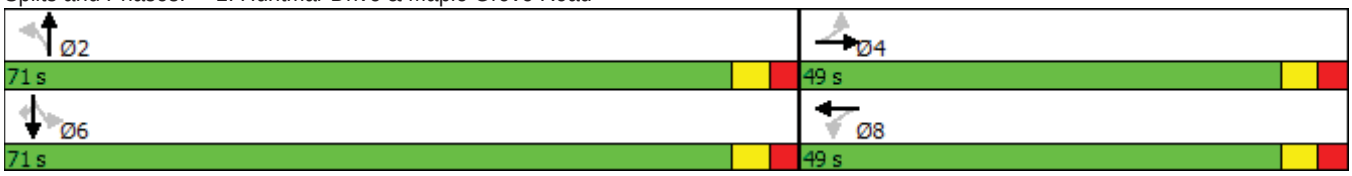
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Future Volume (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	85.0		0.0	40.0		0.0	50.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.951			0.986			0.975				0.850
Flt Protected	0.950				0.984		0.950			0.950		
Satd. Flow (prot)	1658	1660	0	0	1693	0	1658	1701	0	1658	1745	1483
Flt Permitted	0.468				0.791		0.166			0.369		
Satd. Flow (perm)	817	1660	0	0	1361	0	290	1701	0	644	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			5			13				150
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	121	126	61	127	221	39	67	420	82	61	769	335
Shared Lane Traffic (%)												
Lane Group Flow (vph)	121	187	0	0	387	0	67	502	0	61	769	335
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	31.1	31.1		31.1	31.1		24.1	24.1		24.1	24.1	24.1
Total Split (s)	49.0	49.0		49.0	49.0		71.0	71.0		71.0	71.0	71.0
Total Split (%)	40.8%	40.8%		40.8%	40.8%		59.2%	59.2%		59.2%	59.2%	59.2%
Maximum Green (s)	42.9	42.9		42.9	42.9		64.9	64.9		64.9	64.9	64.9
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.8	2.8		2.8	2.8		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.1	6.1			6.1		6.1	6.1		6.1	6.1	6.1
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	0
Act Effct Green (s)	33.4	33.4			33.4		50.1	50.1		50.1	50.1	50.1
Actuated g/C Ratio	0.35	0.35			0.35		0.52	0.52		0.52	0.52	0.52
v/c Ratio	0.43	0.32			0.82		0.45	0.57		0.18	0.85	0.40
Control Delay	33.0	23.9			45.9		27.7	18.8		15.2	31.3	9.3
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	33.0	23.9			45.9		27.7	18.8		15.2	31.3	9.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		C	B		B	C	A
Approach Delay		27.5			45.9			19.9			24.1	
Approach LOS		C			D			B			C	
Queue Length 50th (m)	16.9	21.7			63.6		7.3	58.0		5.7	115.2	17.8
Queue Length 95th (m)	36.1	42.2			#118.1		21.6	94.3		13.8	184.7	38.7
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	85.0						50.0			15.0		30.0
Base Capacity (vph)	390	805			653		203	1195		451	1222	1084
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.31	0.23			0.59		0.33	0.42		0.14	0.63	0.31

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 96.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 27.0 Intersection LOS: C
Intersection Capacity Utilization 104.5% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Intersection	
Int Delay, s/veh	2.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	185	34	29	71	14	63
Future Vol, veh/h	185	34	29	71	14	63
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, %	2	2	2	2	2	2
Mvmt Flow	185	34	29	71	14	63

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	219	0	331	202
Stage 1	-	-	-	-	202	-
Stage 2	-	-	-	-	129	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1350	-	664	839
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	897	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1350	-	649	839
Mov Cap-2 Maneuver	-	-	-	-	649	-
Stage 1	-	-	-	-	832	-
Stage 2	-	-	-	-	877	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	10
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	797	-	-	1350	-
HCM Lane V/C Ratio	0.097	-	-	0.021	-
HCM Control Delay (s)	10	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	3.2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	136	29	95	225	44	46
Future Vol, veh/h	136	29	95	225	44	46
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, %	2	2	2	2	2	2
Mvmt Flow	136	29	95	225	44	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	165	0	566	151
Stage 1	-	-	-	-	151	-
Stage 2	-	-	-	-	415	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1413	-	486	895
Stage 1	-	-	-	-	877	-
Stage 2	-	-	-	-	666	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1413	-	449	895
Mov Cap-2 Maneuver	-	-	-	-	449	-
Stage 1	-	-	-	-	877	-
Stage 2	-	-	-	-	615	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.3	12
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	602	-	-	1413	-
HCM Lane V/C Ratio	0.15	-	-	0.067	-
HCM Control Delay (s)	12	-	-	7.7	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	112	12	14	41	30	5	2	51	56	4	11
Future Vol, veh/h	6	112	12	14	41	30	5	2	51	56	4	11
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	112	12	14	41	30	5	2	51	56	4	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	71	0	0	124	0	0	222	229	118	241	220	56
Stage 1	-	-	-	-	-	-	130	130	-	84	84	-
Stage 2	-	-	-	-	-	-	92	99	-	157	136	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1529	-	-	1463	-	-	734	671	934	713	678	1011
Stage 1	-	-	-	-	-	-	874	789	-	924	825	-
Stage 2	-	-	-	-	-	-	915	813	-	845	784	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1529	-	-	1463	-	-	715	662	934	665	669	1011
Mov Cap-2 Maneuver	-	-	-	-	-	-	715	662	-	665	669	-
Stage 1	-	-	-	-	-	-	871	786	-	920	817	-
Stage 2	-	-	-	-	-	-	892	805	-	794	781	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.2	9.3	10.7
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	898	1529	-	-	1463	-	-	702
HCM Lane V/C Ratio	0.065	0.004	-	-	0.01	-	-	0.101
HCM Control Delay (s)	9.3	7.4	0	-	7.5	0	-	10.7
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	87	10	64	122	56	14	3	14	46	3	9
Future Vol, veh/h	10	87	10	64	122	56	14	3	14	46	3	9
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	87	10	64	122	56	14	3	14	46	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	178	0	0	97	0	0	396	418	92	399	395	150
Stage 1	-	-	-	-	-	-	112	112	-	278	278	-
Stage 2	-	-	-	-	-	-	284	306	-	121	117	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1398	-	-	1496	-	-	564	526	965	561	542	896
Stage 1	-	-	-	-	-	-	893	803	-	728	680	-
Stage 2	-	-	-	-	-	-	723	662	-	883	799	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1398	-	-	1496	-	-	532	497	965	527	512	896
Mov Cap-2 Maneuver	-	-	-	-	-	-	532	497	-	527	512	-
Stage 1	-	-	-	-	-	-	886	797	-	722	647	-
Stage 2	-	-	-	-	-	-	678	630	-	860	793	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	2	10.7	12.1
HCM LOS			B	B

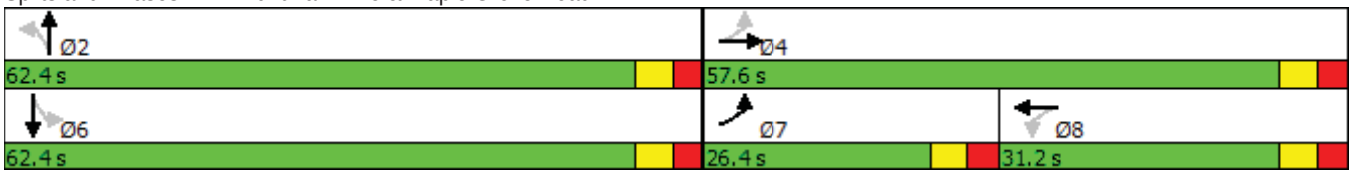
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	662	1398	-	-	1496	-	-	562
HCM Lane V/C Ratio	0.047	0.007	-	-	0.043	-	-	0.103
HCM Control Delay (s)	10.7	7.6	0	-	7.5	0	-	12.1
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.1	0	-	-	0.1	-	-	0.3

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Future Volume (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	15.0		0.0	15.0		40.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.953			0.977			0.974	
Flt Protected	0.950				0.989		0.950				0.997	
Satd. Flow (prot)	1658	1691	0	0	1645	0	1658	1705	0	0	1695	0
Flt Permitted	0.465				0.865		0.403				0.770	
Satd. Flow (perm)	811	1691	0	0	1439	0	703	1705	0	0	1309	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			20			10			13	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	287	241	0	0	165	0	39	559	0	0	441	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	11.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	
Total Split (s)	26.4	57.6		31.2	31.2		62.4	62.4		62.4	62.4	
Total Split (%)	22.0%	48.0%		26.0%	26.0%		52.0%	52.0%		52.0%	52.0%	
Maximum Green (s)	20.2	51.4		25.0	25.0		56.3	56.3		56.3	56.3	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	39.8	39.8			15.2		33.4	33.4			33.4	
Actuated g/C Ratio	0.46	0.46			0.18		0.39	0.39			0.39	
v/c Ratio	0.52	0.31			0.61		0.14	0.84			0.86	
Control Delay	21.4	17.3			42.7		19.1	36.1			41.1	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	21.4	17.3			42.7		19.1	36.1			41.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	B			D		B	D			D	
Approach Delay		19.5			42.7			35.0			41.1	
Approach LOS		B			D			C			D	
Queue Length 50th (m)	25.9	19.5			20.3		3.7	73.8			58.3	
Queue Length 95th (m)	63.3	50.1			48.6		10.9	128.4			108.9	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0					
Base Capacity (vph)	585	1079			458		489	1189			915	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.49	0.22			0.36		0.08	0.47			0.48	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 86.3			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.86			
Intersection Signal Delay: 32.6		Intersection LOS: C	
Intersection Capacity Utilization 90.6%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Future Volume (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.954			0.986			0.976			0.959	
Flt Protected	0.950				0.985		0.950				0.997	
Satd. Flow (prot)	1658	1665	0	0	1695	0	1658	1703	0	0	1669	0
Flt Permitted	0.421				0.729		0.235				0.951	
Satd. Flow (perm)	735	1665	0	0	1254	0	410	1703	0	0	1592	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			5			16			35	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Shared Lane Traffic (%)												
Lane Group Flow (vph)	128	184	0	0	370	0	64	460	0	0	1091	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	31.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	
Total Split (s)	38.4	38.4		38.4	38.4		81.6	81.6		81.6	81.6	
Total Split (%)	32.0%	32.0%		32.0%	32.0%		68.0%	68.0%		68.0%	68.0%	
Maximum Green (s)	32.2	32.2		32.2	32.2		75.5	75.5		75.5	75.5	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	32.2	32.2			32.2		75.5	75.5			75.5	
Actuated g/C Ratio	0.27	0.27			0.27		0.63	0.63			0.63	
v/c Ratio	0.65	0.40			1.09		0.25	0.43			1.08	
Control Delay	56.1	35.4			115.8		12.9	12.3			73.8	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	56.1	35.4			115.8		12.9	12.3			73.8	

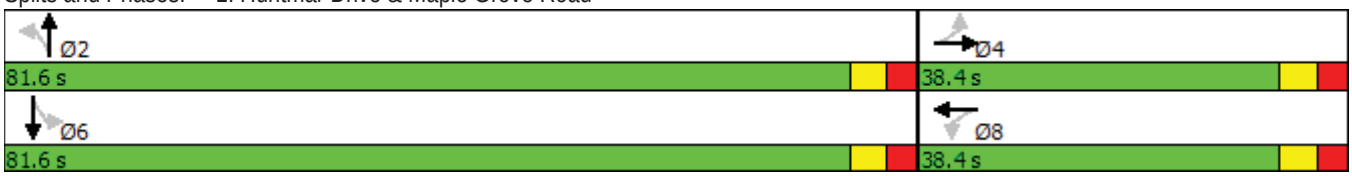
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	D			F		B	B			E	
Approach Delay		43.9			115.8			12.4			73.8	
Approach LOS		D			F			B			E	
Queue Length 50th (m)	24.7	29.5			~89.6		5.7	45.3			~261.0	
Queue Length 95th (m)	#48.9	48.7			#144.2		13.0	65.2			#334.0	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0					
Base Capacity (vph)	197	459			340		257	1077			1014	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.65	0.40			1.09		0.25	0.43			1.08	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Natural Cycle: 100			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.09			
Intersection Signal Delay: 62.5		Intersection LOS: E	
Intersection Capacity Utilization 142.3%		ICU Level of Service H	
Analysis Period (min) 15			

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



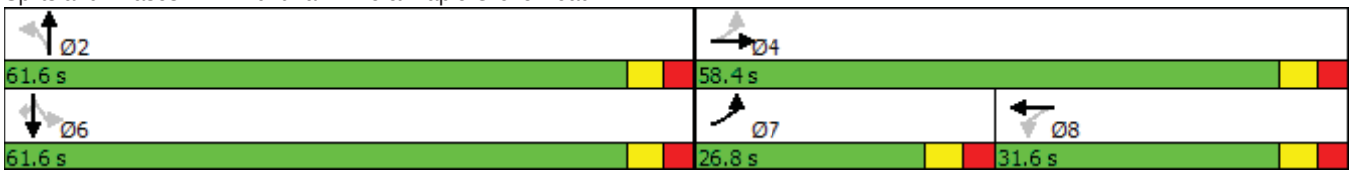
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Future Volume (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	15.0		0.0	15.0		40.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.953			0.977				0.850
Flt Protected	0.950				0.989		0.950			0.950		
Satd. Flow (prot)	1658	1691	0	0	1645	0	1658	1705	0	1658	1745	1483
Flt Permitted	0.465				0.865		0.467			0.216		
Satd. Flow (perm)	811	1691	0	0	1439	0	815	1705	0	377	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			20			10				85
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	287	191	50	36	72	57	39	475	84	28	329	84
Shared Lane Traffic (%)												
Lane Group Flow (vph)	287	241	0	0	165	0	39	559	0	28	329	84
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	24.1
Total Split (s)	26.8	58.4		31.6	31.6		61.6	61.6		61.6	61.6	61.6
Total Split (%)	22.3%	48.7%		26.3%	26.3%		51.3%	51.3%		51.3%	51.3%	51.3%
Maximum Green (s)	20.6	52.2		25.4	25.4		55.5	55.5		55.5	55.5	55.5
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1		6.1	6.1	6.1
Lead/Lag	Lead			Lag	Lag							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	0
Act Effct Green (s)	40.0	40.0			15.2		33.2	33.2		33.2	33.2	33.2
Actuated g/C Ratio	0.46	0.46			0.18		0.38	0.38		0.38	0.38	0.38
v/c Ratio	0.52	0.31			0.61		0.12	0.84		0.19	0.49	0.14
Control Delay	21.1	17.1			42.8		18.7	36.7		22.1	22.9	4.5
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	21.1	17.1			42.8		18.7	36.7		22.1	22.9	4.5

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	B			D		B	D		C	C	A
Approach Delay		19.3			42.8			35.5			19.3	
Approach LOS		B			D			D			B	
Queue Length 50th (m)	25.9	19.5			20.5		3.7	74.5		2.8	37.1	0.0
Queue Length 95th (m)	62.6	49.4			48.4		10.7	129.4		9.3	66.6	7.6
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						15.0			15.0		40.0
Base Capacity (vph)	591	1095			465		558	1171		258	1196	1043
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.49	0.22			0.35		0.07	0.48		0.11	0.28	0.08

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 86.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 27.1 — Intersection LOS: C
Intersection Capacity Utilization 76.2% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

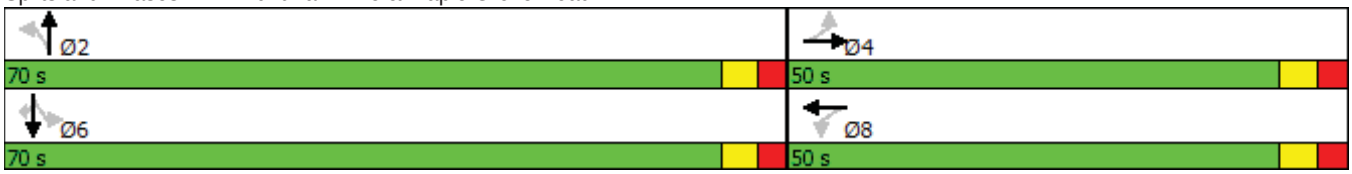


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Future Volume (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.954			0.986			0.976				0.850
Flt Protected	0.950				0.985		0.950			0.950		
Satd. Flow (prot)	1658	1665	0	0	1695	0	1658	1703	0	1658	1745	1483
Flt Permitted	0.480				0.820		0.208			0.403		
Satd. Flow (perm)	838	1665	0	0	1411	0	363	1703	0	703	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			5			13				159
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	128	127	57	116	217	37	64	385	75	58	704	329
Shared Lane Traffic (%)												
Lane Group Flow (vph)	128	184	0	0	370	0	64	460	0	58	704	329
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	31.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	24.1
Total Split (s)	50.0	50.0		50.0	50.0		70.0	70.0		70.0	70.0	70.0
Total Split (%)	41.7%	41.7%		41.7%	41.7%		58.3%	58.3%		58.3%	58.3%	58.3%
Maximum Green (s)	43.8	43.8		43.8	43.8		63.9	63.9		63.9	63.9	63.9
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1		6.1	6.1	6.1
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	0
Act Effct Green (s)	30.0	30.0			30.0		44.1	44.1		44.1	44.1	44.1
Actuated g/C Ratio	0.34	0.34			0.34		0.50	0.50		0.50	0.50	0.50
v/c Ratio	0.45	0.32			0.76		0.35	0.53		0.16	0.80	0.40
Control Delay	31.4	22.5			38.8		21.4	17.6		14.6	27.1	8.7
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	31.4	22.5			38.8		21.4	17.6		14.6	27.1	8.7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		C	B		B	C	A
Approach Delay		26.1			38.8			18.0			20.9	
Approach LOS		C			D			B			C	
Queue Length 50th (m)	14.9	17.8			48.7		5.5	43.3		4.5	83.9	13.6
Queue Length 95th (m)	37.5	41.3			101.1		17.9	85.4		13.3	161.2	36.9
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0			15.0		30.0
Base Capacity (vph)	461	926			779		273	1284		528	1312	1155
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.28	0.20			0.47		0.23	0.36		0.11	0.54	0.28

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 87.6			
Natural Cycle: 70			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.80			
Intersection Signal Delay: 23.8		Intersection LOS: C	
Intersection Capacity Utilization 99.9%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Intersection	
Int Delay, s/veh	2.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	212	38	29	86	16	63
Future Vol, veh/h	212	38	29	86	16	63
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, %	2	2	2	2	2	2
Mvmt Flow	212	38	29	86	16	63

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	250	0	375	231
Stage 1	-	-	-	-	231	-
Stage 2	-	-	-	-	144	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1316	-	626	808
Stage 1	-	-	-	-	807	-
Stage 2	-	-	-	-	883	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1316	-	612	808
Mov Cap-2 Maneuver	-	-	-	-	612	-
Stage 1	-	-	-	-	807	-
Stage 2	-	-	-	-	863	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2	10.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	759	-	-	1316	-
HCM Lane V/C Ratio	0.104	-	-	0.022	-
HCM Control Delay (s)	10.3	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	161	31	95	231	42	46
Future Vol, veh/h	161	31	95	231	42	46
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, %	2	2	2	2	2	2
Mvmt Flow	161	31	95	231	42	46

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	192	0	598	177
Stage 1	-	-	-	-	177	-
Stage 2	-	-	-	-	421	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1381	-	465	866
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	662	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1381	-	428	866
Mov Cap-2 Maneuver	-	-	-	-	428	-
Stage 1	-	-	-	-	854	-
Stage 2	-	-	-	-	610	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.3	12.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	582	-	-	1381	-
HCM Lane V/C Ratio	0.151	-	-	0.069	-
HCM Control Delay (s)	12.3	-	-	7.8	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.5	-	-	0.2	-

Intersection	
Int Delay, s/veh	4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	120	13	16	48	30	5	2	52	56	4	11
Future Vol, veh/h	6	120	13	16	48	30	5	2	52	56	4	11
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	120	13	16	48	30	5	2	52	56	4	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	78	0	0	133	0	0	242	249	127	261	240	63
Stage 1	-	-	-	-	-	-	139	139	-	95	95	-
Stage 2	-	-	-	-	-	-	103	110	-	166	145	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1520	-	-	1452	-	-	712	654	923	692	661	1002
Stage 1	-	-	-	-	-	-	864	782	-	912	816	-
Stage 2	-	-	-	-	-	-	903	804	-	836	777	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1520	-	-	1452	-	-	692	644	923	644	650	1002
Mov Cap-2 Maneuver	-	-	-	-	-	-	692	644	-	644	650	-
Stage 1	-	-	-	-	-	-	861	779	-	908	806	-
Stage 2	-	-	-	-	-	-	878	794	-	784	774	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.3	9.4	10.9
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	885	1520	-	-	1452	-	-	682
HCM Lane V/C Ratio	0.067	0.004	-	-	0.011	-	-	0.104
HCM Control Delay (s)	9.4	7.4	0	-	7.5	0	-	10.9
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.3

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	95	10	65	132	56	14	3	36	46	3	9
Future Vol, veh/h	10	95	10	65	132	56	14	3	36	46	3	9
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	95	10	65	132	56	14	3	36	46	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	188	0	0	105	0	0	416	438	100	430	415	160
Stage 1	-	-	-	-	-	-	120	120	-	290	290	-
Stage 2	-	-	-	-	-	-	296	318	-	140	125	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1386	-	-	1486	-	-	547	512	956	535	528	885
Stage 1	-	-	-	-	-	-	884	796	-	718	672	-
Stage 2	-	-	-	-	-	-	712	654	-	863	792	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1386	-	-	1486	-	-	516	483	956	490	498	885
Mov Cap-2 Maneuver	-	-	-	-	-	-	516	483	-	490	498	-
Stage 1	-	-	-	-	-	-	877	790	-	712	639	-
Stage 2	-	-	-	-	-	-	667	622	-	821	786	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.7	1.9	10.2	12.7
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	746	1386	-	-	1486	-	-	527
HCM Lane V/C Ratio	0.071	0.007	-	-	0.044	-	-	0.11
HCM Control Delay (s)	10.2	7.6	0	-	7.5	0	-	12.7
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0.1	-	-	0.4

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	226	88	14	24	6
Future Vol, veh/h	3	226	88	14	24	6
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, %	2	2	2	2	2	2
Mvmt Flow	3	226	88	14	24	6

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	102	0	-	0	327	95
Stage 1	-	-	-	-	95	-
Stage 2	-	-	-	-	232	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1490	-	-	-	667	962
Stage 1	-	-	-	-	929	-
Stage 2	-	-	-	-	807	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1490	-	-	-	666	962
Mov Cap-2 Maneuver	-	-	-	-	666	-
Stage 1	-	-	-	-	929	-
Stage 2	-	-	-	-	805	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1490	-	-	-	710
HCM Lane V/C Ratio	0.002	-	-	-	0.042
HCM Control Delay (s)	7.4	0	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	171	249	24	21	5
Future Vol, veh/h	6	171	249	24	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, %	2	2	2	2	2	2
Mvmt Flow	6	171	249	24	21	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	273	0	-	0	444	261
Stage 1	-	-	-	-	261	-
Stage 2	-	-	-	-	183	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1290	-	-	-	571	778
Stage 1	-	-	-	-	783	-
Stage 2	-	-	-	-	848	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1290	-	-	-	568	778
Mov Cap-2 Maneuver	-	-	-	-	568	-
Stage 1	-	-	-	-	783	-
Stage 2	-	-	-	-	844	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	11.3
HCM LOS			B

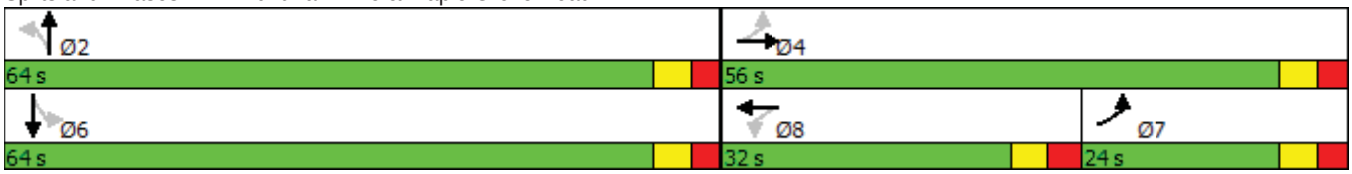
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1290	-	-	-	599
HCM Lane V/C Ratio	0.005	-	-	-	0.043
HCM Control Delay (s)	7.8	0	-	-	11.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Future Volume (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.956			0.977			0.971	
Flt Protected	0.950				0.990		0.950				0.997	
Satd. Flow (prot)	1658	1691	0	0	1652	0	1658	1705	0	0	1689	0
Flt Permitted	0.575				0.749		0.388				0.759	
Satd. Flow (perm)	1003	1691	0	0	1250	0	677	1705	0	0	1286	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		13			19			10			16	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Shared Lane Traffic (%)												
Lane Group Flow (vph)	359	297	0	0	186	0	44	611	0	0	496	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	7	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	11.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	
Total Split (s)	24.0	56.0		32.0	32.0		64.0	64.0		64.0	64.0	
Total Split (%)	20.0%	46.7%		26.7%	26.7%		53.3%	53.3%		53.3%	53.3%	
Maximum Green (s)	17.8	49.8		25.8	25.8		57.9	57.9		57.9	57.9	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag	Lag			Lead	Lead							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	39.7	39.7			18.5		39.6	39.6			39.6	
Actuated g/C Ratio	0.43	0.43			0.20		0.43	0.43			0.43	
v/c Ratio	0.67	0.41			0.70		0.15	0.83			0.89	
Control Delay	33.2	21.1			49.0		18.8	34.6			43.6	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	33.2	21.1			49.0		18.8	34.6			43.6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		B	C			D	
Approach Delay		27.7			49.0			33.5			43.6	
Approach LOS		C			D			C			D	
Queue Length 50th (m)	41.9	31.3			26.3		4.4	87.9			73.1	
Queue Length 95th (m)	83.6	64.6			56.8		11.9	144.3			129.8	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0					
Base Capacity (vph)	614	979			386		453	1145			866	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.58	0.30			0.48		0.10	0.53			0.57	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 92.4			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.89			
Intersection Signal Delay: 35.6		Intersection LOS: D	
Intersection Capacity Utilization 101.8%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



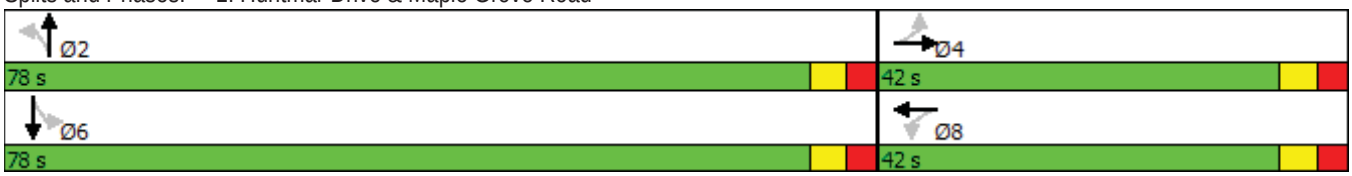
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Future Volume (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	0		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.955			0.988			0.975			0.956	
Flt Protected	0.950				0.986		0.950				0.998	
Satd. Flow (prot)	1658	1667	0	0	1700	0	1658	1701	0	0	1665	0
Flt Permitted	0.397				0.691		0.191				0.950	
Satd. Flow (perm)	693	1667	0	0	1191	0	333	1701	0	0	1585	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			4			15			37	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Shared Lane Traffic (%)												
Lane Group Flow (vph)	169	223	0	0	432	0	76	502	0	0	1237	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	31.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	
Total Split (s)	42.0	42.0		42.0	42.0		78.0	78.0		78.0	78.0	
Total Split (%)	35.0%	35.0%		35.0%	35.0%		65.0%	65.0%		65.0%	65.0%	
Maximum Green (s)	35.8	35.8		35.8	35.8		71.9	71.9		71.9	71.9	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)	35.8	35.8			35.8		71.9	71.9			71.9	
Actuated g/C Ratio	0.30	0.30			0.30		0.60	0.60			0.60	
v/c Ratio	0.82	0.44			1.21		0.38	0.49			1.28	
Control Delay	70.2	34.3			153.7		19.5	15.2			159.8	
Queue Delay	0.0	0.0			0.0		0.0	0.0			0.0	
Total Delay	70.2	34.3			153.7		19.5	15.2			159.8	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	C			F		B	B			F	
Approach Delay		49.8			153.7			15.8			159.8	
Approach LOS		D			F			B			F	
Queue Length 50th (m)	34.0	35.8			~114.1		8.1	56.3			~339.3	
Queue Length 95th (m)	#69.3	57.1			#171.4		19.8	80.6			#413.6	
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0					
Base Capacity (vph)	206	509			358		199	1025			964	
Starvation Cap Reductn	0	0			0		0	0			0	
Spillback Cap Reductn	0	0			0		0	0			0	
Storage Cap Reductn	0	0			0		0	0			0	
Reduced v/c Ratio	0.82	0.44			1.21		0.38	0.49			1.28	

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 120
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.28
Intersection Signal Delay: 110.9 Intersection LOS: F
Intersection Capacity Utilization 159.2% ICU Level of Service H
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

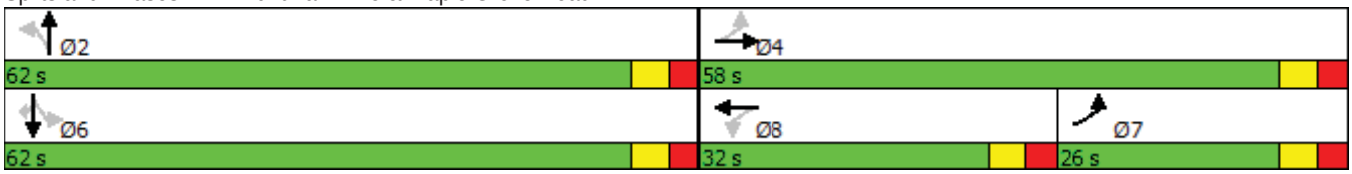


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Future Volume (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.969			0.956			0.977				0.850
Flt Protected	0.950				0.990		0.950			0.950		
Satd. Flow (prot)	1658	1691	0	0	1652	0	1658	1705	0	1658	1745	1483
Flt Permitted	0.574				0.750		0.448			0.202		
Satd. Flow (perm)	1002	1691	0	0	1251	0	782	1705	0	353	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			19			10				87
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	359	236	61	39	86	61	44	519	92	31	360	105
Shared Lane Traffic (%)												
Lane Group Flow (vph)	359	297	0	0	186	0	44	611	0	31	360	105
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	7	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	11.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	24.1
Total Split (s)	26.0	58.0		32.0	32.0		62.0	62.0		62.0	62.0	62.0
Total Split (%)	21.7%	48.3%		26.7%	26.7%		51.7%	51.7%		51.7%	51.7%	51.7%
Maximum Green (s)	19.8	51.8		25.8	25.8		55.9	55.9		55.9	55.9	55.9
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1		6.1	6.1	6.1
Lead/Lag	Lag			Lead	Lead							
Lead-Lag Optimize?	Yes			Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)		7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)		18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	0
Act Effct Green (s)	40.1	40.1			18.3		39.0	39.0		39.0	39.0	39.0
Actuated g/C Ratio	0.43	0.43			0.20		0.42	0.42		0.42	0.42	0.42
v/c Ratio	0.66	0.40			0.71		0.13	0.84		0.21	0.49	0.16
Control Delay	31.9	20.4			49.7		19.0	36.1		22.8	22.7	6.2
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	31.9	20.4			49.7		19.0	36.1		22.8	22.7	6.2

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	C	C			D		B	D		C	C	A
Approach Delay		26.7			49.7			35.0			19.2	
Approach LOS		C			D			C			B	
Queue Length 50th (m)	41.4	30.8			26.1		4.4	87.2		3.2	42.3	1.7
Queue Length 95th (m)	81.0	62.4			56.8		12.1	149.4		10.4	74.4	10.8
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0			15.0		30.0
Base Capacity (vph)	651	1020			387		506	1107		228	1129	991
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.55	0.29			0.48		0.09	0.55		0.14	0.32	0.11

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 92.3			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.84			
Intersection Signal Delay: 29.7		Intersection LOS: C	
Intersection Capacity Utilization 86.0%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 1: Huntmar Drive & Maple Grove Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Future Volume (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	135.0		0.0	30.0		0.0	25.0		0.0	15.0		30.0
Storage Lanes	1		0	0		0	1		0	1		1
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. 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
Frt		0.955			0.988			0.975				0.850
Flt Protected	0.950				0.986		0.950			0.950		
Satd. Flow (prot)	1658	1667	0	0	1700	0	1658	1701	0	1658	1745	1483
Flt Permitted	0.442				0.759		0.144			0.353		
Satd. Flow (perm)	771	1667	0	0	1309	0	251	1701	0	616	1745	1483
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			5			12				172
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		544.6			345.6			287.4			249.0	
Travel Time (s)		39.2			24.9			20.7			17.9	
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
Adj. Flow (vph)	169	156	67	127	266	39	76	420	82	61	769	407
Shared Lane Traffic (%)												
Lane Group Flow (vph)	169	223	0	0	432	0	76	502	0	61	769	407
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Detector Phase	4	4		8	8		2	2		6	6	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	31.2	31.2		31.2	31.2		24.1	24.1		24.1	24.1	24.1
Total Split (s)	52.4	52.4		52.4	52.4		67.6	67.6		67.6	67.6	67.6
Total Split (%)	43.7%	43.7%		43.7%	43.7%		56.3%	56.3%		56.3%	56.3%	56.3%
Maximum Green (s)	46.2	46.2		46.2	46.2		61.5	61.5		61.5	61.5	61.5
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	3.3
All-Red Time (s)	2.9	2.9		2.9	2.9		2.8	2.8		2.8	2.8	2.8
Lost Time Adjust (s)	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2			6.2		6.1	6.1		6.1	6.1	6.1
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None		None	None		Min	Min		Min	Min	Min
Walk Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	7.0
Flash Dont Walk (s)	18.0	18.0		18.0	18.0		11.0	11.0		11.0	11.0	11.0
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	0
Act Effct Green (s)	39.3	39.3			39.3		52.6	52.6		52.6	52.6	52.6
Actuated g/C Ratio	0.38	0.38			0.38		0.50	0.50		0.50	0.50	0.50
v/c Ratio	0.58	0.35			0.87		0.61	0.58		0.20	0.88	0.49
Control Delay	37.8	24.2			51.4		44.5	21.9		17.7	37.1	12.1
Queue Delay	0.0	0.0			0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	37.8	24.2			51.4		44.5	21.9		17.7	37.1	12.1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	C			D		D	C		B	D	B
Approach Delay		30.1			51.4			24.8			27.9	
Approach LOS		C			D			C			C	
Queue Length 50th (m)	28.5	30.5			84.0		11.2	70.8		6.9	140.4	30.3
Queue Length 95th (m)	50.8	48.9			#136.6		#34.2	101.1		14.9	#212.0	53.8
Internal Link Dist (m)		520.6			321.6			263.4			225.0	
Turn Bay Length (m)	135.0						25.0			15.0		30.0
Base Capacity (vph)	356	782			609		154	1052		379	1075	979
Starvation Cap Reductn	0	0			0		0	0		0	0	0
Spillback Cap Reductn	0	0			0		0	0		0	0	0
Storage Cap Reductn	0	0			0		0	0		0	0	0
Reduced v/c Ratio	0.47	0.29			0.71		0.49	0.48		0.16	0.72	0.42

Intersection Summary

Area Type: Other
Cycle Length: 120
Actuated Cycle Length: 104.8
Natural Cycle: 75
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 31.4 Intersection LOS: C
Intersection Capacity Utilization 109.2% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Huntmar Drive & Maple Grove Road

Intersection	
Int Delay, s/veh	2

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	306	51	29	115	20	63
Future Vol, veh/h	306	51	29	115	20	63
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, %	2	2	2	2	2	2
Mvmt Flow	306	51	29	115	20	63

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	357	0	505	332
Stage 1	-	-	-	-	332	-
Stage 2	-	-	-	-	173	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1202	-	527	710
Stage 1	-	-	-	-	727	-
Stage 2	-	-	-	-	857	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1202	-	513	710
Mov Cap-2 Maneuver	-	-	-	-	513	-
Stage 1	-	-	-	-	727	-
Stage 2	-	-	-	-	835	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.6	11.3
HCM LOS			B

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	650	-	-	1202	-
HCM Lane V/C Ratio	0.128	-	-	0.024	-
HCM Control Delay (s)	11.3	-	-	8.1	0
HCM Lane LOS	B	-	-	A	A
HCM 95th %tile Q(veh)	0.4	-	-	0.1	-

Intersection	
Int Delay, s/veh	2.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	223	40	95	329	56	40
Future Vol, veh/h	223	40	95	329	56	40
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, %	2	2	2	2	2	2
Mvmt Flow	223	40	95	329	56	40

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	263	0	762	243
Stage 1	-	-	-	-	243	-
Stage 2	-	-	-	-	519	-
Critical Hdwy	-	-	4.12	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	-	-	2.218	-	3.518	3.318
Pot Cap-1 Maneuver	-	-	1301	-	373	796
Stage 1	-	-	-	-	797	-
Stage 2	-	-	-	-	597	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	1301	-	340	796
Mov Cap-2 Maneuver	-	-	-	-	340	-
Stage 1	-	-	-	-	797	-
Stage 2	-	-	-	-	544	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.8	15.2
HCM LOS			C

Minor Lane/Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	447	-	-	1301	-
HCM Lane V/C Ratio	0.215	-	-	0.073	-
HCM Control Delay (s)	15.2	-	-	8	0
HCM Lane LOS	C	-	-	A	A
HCM 95th %tile Q(veh)	0.8	-	-	0.2	-

Intersection	
Int Delay, s/veh	4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	6	126	13	22	68	30	5	2	54	56	4	11
Future Vol, veh/h	6	126	13	22	68	30	5	2	54	56	4	11
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	126	13	22	68	30	5	2	54	56	4	11

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	98	0	0	139	0	0	280	287	133	300	278	83
Stage 1	-	-	-	-	-	-	145	145	-	127	127	-
Stage 2	-	-	-	-	-	-	135	142	-	173	151	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1495	-	-	1445	-	-	672	623	916	652	630	976
Stage 1	-	-	-	-	-	-	858	777	-	877	791	-
Stage 2	-	-	-	-	-	-	868	779	-	829	772	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1495	-	-	1445	-	-	651	611	916	603	617	976
Mov Cap-2 Maneuver	-	-	-	-	-	-	651	611	-	603	617	-
Stage 1	-	-	-	-	-	-	855	774	-	873	778	-
Stage 2	-	-	-	-	-	-	840	767	-	775	769	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.3	1.4	9.4	11.3
HCM LOS			A	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	873	1495	-	-	1445	-	-	642
HCM Lane V/C Ratio	0.07	0.004	-	-	0.015	-	-	0.111
HCM Control Delay (s)	9.4	7.4	0	-	7.5	0	-	11.3
HCM Lane LOS	A	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.2	0	-	-	0	-	-	0.4

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	116	10	70	145	56	14	3	43	46	3	9
Future Vol, veh/h	10	116	10	70	145	56	14	3	43	46	3	9
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, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	10	116	10	70	145	56	14	3	43	46	3	9

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	201	0	0	126	0	0	460	482	121	477	459	173
Stage 1	-	-	-	-	-	-	141	141	-	313	313	-
Stage 2	-	-	-	-	-	-	319	341	-	164	146	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1371	-	-	1460	-	-	512	484	930	498	499	871
Stage 1	-	-	-	-	-	-	862	780	-	698	657	-
Stage 2	-	-	-	-	-	-	693	639	-	838	776	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1371	-	-	1460	-	-	481	454	930	450	468	871
Mov Cap-2 Maneuver	-	-	-	-	-	-	481	454	-	450	468	-
Stage 1	-	-	-	-	-	-	855	774	-	692	622	-
Stage 2	-	-	-	-	-	-	646	604	-	790	770	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	2	10.4	13.4
HCM LOS			B	B

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	732	1371	-	-	1460	-	-	488
HCM Lane V/C Ratio	0.082	0.007	-	-	0.048	-	-	0.119
HCM Control Delay (s)	10.4	7.6	0	-	7.6	0	-	13.4
HCM Lane LOS	B	A	A	-	A	A	-	B
HCM 95th %tile Q(veh)	0.3	0	-	-	0.2	-	-	0.4

Intersection	
Int Delay, s/veh	3.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	12	226	88	47	131	33
Future Vol, veh/h	12	226	88	47	131	33
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, %	2	2	2	2	2	2
Mvmt Flow	12	226	88	47	131	33

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	135	0	-	0	362	112
Stage 1	-	-	-	-	112	-
Stage 2	-	-	-	-	250	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1449	-	-	-	637	941
Stage 1	-	-	-	-	913	-
Stage 2	-	-	-	-	792	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1449	-	-	-	631	941
Mov Cap-2 Maneuver	-	-	-	-	631	-
Stage 1	-	-	-	-	913	-
Stage 2	-	-	-	-	785	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	12
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1449	-	-	-	676
HCM Lane V/C Ratio	0.008	-	-	-	0.243
HCM Control Delay (s)	7.5	0	-	-	12
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.9

Intersection	
Int Delay, s/veh	2.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	34	171	249	136	92	23
Future Vol, veh/h	34	171	249	136	92	23
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, %	2	2	2	2	2	2
Mvmt Flow	34	171	249	136	92	23

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	385	0	-	0	556	317
Stage 1	-	-	-	-	317	-
Stage 2	-	-	-	-	239	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1173	-	-	-	492	724
Stage 1	-	-	-	-	738	-
Stage 2	-	-	-	-	801	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1173	-	-	-	476	724
Mov Cap-2 Maneuver	-	-	-	-	476	-
Stage 1	-	-	-	-	738	-
Stage 2	-	-	-	-	775	-

Approach	EB	WB	SB
HCM Control Delay, s	1.4	0	14.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1173	-	-	-	511
HCM Lane V/C Ratio	0.029	-	-	-	0.225
HCM Control Delay (s)	8.2	0	-	-	14.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.9

1919 Maple Grove Road

Transportation Impact Assessment Report

Appendix K: Existing Signal Timing Plans

April 2019

IBI

Traffic Signal Timing

City of Ottawa, Transportation Services Department

Traffic Signal Operations Unit

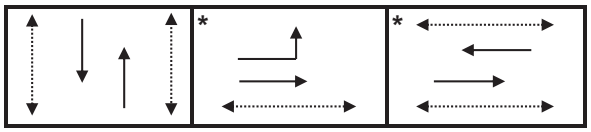
Intersection:	**Main:** Huntmar	**Side:**	Maple Grove
Controller:	**MS-3200**	**TSD:**	**5476**
Author:	Sarah Saade	**Date:**	27-Jun-2018

Existing Timing Plans†

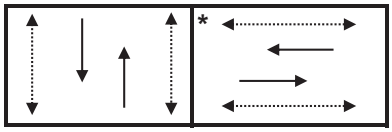
	Plan			**Ped Minimum Time**		
	AM Peak 1	**PM Peak** 3	**Night** 4	***Walk***	***DW***	***A+R***
Cycle	100	125	100			
Offset	X	X	X			
NB Thru	45	76	45	7	8	3.3+2.8
SB Thru	45	76	45	7	8	3.3+2.8
EB Left	25	-	-	-	-	3.3+2.9
EB Thru	30	49	55	7	16	3.3+2.9
WB Thru	30	49	55	7	16	3.3+2.9

Phasing Sequence‡

Plan: 1



Plan: 3,4



Schedule

Weekday

Time	Plan
0:10	4
6:30	1
9:00	4
15:00	3
23:00	4

Weekend

Time	Plan
0:10	4
22:30	4

Notes

†: Time for each direction includes amber and all red intervals

‡: Start of first phase should be used as reference point for offset

Asterisk (*) Indicates actuated phase

(fp): Fully Protected Left Turn

◄·····► Pedestrian signal

Cost is $56.50 ($50 + HST)

1919 Maple Grove Road

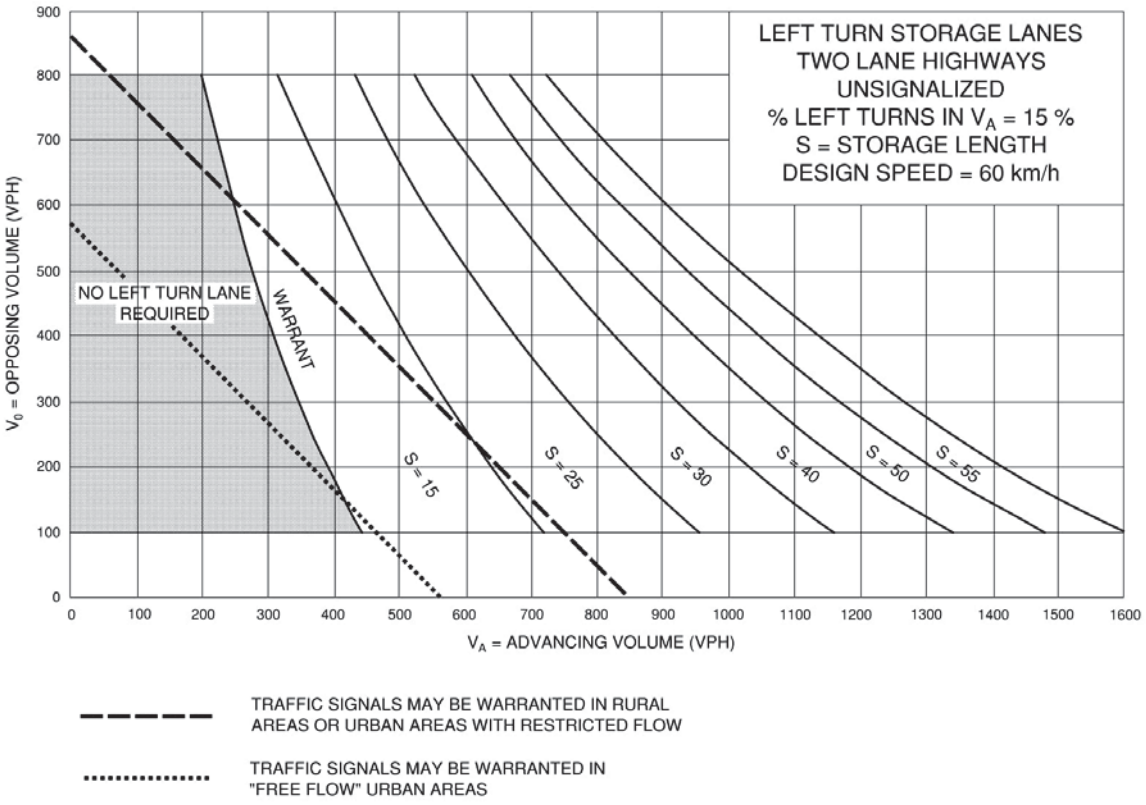
Transportation Impact Assessment Report

Appendix L: Technical Standards

April 2019

IBI

Exhibit 9A-7


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 15 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

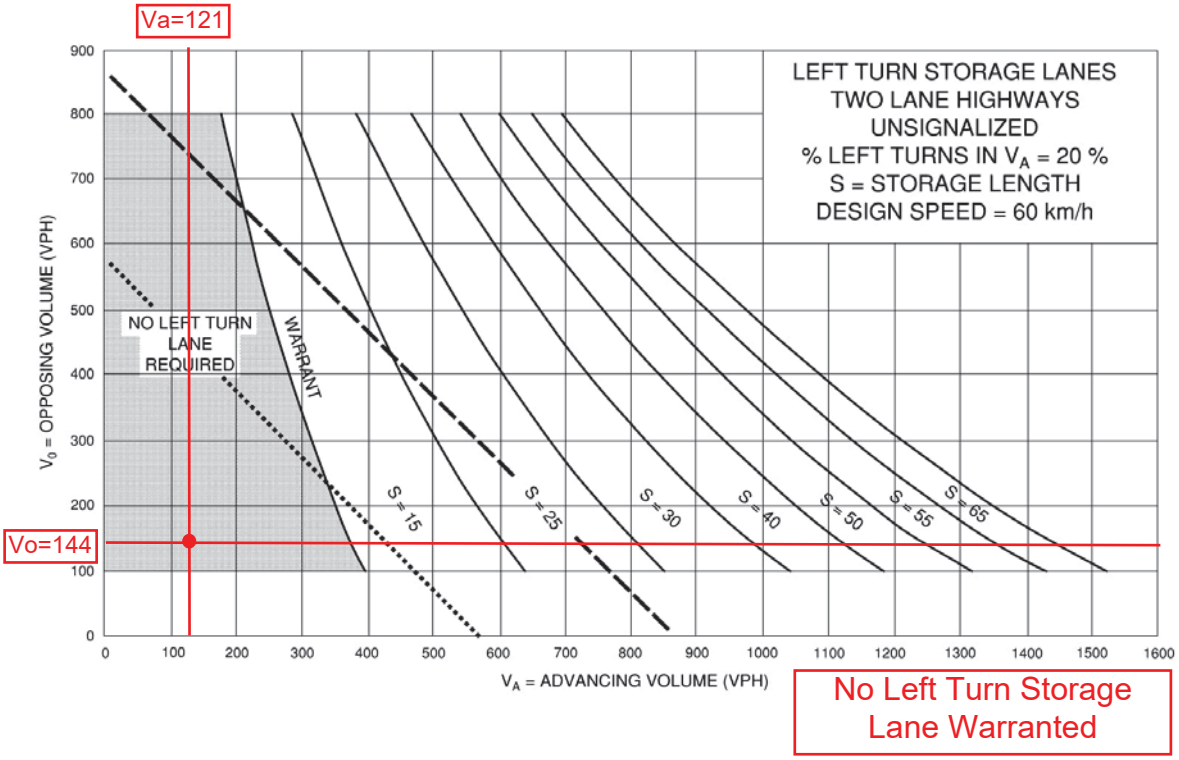
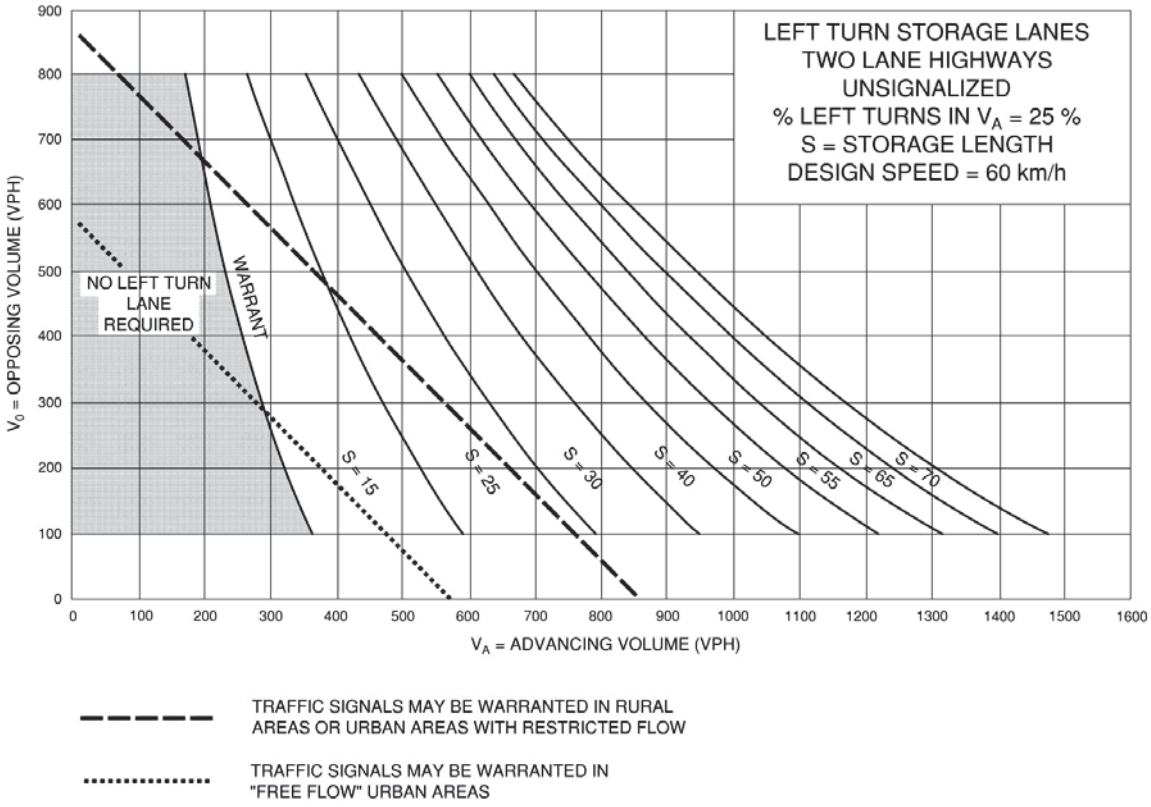

Va=121
Vo=144
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
No Left Turn Storage Lane Warranted

Exhibit 9A-8


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 25 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

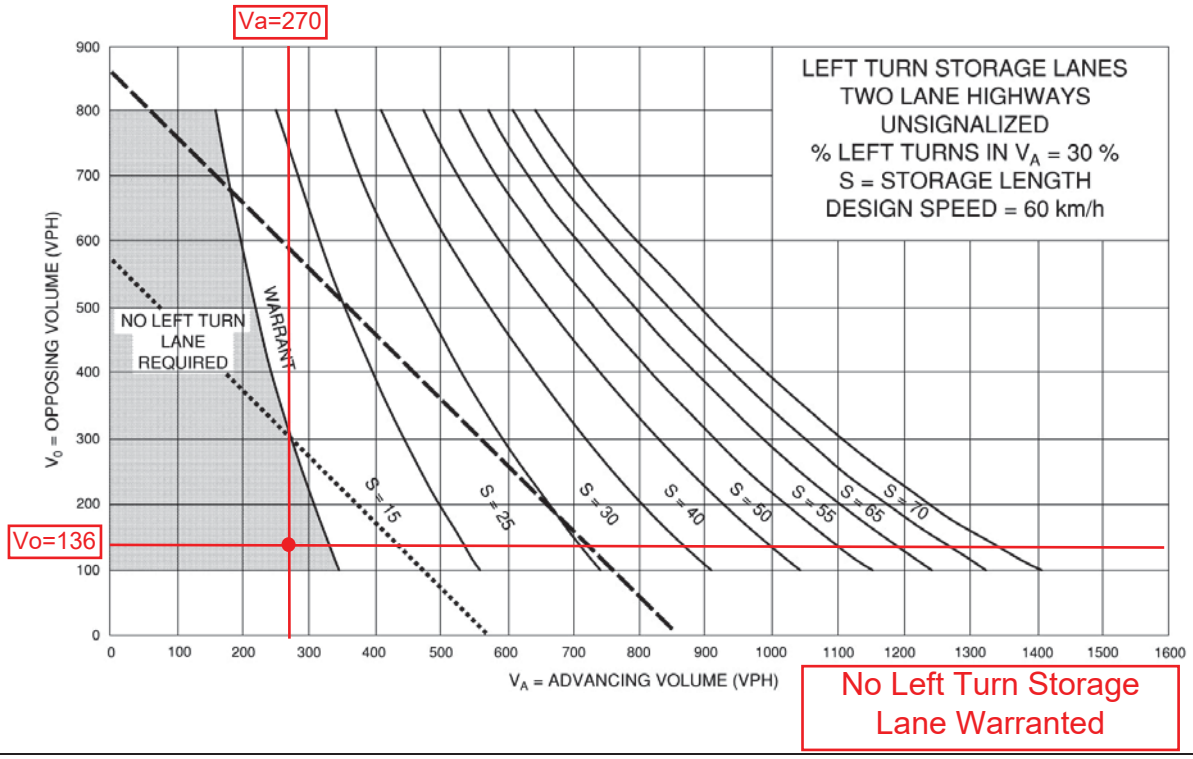
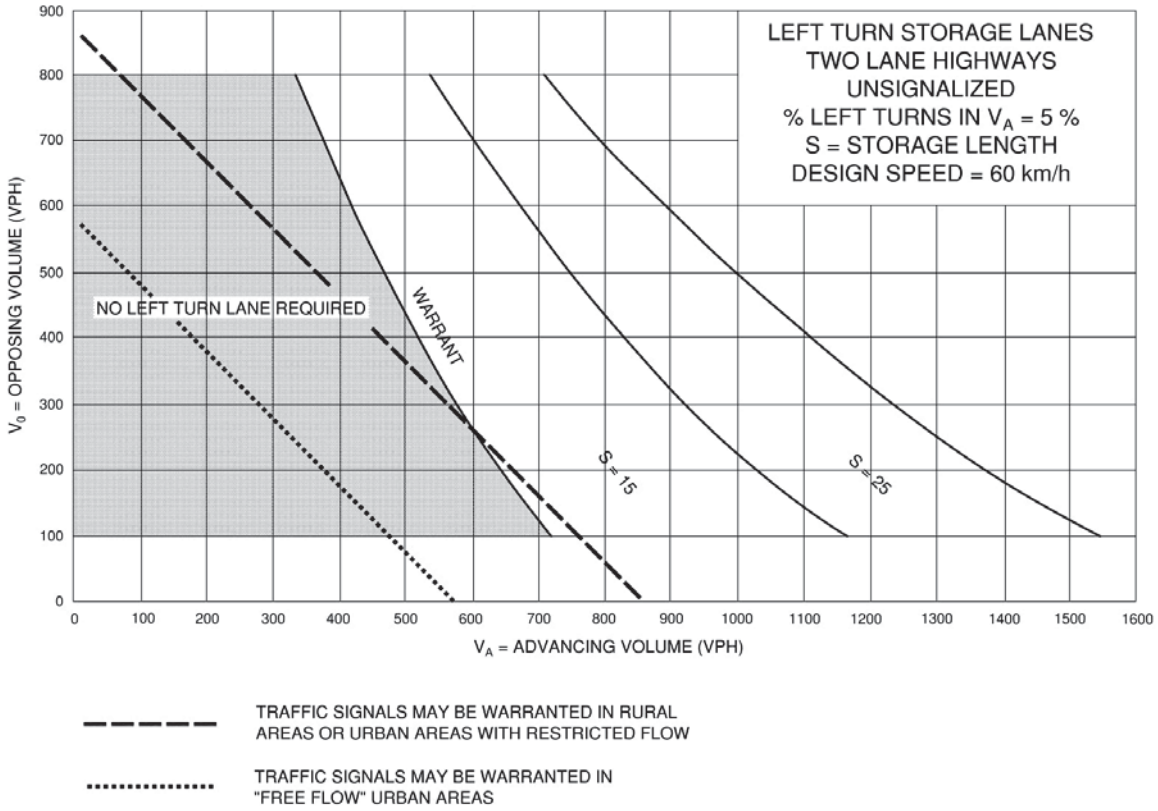

Va=270
Vo=136
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 30 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
No Left Turn Storage Lane Warranted

Exhibit 9A-6


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 5 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

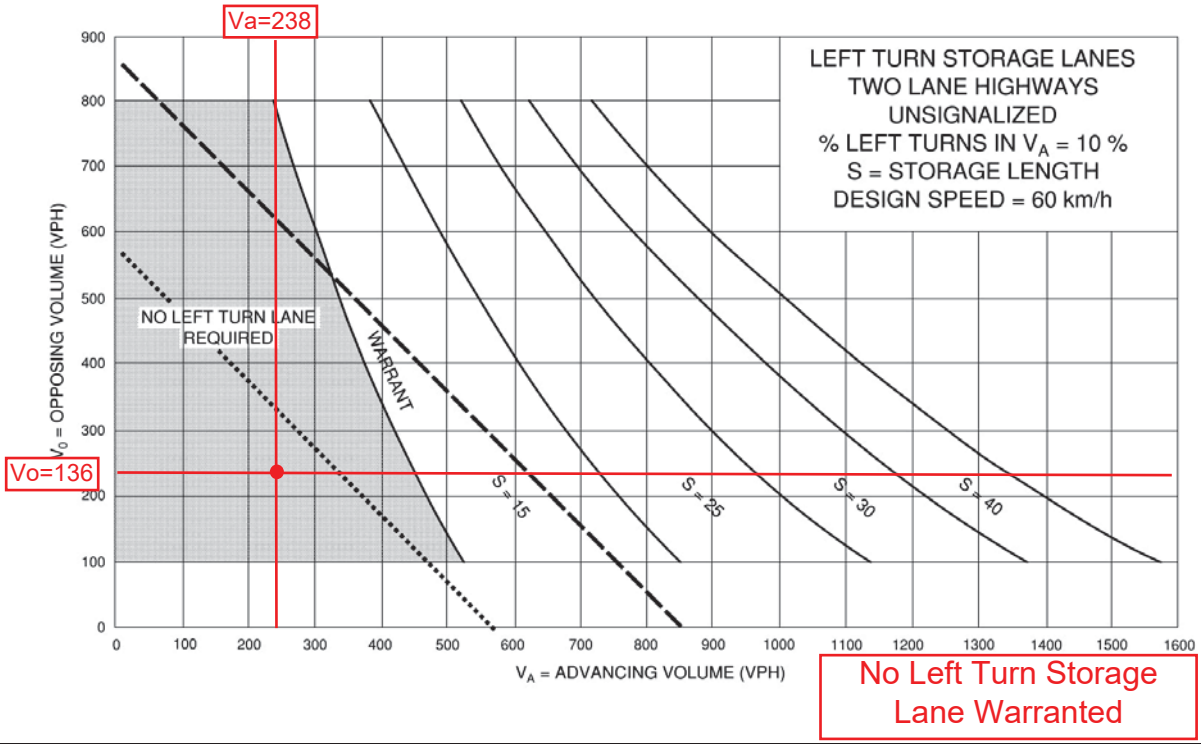
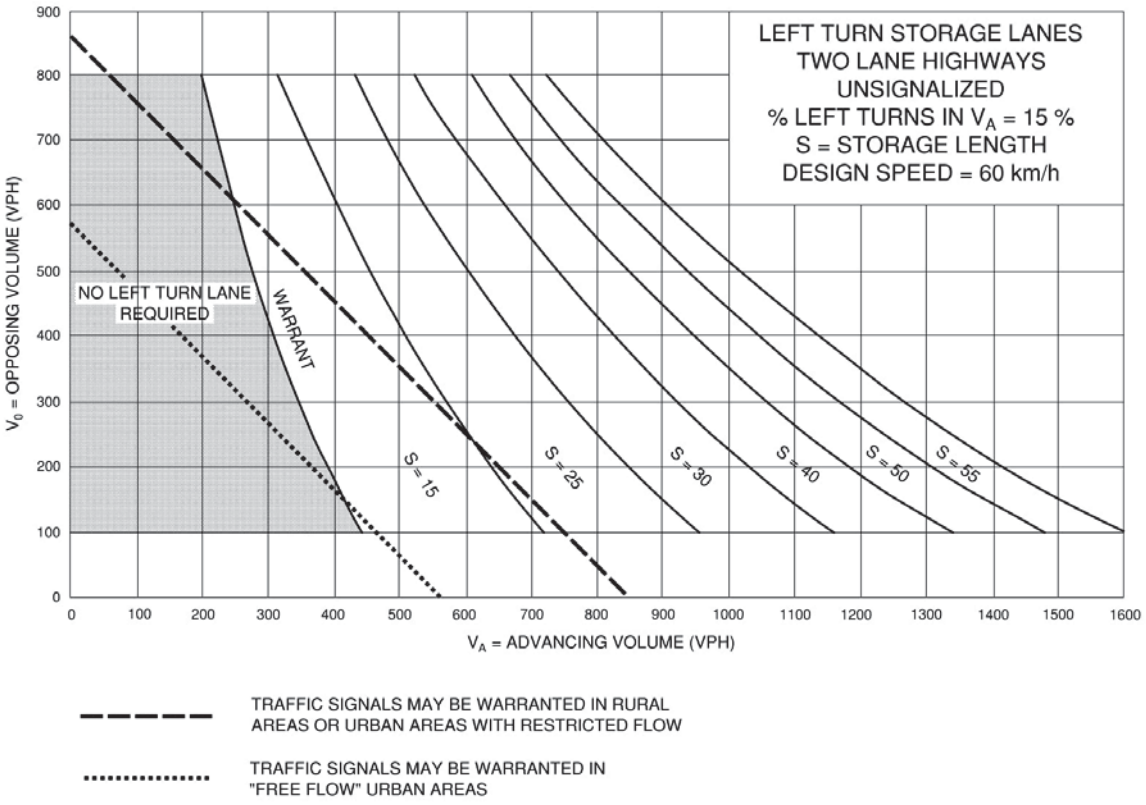

Va=238
Vo=136
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 10 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
No Left Turn Storage Lane Warranted

Exhibit 9A-7


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 15 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
V_O = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

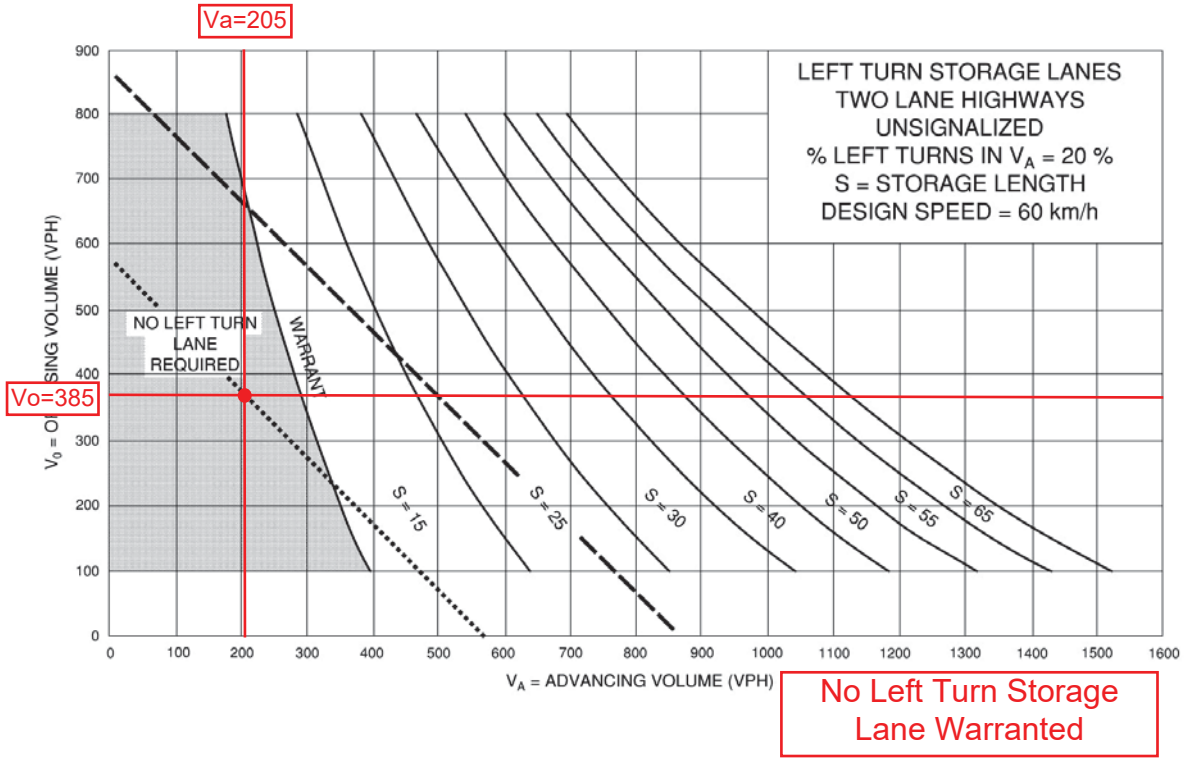
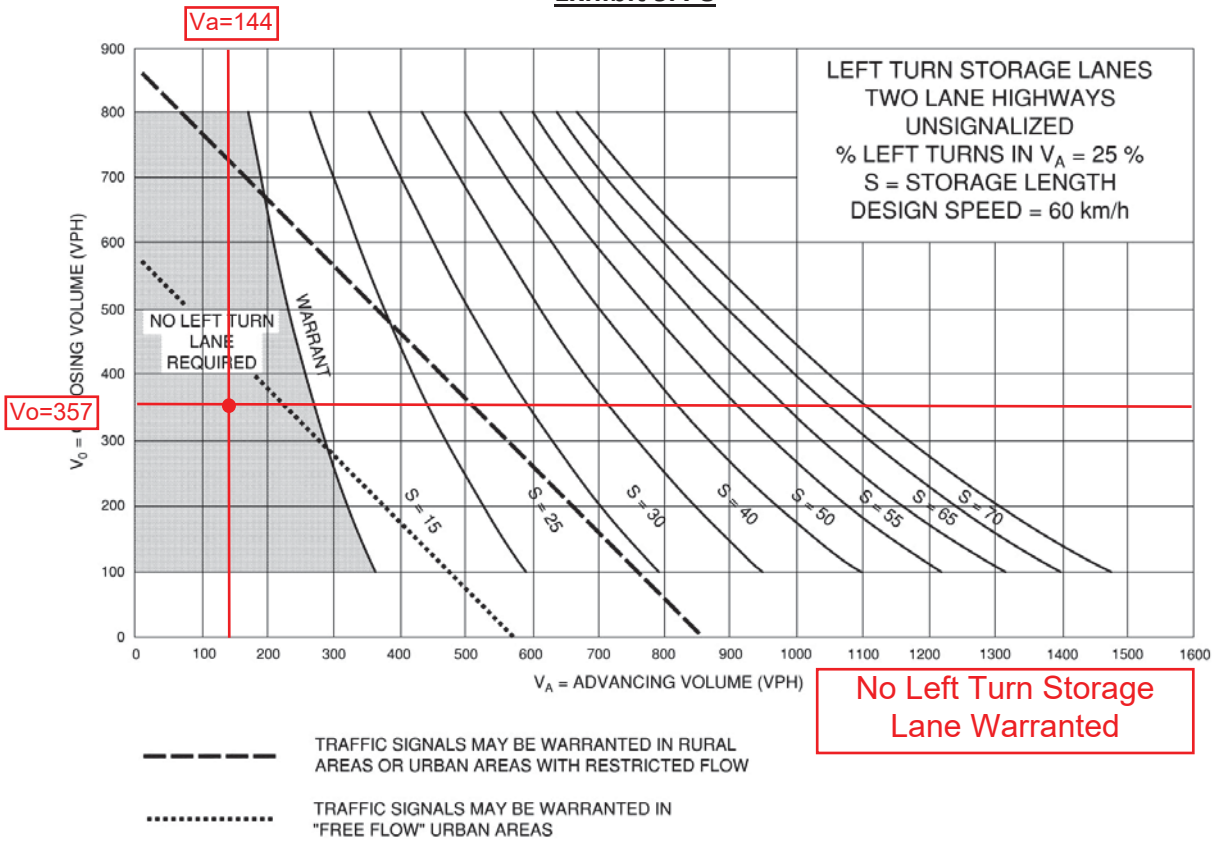

Va=205
Vo=385
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_A = ADVANCING VOLUME (VPH)
No Left Turn Storage Lane Warranted

Exhibit 9A-8


Va=144
Vo=357
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 25 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_A = ADVANCING VOLUME (VPH)
No Left Turn Storage Lane Warranted
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

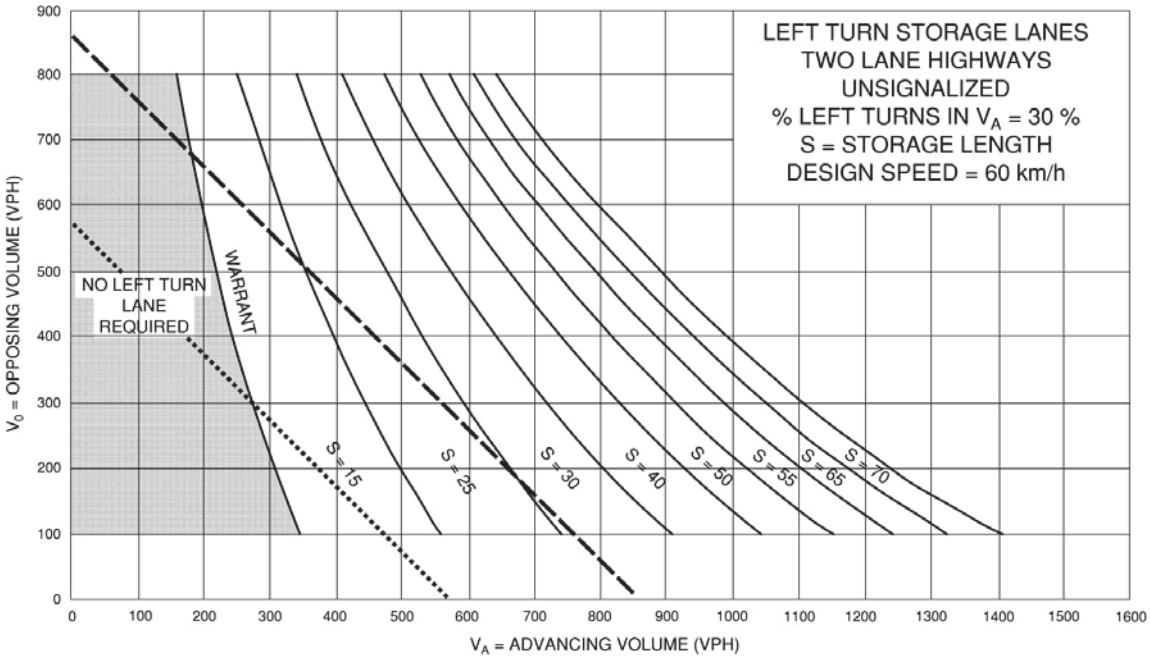
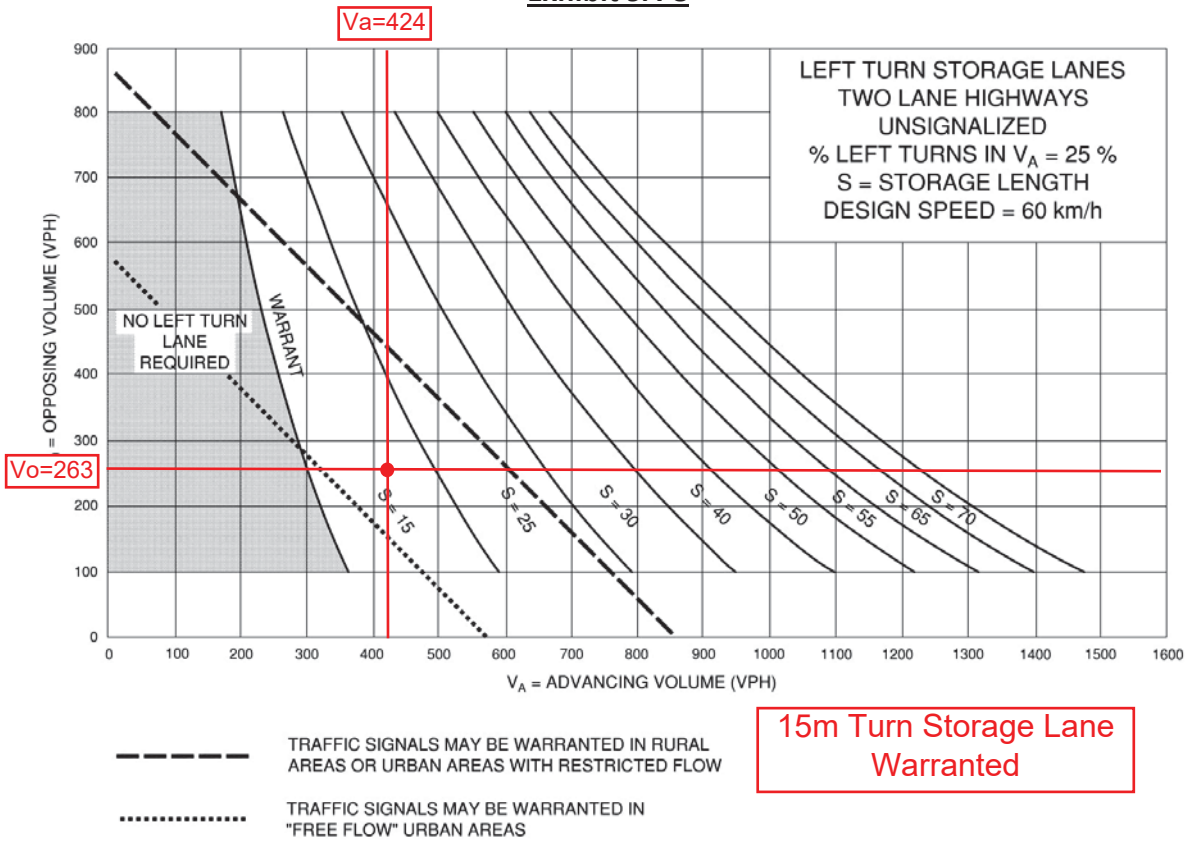
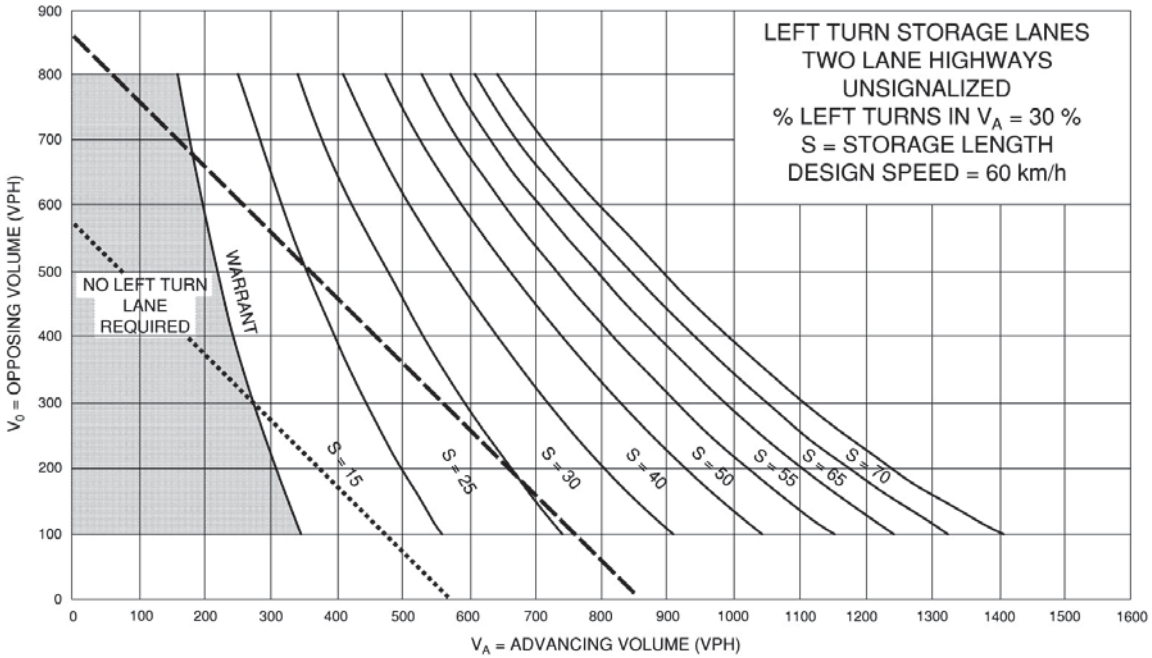

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 30 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_o = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Exhibit 9A-8


Va=424
Vo=263
LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 25 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_o = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS
15m Turn Storage Lane Warranted


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 30 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
S = 50
S = 55
S = 65
S = 70
V_o = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)