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Transportation Impact Study

PROPOSED RESIDENTIAL DEVELOPMENT

186 Hunter Street E
HAMILTON, ONTARIO

December 2021
Project No: NT-20-281

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Aurora ON L4G 6W8

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nexTrans CONSULTING ENGINEERS

NextEng Consulting Group Inc.

December 13, 2021

Attention: Spencer McKay

Urban Solutions Planning & Land Development
3 Studebaker Place, Unit 1
Hamilton, ON L8L 0C8

Re: Transportation Impact Study
Proposed Residential Development
186 Hunter Street E, City of Hamilton
Our Project No. NT-21-281

Nextrans Consulting Engineers (a Division of NextEng Consulting Group Inc.) is pleased to present the enclosed Transportation Impact Study for the above noted site in support of Official Plan and Zoning By-law Amendment Applications for a proposed residential development.

The subject site is located at 186 Hunter Street, south of Hunter Street, between Ferguson Avenue S and Hunter Street E, in the City of Hamilton. The development proposal consists of a 12-storey building with a total of 104 residential dwelling units. The proposed development is proposing a full moves access onto Ferguson Avenue and retain the existing access onto Liberty Street to accommodate the proposed development. The proposed development will also provide a total of 50 vehicle parking spaces and 56 bicycle parking spaces to accommodate the proposed development.

The transportation impact study concludes that the proposed development can adequately be accommodated by the existing transportation network, existing Hamilton Transit service, as well as the recommended Transportation Demand Management measures and incentives recommended in this report.

It is Nextrans' opinion that the City should approve the propose development as it will contribute positively to the on-going housing shortage and affordability crisis in the City of Hamilton and in the Greater Toronto and Hamilton Area. The proposed development will also contribute to the City Development Charges to maintain and building infrastructures.

We trust the enclosed sufficiently addresses your needs. Should you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

Nextrans Consulting Engineers
A Division of NextEng Consulting Group Inc.

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Report Submission Record

Identification	Date	Description of issued and/or revision
Draft Report	December 13, 2021	For Project Team Review

EXECUTIVE SUMMARY

Nextrans Consulting Engineers (A Division of NextEng Consulting Group Inc.) was retained by Wellington Hamilton Non-Profit Housing Inc. (the 'Client') to undertake a Transportation Impact Study in support of Official Plan Amendment and Zoning By-law Amendment Applications for a proposed mixed-use residential development. The subject site is located at 186 Hunter Street, south of Hunter Street, between Ferguson Avenue S and Hunter Street E, in the City of Hamilton.

This Study is prepared in accordance with the City of Hamilton Transportation Impact Study and pre-consultation comments provided by the City staff in the Letter dated October 28, 2021.

The analysis indicates that the proposed development has negligible impact and can be accommodated by the existing transportation network without and physical improvements for the horizon year considered in this Study.

Proposed Development

Currently, the subject land is occupied by one-storey office building and a Impark parking lot. The development proposal consists of a 12-storey building with a total of 104 residential dwelling units.

Proposed Development Access

Currently, the subject site has a full moves access onto Liberty Street and two full moves access onto Hunter Street E, including a loading dock.

As part of the proposed redevelopment of the site, the existing two full moves access onto Hunter Street E will be closed. The existing full moves access onto Liberty Street will be retained and a proposed full moves access will be provided onto Ferguson Avenue S at the southerly limit of the site to accommodate the proposed development:

1. An access onto Liberty Street has the following lane configuration:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Liberty Street
2. An access onto Ferguson Avenue S has the following lane configuration:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Ferguson Avenue S

Based on the findings of this Study and Nextrans' assessment, the proposed access arrangement is appropriate and acceptable as it is optimized the developable lands and consistent with the context of the area. The analysis indicates that both proposed accesses are expected to operate at acceptable levels of service with the proposed lane configurations and access treatment.

It is Nextrans' opinion that the closure of the existing accesses onto Hunter Street E, especially the loading dock access, will improve the walking and cycling operational and safety along the frontage of the proposed redevelopment of the site.

Capacity Analysis

The proposed development is expected to generate 42 total two-way trips (10 inbound and 32 outbound) and 44 total two-way trips (27 inbound and 17 outbound) during the morning and afternoon peak hours, respectively.

Auto Mode Assessment

Under the existing, 2029 future background and future total traffic conditions, the analysis indicates that all the intersections considered are expected to operate at acceptable levels of service. No improvements are required for the horizon considered and to accommodate the proposed development.

Active Transportation Mode Assessment

Walking

As indicated in Section 2.3 of this Study, sidewalks are currently provided along both sides of Hunter Street E, Ferguson Avenue S, Liberty Street, Walnut Street and Wellington Street S south of Hunter Street E. There is no missing links or gaps in the network. In addition, sidewalks are generally in good conditions, therefore, it is Nextrans' opinion that no improvements to the sidewalk network are required under the horizon considered in this Study to accommodate the proposed development.

As part of the proposed development, the existing sidewalks along the frontage of the site on Hunter Street E, Liberty Street and Ferguson Avenue will be maintained and enhanced. In addition, the main building entrances will be provided directly onto Hunter Street E to facilitate pedestrian movements. It is Nextrans' opinion that these provisions meet the City of Hamilton mobility and TDM requirements.

Cycling

Similarly, under the existing conditions, there are dedicated bike lanes on the south side along Hunter Street E west of Liberty Street that connects to other cycling routes in the City and Hamilton GO Train Station to the west of the subject site. There are also signed routes and paved trails in the area.

It is Nextrans' opinion that the cycling network in the area is well-connected and complete and it also connects to the existing Hamilton GO Train Station and MacNab Terminal. Given that the existing speed limits on the surrounding streets are low, it is appropriate to cycle on these streets without dedicated facilities.

As part of the proposed development, sufficient bicycle parking spaces will be provided as per the current Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that these provisions meet the City of Hamilton mobility and TDM requirements.

Transit Mode Assessment

If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 4 two-way transit trips (1 inbound and 3 outbound) and 4 two-way transit trips (3 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

The proposed development is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. In addition, the proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk.

It is Nextrans' opinion that the proposed development transit ridership can be accommodated by the existing transit system and the Future Rapid Transit Corridor on King Street E. Therefore, no improvements to the transit system is required to accommodate the proposed development.

Vehicle Parking Review

It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593. However, as the City has new consolidated Zoning By-law, for the purpose of this assessment, Zoning By-law No. 05-200 Section 5.6 (Consolidated as of September, 2019) has been reviewed and applied in the analysis.

Based on the City's By-Law No. 05-200, a total of 34 vehicle parking spaces should be provided for the proposed development. The proposed development will provide 50 vehicle parking spaces, which slightly exceed the minimum Zoning By-law requirements. As the surplus parking is minimal, therefore, it is acceptable.

Bicycle Parking Review

It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593, however, there is no bicycle parking requirement for the proposed development under this Zoning By-law.

To support and encourage the future residents to take active mode of transportation instead of driving private vehicles, Nextrans recommends that the proposed development meet or provide close to the bicycle parking requirements based on the consolidated Zoning By-law No. 05-200. Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 57 bicycle parking spaces, which include 5 short-term and 52 long-term spaces.

The proposed development will provide a total of 56 bicycle parking spaces, inclusive of short-term and long-term spaces, which is very close to meet the Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision is acceptable and reasonable given that the proposed development is not required to provide any bicycle parking spaces under applicable Zoning By-law No. 6593.

Transportation Demand Management Measures and Incentives

The Report identifies and recommends appropriate Transportation Demand Management measures and incentives to support active transportation and transit, to meet the objectives and requirements in the City of Hamilton's TDM for Development Report (June, 2015).

Loading Requirement

The proposed development will provide one loading space to service the proposed development. This is consistent with the current Zoning By-law No. 05-200. AutoTURN software was used to generate the vehicle turning movements and provided in Section 7 of this Study.

Study Conclusions and Recommendations

Based on the findings and conclusions of this study, the following recommendations are provided:

- The proposed development implements the TDM measures and incentives identified in this report to support active transportation and transit and to reduce the numbers of single-occupant-vehicle trips to and from the proposed development;
- No additional physical improvements for the area at this time to accommodate the proposed development, under the future background and future total conditions.
- Site access lane configurations:
  - Access onto Liberty Street:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Liberty Street
  - Access onto Ferguson Avenue S:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Ferguson Avenue S

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 EXISTING TRAFFIC CONDITIONS 2

2.1. Existing Road Network 2

2.2. Existing Active Transportation Network 3

2.3. Existing Active Transportation Assessment 4

2.4. Existing Hamilton Transit (HSR) System 4

2.3. Existing Area Context 5

2.4. Existing Traffic Volumes 5

2.5. Existing Traffic Assessment 5

3.0 TRANSPORTATION PLANNING CONTEXT IN THE AREA 7

3.1. Existing Land Use Context and Amenities 7

3.2. Transportation Planning Context 7

3.3. Future Rapid Transit Corridor Along King Street/Queenston Road 8

4.0 FUTURE BACKGROUND CONDITIONS 8

4.1. Analysis Horizon 8

4.2. Background Development Applications 8

4.3. Future Background Corridor Growth 8

4.4. Future Background Traffic Assessment 8

5.0 SITE TRAFFIC 9

5.1. Proposed Development 9

5.2. Site Trip Generation 10

5.3. Site Trip Distribution Based on 2016 TTS Data 10

6.0 FUTURE TOTAL TRAFFIC CONDITIONS 11

6.1. Future Total Traffic Assessment for Auto Mode 11

6.2. Active Transportation Mode Assessment 13

6.3. Transit Mode Assessment 13

7.0 SITE PLAN REVIEW 13

7.1. Loading Requirement 13
7.2. Driveway Location and Configuration 14
8.0 SAFETY AND OTHER CONSIDERATIONS 14
8.1. Access Safety 14
8.2. Pedestrian Safety 14
8.3. Traffic Calming 15
9.0 PARKING ASSESSMENT 15
9.1. Vehicle Parking Assessment 15
9.2. Bicycle Parking 15
10.0 TRANSPORTATION DEMAND MANAGEMENT 16
10.1. City of Hamilton's TDM for Development (June, 2015) 16
10.1.1. Increase Density and Compact Site Design 16
10.1.2. Site Design Elements 16
10.1.3. Sidewalks and Pathways 16
10.1.4. Bicycle Parking (Long-term and Short-term) 16
10.1.5. Direct Connections to Transit 17
10.1.6. Opportunities for Reduced Parking Requirements 17
10.1.7. Unbundle Parking 17
10.1.8. On-Site Carshare Vehicle(s) and Parking Spot(s) 17
10.1.9. On-Site Bikeshare 17
10.1.10. Wayfinding Signage 17
10.1.11. Travel Planning Tools and Support for Development of a School Travel Plan 17
10.1.12. Opportunities for Transit Passes, Carshare Memberships, or Bikeshare Memberships 18
10.1.13. Proposed Monitoring Evaluation of TDM Measures 18
10.2. Recommended TDM Measures and Incentives for the Proposed Development 18
11.0 CONCLUSIONS / FINDINGS 19
11.1. Study Conclusions 19
11.2. Study Recommendations 20

LIST OF FIGURES

Figure 1 – Proposed Development Location

Figure 2 – Proposed Site Plan

Figure 3 – Existing Lane Configuration and Traffic Control

Figure 4 – Existing Active Transportation Network in the Study Area

Figure 5 – Existing Hamilton Transit Network in the Study Area

Figure 6 – Existing Traffic Volumes

Figure 7 – 2021 Existing Traffic Volumes

Figure 8 – 2028 Future Background Traffic Volumes

Figure 9 – Site Traffic Volumes

Figure 10 – 2028 Future Total Traffic Volumes

Figure 11 – AutoTURN Analysis

LIST OF TABLES

Table 1 – Summary of the Existing Road Network in the Study Area

Table 2 – Existing Levels of Service

Table 3 – 2029 Future Background Levels of Service

Table 4 – Site Traffic Trip Generation

Table 5 – Trip Distribution for Residential Component

Table 6 – Site Trip Distribution for Residential Component

Table 7 – 2029 Future Total Levels of Service

Table 8 – Zoning By-law No. 05-200 Vehicle Parking Requirement for Areas Outside Downtown Zones

Table 9 – Zoning By-law No. 05-200 Bicycle Parking Requirement

Table 10 – Recommended TDM Measures for the Proposed Development

APPENDICES

Appendix A – Pre-Consultation Comments

Appendix B – Existing Traffic Data

Appendix C – Existing Traffic Level of Service Calculations

Appendix D – Future Background Traffic Level of Service Calculations

Appendix E – 2016 TTS Data Extraction

Appendix F – Future Total Traffic Level of Service Calculations

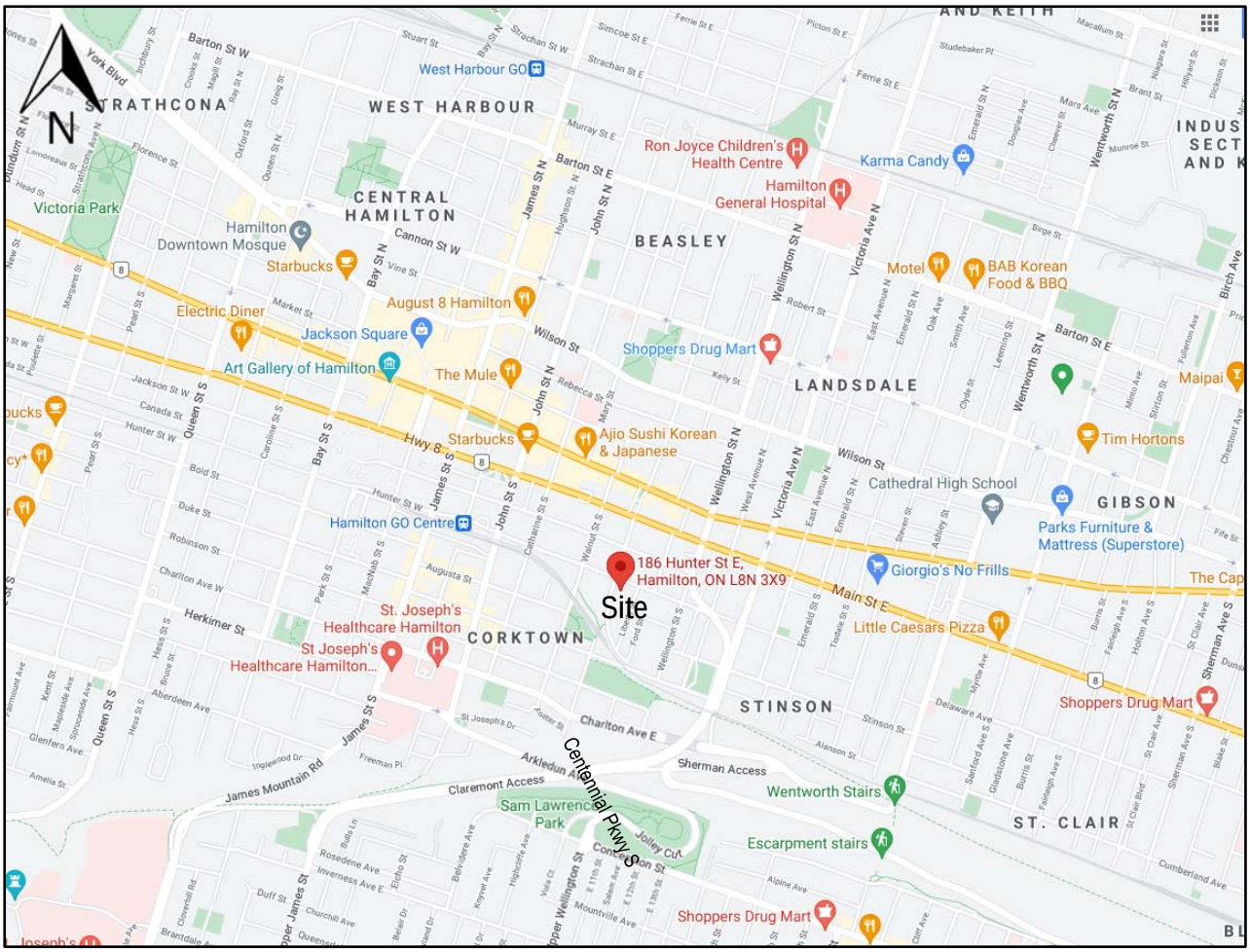
1.0 INTRODUCTION

Nextrans Consulting Engineers (A Division of NextEng Consulting Group Inc.) was retained by Wellington Hamilton Non-Profit Housing Inc. (the 'Client') to undertake a Transportation Impact Study in support of Official Plan Amendment and Zoning By-law Amendment Applications for a proposed mixed-use residential development. The subject site is located at 186 Hunter Street, south of Hunter Street, between Ferguson Avenue S and Hunter Street E, in the City of Hamilton.

This Study is prepared in accordance with the City of Hamilton Transportation Impact Study and pre-consultation (Appendix A) comments provided by the City staff in the Letter dated October 28, 2021.

The location of the proposed development is illustrated in Figure 1.

Figure 1 – Proposed Development Location



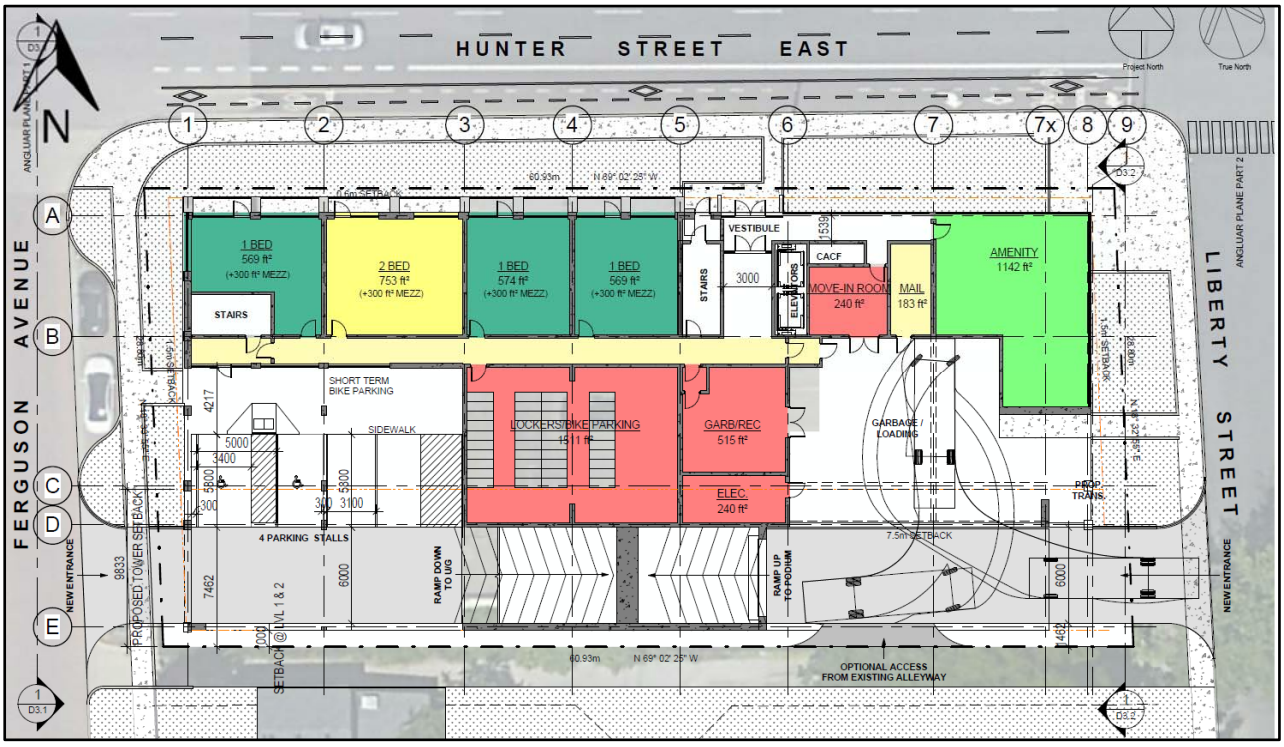
Source: Google Map

Currently, the subject land is occupied by one-storey office building and a Impark parking lot. The development proposal consists of a 12-storey building with a total of 104 residential dwelling units.

The proposed development is proposing a full moves access onto Ferguson Avenue and retain the existing access onto Liberty Street to accommodate the proposed development. The proposed development will also provide a total of 50 vehicle parking spaces and 56 bicycle parking spaces to accommodate the proposed development.

Figure 2 illustrates the proposed site plan.

Figure 2 – Proposed Site Plan



2.0 EXISTING TRAFFIC CONDITIONS

2.1. Existing Road Network

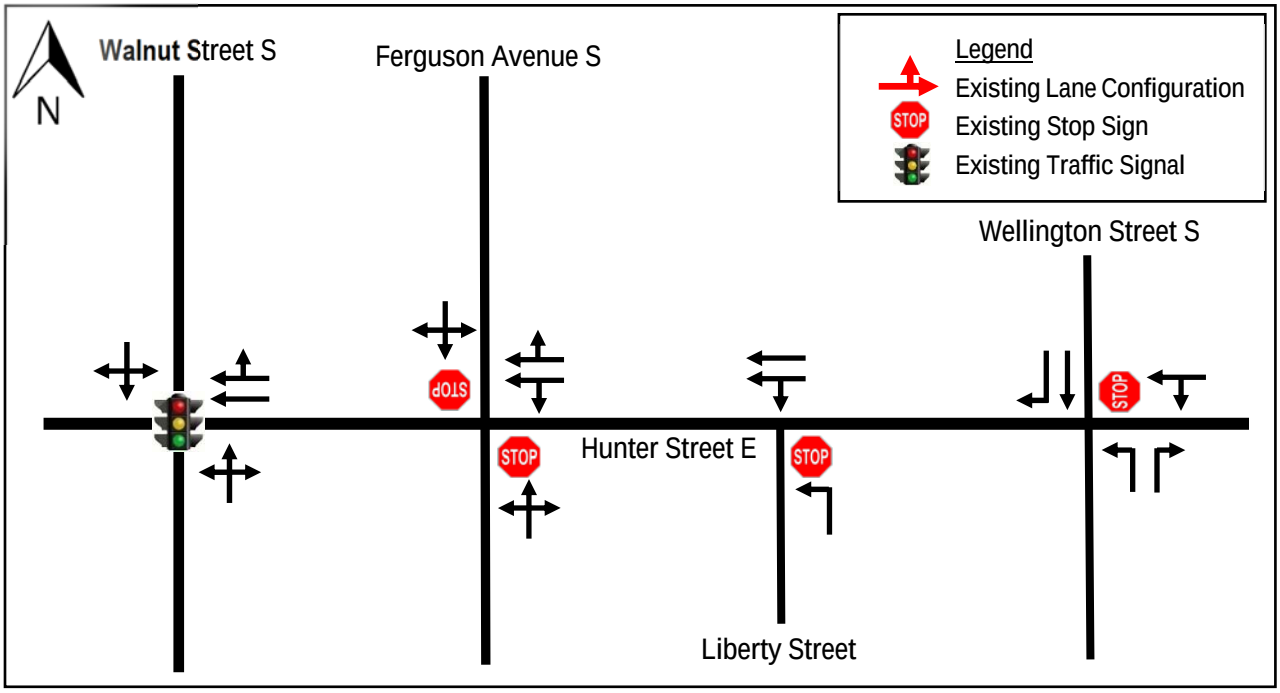
As indicated, the subject site is located at 186 Hunter Street, south of Hunter Street, between Ferguson Avenue S and Hunter Street E, in the City of Hamilton. The description of the existing road network in the study area is summarizes in Table 1 below.

Table 1 – Summary of the Existing Road Network in the Study Area

Road Name	Jurisdiction	Number of Lanes	Speed	Road Type	Sidewalk/Cycling
Hunter Street E	City of Hamilton	2 3 lanes east of Liberty St	40 km/h	One-way westbound direction	Sidewalks on both sides Dedicated cycling lanes on the south side west of Liberty Street
Ferguson Avenue S	City of Hamilton	2 for 50 m and 1 lane	40 km/h	Two-way north-south to the existing apartment ramp and then one lane northbound one-way	Sidewalks on both sides No dedicated cycling lanes
Liberty Street	City of Hamilton	2	40 km/h	Two-way north-south direction	Sidewalks on both sides No dedicated cycling lanes
Walnut Street S	City of Hamilton	2	40 km/h	Two-way north-south direction	Sidewalks on both sides No dedicated cycling lanes
Wellington Street S	City of Hamilton	2 north of Hunter St E and 2 lanes south of Hunter St E	50 km/h	One-way southbound direction north of Hunter St E and two-way operations south of Hunter St E	Sidewalks on both sides south of Hunter St E and on west side only north of Hunter St E

Figure 3 illustrates the existing lane configurations and traffic control devices for the intersections considered in the analysis.

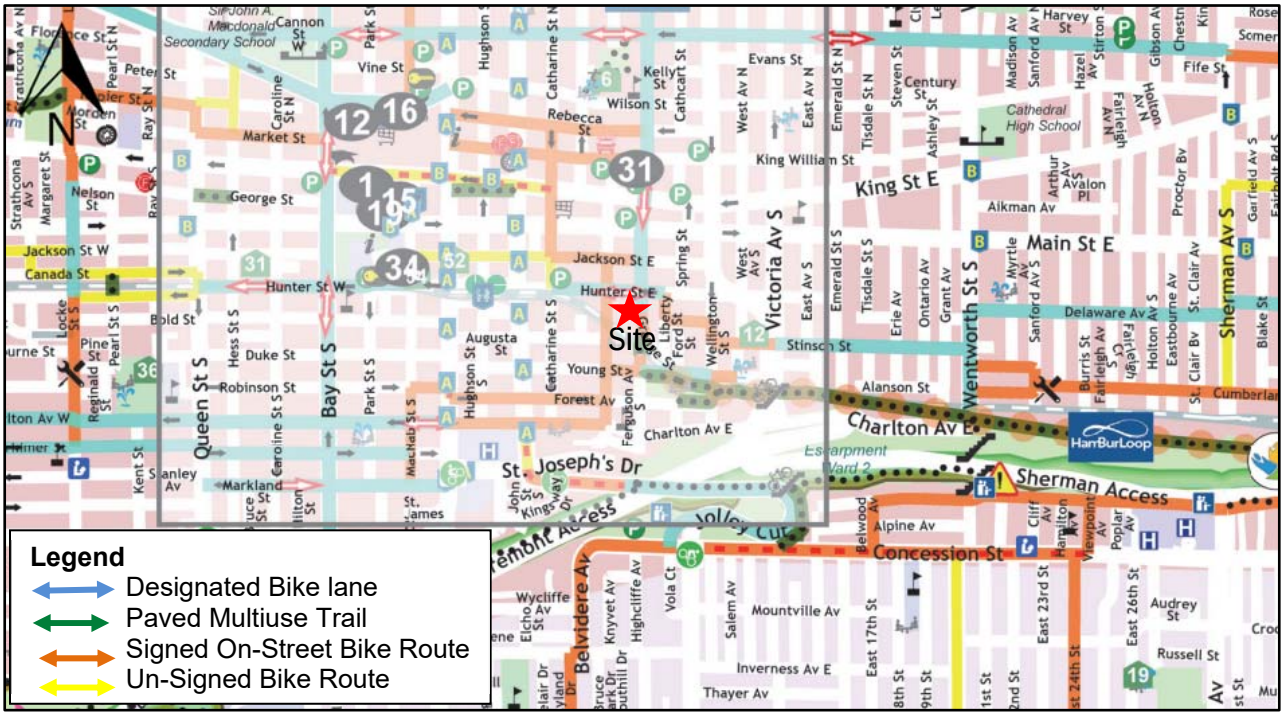
Figure 3 – Existing Lane Configuration and Traffic Control



2.2. Existing Active Transportation Network

Figure 4 illustrates the existing active transportation network in the study area.

Figure 4 – Existing Active Transportation Network in the Study Area



Source: Hamilton Cycling Map

2.3. Existing Active Transportation Assessment

Walking

Sidewalks are currently provided along both sides of Hunter Street E, Ferguson Avenue S, Liberty Street, Walnut Street and Wellington Street S south of Hunter Street E. There is no missing links or gaps in the network. In addition, sidewalks are generally in good conditions, therefore, it is Nextrans' opinion that no improvements to the sidewalk network are required at this time.

As part of this Study, Nextrans will review and recommend appropriate pedestrian connections internally and externally to ensure that the future residents can access the public streets in the area.

Cycling

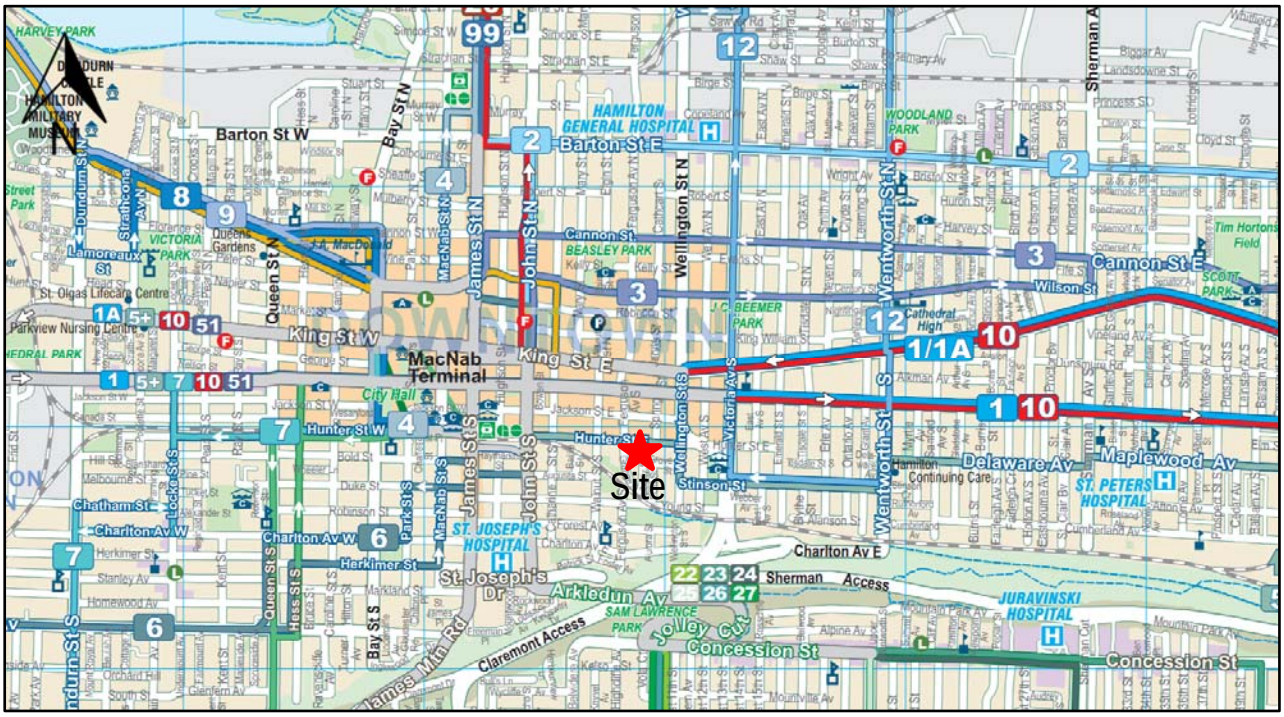
Currently, there are dedicated bike lanes on the south side along Hunter Street E west of Liberty Street that connects to other cycling routes in the City and Hamilton GO Train Station to the west of the subject site. There are also signed routes and paved trails in the area.

It is Nextrans' opinion that the cycling network in the area is well-connected and complete and it also connects to the existing Hamilton GO Train Station and MacNab Terminal. Given that the existing speed limits on the surrounding streets are low, it is appropriate to cycle on these streets without dedicated facilities.

2.4. Existing Hamilton Transit (HSR) System

The area is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. The proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk. Figure 5 illustrates the existing HSR Transit Bus Routes in the study area.

Figure 5 – Existing Hamilton Transit Network in the Study Area



Source: Hamilton Transit website (as of December 2019)

Below are the bus route descriptions based on the information provided on the Hamilton Transit Website (https://www.hamilton.ca/hsr-bus-schedules-fares):

- Route 4 Bayfront – The BAYFRONT route is both an east-west and a north-south route servicing the north end of the city from downtown to the Greenhill area near Red Hill Valley. This service runs 7 days a week from the early morning until after midnight. The service frequency is approximately 20-minute during the weekday peak periods and weekend peak periods.

- Route 5 Delaware – The DELAWARE route generally runs east - west lower Hamilton including Dundas, Ancaster and Stoney Creek. This service runs 7 days a week from the early morning until after midnight. The service frequency is approximately 15-minute during the weekday peak periods and weekend peak periods.

2.3. Existing Area Context

Nextrans has conducted a comprehensive review of the area. The majority of the existing low-rise residential neighbourhoods are located to the north and south of Hunter Street E. There is an existing high-rise apartment building located immediately west of Ferguson Avenue S south of Hunter Street E. There are also several mid-rise residential buildings located on the north side of Hunter Street E as well. The residents can also walk to many other amenities in the area such as:

- Shamrock Park
- Central Memorial Recreation Centre
- Various places of wordship
- Queen Victoria Elementary School; and
- Retails, banks, restaurants and professional offices

2.4. Existing Traffic Volumes

Existing traffic volumes at the study area intersections were obtain from the City of Hamilton and Spectrum for the following intersections:

- Hunter Street E at Liberty Street (Unsignalized) – Count date Tuesday December 7, 2021 (Spectrum)
- Hunter Street E at Wellington Street S (Unsignalized) – Count date Tuesday December 7, 2021 (Spectrum)
- Hunter Street E at Ferguson Avenue S (Unsignalized) – Count date Monday May 6, 2019 (Hamilton)
- Hunter Street E at Walnut Street S (Signalized) – Count date Wednesday May 15, 2019 (Hamilton)

Given that all the existing counts were only conducted in May 2019, which is about two and half years-old, this is acceptable as per the City's requirements and industry standards.

For the purposes of this assessment, the 2019 traffic counts will be adjusted to the 2021 conditions using a typical growth rate of 2% per annum as required by the City of Hamilton for all movements, with the 2021 counts will be adjusted by 10% for the pandemic impact.

Existing turning movement counts are summarized in Appendix B. The existing volumes are illustrated in Figure 6, with Figure 7 illustrating the normalized 2021 volumes.

2.5. Existing Traffic Assessment

The existing volumes in Figure 7 were analyzed using Synchro Version 10 software. It should be noted that the printouts for signalized intersections are based on Synchro so that queues and more detailed information are provided.

The signal timing plans for the signalized intersections were obtained from the City of Hamilton and incorporated into the analysis. The results are provided in Appendix C and summarized in Table 2.

Figure 6 – Existing Traffic Volumes

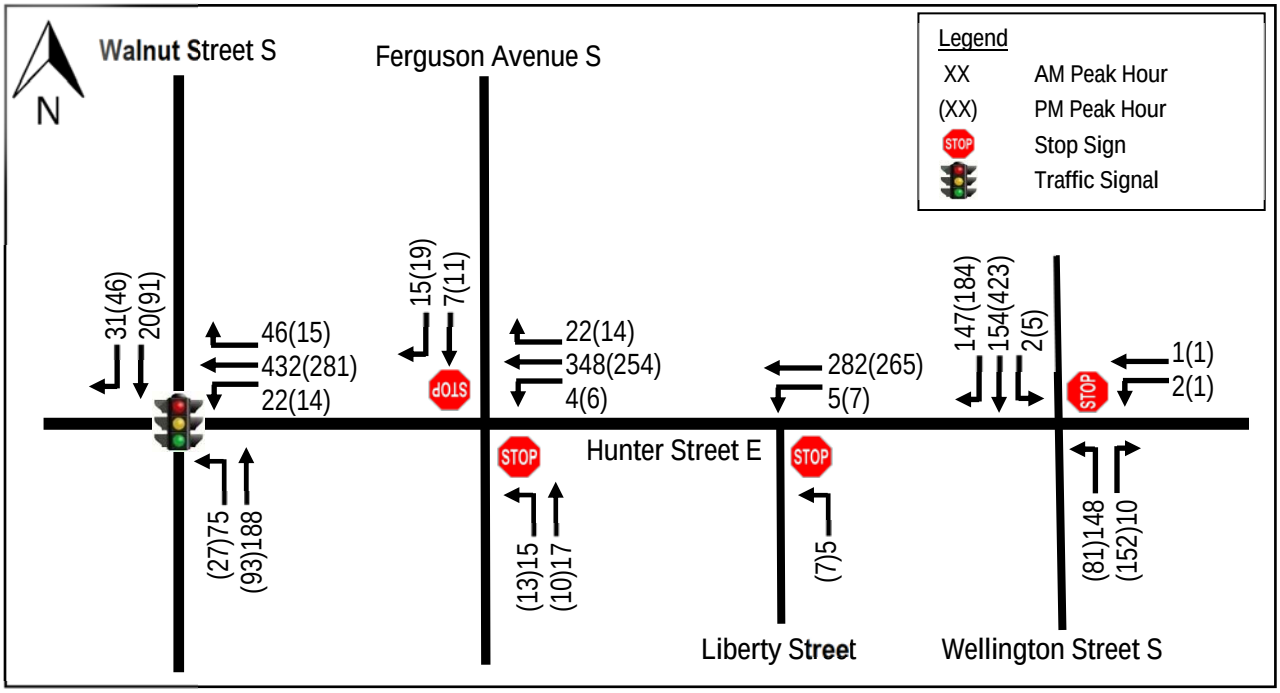
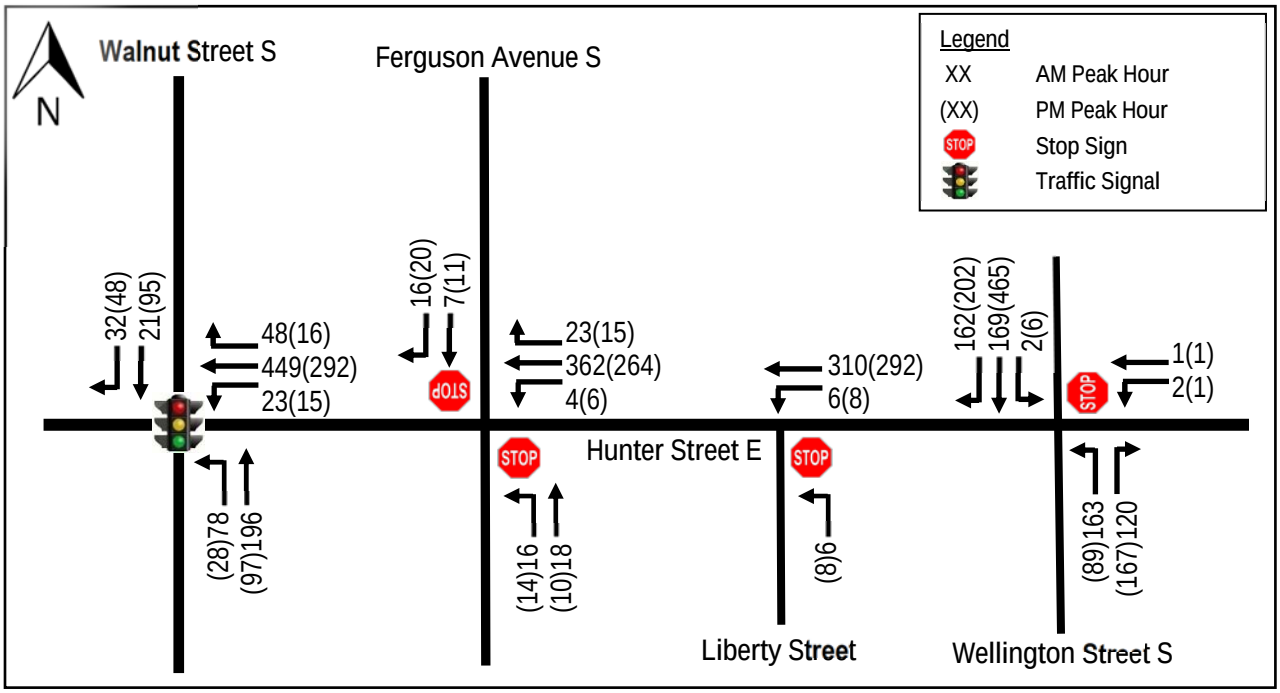


Figure 7 – 2021 Existing Traffic Volumes



The analysis indicates that

Table 2 – Existing Levels of Service

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length
		LOS (v/c)	Delay (s)	95th Queue (m)	LOS (v/c)	Delay (s)	95th Queue (m)	
Hunter Street E/ Walnut Street S (Signalized)	OVERALL	B (0.77)	20		B (0.53)	19		
	WB – LTR	A (0.25)	7	30	A (0.13)	3	13	~100 m
	NB – LTR	D (0.77)	45	76	D (0.53)	43	38	~200 m
	SB – TR	B (0.14)	14	12	C (0.52)	34	37	~100 m
Hunter Street E/ Ferguson Avenue S (Unsignalized)	WB – LTR	A (0.00)	0	0	A (0.00)	0	0	~70 m
	NB – TL	B (0.09)	13	2	B (0.05)	12	1	~60 m
	SB – TR	B (0.05)	11	1	B (0.06)	11	1	~100 m
Hunter Street E/ Liberty Street (Unsignalized)	WB – TL	A (0.00)	0	0	A (0.01)	1	0	~50 m
	NB – L	A (0.01)	10	0	A (0.01)	10	0	~80 m
Hunter Street E/ Wellington Street S (Unsignalized)	WB – TL	C (0.01)	17	0	C (0.01)	18	0	~50 m
	NB – L	A (0.16)	9	5	A (0.11)	10	3	~50 m
	NB – R	A (0.08)	0	0	A (0.10)	0	0	~50 m
	SB – R	A (0.00)	0	0	A (0.00)	0	0	~65 m
	SB – TL	A (0.11)	0	0	A (0.12)	0	0	~65 m

3.0 TRANSPORTATION PLANNING CONTEXT IN THE AREA

3.1. Existing Land Use Context and Amenities

Nextrans has conducted a comprehensive review of the area. The majority of the existing low-rise residential neighbourhoods are located to the north and south of Hunter Street E. There is an existing high-rise apartment building located immediately west of Ferguson Avenue S south of Hunter Street E. There are also several mid-rise residential buildings located on the north side of Hunter Street E as well. The residents can also walk to many other amenities in the area such as:

- Shamrock Park
- Central Memorial Recreation Centre
- Various places of wordship
- Queen Victoria Elementary School; and
- Retails, banks, restaurants and professional offices

It is Nextrans' opinion that the community complete with various amenities to support the future residents in the proposed development.

3.2. Transportation Planning Context

As indicated, the area is currently well-serviced by existing sidewalk network and cycling network. There are no notable missing links or gaps in the active transportation network.

The area is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. The proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk.

It is Nextrans' opinion that the existing transportation network is complete in the area and will be able to accommodate the proposed development.

3.3. Future Rapid Transit Corridor Along King Street/Queenston Road

It is Nextrans' understanding that the Province has cancelled the proposed Light Rail Transit (LRT) and may proceed with a Future Rapid Transit Corridor along King Street E.

Although the LRT could accommodate higher ridership, however, the Future Rapid Transit Corridor will be a significant improvement from the existing conditions.

It is Nextrans' opinion that the proposed development is located just 290 m (or 4 -minute walk) to the King Street E Future Rapid Transit Corridor. The proposed land uses also support future transit ridership and help reduce the numbers of single-occupant-vehicles to and from the proposed development.

4.0 FUTURE BACKGROUND CONDITIONS

4.1. Analysis Horizon

For the purposes of this assessment, it is assumed that the proposed development will be completed by 2024 and therefore a five-year horizon (2029) has been carried out for the study analysis. This provision is consistent with the City of Hamilton's Traffic Impact Study Guidelines.

4.2. Background Development Applications

A comprehensive review of the active developments located within the study area was conducted based on the information extracted from the City of Hamilton development application portal (https://www.hamilton.ca/develop-property/planning-applications/development-applications-mapping).

Based on this information, the majority of the active applications are very minor in nature, which will not materially impact the existing transportation network. It is Nextrans' opinion that the background corridor growth rate of 2% per annum or total of 16% growth would cover the background development site trip generation.

4.3. Future Background Corridor Growth

Based on the City of Hamilton's requirement, a 2% per annum compounded growth rate will be applied to all through movements as per City's guidelines and industry standards, for the horizon year indicated above. This is equivalent to 16% total growth from 2021 to 2029 for all turning movements. Figure 8 illustrates the future background traffic volumes.

4.4. Future Background Traffic Assessment

The estimated 2029 future background traffic volumes are illustrated in Figure 8 and were analyzed using Synchro Version 10 software. The detailed calculations are provided in Appendix D and summarized in Table 3.

Under the future background traffic conditions, the intersection capacity analysis indicates that all the intersections considered are expected to operate at acceptable levels of service. No improvements are required for the horizon year considered herein.

Figure 8 – 2028 Future Background Traffic Volumes

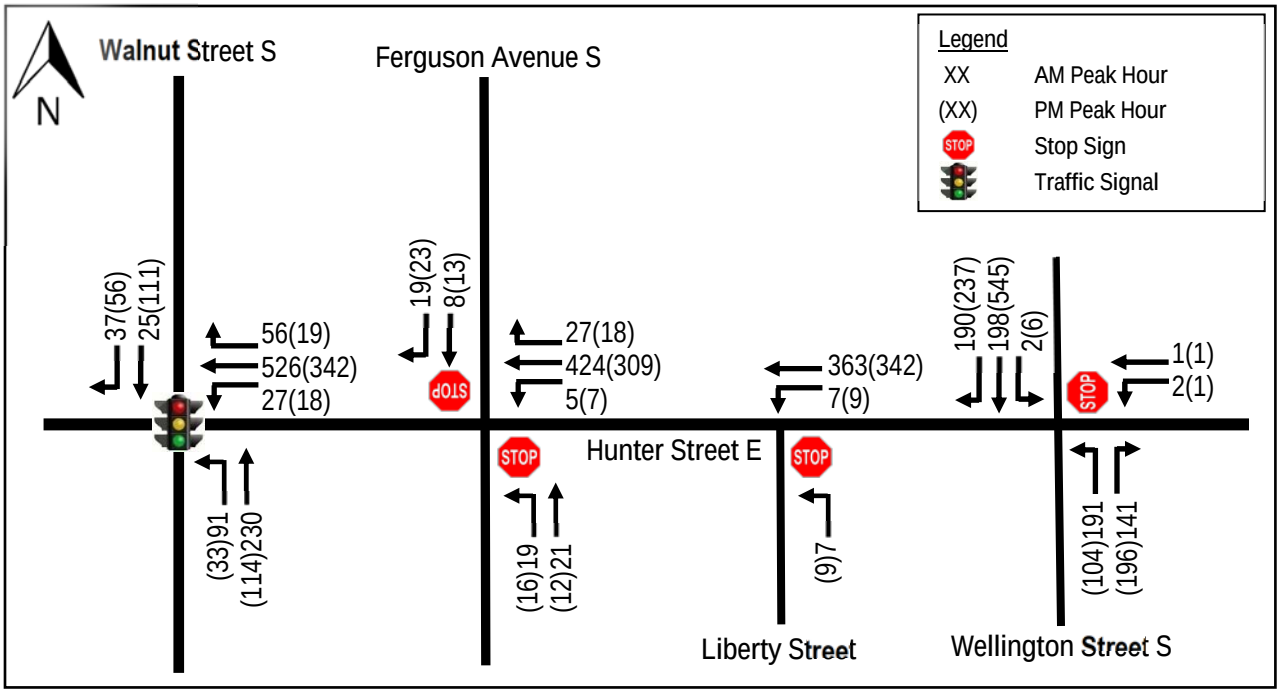


Table 3 – 2029 Future Background Levels of Service

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length
		LOS (v/c)	Delay (s)	95th Queue (m)	LOS (v/c)	Delay (s)	95th Queue (m)	
Hunter Street E/ Walnut Street S (Signalized)	OVERALL	C (0.83)	21		C (0.63)	20		
	WB – LTR	A (0.31)	8	36	A (0.16)	4	16	~100 m
	NB – LTR	D (0.83)	49	99	D (0.63)	46	44	~200 m
	SB – TR	B (0.15)	13	13	D (0.56)	35	42	~100 m
Hunter Street E/ Ferguson Avenue S (Unsignalized)	WB – LTR	A (0.00)	0	0	A (0.01)	0	0	~70 m
	NB – TL	B (0.11)	14	3	B (0.07)	12	2	~60 m
	SB – TR	B (0.06)	12	2	B (0.07)	11	2	~100 m
Hunter Street E/ Liberty Street (Unsignalized)	WB – TL	A (0.00)	0	0	A (0.01)	1	0	~50 m
	NB – L	B (0.01)	10	0	A (0.01)	10	0	~80 m
Hunter Street E/ Wellington Street S (Unsignalized)	WB – TL	C (0.01)	20	0	C (0.01)	21	0	~50 m
	NB – L	A (0.20)	9	6	B (0.14)	11	4	~50 m
	NB – R	A (0.09)	0	0	A (0.12)	0	0	~50 m
	SB – R	A (0.00)	0	0	A (0.00)	0	0	~65 m
	SB – TL	A (0.13)	0	0	A (0.15)	0	0	~65 m

5.0 SITE TRAFFIC

5.1. Proposed Development

As indicated, the development proposal consists of a 12-storey high-rise building with a total of 104 residential dwelling units. The proposed development is proposing a full moves access onto Ferguson Avenue and retain the existing access onto Liberty Street to accommodate the proposed development.

The 2016 Transportation Tomorrow Survey (TTS) and the *Trip Generation Manual, 10th Edition* published by the Institute of Transportation Engineers (ITE) and information was reviewed to estimate the modal split, trip distribution and trip generation for the proposed development.

5.2. Site Trip Generation

The trip generation forecasts were undertaken using the information contained in the *Trip Generation Manual, 10th Edition* published by the Institute of Transportation Engineers (ITE).

For the purposes of this assessment, the ITE Land Use Code (LUC) 222 "Multifamily Housing (High-Rise) General Urban/Suburban" fitted curve equations and average rates have been utilized for the proposed development. The site trip generation is summarized in Table 4.

Table 4 – Site Traffic Trip Generation

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (High-Rise) LUC 222 General Urban/Suburban	104	Trip Rates AM - T = 0.28*(X) + 12.86 PM - T = 0.34*(X) + 8.56	0.1	0.30	0.40	0.26	0.16	0.42
		Total Trips	10	32	42	27	17	44

The proposed development is expected to generate 42 total two-way trips (10 inbound and 32 outbound) and 44 total two-way trips (27 inbound and 17 outbound) during the morning and afternoon peak hours, respectively.

5.3. Site Trip Distribution Based on 2016 TTS Data

The 2016 Transportation Tomorrow Survey (TTS) data was reviewed for Traffic Zones 5035, 5041, 5054 and 5055 in order to estimate the general trip distribution for the proposed development.

Table 5 summarizes general distribution based on the 2016 TTS data for the proposed development, with Table 6 summarizing the site traffic assignment. It should be noted that the auto site trip distribution and assignment have been taken into consideration the TTS information, existing intersection operations and capacity constraints. The detailed 2016 TTS data extraction is included in Appendix E.

Table 5 – Trip Distribution for Residential Component

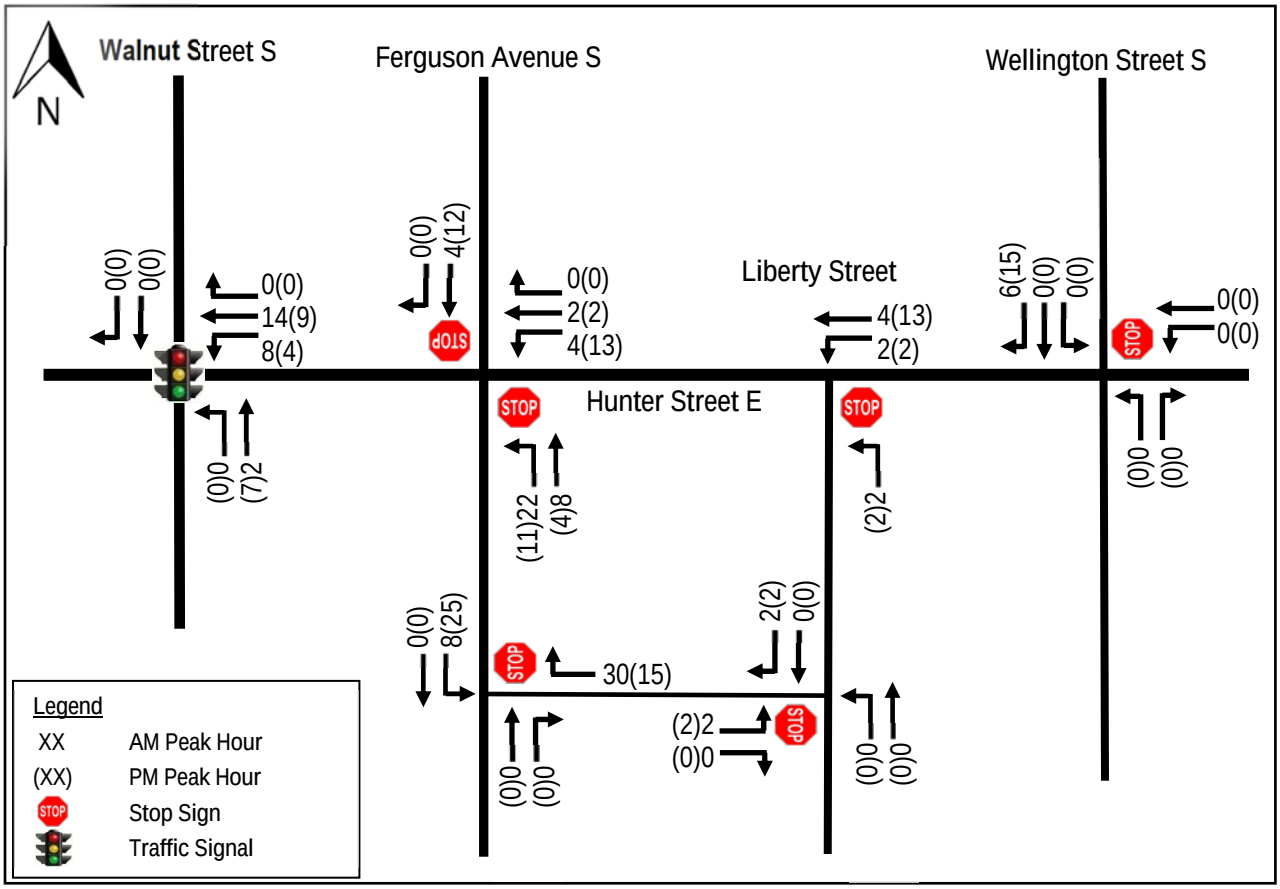
Toronto	Peel Region	Halton Region	City of Hamilton	Glanbrook	Niagara Region	Waterloo Region	Flamborough	Dundas
3%	1%	15%	61%	3%	2%	3%	3%	2%

Table 6 – Site Trip Distribution for Residential Component

General Direction (To/From)	Inbound
South (Victoria Ave S, Walnut Street S)	25%
North (Walnut Street S, Ferguson Avenue S)	30%
East (Main Street E/Hwy 8)	25%
West (Hunter Street E, King Street E)	20%
Total	*100%*

Figure 9 illustrates the proposed development generated traffic volumes for the proposed development.

Figure 9 – Site Traffic Volumes



6.0 FUTURE TOTAL TRAFFIC CONDITIONS

6.1. Future Total Traffic Assessment for Auto Mode

The estimated future total traffic volumes (future background traffic volumes plus site generated traffic volumes) are illustrated in Figure 10, and were analyzed using Synchro Version 10 software. The detailed calculations are provided in Appendix F and summarized in Table 7.

The intersection capacity analysis indicates that all of the intersections considered in the analysis are expected to operate at acceptable levels of service. No physical improvements or signal timing optimization are required to accommodate the proposed development.

The proposed development will only add maximum of one second delay to the critical movements, therefore, it is concluded that the proposed development has negligible impact on the boundary roadway intersections.

The analysis also indicates that the propose development accesses are expected to operate at acceptable levels of service with minimal delay or queues. This also indicates that the proposed development access arrangement is appropriate to accommodate both the anticipated development traffic, servicing vehicles and emergency vehicles.

Figure 10 – 2028 Future Total Traffic Volumes

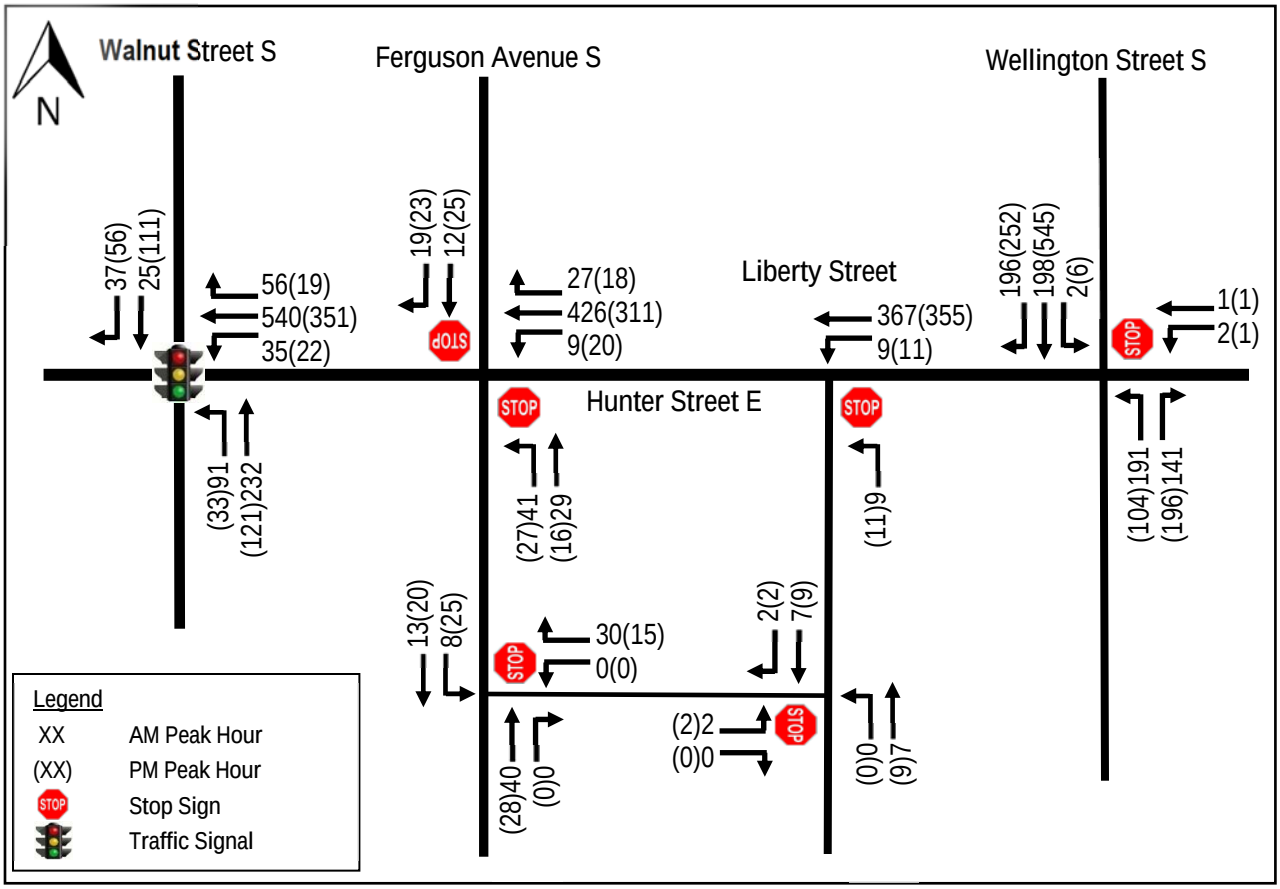


Table 7 – 2029 Future Total Levels of Service

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length
		LOS (v/c)	Delay (s)	95th Queue (m)	LOS (v/c)	Delay (s)	95th Queue (m)	
Hunter Street E/ Walnut Street S (Signalized)	OVERALL	C (0.83)	21		C (0.63)	20		
	WB – LTR	A (0.32)	8	37	A (0.16)	4	17	~100 m
	NB – LTR	D (0.83)	49	100	D (0.63)	46	45	~200 m
	SB – TR	B (0.15)	13	13	D (0.55)	35	42	~100 m
Hunter Street E/ Ferguson Avenue S (Unsignalized)	WB – LTR	A (0.01)	0	0	A (0.02)	0	0	~70 m
	NB – TL	B (0.19)	15	6	B (0.11)	13	3	~60 m
	SB – TR	B (0.07)	12	2	B (0.10)	12	3	~100 m
Hunter Street E/ Liberty Street (Unsignalized)	WB – TL	A (0.01)	0	0	A (0.01)	1	0	~50 m
	NB – L	B (0.02)	10	0	B (0.02)	10	0	~80 m
Hunter Street E/ Wellington Street S (Unsignalized)	WB – TL	C (0.01)	20	0	C (0.01)	22	0	~50 m
	NB – L	A (0.20)	9	6	B (0.14)	11	4	~50 m
	NB – R	A (0.09)	0	0	A (0.12)	0	0	~50 m
	SB – R	A (0.00)	0	0	A (0.00)	0	0	~65 m
	SB – TL	A (0.13)	0	0	A (0.15)	0	0	~65 m
Ferguson Avenue S/ Site Access #1 (Unsignalized)	WB – LR	A (0.03)	10	1	A (0.02)	9	0	~30 m
	NB – TR	A (0.03)	0	0	A (0.02)	0	0	~30 m
	SB – TL	A (0.01)	3	0	A (0.02)	4	0	~30 m
Ferguson Avenue S/ Site Access #1 (Unsignalized)	EB – LR	A (0.00)	9	0	A (0.00)	9	0	~30 m
	NB – TL	A (0.00)	0	0	A (0.00)	0	0	~30 m
	SB – TR	A (0.01)	0	0	A (0.01)	0	0	~30 m

6.2. Active Transportation Mode Assessment

Walking

As indicated in Section 2.3 of this Study, sidewalks are currently provided along both sides of Hunter Street E, Ferguson Avenue S, Liberty Street, Walnut Street and Wellington Street S south of Hunter Street E. There is no missing links or gaps in the network. In addition, sidewalks are generally in good conditions, therefore, it is Nextrans' opinion that no improvements to the sidewalk network are required under the horizon considered in this Study to accommodate the proposed development.

As part of the proposed development, the existing sidewalks along the frontage of the site on Hunter Street E, Liberty Street and Ferguson Avenue will be maintained and enhanced. In addition, the main building entrances will be provided directly onto Hunter Street E to facilitate pedestrian movements. It is Nextrans' opinion that these provisions meet the City of Hamilton mobility and TDM requirements.

Cycling

Similarly, under the existing conditions, there are dedicated bike lanes on the south side along Hunter Street E west of Liberty Street that connects to other cycling routes in the City and Hamilton GO Train Station to the west of the subject site. There are also signed routes and paved trails in the area.

It is Nextrans' opinion that the cycling network in the area is well-connected and complete and it also connects to the existing Hamilton GO Train Station and MacNab Terminal. Given that the existing speed limits on the surrounding streets are low, it is appropriate to cycle on these streets without dedicated facilities.

As part of the proposed development, sufficient bicycle parking spaces will be provided as per the current Zoning By-law requirements. It is Nextrans' opinion that these provisions meet the City of Hamilton mobility and TDM requirements.

6.3. Transit Mode Assessment

If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 4 two-way transit trips (1 inbound and 3 outbound) and 4 two-way transit trips (3 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

As indicated, the proposed development is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. In addition, the proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk.

It is Nextrans' opinion that the proposed development transit ridership can be accommodated by the existing transit system and the Future Rapid Transit Corridor on King Street E. Therefore, no improvements to the transit system is required to accommodate the proposed development.

7.0 SITE PLAN REVIEW

7.1. Loading Requirement

As indicated, the development proposal consists of a 12-storey high-rise building with a total of 104 residential dwelling units. The proposed development will provide one loading space to service the proposed development. This is consistent with the current Zoning By-law No. 05-200.

AutoTURN software was used to generate the vehicle turning movements in and out of the proposed development. The vehicle turning movement templates are illustrated in Figure 11.

7.2. Driveway Location and Configuration

Currently, the subject site has a full moves access onto Liberty Street and two full moves access onto Hunter Street E, including a loading dock.

As part of the proposed redevelopment of the site, the existing two full moves access onto Hunter Street E will be closed. The existing full moves access onto Liberty Street will be retained and a proposed full moves access will be provided onto Ferguson Avenue S at the southerly limit of the site to accommodate the proposed development:

An access onto Liberty Street has the following lane configuration:

- One inbound lane and one outbound lane on the laneway; and
- A shared northbound through/right and a shared southbound through/left on Liberty Street

An access onto Ferguson Avenue S has the following lane configuration:

- One inbound lane and one outbound lane on the laneway; and
- A shared northbound through/right and a shared southbound through/left on Ferguson Avenue S

Based on the findings of this Study and Nextrans' assessment, the proposed access arrangement is appropriate and acceptable as it is optimized the developable lands and consistent with the context of the area. The analysis indicates that both proposed accesses are expected to operate at acceptable levels of service with the proposed lane configurations and access treatment.

It is Nextrans' opinion that the closure of the existing accesses onto Hunter Street E, especially the loading dock access, will improve the walking and cycling operational and safety along the frontage of the proposed redevelopment of the site.

8.0 SAFETY AND OTHER CONSIDERATIONS

8.1. Access Safety

Currently, the subject site has a full moves access onto Liberty Street and two full moves access onto Hunter Street E, including a loading dock.

As part of the proposed redevelopment of the site, the existing two full moves access onto Hunter Street E will be closed. The existing full moves access onto Liberty Street will be retained and a proposed full moves access will be provided onto Ferguson Avenue S at the southerly limit of the site to accommodate the proposed development.

It is Nextrans' opinion that the closure of the existing accesses onto Hunter Street E, especially the loading dock access, will improve the walking and cycling operational and safety along the frontage of the proposed redevelopment of the site.

It is also Nextrans' opinion that as the proposed building will provide sufficient building structure setback from both Liberty Street and Ferguson Avenue S, this provision will provide sufficient sightlines for pedestrians, cyclists and motorists.

8.2. Pedestrian Safety

As part of the proposed development, the existing sidewalks along the frontage of the site on Hunter Street E, Liberty Street and Ferguson Avenue will be maintained and enhanced. In addition, the proposed building will be setback sufficiently to provide sightlines for pedestrians, cyclists and motorists.

It is recommended that ladder crossing to be provided on Liberty Street to facilitate pedestrians crossing Liberty Street.

8.3. Traffic Calming

Given that Hunter Street E, Ferguson Avenue S and Liberty Street only have 40 km/h speed limit with on-street parking, bicycle lanes and sidewalks, traditional traffic calming measures may not be appropriate since these roads need to service buses, servicing vehicles and emergency vehicles. If requires in the future, the City can consider installation speed boards to deter drivers from speeding. However, based on Nextrans' site observation, it is not required at this time.

9.0 PARKING ASSESSMENT

9.1. Vehicle Parking Assessment

It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593. However, as the City has new consolidated Zoning By-law, for the purpose of this assessment, Zoning By-law No. 05-200 Section 5.6 (Consolidated as of September, 2019) has been reviewed and applied in the analysis. Table 8 summarizes the vehicle parking requirement, based on the City's Zoning By-law No. 05-200, Sections 5.6.

Table 8 – Zoning By-law No. 05-200 Vehicle Parking Requirement for Areas Outside Downtown Zones

Type	No. Unit	Ratio	Required
Residential	1-12 units < 50 m^2 13+ units < 50 m^2	0 space/unit = 12 x 0 = 0 space 0.3 spaces/unit = 33 x 0.3 = 10 spaces	10 spaces
	1-12 units > 50 m^2 13+ units > 50 m^2	0 space/unit = 12 x 0 = 0 space 0.5 spaces/unit = 47 x 0.5 = 24 spaces	24 spaces
Total			*34 spaces*

Based on the City's By-Law No. 05-200, a total of 34 vehicle parking spaces are required for the proposed development. The proposed development will provide 50 vehicle parking spaces, which slightly exceed the minimum Zoning By-law requirements. Given that the overall parking supply is still very low relative to the proposed number of units (less than 50%), it is Nextrans' opinion that this is acceptable. Surplus parking spaces can be allocated to bicycle parking spaces in the future, if required.

9.2. Bicycle Parking

As indicated, it is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593, however, there is no bicycle parking requirement for the proposed development under this Zoning By-law.

To support and encourage the future residents to take active mode of transportation instead of driving private vehicles, Nextrans recommends that the proposed development meet or provide close to the bicycle parking requirements based on the consolidated Zoning By-law No. 05-200. Table 9 summarizes the bicycle parking requirements based on the Zoning By-law No. 05-200 Sections 5.7.

Table 9 – Zoning By-law No. 05-200 Bicycle Parking Requirement

Type	Number of Unit	Short-Term Bicycle Parking Requirement	Long-Term Bicycle Parking Requirement	Required
Residential - Condominium	104 units	5 spaces	0.5 space/unit = 52	57 spaces

Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 57 bicycle parking spaces, which include 5 short-term and 52 long-term spaces.

The proposed development will provide a total of 56 bicycle parking spaces, inclusive of short-term and long-term spaces, which is very close to meet the Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision is acceptable and reasonable given that the proposed development is not required to provide any bicycle parking spaces under applicable Zoning By-law No. 6593.

10.0 TRANSPORTATION DEMAND MANAGEMENT

10.1. City of Hamilton's TDM for Development (June, 2015)

The City of Hamilton's TDM for Development Report (June, 2015) has been reviewed and consulted to prepare the TDM requirement for the proposed development. In order to address the City's requirements, the following TDM recommendations are provided to support the proposed development.

Transportation Demand Management (TDM) is a coordinated series of actions aimed at maximizing the people moving capability of the transportation system. According to the City's TDM Report, the main objectives of TDM are:

- Shifting travel modes (e.g. walking, cycling, taking transit or carpooling instead of driving alone);
- Reducing the number of trips people must make (e.g. destinations and activities such as work and shopping, near each other); and,
- Travelling more efficiently (e.g. making trips outside of peak hours).

Potential TDM measures may include but not limited to: TDM supportive land use, bicycle and pedestrian programs and facilities, public transit improvements, preferential treatments for buses and high occupancy vehicles (if applicable), ridesharing, and employee incentives.

10.1.1. Increase Density and Compact Site Design

Currently, the subject land is occupied by one-storey office building and a Impark parking lot. The development proposal consists of a 12-storey building with a total of 104 residential dwelling units.

It is Nextrans' opinion that this is a very compact residential development and design that meet the City's requirements because it does not include low-rise housing units.

The proposed development will contribute positively to the on-going housing shortage and affordability crisis in the City of Hamilton and in the Greater Toronto and Hamilton Area. The proposed development will also contribute to the City Development Charges to maintain and building infrastructures in the City.

10.1.2. Site Design Elements

It is Nextrans' understanding that the proposed development has been designed to include the following design elements:

- Meet minimum bicycle parking requirements as per Zoning By-law No. 05-200;
- Provide direct pedestrian/cycling connections onto Hunter Street E;
- Provide internal pedestrian circulation;

It is Nextrans' opinion that these compact design elements will help facilitate the pedestrian and cyclist movements in efficient and safe manner.

10.1.3. Sidewalks and Pathways

The proposed development provides continuous sidewalks internally and direct connections to Hunter Street E, as illustrated the proposed site plan.

10.1.4. Bicycle Parking (Long-term and Short-term)

It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593, however, there is no bicycle parking requirement for the proposed development under this Zoning By-law. To support and encourage the future residents to take active mode of transportation instead of driving private vehicles, Nextrans recommends that the proposed development meet or provide close to the bicycle parking requirements based on the

consolidated Zoning By-law No. 05-200. Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 57 bicycle parking spaces, which include 5 short-term and 52 long-term spaces.

As the proposed development will provide a total of 56 bicycle parking spaces, inclusive of short-term and long-term spaces, which is very close to meet the Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision is acceptable and reasonable given that the proposed development is not required to provide any bicycle parking spaces under applicable Zoning By-law No. 6593.

10.1.5. Direct Connections to Transit

As indicated, the proposed development is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. In addition, the proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk. It is Nextrans' opinion that the proposed development has great access and short walking distance to existing transit service. Therefore, no additional improvements are required.

10.1.6. Opportunities for Reduced Parking Requirements

It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593. However, as the City has new consolidated Zoning By-law, for the purpose of this assessment, Zoning By-law No. 05-200 Section 5.6 (Consolidated as of September, 2019) has been reviewed and applied in the analysis, as this requirement may be lower than the Zoning By-law No. 6593. Based on the City's By-Law No. 05-200, a total of 34 vehicle parking spaces should be provided for the proposed development. The proposed development will provide 50 vehicle parking spaces, which slightly exceed the minimum Zoning By-law requirements. As the surplus parking is minimal, therefore, it is acceptable.

10.1.7. Unbundle Parking

As parking is the best TDM incentive for resident to take alternative mode of transportation, it is recommended that the proposed development unbundle the parking sale from the unit.

10.1.8. On-Site Carshare Vehicle(s) and Parking Spot(s)

It is Nextrans' opinion that this requirement is more appropriate for larger scale development in the Downtown or Transit Oriented Corridor setting where carshare is economically viable. It is not appropriate for the small development like this and without other high-rise/mid-rise buildings near-by to share the use or carrying costs. As such, it is Nextrans' opinion that this requirement is not appropriate or necessary for the proposed development given the proposed development context and location.

10.1.9. On-Site Bikeshare

It is Nextrans' opinion that bikeshare is more appropriate in the downtown setting surrounded by more mid-rise and high-rise uses, as well as other office and retail uses, in order to share the use and carrying costs to make bikeshare more economically feasible. It is Nextrans' opinion that bikeshare is not appropriate for this proposed development.

10.1.10. Wayfinding Signage

Given that the proposed development is an infill development located in the Downtown Area (Ward 2), it is Nextrans' opinion that wayfinding signage is not required for the proposed development as it is visible to the public, visitors and future residents living in the buildings.

10.1.11. Travel Planning Tools and Support for Development of a School Travel Plan

It is recommended that the proposed development contact and coordinate with the Hamilton-Wentworth District School Board for any potential school travel plan in the area.

10.1.12. Opportunities for Transit Passes, Carshare Memberships, or Bikeshare Memberships

As the proposed development is located in the Downtown Area with direct access and short walking distance to both Hamilton GO Train Station and MacNab Terminal, transit incentive is not required.

10.1.13. Proposed Monitoring Evaluation of TDM Measures

Based on our previous experience, monitoring and evaluation of TDM measure are important but very onerous for the Applicant. When project is completed and the Applicant transfers the ownership to Condominium Board, the Board will have the full control of the proposed development and there are certain conditions and requirements the Condominium Board may not agree with. It is Nextrans' opinion that TDM measures and incentives provided in this report are sufficient and appropriate, as such, monitoring for the proposed development is not required.

10.2. Recommended TDM Measures and Incentives for the Proposed Development

Based on the review of the context of the proposed development in relation to the TDM requirements by the City of Hamilton, a number of TDM measures and incentives are identified for the proposed development to consider, given the limited transit service and active transportation network in the area. Table 10 summarizes the recommended TDM measures and incentives.

Table 10 – Recommended TDM Measures for the Proposed Development

Category	TDM Initiative required by the City or suggested by Nextrans	Recommended Actions	Responsibility
Cycling	• Visible, well-lit, short-term bicycle parking for visitors (above minimum provisions or recommendations) • Secure, indoor bicycle parking storage spaces for tenants/residents • Ensure development connects to bicycle network	• Provide a total of 56 bicycle parking spaces	Applicant
Walking	• Safe, attractive and direct walkways for pedestrians linking building entrances with public sidewalks and with key destinations such as schools • Enhanced pedestrian amenities on-site (benches, landscaping, lighting)	• Provide direct shared pedestrian and cycling connections from the proposed development to Hunter Street E	Applicant
Transit	• Enhance walking routes between main building entrance(s) and transit stops/stations • Bicycle parking located at or near transit stops • Implement transit priority measures (queue jump lanes, traffic signal priority, bus only lanes)	• The proposed development provides a shared pedestrian/cycling connection directly to Hunter Street E and other public streets if appropriate	Applicant
Parking	• Reduced minimum parking requirements based on proximity to transit • Shared parking with nearby developments or on-street spaces • Unbundle parking costs from unit costs	• Consider unbundle parking sell with the unit;	Applicant
Information Brochure/ Letter	• Provide an information brochure/letter for each residential unit that include HSR Transit System schedules, GO Transit schedules, cycling maps and community maps.	• Provide a brochure (or a letter) to new residents that include all website links to Hamilton Transit System schedules, community maps and cycling maps. The information package can be distributed at the sale office.	Applicant

11.0 CONCLUSIONS / FINDINGS

11.1. Study Conclusions

The findings and conclusions of the analysis are as follows:

- The proposed development is expected to generate 42 total two-way trips (10 inbound and 32 outbound) and 44 total two-way trips (27 inbound and 17 outbound) during the morning and afternoon peak hours, respectively.

- Under the existing, 2029 future background and future total traffic conditions, the analysis indicates that all the intersections considered are expected to operate at acceptable levels of service. No improvements are required for the horizon considered and to accommodate the proposed development.

- If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 4 two-way transit trips (1 inbound and 3 outbound) and 4 two-way transit trips (3 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

  The proposed development is current serviced by two existing HSR Transit Bus Routes 4 Bayfront and 5 Delaware. In addition, the proposed development is only located 500 m from the existing Hamilton GO Train Station and MacNab Terminal, or only 7-minute walk.

  It is Nextrans' opinion that the proposed development transit ridership can be accommodated by the existing transit system and the Future Rapid Transit Corridor on King Street E. Therefore, no improvements to the transit system is required to accommodate the proposed development.

- It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593. However, as the City has new consolidated Zoning By-law, for the purpose of this assessment, Zoning By-law No. 05-200 Section 5.6 (Consolidated as of September, 2019) has been reviewed and applied in the analysis.

  Based on the City's By-Law No. 05-200, a total of 34 vehicle parking spaces should be provided for the proposed development. The proposed development will provide 50 vehicle parking spaces, which slightly exceed the minimum Zoning By-law requirements. As the surplus parking is minimal, therefore, it is acceptable.

- It is Nextrans' understanding that the proposed development is subject to the existing Zoning By-law No. 6593, however, there is no bicycle parking requirement for the proposed development under this Zoning By-law.

  To support and encourage the future residents to take active mode of transportation instead of driving private vehicles, Nextrans recommends that the proposed development meet or provide close to the bicycle parking requirements based on the consolidated Zoning By-law No. 05-200. Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 57 bicycle parking spaces, which include 5 short-term and 52 long-term spaces.

  As the proposed development will provide a total of 56 bicycle parking spaces, inclusive of short-term and long-term spaces, which is very close to meet the Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision is acceptable and reasonable given that the proposed

- The proposed development is proposing one full moves access onto Ferguson Avenue S and one full moves access onto Liberty Street (existing access). These proposed lane configurations based on the intersection capacity analysis include:
  - Access onto Liberty Street:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Liberty Street

- Access onto Ferguson Avenue S:
  - One inbound lane and one outbound lane on the laneway; and
  - A shared northbound through/right and a shared southbound through/left on Ferguson Avenue S

The analysis indicates that both proposed accesses are expected to operate at acceptable levels of service with the proposed lane configurations and access treatment. Therefore, the proposed access arrangement is reasonable and acceptable as it is optimized the developable lands and consistent with the context of the area.

- The proposed development will provide one loading space to service the proposed development. This is consistent with the current Zoning By-law No. 05-200. AutoTURN software was used to generate the vehicle turning movements and provided in Section 7 of this Study.

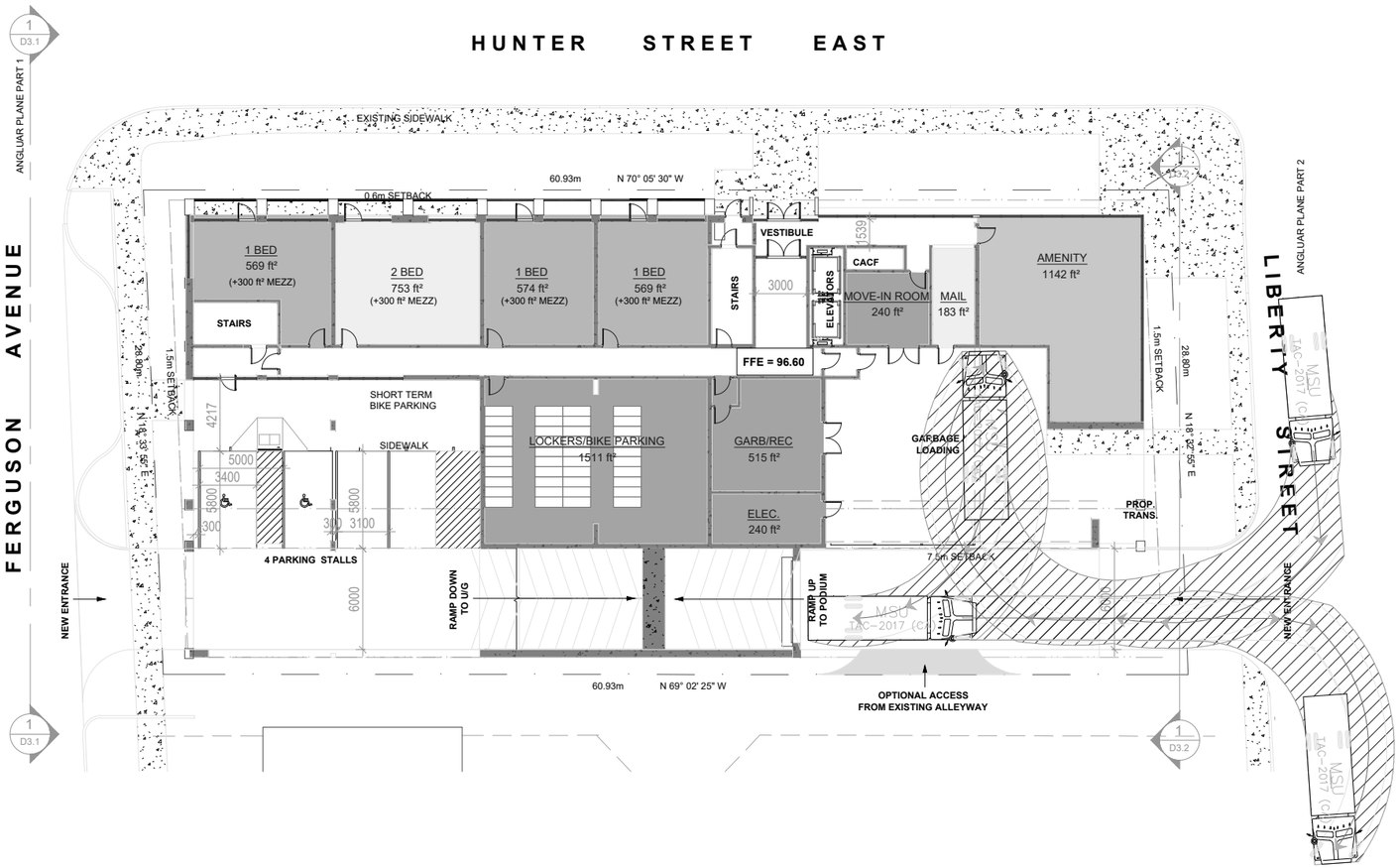
11.2. Study Recommendations

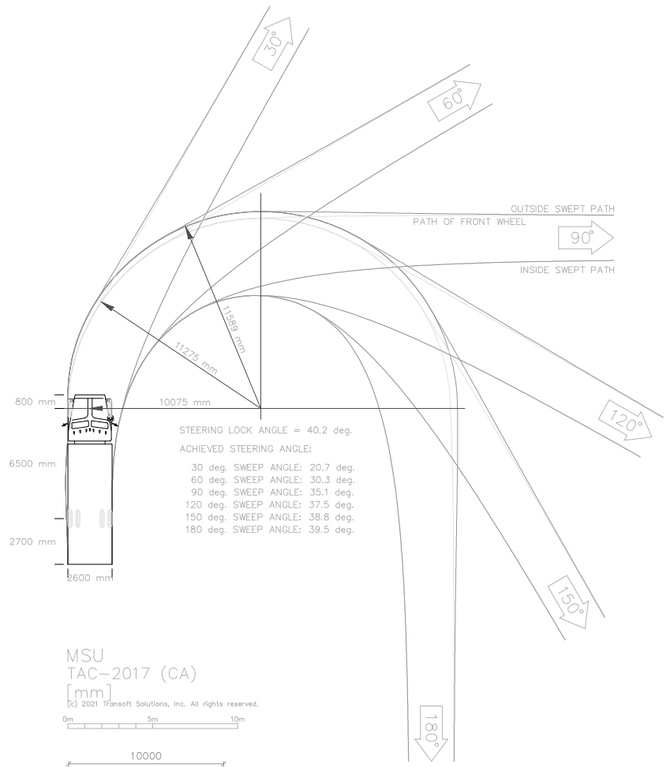
Based on the findings and conclusions of this study, the following recommendations are provided:

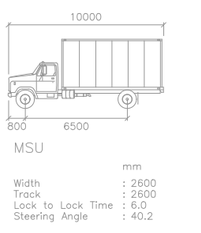
- The proposed development implements the TDM measures and incentives identified in this report to support active transportation and transit and to reduce the numbers of single-occupant-vehicle trips to and from the proposed development;

- No additional physical improvements for the area at this time to accommodate the proposed development, under the future background and future total conditions.

- Site access lane configurations:
  - Access onto Liberty Street:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Liberty Street
  - Access onto Ferguson Avenue S:
    - One inbound lane and one outbound lane on the laneway; and
    - A shared northbound through/right and a shared southbound through/left on Ferguson Avenue S







MSU

	mm
Width	: 2600
Track	: 2600
Lock to Lock Time	: 6.0
Steering Angle	: 40.2

KEY PLAN

BENCHMARK

REVISONS

NO	REVISION	DATE	BY

STAMP

nexTrans
CONSULTING ENGINEERS
Suite 201, 520 Industrial Parkway South
Aurora ON L4G 6W8
Tel: 905-503-2563
Web: www.nextrans.ca

PROJECT NAME:
RESIDENTIAL DEVELOPMENT
186 Hunter Street
(City of Hamilton)

DRAWING TITLE:
AutoTURN Analysis
(MSU TAC-2017)

DESIGN BY: K.A.	DATE: December 7, 2021
CHECKED BY: R.P.	PROJECT NO. NT-21-281
DRAWN BY: K.A.	DRAWING NO. Figure 11
SCALE: NTS	

Appendix A
Pre-Consultation Comments

Transportation Planning
Transportation Planning & Parking Division, Planning & Economic Development
Email: tplanning@hamilton.ca

October 18, 2021

Attention: Shannon McKie, Senior Project Manager, Development Planning
Daniel Barnett, Planner II, Development Planning

From: Matthew Radaelli, Project Manager, Transportation Planning
Gregory Borys, Transportation Planning Technologist, Transportation Planning

SUBJECT: 186 Hunter Street East, Hamilton (Ward 2)
FC-21-144

- Transportation Impact Study – **REPORT REQUIRED**
- Transportation Demand Management & Transit Oriented Design – **MEASURES REQUIRED**
- Right-of-Way Dedications – **NOT REQUIRED**
- Daylighting Triangle Dedications – **REQUIRED**
- Infrastructure Improvements – **INFORMATION ONLY**
- Future Site Plan – **REQUIREMENTS**

DISCLAIMER: The following information provided by the Transportation Planning section at the Formal Consultation stage is intended to help educate and inform the Applicant about required studies, applicable policies and key issues in advance of submitting a formal Planning Act application.
These comments do not address all transportation issues and/or details that may affect final approval of the site, and which may be identified at the next stage of Planning Act approvals.
It is the Applicants' responsibility to review all relevant City plans and guidelines such as the Official Plans and Secondary Plans, Zoning By-laws, the Transportation Master Plans, Site Plan Guidelines/Design Standards and Comprehensive Development Guidelines & Financial policies, as well as relevant transportation industry reference material, guidelines and standards from the Transportation Association of Canada (TAC), Ontario Traffic Council (OTC) and other Provincial and National organizations.

Documents Reviewed

Transportation Planning has reviewed the subject file. The following comments and recommendations refer to:

- Site Plan – *SITE PLAN / LEVEL 1* – Revision Unknown – September 20, 2021
- Underground Plan – *UNDERGROUND PARKING LEVEL* – Revision Unknown – September 20, 2021
- Underground Plan – *LEVEL 2 (PARKING PODIUM)* – Revision Unknown – September 20, 2021

Transportation Impact Study – Report Required

1. A Transportation Impact Study (TIS) is to be submitted to the satisfaction and approval of the Manager, Transportation Planning. The Transportation Consultant is to provide a proposed scope for review and approval by Transportation Planning prior to commencement of the study.
   - All email correspondence is to have the City development application number(s) and municipal address(es)
   - Full guidelines can be found at https://www.hamilton.ca/develop-property/policies-guidelines/traffic-impact-study-guidelines
   - The Transportation Consultant is to contact the planner on file, to obtain the approved developments in the study area.
   - The Transportation Consultant is permitted to use other TIS reports for background developments. They are to calculate their own trip generation and use no other data from the reports.
   - The City may have useable traffic volume counts available for purchase. The traffic consultant is to contact trafficops@hamilton.ca.
   - Any analysis within the TIS must use the existing signal timings. Optimized signal timings are permissible only when existing timing analysis is also provided in the review. For information on existing traffic signal timings contact trafficops@hamilton.ca.

Transportation Demand Management & Transit Oriented Design – Measures Required

2. The Urban Hamilton Official Plan embraces creating compact complete communities with the integration of land use and transportation, which can contribute to better overall quality of life, less automobile dependency, and promote transit-oriented development. For sites located in proximity to current or future transit service, improving the overall pedestrian realm will improve access to transit, which can increase property values, demand rent premiums, and can create an increased potential for development with less parking required. The following TDM and TOD measures are recommended:
   - Provide short-term bicycle parking within the property limits as per the City of Hamilton Zoning By-Law 05-200 for the proposed land use type.
   - Provide long-term bicycle parking that is secure and shielded from the elements as per the City of Hamilton Zoning By-Law 05-200 for the proposed land use type.
   - Automobile parking should not be a prominent feature. Parking should not be oversupplied and should be relocated to the rear of the building or underground, and unbundled from the cost of purchasing/renting a residential unit.

- Additional TDM measures can be recommended within the required TIS report, however recommended measures included within the TIS will be required to be implemented by the Owner.

Right-of-Way Dedications – Not Required

3. Based on the existing 20.0 metre right-of-way along Hunter Street East no further land dedication is required along the frontage of 186 Hunter Street East as per the as per the Council Approved Urban Official Plan: Schedule C-2 - Future Right-of-Way Dedications. Hunter Street East (OPA 102) is to be 20.117 metres from Queen Street to Wellington Street.

4. Based on the existing 20.0 metre right-of-way along Grange Street no further land dedication is required along the frontage of 186 Hunter Street East as per the Council Approved Urban Official Plan: Chapter C - City Wide Systems and Designations, 4.5 Road Network Functional Classification, 4.5.2. Local roads (Grange Street) are to be a maximum of 20.0 metres.

5. The existing right-of-way at the subject property along Liberty Street is 17.0 metres. Some Local Roads within older urban downtown or urban core areas are subject to the following policy in the Council Approved Urban Official Plan: Chapter C - City Wide Systems and Designations, 4.5 Road Network Functional Classification, 4.5.2. f) Local Roads iii) The City recognizes that in older urban built up areas there are existing road right-of-way widths significantly less than 20.117 metres. Notwithstanding the other road right-of-way widening policies of this Plan, it is the intent of the City to increase these existing road rights-of-ways to a minimum of 15.24 metres with daylighting triangles at intersections instead of the minimum required 20.117 metre road right-of-way width, provided all the required road facilities, municipal sidewalks and utilities can be accommodated in this reduced road right-of-way width. As such, without setting precedent no right-of-way dedications are required along Liberty Street.

Daylighting Triangle Dedications – Required

6. Hunter Street East is a Collector Road and Ferguson Avenue South is a Local Road. The Applicant is to dedicate a 9.14 metres x 9.14 metres Daylighting Triangle to the right-of-way, as per the Council Approved Urban Official Plan: Chapter C - City Wide Systems and Designations 4.5 Road Network Functional Classification; Daylighting Triangles 4.5.7.

7. Hunter Street East is a Collector Road and Liberty Street is a Local Road. The Applicant is to dedicate a 9.14 metres x 9.14 metres Daylighting Triangle to the right-of-way, as per the Council Approved Urban Official Plan: Chapter C - City

Wide Systems and Designations 4.5 Road Network Functional Classification; Daylighting Triangles 4.5.7.

Infrastructure Improvements – Information Only

8. The Applicant will be responsible for any road improvements that are identified in association with their development (traffic signals, left turn lanes, right turn lanes, centre median, etc.) all at their cost. Infrastructure improvements may be identified as part of the TIS analysis required to be submitted by the Applicant.

Future Site Plan – Requirements

9. Transportation Planning notes that a maximum grade percentage of 10% is required as per City of Hamilton Comprehensive Development Guidelines for parking garage ramps. Should the proposed ramp grade not conform to City Development Guidelines, as a Special Condition of Site Plan Approval, prior to application for any building permits, a letter certifying the design of the ramp will be required, to be provided and signed by a Licensed Architect or Engineer, to the satisfaction of the Manager, Transportation Planning.

10. A 3.0 metres x 3.0 metres local road visibility triangles must be provided for each driveway access. They must be illustrated, dimensioned and identified on the site plan. Visibility triangles are between the driveway limits and the ultimate property line (right-of-way limit) and no object or mature vegetation can exceed a height of 0.6 metres above the corresponding perpendicular centreline elevation of the adjacent street. Transportation Planning notes that visibility triangle requirements have the potential to affect the proposed building envelope.

11. For two-way operation onto municipal road, the driveway access width(s) must be 7.5 metres at the ultimate property line and curve radii minimum 6.0 metres. All shall be identified and dimensioned on the plan. Transportation Planning notes that driveway width requirements have the potential to affect the proposed building envelope.

Should you have any questions, please email tplanning@hamilton.ca, referencing: 186 Hunter Street East – FC-21-144 (Ward 2) Transportation Planning Response

cc: Development Engineering Approvals

Appendix B
Existing Traffic Data and Signal Timing Plans

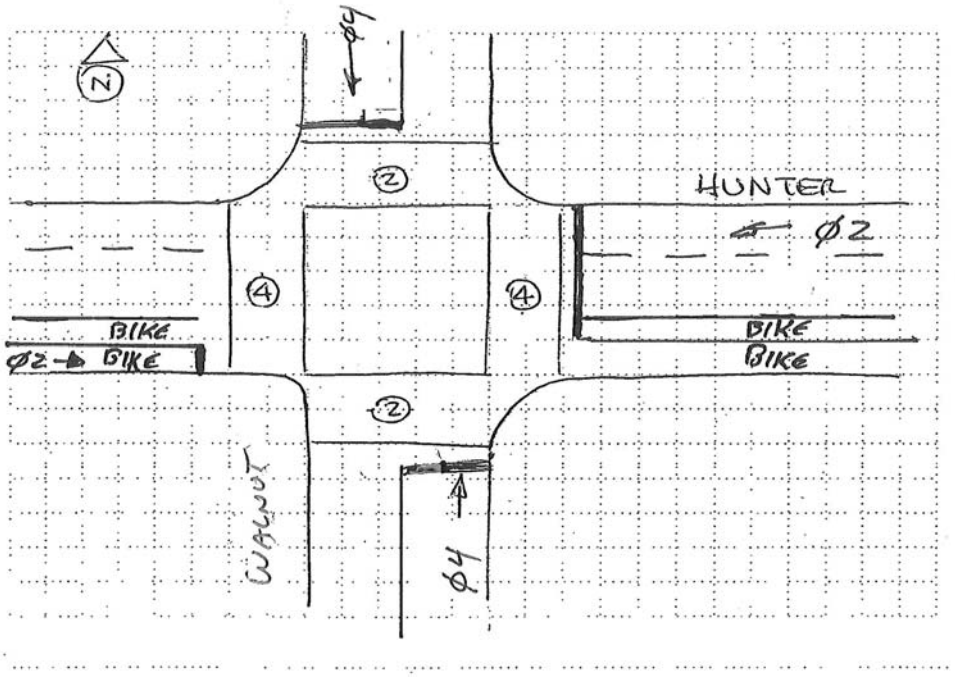
City of Hamilton - Traffic
Traffic Signal Controller Timing Data

Intersection: **Walnut & Hunter**

Controller Type: **3000E** Page **1** of **15**

Programmed By: **RDG** Installed By:

Date: **March 5/15** Date:



ϕ1:
ϕ2: **Hunter - EB/WB, North & South Xwalks**
ϕ3:
ϕ4: **Walnut - NB/SB, East & West Xwalks**
ϕ5:
ϕ6:
ϕ7:
ϕ8:

Flash Operation: **Red: Walnut**
Red: Hunter

SEQUENCE/START-UP (MM-3-1-1)

START-UP PHASES/INTERVAL/SEQUENCE

(X = Enable for start-up phases. Must be compatible if more than one)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
START-UP	Phases				**X**												
	Interval	**0**	(0=Red, 1=Yel, 2= Grn, determines color of selected phases above on start-up)														
	Flash	**10**	(0-255 seconds start-up flash time)														
	Red	**5.0**	(0-25.5 secs = length of first red after start-up if start-up in yellow or red)														
	Sequence	**2**	(2=single ring, 3=dual ring, 4=123/567+48, 5=12/56+3478, 6=1234/56+78, 7=1234/5678, 8=dual quad, 9=12ph														

PHASE RING ASSIGNMENTS

X = Phase assigned to ring (if used). Phases in different rings but same co-phase group can time together.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
RING	Ring 1		**X**		**X**												
	Ring 2																
	Ring 3																
	Ring 4																

CO-PHASE GRP 1-4 ASSIGNMENTS

X = phase assigned to co-phase group. All ph's assigned to rings must be assigned to co-phase group.

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
CO-PHASE	CO PH 1		**X**														
	CO PH 2				**X**												
	CO PH 3																
	CO PH 4																

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CONTROLLER DATA

PHASE RECALLS/MODES; MIN, MAX, etc. (MM-3-1-2-1-PGDN, etc.) USE 1 TO ALL 4 TIMING PLANS

TP1 PHASE RECALLS

(X = ENABLE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK																
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

TP2 PHASE RECALLS

(X = ENABLE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK																
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

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TP3 PHASE RECALLS

(X = ENABLE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK																
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

TP4 PHASE RECALLS

(X = ENABLE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK																
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

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CONTROLLER DATA

PHASE RECALLS/MODES; CNA, INH MAX, PED OPTIONS, etc. (MM-3-1-2-2) ONLY 1 PLAN PER UNIT

(X = ENABLE)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	CNA 1		X		X												
	CNA 2																
	CNA 3																
	CNA 4																
	WRM		X		X												
	INH MAX																
	PED RECY																
	FL WALK																
	FDW->YEL																
	FDW->RED																
	COND PED																

PHASE TIMES (MM-3-1-3-PGDN, etc.) USE 1 TO ALL 4 TIMING PLANS

TP1

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial		**10**		**10**												
	Passage																
	Yellow		**3.3**		**3.3**												
	Red		**2.0**		**1.8**												
	Walk		**12**		**12**												
	Ped Clr		**9**		**10**												
	Max 1		**40**		**30**												
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
	Max In																

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TP2

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial		**10**		**10**												
	Passage																
	Yellow		**3.3**		**3.3**												
	Red		**2.0**		**1.8**												
	Walk		**12**		**12**												
	Ped Clr		**9**		**10**												
	Max 1		**60**		**30**												
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
	Max In																

TP3

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial		**10**		**10**												
	Passage																
	Yellow		**3.3**		**3.3**												
	Red		**2.0**		**1.8**												
	Walk		**12**		**12**												
	Ped Clr		**9**		**10**												
	Max 1		**55**		**35**												
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
	Max In																

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CONTROLLER DATA

		TP4															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial																
	Passage																
	Yellow																
	Red																
	Walk																
	Ped Clr																
	Max 1																
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
	Max In																

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SELECTION SOURCE (MM-3-2-2)

Entries determine how parameters get selected

Cycle Source:	**1**	0=TOD, 1=CL, 2=INT
Split Source:	**1**	0=TOD, 1=CL, 2=INT
Offset Source:	**1**	0=TOD, 1=CL, 2=INT

Free Source:	**1**	0=TOD, 1=CL, 2=INT
Flash Source:	**0**	0=TOD, 1=CL, 2=INT
Inter-TOD Revert:	**255**	0-255 SECS

TOD = Time of day control by internal clock, CL = Closed loop (comm), INT = Interconnect. Inter-TOD Revert is time allowed after failed interconnect before unit reverts to TOD (Time Base) control.

COORD BASIC OPTIONS (MM-3-2-3)

Reference to End (vs. begin) of Main St.:	**N**	Y/N: Y = Offset references to end of main st. green. N = Beginning of Main st. green.
Use % (vs. secs) for Phase Allocation:	**N**	Y/N: Y = Phase allocations loaded as percent of 100. N = Allocations in seconds.
Use % (vs. secs) for Offset Entry:	**N**	Y/N: Y = Offset loaded as percent of 100. N = Offset loaded in seconds.
Use Fixed (vs. floating) Force Offs:	**Y**	Y/N: Y = Force offs are fixed to cycle. N=Force offs like max times, begin with green.
Permissive Type:	**1**	0-2: 0=Yield, 1= Single, 2= Multiple. See Permissives note below

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C/S TO TIMING PLAN (MM-3-2-9-6)

USE THIS CHART WHEN 4 SPLITS/CYCLE = Y

	CYCLE	1	2	3	4	5	6
SPLIT TO TIME PLAN	SPLIT 1	**1**	**2**	**3**	**4**		
	SPLIT 2						
	SPLIT 3						
	SPLIT 4						

(0-4 = TIME PLAN IMPLEMENTED WHEN SPLIT IN EFFECT)

CYCLES & OFFSETS (MM-3-2-4)

NOTE: FIRST SPECIFY OFSET SEEKING MODE AND 4 SPLITS CYCLE MODE (ENHANCED OPTIONS, OPERATING MODES)

	Cycle #	1/1	2/1	3/1	4/1		
CYCLE & OFFSETS	Length	**70**	**90**	**90**			
	Offset 1	**62**	**58**	**0**			
	Offset 2						
	Offset 3						
	Offset 4						
	Offset 5						
	Max Dwell	**32**	**32**	**32**			

COORD PHASES (MM-3-2-5)

	CYCLE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
COORD PHASES	**1-1**		**X**														
	2-1		**X**														
	3-1		**X**														
	4-1																

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OFFSET SEEKING MODE (MM-3-2-7)

Offset Seeeling Mode:	**0**

Mode

0 Add only, cycle times 20% slow only to get in sync

1 Dwell, cycle timer stops at cycle 0 up to max dwell time to get in step

2 Short Route, cycle times 20% fast or slow--whichever gets in step fastest

ENHANCED OPTIONS

OPERATING OPTIONS (MM-3-2-9-1)

Enhanced Perm:	**Y**	Y/N: See note	Invert Free In:	**N**	Y/N: See note
Central Override:	**N**	Y/N: See note	Split Matrix:	**N**	Y/N: See note
No PCL Offset Adjust:	**N**	Y/N: See note	4 Splits/Cycle:	**Y**	Y/N: See note
			No Early Coord Ped:	**N**	Y/N: See note

Yeil Percent	**0**	0-10%: See note
EGB%	**0**	0-100%: See note
RGB%	**0**	0-100%: See note
# Cycles to out of step:	**0**	0-255: 0=Disable

CYCLE SYNC OPTIONS (MM-3-2-9-2)

Sync Source:	**0**	0-2, 0=TOD/CL/Interconnect, 1= City Zero, 2= Absolute

Charts below only For City Zero offfsets or Absolute (0's). These are not daily reference times for Sync Source Option 0 (see TOD).

Cycle 1:	**0**	Cycle 2:	**0**	Cycle 3:	**0**
Cycle 4:	**0**	Cycle 5:	**0**	Cycle 6:	**0**

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MANUAL/AUTO FORCE OFFS & PERMS

SET MANUAL MODE (MM-3-2-9-3-1)

Auto Perm and FO:	**N**	Y/N: Y = Perms & Force offs auto-calculated from phase allocations. N = Manually entered
Ped Perm:	**0**	0-255: 0 = Auto calculated. 1-255 = secs each ped perm, starting with vehicle permissives

LOAD MANUAL PERMISSIVES (MM-3-2-9-3-2) ONLY USED IF AUTO PERM & FO MODE = N

Cycle 1	Split 1/PH	1	2	3	4	5	6	7	8
	Start				**21**				
MANUAL	End				**36**				
PERMS	Split 2/PH	1	2	3	4	5	6	7	8
	Start								
	End								

Cycle 2	Split 1/PH	1	2	3	4	5	6	7	8
	Start				**36**				
MANUAL	End				**51**				
PERMS	Split 2/PH	1	2	3	4	5	6	7	8
	Start								
	End								

Cycle 3	Split 1/PH	1	2	3	4	5	6	7	8
	Start				**36**				
MANUAL	End				**51**				
PERMS	Split 2/PH	1	2	3	4	5	6	7	8
	Start								
	End								

Cycle 4	Split 1/PH	1	2	3	4	5	6	7	8
	Start								
MANUAL	End								
PERMS	Split 2/PH	1	2	3	4	5	6	7	8
	Start								
	End								

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LOAD MANUAL FORCE OFFS (MM-3-2-9-3-3) ONLY USED IF AUTO PERM & FO MODE = N

Cycle 1	PHASE	1	2	3	4	5	6	7	8
FO's	SPLIT 1				**64**				
	PHASE	1	2	3	4	5	6	7	8
	SPLIT 2								

Cycle 2	PHASE	1	2	3	4	5	6	7	8
FO's	SPLIT 1				**84**				
	PHASE	1	2	3	4	5	6	7	8
	SPLIT 2								

Cycle 3	PHASE	1	2	3	4	5	6	7	8
FO's	SPLIT 1				**84**				
	PHASE	1	2	3	4	5	6	7	8
	SPLIT 2								

Cycle 4	PHASE	1	2	3	4	5	6	7	8
FO's	SPLIT 1								
	PHASE	1	2	3	4	5	6	7	8
	SPLIT 2								

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DAY PLANS (MM-3-3-1-#)

	HH	MM	CIRCUIT PLAN	C	O	S	CKT	ON/OFF
1	00	00					11(FRE)	OFF
	00	00		1	1	1		
2	00	00					11(FRE)	OFF
	00	00		1	1	1		
	06	30		2	1	1		
	09	30		1	1	1		
	15	30		3	1	1		
	18	00		1	1	1		

WEEK PLANS (MM-3-3-3)

Plan	SUN	MON	TUE	WED	THU	FRI	SAT
1	1	2	2	2	2	2	1
2							
3							
4							
5							

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CIRCUIT OVERRIDES (MM-3-3-6)

For each ciruit specify TOD (time of day controlled), or manually ON or OFF. Default = TOD

CIRCUIT OVER-RIDES	Circuit	65	66	67	68	69	70	71	72
	Function	LL1	LL2	LL3	LL4	LL5	LL6	LL7	LL8
	State								
	Circuit	**73**	74	75	76	**77**	78	79	80
	Function	**CN1**	CN2	CN3	CN4	**WRM**	MIN	DIM	CVS
	State	**ON**				**ON**			
CIRCUIT OVER-RIDES	Circuit	113	114	115	116	117	118	119	120
	Function	UD1	UD2	UD3	UD4	UD5	UD6	UD7	UD8
	State								
	Circuit	121	122	123	124	**125**	**126**	127	128
	Function	PH2	DP2	DP3	3CD	**EVL**	**EML**	ASC	DCP
	State					**ON**	**ON**		

DAYLIGHT SAVINGS (MM-3-3-7)

DAY LIGHT SAVINGS	Spring		Fall	
	(0-12)	(0-5)	(0-12)	(0-5)
	Month	WOM	Month	WOM
	3	**2**	**11**	**1**

Enter Month and Week of Month for Spring Forward and Fall Back days (typical 4 - 1 and 10 - 5). Unit will adjust at 2AM on Sunday of week specified. Enter zero (or leave blank) if Daylight Savings not used.

SYNC REFERENCE MODE (MM-3-3-8)

Mode:	**0**	0 = Time dependent, 1 = C/O/S Event

	HH	MM	
Time Clock Reset:	**00**	**00**	TOD clock reset to by TBC input
Interrupter:		**N**	Y/N; Y = Interrupter pulses provided
Pulses:		**0**	0-6 = Number of interrupter pulses

TIME DEPENDENT CYCLE REFERENCES		HH	MM		HH	MM		HH	MM
	CYC 1:	**00**	**00**	CYC 2:	**00**	**00**	CYC 3:	**00**	**00**
	CYC 4:	**00**	**00**	CYC 5:	**00**	**00**	CYC 6:	**00**	**00**

When mode = Time dependent, enter reference times of day for each cycle. Default = 00:00 = midnight = most commonly used reference.
When mode = C/O/S Event, cycle restarts on each COS change. Only use this mode for specific reasons. Time dependent most common used mode.

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CLOSED LOOP ID (MM-3-5-1)

CLOSED LOOP ID	Master Type:	**1**	0 = None, 1 = 3000 Series Master, 2 = 3800 EL master
	Intersection ID	**27**	0-255
	Master Identification	**11**	0-255
	Allow Comm Xfer Between Ports 2 & 3		Y/N: Y = Incoming signal on Master port (2 or 3), gets echo'd on other port

COMM SET-UP (MM-3-5-2)

PG1 PORT ASSIGN	Master (CL) Port:		0 = None, 2 = Port 2, 3 = Port 3 (Port to be used to receive Master Comm)
	Monitor Port		0 = None, 2 = Port 2, 3 = Port 3 (Port to be used for Monitor Data Upload)
	Central Port:		0 = None, 2 = Port 2, 3 = Port 3 (Port to be used for Direct Dial-up Modem)

PG2 PORT 2 SETUP	Data Rate:	**9600**	1200, 2400, 4800, 9600, 14400, 19200
	Parity	**0**	0 = None, 1 = Odd, 2=Even
	Data bits	**1**	0 = 7 bits, 1 = 8 bits

PG3 PORT 3 SETUP	Data Rate:	**1200**	1200, 2400, 4800, 9600, 14400, 19200
	Parity	**0**	0 = None, 1 = Odd, 2=Even
	Data bits	**1**	0 = 7 bits, 1 = 8 bits

PG4	Modem Set-up String:		Up to 40 charaters; A-Z, or # @ = , ! ; % \ &

PHONE NUMBERS (MM-3-5-3)

PHONE NUM-BERS	Tone:		Y/N
	Phone 1:		Number & control characters (W , ; # ' / T P) if used
	Phone 2:		Number & control characters (W , ; # ' / T P) if used

LOG DATA (MM-3-5-5)

PG1 SAMPLE	Volume Log Sample period:	**60**	0, 6, 10, 15, 20, 30, 60 minutes, Enabled by TOD Ckt. 125 (EVL)
	MOE Log Sample period:	**60**	0, 6, 10, 15, 20, 30, 60 minutes, Enabled by TOD Ckt. 126 (EML)

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Turning Movement Count (1 . HUNTER ST E & LIBERTY ST)

Start Time	E Approach HUNTER ST E					S Approach LIBERTY ST					W Approach HUNTER ST E					Int. Total (15 min)	Int. Total (1 hr)
	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	UTurn W:W	Peds W:	Approach Total		
07:00:00	37	0	0	0	37	0	2	0	0	2	1	0	0	0	1	40	
07:15:00	29	2	0	0	31	0	2	0	0	2	2	0	0	0	2	35	
07:30:00	42	3	0	0	45	0	1	0	0	1	0	0	0	1	0	46	
07:45:00	56	2	0	0	58	0	5	0	2	5	1	0	0	1	1	64	185
08:00:00	53	1	0	1	54	0	0	0	3	0	0	0	0	1	0	54	199
08:15:00	67	1	0	1	68	0	1	0	5	1	0	0	0	1	0	69	233
08:30:00	65	0	0	0	65	0	2	0	5	2	0	0	0	0	0	67	254
08:45:00	85	0	0	0	85	0	2	0	1	2	0	0	0	0	0	87	277
09:00:00	65	4	0	0	69	0	0	0	1	0	0	0	0	0	0	69	292
09:15:00	38	0	0	0	38	1	0	0	0	1	0	0	0	0	0	39	262
09:30:00	49	1	0	0	50	0	0	0	1	0	1	0	0	0	1	51	246
09:45:00	43	2	0	0	45	0	0	0	0	0	0	0	0	0	0	45	204
BREAK																	
16:00:00	43	3	0	0	46	0	0	0	0	0	1	0	0	0	1	47	
16:15:00	72	2	0	0	74	0	2	0	1	2	1	0	0	2	1	77	
16:30:00	55	2	0	0	57	0	1	0	5	1	0	0	0	1	0	58	
16:45:00	73	3	0	0	76	0	2	0	4	2	0	0	0	0	0	78	260
17:00:00	65	0	0	3	65	0	2	0	6	2	1	0	0	0	1	68	281
17:15:00	66	1	0	2	67	0	2	0	1	2	1	0	0	0	1	70	274
17:30:00	54	5	0	0	59	0	4	0	2	4	1	0	0	0	1	64	280
17:45:00	49	2	0	0	51	0	3	0	5	3	1	0	0	0	1	55	257
18:00:00	49	1	0	2	50	0	2	0	0	2	1	0	0	0	1	53	242
18:15:00	48	6	0	0	54	0	1	0	1	1	0	0	0	0	0	55	227
18:30:00	53	2	0	0	55	0	0	0	1	0	0	0	0	0	0	55	218
18:45:00	37	2	0	0	39	0	1	0	1	1	2	0	0	0	2	42	205
Grand Total	1293	45	0	9	1338	1	35	0	45	36	14	0	0	7	14	**1388**	-
Approach%	96.6%	3.4%	0%		-	2.8%	97.2%	0%		-	100%	0%	0%		-	**-**	-
Totals %	93.2%	3.2%	0%		96.4%	0.1%	2.5%	0%		2.6%	1%	0%	0%		1%	**-**	-
Heavy	62	2	0		-	0	0	0		-	0	0	0		-	**-**	-
Heavy %	4.8%	4.4%	0%		-	0%	0%	0%		-	0%	0%	0%		-	**-**	-
Bicycles	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-
Bicycle %	-	-	-		-	-	-	-		-	-	-	-		-	**-**	-

NexTrans
SUITE 204 15260 YONGE ST
AURORA ONTARIO, L4G 1N4
CANADA

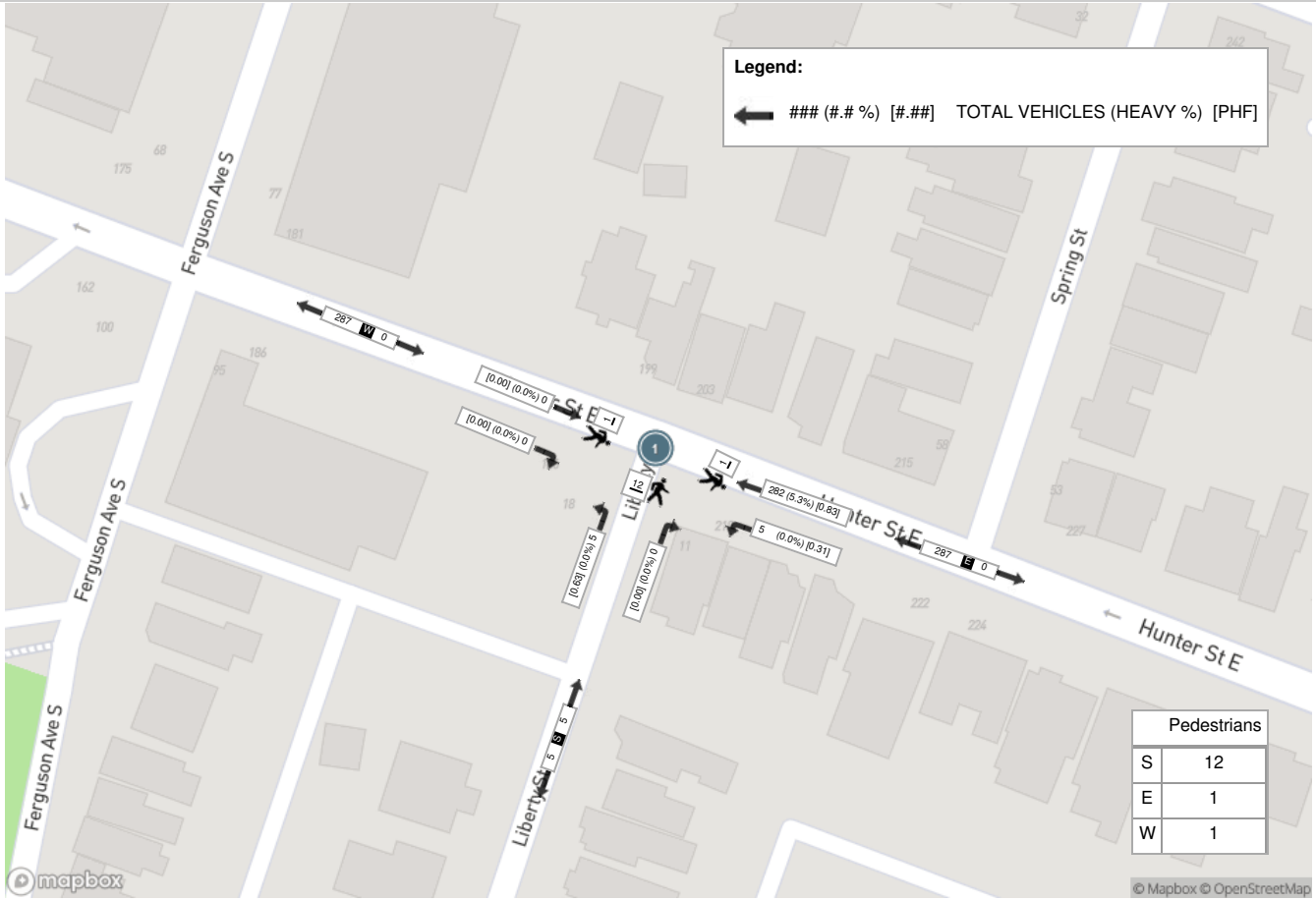
Peak Hour: 08:15 AM - 09:15 AM Weather: Broken Clouds (-2.78 °C)

Start Time	E Approach HUNTER ST E					S Approach LIBERTY ST					W Approach HUNTER ST E					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
08:15:00	67	1	0	1	68	0	1	0	5	1	0	0	0	1	0	69
08:30:00	65	0	0	0	65	0	2	0	5	2	0	0	0	0	0	67
08:45:00	85	0	0	0	85	0	2	0	1	2	0	0	0	0	0	87
09:00:00	65	4	0	0	69	0	0	0	1	0	0	0	0	0	0	69
Grand Total	282	5	0	1	287	0	5	0	12	5	0	0	0	1	0	**292**
Approach%	98.3%	1.7%	0%		-	0%	100%	0%		-	0%	0%	0%		-	**-**
Totals %	96.6%	1.7%	0%		98.3%	0%	1.7%	0%		1.7%	0%	0%	0%		0%	**-**
PHF	0.83	0.31	0		0.84	0	0.63	0		0.63	0	0	0		0	**-**
Heavy	15	0	0		15	0	0	0		0	0	0	0		0	**-**
Heavy %	5.3%	0%	0%		5.2%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Lights	266	5	0		271	0	5	0		5	0	0	0		0	**-**
Lights %	94.3%	100%	0%		94.4%	0%	100%	0%		100%	0%	0%	0%		0%	**-**
Single-Unit Trucks	6	0	0		6	0	0	0		0	0	0	0		0	**-**
Single-Unit Trucks %	2.1%	0%	0%		2.1%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Buses	9	0	0		9	0	0	0		0	0	0	0		0	**-**
Buses %	3.2%	0%	0%		3.1%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Bicycles on Road	1	0	0		1	0	0	0		0	0	0	0		0	**-**
Bicycles on Road %	0.4%	0%	0%		0.3%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	1	-	-	-	-	12	-	-	-	-	1	-	**-**
Pedestrians%	-	-	-	7.1%		-	-	-	85.7%		-	-	-	7.1%		**-**

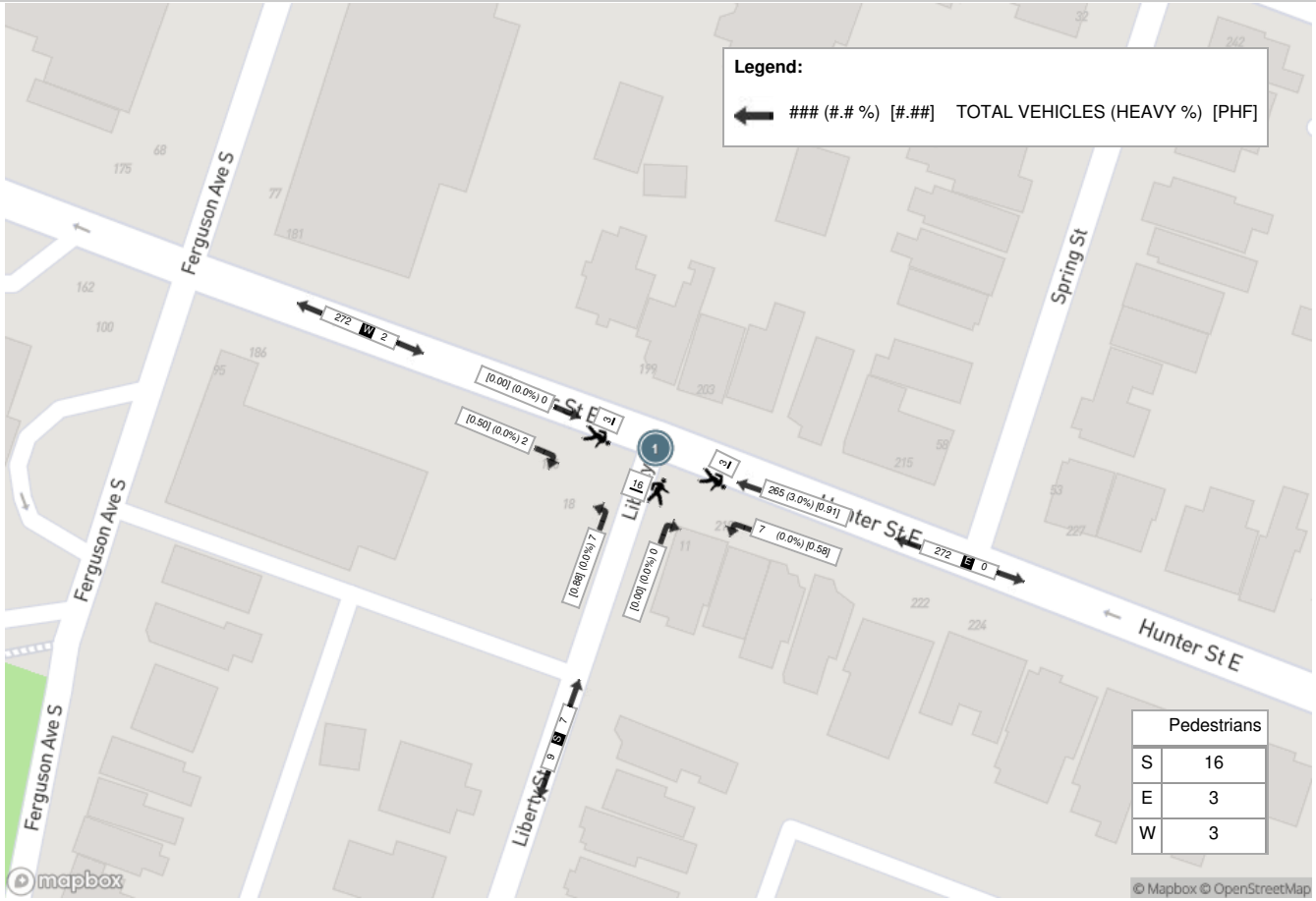
Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (-2.62 °C)

Start Time	E Approach HUNTER ST E					S Approach LIBERTY ST					W Approach HUNTER ST E					Int. Total (15 min)
	Thru	Left	UTurn	Peds	Approach Total	Right	Left	UTurn	Peds	Approach Total	Right	Thru	UTurn	Peds	Approach Total	
16:15:00	72	2	0	0	74	0	2	0	1	2	1	0	0	2	1	77
16:30:00	55	2	0	0	57	0	1	0	5	1	0	0	0	1	0	58
16:45:00	73	3	0	0	76	0	2	0	4	2	0	0	0	0	0	78
17:00:00	65	0	0	3	65	0	2	0	6	2	1	0	0	0	1	68
Grand Total	265	7	0	3	272	0	7	0	16	7	2	0	0	3	2	**281**
Approach%	97.4%	2.6%	0%		-	0%	100%	0%		-	100%	0%	0%		-	**-**
Totals %	94.3%	2.5%	0%		96.8%	0%	2.5%	0%		2.5%	0.7%	0%	0%		0.7%	**-**
PHF	0.91	0.58	0		0.89	0	0.88	0		0.88	0.5	0	0		0.5	**-**
Heavy	8	0	0		8	0	0	0		0	0	0	0		0	**-**
Heavy %	3%	0%	0%		2.9%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Lights	253	6	0		259	0	6	0		6	1	0	0		1	**-**
Lights %	95.5%	85.7%	0%		95.2%	0%	85.7%	0%		85.7%	50%	0%	0%		50%	**-**
Single-Unit Trucks	1	0	0		1	0	0	0		0	0	0	0		0	**-**
Single-Unit Trucks %	0.4%	0%	0%		0.4%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Buses	7	0	0		7	0	0	0		0	0	0	0		0	**-**
Buses %	2.6%	0%	0%		2.6%	0%	0%	0%		0%	0%	0%	0%		0%	**-**
Bicycles on Road	4	1	0		5	0	1	0		1	1	0	0		1	**-**
Bicycles on Road %	1.5%	14.3%	0%		1.8%	0%	14.3%	0%		14.3%	50%	0%	0%		50%	**-**
Pedestrians	-	-	-	3	-	-	-	-	16	-	-	-	-	3	-	**-**
Pedestrians%	-	-	-	13.6%		-	-	-	72.7%		-	-	-	13.6%		**-**

Peak Hour: 08:15 AM - 09:15 AM Weather: Broken Clouds (-2.78 °C)



Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (-2.62 °C)



Spectrum

Turning Movement Count
Location Name: HUNTER ST E & WELLINGTON ST
Date: Tue, Dec 07, 2021 Deployment Lead: Theo Daglis

NexTrans
SUITE 204 15260 YONGE ST
AURORA ONTARIO, L4G 1N4
CANADA

Turning Movement Count (2 . HUNTER ST E & WELLINGTON ST)

Start Time	N Approach WELLINGTON ST						E Approach MOUNTAIN ACC						S Approach WELLINGTON ST						W Approach HUNTER ST E						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total		
07:00:00	19	19	1	0	0	39	0	0	0	0	0	0	13	0	15	0	4	28	0	0	0	0	1	0	67	
07:15:00	16	14	1	0	0	31	0	1	0	0	0	1	27	0	16	0	2	43	0	0	0	0	2	0	75	
07:30:00	25	28	1	0	0	54	0	1	0	0	0	1	24	0	21	0	1	45	0	0	0	0	4	0	100	
07:45:00	25	38	0	0	0	63	0	1	0	0	0	1	25	0	33	0	1	58	0	0	0	0	2	0	122	364
08:00:00	28	29	0	0	0	57	0	0	0	0	0	0	20	0	25	0	2	45	0	0	0	0	5	0	102	399
08:15:00	36	36	0	0	0	72	0	0	0	0	0	0	38	0	39	0	2	77	0	0	0	0	10	0	149	473
08:30:00	31	38	0	0	0	69	0	0	0	0	0	0	27	0	34	0	3	61	0	0	0	0	7	0	130	503
08:45:00	47	37	1	0	0	85	0	0	1	0	0	1	23	0	46	0	2	69	0	0	0	0	2	0	155	536
09:00:00	33	43	1	0	0	77	0	1	1	0	0	2	21	0	29	0	3	50	0	0	0	0	5	0	129	563
09:15:00	22	31	1	0	2	54	0	1	0	0	2	1	13	0	23	0	0	36	0	0	0	0	2	0	91	505
09:30:00	29	56	0	0	0	85	0	0	0	0	1	0	18	0	21	0	3	39	0	0	0	0	4	0	124	499
09:45:00	23	44	0	0	0	67	0	0	0	0	0	0	18	0	24	0	2	42	0	0	0	0	3	0	109	453
BREAK																										
16:00:00	33	107	2	0	1	142	0	0	0	0	1	0	49	0	21	0	2	70	0	1	0	0	10	1	213	
16:15:00	51	93	1	0	0	145	0	0	0	0	0	0	47	1	20	0	1	68	0	1	0	0	5	1	214	
16:30:00	45	112	2	0	0	159	0	0	1	0	0	1	24	0	12	0	1	36	0	0	0	0	3	0	196	
16:45:00	50	103	0	0	0	153	0	0	0	0	1	0	44	0	28	0	3	72	0	0	0	0	10	0	225	848
17:00:00	38	115	2	0	0	155	0	1	0	0	0	1	37	0	21	0	1	58	0	0	0	0	7	0	214	849
17:15:00	49	97	1	0	0	147	0	1	0	0	1	1	37	0	21	0	2	58	0	0	0	0	6	0	206	841
17:30:00	39	100	1	0	0	140	0	1	0	0	0	1	26	0	23	0	1	49	0	0	0	0	3	0	190	835
17:45:00	32	78	1	0	0	111	0	0	0	0	0	0	26	0	10	0	2	36	0	0	0	0	9	0	147	757
18:00:00	24	82	1	0	0	107	0	1	0	0	0	1	32	0	22	0	0	54	1	0	0	0	2	1	163	706
18:15:00	38	76	0	0	0	114	0	1	0	0	1	1	23	0	20	0	2	43	0	0	0	0	7	0	158	658
18:30:00	32	63	0	0	0	95	0	1	0	0	0	1	21	0	20	0	2	41	0	0	0	0	3	0	137	605
18:45:00	29	75	0	0	0	104	0	0	1	0	0	1	32	0	16	0	2	48	0	0	0	0	4	0	153	611
Grand Total	794	1514	17	0	3	2325	0	11	4	0	7	15	665	1	560	0	44	1226	1	2	0	0	116	3	**3569**	-
Approach%	34.2%	65.1%	0.7%	0%		-	0%	73.3%	26.7%	0%		-	54.2%	0.1%	45.7%	0%		-	33.3%	66.7%	0%	0%		-	**-**	-
Totals %	22.2%	42.4%	0.5%	0%		65.1%	0%	0.3%	0.1%	0%		0.4%	18.6%	0%	15.7%	0%		34.4%	0%	0.1%	0%	0%		0.1%	**-**	-
Heavy	14	75	0	0		-	0	0	1	0		-	7	0	52	0		-	0	0	0	0		-	**-**	-
Heavy %	1.8%	5%	0%	0%		-	0%	0%	25%	0%		-	1.1%	0%	9.3%	0%		-	0%	0%	0%	0%		-	**-**	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	**-**	-

Peak Hour: 08:15 AM - 09:15 AM Weather: Broken Clouds (-2.78 °C)

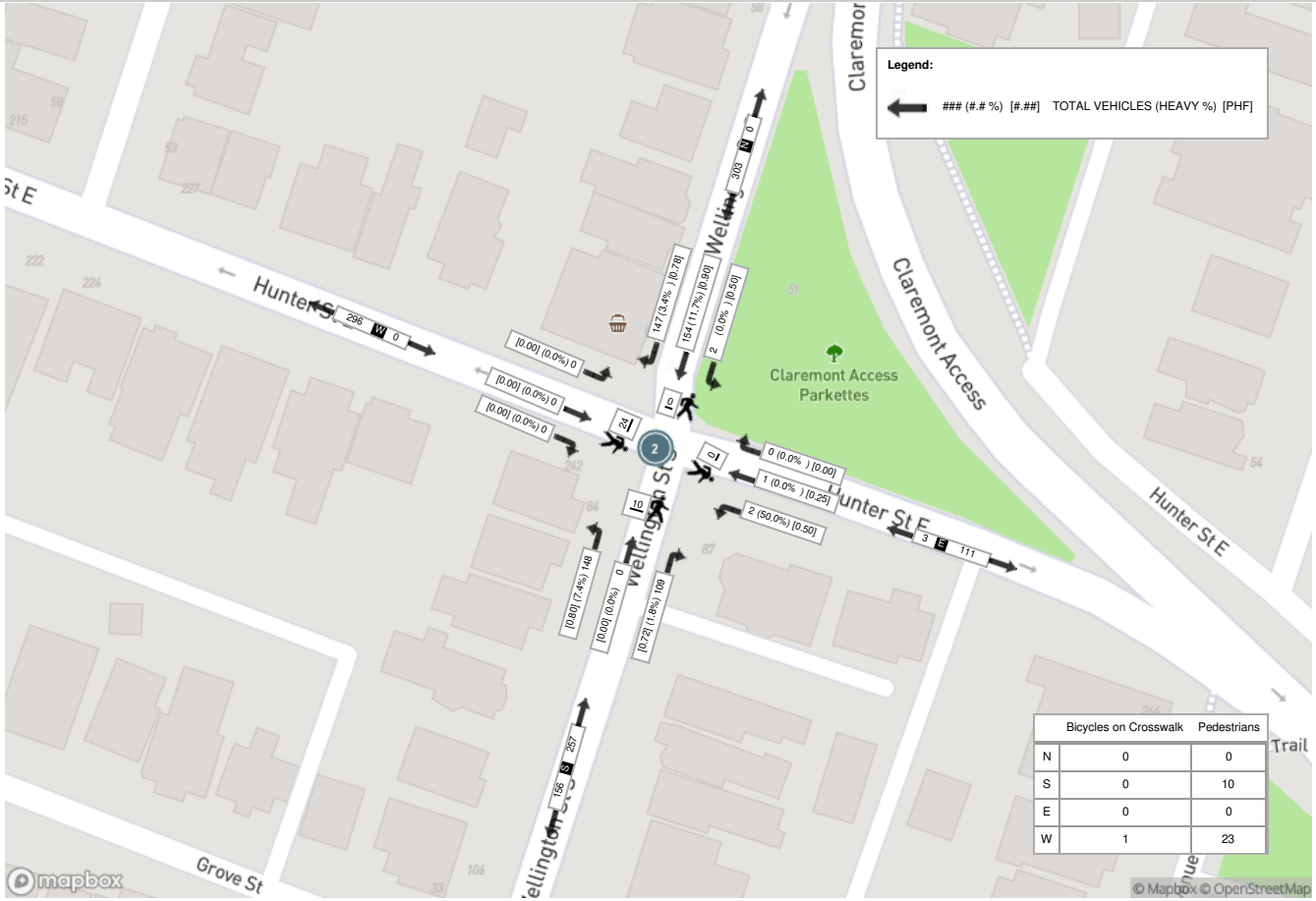
Start Time	N Approach WELLINGTON ST						E Approach MOUNTAIN ACC						S Approach WELLINGTON ST						W Approach HUNTER ST E						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
08:15:00	36	36	0	0	0	72	0	0	0	0	0	0	38	0	39	0	2	77	0	0	0	0	10	0	149
08:30:00	31	38	0	0	0	69	0	0	0	0	0	0	27	0	34	0	3	61	0	0	0	0	7	0	130
08:45:00	47	37	1	0	0	85	0	0	1	0	0	1	23	0	46	0	2	69	0	0	0	0	2	0	155
09:00:00	33	43	1	0	0	77	0	1	1	0	0	2	21	0	29	0	3	50	0	0	0	0	5	0	129
Grand Total	147	154	2	0	0	303	0	1	2	0	0	3	109	0	148	0	10	257	0	0	0	0	24	0	**563**
Approach%	48.5%	50.8%	0.7%	0%		-	0%	33.3%	66.7%	0%		-	42.4%	0%	57.6%	0%		-	0%	0%	0%	0%		-	**-**
Totals %	26.1%	27.4%	0.4%	0%		53.8%	0%	0.2%	0.4%	0%		0.5%	19.4%	0%	26.3%	0%		45.6%	0%	0%	0%	0%		0%	**-**
PHF	0.78	0.9	0.5	0		0.89	0	0.25	0.5	0		0.38	0.72	0	0.8	0		0.83	0	0	0	0		0	**-**
Heavy	5	18	0	0		23	0	0	1	0		1	2	0	11	0		13	0	0	0	0		0	**-**
Heavy %	3.4%	11.7%	0%	0%		7.6%	0%	0%	50%	0%		33.3%	1.8%	0%	7.4%	0%		5.1%	0%	0%	0%	0%		0%	**-**
Lights	142	136	2	0		280	0	1	1	0		2	107	0	134	0		241	0	0	0	0		0	**-**
Lights %	96.6%	88.3%	100%	0%		92.4%	0%	100%	50%	0%		66.7%	98.2%	0%	90.5%	0%		93.8%	0%	0%	0%	0%		0%	**-**
Single-Unit Trucks	4	8	0	0		12	0	0	1	0		1	1	0	3	0		4	0	0	0	0		0	**-**
Single-Unit Trucks %	2.7%	5.2%	0%	0%		4%	0%	0%	50%	0%		33.3%	0.9%	0%	2%	0%		1.6%	0%	0%	0%	0%		0%	**-**
Buses	0	10	0	0		10	0	0	0	0		0	1	0	8	0		9	0	0	0	0		0	**-**
Buses %	0%	6.5%	0%	0%		3.3%	0%	0%	0%	0%		0%	0.9%	0%	5.4%	0%		3.5%	0%	0%	0%	0%		0%	**-**
Articulated Trucks	1	0	0	0		1	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	**-**
Articulated Trucks %	0.7%	0%	0%	0%		0.3%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	**-**
Bicycles on Road	0	0	0	0		0	0	0	0	0		0	0	0	3	0		3	0	0	0	0		0	**-**
Bicycles on Road %	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	2%	0%		1.2%	0%	0%	0%	0%		0%	**-**
Pedestrians	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	10	-	-	-	-	-	23	-	**-**
Pedestrians%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	29.4%		-	-	-	-	67.6%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	1	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	2.9%		**-**

NexTrans
SUITE 204 15260 YONGE ST
AURORA ONTARIO, L4G 1N4
CANADA

Peak Hour: 04:15 PM - 05:15 PM Weather: Overcast Clouds (-2.62 °C)

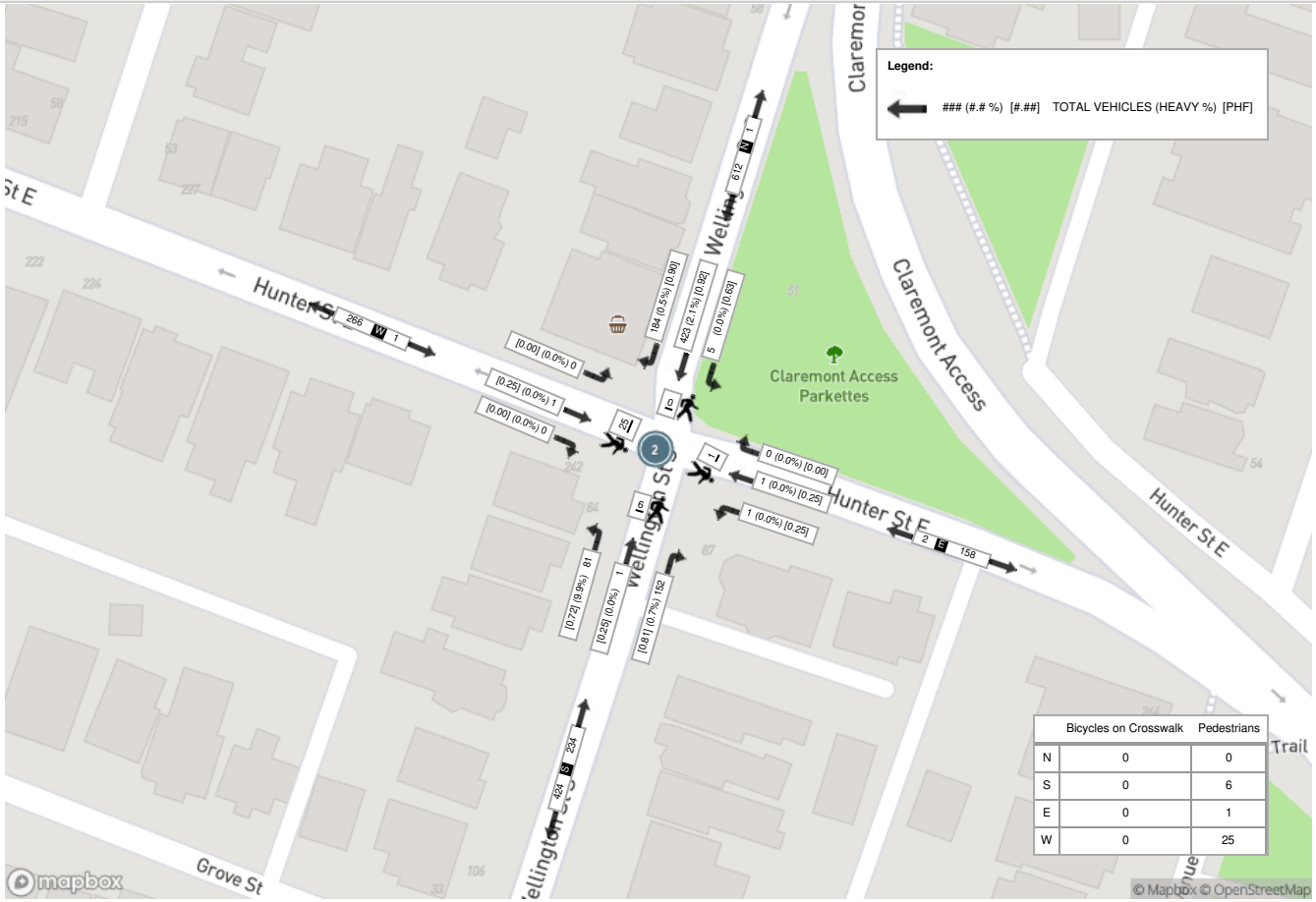
Start Time	N Approach WELLINGTON ST						E Approach MOUNTAIN ACC						S Approach WELLINGTON ST						W Approach HUNTER ST E						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
16:15:00	51	93	1	0	0	145	0	0	0	0	0	0	47	1	20	0	1	68	0	1	0	0	5	1	214
16:30:00	45	112	2	0	0	159	0	0	1	0	0	1	24	0	12	0	1	36	0	0	0	0	3	0	196
16:45:00	50	103	0	0	0	153	0	0	0	0	1	0	44	0	28	0	3	72	0	0	0	0	10	0	225
17:00:00	38	115	2	0	0	155	0	1	0	0	0	1	37	0	21	0	1	58	0	0	0	0	7	0	214
Grand Total	184	423	5	0	0	612	0	1	1	0	1	2	152	1	81	0	6	234	0	1	0	0	25	1	**849**
Approach%	30.1%	69.1%	0.8%	0%		-	0%	50%	50%	0%		-	65%	0.4%	34.6%	0%		-	0%	100%	0%	0%		-	**-**
Totals %	21.7%	49.8%	0.6%	0%		72.1%	0%	0.1%	0.1%	0%		0.2%	17.9%	0.1%	9.5%	0%		27.6%	0%	0.1%	0%	0%		0.1%	**-**
PHF	0.9	0.92	0.63	0		0.96	0	0.25	0.25	0		0.5	0.81	0.25	0.72	0		0.81	0	0.25	0	0		0.25	**-**
Heavy	1	9	0	0		10	0	0	0	0		0	1	0	8	0		9	0	0	0	0		0	**-**
Heavy %	0.5%	2.1%	0%	0%		1.6%	0%	0%	0%	0%		0%	0.7%	0%	9.9%	0%		3.8%	0%	0%	0%	0%		0%	**-**
Lights	182	414	4	0		600	0	0	0	0		0	151	1	70	0		222	0	0	0	0		0	**-**
Lights %	98.9%	97.9%	80%	0%		98%	0%	0%	0%	0%		0%	99.3%	100%	86.4%	0%		94.9%	0%	0%	0%	0%		0%	**-**
Single-Unit Trucks	1	1	0	0		2	0	0	0	0		0	1	0	0	0		1	0	0	0	0		0	**-**
Single-Unit Trucks %	0.5%	0.2%	0%	0%		0.3%	0%	0%	0%	0%		0%	0.7%	0%	0%	0%		0.4%	0%	0%	0%	0%		0%	**-**
Buses	0	7	0	0		7	0	0	0	0		0	0	0	8	0		8	0	0	0	0		0	**-**
Buses %	0%	1.7%	0%	0%		1.1%	0%	0%	0%	0%		0%	0%	0%	9.9%	0%		3.4%	0%	0%	0%	0%		0%	**-**
Articulated Trucks	0	1	0	0		1	0	0	0	0		0	0	0	0	0		0	0	0	0	0		0	**-**
Articulated Trucks %	0%	0.2%	0%	0%		0.2%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	0%	0%	0%	0%		0%	**-**
Bicycles on Road	1	0	1	0		2	0	1	1	0		2	0	0	3	0		3	0	1	0	0		1	**-**
Bicycles on Road %	0.5%	0%	20%	0%		0.3%	0%	100%	100%	0%		100%	0%	0%	3.7%	0%		1.3%	0%	100%	0%	0%		100%	**-**
Pedestrians	-	-	-	-	0	-	-	-	-	-	1	-	-	-	-	-	6	-	-	-	-	-	25	-	**-**
Pedestrians%	-	-	-	-	0%		-	-	-	-	3.1%		-	-	-	-	18.8%		-	-	-	-	78.1%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Peak Hour: 08:15 AM - 09:15 AM **Weather: Broken Clouds (-2.78 °C)**



	Bicycles on Crosswalk	Pedestrians
N	0	0
S	0	10
E	0	0
W	1	23

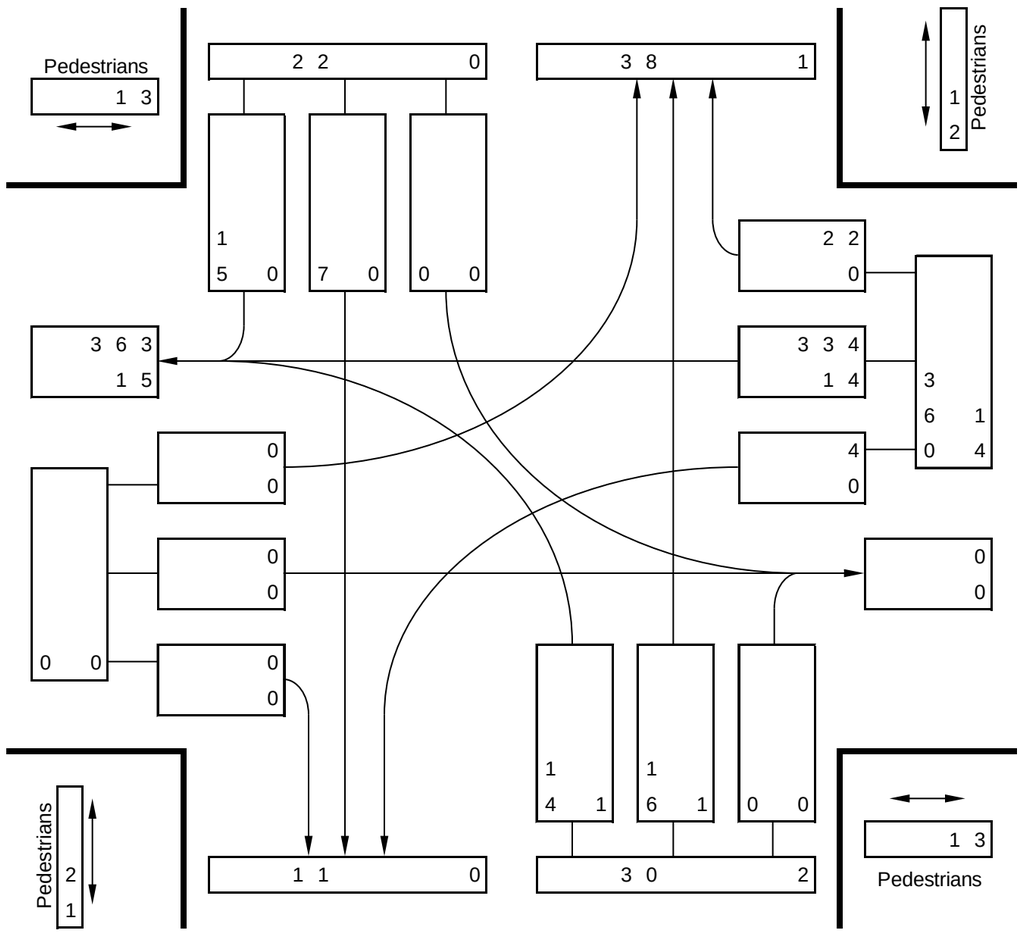
Peak Hour: 04:15 PM - 05:15 PM **Weather: Overcast Clouds (-2.62 °C)**



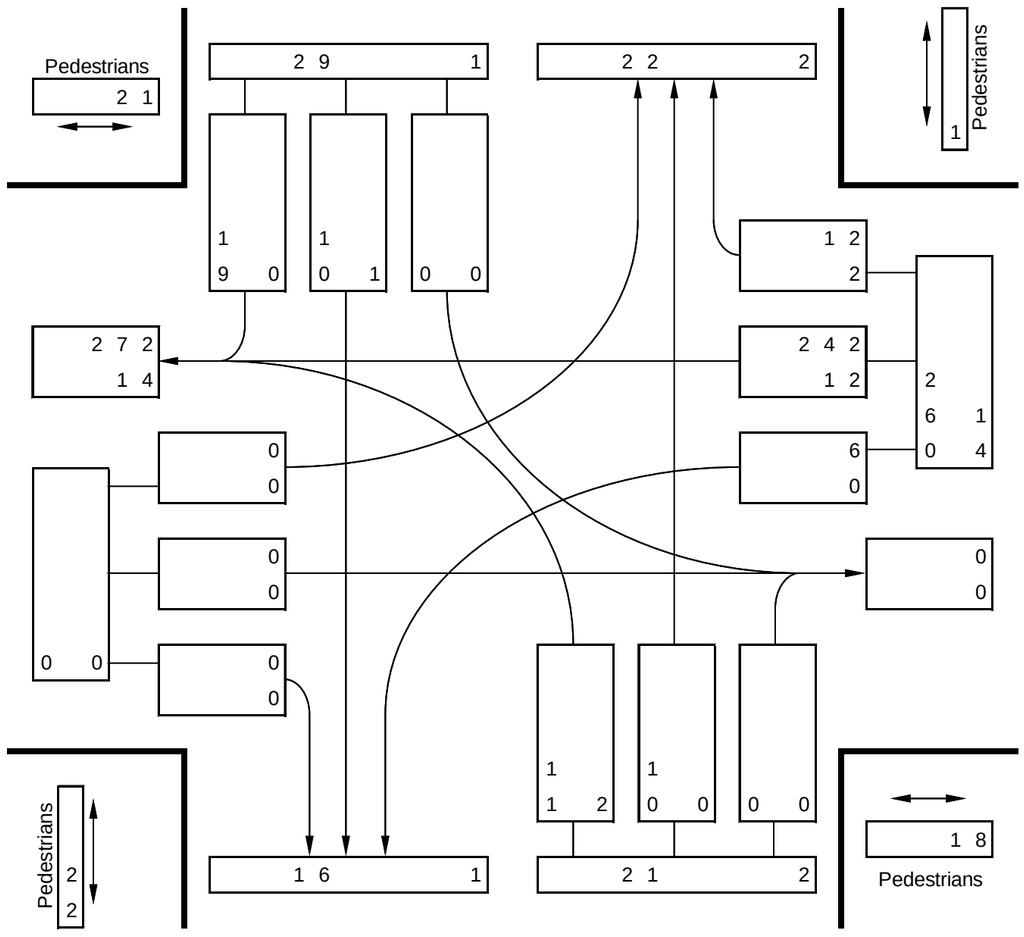
	Bicycles on Crosswalk	Pedestrians
N	0	0
S	0	6
E	0	1
W	0	25

City of Hamilton **TURNING MOVEMENT FLOW CHART** Loc. Code: 5124

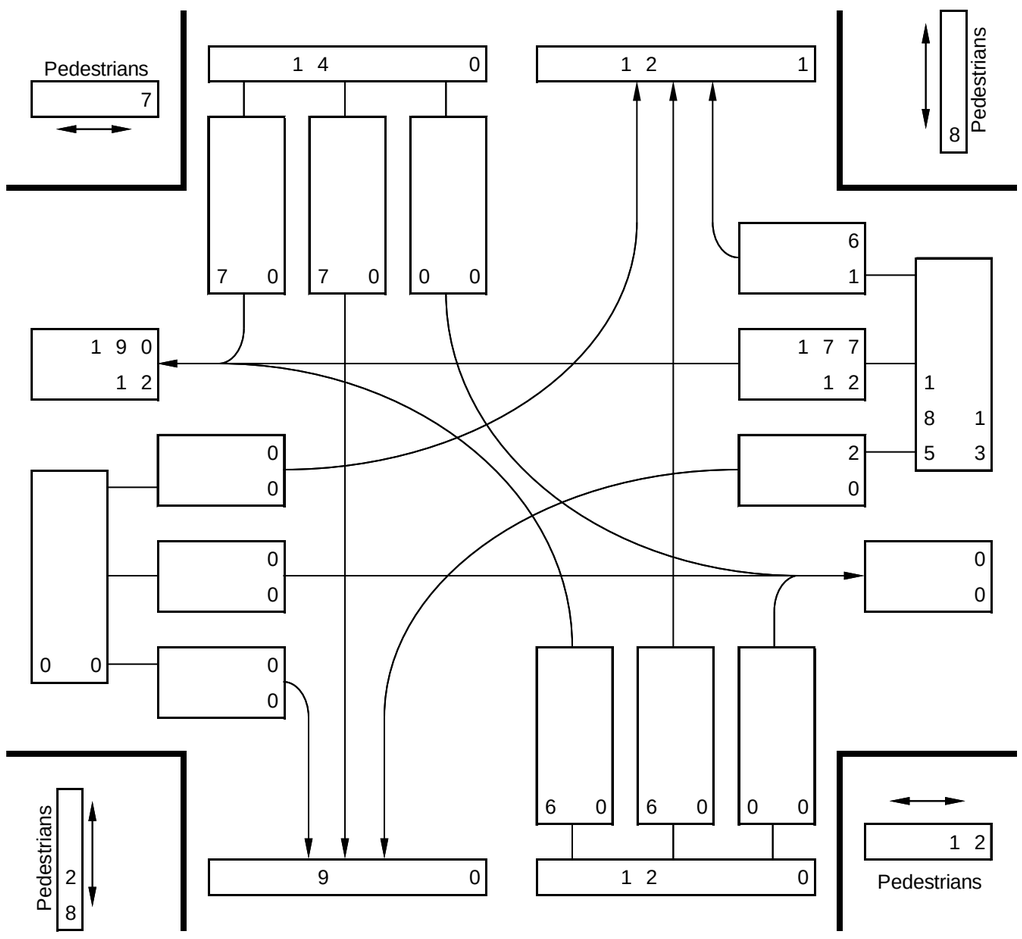
Intersection: **Hunter St E** **at** **Ferguson Ave S** Total Vehicles: 1,897 Date: Monday
Direction: (East/West) (North/South) M.V.E./Year: 1.348 May 6, 2019
Road Condition: Dry Weather: Clear AWDT Factor: 2.09 Period: 7 hours
Comments:



A.M. PEAK HOUR = 8:30 AM - 9:30 AM

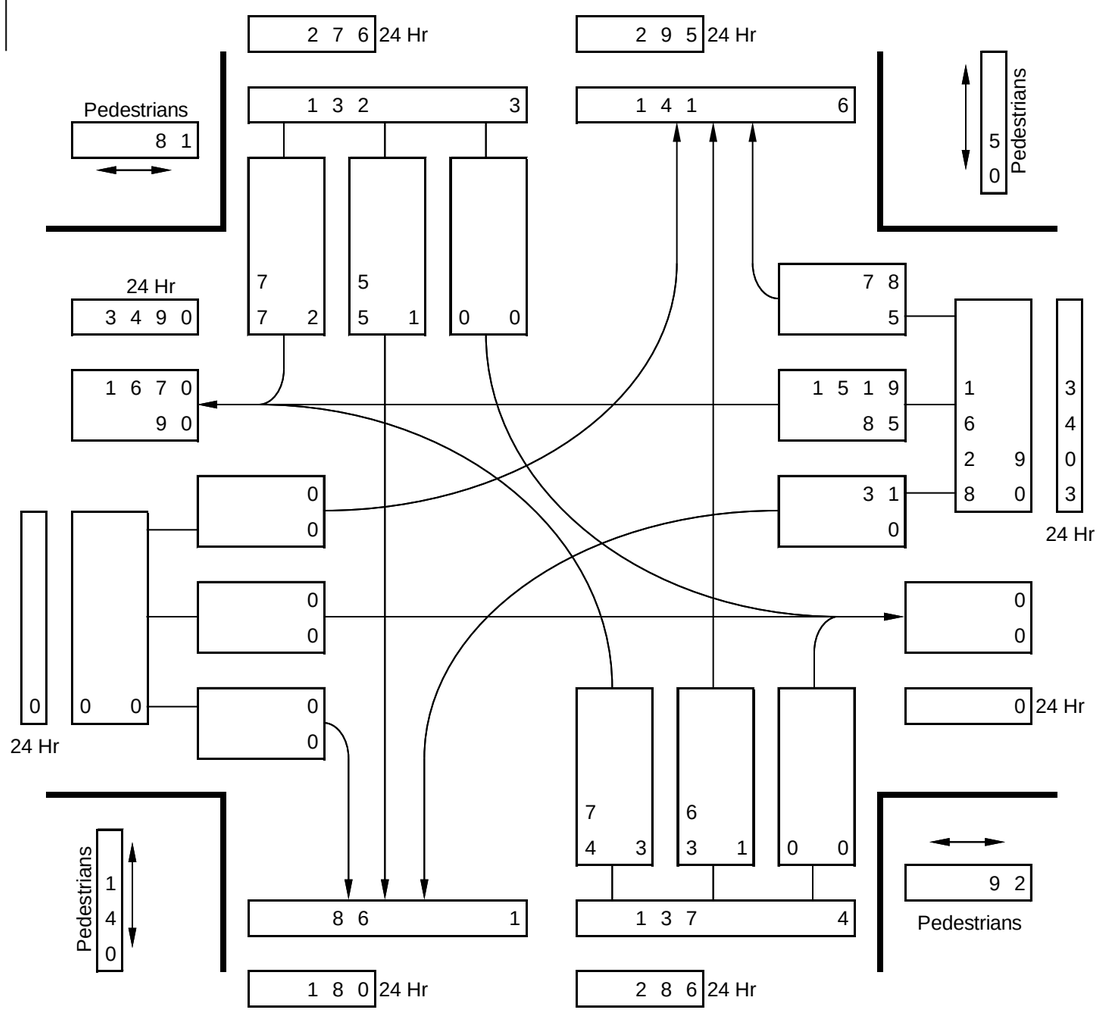


P.M. PEAK HOUR = 4:00 PM - 5:00 PM



NORMAL HOUR = 1:30 PM - 2:30 PM

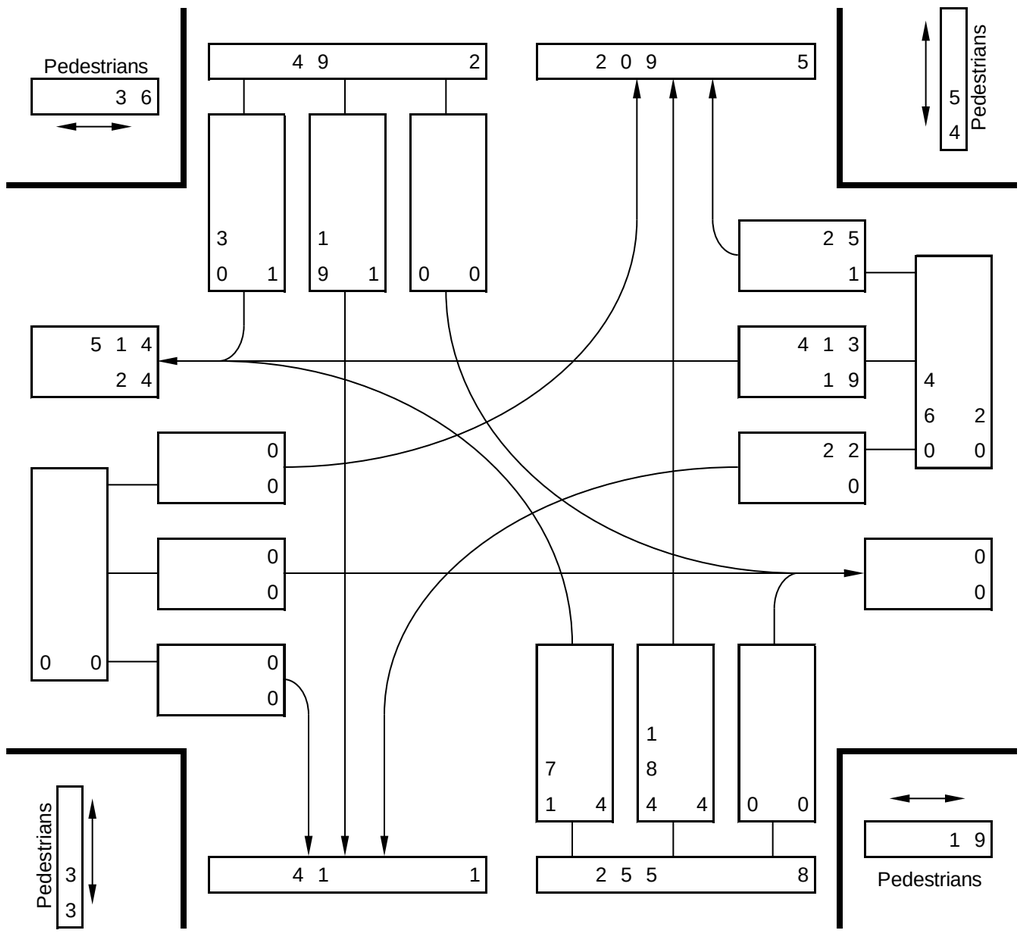
N



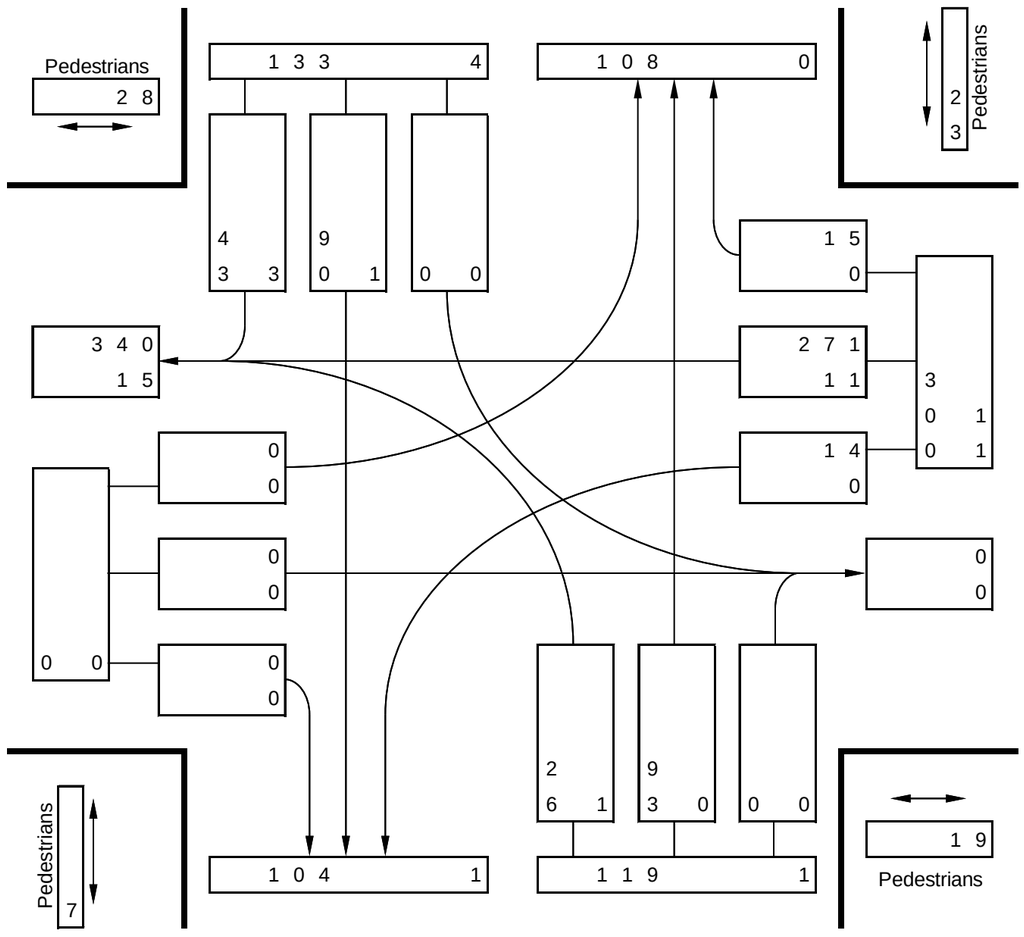
7 Hr & 24 Hr TOTAL VOLUMES

City of Hamilton **TURNING MOVEMENT FLOW CHART** Loc. Code: 5131

Intersection: **Hunter St E** **at** **Walnut St S** Total Vehicles: 3,470 Date: Wednesday
Direction: (East/West) (North/South) M.V.E./Year: 2.407 May 15, 2019
Road Condition: Dry Weather: Clear AWDT Factor: 2.04 Period: 7 hours
Comments:

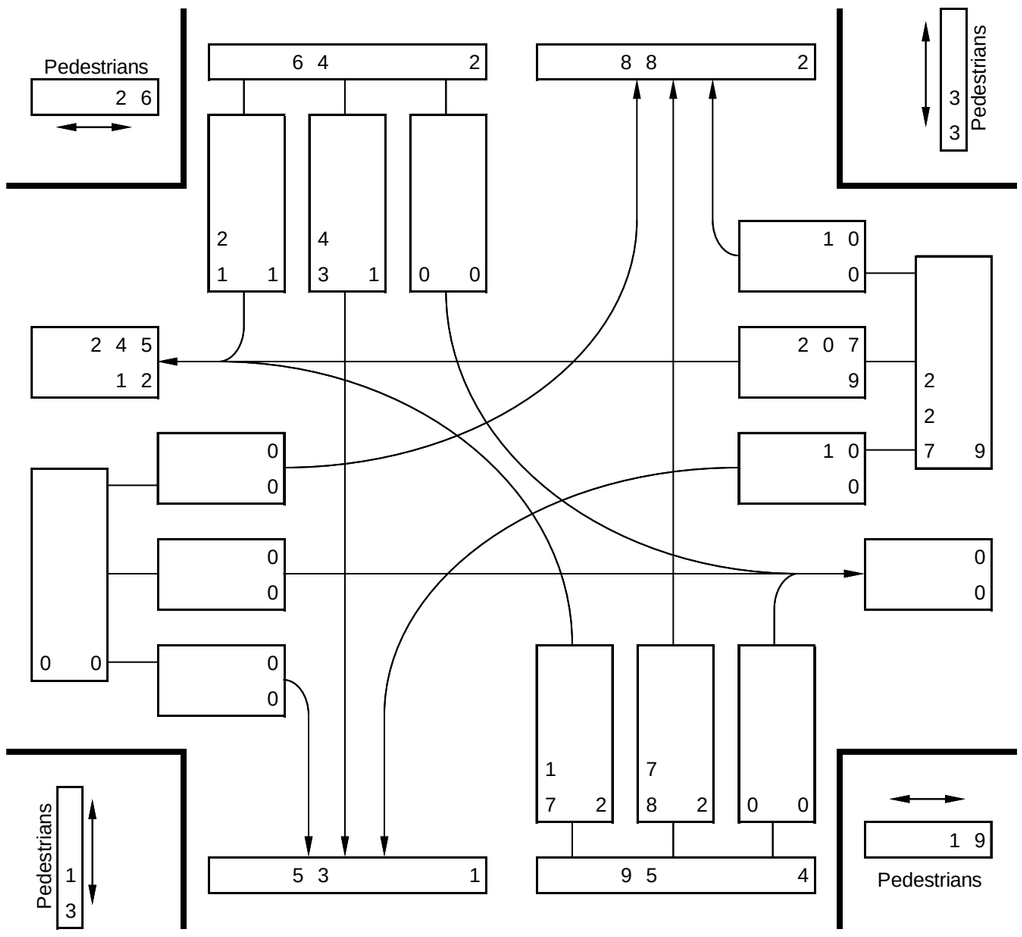


A.M. PEAK HOUR = 8:15 AM - 9:15 AM

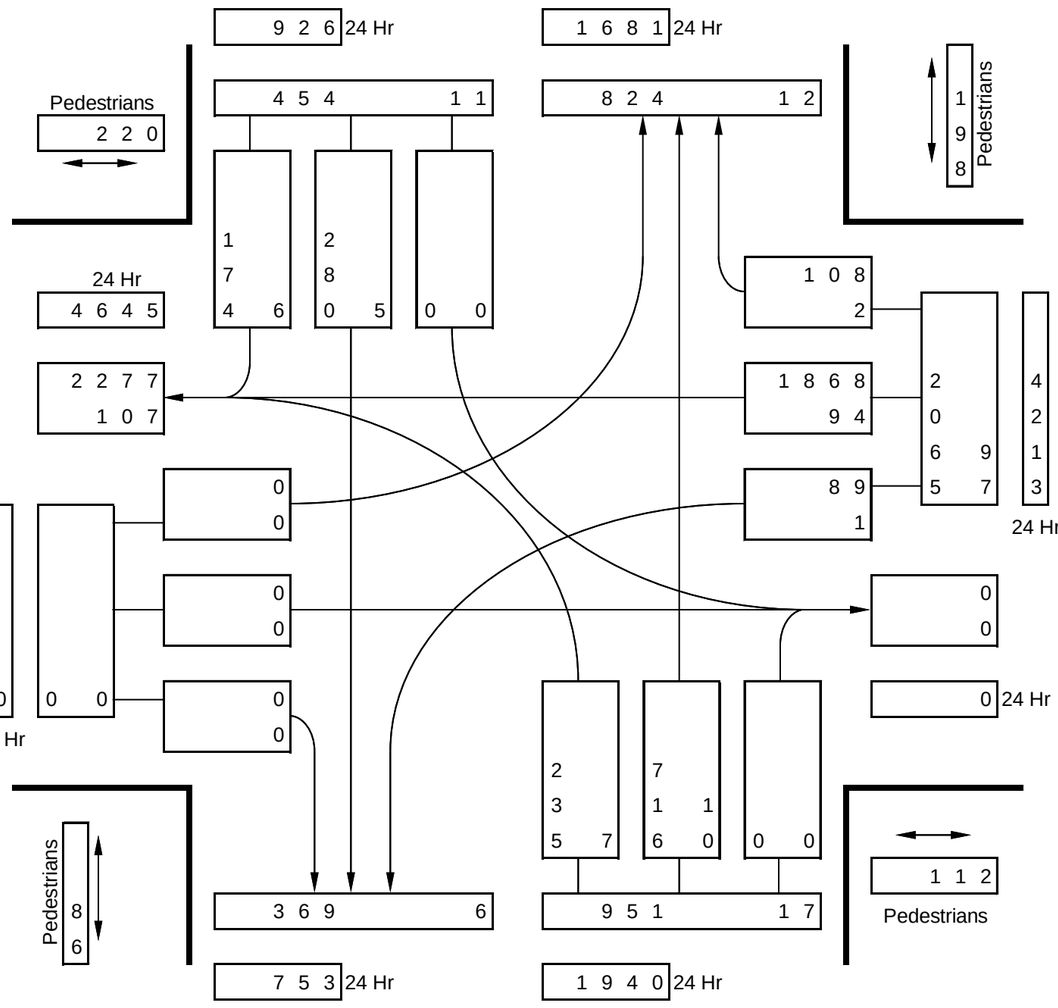


P.M. PEAK HOUR = 4:30 PM - 5:30 PM

N

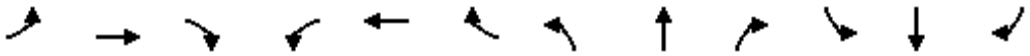


NORMAL HOUR = 2:30 PM - 3:30 PM



7 Hr & 24 Hr TOTAL VOLUMES

Appendix C
Existing Traffic Level of Service Calculations

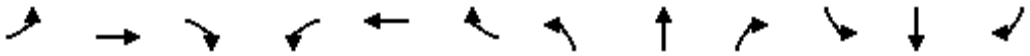


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	23	449	48	78	196	0	0	21	32
Future Volume (vph)	0	0	0	23	449	48	78	196	0	0	21	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3354	0	0	1801	0	0	1612	0
Flt Permitted					0.998			0.889				
Satd. Flow (perm)	0	0	0	0	3348	0	0	1607	0	0	1612	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					22						35	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	36		19	19		36	33		54	54		33
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	4%	5%	2%	0%	0%	5%	3%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	565	0	0	298	0	0	58	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					59.8			21.8			21.8	
Actuated g/C Ratio					0.66			0.24			0.24	
v/c Ratio					0.25			0.77			0.14	
Control Delay					6.7			44.9			13.5	
Queue Delay					0.0			0.0			0.0	
Total Delay					6.7			44.9			13.5	
LOS					A			D			B	
Approach Delay					6.7			44.9			13.5	
Approach LOS					A			D			B	
Queue Length 50th (m)					19.0			49.9			3.2	
Queue Length 95th (m)					29.8			75.8			12.0	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2232			462			488	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.25			0.65			0.12	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.77			
Intersection Signal Delay: 19.5		Intersection LOS: B	
Intersection Capacity Utilization 46.5%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	4	362	23	16	18	0	0	7	16
Future Volume (Veh/h)	0	0	0	4	362	23	16	18	0	0	7	16
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	0	0	5	453	29	20	23	0	0	9	20
Pedestrians		21			12			13			13	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120			233							
pX, platoon unblocked												
vC, conflicting volume	495			13			295	518	25	514	504	275
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	495			13			295	518	25	514	504	275
tC, single (s)	4.1			4.1			7.6	6.6	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			100			97	95	100	100	98	97
cM capacity (veh/h)	1068			1602			579	441	1031	414	462	721

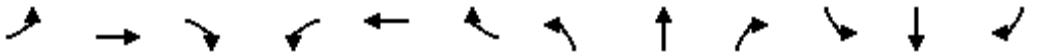
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	232	256	43	29
Volume Left	5	0	20	0
Volume Right	0	29	0	20
cSH	1602	1700	496	614
Volume to Capacity	0.00	0.15	0.09	0.05
Queue Length 95th (m)	0.1	0.0	2.3	1.2
Control Delay (s)	0.2	0.0	13.0	11.2
Lane LOS	A		B	B
Approach Delay (s)	0.1		13.0	11.2
Approach LOS			B	B

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	30.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	6	310	6	0
Future Volume (Veh/h)	0	0	6	310	6	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	0	7	369	7	0
Pedestrians	1			1	12	
Lane Width (m)	0.0			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198			155		
pX, platoon unblocked						
vC, conflicting volume			12		212	13
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			12		212	13
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1604		752	1059

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	130	246	7
Volume Left	7	0	7
Volume Right	0	0	0
cSH	1604	1700	752
Volume to Capacity	0.00	0.14	0.01
Queue Length 95th (m)	0.1	0.0	0.2
Control Delay (s)	0.4	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	0.1		9.8
Approach LOS			A

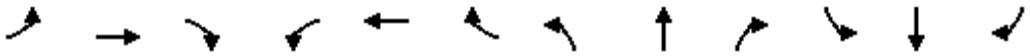
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	2	1	0	163	0	120	2	169	162
Future Volume (Veh/h)	0	0	0	2	1	0	163	0	120	2	169	162
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	0	2	1	0	183	0	135	2	190	182
Pedestrians		24						10				
Lane Width (m)		0.0						3.5				
Walking Speed (m/s)		1.2						1.2				
Percent Blockage		0						1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	584	719	224	570	766	0	396			135		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	584	719	224	570	766	0	396			135		
tC, single (s)	7.1	6.5	6.2	7.6	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.0	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	99	100	100	84			100		
cM capacity (veh/h)	372	299	814	320	281	1091	1136			1462		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	3	183	135	192	182
Volume Left	2	183	0	2	0
Volume Right	0	0	135	0	182
cSH	306	1136	1700	1462	1700
Volume to Capacity	0.01	0.16	0.08	0.00	0.11
Queue Length 95th (m)	0.2	4.6	0.0	0.0	0.0
Control Delay (s)	16.9	8.8	0.0	0.1	0.0
Lane LOS	C	A		A	
Approach Delay (s)	16.9	5.1		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	2.4			
Intersection Capacity Utilization	36.6%	ICU Level of Service		A
Analysis Period (min)	15			

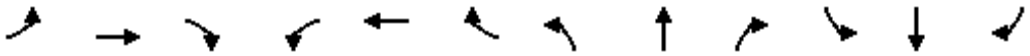


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	15	292	16	28	97	0	0	95	48
Future Volume (vph)	0	0	0	15	292	16	28	97	0	0	95	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3401	0	0	1842	0	0	1730	0
Flt Permitted					0.998			0.863				
Satd. Flow (perm)	0	0	0	0	3395	0	0	1605	0	0	1730	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					11						28	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	28		19	19		28	7		23	23		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	0%	4%	0%	0%	0%	1%	7%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	332	0	0	129	0	0	147	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					68.0			13.6			13.6	
Actuated g/C Ratio					0.76			0.15			0.15	
v/c Ratio					0.13			0.53			0.52	
Control Delay					3.3			42.9			34.3	
Queue Delay					0.0			0.0			0.0	
Total Delay					3.3			42.9			34.3	
LOS					A			D			C	
Approach Delay					3.3			42.9			34.3	
Approach LOS					A			D			C	
Queue Length 50th (m)					6.4			22.1			20.2	
Queue Length 95th (m)					12.6			37.9			36.9	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2566			461			517	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.13			0.28			0.28	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 19.2		Intersection LOS: B	
Intersection Capacity Utilization 52.0%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	6	264	15	14	10	0	0	11	20
Future Volume (Veh/h)	0	0	0	6	264	15	14	10	0	0	11	20
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	0	0	0	7	322	18	17	12	0	0	13	24
Pedestrians		22			1			18			21	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			1			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120			233							
pX, platoon unblocked												
vC, conflicting volume	361			18			246	393	19	373	384	213
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	361			18			246	393	19	373	384	213
tC, single (s)	4.1			4.1			7.8	6.5	6.9	7.5	6.7	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	3.5	4.1	3.3
p0 queue free %	100			100			97	98	100	100	97	97
cM capacity (veh/h)	1188			1588			597	527	1045	529	514	785

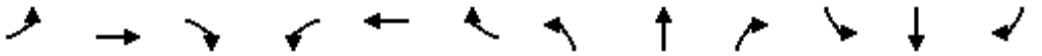
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	168	179	29	37
Volume Left	7	0	17	0
Volume Right	0	18	0	24
cSH	1588	1700	566	662
Volume to Capacity	0.00	0.11	0.05	0.06
Queue Length 95th (m)	0.1	0.0	1.3	1.4
Control Delay (s)	0.3	0.0	11.7	10.8
Lane LOS	A		B	B
Approach Delay (s)	0.2		11.7	10.8
Approach LOS			B	B

Intersection Summary				
Average Delay	1.9			
Intersection Capacity Utilization	27.6%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	8	292	8	0
Future Volume (Veh/h)	0	0	8	292	8	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	9	328	9	0
Pedestrians					16	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198			155		
pX, platoon unblocked						
vC, conflicting volume			16		198	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			16		198	16
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	100
cM capacity (veh/h)			1594		764	1052

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	118	219	9
Volume Left	9	0	9
Volume Right	0	0	0
cSH	1594	1700	764
Volume to Capacity	0.01	0.13	0.01
Queue Length 95th (m)	0.1	0.0	0.3
Control Delay (s)	0.6	0.0	9.8
Lane LOS	A		A
Approach Delay (s)	0.2		9.8
Approach LOS			A

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization		21.6%	ICU Level of Service A
Analysis Period (min)		15	

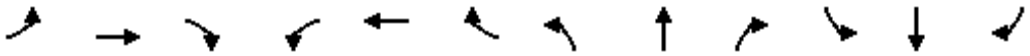


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	1	0	89	0	167	6	465	202
Future Volume (Veh/h)	0	0	0	1	1	0	89	0	167	6	465	202
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1	1	0	93	0	174	6	484	210
Pedestrians		25			1			10				
Lane Width (m)		0.0			3.5			3.5				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		0			0			1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	708	882	519	693	918	1	719			175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	708	882	519	693	918	1	719			175		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	100	100	100	89			100		
cM capacity (veh/h)	321	254	556	326	242	1089	847			1412		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	2	93	174	490	210
Volume Left	1	93	0	6	0
Volume Right	0	0	174	0	210
cSH	278	847	1700	1412	1700
Volume to Capacity	0.01	0.11	0.10	0.00	0.12
Queue Length 95th (m)	0.2	3.0	0.0	0.1	0.0
Control Delay (s)	18.0	9.8	0.0	0.1	0.0
Lane LOS	C	A		A	
Approach Delay (s)	18.0	3.4		0.1	
Approach LOS	C				

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	46.2%	ICU Level of Service		A
Analysis Period (min)	15			

Appendix D
Background Development Trip Generation



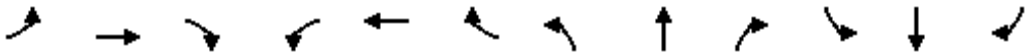
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	27	526	56	91	230	0	0	25	37
Future Volume (vph)	0	0	0	27	526	56	91	230	0	0	25	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3354	0	0	1801	0	0	1612	0
Flt Permitted					0.998			0.885				
Satd. Flow (perm)	0	0	0	0	3348	0	0	1600	0	0	1612	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					22						40	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	36		19	19		36	33		54	54		33
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	4%	5%	2%	0%	0%	5%	3%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	662	0	0	349	0	0	67	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					57.9			23.7			23.7	
Actuated g/C Ratio					0.64			0.26			0.26	
v/c Ratio					0.31			0.83			0.15	
Control Delay					7.7			48.8			13.1	
Queue Delay					0.0			0.0			0.0	
Total Delay					7.7			48.8			13.1	
LOS					A			D			B	
Approach Delay					7.7			48.8			13.1	
Approach LOS					A			D			B	
Queue Length 50th (m)					26.1			57.6			3.6	
Queue Length 95th (m)					35.7			#99.0			13.3	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2163			460			492	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.31			0.76			0.14	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 21.3		Intersection LOS: C	
Intersection Capacity Utilization 51.5%		ICU Level of Service A	
Analysis Period (min) 15			

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

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	5	424	27	19	21	0	0	8	19
Future Volume (Veh/h)	0	0	0	5	424	27	19	21	0	0	8	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	0	0	6	530	34	24	26	0	0	10	24
Pedestrians		21			12			13			13	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120										
pX, platoon unblocked												
vC, conflicting volume	577			13			340	602	25	597	585	316
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	577			13			340	602	25	597	585	316
tC, single (s)	4.1			4.1			7.6	6.6	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			100			95	93	100	100	98	96
cM capacity (veh/h)	996			1602			531	394	1031	357	415	678

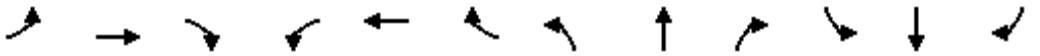
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	271	299	50	34
Volume Left	6	0	24	0
Volume Right	0	34	0	24
cSH	1602	1700	449	572
Volume to Capacity	0.00	0.18	0.11	0.06
Queue Length 95th (m)	0.1	0.0	3.0	1.5
Control Delay (s)	0.2	0.0	14.0	11.7
Lane LOS	A		B	B
Approach Delay (s)	0.1		14.0	11.7
Approach LOS			B	B

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	33.1%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	7	363	7	0
Future Volume (Veh/h)	0	0	7	363	7	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	0	8	432	8	0
Pedestrians	1			1	12	
Lane Width (m)	0.0			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198					
pX, platoon unblocked						
vC, conflicting volume			12		245	13
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			12		245	13
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	100
cM capacity (veh/h)			1604		717	1059

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	152	288	8
Volume Left	8	0	8
Volume Right	0	0	0
cSH	1604	1700	717
Volume to Capacity	0.00	0.17	0.01
Queue Length 95th (m)	0.1	0.0	0.3
Control Delay (s)	0.4	0.0	10.1
Lane LOS	A		B
Approach Delay (s)	0.1		10.1
Approach LOS			B

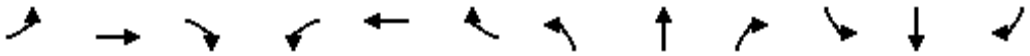
Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	2	1	0	191	0	141	2	198	190
Future Volume (Veh/h)	0	0	0	2	1	0	191	0	141	2	198	190
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	0	2	1	0	215	0	158	2	222	213
Pedestrians		24						10				
Lane Width (m)		0.0						3.5				
Walking Speed (m/s)		1.2						1.2				
Percent Blockage		0						1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	680	838	256	666	893	0	459			158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	680	838	256	666	893	0	459			158		
tC, single (s)	7.1	6.5	6.2	7.6	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.0	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	99	100	100	80			100		
cM capacity (veh/h)	310	243	781	264	226	1091	1076			1434		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	3	215	158	224	213
Volume Left	2	215	0	2	0
Volume Right	0	0	158	0	213
cSH	250	1076	1700	1434	1700
Volume to Capacity	0.01	0.20	0.09	0.00	0.13
Queue Length 95th (m)	0.3	6.0	0.0	0.0	0.0
Control Delay (s)	19.6	9.2	0.0	0.1	0.0
Lane LOS	C	A		A	
Approach Delay (s)	19.6	5.3		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	38.8%	ICU Level of Service		A
Analysis Period (min)	15			

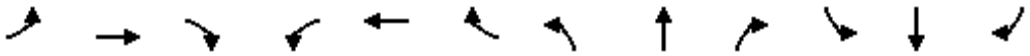


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	18	342	19	33	114	0	0	111	56
Future Volume (vph)	0	0	0	18	342	19	33	114	0	0	111	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3398	0	0	1842	0	0	1728	0
Flt Permitted					0.998			0.794				
Satd. Flow (perm)	0	0	0	0	3391	0	0	1476	0	0	1728	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					11						29	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	28		19	19		28	7		23	23		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	0%	4%	0%	0%	0%	1%	7%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	392	0	0	152	0	0	172	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					66.9			14.7			14.7	
Actuated g/C Ratio					0.74			0.16			0.16	
v/c Ratio					0.16			0.63			0.56	
Control Delay					3.8			46.4			35.3	
Queue Delay					0.0			0.0			0.0	
Total Delay					3.8			46.4			35.3	
LOS					A			D			D	
Approach Delay					3.8			46.4			35.3	
Approach LOS					A			D			D	
Queue Length 50th (m)					8.4			26.2			24.2	
Queue Length 95th (m)					16.0			43.5			41.9	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2521			424			517	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.16			0.36			0.33	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.63			
Intersection Signal Delay: 20.4		Intersection LOS: C	
Intersection Capacity Utilization 52.9%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	7	309	18	16	12	0	0	13	23
Future Volume (Veh/h)	0	0	0	7	309	18	16	12	0	0	13	23
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	0	0	0	9	377	22	20	15	0	0	16	28
Pedestrians		22			1			18			21	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			1			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120			233							
pX, platoon unblocked												
vC, conflicting volume	420			18			282	456	19	436	445	242
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	420			18			282	456	19	436	445	242
tC, single (s)	4.1			4.1			7.8	6.5	6.9	7.5	6.7	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	3.5	4.1	3.3
p0 queue free %	100			99			96	97	100	100	97	96
cM capacity (veh/h)	1130			1588			553	485	1045	475	473	751

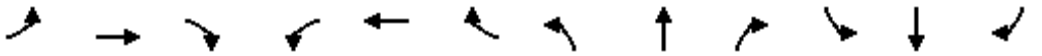
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	198	210	35	44
Volume Left	9	0	20	0
Volume Right	0	22	0	28
cSH	1588	1700	521	619
Volume to Capacity	0.01	0.12	0.07	0.07
Queue Length 95th (m)	0.1	0.0	1.7	1.8
Control Delay (s)	0.4	0.0	12.4	11.3
Lane LOS	A		B	B
Approach Delay (s)	0.2		12.4	11.3
Approach LOS			B	B

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	28.3%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	9	342	9	0
Future Volume (Veh/h)	0	0	9	342	9	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	10	384	10	0
Pedestrians					16	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198			155		
pX, platoon unblocked						
vC, conflicting volume			16		228	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			16		228	16
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		99	100
cM capacity (veh/h)			1594		731	1052

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	138	256	10
Volume Left	10	0	10
Volume Right	0	0	0
cSH	1594	1700	731
Volume to Capacity	0.01	0.15	0.01
Queue Length 95th (m)	0.2	0.0	0.3
Control Delay (s)	0.6	0.0	10.0
Lane LOS	A		A
Approach Delay (s)	0.2		10.0
Approach LOS			A

Intersection Summary			
Average Delay		0.4	
Intersection Capacity Utilization		23.0%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	1	0	104	0	196	6	545	237
Future Volume (Veh/h)	0	0	0	1	1	0	104	0	196	6	545	237
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1	1	0	108	0	204	6	568	247
Pedestrians		25			1			10				
Lane Width (m)		0.0			3.5			3.5				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		0			0			1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	822	1026	603	807	1069	1	840			205		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	822	1026	603	807	1069	1	840			205		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	100	99	100	86			100		
cM capacity (veh/h)	261	202	499	266	191	1089	762			1377		

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	2	108	204	574	247
Volume Left	1	108	0	6	0
Volume Right	0	0	204	0	247
cSH	222	762	1700	1377	1700
Volume to Capacity	0.01	0.14	0.12	0.00	0.15
Queue Length 95th (m)	0.2	3.9	0.0	0.1	0.0
Control Delay (s)	21.4	10.5	0.0	0.1	0.0
Lane LOS	C	B		A	
Approach Delay (s)	21.4	3.6		0.1	
Approach LOS	C				

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	51.2%	ICU Level of Service		A
Analysis Period (min)	15			

Appendix E

2016 Transportation Tomorrow Survey (TTS) Data Analysis

Auto Trip Distribution - External Hamilton

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: Planning district of destination - pd_dest

Filters:
Primary travel mode of trip - mode_prime In D M P T U
and
2006 GTA zone of origin - gta06_orig In 5159 5168 5172
and
Start time of trip - start_time In 600-900

Trip 2016
Table:

	PD 8 of Toronto	Mississauga	Oakville	Burlington	Flamborough	Dundas	Glanbrook	Stoney Creek	Hamilton	Lincoln	St. Catharines	Kitchener	Brant	Haldimand-Norfolk	
5159	0	0	0	110	70	34	0	44	481	8	13	17	23	0	
5168	0	0	79	0	0	0	0	0	322	0	0	0	0	0	
5172	67	25	32	75	0	0	58	99	446	0	0	0	0	30	
	67	25	111	185	70	34	58	143	1249	8	13	17	23	30	2033
	3%	1%	5%	9%	3%	2%	3%	7%	61%	0%	1%	1%	1%	1%	100%

Toronto	3%
Halton	15%
Peel	1%
Flamborough	3%
Dundas	2%
Glanbrook	3%
Stoney Creek	7%
Hamilton	61%
Waterloo	3%
Niagara	2%

Auto Trip Distribution - Internal Hamilton

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of origin - gta06_orig
Column: Ward number of destination - ward_dest

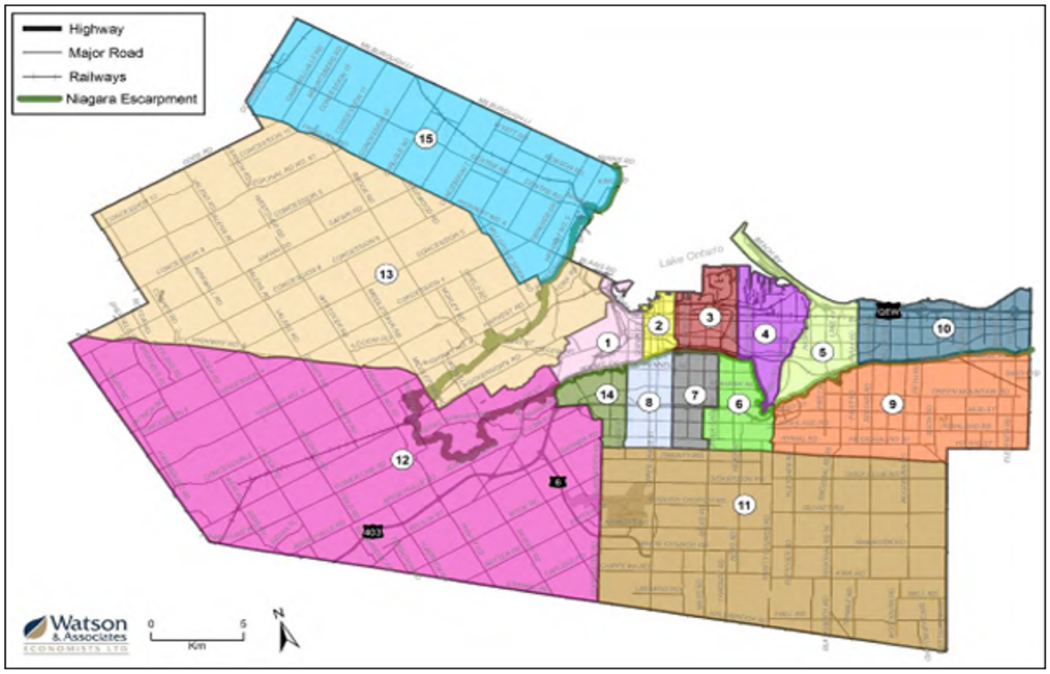
Filters:
Primary travel mode of trip - mode_prime In D M P T U
and
2006 GTA zone of origin - gta06_orig In 5159 5168 5172
and
Start time of trip - start_time In 600-900
and
Ward number of destination - ward_dest In 171-185

Trip 2016
Table:

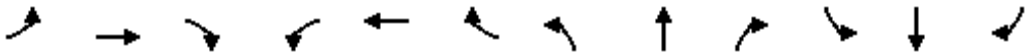
	1	2	3	4	5	6	7	8	10	11	13	15	
	171	172	173	174	175	176	177	178	180	181	183	185	
5159	53	21	97	98	25	66	69	51	0	44	34	70	
5168	20	123	39	53	0	0	14	72	0	0	0	0	
5172	197	83	7	43	56	0	60	0	60	96	0	0	
	441	399	316	368	256	242	320	301	240	321	217	255	3676
	12%	11%	9%	10%	7%	7%	9%	8%	7%	9%	6%	7%	100%

Hamilton 61%

	Ward 2	
East	32%	20%
West	25%	15%
North	11%	7%
South	32%	20%
	100%	61%



Appendix F
Future Total Level of Service Calculations



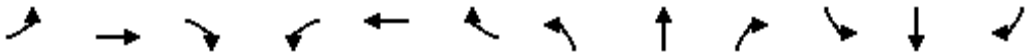
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	35	540	56	91	232	0	0	25	37
Future Volume (vph)	0	0	0	35	540	56	91	232	0	0	25	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3356	0	0	1801	0	0	1612	0
Flt Permitted					0.997			0.886				
Satd. Flow (perm)	0	0	0	0	3349	0	0	1602	0	0	1612	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					21						40	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	36		19	19		36	33		54	54		33
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	4%	5%	2%	0%	0%	5%	3%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	686	0	0	351	0	0	67	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					57.9			23.7			23.7	
Actuated g/C Ratio					0.64			0.26			0.26	
v/c Ratio					0.32			0.83			0.15	
Control Delay					7.8			48.9			13.1	
Queue Delay					0.0			0.0			0.0	
Total Delay					7.8			48.9			13.1	
LOS					A			D			B	
Approach Delay					7.8			48.9			13.1	
Approach LOS					A			D			B	
Queue Length 50th (m)					27.5			58.1			3.6	
Queue Length 95th (m)					37.3			#99.6			13.3	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2161			461			492	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.32			0.76			0.14	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 21.2		Intersection LOS: C	
Intersection Capacity Utilization 52.2%		ICU Level of Service A	
Analysis Period (min) 15			

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

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	9	426	27	41	29	0	0	12	19
Future Volume (Veh/h)	0	0	0	9	426	27	41	29	0	0	12	19
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	0	0	0	11	533	34	51	36	0	0	15	24
Pedestrians		21			12			13			13	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			1			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120										
pX, platoon unblocked												
vC, conflicting volume	580			13			354	615	25	615	598	318
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	580			13			354	615	25	615	598	318
tC, single (s)	4.1			4.1			7.6	6.6	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			99			90	91	100	100	96	96
cM capacity (veh/h)	993			1602			512	386	1031	338	407	677

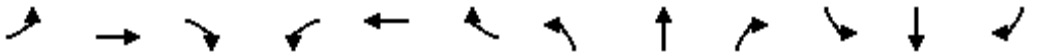
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	278	300	87	39
Volume Left	11	0	51	0
Volume Right	0	34	0	24
cSH	1602	1700	451	539
Volume to Capacity	0.01	0.18	0.19	0.07
Queue Length 95th (m)	0.2	0.0	5.6	1.9
Control Delay (s)	0.3	0.0	14.9	12.2
Lane LOS	A		B	B
Approach Delay (s)	0.2		14.9	12.2
Approach LOS			B	B

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	34.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	9	367	9	0
Future Volume (Veh/h)	0	0	9	367	9	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	0	11	437	11	0
Pedestrians	1			1	12	
Lane Width (m)	0.0			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	0			0	1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198					
pX, platoon unblocked						
vC, conflicting volume			12		254	13
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			12		254	13
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	100
cM capacity (veh/h)			1604		707	1059

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	157	291	11
Volume Left	11	0	11
Volume Right	0	0	0
cSH	1604	1700	707
Volume to Capacity	0.01	0.17	0.02
Queue Length 95th (m)	0.2	0.0	0.4
Control Delay (s)	0.6	0.0	10.2
Lane LOS	A		B
Approach Delay (s)	0.2		10.2
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	24.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	2	1	0	191	0	141	2	198	196
Future Volume (Veh/h)	0	0	0	2	1	0	191	0	141	2	198	196
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	0	2	1	0	215	0	158	2	222	220
Pedestrians		24						10				
Lane Width (m)		0.0						3.5				
Walking Speed (m/s)		1.2						1.2				
Percent Blockage		0						1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	680	838	256	666	900	0	466			158		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	680	838	256	666	900	0	466			158		
tC, single (s)	7.1	6.5	6.2	7.6	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	4.0	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	99	100	100	80			100		
cM capacity (veh/h)	309	243	781	264	224	1091	1070			1434		

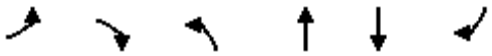
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	3	215	158	224	220
Volume Left	2	215	0	2	0
Volume Right	0	0	158	0	220
cSH	249	1070	1700	1434	1700
Volume to Capacity	0.01	0.20	0.09	0.00	0.13
Queue Length 95th (m)	0.3	6.0	0.0	0.0	0.0
Control Delay (s)	19.6	9.2	0.0	0.1	0.0
Lane LOS	C	A		A	
Approach Delay (s)	19.6	5.3		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	2.5			
Intersection Capacity Utilization	38.8%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	30	40	0	8	13
Future Volume (Veh/h)	0	30	40	0	8	13
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	33	43	0	9	14
Pedestrians	10		10			10
Lane Width (m)	3.5		3.5			3.5
Walking Speed (m/s)	1.2		1.2			1.2
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	95	63			53	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	95	63			53	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	97			99	
cM capacity (veh/h)	890	991			1553	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	33	43	23
Volume Left	0	0	9
Volume Right	33	0	0
cSH	991	1700	1553
Volume to Capacity	0.03	0.03	0.01
Queue Length 95th (m)	0.8	0.0	0.1
Control Delay (s)	8.8	0.0	2.9
Lane LOS	A		A
Approach Delay (s)	8.8	0.0	2.9
Approach LOS	A		

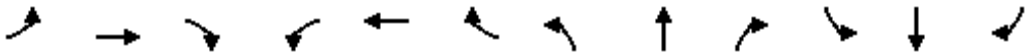
Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	0	7	7	2
Future Volume (Veh/h)	2	0	0	7	7	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	0	8	8	2
Pedestrians	10			10	10	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	37	29	20			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	37	29	20			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	965	1035	1596			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	2	8	10
Volume Left	2	0	0
Volume Right	0	0	2
cSH	965	1596	1700
Volume to Capacity	0.00	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	8.7	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.7	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		

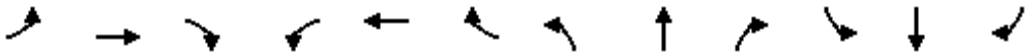


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	22	351	19	33	121	0	0	111	56
Future Volume (vph)	0	0	0	22	351	19	33	121	0	0	111	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	0.0		0.0	0.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	0		0	0		0	0		0	0		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	0	0	0	0	3399	0	0	1842	0	0	1728	0
Flt Permitted					0.997			0.810				
Satd. Flow (perm)	0	0	0	0	3391	0	0	1507	0	0	1728	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					11						29	
Link Speed (k/h)		40			40			40			40	
Link Distance (m)		94.1			120.2			218.4			83.7	
Travel Time (s)		8.5			10.8			19.7			7.5	
Confl. Peds. (#/hr)	28		19	19		28	7		23	23		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	0%	0%	0%	4%	0%	4%	0%	0%	0%	1%	7%
Bus Blockages (#/hr)	0	0	0	0	0	4	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	0	0	0	405	0	0	159	0	0	172	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type				Perm	NA		Perm	NA			NA	
Protected Phases					2			4			4	
Permitted Phases				2			4					
Detector Phase				2	2		4	4			4	
Switch Phase												
Minimum Initial (s)				10.0	10.0		10.0	10.0			10.0	
Minimum Split (s)				28.3	28.3		28.1	28.1			28.1	
Total Split (s)				60.0	60.0		30.0	30.0			30.0	
Total Split (%)				66.7%	66.7%		33.3%	33.3%			33.3%	
Maximum Green (s)				54.7	54.7		24.9	24.9			24.9	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.0	2.0		1.8	1.8			1.8	
Lost Time Adjust (s)					-1.0			-1.0			-1.0	
Total Lost Time (s)					4.3			4.1			4.1	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	
Minimum Gap (s)				3.0	3.0		3.0	3.0			3.0	
Time Before Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Time To Reduce (s)				0.0	0.0		0.0	0.0			0.0	
Recall Mode				C-Max	C-Max		None	None			None	
Walk Time (s)				12.0	12.0		12.0	12.0			12.0	
Flash Dont Walk (s)				9.0	9.0		10.0	10.0			10.0	
Pedestrian Calls (#/hr)				0	0		0	0			0	
Act Effct Green (s)					66.6			15.0			15.0	
Actuated g/C Ratio					0.74			0.17			0.17	
v/c Ratio					0.16			0.63			0.55	
Control Delay					3.9			46.0			34.7	
Queue Delay					0.0			0.0			0.0	
Total Delay					3.9			46.0			34.7	
LOS					A			D			C	
Approach Delay					3.9			46.0			34.7	
Approach LOS					A			D			C	
Queue Length 50th (m)					8.8			27.4			24.0	
Queue Length 95th (m)					16.9			44.9			41.6	
Internal Link Dist (m)		70.1			96.2			194.4			59.7	
Turn Bay Length (m)												
Base Capacity (vph)					2511			433			517	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			0	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.16			0.37			0.33	

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Offset: 58 (64%), Referenced to phase 2:WBTL, Start of Green			
Natural Cycle: 60			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.63			
Intersection Signal Delay: 20.2		Intersection LOS: C	
Intersection Capacity Utilization 52.9%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 3: Walnut Street S & Hunter Street E



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	20	311	18	27	16	0	0	25	23
Future Volume (Veh/h)	0	0	0	20	311	18	27	16	0	0	25	23
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	0	0	0	24	379	22	33	20	0	0	30	28
Pedestrians		22			1			18			21	
Lane Width (m)		0.0			3.5			3.5			3.5	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			0			1			2	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		120										
pX, platoon unblocked												
vC, conflicting volume	422			18			320	488	19	470	477	244
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	422			18			320	488	19	470	477	244
tC, single (s)	4.1			4.1			7.8	6.5	6.9	7.5	6.7	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.6	4.0	3.3	3.5	4.1	3.3
p0 queue free %	100			98			93	96	100	100	93	96
cM capacity (veh/h)	1128			1588			501	461	1045	441	449	750

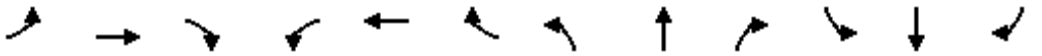
Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	214	212	53	58
Volume Left	24	0	33	0
Volume Right	0	22	0	28
cSH	1588	1700	485	557
Volume to Capacity	0.02	0.12	0.11	0.10
Queue Length 95th (m)	0.4	0.0	2.9	2.8
Control Delay (s)	0.9	0.0	13.3	12.2
Lane LOS	A		B	B
Approach Delay (s)	0.5		13.3	12.2
Approach LOS			B	B

Intersection Summary				
Average Delay	3.0			
Intersection Capacity Utilization	29.1%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	11	355	11	0
Future Volume (Veh/h)	0	0	11	355	11	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	0	0	12	399	12	0
Pedestrians					16	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	198					
pX, platoon unblocked						
vC, conflicting volume			16		240	16
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			16		240	16
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		98	100
cM capacity (veh/h)			1594		718	1052

Direction, Lane #	WB 1	WB 2	NB 1
Volume Total	145	266	12
Volume Left	12	0	12
Volume Right	0	0	0
cSH	1594	1700	718
Volume to Capacity	0.01	0.16	0.02
Queue Length 95th (m)	0.2	0.0	0.4
Control Delay (s)	0.7	0.0	10.1
Lane LOS	A		B
Approach Delay (s)	0.2		10.1
Approach LOS			B

Intersection Summary			
Average Delay		0.5	
Intersection Capacity Utilization		23.5%	ICU Level of Service A
Analysis Period (min)		15	



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	1	1	0	104	0	196	6	545	252
Future Volume (Veh/h)	0	0	0	1	1	0	104	0	196	6	545	252
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	0	0	0	1	1	0	108	0	204	6	568	263
Pedestrians		25			1			10				
Lane Width (m)		0.0			3.5			3.5				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		0			0			1				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	822	1026	603	807	1085	1	856			205		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	822	1026	603	807	1085	1	856			205		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	100	100	99	100	86			100		
cM capacity (veh/h)	261	202	499	265	186	1089	751			1377		

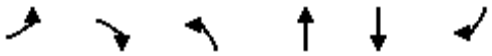
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	2	108	204	574	263
Volume Left	1	108	0	6	0
Volume Right	0	0	204	0	263
cSH	219	751	1700	1377	1700
Volume to Capacity	0.01	0.14	0.12	0.00	0.15
Queue Length 95th (m)	0.2	4.0	0.0	0.1	0.0
Control Delay (s)	21.6	10.6	0.0	0.1	0.0
Lane LOS	C	B		A	
Approach Delay (s)	21.6	3.7		0.1	
Approach LOS	C				

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	51.2%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	0	15	28	0	25	20
Future Volume (Veh/h)	0	15	28	0	25	20
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	16	30	0	27	22
Pedestrians	10		10			10
Lane Width (m)	3.5		3.5			3.5
Walking Speed (m/s)	1.2		1.2			1.2
Percent Blockage	1		1			1
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	126	50			40	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	126	50			40	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	98			98	
cM capacity (veh/h)	845	1007			1570	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	30	49
Volume Left	0	0	27
Volume Right	16	0	0
cSH	1007	1700	1570
Volume to Capacity	0.02	0.02	0.02
Queue Length 95th (m)	0.4	0.0	0.4
Control Delay (s)	8.6	0.0	4.1
Lane LOS	A		A
Approach Delay (s)	8.6	0.0	4.1
Approach LOS	A		

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	0	0	9	9	2
Future Volume (Veh/h)	2	0	0	9	9	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	0	10	10	2
Pedestrians	10			10	10	
Lane Width (m)	3.5			3.5	3.5	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	1			1	1	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	41	31	22			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	41	31	22			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	100	100			
cM capacity (veh/h)	960	1032	1594			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	2	10	12
Volume Left	2	0	0
Volume Right	0	0	2
cSH	960	1594	1700
Volume to Capacity	0.00	0.00	0.01
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	8.8	0.0	0.0
Lane LOS	A		
Approach Delay (s)	8.8	0.0	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	19.0%	ICU Level of Service	A
Analysis Period (min)	15		