Barrick Road Transportation Study

Elevate Fourth Developments Ltd.
Port Colborne, ON

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R.J. Burnside & Associates Limited
1465 Pickering Parkway Suite 200
Pickering ON L1V 7G7 CANADA

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300055622.0000

R.J. Burnside & Associates Limited

Report Prepared By:

Neevijan Pugalendiran, E.I.T.
Transportation Planner
NP/BW:cv

Benedict Wong, P.Eng.
Transportation Engineer

Report Reviewed By:

David Angelakis, C.E.T.
Senior Project Manager - Transportation
DWA:cv

Executive Summary

R.J. Burnside & Associates Limited (Burnside) was retained by Elevate Fourth Development Ltd. (the Client) to undertake a Transportation Study for a future residential subdivision in the northwest quadrant of Barrick Road and West Side Road in the City of Port Colborne. The development will consist of a mix of single-family homes, semi-detached homes, townhomes, stacked townhomes, and a single apartment building totaling 385 units.

This Transportation Study is part of the required Draft Plan of Subdivision and Zoning By-law Amendment applications.

The following is a summary of our key findings.

Traffic Operations

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity, a LOS E or better, and all queues will be contained within their respective storage lengths and link distances, except for some movements at the following intersections:

West Side Road / Barrick Road

The eastbound left / through / right turn movement during the weekday PM peak hour is expected to experience a LOS F under 2030 and 2035 total conditions. This movement will operate well below capacity and it's future queue lengths will be contained within its link distance. It is recommended that MTO monitor this intersection for future improvements.

West Side Road / Windsor Terrace

The westbound shared left / right turn movement where it is expected to experience a LOS F (200 seconds delay) under all future conditions, including background conditions, and operate over capacity under 2035 total conditions. It is recommended that MTO monitor this intersection for future improvements.

West Side Road / Stonebridge Drive

The westbound left / through / right turn movement during the PM peak hour is expected to experience a LOS F under 2035 total conditions. It is noted that this movement is expected to operate well below capacity and with future queue lengths contained within its link distance. It is recommended that MTO monitor this intersection for future improvements.

Draft Plan Review

Road Classification and Geometrics

The draft plan is well-designed to accommodate all modes of travel. The proposed Draft Plan complies with the Town standards. .

Pedestrian and Cyclist Accommodation

Pedestrians will be accommodated by proposed sidewalks on all local streets and laneway ‘A’ and ‘C’. Cyclists can utilize all proposed local roads and laneways and will have connections to Barrick Road.

Traffic Control

It is recommended that all intersections within the development be under 2-way stop control.

Transit

Transit coverage for the development will be over 80%.based on the existing transit stop at Barrick / West Side Road.

Transportation Demand Management

To further facilitate other modes of travel, several TDM measures are proposed by the development as follows:

- Internal sidewalk connections to future sidewalks on Barrick Road.
- Internal sidewalks on both sides of Street ‘E’.
- Internal sidewalks on one side of Laneway ‘A’ and ’C, and Street ‘A’, ‘B’, ‘C’, and ‘D’.
- Internal secure bicycle storage will be provided in each resident’s private garage within an accessory building, private yard, or dedicated storage facility in the case of multi-unit apartments.
- An information package on available transit/walking/cycling facilities will be provided to residents.

Parking Review

The proposed development will exceed the City's ZBL requirement except for the proposed apartment building, which will have a deficit of 26 spaces. However, it is our opinion that the proposed parking supply will meet or exceed future parking demand based on a review of other municipalities' requirements, and variances for other similar projects in Welland and Guelph with much lower parking rates.

Table of Contents

1.0 Introduction 1
1.1 Background 1
1.2 Scope of Work 2
1.3 Intersection Analysis Methodology 2
2.0 Existing Conditions 3
2.1 Site Context 3
2.2 Existing Road Network 3
2.3 Existing Traffic Volumes 5
2.4 Existing Transit Services 6
3.0 Future Background Conditions 7
3.1 Future Road Network 7
3.2 Future Transit 8
3.3 Future Active Transportation 8
3.4 Background Traffic Growth 9
3.5 Background Development 10
3.6 Background Traffic Volumes 10
4.0 Proposed Development 12
4.1 Trip Generation 14
4.2 Trip Distribution & Assignment 14
5.0 Total Traffic Volumes 15
6.0 Traffic Operations 17
6.1 West Side Road / Barrick Road 18
6.2 West Side Road / Windsor Terrace 20
6.3 West Side Road / Stonebridge Drive 21
6.4 West Side Road / Northland Avenue 23
6.5 Barrick Road / Future Street ‘E’ 25
6.6 Barrick Road / Future Street ‘A’ 26
7.0 Draft Plan Review 26
7.1 Pedestrian and Cyclist Accommodation 27
7.2 Traffic Control 27
7.3 Transit 27
8.0 Parking Review 30
8.1 Vehicle Parking 30
8.2 Other Municipalities’ Requirements 30
8.3 Parking Variances 31
8.4 Vehicular Parking Conclusions 31
9.0 Transportation Demand Management (TDM) 31
10.0 Conclusions 32
10.1 Traffic Operations 32
10.2 Draft Plan Review 33

10.3 Transportation Demand Management....33
10.4 Parking Review....34

Tables

Table 1: Background Developments....10
Table 2: Trip Generation....14
Table 3: Trip Distribution....14
Table 4: West Side Road / Barrick Road Operations....18
Table 5: West Side Road / Barrick Road Operations Sensitivity Analysis....19
Table 6: West Side Road / Barrick Road Signal Warrant Analysis – Total 2035....19
Table 7: West Side Road / Windsor Terrace Operations....20
Table 8: West Side Road / Windsor Terrace Operations Sensitivity Analysis....21
Table 9: West Side Road / Stonebridge Drive Operations....22
Table 10: West Side Road / Stonebridge Drive Operations Sensitivity Analysis....23
Table 11: West Side Road / Northland Avenue Operations....24
Table 12: Barrick Road / Street 'E' Operations (Unsignalized)....26
Table 13: Barrick Road / Street 'A' Operations....26
Table 14: ZBL Parking Requirements....30
Table 15: Other Municipalities' ZBL Rates....31
Table 16: Proxy Site Parking Variances....31

Figures

Figure 1: Site Location....1
Figure 2: Existing Road Network....4
Figure 3: Existing 2024 Traffic Volumes....6
Figure 4: NRT Transit Route....7
Figure 5: Proposed Transit Network....8
Figure 6: Proposed Cycling Network....9
Figure 7: Background 2030 Traffic Volumes....11
Figure 8: Background 2035 Traffic Volumes....12
Figure 9: Concept Draft Plan....13
Figure 10: Site Traffic Volumes....15
Figure 11: 2030 Total Traffic Volumes....16
Figure 12: 2035 Total Traffic Volumes....17
Figure 13: Active Transportation and Traffic Control....28
Figure 14: Future Transit Access....29

Appendices

Appendix A Operations Analysis Methodology
Appendix B Traffic Data Counts & Signal Timing Plan
Appendix C Background Development Site Traffic
Appendix D Existing 2024 Traffic Operations
Appendix E Background 2030 Traffic Operations

Appendix F Background 2035 Traffic Operations
Appendix G Total 2030 Traffic Operations
Appendix H Total 2035 Traffic Operations
Appendix I Total 2035 Traffic Operations
Sensitivity Analysis
Appendix J Signal Warrant Analysis
Appendix K Zoning By-law 6575-30-18 Excerpts

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1.0 Introduction

1.1 Background

Elevate Fourth Development Ltd. (the Client) is proposing to develop 385 residential units consisting of single-family homes, semi-detached homes, street townhomes, and a apartment building in the northwest quadrant of the intersection of Barrick Road / West Side Road (Highway 58) in the City of Port Colborne. Access will be provided by two local street connections to Barrick Road. The proposed development location is shown in Figure 1.

Figure 1: Site Location

1.2 Scope of Work

The following scope of work was discussed and confirmed with staff from the City of Port Colborne (the City), the Region of Niagara (the Region) and the Ministry of Transportation (MTO).

Analysis Scenarios	• Existing traffic conditions • 2030 and 2035 background and total traffic conditions
Analysis Time Periods	• Weekday AM peak hour (7:00 AM to 9:00 AM) • Weekday PM peak hour (4:00 PM to 6:00 PM)
Analysis Intersection (Study Area)	• West Side Road (Highway 58) / Northland Drive • West Side Road / Barrick Road • West Side Road / Windsor Terrace • West Side Road / Stonebridge Drive • Barrick Road / Site Driveway (2)
Signal Warrant Analysis	• West Side Road / Barrick Road
Draft Plan Review	• Street network geometrics • Intersection control • Active transportation accommodation
Transportation Demand Management (TDM) Plan	• Provide recommendations on feasible TDM strategies to discourage single occupant motor vehicle use

IThe intersections of Main Street West / West Side Road and Main Street West / Oakwood St were originally requested in the pre-consultation, however, were omitted from the analysis following subsequent discussions with the Region.

The City's *Guidelines for Transportation Impact Studies* dated May 2012 and the Ministry of Transportation' s (MTO) *General Guidelines for the Preparation of Traffic Impact Studies*, dated March 2023 were taken into consideration.

1.3 Intersection Analysis Methodology

Signalized and stop controlled intersection operations were assessed for intersections in the study area using the software program Synchro 11, which employs methodology from the *Highway Capacity Manual* (HCM 2000, HCM 2010 and HCM 6), published by the Transportation Research Board National Research Council.

Synchro 11 can analyze both signalized and unsignalized intersections in a road corridor or network taking into account the spacing, interaction, queues and operations between

intersections. The analysis utilizes the HCM 2000 methodology for all intersections. The intersection analysis methodology is provided in Appendix A.

2.0 Existing Conditions

2.1 Site Context

The subject development is bounded by vacant land to the north and west, West Side Road to the east, and 15 single detached homes on Barrick Road to the south.

2.2 Existing Road Network

The existing road network is described below and is illustrated in Figure 2, including existing traffic controls. All streets are under the City's jurisdiction, except for West Side Road (Highway 58), which is under MTO's jurisdiction.

West Side Road (Highway 58)

West Side Road (Highway 58) is a north-south provincial highway. The roadway has a 5-lane rural cross-section south of Highway 58 and a 2-lane rural cross-section north of Highway 58. A center 2-way left-turn lane is provided south of Barrick Road. The roadway has a posted speed limit of 80 km / h north of Barrick Road and 70 km / h south of Barrick Road. A narrow paved sidewalk is provided on the east side of Highway 58 south of Barrick Road.

Barrick Road

Barrick Road is an east-west collector road. The roadway has a 2-lane rural cross-section west of and a 2-lane urban cross-section east of Highway 48, respectively. The roadway has a posted and unposted speed limit of 50 km/ hr, east and west of Highway 58, respectively. No sidewalks are provided on either side of the road within the vicinity of the site.

Stonebridge Drive

Stonebridge Drive is an east-west industrial collector road. The roadway has a 2-lane rural cross-section with a posted speed limit of 50 km / h. No sidewalks are provided on either side of the road.

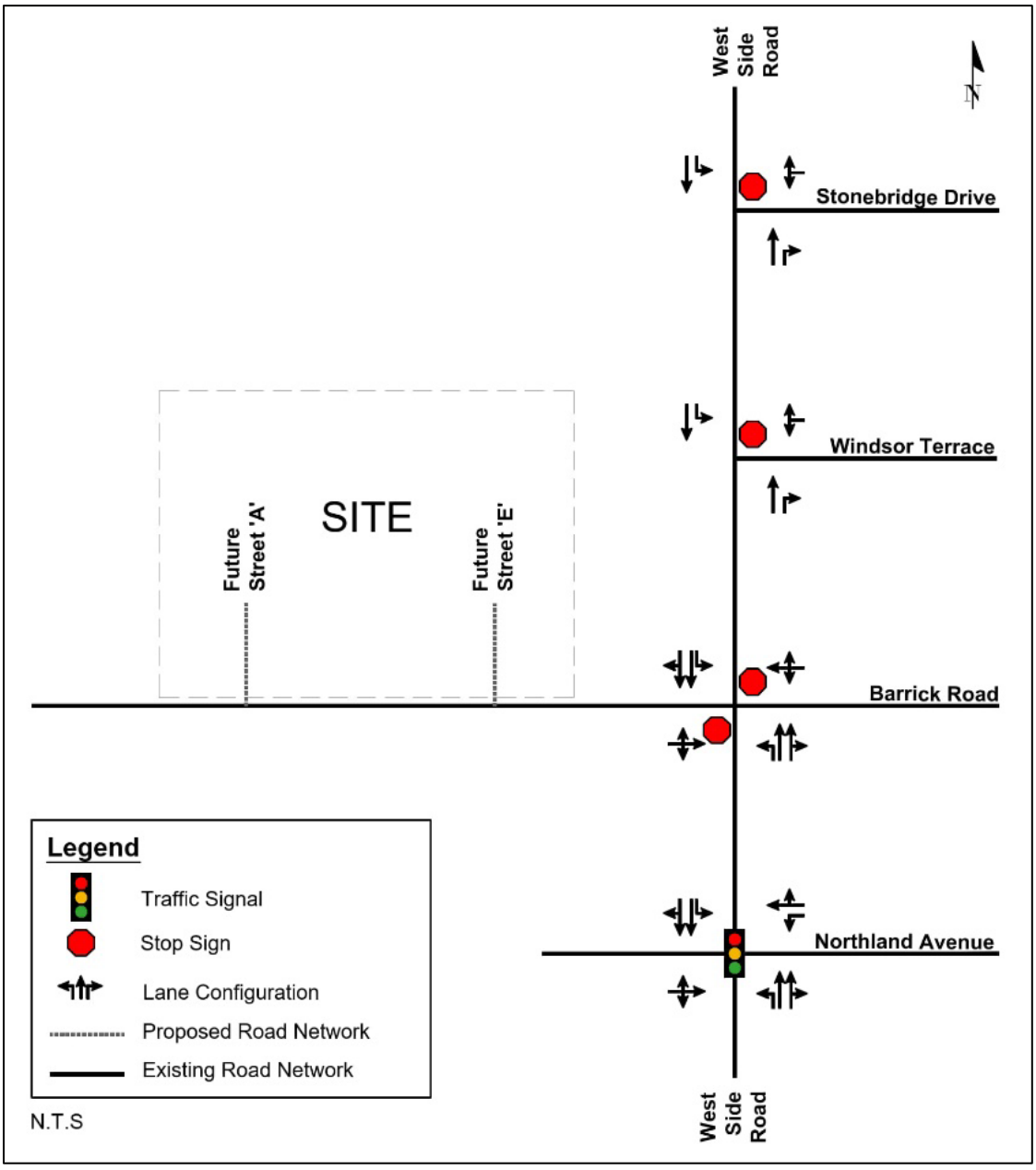
Windsor Terrace

Windsor Terrace is an east-west local road. The roadway has a 2-lane rural cross-section with an unposted speed limit of 50 km / h. No sidewalks are provided on either side of the road.

Northland Avenue

Northland Avenue is an east–west local road. The roadway has a 2-lane rural cross-section with an unposted speed limit of 50 km / h. Sidewalks are provided on the south side, which terminate approximately 104 m and 69 m east and west of Highway 58, respectively.

Figure 2: Existing Road Network

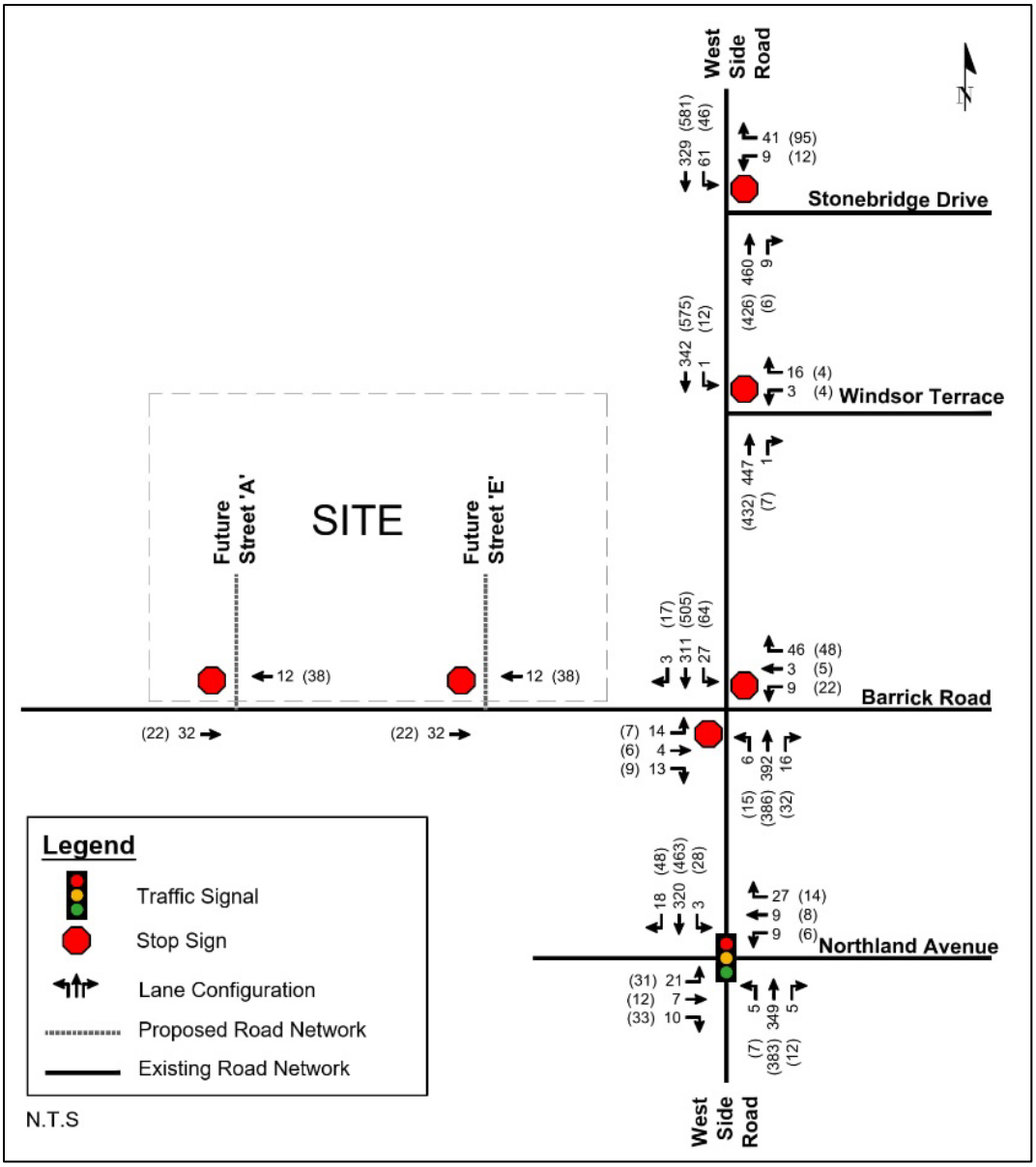


2.3 Existing Traffic Volumes

Existing traffic counts were conducted by Pyramid Traffic Inc., on behalf of Burnside, for the weekday morning (7:00 AM to 9:00 AM) and weekday afternoon (4:00 PM to 6:00 PM) peak periods on Thursday, January 18th, 2023, at all study intersections. The weekday AM and PM peak hours were selected as these are the typical peak traffic periods for the proposed uses within this development.

As mentioned in Section 3.4, a corridor growth of 0.27% was found based on historical traffic data. However, for a conservative analysis and to follow other transportation studies, the existing counts were grown to the current year with a grow rate of 2% as per the Region's *Guidelines for Transportation Impact Studies*. Existing 2024 traffic volumes are illustrated in Figure 3. All traffic counts are provided in Appendix B.

Figure 3: Existing 2024 Traffic Volumes

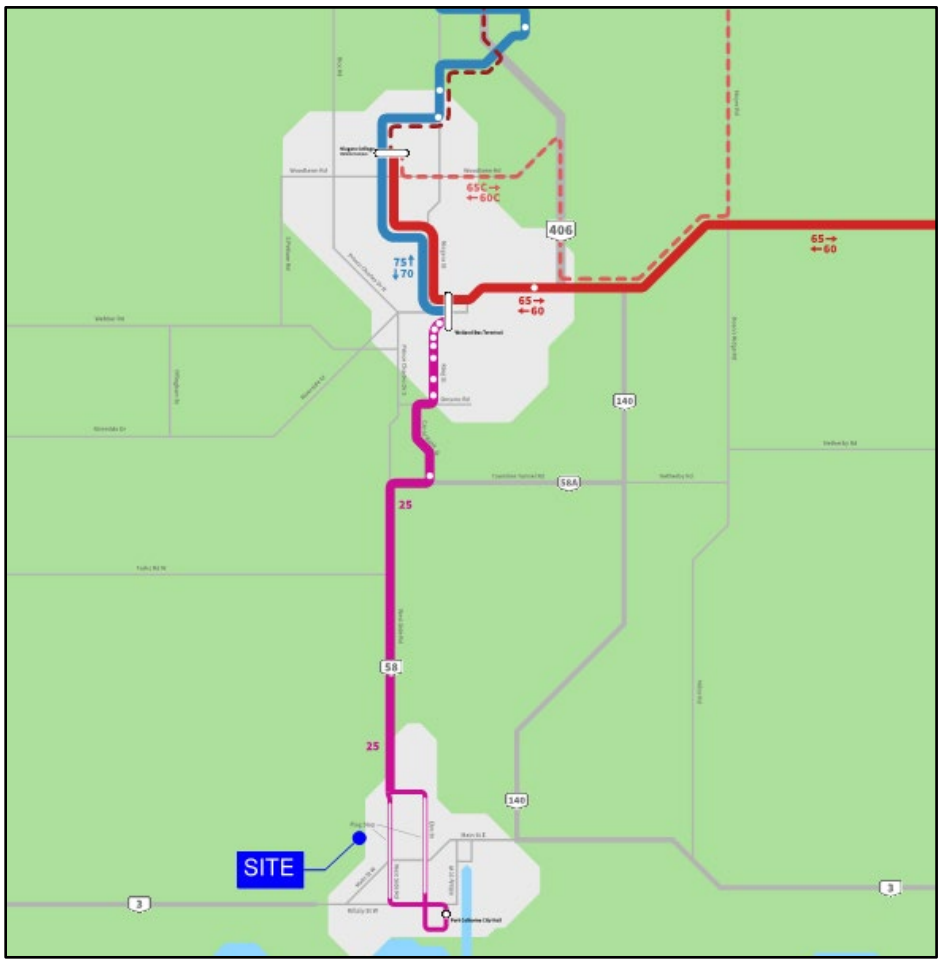


2.4 Existing Transit Services

An intermunicipal transit service (between Welland and Port Colborne) is provided by Niagara Region Transit (NRT) for the City. NRT Route 25 operates from 6:30 AM to 10:00 PM, Monday – Saturday with a headway of 1 hour. In addition, NRT also provides an OnDemand service year-round, Monday – Saturday, 7:00 AM to 10:00 PM within the City, which is a rideshare service where residents can book a ride via a mobile application and / or by calling a service number. There is no fixed route. The service will take riders within the City for a fixed fee and across West Niagara and to designated

transit hubs in St. Catharines, Welland and Port Colborne. A map of NRT routes is shown in Figure 4.

Figure 4: NRT Transit Route



Source: Niagara Region Transit

3.0 Future Background Conditions

Future background traffic consists of existing traffic, background traffic growth and traffic from other developments. Background traffic growth and traffic from other developments are discussed below. Future road network and transit improvements within the study horizon year are also discussed. The horizon years of 2030 and 2035 were selected for future projections, assuming buildout by 2025.

3.1 Future Road Network

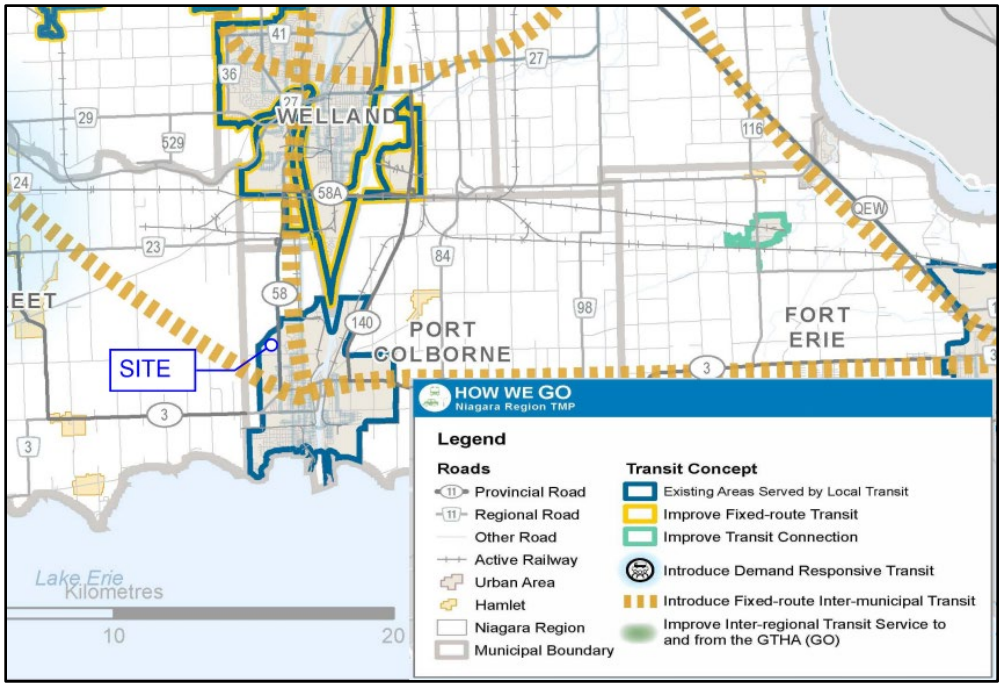
The City's *Official Plan*, dated September 2017 identifies all collector roads should have a future right-of-way (ROW) of 26 m. It is noted that Barrick Road is classified as a

collector road and will undergo a future widening. However, there is no indication of when this widening will occur.

3.2 Future Transit

Niagara Region's (Region) *Transportation Master Plan,* dated October 2017 (Region TMP), proposes to introduce an inter-municipal transit fixed route within the vicinity of the development. However, there is no indication of timeline. The proposed transit routes are illustrated in Figure 5. Between Port Colborne and Welland there is an existing inter-municipal transit route.

Figure 5: Proposed Transit Network

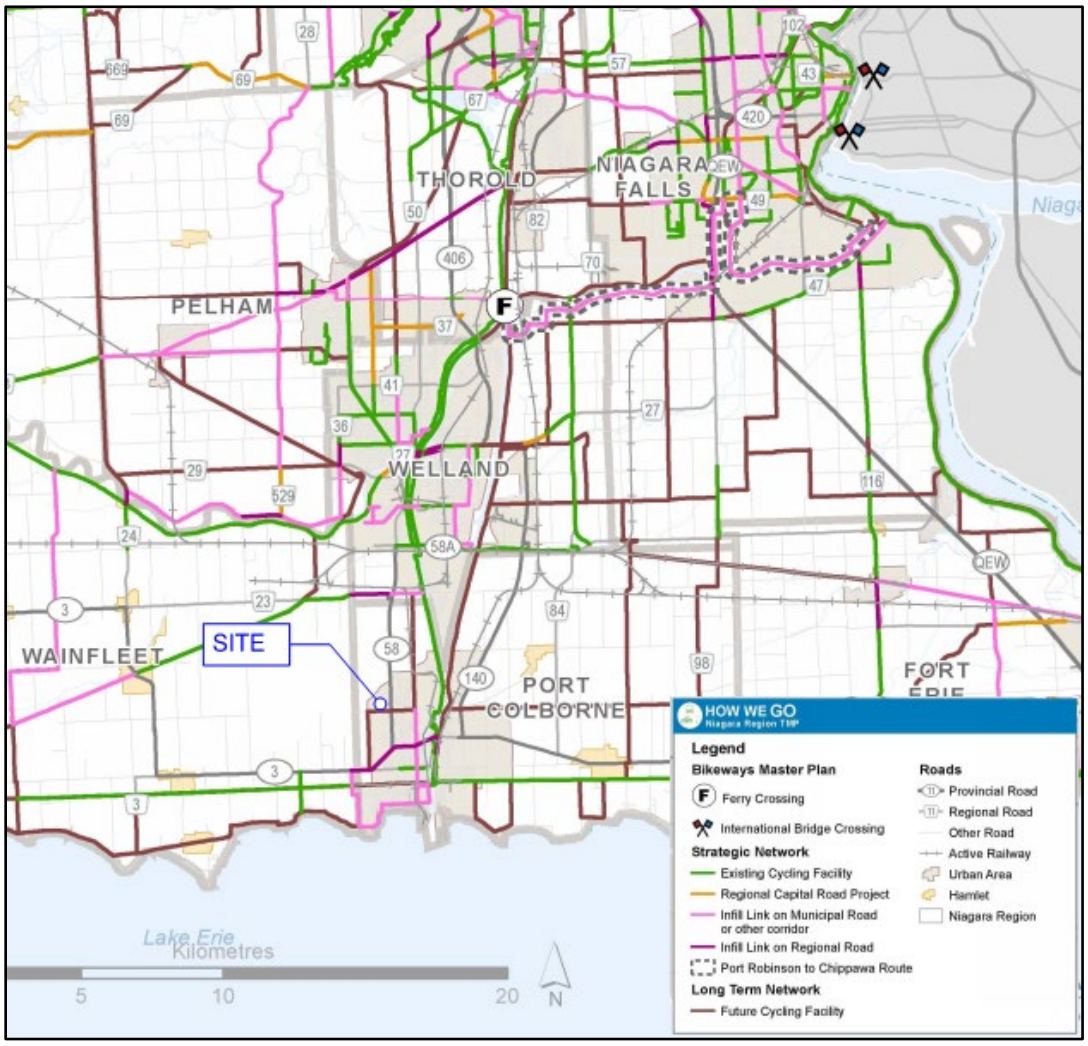


Source: Map 4 – Niagara Region Transportation Master Plan, dated October 2017

3.3 Future Active Transportation

The Region TMP proposes a future cycling facility on Minor Road, Barrick Road, and Elm Street. However, there is no indication of timeline. The proposed cycling route is illustrated in Figure 6.

Figure 6: Proposed Cycling Network



Source: Map 3 – Niagara Region Transportation Master Plan, dated October 2017

3.4 Background Traffic Growth

Historical traffic counts from the MTO AADT database and other transportation studies were reviewed, and annual negative growth was found on Highway 58 south of Barrick Road, and a modest 0.27% annual growth was found on Highway 58 at Forks Road. However, for a conservative analysis and to follow other transportation studies, a growth of 2% as per the Region's *Guidelines for Transportation Impact Studies*, dated May 2012, was applied to through movements along Highway 58 and Barrick Road.

3.5 Background Development

Several background developments were identified within the proximity of the site based on the City's online development application website, which were confirmed with the City, and are summarized in Table 1.

Table 1: Background Developments

Address	Description	Source
Northland Avenue & Highway 58	• Single Family Homes (172 units) • Mid-rise residential (50 units) • Retail (1500 m^2)	*Northland Estates Residential Development Traffic Impact Study by RV Anderson Associates Limited, dated July 2022*
100 Oxford Boulevard	• Single Family Homes (249 units)	*100 Oxford Boulevard Residential Subdivision Traffic Impact Study Final, by RV Anderson Associates Limited dated November 2023*
Barrick Road & Highway 58	• Low-rise residential (79 units) • Mid-rise residential (100 units)	*Barrick Road & Highway 58 (West Side Road) City of Port Colborne Traffic Impact & Parking Study, by Paradigm Limited, dated December 2023*
135 Coronation Drive	• Stacked Townhouses (114 units)	*Submitted Site Plan, by Organica Studio Inc dated May 2023.*

Site traffic figures were provided for each development's traffic study except for 135 Coronation Drive, where trip generation was based on the *Trip Generation Manual, 11th Edition* (Trip Generation Manual), by the Institute of Transportation Engineers (ITE) and only a submitted site was available at the time. Excerpts of the site traffic figures for the background developments and estimated trips for 135 Coronation Drive are provided in Appendix C.

3.6 Background Traffic Volumes

Background traffic volumes consist of the application of growth per annum (up to the horizon years of 2030 and 2035) to the existing traffic volumes in Figure 3, along with traffic from background developments, as described above in Table 3. The resulting background 2030 and 2035 traffic volumes are shown in Figure 7 and Figure 8, respectively.

Figure 7: Background 2030 Traffic Volumes

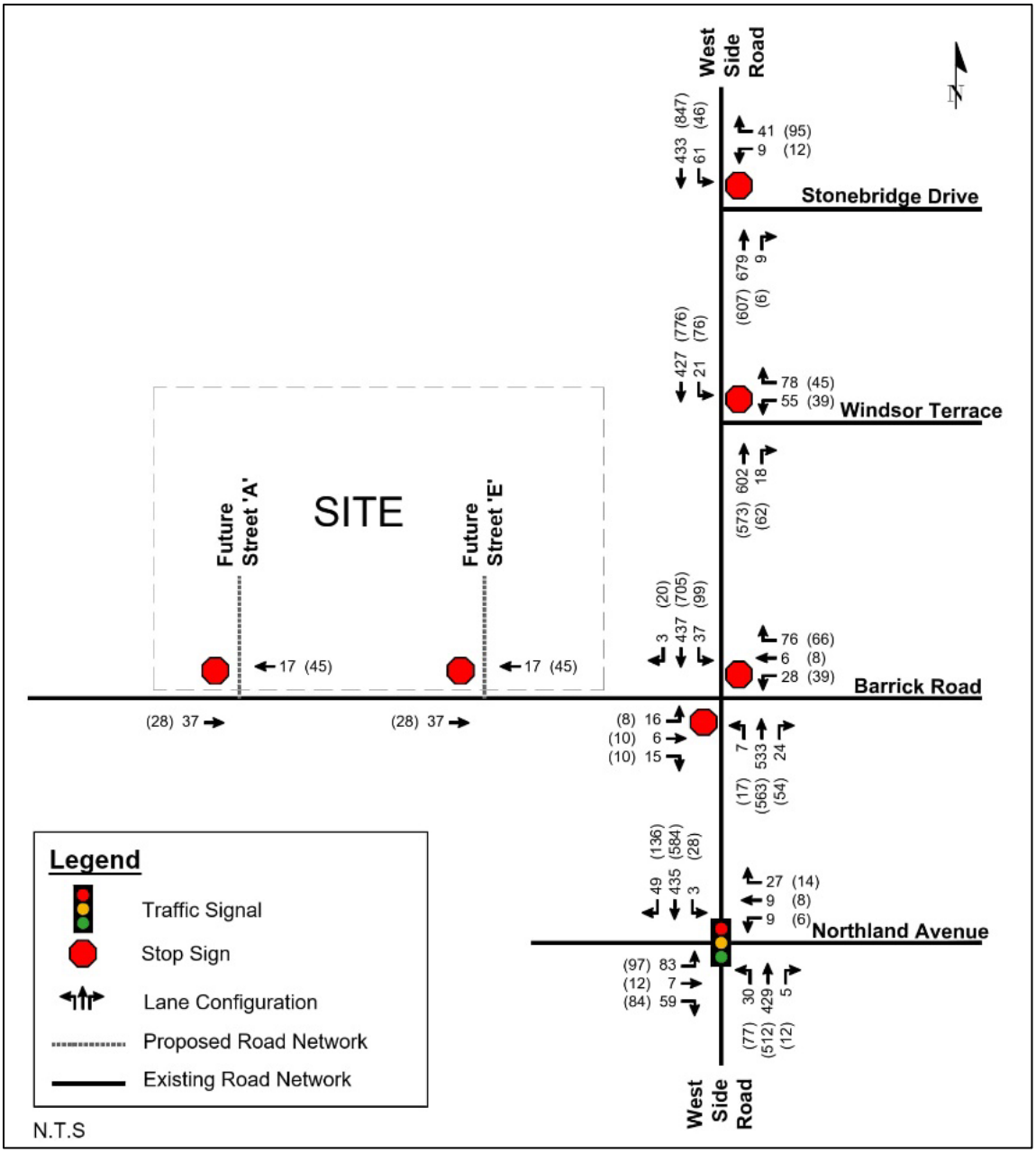
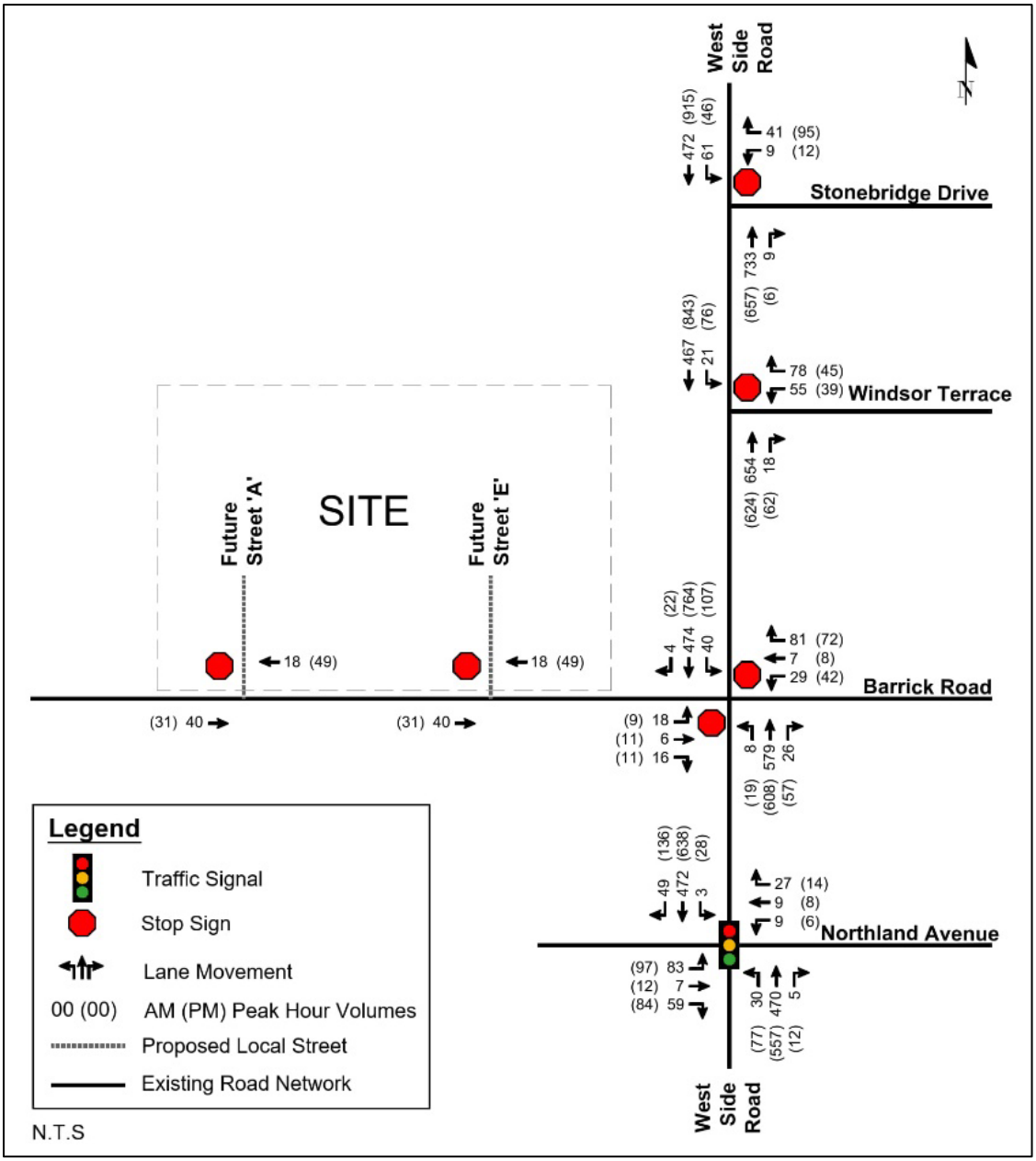


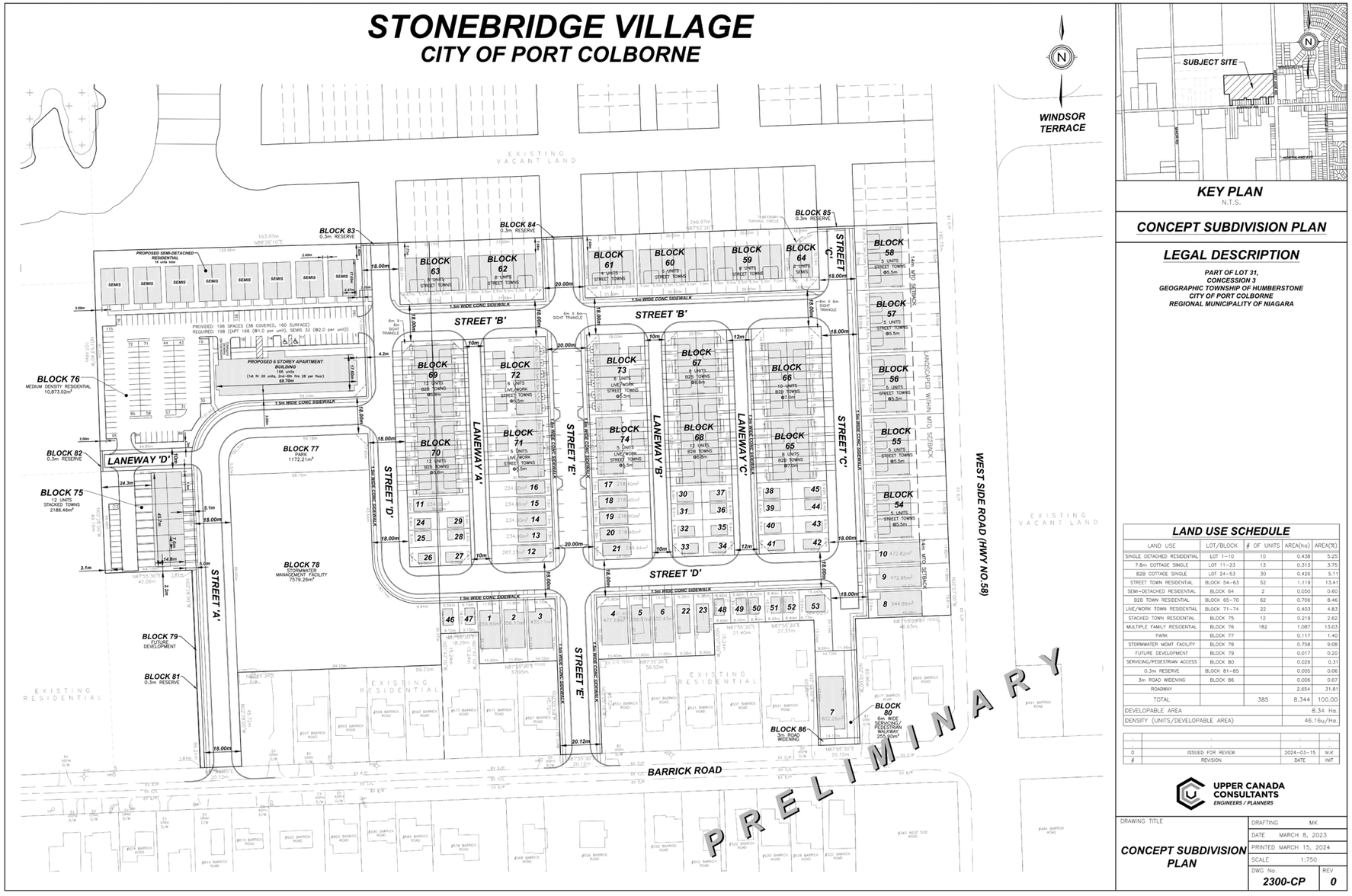
Figure 8: Background 2035 Traffic Volumes



4.0 Proposed Development

According to the concept plan by Upper Canada Consultants Inc, dated January 24, 2024, the proposed development will include 25 single-family homes, , 166 street and back-to-back townhomes, 12 stacked townhomes, and an apartment building with 182 units, for a grand total of 385 units. Access to the subdivision will be provided by two local street connections on Barrick Road and three local street connections to future development to the north. The concept draft plan is shown in Figure 9.

Figure 9: Concept Draft Plan



4.1 Trip Generation

Trip Generation for the proposed development was based on information contained in the *Trip Generation Manual*. The following Land Use Codes (LUC) were used for the generation of trips:

- Single family detached homes & semi-detached homes: Single-Family Detached Housing (LUC 210).
- Street and Back-to-Back Townhomes: Single-Family Attached Housing (LUC 215).
- Stacked Townhomes: Multifamily Housing Low-Rise (LUC 220).
- Mid Rise Apartment: Multifamily Housing Mid-Rise (LUC 221).

The projected trips generated for the weekday AM and PM peak hours are summarized in Table 2.

Table 2: Trip Generation

Land Use	Weekday AM Peak Hour			Weekday PM Peak Hour		
	In	Out	Total	In	Out	Total
Single-Family Detached Housing (LUC 210) - 25 Units	5	16	21	17	10	27
Single-Family Attached Housing (LUC 215) - 166 Units	20	61	81	57	39	96
Multifamily Housing – Low Rise (LUC 220) - 12 Units	6	21	27	16	10	26
Multifamily Housing – Mid Rise (LUC 221) - 182 Units	16	52	68	43	28	71
Total Trips	**47**	**150**	**197**	**133**	**87**	**220**

4.2 Trip Distribution & Assignment

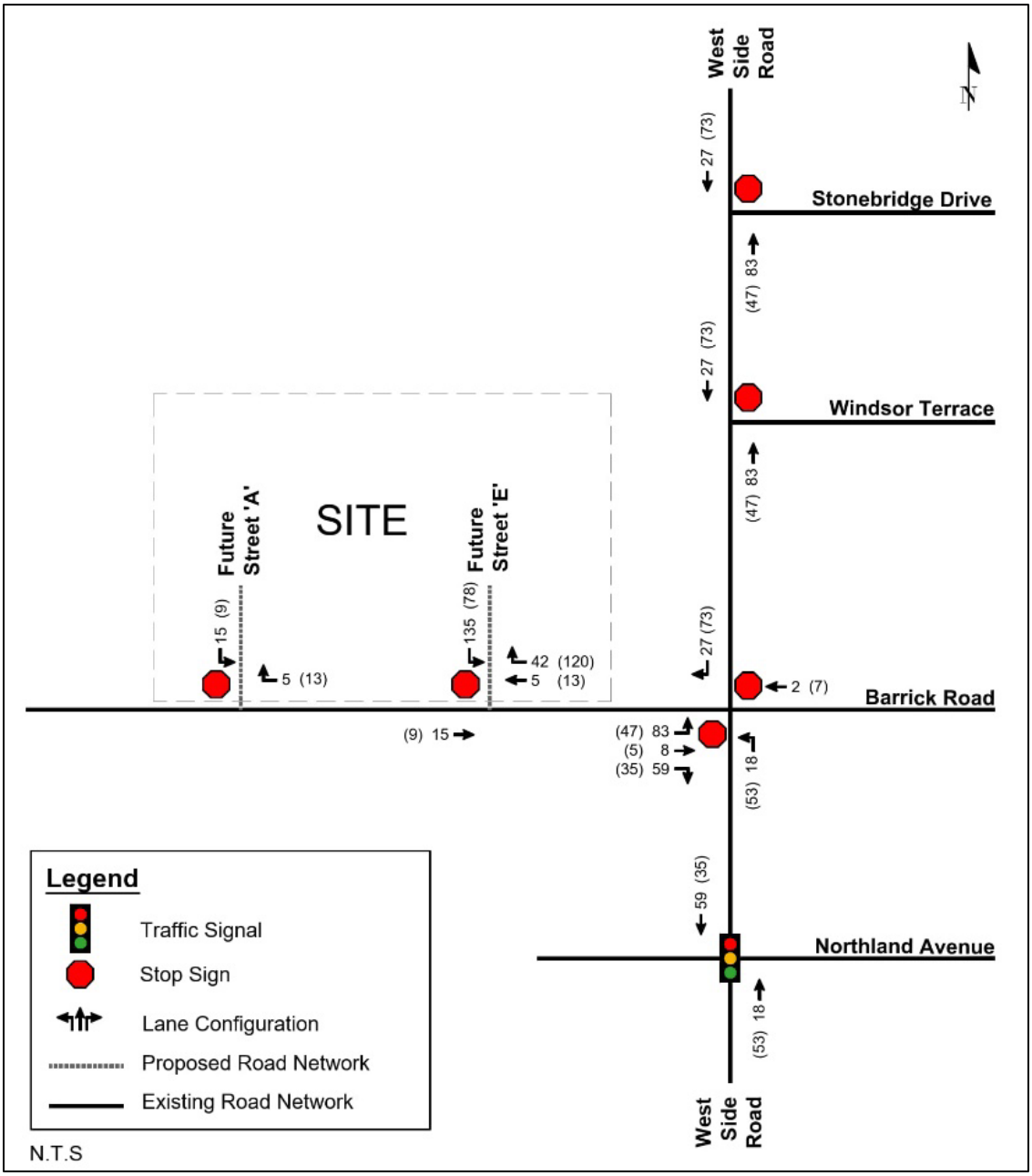
Trip distribution and assignment were derived from existing traffic patterns, the *2016 Transportation Tomorrow Survey*, the existing and future road network, and the expected destination of residents. The estimated distribution is summarized in Table 3.

Table 3: Trip Distribution

To/From	Via	Residential
North	West Side Road (Highway 58)	55%
South	West Side Road (Highway 58)	40%
East	Barrick Road	5%
Total		**100%**

The projected site traffic volumes are shown in Figure 10.

Figure 10: Site Traffic Volumes



5.0 Total Traffic Volumes

Total traffic volumes consist of background traffic volumes in Figure 7 and Figure 8 plus the site traffic shown in Figure 10. The resulting 2030 and 2035 total traffic volumes are shown in Figure 11 and Figure 12, respectively.

Figure 11: 2030 Total Traffic Volumes

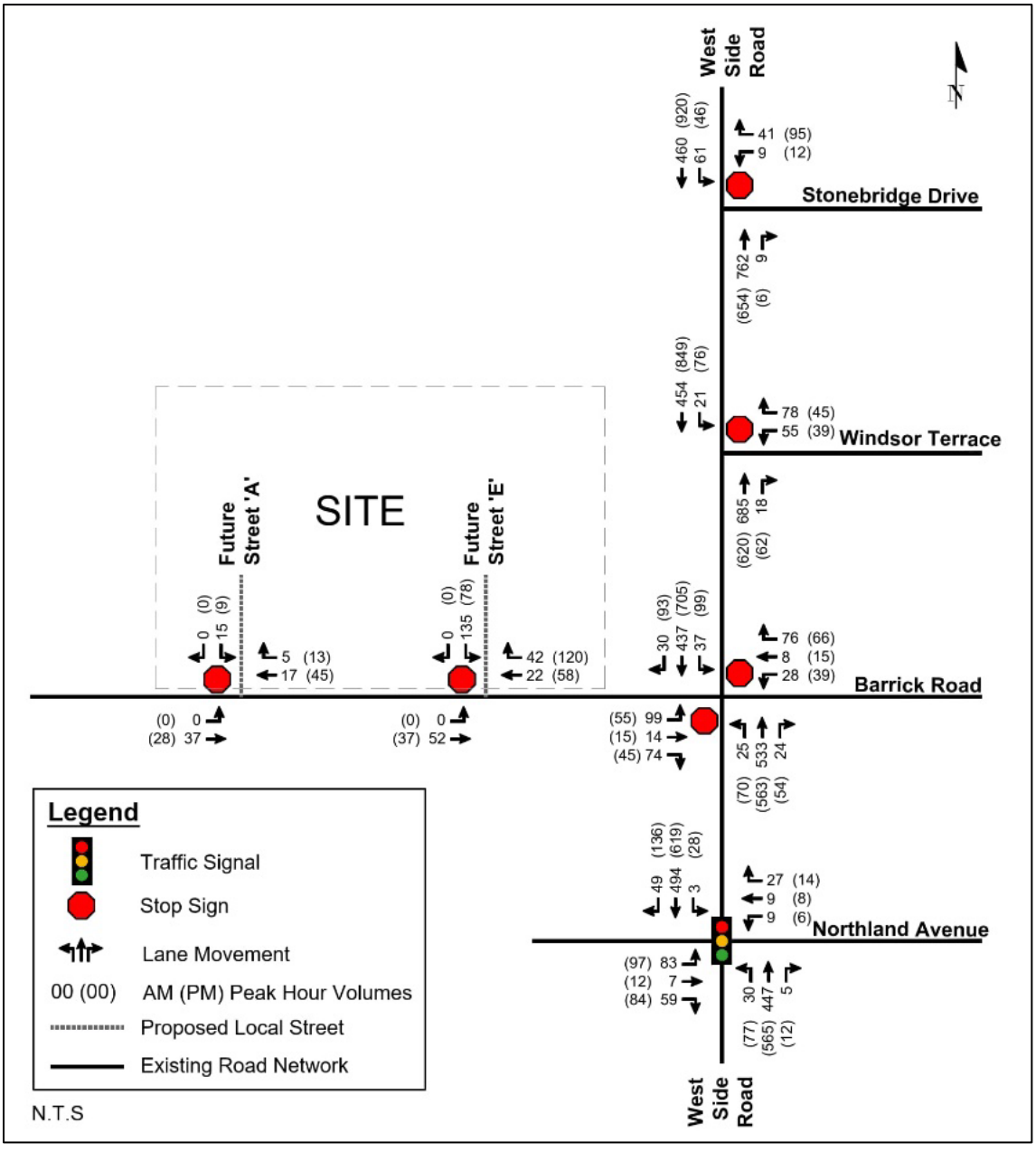
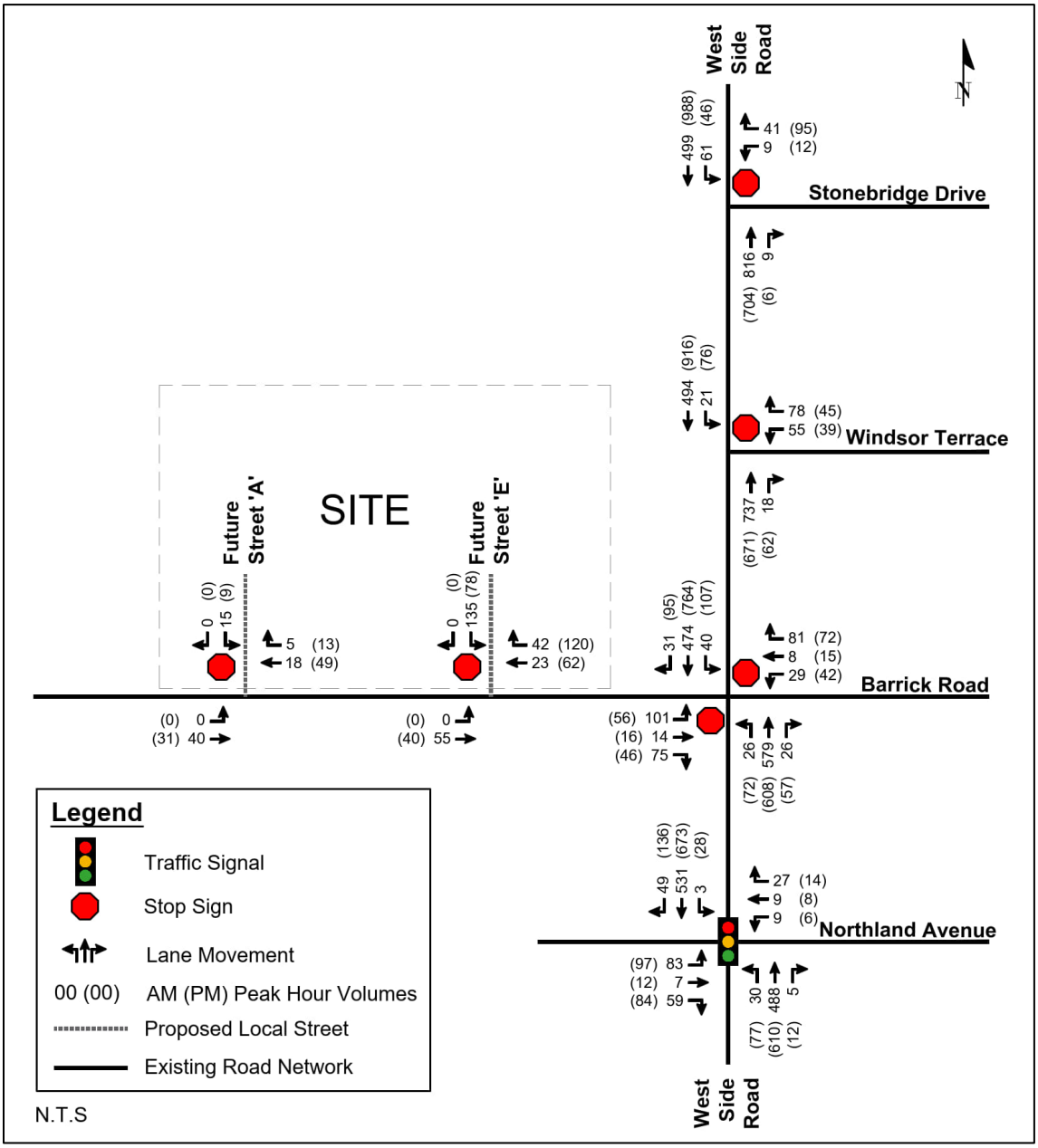


Figure 12: 2035 Total Traffic Volumes



6.0 Traffic Operations

Traffic operations analyses were conducted under existing and future traffic conditions for the weekday AM and PM peak hours at all study intersections. Queueing was reviewed using Synchro's 95th percentile queue. A comparison of the existing storage / link distances and projected queues are summarized for all movements. Detailed Synchro and queue reports are provided in Appendices D to H.

6.1 West Side Road / Barrick Road

Existing and future traffic operations for the intersection of West Side Road / Barrick Road are summarized in Table 4.

Table 4: West Side Road / Barrick Road Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
Existing Conditions							
EBLTR	250+	0.06	B	2	0.06	B	2
WBLTR	250+	0.09	B	3	0.16	B	5
NBL	85+	0.00	A	1	0.02	A	1
NBTR	412	0.17	A	0	0.18	A	0
SBL	128	0.03	A	1	0.07	A	2
SBTR	304	0.13	A	0	0.23	A	0
2030 Background Conditions							
EBLTR	250+	0.09	B	3	0.13	C	4
WBLTR	250+	0.23	B	7	0.35	C	12
NBL	85+	0.01	A	1	0.03	A	1
NBTR	412	0.22	A	0	0.26	A	0
SBL	128	0.04	A	1	0.13	A	4
SBTR	304	0.18	A	0	0.32	A	0
2035 Background Conditions							
EBLTR	250+	0.10	B	3	0.17	D	5
WBLTR	250+	0.26	C	8	0.42	C	16
NBL	85+	0.01	A	1	0.03	B	1
NBTR	412	0.24	A	0	0.28	A	0
SBL	128	0.05	A	2	0.15	A	4
SBTR	304	0.20	A	0	0.35	A	0
2030 Total Conditions							
EBLTR	250+	0.48	C	20	0.67	F	31
WBLTR	250+	0.26	C	8	0.52	D	21
NBL	85+	0.03	A	1	0.12	B	3
NBTR	412	0.22	A	0	0.26	A	0
SBL	128	0.04	A	1	0.13	A	4
SBTR	304	0.18	A	0	0.32	A	0
2035 Total Conditions							
EBLTR	250+	0.53	C	23	0.81	F	41
WBLTR	250+	0.29	C	10	0.64	E	30
NBL	85+	0.03	A	1	0.13	B	4
NBTR	412	0.24	A	0	0.28	A	0
SBL	128	0.05	A	2	0.15	A	4
SBTR	304	0.20	A	0	0.35	A	0

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity, a LOS E or better, and all queues will be contained within their respective storage lengths and link distances with the exception

of the eastbound left / through / right (EBLTR) movement during the weekday PM peak hour which is projected to experience a LOS F under 2030 and 2035 total conditions. This movement will operate well below capacity and it's future queue lengths will be contained within its link distance. The delay experienced for this movement under 2030 and 2035 conditions is expected to be 53 seconds and 81 seconds, respectively. A sensitivity analysis was conducted with a peak hour factor (PHF) of 0.92 (synchro default) instead of the existing 0.86, as it is expected that the future PHF will increase with higher traffic volumes. The results for 2035 Total PM conditions (worst case scenario) are shown in Table 5 and a synchro report is provided in Appendix I.

Table 5: West Side Road / Barrick Road Operations Sensitivity Analysis

Movement	Existing Storage/ Link Distance (m)	Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)
2035 Total Conditions				
EBLTR	800+	0.64	F	29
WBLTR	800+	0.52	D	21
NBL	412	0.11	B	3
NBTR	412	0.26	A	0
SBL	128	0.13	A	4
SBTR	304	0.33	A	0

Under future conditions the EBLTR movement will operate with excess capacity and a LOS F. However, it should be noted that this movement will only experience a delay of 51 seconds, which is one second over the LOS F delay threshold.

At the request of MTO a traffic signal warrant analysis under 2035 total conditions was conducted based on the methodology contained in the Ontario Traffic Manual Book 12 (OTM Book 12), published by the MTO. The results are summarized in Table 6 and the detailed analysis is provided in Appendix J.

Table 6: West Side Road / Barrick Road Signal Warrant Analysis – Total 2035

Justification	Justification 1 Minimum Vehicular Volume [1]		Justification 2 Delay to Cross Traffic [1]		Justification 3 Combination [2]	
	1A	1B	2A	2B	3A	3B
Compliance	95%	82%	80%	87%	82%	80%
Justified	No		No		No	

Notes: 1. 1A and 2A are total intersection volumes while 1B and 2B are crossing (of the main road) volumes.
2. 3A is Justification 1, while 3B is Justification 2

For each justification, the lower percentage governs the warrant. A signal can be warranted by just one of the justifications, provided that it meets the threshold for both categories. The threshold required for each justification is 120% for projected volumes.

Under each justification, the minimum threshold is not met, therefore, a traffic signal will not be warranted under total 2035 conditions.

6.2 West Side Road / Windsor Terrace

Existing and future traffic operations for the intersection of West Side Road / Windsor Terrace are summarized in Table 7.

Table 7: West Side Road / Windsor Terrace Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
Existing Conditions							
WBLR	69	0.04	B	1	0.04	C	1
NBT	304	0.28	A	0	0.31	A	0
NBR	27	0.00	A	0	0.00	A	0
SBL	144	0.00	A	0	0.01	A	1
SBT	900+	0.21	A	0	0.41	A	0
2030 Background Conditions							
WBLR	69	0.48	D	19	0.74	F	33
NBT	304	0.38	A	0	0.41	A	0
NBR	27	0.01	A	0	0.04	A	0
SBL	144	0.02	A	1	0.11	A	3
SBT	900+	0.27	A	0	0.55	A	0
2035 Background Conditions							
WBLR	69	0.55	D	23	0.89	F	42
NBT	304	0.41	A	0	0.44	A	0
NBR	27	0.01	A	0	0.04	A	0
SBL	144	0.02	A	1	0.12	B	3
SBT	900+	0.29	A	0	0.60	A	0
2030 Total Conditions							
WBLR	69	0.57	E	24	0.89	F	42
NBT	304	0.43	A	0	0.44	A	0
NBR	27	0.01	A	0	0.04	A	0
SBL	144	0.03	A	1	0.12	B	3
SBT	900+	0.28	A	0	0.60	A	0
2035 Total Conditions							
WBLR	69	0.64	E	29	1.08	F	51
NBT	304	0.46	A	0	0.48	A	0
NBR	27	0.01	A	0	0.04	A	0
SBL	144	0.03	A	1	0.12	B	4
SBT	900+	0.31	A	0	0.65	A	0

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity and a LOS C or better, with the exception of the westbound shared left / right (WBLR) movement where it is expected to experience a LOS F under all future conditions, including background conditions, and

operate over capacity under 2035 total conditions. A sensitivity analysis was conducted with a PHF of 0.92, instead of the existing 0.83 as it is expected that the future PHF will increase with higher traffic volumes, for the worst case scenario (PM peak hour under 2035 total conditions) and the results are shown in Table 8 and a synchro report ius provided in Appendix I.

Table 8: West Side Road / Windsor Terrace Operations Sensitivity Analysis

Movement	Existing Storage/ Link Distance (m)	Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)
WBLR	69	0.73	F	32
NBT	304	0.43	A	0
NBR	27	0.04	A	0
SBL	144	0.10	B	3
SBT	900+	0.59	A	0

Under future conditions the WBLR movement will operate with excess capacity (v/c of 0.73) and a LOS F (87 seconds). As mentioned above under background conditions this movement is expected to operate with a LOS F and therefore the issue is not solely caused by the subject development. Adding additional northbound and southbound through lanes will resolve this issue as the typical lane capacity for this type of roadway is 900 vehicles per lane and the southbound lane is reaching capacity under background conditions. It is recommended that MTO monitor this intersection for possible future improvements.

6.3 West Side Road / Stonebridge Drive

Existing and future traffic operations for the intersection of West Side Road / Stonebridge Drive are summarized in Table 9.

Table 9: West Side Road / Stonebridge Drive Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
Existing Conditions							
WBLR	850+	0.13	B	4	0.33	C	11
NBT	900+	0.29	A	0	0.31	A	0
NBR	126	0.01	A	0	0.00	A	0
SBL	144	0.07	A	2	0.07	A	2
SBT	1000+	0.21	A	0	0.43	A	0
2030 Background Conditions							
WBLR	850+	0.19	C	6	0.55	E	23
NBT	900+	0.43	A	0	0.45	A	0
NBR	126	0.01	A	0	0.00	A	0
SBL	144	0.08	B	3	0.08	B	2
SBT	1000+	0.28	A	0	0.62	A	0
2035 Background Conditions							
WBLR	850+	0.21	C	6	0.63	E	29
NBT	900+	0.47	A	0	0.48	A	0
NBR	126	0.01	A	0	0.00	A	0
SBL	144	0.09	B	3	0.08	B	3
SBT	1000+	0.30	A	0	0.67	A	0
2030 Total Conditions							
WBLR	850+	0.22	C	7	0.63	E	29
NBT	900+	0.49	A	0	0.48	A	0
NBR	126	0.01	A	0	0.00	A	0
SBL	144	0.09	B	3	0.08	B	3
SBT	1000+	0.29	A	0	0.68	A	0
2035 Total Conditions							
WBLR	850+	0.24	D	8	0.74	F	36
NBT	900+	0.52	A	0	0.52	A	0
NBR	126	0.01	A	0	0.00	A	0
SBL	144	0.10	B	3	0.09	B	3
SBT	1000+	0.32	A	0	0.73	A	0

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity and a LOS E or better, with the exception of the westbound left / through / right (WBLR) movement during the PM peak hour, which is expected to experience a LOS F (67 seconds) under 2035 total conditions. This movement is expected to operate well below capacity. A sensitivity analysis was conducted with a PHF of 0.92 instead of the existing 0.80 and the results are shown in Table 10 and a synchro report ius provided in Appendix I.

Table 10: West Side Road / Stonebridge Drive Operations Sensitivity Analysis

Movement	Existing Storage/ Link Distance (m)	Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)
2035 Total Conditions				
WBLR	850+	0.47	D	18
NBT	900+	0.45	A	0
NBR	126	0.00	A	0
SBL	144	0.07	B	2
SBT	1000+	0.63	A	0

Under future conditions the WBLR movement will operate with excess capacity and a LOS D.

6.4 West Side Road / Northland Avenue

Existing and future traffic operations for the intersection of West Side Road / Northland Avenue are summarized in Table 11.

Table 11: West Side Road / Northland Avenue Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
Existing Conditions							
Overall	-	0.17	A	-	0.25	A	-
EBL	75	0.21	C	8	0.23	C	10
EBTR	75	0.06	C	6	0.10	C	9
WBL	26	0.09	C	5	0.04	C	4
WBTR	300	0.08	C	9	0.06	C	6
NBL	80	0.01	A	2	0.02	A	2
NBTR	600+	0.16	A	13	0.20	A	14
SBL	142	0.00	A	1	0.06	A	4
SBTR	412	0.15	A	13	0.26	A	18
2030 Background Conditions							
Overall	-	0.29	A	-	0.42	A	-
EBL	75	0.54	C	23	0.49	C	25
EBTR	75	0.07	C	10	0.12	C	11
WBL	26	0.06	C	5	0.03	C	4
WBTR	300	0.06	C	8	0.04	C	6
NBL	80	0.06	A	5	0.25	A	12
NBTR	600+	0.21	A	20	0.29	A	25
SBL	142	0.00	A	1	0.07	A	5
SBTR	412	0.24	A	22	0.40	A	34
2035 Background Conditions							
Overall	-	0.30	A	-	0.44	A	-
EBL	75	0.54	C	23	0.49	C	25
EBTR	75	0.07	C	10	0.12	C	11
WBL	26	0.06	C	5	0.03	C	4
WBTR	300	0.06	C	8	0.04	C	6
NBL	80	0.06	A	5	0.28	A	12
NBTR	600+	0.23	A	22	0.31	A	27
SBL	142	0.01	A	1	0.07	A	5
SBTR	412	0.25	A	24	0.43	A	38

Table 11: West Side Road / Northland Avenue Operations Continued

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
2030 Total Conditions							
Overall	-	0.31	A	-	0.44	A	-
EBL	75	0.54	C	23	0.49	C	25
EBTR	75	0.07	C	10	0.12	C	11
WBL	26	0.06	C	5	0.03	C	4
WBTR	300	0.06	C	8	0.04	C	6
NBL	80	0.06	A	5	0.27	A	12
NBTR	600+	0.22	A	21	0.32	A	28
SBL	142	0.01	A	1	0.08	A	5
SBTR	412	0.26	A	25	0.42	A	36
2035 Total Conditions							
Overall	-	0.33	A	-	0.46	A	-
EBL	75	0.54	C	23	0.49	C	25
EBTR	75	0.07	C	10	0.12	C	11
WBL	26	0.06	C	5	0.03	C	4
WBTR	300	0.06	C	8	0.04	C	6
NBL	80	0.06	A	5	0.30	A	13
NBTR	600+	0.24	A	23	0.34	A	30
SBL	142	0.01	A	1	0.08	A	5
SBTR	412	0.28	A	27	0.45	A	40

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity, a LOS C or better and all queues within their storage / link distances.

6.5 Barrick Road / Future Street ‘E’

Future traffic operations for the intersection of Barrick Road / Future Street ‘E’ are summarized in Table 12.

Table 12: Barrick Road / Street 'E' Operations (Unsignalized)

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
2030 Total Conditions							
EBLT	100+	0.00	A	0	0.00	A	0
WBTR	200+	0.04	A	0	0.11	A	0
SBLR	50+	0.16	A	5	0.10	A	3
2035 Total Conditions							
EBLT	100+	0.00	A	0	0.00	A	0
WBTR	200+	0.04	A	0	0.12	A	0
SBLR	50+	0.16	A	5	0.10	A	3

Under future conditions during both peak hours, will operate with excess capacity, a LOS A or better and within their storage / link distances.

6.6 Barrick Road / Future Street 'A'

Future traffic operations for the intersection of Barrick Road / Future Street 'A' are summarized in Table 13.

Table 13: Barrick Road / Street 'A' Operations

Movement	Existing Storage/ Link Distance (m)	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c	LOS	95th Queue (m)	v/c	LOS	95th Queue (m)
2030 Total Conditions							
EBLT	100+	0.00	A	0	0.00	A	0
WBTR	100+	0.01	A	0	0.04	A	0
SBLR	50	0.02	A	1	0.01	A	1
2035 Total Conditions							
EBLT	100+	0.00	A	0	0.00	A	0
WBTR	100+	0.01	A	0	0.04	A	0
SBLR	50	0.02	A	1	0.01	A	1

Under future conditions during both peak hours, all movements are operating and will operate with excess capacity, a LOS A or better and all queues within their storage / link distances.

7.0 Draft Plan Review

The draft plan was reviewed and found to be in compliance with City standards, including the City's draft *Design and Development Manual,* dated January 2024 (City Design Manual).

All roads within the development will be classed as local streets based on function and required traffic capacity. All other roadways will be private laneways.

7.1 Pedestrian and Cyclist Accommodation

Sidewalks are proposed on one side of Laneway ‘A’, Laneway ’C’, Street ‘A’, Street ‘B’, Street ‘C’, and Street ‘D’ and on both sides of Street ‘E’. These sidewalks will connect to the future external sidewalk network on Barrick Road. Cyclists can utilize all proposed local roads and laneways. The proposed active transportation network is shown in Figure 13.

7.2 Traffic Control

It is recommended that all intersections within the development be under 2-way stop control, with recommended intersection traffic control shown in Figure 13.

7.3 Transit

An analysis was conducted for the typical walking distance of 400 m (a 5-6 minute walk) for transit coverage based on the existing transit stop at Barrick / West Side Road, which is illustrated in Figure 14**.** Transit coverage will be over 80%.

Figure 13: Active Transportation and Traffic Control

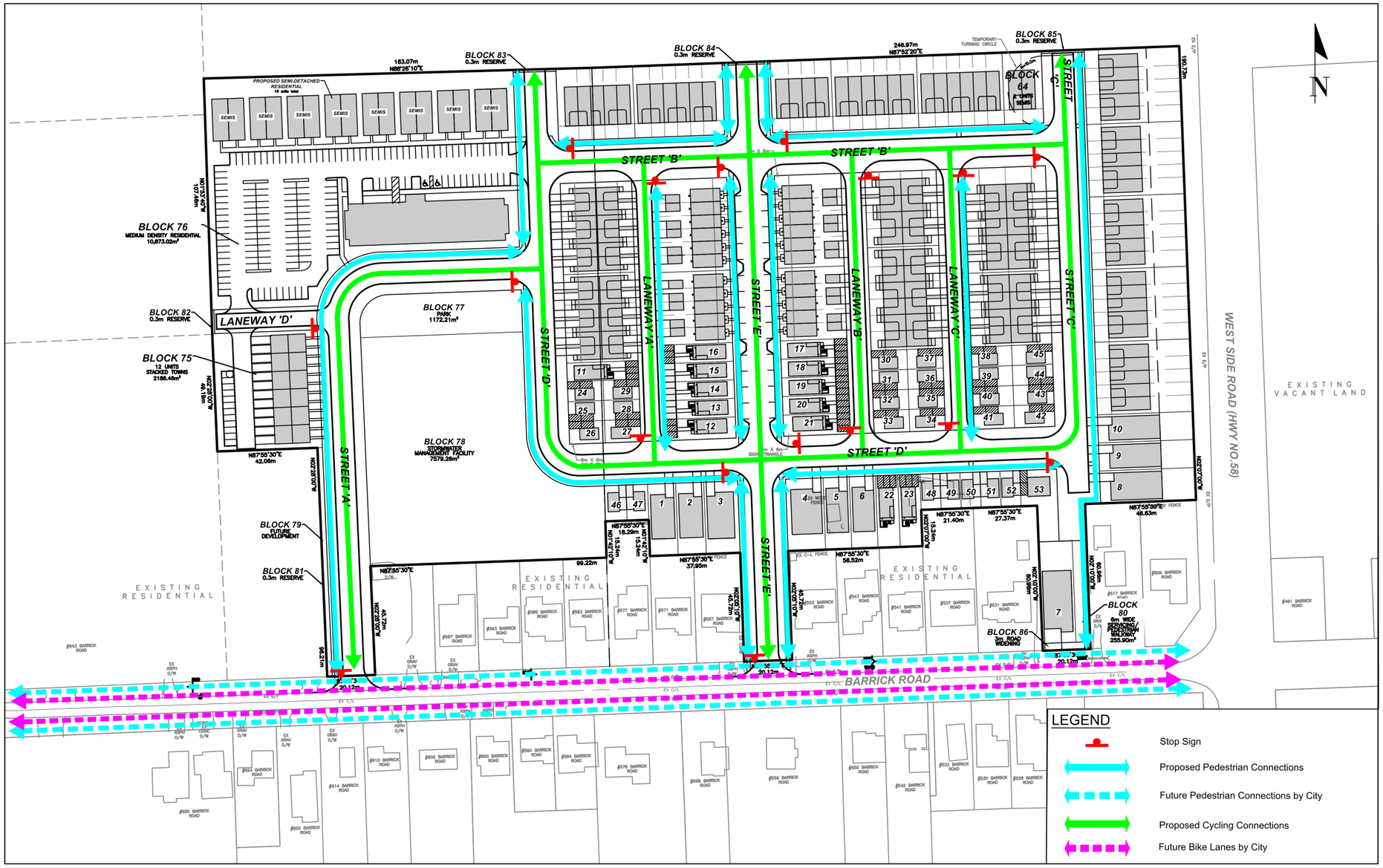
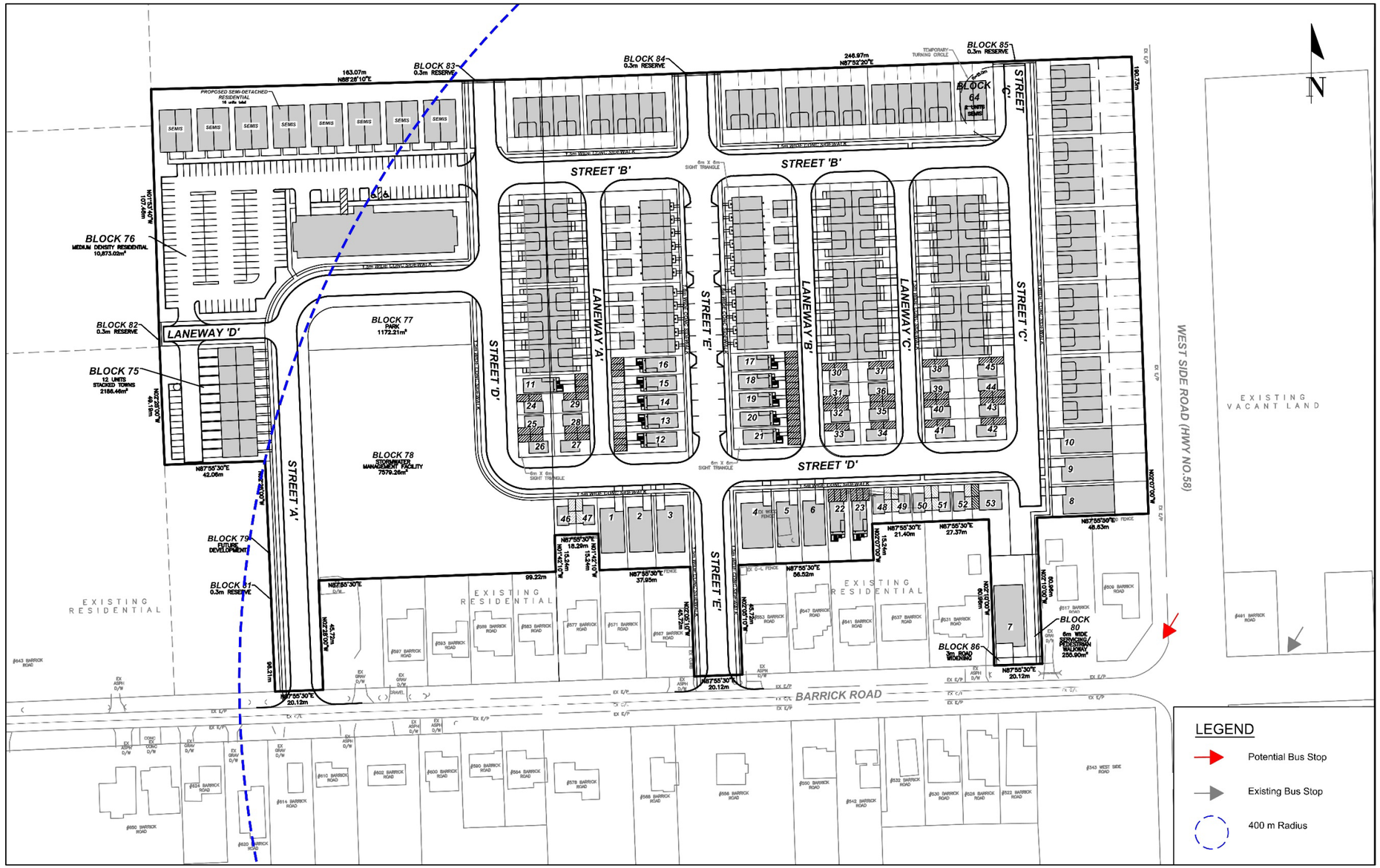


Figure 14: Future Transit Access



8.0 Parking Review

8.1 Vehicle Parking

The subject site is currently governed by Zoning By-Law 6575-30-18 (ZBL) with a summary of the parking requirements provided in Table 14 and the applicable excerpts from the ZBL provided in Appendix K.

Table 14: ZBL Parking Requirements

Use	ZBL Use	# of Units	Parking Rate (units)	Required Spaces	Provided Spaces	Deficit / Surplus
Single Detached Homes	Dwelling, Detached	10	1	10	20	+10
Cottage Singles		43	1	43	86	+43
Semi-Detached Homes (Block 64)	Dwelling Semi-Detached	2	1	2	4	+2
Street, Back-to-Back, and Live/Work Townhomes	Dwelling, Townhouse, Block & Street	136	1	136	272	+136
Stacked Townhomes	Dwelling, Duplex	12	1	12	24	+12
Mid Rise Apartment & Semi-Detached Homes (Block 76)	Apartment Building	166	1.25	208	182	-26
	Dwelling Semi-Detached	16	1	16	16	0
	Total	**385**	**Block 76 Total**	**224**	**198**	**-26**

The proposed parking supply for all uses will meet or exceed the ZBL requirements, with the exception of the apartment building in Block 76. The proposed parking supply rate for the apartment building is 1.09 spaces / unit which is less than the minimum required rate of 1.25 spaces / unit which results in an overall deficit of 26 spaces according to the ZBL.

8.2 Other Municipalities' Requirements

A review was conducted of ZBL apartment rates from other municipalities, which is summarized in Table 15.

Table 15: Other Municipalities' ZBL Rates

Municipality	ZBL Land Use	ZBL Rate
City of Welland	Apartment Dwelling	1 space / unit and 0.3 spaces / unit if the gross floor area of a dwelling unit is less than 50 m^2
City of Guelph	Apartment Building	1 space / unit

Other municipalities have adopted lower parking rates requiring a minimum of 1.0 space /unit.

8.3 Parking Variances

Two approved proxy sites in Welland were found that are similar to the proposed apartment building, which are summarized in Table 16.

Table 16: Proxy Site Parking Variances

Location	Land Use	Approved Parking Rate
695 Niagara Street	84-unit apartment building	0.42 spaces/unit
699 Niagara Street	129-unit apartment building	0.40 spaces/unit

The proxy sites have approved parking supply rates between 0.40 to 0.42 spaces / unit.

8.4 Vehicular Parking Conclusions

It is our opinion that the proposed parking supply will meet or exceed future parking demand based on a review of other municipalities' requirements, and variances for other similar projects in Welland.

9.0 Transportation Demand Management (TDM)

The proposed draft plan incorporates pedestrian and cyclist friendly design elements to discourage dependency on the single-occupant motor vehicle. This compliments the City's overall transportation vision to achieve a greater sustainable transportation system by promoting and encouraging alternative modes of travel including walking, cycling, and transit. To facilitate other modes of travel, the following TDM measures are proposed:

- Internal sidewalk connections to future sidewalks on Barrick Road.
- Internal sidewalks on both sides of Street 'E'.
- Internal sidewalks on one side of Laneway 'A' and 'C, and Street 'A', 'B', 'C', and 'D'.
- Internal secure bicycle storage is either provided in each resident's private garage within an accessory building, private yard, or dedicated storage facility in the case of apartment building.
- An information package on available transit/walking/cycling facilities will be provided to residents.

These measures are expected to reduce not only vehicular trips but also parking demand.

10.0 Conclusions

10.1 Traffic Operations

Under existing and future conditions during both peak hours, all movements are operating and will operate with excess capacity, a LOS E or better, and all queues will be contained within their respective storage lengths and link distances, except for the following intersections:

West Side Road / Barrick Road

The eastbound left / through / right turn (EBLTR) movement during the weekday PM peak hour is expected to experience a LOS F under 2030 and 2035 total conditions. This movement will operate well below capacity and it's future queue lengths will be contained within its link distance. The delay experienced for this movement under 2030 and 2035 conditions is expected to be 53 seconds and 81 seconds, respectively. A sensitivity analysis was conducted with a PHF of 0.92 instead of the existing 0.86, which reduced the delay to 51 seconds for 2035 total conditions (worst case scenario). It is recommended that MTO monitor this intersection for any future improvements.

West Side Road / Windsor Terrace

The westbound shared left / right turn (WBLR) movement where it is expected to experience a LOS F under all future conditions, including background conditions, and operate over capacity under 2035 total conditions. A sensitivity analysis was conducted with a PHF of 0.92 instead of the existing 0.83. As a result, the westbound shared left / right turn movement is projected to operate with excess capacity with LOS F (87 seconds delay). It is recommended that MTO monitor this intersection for any future improvements.

West Side Road / Stonebridge Drive

The westbound left / through / right turn movement during the PM peak hour is expected to experience a LOS F (67 seconds delay) under 2035 total conditions. It is noted that this movement is expected to operate well below capacity and with future queue lengths contained within its link distance. Similarly to the above a sensitivity analysis was conducted with a PHF of 0.92 instead of the existing 0.80, improving the delay to LOS D (33 seconds delay). It is recommended that MTO monitor this intersection for any future improvements.

10.2 Draft Plan Review

Road Classification and Geometrics

A review of the proposed Draft Plan was conducted based on the City's Draft Design and Development Manual (January 2024) and the Draft Plan was found to comply with the Town standard All roads within the subdivision will be classed as local roads based on function and required traffic capacity. All other roadways will be private laneways.

Pedestrian and Cyclist Accommodation

Pedestrians will be accommodated by proposed sidewalks on all local streets and laneway 'A' and 'C', which will be further addressed in the detail design stages. Sidewalks in the development will connect to the future external sidewalk network on Barrick Road. Cyclists can utilize all proposed local roads and laneways.

Traffic Control

It is recommended that all intersections within the development be under 2-way stop control.

Transit

An analysis was conducted for the typical walking distance of 400 m (a 5–6 minute walk) for transit coverage based on the existing transit stop at Barrick / West Side Road. Transit coverage for the development will be over 80%.

10.3 Transportation Demand Management

To further facilitate other modes of travel, several TDM measures are proposed by the development as follows:

- Internal sidewalk connections to future sidewalks on Barrick Road.
- Internal sidewalks on both sides of Street 'E'.
- Internal sidewalks on one side of Laneway 'A' and 'C, and Street 'A', 'B', 'C', and 'D'.
- Internal secure bicycle storage will be provided in each resident's private garage within an accessory building, private yard, or dedicated storage facility in the case of multi-unit apartments.
- An information package on available transit/walking/cycling facilities will be provided to residents.

The combination of these proposed TDM measures and the additional active transportation improvements in the area are expected to reduce vehicle trips and parking demand.

10.4 Parking Review

The proposed development will exceed the City's ZBL requirement except for the proposed apartment building, which will have a deficit of 26 spaces. However, it is our opinion that the proposed parking supply will meet or exceed future parking demand based on a review of other municipalities' requirements, variances for other similar projects in Welland and Guelph with much lower parking rates.

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Appendix A

Operations Analysis Methodology

Intersection Analysis Methodology for Motor Vehicles

Signalized intersection analysis considers two separate measures of performance:

- The capacity of all intersection movements, which is based on a volume to capacity ratio that is a measure of the degree of capacity utilized.
- The level of service (LOS) for all intersection movements, which is based on the average control delay per vehicle for the various movements through the intersection and overall. Delay is an indicator of how long a vehicle must wait to complete a movement and is represented by a letter between A and F, with F being the longest delay. The link between LOS and delay (in seconds) for signalized intersections is summarized below.

Level of Service	Control Delay per Vehicle(s)
A	≤10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

Unsignalized intersection analysis considers two separate measures of performance:

- The capacity of the intersection's critical movements, which is based on a volume to capacity ratio.
- The level of service for the critical movements, which is based on the average control delay per vehicle for the various critical movements within the intersection. The link between LOS and delay (in seconds) for unsignalized intersections is summarized below.

Level of Service	Control Delay per Vehicle(s)
A	0 – 10
B	> 10 – 15
C	> 15 – 25
D	> 25 – 35
E	> 35 – 50
F	> 50

The intersection analysis is also consistent with the City's *Guidelines Transportation Impact Studies* dated May 2012 and the Ministry of Transportation' s (MTO) *General Guidelines for the Preparation of Traffic Impact Studies*, dated March 2023.

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Appendix B

Traffic Data Counts & Signal Timing Plan

West Side Rd @ Barrick Rd

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

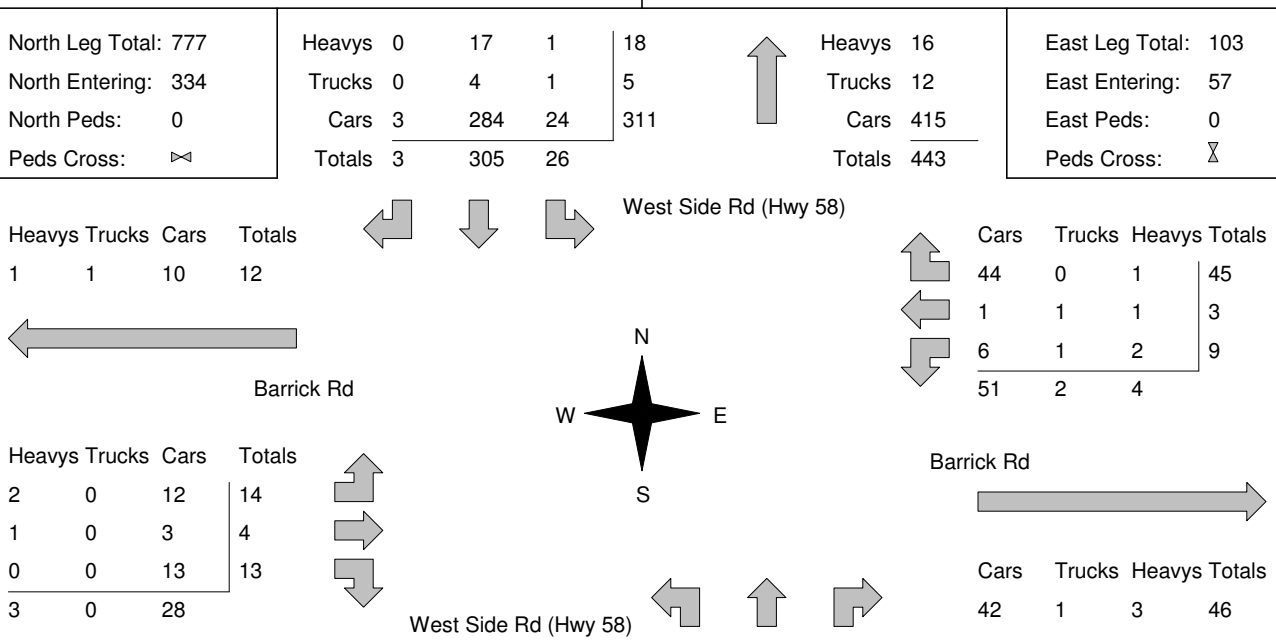
Municipality: Port Colborne
Site #: 0000000002
Intersection: West Side Rd (Hwy 58) & Barrick R(
TFR File #: 2
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S



Comments

West Side Rd @ Barrick Rd

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

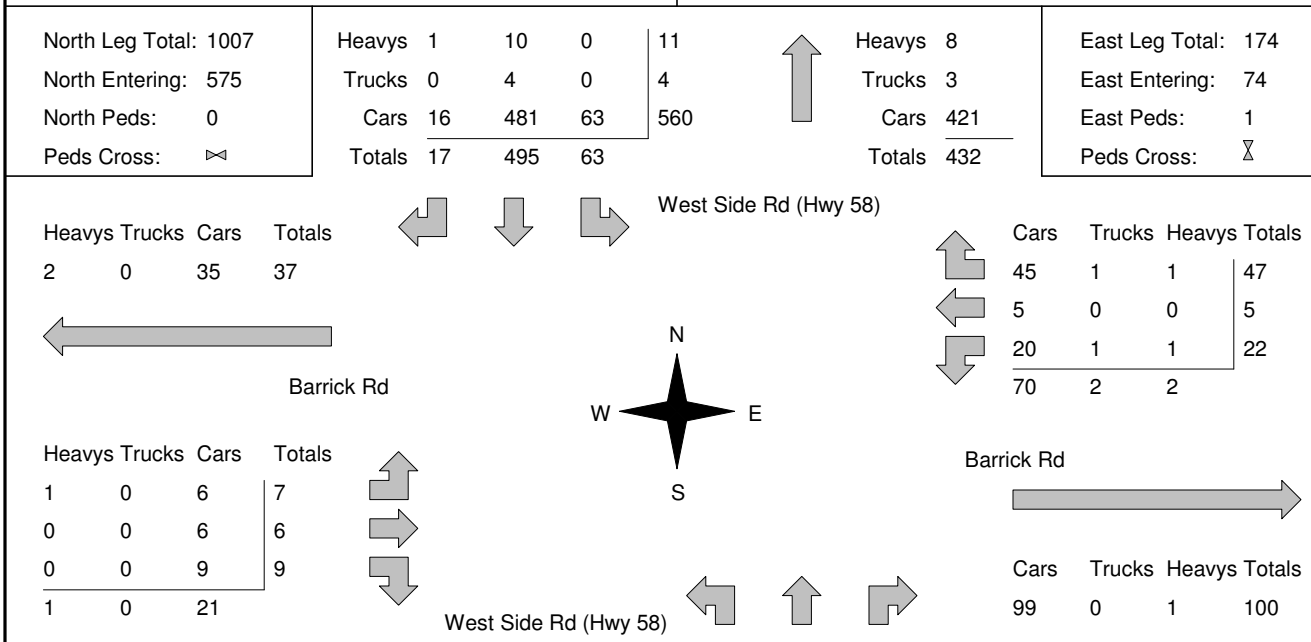
Municipality: Port Colborne
Site #: 0000000002
Intersection: West Side Rd (Hwy 58) & Barrick Rd
TFR File #: 2
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S



Comments

West Side Rd @ Barrick Rd

Total Count Diagram

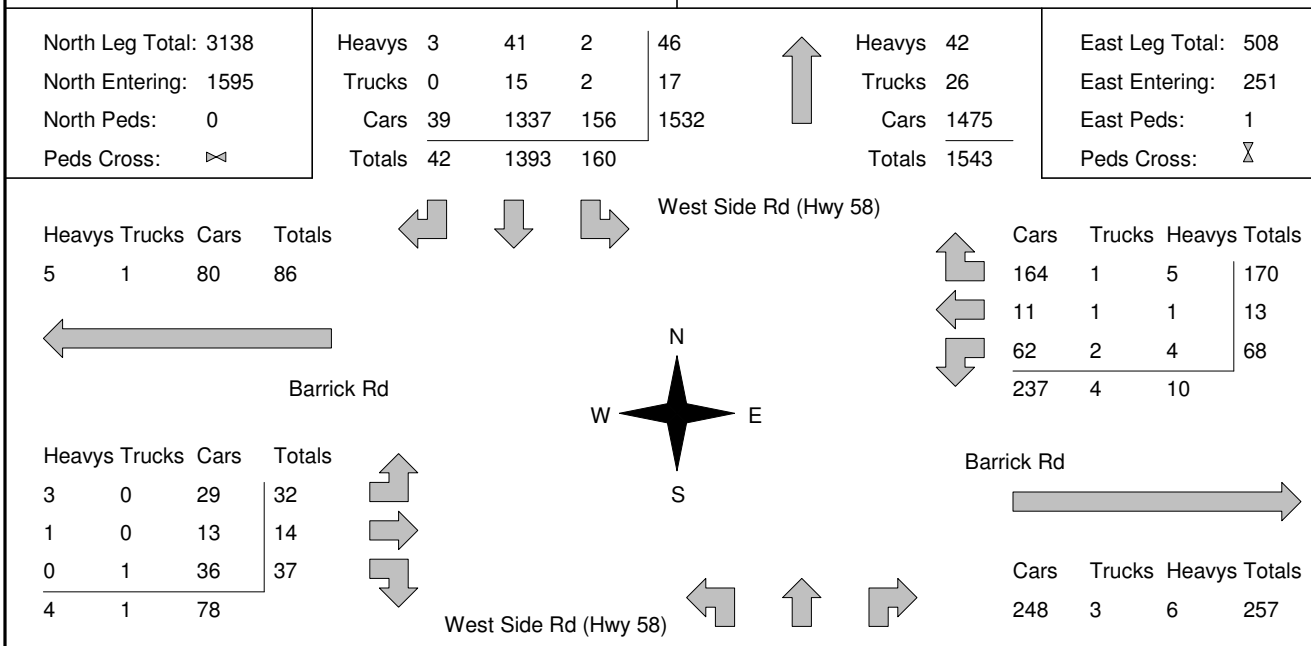
Municipality: Port Colborne
Site #: 0000000002
Intersection: West Side Rd (Hwy 58) & Barrick Rd
TFR File #: 2
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S



Comments

West Side Rd @ Northland Ave

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

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

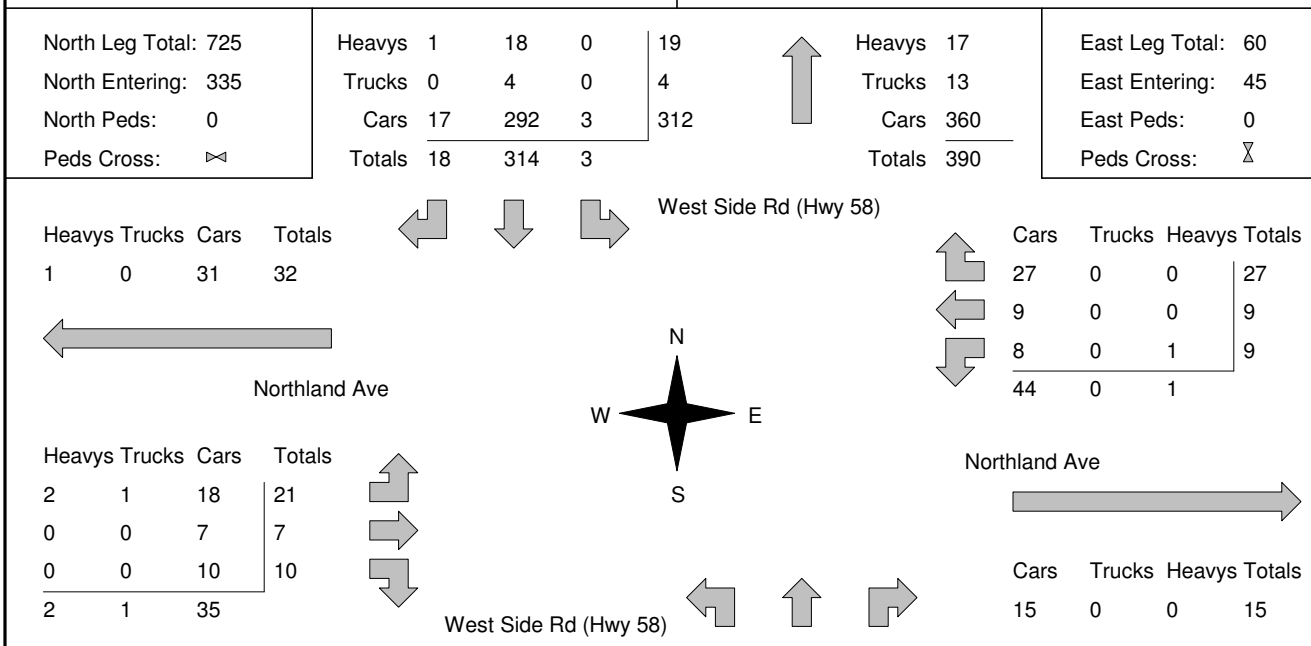
Municipality: Port Colborne
Site #: 0000000001
Intersection: West Side Rd (Hwy 58) & Northland
TFR File #: 1
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S



Comments

West Side Rd @ Northland Ave

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

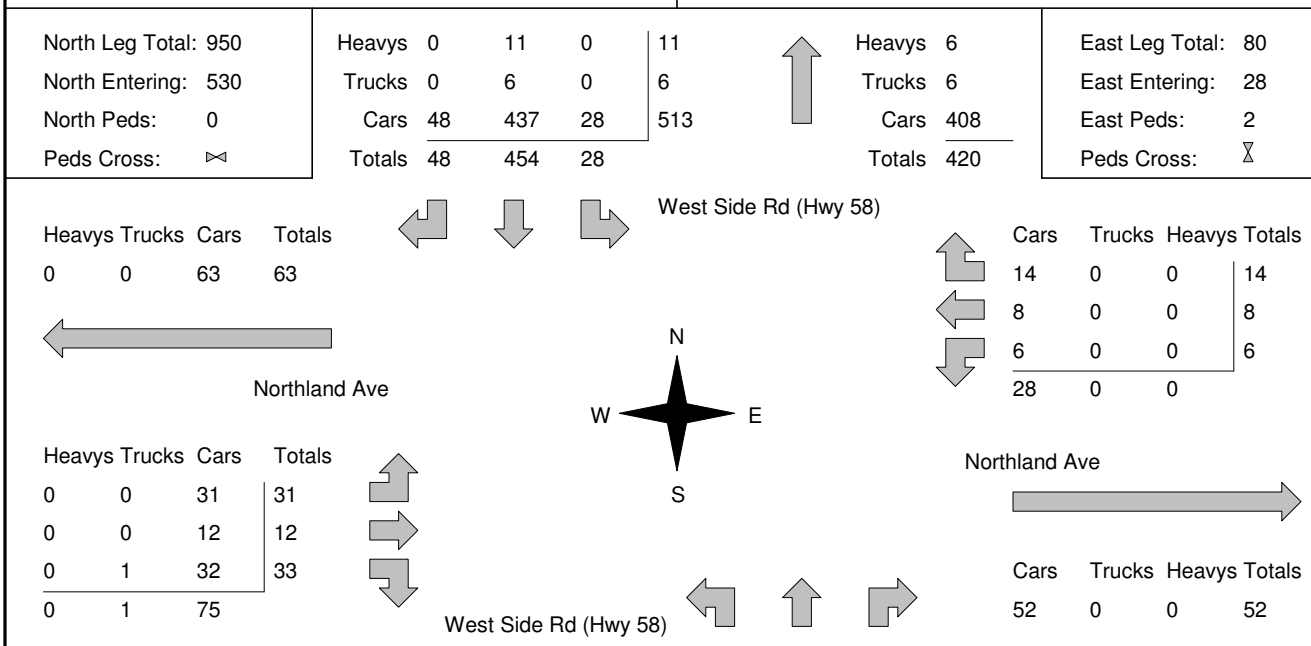
Municipality: Port Colborne
Site #: 0000000001
Intersection: West Side Rd (Hwy 58) & Northland
TFR File #: 1
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S



Comments

West Side Rd @ Northland Ave

Total Count Diagram

Municipality: Port Colborne
Site #: 0000000001
Intersection: West Side Rd (Hwy 58) & Northland
TFR File #: 1
Count date: 18-Jan-2023

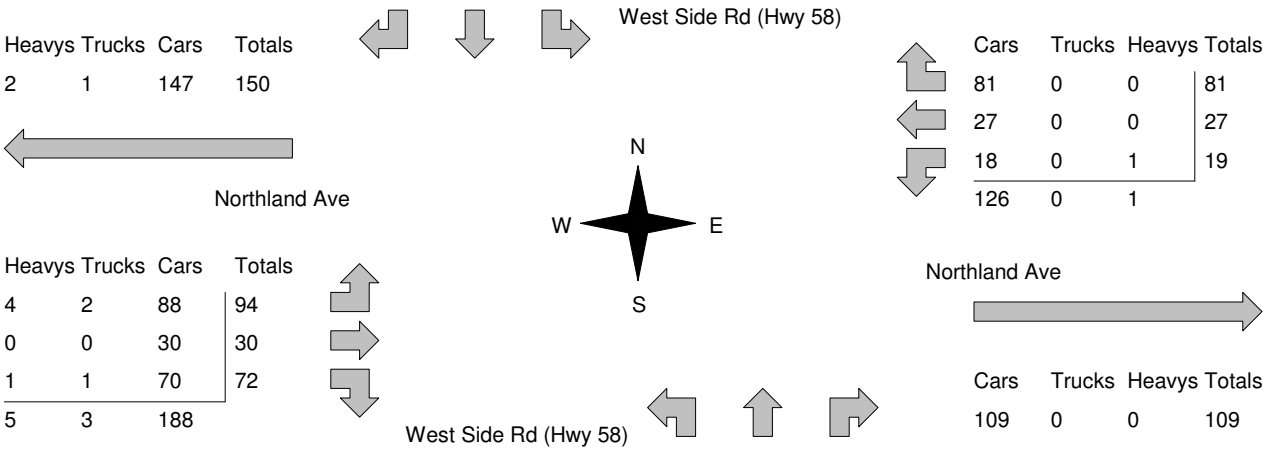
Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S

North Leg Total:	2968			
North Entering:	1508			
North Peds:	0			
Peds Cross:	⋈			
Heavys	2	46	0	48
Trucks	0	18	0	18
Cars	100	1292	50	1442
Totals	102	1356	50	
Heavys	38			
Trucks	24			
Cars	1398			
Totals	1460			
East Leg Total:	236			
East Entering:	127			
East Peds:	2			
Peds Cross:	⧖			



Peds Cross:	⧖			
West Peds:	2			
West Entering:	196			
West Leg Total:	346			
Cars	1380			
Trucks	19			
Heavys	48			
Totals	1447			
Cars	20	1229	29	1278
Trucks	1	22	0	23
Heavys	0	34	0	34
Totals	21	1285	29	
Peds Cross:	⋈			
South Peds:	6			
South Entering:	1335			
South Leg Total:	2782			

Comments

West Side Rd @ Stonebridge Dr

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

Municipality: Port Colborne
Site #: 0000000004
Intersection: West Side Rd (Hwy 58) & Stonebrid
TFR File #: 4
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S

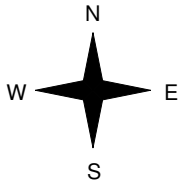
North Leg Total: 876
North Entering: 384
North Peds: 0
Peds Cross: ⋈

Heavys	16	11	27
Trucks	6	2	8
Cars	301	48	349
Totals	323	61	

Heavys	27
Trucks	15
Cars	450
Totals	492

East Leg Total: 120
East Entering: 50
East Peds: 0
Peds Cross: ⋈

	Cars	Trucks	Heavys	Totals
	23	7	11	41
	9	0	0	9
	32	7	11	



	Cars	Trucks	Heavys	Totals
	55	4	11	70

West Side Rd (Hwy 58)

Cars	310	Cars	427	7	434
Trucks	6	Trucks	8	2	10
Heavys	16	Heavys	16	0	16
Totals	332	Totals	451	9	

Peds Cross: ⋈
South Peds: 0
South Entering: 460
South Leg Total: 792

Comments

West Side Rd @ Stonebridge Dr

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

Municipality: Port Colborne
Site #: 0000000004
Intersection: West Side Rd (Hwy 58) & Stonebrid
TFR File #: 4
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

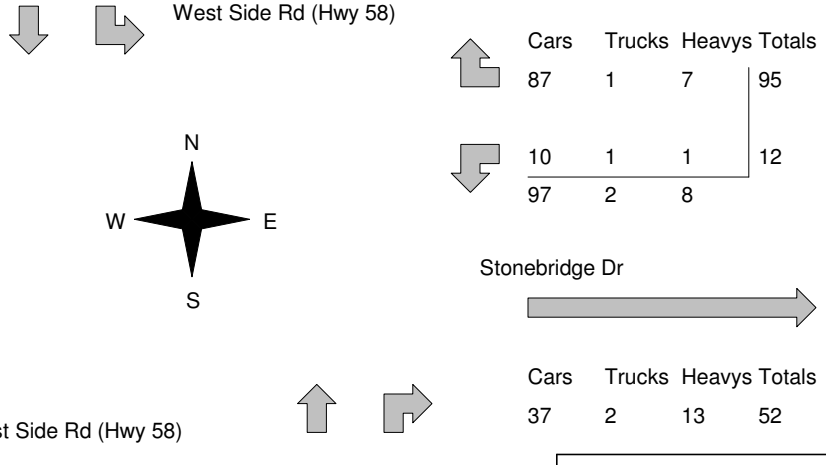
Major Road: West Side Rd (Hwy 58) runs N/S

North Leg Total: 1129
North Entering: 616
North Peds: 0
Peds Cross: ⋈

Heavys	10	13	23
Trucks	5	2	7
Cars	555	31	586
Totals	570	46	

Heavys	14
Trucks	3
Cars	496
Totals	513

East Leg Total: 159
East Entering: 107
East Peds: 0
Peds Cross: ⋈



Cars	565		
Trucks	6		
Heavys	11		
Totals	582		

Cars	409	6	415
Trucks	2	0	2
Heavys	7	0	7
Totals	418	6	

Peds Cross: ⋈
South Peds: 0
South Entering: 424
South Leg Total: 1006

Comments

West Side Rd @ Stonebridge Dr

Total Count Diagram

Municipality: Port Colborne
Site #: 0000000004
Intersection: West Side Rd (Hwy 58) & Stonebrid
TFR File #: 4
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

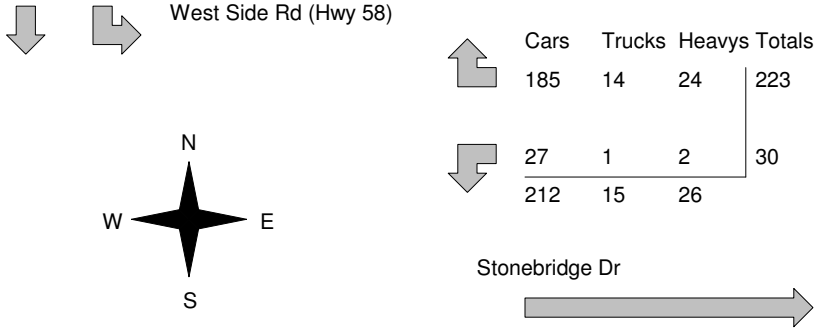
Major Road: West Side Rd (Hwy 58) runs N/S

North Leg Total: 3528
North Entering: 1772
North Peds: 0
Peds Cross: ⋈

Heavys	43	30	73
Trucks	22	9	31
Cars	1520	148	1668
Totals	1585	187	

Heavys	62
Trucks	34
Cars	1660
Totals	1756

East Leg Total: 464
East Entering: 253
East Peds: 0
Peds Cross: ⋈



	Cars	Trucks	Heavys	Totals
	185	14	24	223
	27	1	2	30
	212	15	26	

	Cars	Trucks	Heavys	Totals
	168	11	32	211

Cars	1547		
Trucks	23		
Heavys	45		
Totals	1615		

Cars	1475	20	1495
Trucks	20	2	22
Heavys	38	2	40
Totals	1533	24	

Peds Cross: ⋈
South Peds: 0
South Entering: 1557
South Leg Total: 3172

Comments

West Side Rd @ Windsor Terrace

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:30:00
To: 8:30:00

Municipality: Port Colborne
Site #: 0000000003
Intersection: West Side Rd (Hwy 58) & Windsor T
TFR File #: 3
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S

North Leg Total: 790
North Entering: 336
North Peds: 0
Peds Cross: ⋈

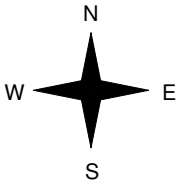
Heavys	16	0	16
Trucks	5	0	5
Cars	314	1	315
Totals	335	1	

Heavys	16
Trucks	11
Cars	427
Totals	454

East Leg Total: 21
East Entering: 19
East Peds: 0
Peds Cross: ⋈

West Side Rd (Hwy 58)

	Cars	Trucks	Heavys	Totals
	16	0	0	16
	2	0	1	3
	18	0	1	



Windsor Terrace

Cars	Trucks	Heavys	Totals
2	0	0	2

West Side Rd (Hwy 58)

Cars	316		
Trucks	5		
Heavys	17		
Totals	338		

Cars	411	1	412
Trucks	11	0	11
Heavys	16	0	16
Totals	438	1	

Peds Cross: ⋈
South Peds: 0
South Entering: 439
South Leg Total: 777

Comments

West Side Rd @ Windsor Terrace

Afternoon Peak Diagram

Specified Period
From: 16:00:00
To: 18:00:00

One Hour Peak
From: 16:00:00
To: 17:00:00

Municipality: Port Colborne
Site #: 0000000003
Intersection: West Side Rd (Hwy 58) & Windsor T
TFR File #: 3
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

Major Road: West Side Rd (Hwy 58) runs N/S

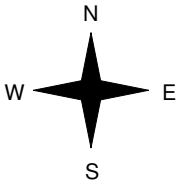
North Leg Total: 1004
North Entering: 576
North Peds: 0
Peds Cross: ⋈

Heavys	11	1	12
Trucks	5	0	5
Cars	548	11	559
Totals	564	12	

Heavys	7
Trucks	2
Cars	419
Totals	428

East Leg Total: 27
East Entering: 8
East Peds: 0
Peds Cross: ⋈

	Cars	Trucks	Heavys	Totals
	3	0	1	4
	4	0	0	4
	7	0	1	



	Cars	Trucks	Heavys	Totals
	17	0	2	19

Cars	552		
Trucks	5		
Heavys	11		
Totals	568		

Cars	416	6	422
Trucks	2	0	2
Heavys	6	1	7
Totals	424	7	

Peds Cross: ⋈
South Peds: 0
South Entering: 431
South Leg Total: 999

Comments

West Side Rd @ Windsor Terrace

Total Count Diagram

Municipality: Port Colborne
Site #: 0000000003
Intersection: West Side Rd (Hwy 58) & Windsor T
TFR File #: 3
Count date: 18-Jan-2023

Weather conditions:
Overcast/Wet

Person(s) who counted:
Cam

**** Non-Signalized Intersection ****

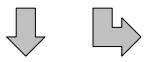
Major Road: West Side Rd (Hwy 58) runs N/S

North Leg Total: 3166
North Entering: 1590
North Peds: 0
Peds Cross: ⋈

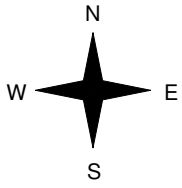
Heavys	41	2	43
Trucks	16	0	16
Cars	1513	18	1531
Totals	1570	20	

Heavys	42
Trucks	16
Cars	1518
Totals	1576

East Leg Total: 77
East Entering: 46
East Peds: 0
Peds Cross: ⧖



	Cars	Trucks	Heavys	Totals
	32	0	1	33
	11	0	2	13
	43	0	3	



Windsor Terrace

	Cars	Trucks	Heavys	Totals
	28	0	3	31

West Side Rd (Hwy 58)

Cars	1524		
Trucks	16		
Heavys	43		
Totals	1583		

Cars	1486	10	1496
Trucks	16	0	16
Heavys	41	1	42
Totals	1543	11	

Peds Cross: ⋈
South Peds: 0
South Entering: 1554
South Leg Total: 3137

Comments

Signal Code: H58NRT

Intersection: HIGHWAY #58 & NORTHLAND DR./CANADIAN TIRE

Municipality: ptcolborne

Owner: MTO

Last Modified: 2011-10-20 2:08:18 PM

Timing Parameters	NBD & SBD HWY 58	EBD & WBD NORTHLAND	n/a	n/a	n/a	n/a
Min Green	20	10	0	0	0	0
Walk	26	17	0	0	0	0
Ped Clearance	15	31	0	0	0	0
Vehicle Ext.	4.5	3	0	0	0	0
Max Green	41	30	0	0	0	0
Yellow	5	4	0	0	0	0
All Red	2	2.2	0	0	0	0

		Offset
Minimum Cycle	43.2	0
Pedestrian Cycle	102.2	
Maximum Cycle	84.2	0
Operation	SA	

Installed On:	2000-06-27
Count Date:	--/--/----

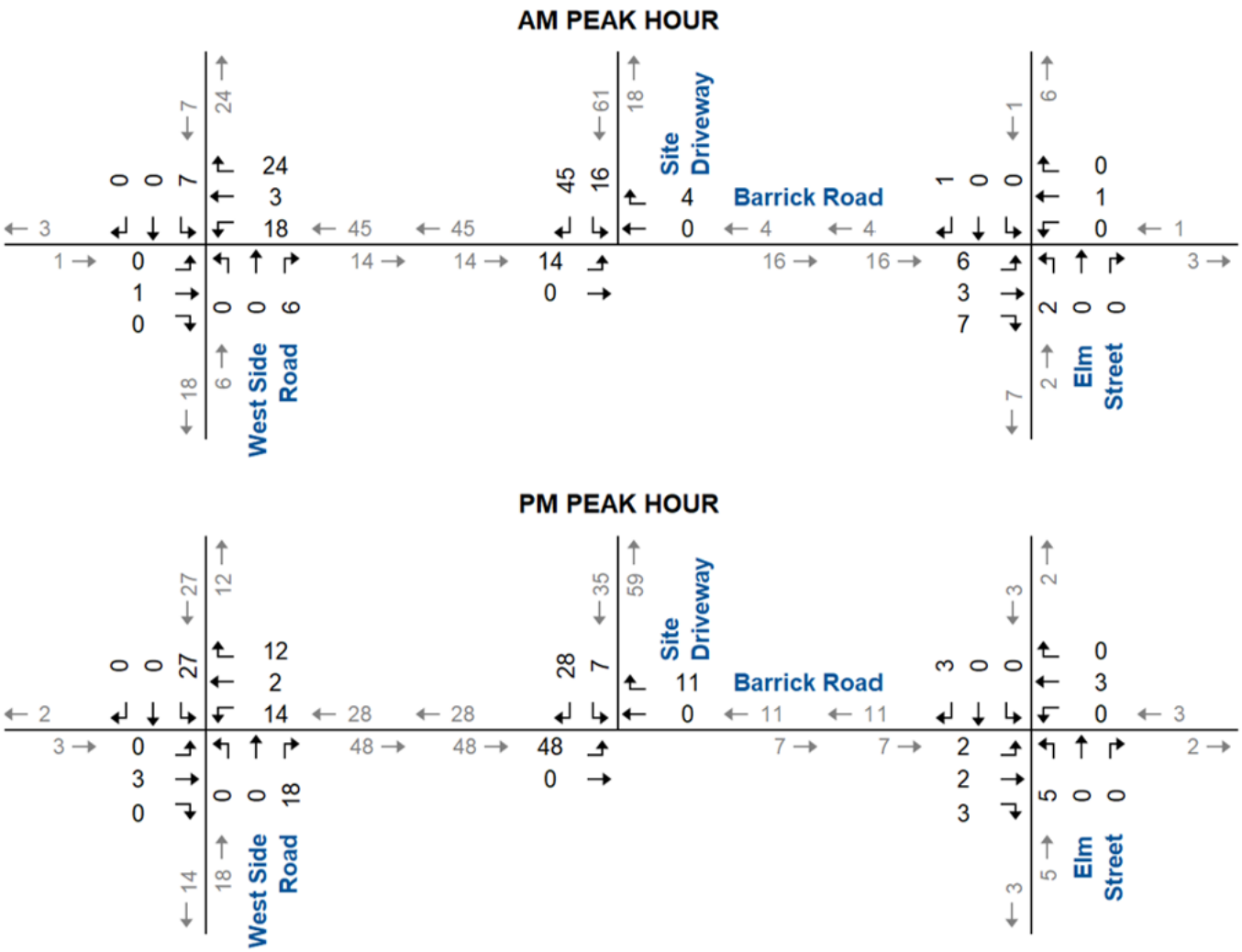
FA = Fully Actuated SA = Semi Actuated FT = Fixed Time

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Background Development Site Traffic



NTS

Forecast Site Generated Traffic

Barrick Road & Highway 58
230423

Figure 3.2

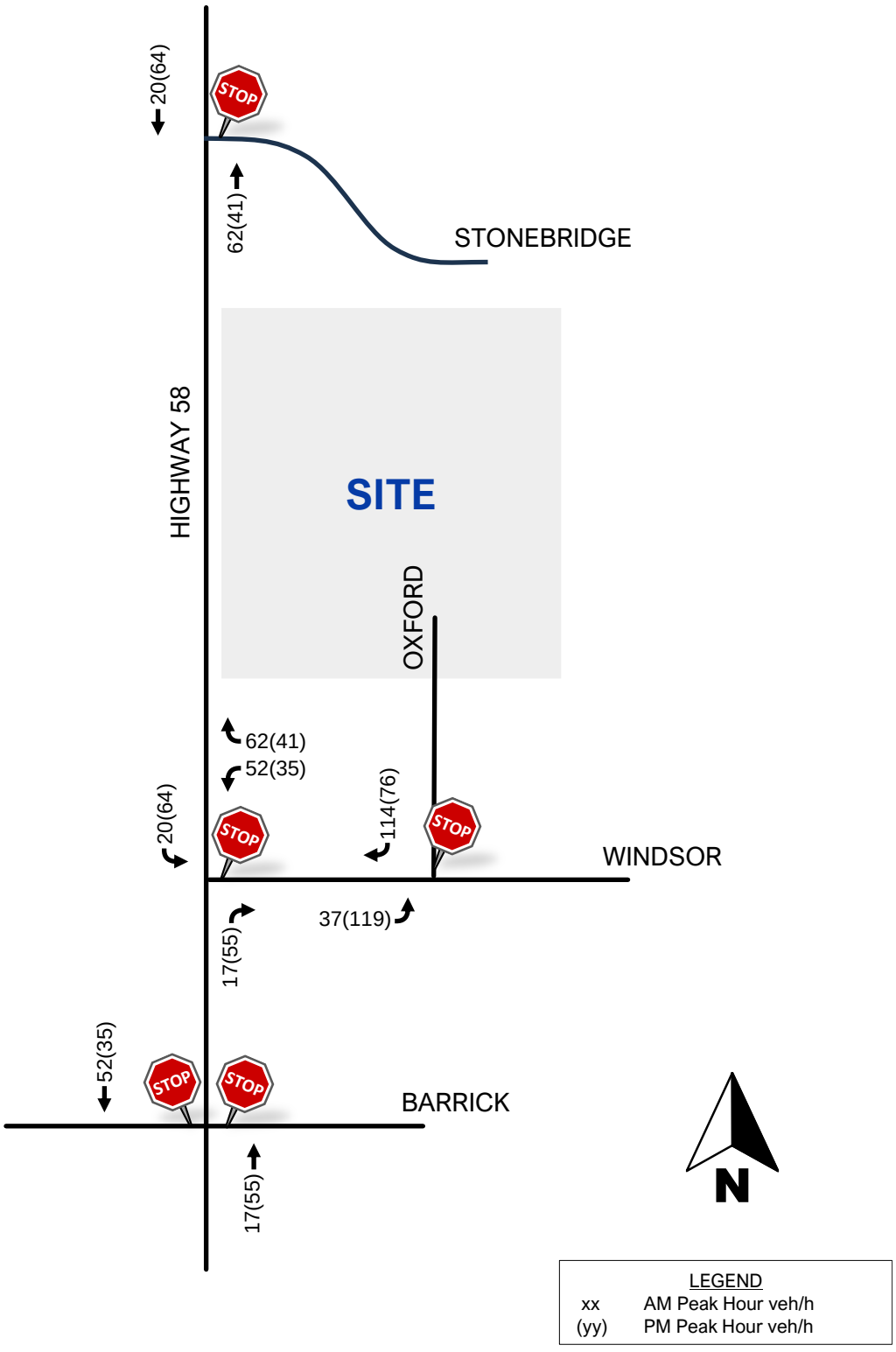


Figure 6-1 – Projected Site-Generated Trips

4.3 Trip Distribution

Given the majority of trips generated by the site during the weekday a.m. and p.m. peak hours will be commuter trips, and given the predominantly residential nature of the development, 2016 Transportation Tomorrow Survey (TTS) commuter data was reviewed to estimate the distribution of the site generated traffic to the surrounding road network. **Table 4-2** outlines the estimated trip distribution assumptions for the site generated trips, which is based on the analyzed TTS data provided in **Appendix B**.

Table 4-2: Trip Distribution

Direction	Distribution Percentages
North on West Side Road	56%
South on West Side Road	44%
Total	**100%**

4.4 Trip Assignment

The site generated traffic has been assigned to individual turning movements at the study area intersections based on the trip generation estimates and the trip distribution assumptions. The estimated peak hour site generated traffic for the proposed residential development is shown in **Figure 4-1**.

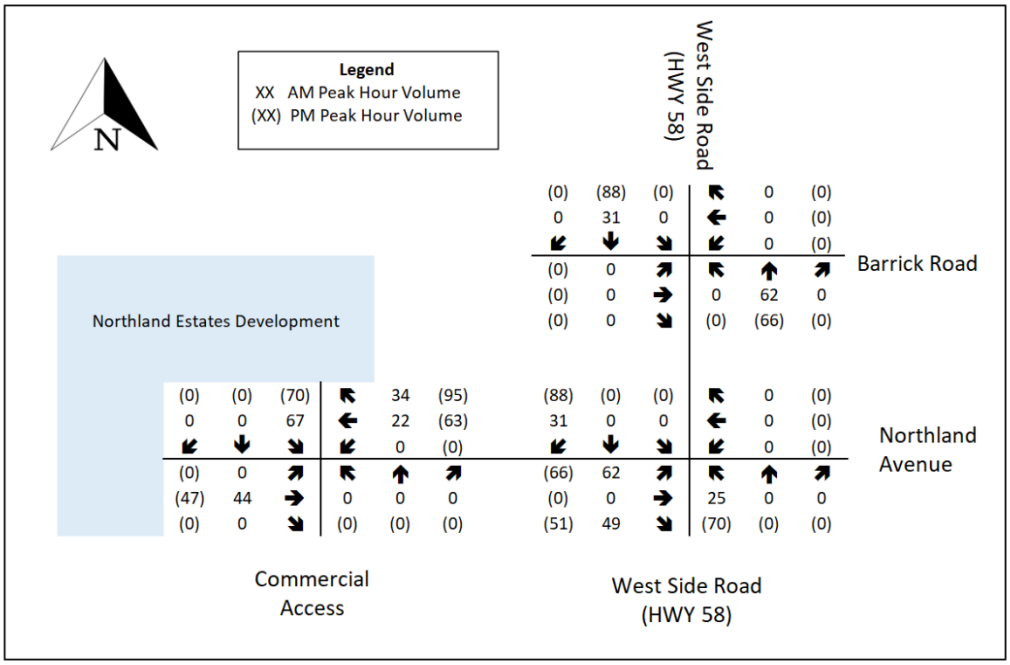
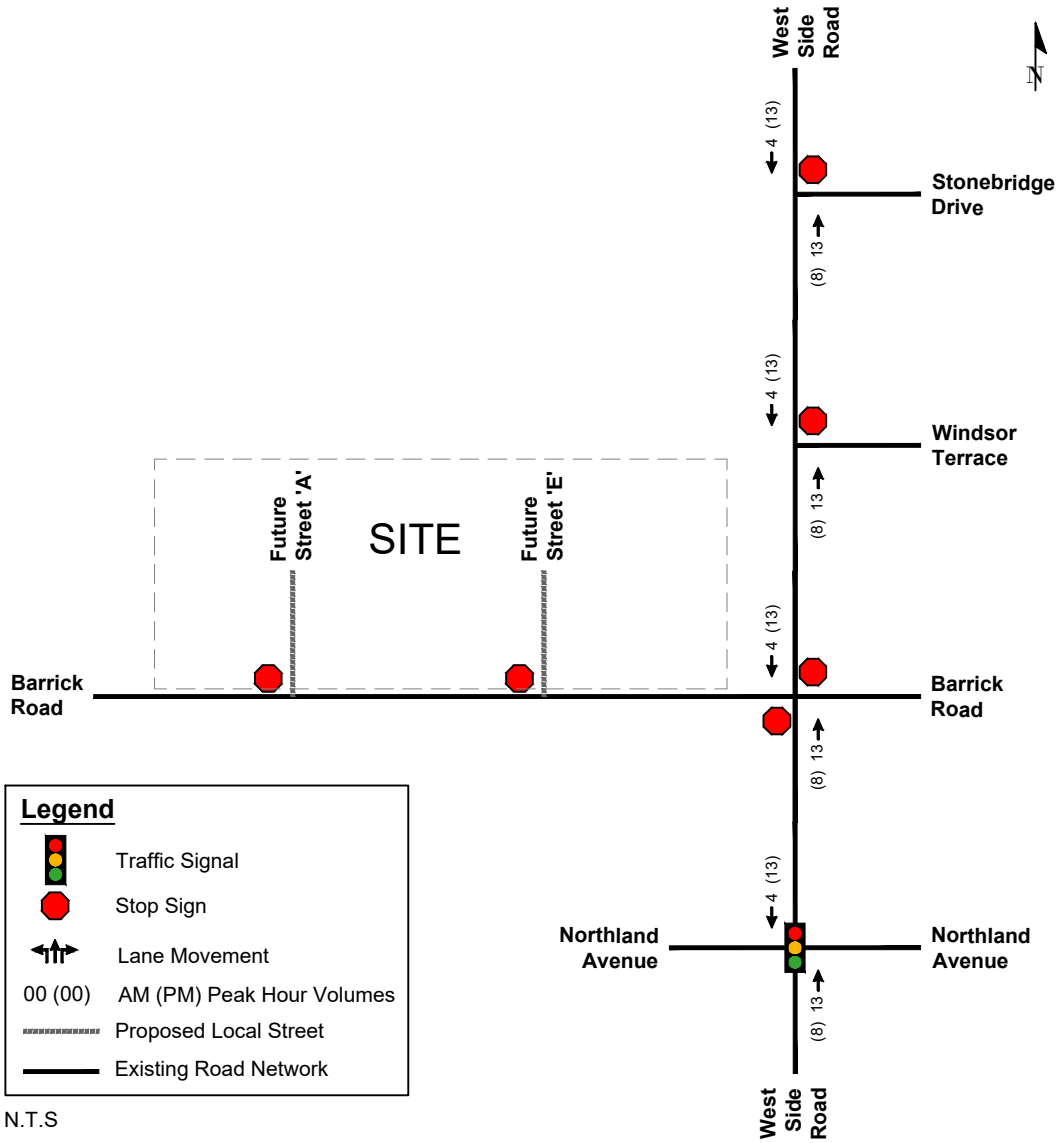


Figure 4-1 – Trip Assignment Traffic Volumes

BG DEV: 135 Coronation Drive Site Traffic



N.T.S

BURNSIDE

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Appendix D

Existing 2024 Traffic Operations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	41	460	9	61	329
Future Volume (Veh/h)	9	41	460	9	61	329
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)	10	45	500	10	66	358
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	990	500			510	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	990	500			510	
tC, single (s)	6.4	6.6			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.4	
p0 queue free %	96	91			93	
cM capacity (veh/h)	257	495			965	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	55	500	10	66	358
Volume Left	10	0	0	66	0
Volume Right	45	0	10	0	0
cSH	424	1700	1700	965	1700
Volume to Capacity	0.13	0.29	0.01	0.07	0.21
Queue Length 95th (m)	3.4	0.0	0.0	1.7	0.0
Control Delay (s)	14.8	0.0	0.0	9.0	0.0
Lane LOS	B			A	
Approach Delay (s)	14.8	0.0		1.4	
Approach LOS	B				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	40.9%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	3	16	447	1	1	342
Future Volume (Veh/h)	3	16	447	1	1	342
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	3	17	476	1	1	364
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	842	476			477	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	842	476			477	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	99	97			100	
cM capacity (veh/h)	296	593			1096	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	20	476	1	1	364
Volume Left	3	0	0	1	0
Volume Right	17	0	1	0	0
cSH	516	1700	1700	1096	1700
Volume to Capacity	0.04	0.28	0.00	0.00	0.21
Queue Length 95th (m)	0.9	0.0	0.0	0.0	0.0
Control Delay (s)	12.3	0.0	0.0	8.3	0.0
Lane LOS	B			A	
Approach Delay (s)	12.3	0.0		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	33.5%	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)	14	4	13	9	3	46	6	392	16	27	311	3
Future Volume (Veh/h)	14	4	13	9	3	46	6	392	16	27	311	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	15	4	14	10	3	49	6	422	17	29	334	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	667	844	168	684	838	220	337			439		
vC1, stage 1 conf vol	394	394		442	442							
vC2, stage 2 conf vol	274	451		241	395							
vCu, unblocked vol	667	844	168	684	838	220	337			439		
tC, single (s)	7.8	7.0	6.9	8.2	7.8	6.9	4.1			4.3		
tC, 2 stage (s)	6.8	6.0		7.2	6.8							
tF (s)	3.6	4.2	3.3	3.8	4.7	3.3	2.2			2.3		
p0 queue free %	97	99	98	98	99	94	100			97		
cM capacity (veh/h)	469	411	852	434	351	785	1234			1076		

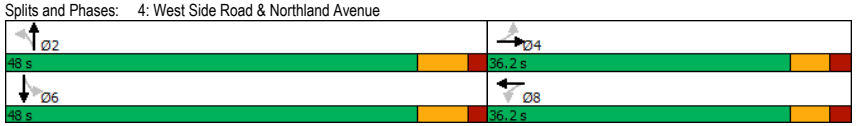
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	33	62	6	281	158	29	223	114
Volume Left	15	10	6	0	0	29	0	0
Volume Right	14	49	0	0	17	0	0	3
cSH	568	659	1234	1700	1700	1076	1700	1700
Volume to Capacity	0.06	0.09	0.00	0.17	0.09	0.03	0.13	0.07
Queue Length 95th (m)	1.4	2.4	0.1	0.0	0.0	0.6	0.0	0.0
Control Delay (s)	11.7	11.0	7.9	0.0	0.0	8.4	0.0	0.0
Lane LOS	B	B	A			A		
Approach Delay (s)	11.7	11.0	0.1			0.7		
Approach LOS	B	B						

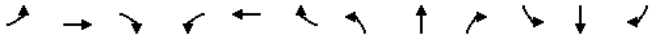
Intersection Summary					
Average Delay			1.5		
Intersection Capacity Utilization			28.8%	ICU Level of Service	A
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	21	7	9	9	5	349	3	320
Future Volume (vph)	21	7	9	9	5	349	3	320
Lane Group Flow (vph)	23	19	10	40	5	389	3	372
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.12	0.07	0.05	0.14	0.01	0.15	0.00	0.14
Control Delay	25.1	16.9	23.9	13.4	4.2	3.7	4.3	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.1	16.9	23.9	13.4	4.2	3.7	4.3	3.6
Queue Length 50th (m)	2.4	0.8	1.0	1.0	0.2	8.3	0.1	7.7
Queue Length 95th (m)	8.0	5.8	4.6	8.1	1.1	13.0	0.8	12.3
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	579	831	606	818	799	2644	784	2653
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.02	0.02	0.05	0.01	0.15	0.00	0.14

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 63.7
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	21	7	10	9	9	27	5	349	5	3	320	18
Future Volume (vph)	21	7	10	9	9	27	5	349	5	3	320	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.91		1.00	0.89		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	1754		1644	1705		1825	3376		1824	3386	
Flt Permitted	0.73	1.00		0.75	1.00		0.53	1.00		0.52	1.00	
Satd. Flow (perm)	1232	1754		1289	1705		1019	3376		1002	3386	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	23	8	11	10	10	30	5	384	5	3	352	20
RTOR Reduction (vph)	0	10	0	0	27	0	0	1	0	0	3	0
Lane Group Flow (vph)	23	9	0	10	13	0	5	388	0	3	369	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	14%	0%	0%	11%	0%	0%	0%	8%	0%	0%	7%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	6.0	6.0		6.0	6.0		47.1	47.1		47.1	47.1	
Effective Green, g (s)	6.0	6.0		6.0	6.0		47.1	47.1		47.1	47.1	
Actuated g/C Ratio	0.09	0.09		0.09	0.09		0.71	0.71		0.71	0.71	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	111	158		116	154		723	2398		711	2405	
v/s Ratio Prot		0.01			0.01			c0.12			0.11	
v/s Ratio Perm	c0.02			0.01			0.00			0.00		
v/c Ratio	0.21	0.06		0.09	0.08		0.01	0.16		0.00	0.15	
Uniform Delay, d1	27.9	27.6		27.6	27.6		2.8	3.1		2.8	3.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.9	0.2		0.3	0.2		0.0	0.1		0.0	0.1	
Delay (s)	28.9	27.7		28.0	27.9		2.8	3.3		2.8	3.3	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		28.4			27.9			3.3			3.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	5.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.17		
Actuated Cycle Length (s)	66.3	Sum of lost time (s)	13.2
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	426	6	46	581
Future Volume (Veh/h)	12	95	426	6	46	581
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	15	119	532	8	58	726
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1374	532			540	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1374	532			540	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	89	78			93	
cM capacity (veh/h)	139	536			889	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	134	532	8	58	726
Volume Left	15	0	0	58	0
Volume Right	119	0	8	0	0
cSH	406	1700	1700	889	1700
Volume to Capacity	0.33	0.31	0.00	0.07	0.43
Queue Length 95th (m)	10.8	0.0	0.0	1.6	0.0
Control Delay (s)	18.2	0.0	0.0	9.3	0.0
Lane LOS	C			A	
Approach Delay (s)	18.2	0.0		0.7	
Approach LOS	C				

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	43.8%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	4	432	7	12	575
Future Volume (Veh/h)	4	4	432	7	12	575
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	5	5	520	8	14	693
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1241	520			528	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1241	520			528	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	97	99			99	
cM capacity (veh/h)	192	513			1009	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	10	520	8	14	693
Volume Left	5	0	0	14	0
Volume Right	5	0	8	0	0
cSH	280	1700	1700	1009	1700
Volume to Capacity	0.04	0.31	0.00	0.01	0.41
Queue Length 95th (m)	0.8	0.0	0.0	0.3	0.0
Control Delay (s)	18.3	0.0	0.0	8.6	0.0
Lane LOS	C			A	
Approach Delay (s)	18.3	0.0		0.2	
Approach LOS	C				

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	40.3%	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)	7	6	9	22	5	48	15	386	32	64	505	17
Future Volume (Veh/h)	7	6	9	22	5	48	15	386	32	64	505	17
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	8	7	10	26	6	56	17	449	37	74	587	20
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1064	1266	304	958	1258	245	607			487		
vC1, stage 1 conf vol	745	745		502	502							
vC2, stage 2 conf vol	318	521		455	755							
vCu, unblocked vol	1064	1266	304	958	1258	245	607			487		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	97	98	99	93	98	93	98			93		
cM capacity (veh/h)	288	323	699	371	329	748	934			1085		

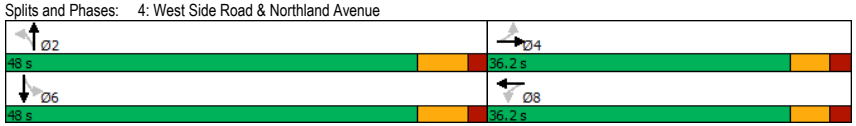
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	25	88	17	299	187	74	391	216
Volume Left	8	26	17	0	0	74	0	0
Volume Right	10	56	0	0	37	0	0	20
cSH	392	539	934	1700	1700	1085	1700	1700
Volume to Capacity	0.06	0.16	0.02	0.18	0.11	0.07	0.23	0.13
Queue Length 95th (m)	1.5	4.4	0.4	0.0	0.0	1.7	0.0	0.0
Control Delay (s)	14.8	13.0	8.9	0.0	0.0	8.6	0.0	0.0
Lane LOS	B	B	A			A		
Approach Delay (s)	14.8	13.0	0.3			0.9		
Approach LOS	B	B						

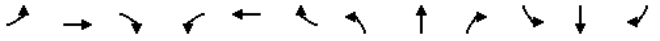
Intersection Summary					
Average Delay			1.8		
Intersection Capacity Utilization			33.8%	ICU Level of Service	A
Analysis Period (min)			15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	31	12	6	8	7	383	28	463
Future Volume (vph)	31	12	6	8	7	383	28	463
Lane Group Flow (vph)	38	56	7	27	9	488	35	631
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.18	0.20	0.03	0.10	0.02	0.19	0.05	0.25
Control Delay	26.2	13.2	23.5	15.5	4.4	4.4	4.6	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	13.2	23.5	15.5	4.4	4.4	4.6	4.6
Queue Length 50th (m)	4.0	1.5	0.7	1.0	0.3	10.7	1.3	14.2
Queue Length 95th (m)	10.0	8.4	3.3	6.0	1.4	14.1	3.5	18.1
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	647	777	630	796	570	2544	656	2509
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.07	0.01	0.03	0.02	0.19	0.05	0.25

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 66.1
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	12	33	6	8	14	7	383	12	28	463	48
Future Volume (vph)	31	12	33	6	8	14	7	383	12	28	463	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.89		1.00	0.91		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	1658		1824	1726		1825	3528		1824	3473	
Flt Permitted	0.74	1.00		0.72	1.00		0.41	1.00		0.47	1.00	
Satd. Flow (perm)	1420	1658		1383	1726		792	3528		910	3473	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	38	15	41	7	10	17	9	473	15	35	572	59
RTOR Reduction (vph)	0	36	0	0	15	0	0	2	0	0	6	0
Lane Group Flow (vph)	38	20	0	7	12	0	9	486	0	35	625	0
Confl. Peds. (#/hr)	2		2	2		2			2	2		
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	7.9	7.9		7.9	7.9		46.2	46.2		46.2	46.2	
Effective Green, g (s)	7.9	7.9		7.9	7.9		46.2	46.2		46.2	46.2	
Actuated g/C Ratio	0.12	0.12		0.12	0.12		0.69	0.69		0.69	0.69	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	166	194		162	202		543	2421		624	2384	
v/s Ratio Prot		0.01			0.01			0.14			c0.18	
v/s Ratio Perm	c0.03			0.01			0.01			0.04		
v/c Ratio	0.23	0.10		0.04	0.06		0.02	0.20		0.06	0.26	
Uniform Delay, d1	26.9	26.5		26.3	26.4		3.3	3.8		3.4	4.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.2		0.1	0.1		0.1	0.2		0.2	0.3	
Delay (s)	27.6	26.8		26.5	26.5		3.4	4.0		3.6	4.3	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		27.1			26.5			4.0			4.3	
Approach LOS		C			C			A			A	

Intersection Summary					
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service		A	
HCM 2000 Volume to Capacity ratio	0.26				
Actuated Cycle Length (s)	67.3	Sum of lost time (s)		13.2	
Intersection Capacity Utilization	55.6%	ICU Level of Service		B	
Analysis Period (min)	15				

c Critical Lane Group

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

Background 2030 Traffic Operations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	41	679	9	61	433
Future Volume (Veh/h)	9	41	679	9	61	433
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)	10	45	738	10	66	471
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1341	738			748	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1341	738			748	
tC, single (s)	6.4	6.6			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.4	
p0 queue free %	94	87			92	
cM capacity (veh/h)	155	356			781	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	55	738	10	66	471
Volume Left	10	0	0	66	0
Volume Right	45	0	10	0	0
cSH	288	1700	1700	781	1700
Volume to Capacity	0.19	0.43	0.01	0.08	0.28
Queue Length 95th (m)	5.2	0.0	0.0	2.1	0.0
Control Delay (s)	20.4	0.0	0.0	10.0	0.0
Lane LOS	C			B	
Approach Delay (s)	20.4	0.0		1.2	
Approach LOS	C				

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	52.4%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	55	78	602	18	21	427
Future Volume (Veh/h)	55	78	602	18	21	427
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	59	83	640	19	22	454
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1138	640			659	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1138	640			659	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	69	83			98	
cM capacity (veh/h)	189	479			939	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	142	640	19	22	454
Volume Left	59	0	0	22	0
Volume Right	83	0	19	0	0
cSH	293	1700	1700	939	1700
Volume to Capacity	0.48	0.38	0.01	0.02	0.27
Queue Length 95th (m)	18.9	0.0	0.0	0.5	0.0
Control Delay (s)	28.3	0.0	0.0	8.9	0.0
Lane LOS	D			A	
Approach Delay (s)	28.3	0.0		0.4	
Approach LOS	D				

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	46.2%	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)	16	6	15	28	6	76	7	533	24	37	437	3
Future Volume (Veh/h)	16	6	15	28	6	76	7	533	24	37	437	3
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	17	6	16	30	6	82	8	573	26	40	470	3
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	939	1166	236	936	1155	300	473			599		
vC1, stage 1 conf vol	552	552		602	602							
vC2, stage 2 conf vol	388	615		334	553							
vCu, unblocked vol	939	1166	236	936	1155	300	473			599		
tC, single (s)	7.8	7.0	6.9	8.2	7.8	6.9	4.1			4.3		
tC, 2 stage (s)	6.8	6.0		7.2	6.8							
tF (s)	3.6	4.2	3.3	3.8	4.7	3.3	2.2			2.3		
p0 queue free %	95	98	98	91	98	88	99			96		
cM capacity (veh/h)	345	316	771	333	267	697	1099			934		

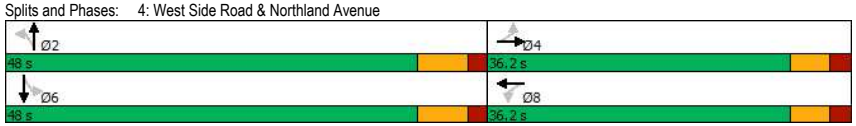
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	39	118	8	382	217	40	313	160
Volume Left	17	30	8	0	0	40	0	0
Volume Right	16	82	0	0	26	0	0	3
cSH	438	513	1099	1700	1700	934	1700	1700
Volume to Capacity	0.09	0.23	0.01	0.22	0.13	0.04	0.18	0.09
Queue Length 95th (m)	2.2	6.7	0.2	0.0	0.0	1.0	0.0	0.0
Control Delay (s)	14.0	14.1	8.3	0.0	0.0	9.0	0.0	0.0
Lane LOS	B	B	A			A		
Approach Delay (s)	14.0	14.1	0.1			0.7		
Approach LOS	B	B						

Intersection Summary					
Average Delay		2.1			
Intersection Capacity Utilization		36.1%	ICU Level of Service		A
Analysis Period (min)		15			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	83	7	9	9	30	429	3	435
Future Volume (vph)	83	7	9	9	30	429	3	435
Lane Group Flow (vph)	91	73	10	40	33	476	3	532
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.43	0.21	0.05	0.13	0.05	0.20	0.00	0.23
Control Delay	31.0	9.8	22.8	12.5	5.6	5.3	5.3	5.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	9.8	22.8	12.5	5.6	5.3	5.3	5.2
Queue Length 50th (m)	10.0	0.8	1.0	1.0	1.3	10.5	0.1	11.5
Queue Length 95th (m)	22.2	10.0	4.5	7.9	4.7	19.8	1.0	21.6
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	567	801	564	800	609	2359	644	2356
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.09	0.02	0.05	0.05	0.20	0.00	0.23

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 65.2
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	7	59	9	9	27	30	429	5	3	435	49
Future Volume (vph)	83	7	59	9	9	27	30	429	5	3	435	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.89		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	1665		1644	1705		1825	3376		1824	3363	
Flt Permitted	0.73	1.00		0.71	1.00		0.45	1.00		0.48	1.00	
Satd. Flow (perm)	1232	1665		1228	1705		873	3376		921	3363	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	91	8	65	10	10	30	33	471	5	3	478	54
RTOR Reduction (vph)	0	56	0	0	26	0	0	1	0	0	7	0
Lane Group Flow (vph)	91	17	0	10	14	0	33	475	0	3	525	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	14%	0%	0%	11%	0%	0%	0%	8%	0%	0%	7%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Effective Green, g (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.66	0.66		0.66	0.66	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	170	230		169	235		578	2238		610	2230	
v/s Ratio Prot		0.01			0.01			0.14			c0.16	
v/s Ratio Perm	c0.07			0.01			0.04			0.00		
v/c Ratio	0.54	0.07		0.06	0.06		0.06	0.21		0.00	0.24	
Uniform Delay, d1	26.7	24.9		24.9	24.9		3.9	4.4		3.8	4.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.1		0.1	0.1		0.2	0.2		0.0	0.2	
Delay (s)	29.9	25.1		25.0	25.0		4.1	4.6		3.8	4.7	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		27.7			25.0			4.6			4.7	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.29			
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	56.4%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	2	2	9	3	0	10
Future Volume (Veh/h)	2	2	9	3	0	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	3	3	13	4	0	14
Pedestrians				2	2	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.1	1.1	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		36	8
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		36	8
tC, single (s)			4.4		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.5		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1429		970	1075

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	6	17	14
Volume Left	0	13	0
Volume Right	3	0	14
cSH	1700	1429	1075
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.0	0.2	0.3
Control Delay (s)	0.0	5.8	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.8	8.4
Approach LOS			A

Intersection Summary				
Average Delay	5.8			
Intersection Capacity Utilization	18.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	607	6	46	847
Future Volume (Veh/h)	12	95	607	6	46	847
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	15	119	759	8	58	1059
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1934	759			767	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1934	759			767	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	75	70			92	
cM capacity (veh/h)	61	397			723	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	134	759	8	58	1059
Volume Left	15	0	0	58	0
Volume Right	119	0	8	0	0
cSH	245	1700	1700	723	1700
Volume to Capacity	0.55	0.45	0.00	0.08	0.62
Queue Length 95th (m)	22.7	0.0	0.0	2.0	0.0
Control Delay (s)	36.1	0.0	0.0	10.4	0.0
Lane LOS	E			B	
Approach Delay (s)	36.1	0.0		0.5	
Approach LOS	E				

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	57.8%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	39	45	573	62	76	776
Future Volume (Veh/h)	39	45	573	62	76	776
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	47	54	690	75	92	935
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1809	690			765	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1809	690			765	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	40	87			89	
cM capacity (veh/h)	78	408			822	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	101	690	75	92	935
Volume Left	47	0	0	92	0
Volume Right	54	0	75	0	0
cSH	137	1700	1700	822	1700
Volume to Capacity	0.74	0.41	0.04	0.11	0.55
Queue Length 95th (m)	32.6	0.0	0.0	2.9	0.0
Control Delay (s)	82.4	0.0	0.0	9.9	0.0
Lane LOS	F			A	
Approach Delay (s)	82.4	0.0		0.9	
Approach LOS	F				

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	52.4%	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)	8	10	10	39	8	66	17	563	54	99	705	20
Future Volume (Veh/h)	8	10	10	39	8	66	17	563	54	99	705	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	9	12	12	45	9	77	20	655	63	115	820	23
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1512	1820	422	1386	1800	361	843			719		
vC1, stage 1 conf vol	1062	1062		728	728							
vC2, stage 2 conf vol	450	759		658	1073							
vCu, unblocked vol	1512	1820	422	1386	1800	361	843			719		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	95	94	98	81	96	88	97			87		
cM capacity (veh/h)	167	201	586	240	211	629	758			891		

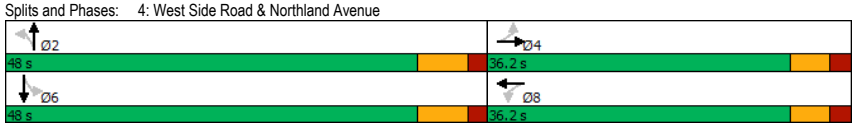
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	33	131	20	437	281	115	547	296
Volume Left	9	45	20	0	0	115	0	0
Volume Right	12	77	0	0	63	0	0	23
cSH	246	372	758	1700	1700	891	1700	1700
Volume to Capacity	0.13	0.35	0.03	0.26	0.17	0.13	0.32	0.17
Queue Length 95th (m)	3.5	11.8	0.6	0.0	0.0	3.4	0.0	0.0
Control Delay (s)	21.9	19.9	9.9	0.0	0.0	9.6	0.0	0.0
Lane LOS	C	C	A			A		
Approach Delay (s)	21.9	19.9	0.3			1.2		
Approach LOS	C	C						

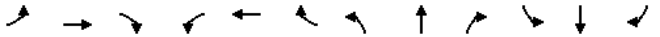
Intersection Summary					
Average Delay		2.5			
Intersection Capacity Utilization		43.1%	ICU Level of Service		A
Analysis Period (min)		15			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	97	12	6	8	77	512	28	584
Future Volume (vph)	97	12	6	8	77	512	28	584
Lane Group Flow (vph)	120	119	7	27	95	647	35	889
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.49	0.33	0.03	0.09	0.25	0.29	0.07	0.41
Control Delay	31.8	9.6	22.2	14.5	8.4	6.3	6.0	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	9.6	22.2	14.5	8.4	6.3	6.0	6.8
Queue Length 50th (m)	13.4	1.5	0.7	1.0	4.3	15.6	1.4	22.2
Queue Length 95th (m)	24.1	10.5	3.3	5.7	11.4	24.5	4.6	33.6
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	627	768	577	772	373	2238	493	2192
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.15	0.01	0.03	0.25	0.29	0.07	0.41

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 68.1
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue

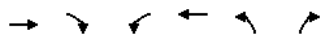




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	12	84	6	8	14	77	512	12	28	584	136
Future Volume (vph)	97	12	84	6	8	14	77	512	12	28	584	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.91		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	1608		1824	1726		1825	3532		1824	3435	
Flt Permitted	0.74	1.00		0.68	1.00		0.31	1.00		0.41	1.00	
Satd. Flow (perm)	1420	1608		1306	1726		590	3532		779	3435	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	120	15	104	7	10	17	95	632	15	35	721	168
RTOR Reduction (vph)	0	86	0	0	14	0	0	1	0	0	17	0
Lane Group Flow (vph)	120	33	0	7	13	0	95	646	0	35	872	0
Confl. Peds. (#/hr)	2		2	2		2			2	2		
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Effective Green, g (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	244	276		224	296		373	2238		493	2177	
v/s Ratio Prot		0.02			0.01			0.18			c0.25	
v/s Ratio Perm	c0.08			0.01			0.16			0.04		
v/c Ratio	0.49	0.12		0.03	0.04		0.25	0.29		0.07	0.40	
Uniform Delay, d1	25.5	23.8		23.4	23.5		5.4	5.6		4.8	6.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2		0.1	0.1		1.6	0.3		0.3	0.6	
Delay (s)	27.0	24.0		23.5	23.5		7.1	5.9		5.1	6.7	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		25.5			23.5			6.1			6.6	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.42			
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	3	0	15	3	0	13
Future Volume (Veh/h)	3	0	15	3	0	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	4	0	21	4	0	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			4		50	4
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			4		50	4
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1631		952	1085

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	4	25	18
Volume Left	0	21	0
Volume Right	0	0	18
cSH	1700	1631	1085
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	6.1	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	6.1	8.4
Approach LOS			A

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix F

Background 2035 Traffic Operations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	41	733	9	61	472
Future Volume (Veh/h)	9	41	733	9	61	472
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)	10	45	797	10	66	513
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1442	797			807	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1442	797			807	
tC, single (s)	6.4	6.6			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.4	
p0 queue free %	93	86			91	
cM capacity (veh/h)	134	328			741	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	55	797	10	66	513
Volume Left	10	0	0	66	0
Volume Right	45	0	10	0	0
cSH	260	1700	1700	741	1700
Volume to Capacity	0.21	0.47	0.01	0.09	0.30
Queue Length 95th (m)	5.9	0.0	0.0	2.2	0.0
Control Delay (s)	22.5	0.0	0.0	10.3	0.0
Lane LOS	C			B	
Approach Delay (s)	22.5	0.0		1.2	
Approach LOS	C				

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	55.3%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	55	78	654	18	21	467
Future Volume (Veh/h)	55	78	654	18	21	467
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	59	83	696	19	22	497
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1237	696			715	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1237	696			715	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	64	81			98	
cM capacity (veh/h)	164	445			895	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	142	696	19	22	497
Volume Left	59	0	0	22	0
Volume Right	83	0	19	0	0
cSH	260	1700	1700	895	1700
Volume to Capacity	0.55	0.41	0.01	0.02	0.29
Queue Length 95th (m)	22.8	0.0	0.0	0.6	0.0
Control Delay (s)	34.4	0.0	0.0	9.1	0.0
Lane LOS	D			A	
Approach Delay (s)	34.4	0.0		0.4	
Approach LOS	D				

Intersection Summary				
Average Delay	3.7			
Intersection Capacity Utilization	48.9%	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)	18	6	16	29	7	81	8	579	26	40	474	4
Future Volume (Veh/h)	18	6	16	29	7	81	8	579	26	40	474	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	19	6	17	31	8	87	9	623	28	43	510	4
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1018	1267	257	1016	1255	326	514			651		
vC1, stage 1 conf vol	598	598		655	655							
vC2, stage 2 conf vol	420	669		361	600							
vCu, unblocked vol	1018	1267	257	1016	1255	326	514			651		
tC, single (s)	7.8	7.0	6.9	8.2	7.8	6.9	4.1			4.3		
tC, 2 stage (s)	6.8	6.0		7.2	6.8							
tF (s)	3.6	4.2	3.3	3.8	4.7	3.3	2.2			2.3		
p0 queue free %	94	98	98	90	97	87	99			95		
cM capacity (veh/h)	315	290	748	306	244	670	1062			892		

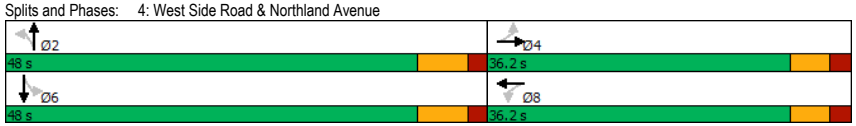
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	42	126	9	415	236	43	340	174
Volume Left	19	31	9	0	0	43	0	0
Volume Right	17	87	0	0	28	0	0	4
cSH	405	478	1062	1700	1700	892	1700	1700
Volume to Capacity	0.10	0.26	0.01	0.24	0.14	0.05	0.20	0.10
Queue Length 95th (m)	2.6	8.0	0.2	0.0	0.0	1.2	0.0	0.0
Control Delay (s)	14.9	15.2	8.4	0.0	0.0	9.2	0.0	0.0
Lane LOS	B	C	A			A		
Approach Delay (s)	14.9	15.2	0.1			0.7		
Approach LOS	B	C						

Intersection Summary				
Average Delay		2.2		
Intersection Capacity Utilization		37.8%	ICU Level of Service	A
Analysis Period (min)		15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	83	7	9	9	30	470	3	472
Future Volume (vph)	83	7	9	9	30	470	3	472
Lane Group Flow (vph)	91	73	10	40	33	521	3	573
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.43	0.21	0.05	0.13	0.06	0.22	0.00	0.24
Control Delay	31.0	9.8	22.8	12.5	5.6	5.4	5.3	5.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	9.8	22.8	12.5	5.6	5.4	5.3	5.3
Queue Length 50th (m)	10.0	0.8	1.0	1.0	1.3	11.7	0.1	12.7
Queue Length 95th (m)	22.2	10.0	4.5	7.9	4.7	21.8	1.0	23.5
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	567	801	564	800	585	2361	615	2358
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.09	0.02	0.05	0.06	0.22	0.00	0.24

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 65.2
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	7	59	9	9	27	30	470	5	3	472	49
Future Volume (vph)	83	7	59	9	9	27	30	470	5	3	472	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.89		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	1665		1644	1705		1825	3377		1824	3366	
Flt Permitted	0.73	1.00		0.71	1.00		0.44	1.00		0.46	1.00	
Satd. Flow (perm)	1232	1665		1228	1705		839	3377		882	3366	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	91	8	65	10	10	30	33	516	5	3	519	54
RTOR Reduction (vph)	0	56	0	0	26	0	0	1	0	0	6	0
Lane Group Flow (vph)	91	17	0	10	14	0	33	520	0	3	567	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	14%	0%	0%	11%	0%	0%	0%	8%	0%	0%	7%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Effective Green, g (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.66	0.66		0.66	0.66	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	170	230		169	235		556	2239		584	2232	
v/s Ratio Prot		0.01			0.01			0.15			c0.17	
v/s Ratio Perm	c0.07			0.01			0.04			0.00		
v/c Ratio	0.54	0.07		0.06	0.06		0.06	0.23		0.01	0.25	
Uniform Delay, d1	26.7	24.9		24.9	24.9		3.9	4.5		3.8	4.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.1		0.1	0.1		0.2	0.2		0.0	0.3	
Delay (s)	29.9	25.1		25.0	25.0		4.1	4.7		3.8	4.8	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		27.7			25.0			4.7			4.8	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.30			
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	56.4%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	3	2	9	4	0	10
Future Volume (Veh/h)	3	2	9	4	0	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	4	3	13	6	0	14
Pedestrians				2	2	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.1	1.1	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			9		40	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			9		40	10
tC, single (s)			4.4		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.5		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1428		967	1074

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	7	19	14
Volume Left	0	13	0
Volume Right	3	0	14
cSH	1700	1428	1074
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.0	0.2	0.3
Control Delay (s)	0.0	5.2	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.2	8.4
Approach LOS			A

Intersection Summary				
Average Delay	5.4			
Intersection Capacity Utilization	18.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	657	6	46	915
Future Volume (Veh/h)	12	95	657	6	46	915
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	15	119	821	8	58	1144
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2081	821			829	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2081	821			829	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	69	67			92	
cM capacity (veh/h)	49	365			684	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	134	821	8	58	1144
Volume Left	15	0	0	58	0
Volume Right	119	0	8	0	0
cSH	211	1700	1700	684	1700
Volume to Capacity	0.63	0.48	0.00	0.08	0.67
Queue Length 95th (m)	28.5	0.0	0.0	2.1	0.0
Control Delay (s)	47.6	0.0	0.0	10.8	0.0
Lane LOS	E			B	
Approach Delay (s)	47.6	0.0		0.5	
Approach LOS	E				

Intersection Summary				
Average Delay	3.2			
Intersection Capacity Utilization	61.4%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	39	45	624	62	76	843
Future Volume (Veh/h)	39	45	624	62	76	843
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	47	54	752	75	92	1016
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1952	752			827	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1952	752			827	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	25	86			88	
cM capacity (veh/h)	63	375			779	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	101	752	75	92	1016
Volume Left	47	0	0	92	0
Volume Right	54	0	75	0	0
cSH	113	1700	1700	779	1700
Volume to Capacity	0.89	0.44	0.04	0.12	0.60
Queue Length 95th (m)	41.2	0.0	0.0	3.0	0.0
Control Delay (s)	127.4	0.0	0.0	10.2	0.0
Lane LOS	F			B	
Approach Delay (s)	127.4	0.0		0.9	
Approach LOS	F				

Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	56.0%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	11	11	42	8	72	19	608	57	107	764	22
Future Volume (Veh/h)	9	11	11	42	8	72	19	608	57	107	764	22
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	10	13	13	49	9	84	22	707	66	124	888	26
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1636	1967	457	1496	1947	388	914			774		
vC1, stage 1 conf vol	1149	1149		785	785							
vC2, stage 2 conf vol	487	818		712	1162							
vCu, unblocked vol	1636	1967	457	1496	1947	388	914			774		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	93	93	98	77	95	86	97			85		
cM capacity (veh/h)	143	177	556	213	186	603	711			850		

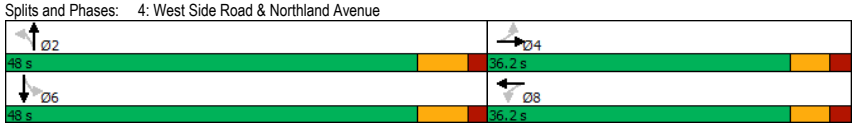
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	36	142	22	471	302	124	592	322
Volume Left	10	49	22	0	0	124	0	0
Volume Right	13	84	0	0	66	0	0	26
cSH	216	340	711	1700	1700	850	1700	1700
Volume to Capacity	0.17	0.42	0.03	0.28	0.18	0.15	0.35	0.19
Queue Length 95th (m)	4.5	15.1	0.7	0.0	0.0	3.9	0.0	0.0
Control Delay (s)	25.0	23.0	10.2	0.0	0.0	10.0	0.0	0.0
Lane LOS	D	C	B			A		
Approach Delay (s)	25.0	23.0	0.3			1.2		
Approach LOS	D	C						

Intersection Summary					
Average Delay		2.8			
Intersection Capacity Utilization	45.5%	ICU Level of Service		A	
Analysis Period (min)	15				

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	97	12	6	8	77	557	28	638
Future Volume (vph)	97	12	6	8	77	557	28	638
Lane Group Flow (vph)	120	119	7	27	95	703	35	956
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.49	0.33	0.03	0.09	0.28	0.31	0.08	0.44
Control Delay	31.8	9.6	22.2	14.5	9.0	6.5	6.1	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	9.6	22.2	14.5	9.0	6.5	6.1	7.1
Queue Length 50th (m)	13.4	1.5	0.7	1.0	4.4	17.3	1.4	24.8
Queue Length 95th (m)	24.1	10.5	3.3	5.7	11.9	26.8	4.6	37.1
Internal Link Dist (m)		126.8		191.1		138.9		420.5
Turn Bay Length (m)	75.0		26.0		80.0			
Base Capacity (vph)	627	768	577	772	341	2238	466	2193
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.15	0.01	0.03	0.28	0.31	0.08	0.44

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 68.1
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	12	84	6	8	14	77	557	12	28	638	136
Future Volume (vph)	97	12	84	6	8	14	77	557	12	28	638	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.91		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	1608		1824	1726		1825	3533		1824	3440	
Flt Permitted	0.74	1.00		0.68	1.00		0.28	1.00		0.38	1.00	
Satd. Flow (perm)	1420	1608		1306	1726		540	3533		738	3440	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	120	15	104	7	10	17	95	688	15	35	788	168
RTOR Reduction (vph)	0	86	0	0	14	0	0	1	0	0	15	0
Lane Group Flow (vph)	120	33	0	7	13	0	95	702	0	35	941	0
Confl. Peds. (#/hr)	2		2	2		2			2	2		
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Effective Green, g (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	244	276		224	296		342	2239		467	2180	
v/s Ratio Prot		0.02			0.01			0.20			c0.27	
v/s Ratio Perm	c0.08			0.01			0.18			0.05		
v/c Ratio	0.49	0.12		0.03	0.04		0.28	0.31		0.07	0.43	
Uniform Delay, d1	25.5	23.8		23.4	23.5		5.5	5.7		4.8	6.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2		0.1	0.1		2.0	0.4		0.3	0.6	
Delay (s)	27.0	24.0		23.5	23.5		7.5	6.1		5.1	6.9	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		25.5			23.5			6.2			6.8	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.44			
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	4	0	15	4	0	13
Future Volume (Veh/h)	4	0	15	4	0	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	5	0	21	5	0	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			5		52	5
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			5		52	5
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1630		949	1084

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	5	26	18
Volume Left	0	21	0
Volume Right	0	0	18
cSH	1700	1630	1084
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	5.9	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.9	8.4
Approach LOS			A

Intersection Summary				
Average Delay	6.2			
Intersection Capacity Utilization	17.7%	ICU Level of Service	A	
Analysis Period (min)	15			

BURNSIDE

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Appendix G

Total 2030 Traffic Operations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	41	762	9	61	460
Future Volume (Veh/h)	9	41	762	9	61	460
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)	10	45	828	10	66	500
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1460	828			838	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1460	828			838	
tC, single (s)	6.4	6.6			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.4	
p0 queue free %	92	86			91	
cM capacity (veh/h)	131	314			720	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	55	828	10	66	500
Volume Left	10	0	0	66	0
Volume Right	45	0	10	0	0
cSH	250	1700	1700	720	1700
Volume to Capacity	0.22	0.49	0.01	0.09	0.29
Queue Length 95th (m)	6.2	0.0	0.0	2.3	0.0
Control Delay (s)	23.4	0.0	0.0	10.5	0.0
Lane LOS	C			B	
Approach Delay (s)	23.4	0.0		1.2	
Approach LOS	C				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	56.8%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	55	78	685	18	21	454
Future Volume (Veh/h)	55	78	685	18	21	454
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	59	83	729	19	22	483
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1256	729			748	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1256	729			748	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	63	81			97	
cM capacity (veh/h)	159	426			870	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	142	729	19	22	483
Volume Left	59	0	0	22	0
Volume Right	83	0	19	0	0
cSH	251	1700	1700	870	1700
Volume to Capacity	0.57	0.43	0.01	0.03	0.28
Queue Length 95th (m)	24.0	0.0	0.0	0.6	0.0
Control Delay (s)	36.4	0.0	0.0	9.2	0.0
Lane LOS	E			A	
Approach Delay (s)	36.4	0.0		0.4	
Approach LOS	E				

Intersection Summary				
Average Delay	3.9			
Intersection Capacity Utilization	50.6%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
3: West Side Road & Barrick Road

2030 Total AM Conditions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	99	14	74	28	8	76	25	533	24	37	437	30
Future Volume (Veh/h)	99	14	74	28	8	76	25	533	24	37	437	30
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	106	15	80	30	9	82	27	573	26	40	470	32
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	993	1219	251	1042	1222	300	502			599		
vC1, stage 1 conf vol	566	566		640	640							
vC2, stage 2 conf vol	427	653		402	582							
vCu, unblocked vol	993	1219	251	1042	1222	300	502			599		
tC, single (s)	7.8	7.0	6.9	8.2	7.8	6.9	4.1			4.3		
tC, 2 stage (s)	6.8	6.0		7.2	6.8							
tF (s)	3.6	4.2	3.3	3.8	4.7	3.3	2.2			2.3		
p0 queue free %	67	95	89	89	96	88	97			96		
cM capacity (veh/h)	323	298	755	283	244	697	1073			934		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	201	121	27	382	217	40	313	189
Volume Left	106	30	27	0	0	40	0	0
Volume Right	80	82	0	0	26	0	0	32
cSH	415	464	1073	1700	1700	934	1700	1700
Volume to Capacity	0.48	0.26	0.03	0.22	0.13	0.04	0.18	0.11
Queue Length 95th (m)	19.5	7.9	0.6	0.0	0.0	1.0	0.0	0.0
Control Delay (s)	21.6	15.5	8.4	0.0	0.0	9.0	0.0	0.0
Lane LOS	C	C	A			A		
Approach Delay (s)	21.6	15.5	0.4			0.7		
Approach LOS	C	C						

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

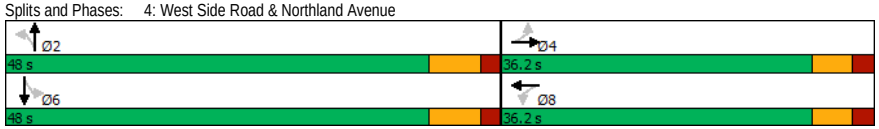
Timings
4: West Side Road & Northland Avenue

2030 Total AM Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	83	7	9	9	30	447	3	494
Future Volume (vph)	83	7	9	9	30	447	3	494
Lane Group Flow (vph)	91	73	10	40	33	496	3	597
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.43	0.21	0.05	0.13	0.06	0.21	0.00	0.25
Control Delay	31.0	9.8	22.8	12.5	5.6	5.3	5.3	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	9.8	22.8	12.5	5.6	5.3	5.3	5.4
Queue Length 50th (m)	10.0	0.8	1.0	1.0	1.3	11.0	0.1	13.4
Queue Length 95th (m)	22.2	10.0	4.5	7.9	4.7	20.7	1.0	24.7
Internal Link Dist (m)		70.3		191.1		138.9		420.5
Turn Bay Length (m)			26.0		80.0		133.0	
Base Capacity (vph)	567	801	564	800	571	2359	630	2357
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.09	0.02	0.05	0.06	0.21	0.00	0.25

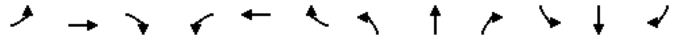
Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 65.2
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



HCM Signalized Intersection Capacity Analysis
4: West Side Road & Northland Avenue

2030 Total AM Conditions



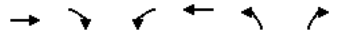
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	7	59	9	9	27	30	447	5	3	494	49
Future Volume (vph)	83	7	59	9	9	27	30	447	5	3	494	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.89		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	1665		1644	1705		1825	3376		1824	3368	
Flt Permitted	0.73	1.00		0.71	1.00		0.43	1.00		0.47	1.00	
Satd. Flow (perm)	1232	1665		1228	1705		819	3376		903	3368	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	91	8	65	10	10	30	33	491	5	3	543	54
RTOR Reduction (vph)	0	56	0	0	26	0	0	1	0	0	6	0
Lane Group Flow (vph)	91	17	0	10	14	0	33	495	0	3	591	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	14%	0%	0%	11%	0%	0%	0%	8%	0%	0%	7%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Effective Green, g (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.66	0.66		0.66	0.66	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	170	230		169	235		543	2238		598	2233	
v/s Ratio Prot		0.01			0.01			0.15			c0.18	
v/s Ratio Perm	c0.07			0.01			0.04			0.00		
v/c Ratio	0.54	0.07		0.06	0.06		0.06	0.22		0.01	0.26	
Uniform Delay, d1	26.7	24.9		24.9	24.9		3.9	4.4		3.8	4.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.1		0.1	0.1		0.2	0.2		0.0	0.3	
Delay (s)	29.9	25.1		25.0	25.0		4.1	4.7		3.8	4.9	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		27.7			25.0			4.6			4.9	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	8.3	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.31			
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	56.4%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
5: Minor Road & Barrick Road

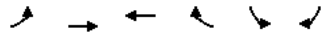
2030 Total AM Conditions



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	2	2	9	3	0	10
Future Volume (Veh/h)	2	2	9	3	0	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	3	3	13	4	0	14
Pedestrians				2	2	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.1	1.1	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			8		36	8
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			8		36	8
tC, single (s)			4.4		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.5		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1429		970	1075

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	6	17	14
Volume Left	0	13	0
Volume Right	3	0	14
cSH	1700	1429	1075
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.0	0.2	0.3
Control Delay (s)	0.0	5.8	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.8	8.4
Approach LOS			A

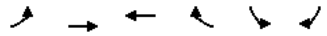
Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	18.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	52	22	42	135	0
Future Volume (Veh/h)	0	52	22	42	135	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	57	24	46	147	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	70				104	47
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	70				104	47
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				84	100
cM capacity (veh/h)	1544				899	1028

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	57	70	147
Volume Left	0	0	147
Volume Right	0	46	0
cSH	1544	1700	899
Volume to Capacity	0.00	0.04	0.16
Queue Length 95th (m)	0.0	0.0	4.4
Control Delay (s)	0.0	0.0	9.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	17.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	37	17	5	15	0
Future Volume (Veh/h)	0	37	17	5	15	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	40	18	5	16	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	23				60	20
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	23				60	20
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1605				951	1063

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	40	23	16
Volume Left	0	0	16
Volume Right	0	5	0
cSH	1605	1700	951
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	8.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.8
Approach LOS			A

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	654	6	46	920
Future Volume (Veh/h)	12	95	654	6	46	920
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	15	119	818	8	58	1150
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2084	818			826	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2084	818			826	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	69	68			92	
cM capacity (veh/h)	48	367			685	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	134	818	8	58	1150
Volume Left	15	0	0	58	0
Volume Right	119	0	8	0	0
cSH	211	1700	1700	685	1700
Volume to Capacity	0.63	0.48	0.00	0.08	0.68
Queue Length 95th (m)	28.5	0.0	0.0	2.1	0.0
Control Delay (s)	47.6	0.0	0.0	10.7	0.0
Lane LOS	E			B	
Approach Delay (s)	47.6	0.0		0.5	
Approach LOS	E				

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	39	45	620	62	76	849
Future Volume (Veh/h)	39	45	620	62	76	849
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	47	54	747	75	92	1023
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1954	747			822	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1954	747			822	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	25	86			88	
cM capacity (veh/h)	63	378			782	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	101	747	75	92	1023
Volume Left	47	0	0	92	0
Volume Right	54	0	75	0	0
cSH	113	1700	1700	782	1700
Volume to Capacity	0.89	0.44	0.04	0.12	0.60
Queue Length 95th (m)	41.3	0.0	0.0	3.0	0.0
Control Delay (s)	127.6	0.0	0.0	10.2	0.0
Lane LOS	F			B	
Approach Delay (s)	127.6	0.0		0.8	
Approach LOS	F				

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	15	45	39	15	66	70	563	54	99	705	93
Future Volume (Veh/h)	55	15	45	39	15	66	70	563	54	99	705	93
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	64	17	52	45	17	77	81	655	63	115	820	108
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1680	1985	464	1550	2008	361	928			719		
vC1, stage 1 conf vol	1104	1104		850	850							
vC2, stage 2 conf vol	576	881		700	1158							
vCu, unblocked vol	1680	1985	464	1550	2008	361	928			719		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	53	90	91	72	88	88	88			87		
cM capacity (veh/h)	137	164	550	163	143	629	702			891		

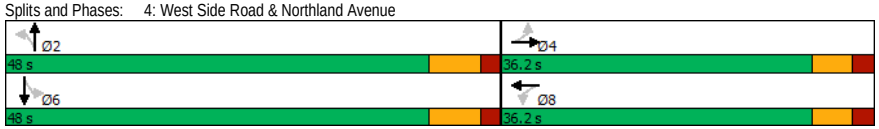
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	133	139	81	437	281	115	547	381
Volume Left	64	45	81	0	0	115	0	0
Volume Right	52	77	0	0	63	0	0	108
cSH	200	268	702	1700	1700	891	1700	1700
Volume to Capacity	0.67	0.52	0.12	0.26	0.17	0.13	0.32	0.22
Queue Length 95th (m)	30.7	20.9	3.0	0.0	0.0	3.4	0.0	0.0
Control Delay (s)	53.1	32.0	10.8	0.0	0.0	9.6	0.0	0.0
Lane LOS	F	D	B			A		
Approach Delay (s)	53.1	32.0	1.1			1.1		
Approach LOS	F	D						

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	97	12	6	8	77	565	28	619
Future Volume (vph)	97	12	6	8	77	565	28	619
Lane Group Flow (vph)	120	119	7	27	95	713	35	932
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.49	0.33	0.03	0.09	0.27	0.32	0.08	0.43
Control Delay	31.8	9.6	22.2	14.5	8.8	6.5	6.1	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	9.6	22.2	14.5	8.8	6.5	6.1	7.0
Queue Length 50th (m)	13.4	1.5	0.7	1.0	4.4	17.7	1.4	23.8
Queue Length 95th (m)	24.1	10.5	3.3	5.7	11.7	27.2	4.6	35.8
Internal Link Dist (m)		70.3		191.1		138.9		420.5
Turn Bay Length (m)			26.0		80.0		133.0	
Base Capacity (vph)	627	768	577	772	352	2238	462	2192
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.15	0.01	0.03	0.27	0.32	0.08	0.43

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 68.1
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



HCM Signalized Intersection Capacity Analysis
4: West Side Road & Northland Avenue

2030 Total PM Conditions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	12	84	6	8	14	77	565	12	28	619	136
Future Volume (vph)	97	12	84	6	8	14	77	565	12	28	619	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.91		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	1608		1824	1726		1825	3533		1824	3439	
Flt Permitted	0.74	1.00		0.68	1.00		0.29	1.00		0.38	1.00	
Satd. Flow (perm)	1420	1608		1306	1726		557	3533		731	3439	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	120	15	104	7	10	17	95	698	15	35	764	168
RTOR Reduction (vph)	0	86	0	0	14	0	0	1	0	0	16	0
Lane Group Flow (vph)	120	33	0	7	13	0	95	712	0	35	916	0
Confl. Peds. (#/hr)	2		2	2		2			2	2		
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Effective Green, g (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	244	276		224	296		353	2239		463	2179	
v/s Ratio Prot		0.02			0.01			0.20			c0.27	
v/s Ratio Perm	c0.08			0.01			0.17			0.05		
v/c Ratio	0.49	0.12		0.03	0.04		0.27	0.32		0.08	0.42	
Uniform Delay, d1	25.5	23.8		23.4	23.5		5.5	5.7		4.8	6.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2		0.1	0.1		1.9	0.4		0.3	0.6	
Delay (s)	27.0	24.0		23.5	23.5		7.4	6.1		5.1	6.8	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		25.5			23.5			6.2			6.8	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.44			
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

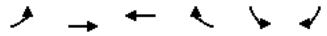
HCM Unsignalized Intersection Capacity Analysis
5: Minor Road & Barrick Road

2030 Total PM Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	3	0	15	3	0	13
Future Volume (Veh/h)	3	0	15	3	0	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	4	0	21	4	0	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			4		50	4
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			4		50	4
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1631		952	1085

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	4	25	18
Volume Left	0	21	0
Volume Right	0	0	18
cSH	1700	1631	1085
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	6.1	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	6.1	8.4
Approach LOS			A

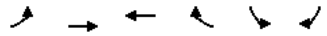
Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	37	58	120	78	0
Future Volume (Veh/h)	0	37	58	120	78	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	40	63	130	85	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	193				168	128
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	193				168	128
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				90	100
cM capacity (veh/h)	1392				827	927

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	40	193	85
Volume Left	0	0	85
Volume Right	0	130	0
cSH	1392	1700	827
Volume to Capacity	0.00	0.11	0.10
Queue Length 95th (m)	0.0	0.0	2.6
Control Delay (s)	0.0	0.0	9.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	21.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	28	45	13	9	0
Future Volume (Veh/h)	0	28	45	13	9	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	30	49	14	10	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	63				86	56
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	63				86	56
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1553				920	1016

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	30	63	10
Volume Left	0	0	10
Volume Right	0	14	0
cSH	1553	1700	920
Volume to Capacity	0.00	0.04	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	9.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix H

Total 2035 Traffic Operations

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	9	41	816	9	61	499
Future Volume (Veh/h)	9	41	816	9	61	499
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)	10	45	887	10	66	542
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1561	887			897	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1561	887			897	
tC, single (s)	6.4	6.6			4.3	
tC, 2 stage (s)						
tF (s)	3.5	3.7			2.4	
p0 queue free %	91	84			90	
cM capacity (veh/h)	113	289			683	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	55	887	10	66	542
Volume Left	10	0	0	66	0
Volume Right	45	0	10	0	0
cSH	225	1700	1700	683	1700
Volume to Capacity	0.24	0.52	0.01	0.10	0.32
Queue Length 95th (m)	7.1	0.0	0.0	2.4	0.0
Control Delay (s)	26.1	0.0	0.0	10.8	0.0
Lane LOS	D			B	
Approach Delay (s)	26.1	0.0		1.2	
Approach LOS	D				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	55	78	737	18	21	494
Future Volume (Veh/h)	55	78	737	18	21	494
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	59	83	784	19	22	526
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1354	784			803	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1354	784			803	
tC, single (s)	6.7	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.8	3.3			2.2	
p0 queue free %	57	79			97	
cM capacity (veh/h)	138	396			830	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	142	784	19	22	526
Volume Left	59	0	0	22	0
Volume Right	83	0	19	0	0
cSH	223	1700	1700	830	1700
Volume to Capacity	0.64	0.46	0.01	0.03	0.31
Queue Length 95th (m)	29.0	0.0	0.0	0.6	0.0
Control Delay (s)	45.8	0.0	0.0	9.5	0.0
Lane LOS	E			A	
Approach Delay (s)	45.8	0.0		0.4	
Approach LOS	E				

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	53.3%	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)	101	14	75	29	9	81	26	579	26	40	474	31
Future Volume (Veh/h)	101	14	75	29	9	81	26	579	26	40	474	31
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	109	15	81	31	10	87	28	623	28	43	510	33
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1072	1320	272	1122	1322	326	543			651		
vC1, stage 1 conf vol	612	612		693	693							
vC2, stage 2 conf vol	460	707		430	629							
vCu, unblocked vol	1072	1320	272	1122	1322	326	543			651		
tC, single (s)	7.8	7.0	6.9	8.2	7.8	6.9	4.1			4.3		
tC, 2 stage (s)	6.8	6.0		7.2	6.8							
tF (s)	3.6	4.2	3.3	3.8	4.7	3.3	2.2			2.3		
p0 queue free %	63	95	89	88	96	87	97			95		
cM capacity (veh/h)	295	274	732	260	223	670	1036			892		

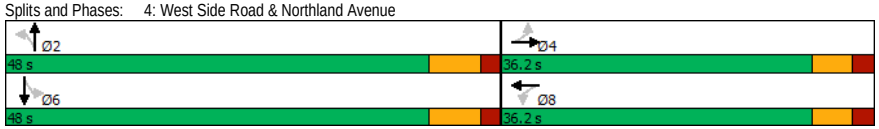
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	205	128	28	415	236	43	340	203
Volume Left	109	31	28	0	0	43	0	0
Volume Right	81	87	0	0	28	0	0	33
cSH	384	435	1036	1700	1700	892	1700	1700
Volume to Capacity	0.53	0.29	0.03	0.24	0.14	0.05	0.20	0.12
Queue Length 95th (m)	23.0	9.2	0.6	0.0	0.0	1.2	0.0	0.0
Control Delay (s)	24.6	16.7	8.6	0.0	0.0	9.2	0.0	0.0
Lane LOS	C	C	A			A		
Approach Delay (s)	24.6	16.7	0.4			0.7		
Approach LOS	C	C						

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	47.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	83	7	9	9	30	488	3	531
Future Volume (vph)	83	7	9	9	30	488	3	531
Lane Group Flow (vph)	91	73	10	40	33	541	3	638
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.43	0.21	0.05	0.13	0.06	0.23	0.00	0.27
Control Delay	31.0	9.8	22.8	12.5	5.7	5.4	5.3	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.0	9.8	22.8	12.5	5.7	5.4	5.3	5.5
Queue Length 50th (m)	10.0	0.8	1.0	1.0	1.3	12.3	0.1	14.6
Queue Length 95th (m)	22.2	10.0	4.5	7.9	4.7	22.7	1.0	26.6
Internal Link Dist (m)		70.3		191.1		138.9		420.5
Turn Bay Length (m)			26.0		80.0		133.0	
Base Capacity (vph)	567	801	564	800	550	2361	603	2359
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.09	0.02	0.05	0.06	0.23	0.00	0.27

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 65.2
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



HCM Signalized Intersection Capacity Analysis
4: West Side Road & Northland Avenue

2035 Total AM Conditions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	7	59	9	9	27	30	488	5	3	531	49
Future Volume (vph)	83	7	59	9	9	27	30	488	5	3	531	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.89		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1601	1665		1644	1705		1825	3377		1824	3371	
Flt Permitted	0.73	1.00		0.71	1.00		0.41	1.00		0.45	1.00	
Satd. Flow (perm)	1232	1665		1228	1705		787	3377		865	3371	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	91	8	65	10	10	30	33	536	5	3	584	54
RTOR Reduction (vph)	0	56	0	0	26	0	0	0	0	0	5	0
Lane Group Flow (vph)	91	17	0	10	14	0	33	541	0	3	633	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	14%	0%	0%	11%	0%	0%	0%	8%	0%	0%	7%	6%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Effective Green, g (s)	9.2	9.2		9.2	9.2		44.1	44.1		44.1	44.1	
Actuated g/C Ratio	0.14	0.14		0.14	0.14		0.66	0.66		0.66	0.66	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	170	230		169	235		521	2239		573	2235	
v/s Ratio Prot		0.01			0.01			0.16			c0.19	
v/s Ratio Perm	c0.07			0.01			0.04			0.00		
v/c Ratio	0.54	0.07		0.06	0.06		0.06	0.24		0.01	0.28	
Uniform Delay, d1	26.7	24.9		24.9	24.9		3.9	4.5		3.8	4.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.1		0.1	0.1		0.2	0.3		0.0	0.3	
Delay (s)	29.9	25.1		25.0	25.0		4.2	4.7		3.8	5.0	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		27.7			25.0			4.7			5.0	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.33			
Actuated Cycle Length (s)	66.5	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	56.4%	ICU Level of Service	B	
Analysis Period (min)	15			

c Critical Lane Group

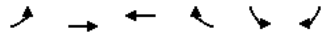
HCM Unsignalized Intersection Capacity Analysis
5: Minor Road & Barrick Road

2035 Total AM Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	3	2	9	4	0	10
Future Volume (Veh/h)	3	2	9	4	0	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69
Hourly flow rate (vph)	4	3	13	6	0	14
Pedestrians				2	2	
Lane Width (m)				3.7	3.7	
Walking Speed (m/s)				1.1	1.1	
Percent Blockage				0	0	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			9		40	10
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			9		40	10
tC, single (s)			4.4		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.5		3.5	3.3
p0 queue free %			99		100	99
cM capacity (veh/h)			1428		967	1074

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	7	19	14
Volume Left	0	13	0
Volume Right	3	0	14
cSH	1700	1428	1074
Volume to Capacity	0.00	0.01	0.01
Queue Length 95th (m)	0.0	0.2	0.3
Control Delay (s)	0.0	5.2	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.2	8.4
Approach LOS			A

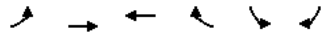
Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	18.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	55	23	42	135	0
Future Volume (Veh/h)	0	55	23	42	135	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	60	25	46	147	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	71				108	48
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	71				108	48
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				84	100
cM capacity (veh/h)	1542				894	1027

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	60	71	147
Volume Left	0	0	147
Volume Right	0	46	0
cSH	1542	1700	894
Volume to Capacity	0.00	0.04	0.16
Queue Length 95th (m)	0.0	0.0	4.5
Control Delay (s)	0.0	0.0	9.8
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.8
Approach LOS			A

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	17.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	40	18	5	15	0
Future Volume (Veh/h)	0	40	18	5	15	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	20	5	16	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	25				66	22
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	25				66	22
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				98	100
cM capacity (veh/h)	1603				945	1060

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	43	25	16
Volume Left	0	0	16
Volume Right	0	5	0
cSH	1603	1700	945
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.0	0.4
Control Delay (s)	0.0	0.0	8.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	704	6	46	988
Future Volume (Veh/h)	12	95	704	6	46	988
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80
Hourly flow rate (vph)	15	119	880	8	58	1235
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2231	880			888	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2231	880			888	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	61	65			91	
cM capacity (veh/h)	39	338			647	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	134	880	8	58	1235
Volume Left	15	0	0	58	0
Volume Right	119	0	8	0	0
cSH	181	1700	1700	647	1700
Volume to Capacity	0.74	0.52	0.00	0.09	0.73
Queue Length 95th (m)	36.0	0.0	0.0	2.2	0.0
Control Delay (s)	66.7	0.0	0.0	11.1	0.0
Lane LOS	F			B	
Approach Delay (s)	66.7	0.0		0.5	
Approach LOS	F				

Intersection Summary				
Average Delay	4.1			
Intersection Capacity Utilization	65.2%	ICU Level of Service		C
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	39	45	671	62	76	916
Future Volume (Veh/h)	39	45	671	62	76	916
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	47	54	808	75	92	1104
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	2096	808			883	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	2096	808			883	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	8	84			88	
cM capacity (veh/h)	51	348			741	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	101	808	75	92	1104
Volume Left	47	0	0	92	0
Volume Right	54	0	75	0	0
cSH	94	1700	1700	741	1700
Volume to Capacity	1.08	0.48	0.04	0.12	0.65
Queue Length 95th (m)	50.5	0.0	0.0	3.2	0.0
Control Delay (s)	199.4	0.0	0.0	10.5	0.0
Lane LOS	F			B	
Approach Delay (s)	199.4	0.0		0.8	
Approach LOS	F				

Intersection Summary				
Average Delay	9.7			
Intersection Capacity Utilization	59.8%	ICU Level of Service		B
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	56	16	46	42	15	72	72	608	57	107	764	95
Future Volume (Veh/h)	56	16	46	42	15	72	72	608	57	107	764	95
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	65	19	53	49	17	84	84	707	66	124	888	110
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1806	2133	499	1664	2155	388	998			774		
vC1, stage 1 conf vol	1191	1191		909	909							
vC2, stage 2 conf vol	615	942		754	1246							
vCu, unblocked vol	1806	2133	499	1664	2155	388	998			774		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	43	86	90	64	86	86	87			85		
cM capacity (veh/h)	114	139	522	137	118	603	660			850		

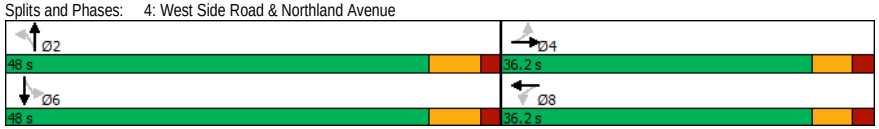
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	137	150	84	471	302	124	592	406
Volume Left	65	49	84	0	0	124	0	0
Volume Right	53	84	0	0	66	0	0	110
cSH	170	234	660	1700	1700	850	1700	1700
Volume to Capacity	0.81	0.64	0.13	0.28	0.18	0.15	0.35	0.24
Queue Length 95th (m)	41.0	29.7	3.3	0.0	0.0	3.9	0.0	0.0
Control Delay (s)	80.5	44.4	11.3	0.0	0.0	10.0	0.0	0.0
Lane LOS	F	E	B			A		
Approach Delay (s)	80.5	44.4	1.1			1.1		
Approach LOS	F	E						

Intersection Summary			
Average Delay	8.8		
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	97	12	6	8	77	610	28	673
Future Volume (vph)	97	12	6	8	77	610	28	673
Lane Group Flow (vph)	120	119	7	27	95	768	35	999
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0
Minimum Split (s)	16.2	16.2	16.2	16.2	27.0	27.0	27.0	27.0
Total Split (s)	36.2	36.2	36.2	36.2	48.0	48.0	48.0	48.0
Total Split (%)	43.0%	43.0%	43.0%	43.0%	57.0%	57.0%	57.0%	57.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.2	2.2	2.2	2.2	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.49	0.33	0.03	0.09	0.30	0.34	0.08	0.46
Control Delay	31.8	9.6	22.2	14.5	9.5	6.7	6.2	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	9.6	22.2	14.5	9.5	6.7	6.2	7.3
Queue Length 50th (m)	13.4	1.5	0.7	1.0	4.4	19.5	1.4	26.5
Queue Length 95th (m)	24.1	10.5	3.3	5.7	12.2	29.6	4.6	39.4
Internal Link Dist (m)		70.3		191.1		138.9		420.5
Turn Bay Length (m)			26.0		80.0		133.0	
Base Capacity (vph)	627	768	577	772	322	2238	436	2194
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.19	0.15	0.01	0.03	0.30	0.34	0.08	0.46

Intersection Summary
Cycle Length: 84.2
Actuated Cycle Length: 68.1
Natural Cycle: 45
Control Type: Semi Act-Uncoord

Splits and Phases: 4: West Side Road & Northland Avenue



HCM Signalized Intersection Capacity Analysis
4: West Side Road & Northland Avenue

2035 Total PM Conditions

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	97	12	84	6	8	14	77	610	12	28	673	136
Future Volume (vph)	97	12	84	6	8	14	77	610	12	28	673	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.87		1.00	0.91		1.00	1.00		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	1608		1824	1726		1825	3534		1824	3443	
Flt Permitted	0.74	1.00		0.68	1.00		0.27	1.00		0.36	1.00	
Satd. Flow (perm)	1420	1608		1306	1726		509	3534		689	3443	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	120	15	104	7	10	17	95	753	15	35	831	168
RTOR Reduction (vph)	0	86	0	0	14	0	0	1	0	0	14	0
Lane Group Flow (vph)	120	33	0	7	13	0	95	767	0	35	985	0
Confl. Peds. (#/hr)	2		2	2		2			2	2		
Heavy Vehicles (%)	0%	0%	3%	0%	0%	0%	0%	3%	0%	0%	4%	0%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Effective Green, g (s)	11.7	11.7		11.7	11.7		43.1	43.1		43.1	43.1	
Actuated g/C Ratio	0.17	0.17		0.17	0.17		0.63	0.63		0.63	0.63	
Clearance Time (s)	6.2	6.2		6.2	6.2		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)	244	276		224	296		322	2239		436	2182	
v/s Ratio Prot		0.02			0.01			0.22			c0.29	
v/s Ratio Perm	c0.08			0.01			0.19			0.05		
v/c Ratio	0.49	0.12		0.03	0.04		0.30	0.34		0.08	0.45	
Uniform Delay, d1	25.5	23.8		23.4	23.5		5.6	5.8		4.8	6.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	0.2		0.1	0.1		2.3	0.4		0.4	0.7	
Delay (s)	27.0	24.0		23.5	23.5		7.9	6.2		5.2	7.1	
Level of Service	C	C		C	C		A	A		A	A	
Approach Delay (s)		25.5			23.5			6.4			7.0	
Approach LOS		C			C			A			A	

Intersection Summary				
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A	
HCM 2000 Volume to Capacity ratio	0.46			
Actuated Cycle Length (s)	68.0	Sum of lost time (s)	13.2	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

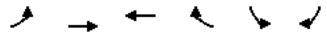
HCM Unsignalized Intersection Capacity Analysis
5: Minor Road & Barrick Road

2035 Total PM Conditions

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	4	0	15	4	0	13
Future Volume (Veh/h)	4	0	15	4	0	13
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.73	0.73	0.73	0.73	0.73	0.73
Hourly flow rate (vph)	5	0	21	5	0	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			5		52	5
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			5		52	5
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	98
cM capacity (veh/h)			1630		949	1084

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	5	26	18
Volume Left	0	21	0
Volume Right	0	0	18
cSH	1700	1630	1084
Volume to Capacity	0.00	0.01	0.02
Queue Length 95th (m)	0.0	0.3	0.4
Control Delay (s)	0.0	5.9	8.4
Lane LOS		A	A
Approach Delay (s)	0.0	5.9	8.4
Approach LOS			A

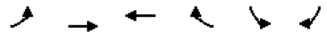
Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	17.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	40	62	120	78	0
Future Volume (Veh/h)	0	40	62	120	78	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	43	67	130	85	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	197				175	132
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	197				175	132
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				90	100
cM capacity (veh/h)	1388				819	923

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	43	197	85
Volume Left	0	0	85
Volume Right	0	130	0
cSH	1388	1700	819
Volume to Capacity	0.00	0.12	0.10
Queue Length 95th (m)	0.0	0.0	2.6
Control Delay (s)	0.0	0.0	9.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.9
Approach LOS			A

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	21.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	31	49	13	9	0
Future Volume (Veh/h)	0	31	49	13	9	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	34	53	14	10	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	67				94	60
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	67				94	60
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1547				911	1011

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	34	67	10
Volume Left	0	0	10
Volume Right	0	14	0
cSH	1547	1700	911
Volume to Capacity	0.00	0.04	0.01
Queue Length 95th (m)	0.0	0.0	0.3
Control Delay (s)	0.0	0.0	9.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	13.4%	ICU Level of Service	A
Analysis Period (min)	15		

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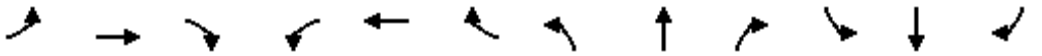
Appendix I

Total 2035 Traffic Operations Sensitivity Analysis



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	56	16	46	42	15	72	72	608	57	107	764	95
Future Volume (Veh/h)	56	16	46	42	15	72	72	608	57	107	764	95
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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
Hourly flow rate (vph)	61	17	50	46	16	78	78	661	62	116	830	103
Pedestrians					1						1	
Lane Width (m)					3.7						3.7	
Walking Speed (m/s)					1.1						1.1	
Percent Blockage					0						0	
Right turn flare (veh)												
Median type								TWLTL			None	
Median storage veh)								2				
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	1687	1994	466	1554	2014	364	933			724		
vC1, stage 1 conf vol	1114	1114		849	849							
vC2, stage 2 conf vol	574	880		706	1165							
vCu, unblocked vol	1687	1994	466	1554	2014	364	933			724		
tC, single (s)	7.8	6.5	6.9	7.7	6.5	7.0	4.2			4.1		
tC, 2 stage (s)	6.8	5.5		6.7	5.5							
tF (s)	3.6	4.0	3.3	3.6	4.0	3.3	2.3			2.2		
p0 queue free %	55	90	91	72	89	88	89			87		
cM capacity (veh/h)	136	163	548	164	143	626	699			887		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	128	140	78	441	282	116	553	380
Volume Left	61	46	78	0	0	116	0	0
Volume Right	50	78	0	0	62	0	0	103
cSH	199	271	699	1700	1700	887	1700	1700
Volume to Capacity	0.64	0.52	0.11	0.26	0.17	0.13	0.33	0.22
Queue Length 95th (m)	28.9	20.9	2.8	0.0	0.0	3.4	0.0	0.0
Control Delay (s)	51.0	31.7	10.8	0.0	0.0	9.7	0.0	0.0
Lane LOS	F	D	B			A		
Approach Delay (s)	51.0	31.7	1.1			1.1		
Approach LOS	F	D						

Intersection Summary				
Average Delay	6.1			
Intersection Capacity Utilization	48.6%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	39	45	671	62	76	916
Future Volume (Veh/h)	39	45	671	62	76	916
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)	42	49	729	67	83	996
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1891	729			796	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1891	729			796	
tC, single (s)	6.4	6.5			4.2	
tC, 2 stage (s)						
tF (s)	3.5	3.5			2.3	
p0 queue free %	40	87			90	
cM capacity (veh/h)	70	387			800	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	91	729	67	83	996
Volume Left	42	0	0	83	0
Volume Right	49	0	67	0	0
cSH	125	1700	1700	800	1700
Volume to Capacity	0.73	0.43	0.04	0.10	0.59
Queue Length 95th (m)	31.1	0.0	0.0	2.6	0.0
Control Delay (s)	87.3	0.0	0.0	10.0	0.0
Lane LOS	F			B	
Approach Delay (s)	87.3	0.0		0.8	
Approach LOS	F				

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	95	704	6	46	988
Future Volume (Veh/h)	12	95	704	6	46	988
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)	13	103	765	7	50	1074
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1939	765			772	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1939	765			772	
tC, single (s)	6.6	6.3			4.4	
tC, 2 stage (s)						
tF (s)	3.7	3.4			2.5	
p0 queue free %	79	74			93	
cM capacity (veh/h)	61	394			720	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	116	765	7	50	1074
Volume Left	13	0	0	50	0
Volume Right	103	0	7	0	0
cSH	244	1700	1700	720	1700
Volume to Capacity	0.47	0.45	0.00	0.07	0.63
Queue Length 95th (m)	18.0	0.0	0.0	1.7	0.0
Control Delay (s)	32.4	0.0	0.0	10.4	0.0
Lane LOS	D			B	
Approach Delay (s)	32.4	0.0		0.5	
Approach LOS	D				

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

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Appendix J

Signal Warrant Analysis

Input Sheet

Main Road	West Side Road
Minor Road	Barrick road
Direction of Main Road	North / South
Date:	18-Apr-24
No. of Lanes on Main	2 or more
T-Intersection	No
Operating Environment	Urban
Scenario	Forecasted Traffic Volumes (Existing Intersection)

Analysis Sheet

Justification 1: Minimum Vehicle Volumes

Justification	Guidance Approach Lanes				Total	Section Percent
	1 Lanes		2 or More Lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
1A (All Approach Lanes)	480	720	600	900		
				x		
	COMPLIANCE %				859	95%
1B (Minor Street Both Approaches)	120	170	120	170		
				x		
	COMPLIANCE %				139	82%
Signal Justification 1:						

Justification 2: Delay to Cross Traffic

Justification	Guidance Approach Lanes				Total	Section Percent
	1 lanes		2 or More lanes			
Flow Condition	FREE FLOW	RESTR. FLOW	FREE FLOW	RESTR. FLOW		
2A (Major Street Both Approaches)	480	720	600	900		
				x		
	COMPLIANCE %				720	80%
2B (Traffic Crossing Major Street)	50	75	50	75		
				x		
	COMPLIANCE %				65	87%
Signal Justification 2:						

Justification 3: Combination (Justification 1 and 2)

Justification Satisfied 80% or More	
Justification 1	Minimun Vehicular Volume
Justification 2	Delay Cross Traffic

Results Sheet

Justification		Compliance	Minimum Target	Signal Justified?	
				YES	NO
1. Minimum Vehicular Volume	A. Total Volume	95%	120%		NO
	B. Crossing Volume	82%			
2. Delay to Cross Traffic	A. Main Road	80%	120%		NO
	B. Crossing Road	87%			
3. Combination	A. Justificaton 1	82%	120%		NO
	B. Justification 2	80%			

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Appendix K

Zoning By-law 6575-30-18 Excerpts

Section 3: Parking Provisions

3.1 Parking Space Requirements

a) Except as otherwise provided in Section 3, the owner or occupant of any lot, building or structure used or erected for any of the purposes set forth in this By-law, shall provide and maintain for the sole use of the owner, occupant or other persons entering upon or making use of the said lot, building or structure from time to time, one or more parking spaces in accordance with the requirements of Section 3.1.1 and 3.1.2.

3.1.1 Parking Space Requirements for Residential Uses

Permitted Use	**No. of Spaces Required per Unit**
Apartment Building	1.25
Apartment Building, Public	1 space per 3 units
Bed and Breakfast	1 space per guest room
Dwelling, Accessory	1
Dwelling, Detached	1
Dwelling, Duplex	1
Dwelling, Fourplex	1
Dwelling, Semi-Detached	1
Dwelling, Townhouse Block	1
Dwelling, Townhouse Street	1
Dwelling, Triplex	1
Dwelling Unit, Accessory	1 (can be tandem)
Long Term Care Facility	0.4 per dwelling unit and per care bed
Supportive Living Facility	0.5

3.1.2 Parking Space Requirements for Non-Residential Uses

Permitted Use	
Adult Oriented Entertainment Establishment	Min 1 space per 20 square metres gfa
Animal Care Establishment	Min 1 space per 20 square metres gfa
Brew Pub	Min 1 space per 20 square metres gfa
Cannabis Production Facility	1 space for every employee on the largest shift
Cultural Facility	Min 1 space per 65 square metres gfa
Contractor's Yard	Min 1 space per 100 square metres gfa
Day Care	Min 1 space per 25 square metres gfa
Golf Course and Driving Range	18 per 9 holes of golf plus 1 per 27 square metres of club house
Heavy Equipment Sales and Service	Min 1 space per 35 square metres gfa

R.J. Burnside & Associates Limited