

Transportation Impact Study

PROPOSED RESIDENTIAL DEVELOPMENT

1187 West 5th Street
HAMILTON, ONTARIO

April 2022
Project No: NT-21-303

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CONSULTING ENGINEERS

NextEng Consulting Group Inc.

April 14, 2022

Attention: Mike Valvasori

1333664 Ontario Inc.
7049 Twenty Road E,
Hamilton, Ontario L0R 1P0

**Re: Transportation Impact Study
 Proposed Residential Development
 1187 West 5th Street, City of Hamilton
 Our Project No. NT-21-303**

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

The subject site is located at 1187 West 5th Street, on the west side of West 5th Street, north of Rymal Road W, in the City of Hamilton. The proposed development includes one mid-rise building (10-storey) with approximately 215 residential dwelling units. A full moves access will be provided onto West 5th Street to service the proposed development. The proposed development will provide a total of 232 vehicle parking spaces, including resident and visitor spaces, as well as 222 bicycle parking spaces to accommodate the proposed development.

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

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

Yours truly,

Nextrans Consulting Engineers

A Division of NextEng Consulting Group Inc.

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Report Submission Record

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Final Report	April 14, 2022	For Final Submission

EXECUTIVE SUMMARY

Nextrans Consulting Engineers (A Division of NextEng Consulting Group Inc.) was retained by 1333664 Ontario Inc. (the 'Client') to undertake a Transportation Impact Study in support of Official Plan Amendment and Zoning By-law Amendment Applications for a proposed residential development. The subject site is located at 1187 West 5th Street, on the west side of West 5th Street, north of Rymal Road W, in the City of Hamilton.

Proposed Development

Currently, the subject site is mostly vacant with two single-family detached residential units. The proposed development includes one mid-rise building (10-storey) with approximately 215 residential dwelling units.

Proposed Development Access

Under the existing conditions, the two existing residential units have two separate accesses onto West 5th Street. As part of the proposed development, one consolidated full moves access will be provided onto West 5th Street to accommodate the proposed development.

Based on the findings of this Study and Nextrans' assessment, the proposed access arrangement is reasonable and acceptable as it is optimized the developable lands and consistent with the context of the area and help eliminate any potential conflicts between pedestrians/cyclists and turning vehicles. The analysis indicates the proposed site access is expected to operate at acceptable levels of service with negligible delays or queues.

The proposed access lane configuration includes:

- One inbound lane (3.0 m);
- One shared left/right outbound lane (3.0 m);
- A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street

Capacity Analysis

The proposed development is expected to generate 83 total two-way trips (19 inbound and 64 outbound) and 84 total two-way trips (51 inbound and 33 outbound) during the morning and afternoon peak hours, respectively.

The analysis indicates that the proposed development generates very little auto trips, at most 1 vehicle every minute in the peak direction (i.e. morning inbound trip).

Auto Mode Assessment

Based on the intersection capacity analysis, under the existing traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is currently operating at acceptable levels of service. The Stone Church Road W/West 5th Street is currently operating at acceptable level of service during the morning and only the northbound left turn is operating over capacity during the afternoon peak hour. With signal timing optimization, this movement is expected to operate at acceptable level of service.

Based on the intersection capacity analysis, under the future background traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service. The Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed. The analysis indicates that the potential widening of Stone Church Road W from 2 to 4 lanes (i.e. to provide two through lanes per direction on Stone Church Road W) would

provide some operational improvements for the critical movements. However, it is a significant cost to the City and tax payer to widening this road given the property constraints and other social/environmental impacts.

Similar to the future background conditions, under the future total traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service. Similar to the future background conditions, under the future total traffic conditions, the Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed.

With the current climate change, it is Nexttrans' opinion that the City must invest in public transit for the future transportation sustainability of the City of Hamilton and to shift the mode of transportation from single-occupant-vehicle trips to transit and active transportation trips. This has been effectively proven in larger cities in the Greater Toronto Area such as Toronto and Mississauga.

In addition, with the ongoing COVID-19 pandemic, more residents are working from home and reduce the need to travel into the office. This trend will continue even after all restrictions are lifted because both employers and employees have invested in working from home equipment and conditions. It is Nexttrans' opinion that there will be a significant reduction in the need to travel to the office during the peak hours in the future.

For the reasons noted above, Nexttrans does not recommend the road widening option for the intersection of Stone Church Road W/West 5th Street. Nexttrans recommends that the City considers the signal timing optimization options provided in this Study as it is the most intuitive and responsible improvements that save the City and tax payer monies moving forward.

It should be noted that, regardless of Nexttrans suggestions for the signal timing plan optimization, it is in the City's discretion to review and optimize the signal timing plans at the City's intersections as required to serve their best interests and objectives for the City. It is Nexttrans' opinion that the intersection overall levels of service for these intersections are acceptable without signal timing optimization or physical improvements given that these are major intersections and they are expected to carry a significant amount of inter-city traffic. The suggested signal timing optimization will be carried for the future total conditions. In addition, as it is anticipated that the traffic conditions will change in the next 5 to 10 years, it is intuitive that the City will be required to review the signal timing plan periodically to ensure that the intersections are operating at their optimum conditions.

Active Transportation Mode Assessment

Walking

As indicated, West 5th Street between Rymal Road W and Stone Church Road W is semi-urban with curb and gutter along the east side, with rural treatment on the west side. The sidewalk is located on the east side of West 5th Street from the subject site to Rymal Road W is appeared to be asphalt and generally not in the best condition.

As part of the proposed development, it is recommended that concrete sidewalk be provided from the north limit of the site to the southerly limit of the site, i.e. along the frontage of the proposed development. The City can improve the rest of the sidewalk along the east side of West 5th Street in the future as part of future developments or through the City capital projects.

Cycling

Currently, there are dedicated bike lanes along Stone Church Road W from Golf Link Road to Paramount Drive/Mud Street W, along Rymal Road W from Hazelton Avenue to Spadara Drive and West 5th Street from Stone Church Road W to Marlowe Drive. The section of West 5th Street and Christie Street from Stone Church Road W to Malton Drive is a signed bicycle route. There are also dedicated cycling lanes for a short section of Upper Wellington south of Stone Church Road E and Rymal Road E, as well as along Garth Street between Stone Church Road W and Twenty Road W.

It is Nextrans' opinion that the cycling network in the area could be improved in the future, especially along West 5th Street and Christie Street to encourage more cycling trips to and from this area. These cycling facilities can be implemented as part of the future capital projects by the City of Hamilton. These facilities are beyond the scope of this Study.

To support active transportation and Transportation Demand Management (TDM), the proposed development will provide a total of 5 short-term bicycle parking spaces, which is not required by the current Zoning By-law for areas located outside the Downtown area. This provision will encourage residents and visitors to use active transportation mode.

Transit Mode Assessment

If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 3 two-way transit trips (1 inbound and 2 outbound) and 3 two-way transit trips (2 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

The proposed development is located approximately 350 m (about 5-minute walk) to Bus Routes 44 Rymal and 35 College stops located at the Rymal Road E/West 5th Street/Christie Street intersection, and about 650 m (about 10-minute walk) to Bus Route 43 Stone Church stops located at the Stone Church Road W/West 5th Street intersection.

It is Nextrans' opinion that the proposed development potential transit ridership (maximum of 3 customers) can be accommodated by the existing transit service in the area and no improvements are required to the existing transit network to accommodate the proposed development.

Vehicle Parking Review

Based on the City's By-Law No. 05-200, a total of 206 vehicle parking spaces are required for the proposed development. The proposed development will provide a total of 232 vehicle parking spaces, which slightly exceeds the minimum Zoning By-law requirement, but significantly less than the maximum. It is Nextrans' opinion that given the context of the area, this provision is acceptable.

Bicycle Parking Review

Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 113 bicycle parking spaces, which include 5 short-term and 108 long-term spaces. The proposed development will provide a total of 222 bicycle parking spaces, inclusive of short-term and long-term spaces, which almost double the minimum Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision will support and encourage new residents to take active modes of transportation instead of driving private vehicles.

Transportation Demand Management Measures and Incentives

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

Loading Requirement

The proposed development will provide one loading space for the condominium. AutoTURN software was used generate turning movement templates and to demonstrate the turning movement requirements for garbage pick-up and delivery vehicles at the proposed loading area and access onto West 5th Street.

Study Conclusions and Recommendations

Based on the findings of this Study, the following recommendations are provided:

- The proposed development implements the TDM measures and incentives identified in this report to support active transportation and transit and to reduce the numbers of single-occupant-vehicle trips to and from the proposed development;
- The proposed access lane configuration includes:
 - One inbound lane (3.0 m);
 - One shared left/right outbound lane (3.0 m);
 - A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street
- The proposed development provides concrete sidewalk along the frontage of the proposed development on east side of West 5th Street. Direct sidewalk connections from the proposed development to West 5th Street should be provided; and
- No additional physical improvements for the area at this time to accommodate the proposed development, under the future background and future total conditions.

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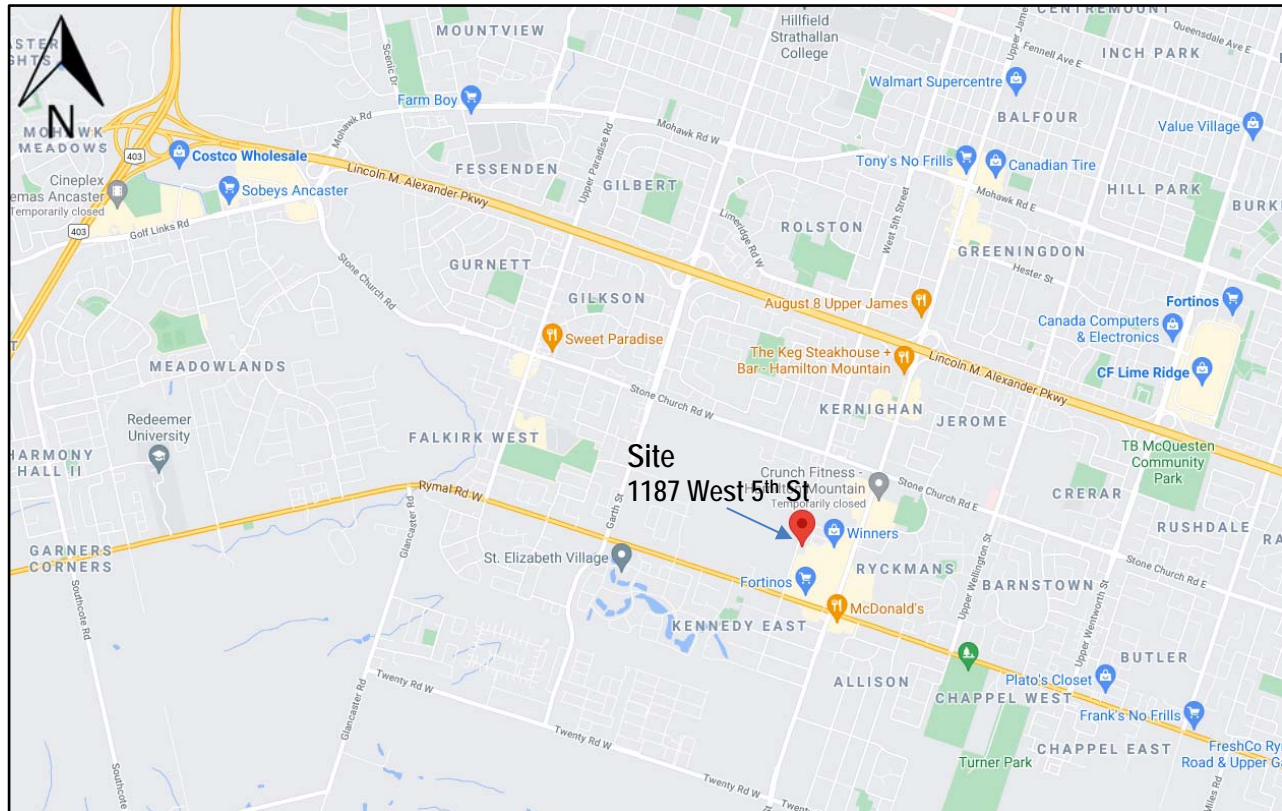
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1.0 INTRODUCTION

Nextrans Consulting Engineers (A Division of NextEng Consulting Group Inc.) was retained by 1333664 Ontario Inc. (the 'Client') to undertake a Transportation Impact Study in support of Official Plan Amendment and Zoning By-law Amendment Applications for a proposed residential development. The subject site is located at 1187 West 5th Street, on the west side of West 5th Street, north of Rymal Road W, in the City of Hamilton.

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

Figure 1 – Proposed Development Location



Source: Google Map

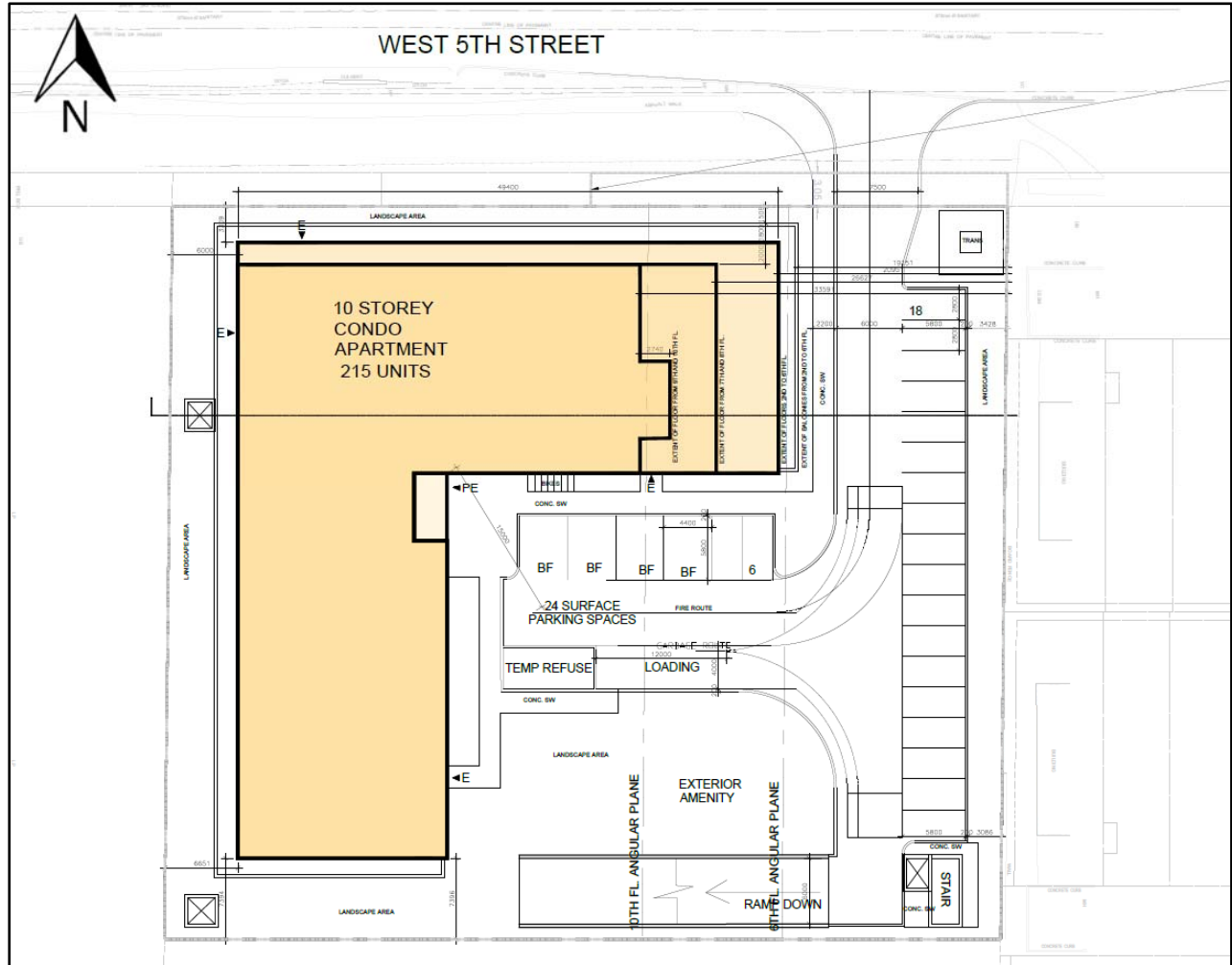
Currently, the subject site is mostly vacant with two single-family detached residential units. The proposed development includes one mid-rise building (10-storey) with approximately 215 residential dwelling units.

Under the existing conditions, the two existing residential units have two separate accesses onto West 5th Street. As part of the proposed development, one consolidated full moves access will be provided onto West 5th Street to accommodate the proposed development.

The proposed development will provide a total of 232 vehicle parking spaces, including resident and visitor spaces, as well as 222 bicycle parking spaces to accommodate the proposed development.

Figure 2 illustrates the proposed development site plan.

Figure 2 – Proposed Site Plan



2.0 EXISTING TRAFFIC CONDITIONS

2.1 Existing Road Network

As indicated, the subject site is located at 1187 West 5th Street, on the west side of West 5th Street, north of Rymal Road W, in the City of Hamilton.

West 5th Street between Rymal Road W and Stone Church Road W is semi-urban with curb and gutter along the east side, with rural treatment on the west side. The sidewalk is located on the east side of West 5th Street from the subject site to Rymal Road W is appeared to be asphalt and generally not the best conditions.

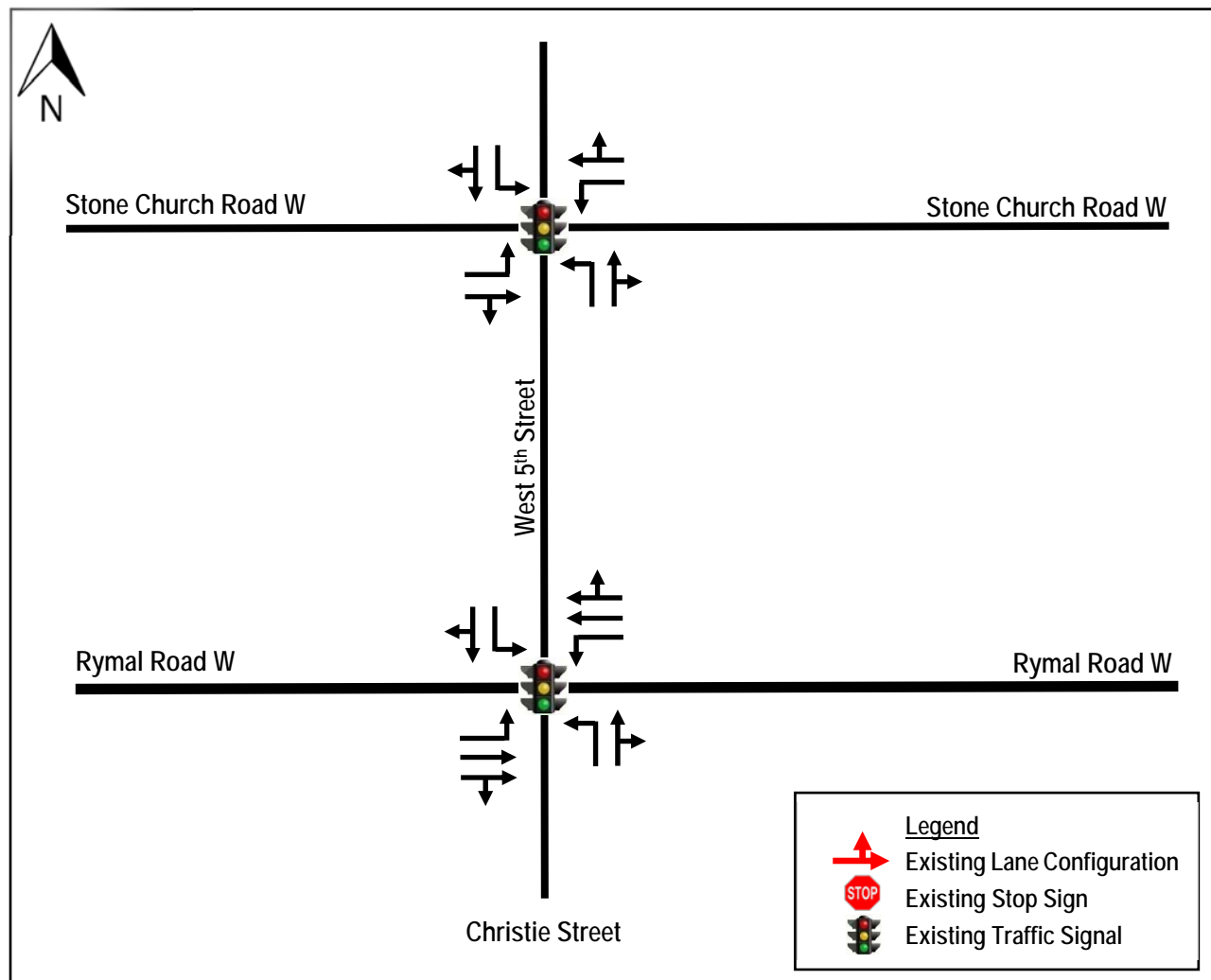
The description of the existing road network in the study area is summarizes in **Table 1** below.

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

Road Name	Jurisdiction	Number of Lanes	Speed	Road Type	Sidewalk/Cycling
West 5 th Street	City of Hamilton	2	50 km/h (posted)	Local	Sidewalk on east side of West 5 th Street
Christie Street	City of Hamilton	2	40 km/h (posted)	Local	Sidewalk on east side of Christie Street
Rymal Road West	City of Hamilton	4	60 km/h (posted)	Major Arterial	Sidewalk on both sides of Rymal Road E
Stone Church Road West	City of Hamilton	3	50 km/h (unposted)	Minor Arterial	Sidewalk on both sides of Stone Church Road W

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

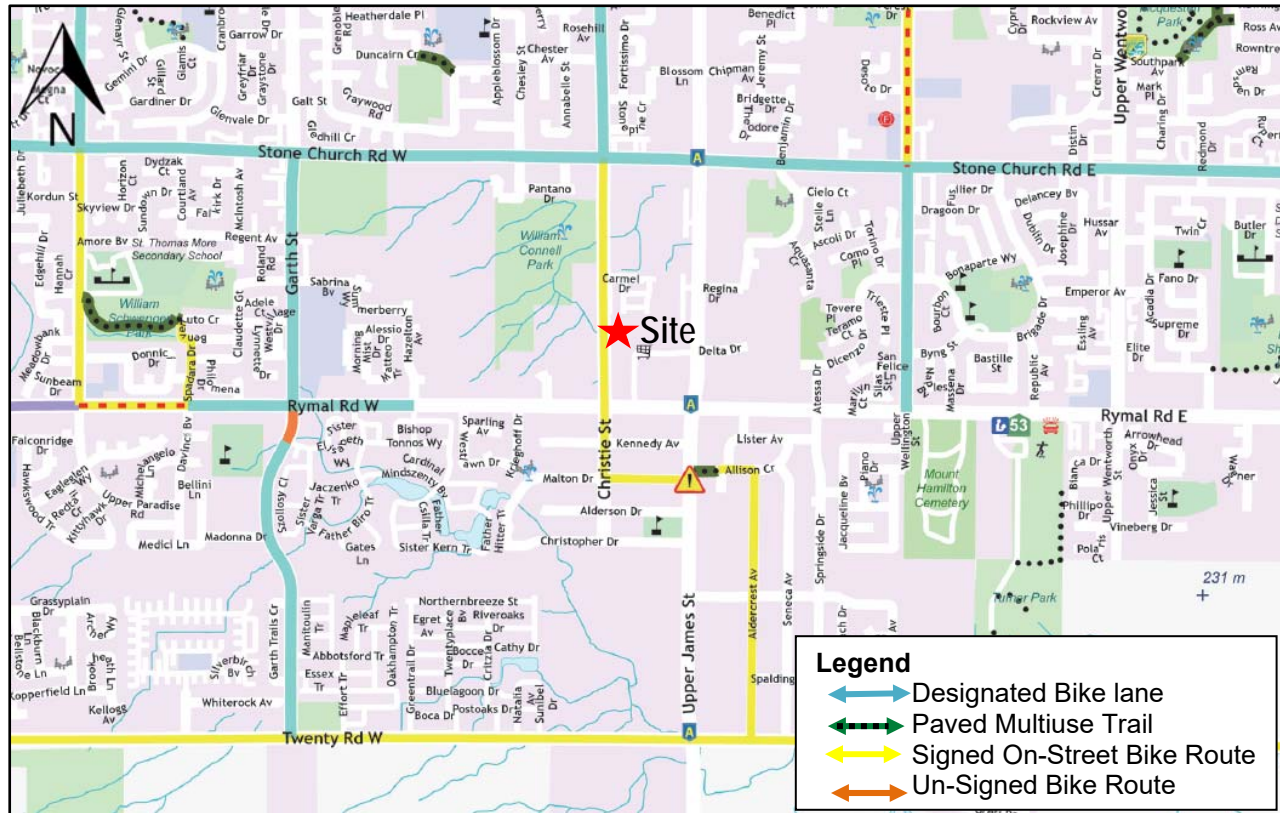
Figure 3 – Existing Lane Configuration and Traffic Control



2.2. Existing Active Transportation Network

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

Figure 4 – Existing Active Transportation Network in the Study Area



Source: Google Map/City of Hamilton Cycling Map

2.3. Existing Active Transportation Assessment

Walking

As indicated, West 5th Street between Rymal Road W and Stone Church Road W is semi-urban with curb and gutter along the east side, with rural treatment on the west side. The sidewalk is located on the east side of West 5th Street from the subject site to Rymal Road W is appeared to be asphalt and generally not in the best condition.

As part of the proposed development, it is recommended that concrete sidewalk be provided from the north limit of the site to the southerly limit of the site, i.e. along the frontage of the proposed development. The City can improve the rest of the sidewalk along the east side of West 5th Street in the future as part of future developments or through the City capital projects.

Cycling

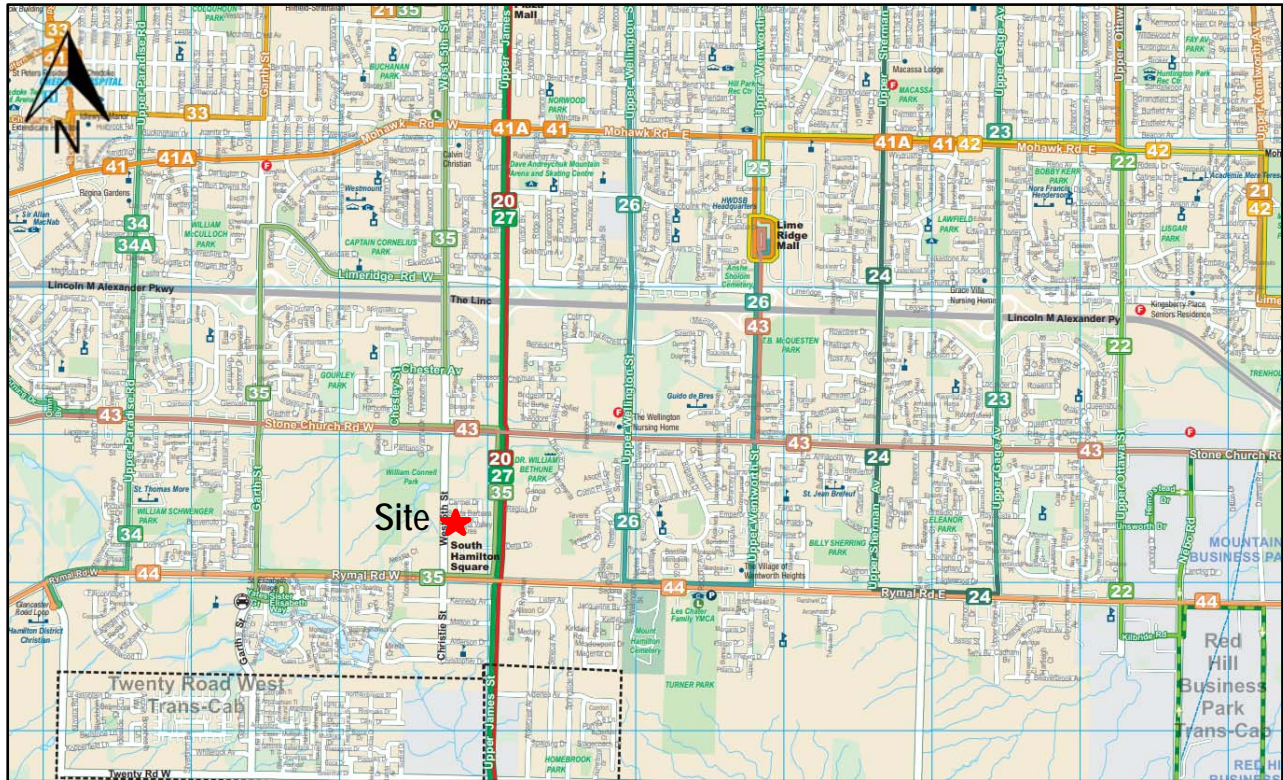
Currently, there are dedicated bike lanes along Stone Church Road W from Golf Link Road to Paramount Drive/Mud Street W, along Rymal Road W from Hazelton Avenue to Spadara Drive and West 5th Street from Stone Church Road W to Marlowe Drive. Th section of West 5th Street and Christie Street from Stone Church Road W to Malton Drive is a signed bicycle route. There are also dedicated cycling lanes for a short section of Upper Wellington south of Stone Church Road E and Rymal Road E, as well as along Garth Street between Stone Church Road W and Twenty Road W.

It is Nextrans' opinion that the cycling network in the area could be improved in the future, especially along West 5th Street and Christie Street to encourage more cycling trips to and from this area. These cycling facilities can be implemented as part of the future capital projects by the City of Hamilton. These facilities are beyond the scope of this Study.

2.4. Existing Hamilton Transit (HSR) System

The area is currently serviced by two existing HSR Transit Bus Routes 44 Rymal, 35 College and 43 Stone Church. Figure 5 illustrates the existing HSR Transit Bus Routes in the study area.

Figure 5 – Existing Hamilton Transit Network in the Study Area



Source: Hamilton Transit website

The proposed development is located approximately 350 m (about 5-minute walk) to Bus Routes 44 Rymal and 35 College stops located at the Rymal Road E/West 5th Street/Christie Street intersection, and about 650 m (about 10-minute walk) to Bus Route 43 Stone Church stops located at the Stone Church Road W/West 5th Street intersection. It is Nexttrans' opinion that the proposed development will contribute a healthy transit ridership for the existing Hamilton transit system in the area. Below are the bus route descriptions based on the information provided on the Hamilton Transit Website (<https://www.hamilton.ca/hsr-bus-schedules-fares>):

- **Route 44 Rymal** – The Rymal route travels generally in the east - west direction from Stoney Creek Walmart to Ancaster Business Park via Eastgate Square. This service runs 7 days a week from the early morning until after midnight. The service frequency is approximately 30-minute during the weekday peak periods and weekend peak periods.
- **Route 43 Stone Church** – The STONE CHURCH route travels east - west from Highland at Saltfleet School to the Meadowlands Terminal. This service runs 7 days a week from the early morning until after midnight. The service frequency is approximately 30-minute during the weekday peak periods and weekend peak periods.
- **Route 35 College** – The COLLEGE route travels north - south from downtown Hamilton at the MacNab Terminal Platform #6 to St. Elizabeth Village. This service runs 7 days a week from the early morning until after midnight. The service frequency is approximately 15-minute during the weekday peak periods and weekend peak periods.

2.3. Existing Area Context

Nexttrans has conducted a comprehensive review of the area. The majority of the existing low-rise residential

neighbourhoods are located to the north, south and east of the subject site. There is an existing South Hamilton Square shopping centre located immediately east of the subject site and along both sides of Upper James Street between Rymal Road and Stone Church Road. Corpus Christi Catholic Elementary School is located south of the site at Christopher Drive and Upper James Street, James Macdonald Public School located north of the site at Appleblossom Drive and Chester Avenue. The William Connell City-Wide Park is located 3-minute walk north of the subject site.

2.4. Existing Traffic Volumes

Existing traffic volumes at the study area intersections were undertaken by Spectrum on Thursday October 4, 2018 during the morning (7:00 a.m. to 10:00 a.m.) and afternoon (4:00 p.m. to 7:00 p.m.) peak periods for the Stone Church Road W/West 5th Street intersection. The turning movement counts for the Rymal Road W/West 5th Street/Christie Street intersection were obtained from the City of Hamilton (Thursday June 28, 2018). It should be noted that the Turning movement counts are summarized in **Appendix A**. The existing volumes are illustrated in **Figure 6**.

2.5. Existing Traffic Assessment

The existing volumes in **Figure 6** were analyzed using Synchro Version 10 software. The methodology of the software follows the procedures described and outlined in the Highway Capacity Manual, HCM 2000, published by the Transportation Research Board. It should be noted that the printouts for unsignalized intersections are based on HCM outputs and the results for signalized intersections are based on Synchro so that queues and more detailed information are provided. The signal timing plans for the signalized intersections were obtained from the City of Hamilton and incorporated into the analysis. The results are provided in **Appendix B** and summarized in **Table 2**.

Figure 6 – Existing Traffic Volumes

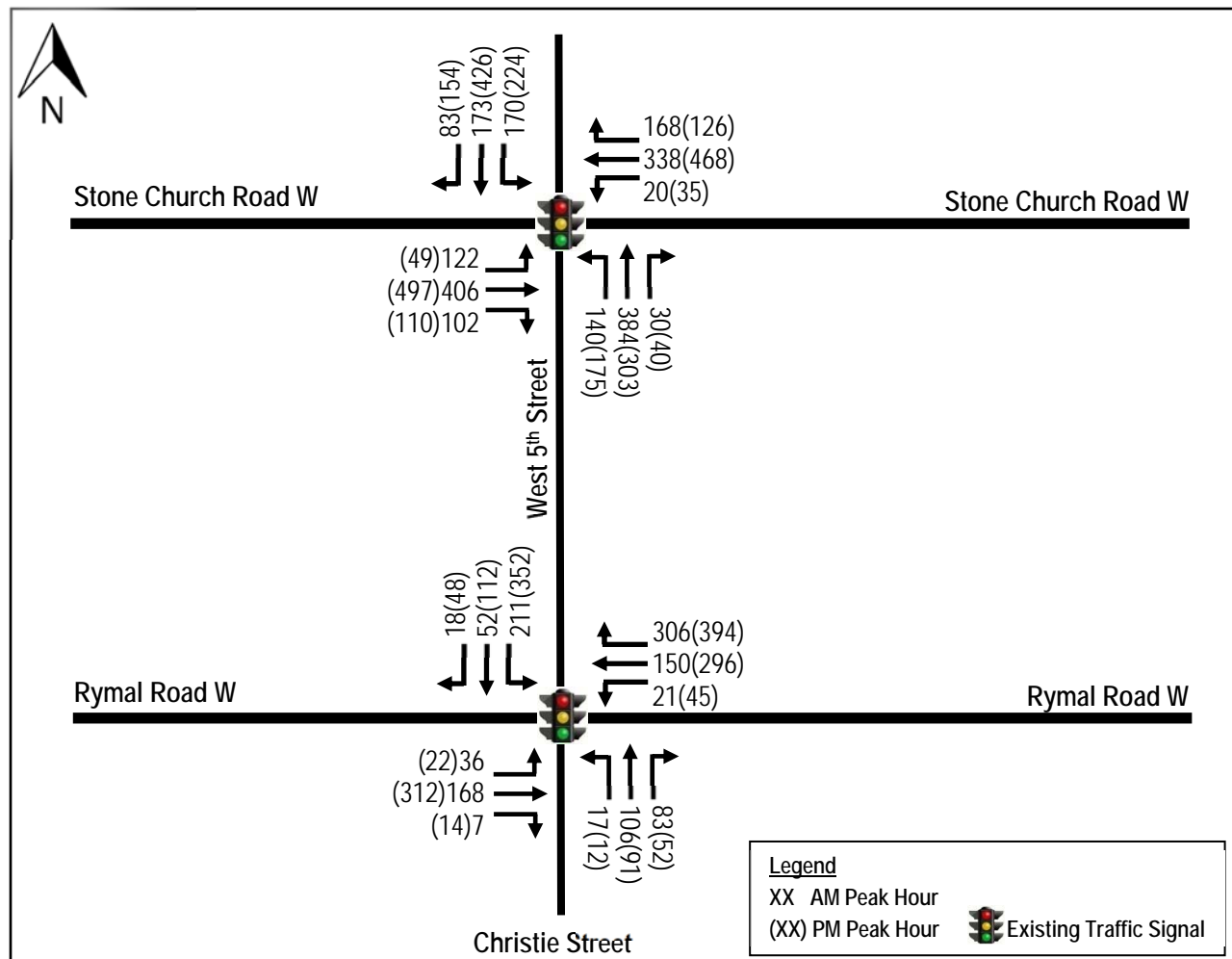


Table 2 – Existing Levels of Service

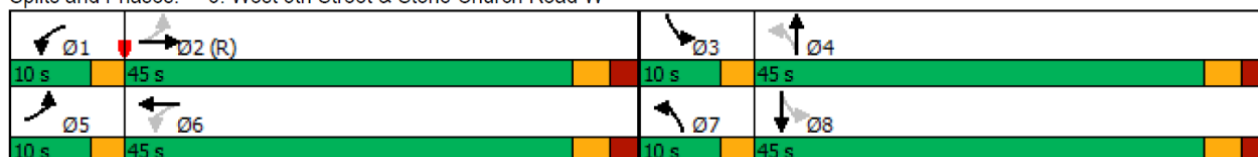
Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length (m)
		LOS (v/c)	Delay (s)	95 th Queue (m)	LOS (v/c)	Delay (s)	95 th Queue (m)	
Rymal Road W/ West 5 th Street/ Christie Street (Signalized)	OVERALL	C (0.86)	25		C (0.93)	28		
	EB – L	A (0.05)	9	8	B (0.05)	11	6	40
	EB – TR	B (0.13)	20	21	C (0.24)	21	37	300
	WB – L	A (0.03)	9	6	B (0.07)	11	10	35
	WB – TR	A (0.32)	7	22	B (0.48)	12	46	350
	NB – L	C (0.06)	26	8	C (0.03)	23	6	15
	NB – TR	C (0.42)	27	44	C (0.24)	21	34	140
	SB – L	E (0.86)	71	71	E (0.93)	70	125	20
SB – TR	C (0.15)	27	17	C (0.27)	33	40	300	
Stone Church Road W/ West 5 th Street (Signalized)	OVERALL	D (0.85)	35		D (1.32)	49		
	EB – L	B (0.37)	15	25	B (0.18)	14	11	55
	EB – TR	C (0.61)	25	144	C (0.77)	34	186	300
	WB – L	B (0.07)	13	6	B (0.13)	14	9	55
	WB – TR	C (0.70)	31	141	D (0.79)	37	182	300
	NB – L	D (0.49)	44	51	F (1.32)	223	100	30
	NB – TR	E (0.85)	59	133	D (0.60)	50	107	300
	SB – L	D (0.82)	51	52	C (0.65)	31	51	55
SB – TR	C (0.41)	24	60	D (0.80)	37	162	200	
Stone Church Road W/ West 5 th Street (Signalized) With signal timing optimization	OVERALL				D (0.93)	46		
	EB – L				B (0.22)	18	13	55
	EB – TR				D (0.83)	41	206	300
	WB – L	Not required	Not required	Not required	B (0.15)	17	10	55
	WB – TR				D (0.86)	45	201	300
	NB – L				E (0.88)	70	65	30
	NB – TR				D (0.54)	45	104	300
	SB – L				C (0.58)	25	47	55
SB – TR				E (0.93)	56	191	200	

Based on the intersection capacity analysis, under the existing traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is currently operating at acceptable levels of service.

The Stone Church Road W/West 5th Street is currently operating at acceptable level of service during the morning and only the northbound left turn is operating over capacity during the afternoon peak hour. With signal timing optimization, this movement is expected to operate at acceptable level of service. The suggested signal timing optimization (which is only required to add an advance green to the northbound left turn) is illustrated below:

PM Peak Hour

Splits and Phases: 6: West 5th Street & Stone Church Road W



It should be noted that, regardless of Nexttrans suggestions for the signal timing plan optimization, it is in the City's discretion to review and optimize the signal timing plans at the City's intersections as required to serve their best interests and objectives for the City. It is Nexttrans' opinion that the intersection overall levels of service for these intersections are acceptable without signal timing optimization or physical improvements given that these are major intersections and they are expected to carry a significant amount of inter-city traffic. The suggested signal timing optimization will be carried for the future background conditions.

In addition, as it is anticipated that the traffic conditions will change in the next 5 to 10 years, it intuitive that the City will be required to review the signal timing plan periodically to ensure that the intersections are operating at their optimum conditions.

3.0 TRANSPORTATION PLANNING CONTEXT IN THE AREA

3.1. Existing Land Use Context and Amenities

Nextrans has conducted a comprehensive review of the area. The majority of the existing low-rise residential neighbourhoods are located to the north, south and east of the subject site.

There is an existing South Hamilton Square shopping centre located immediately east of the subject site and along both sides of Upper James Street between Rymal Road and Stone Church Road. Corpus Christi Catholic Elementary School is located south of the site at Christopher Drive and Upper James Street, James Macdonald Public School located north of the site at Appleblossom Drive and Chester Avenue. The William Connell City-Wide Park is located 3-minute walk north of the subject site.

3.2. Transportation Planning Context

As the existing area today is developed based on the traditional urban sprawl planning with low-rise residential and big box shopping centre where residents will have to drive to school, work, or shopping. It is anticipated that the majority of the mode of transportation in this area would be driving private cars.

It is Nextrans' opinion that the proposed development, a compact development that is different from traditional urban sprawl, will contribute a healthy transit ridership for the existing Hamilton transit system in the area and provide more housing options for the residents. This type of development should be encouraged and embraced in the City of Hamilton. As part of this Study, Nextrans will provide appropriate recommendations that the proposed development can implement to continue to contribute positively to the area and community.

4.0 FUTURE BACKGROUND CONDITIONS

4.1. Analysis Horizon

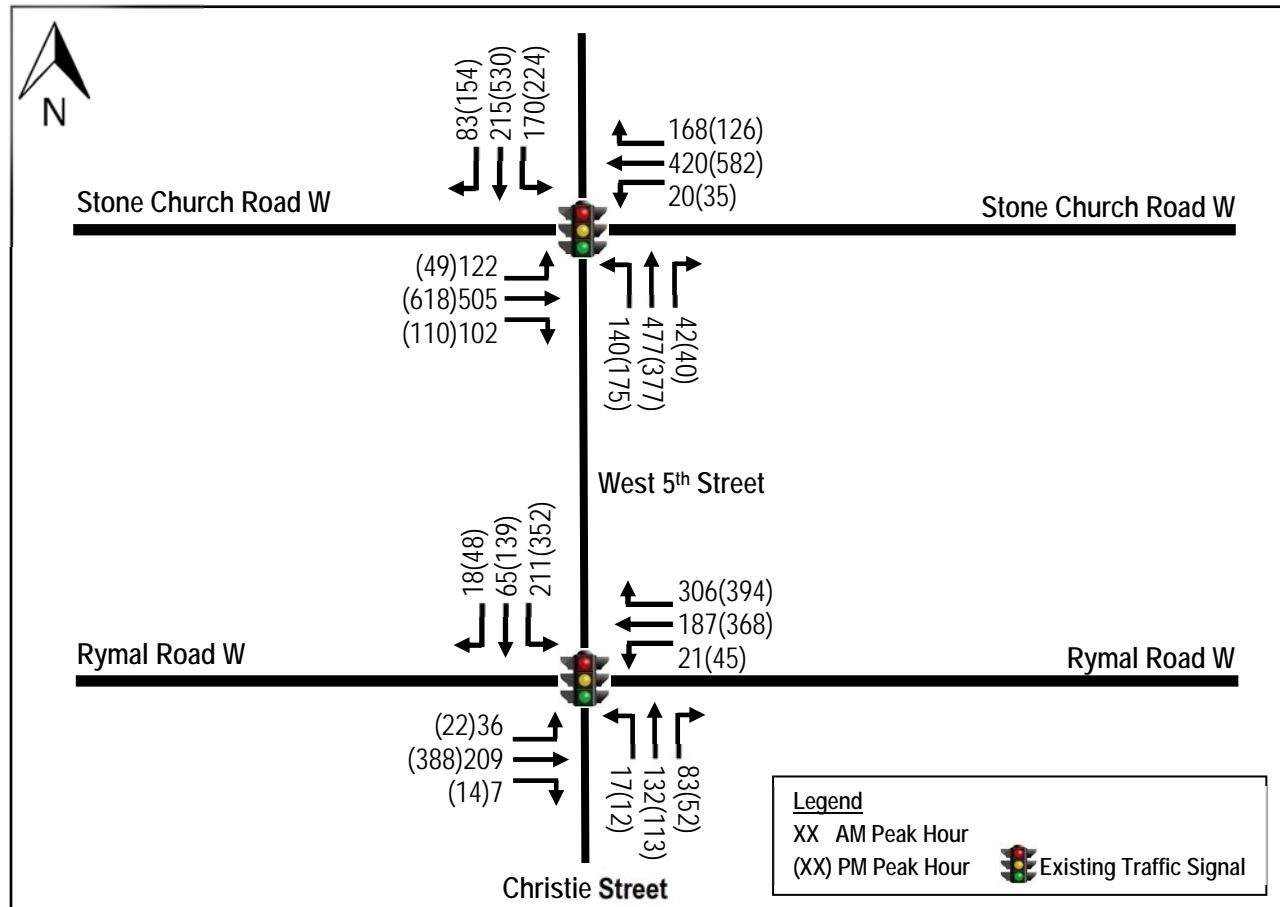
For the purposes of this assessment, it is assumed that the proposed development will be completed by 2024 and therefore a five-year horizon (2029) has been carried out for the study analysis. This provision is consistent with the City of Hamilton's Traffic Impact Study Guidelines.

4.2. Future Background Corridor Growth

Based on the City of Hamilton's requirement, a 2% per annum compounded growth rate will be applied to through movements for the horizon year indicated above. This is equivalent to 22% total growth from 2018 to 2029 for the through turning movements.

Figure 7 illustrates the future background traffic growth for the area intersections for the analysis.

Figure 7 – 2029 Background Corridor Through Growth Traffic Volumes



4.3. Background Development Applications

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

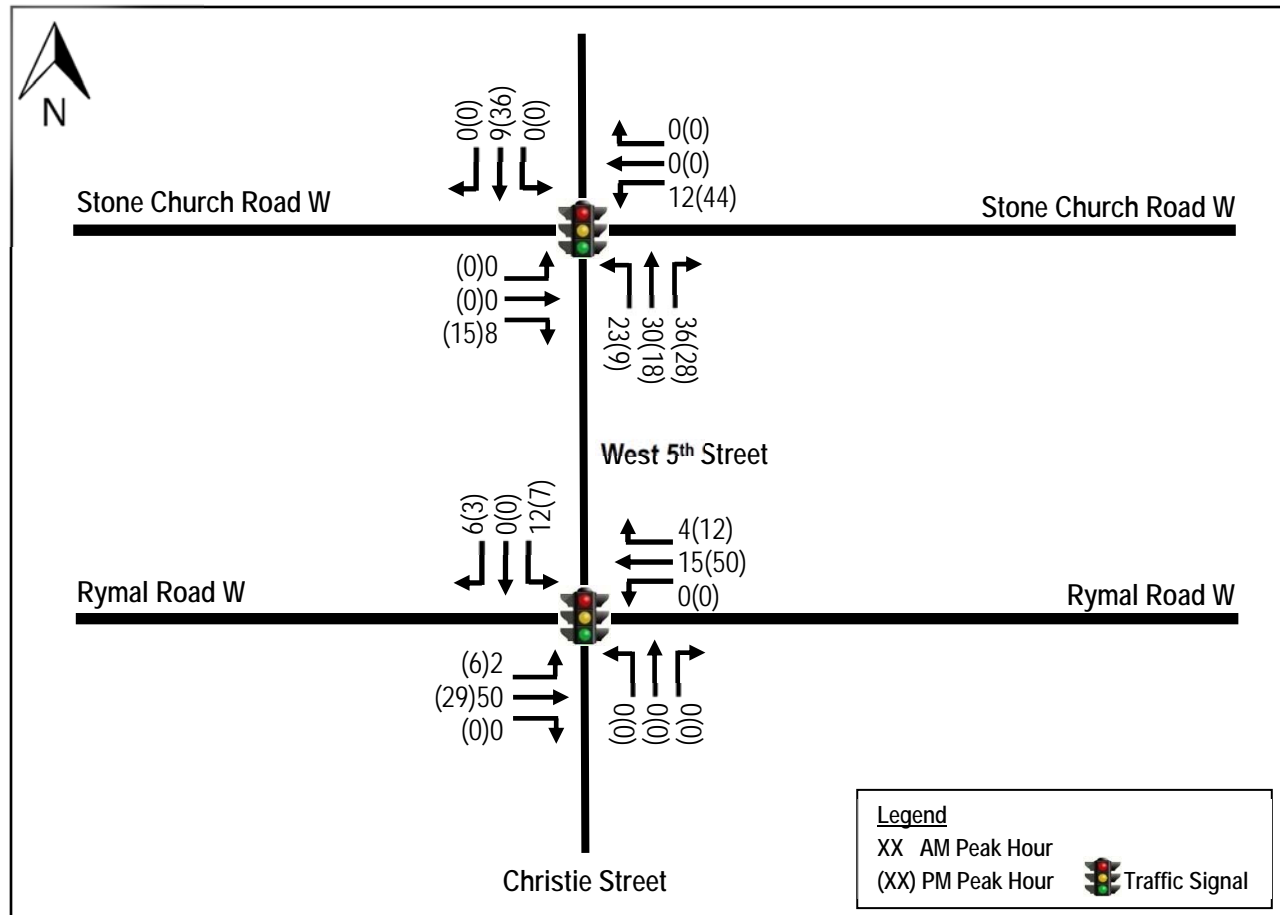
Based on this information, the following background developments will be included in the analysis:

- 1125 West 5th Street – proposed 130 residential townhouse units
- 1029 West 5th Street – proposed 9-storey 216 residential units
- 186, 172, 178 Rymal Road W – proposed 153 residential townhouse units
- 26 Rymal Road W – proposed 44 residential townhouse units

The trip generation for the background developments is estimated based on the *Trip Generation Manual, 10th Edition* published by the Institute of Transportation Engineers (ITE). This information is included in **Appendix C**. The proposed background development trip distribution and assignment are based on the information contain in the 2016 Transportation Tomorrow Survey (TTS), which is included in Tables 5 and 6, and detailed analysis is included in **Appendix E**.

Figure 8 illustrates the background development traffic volumes.

Figure 8 – Background Development Traffic Volumes



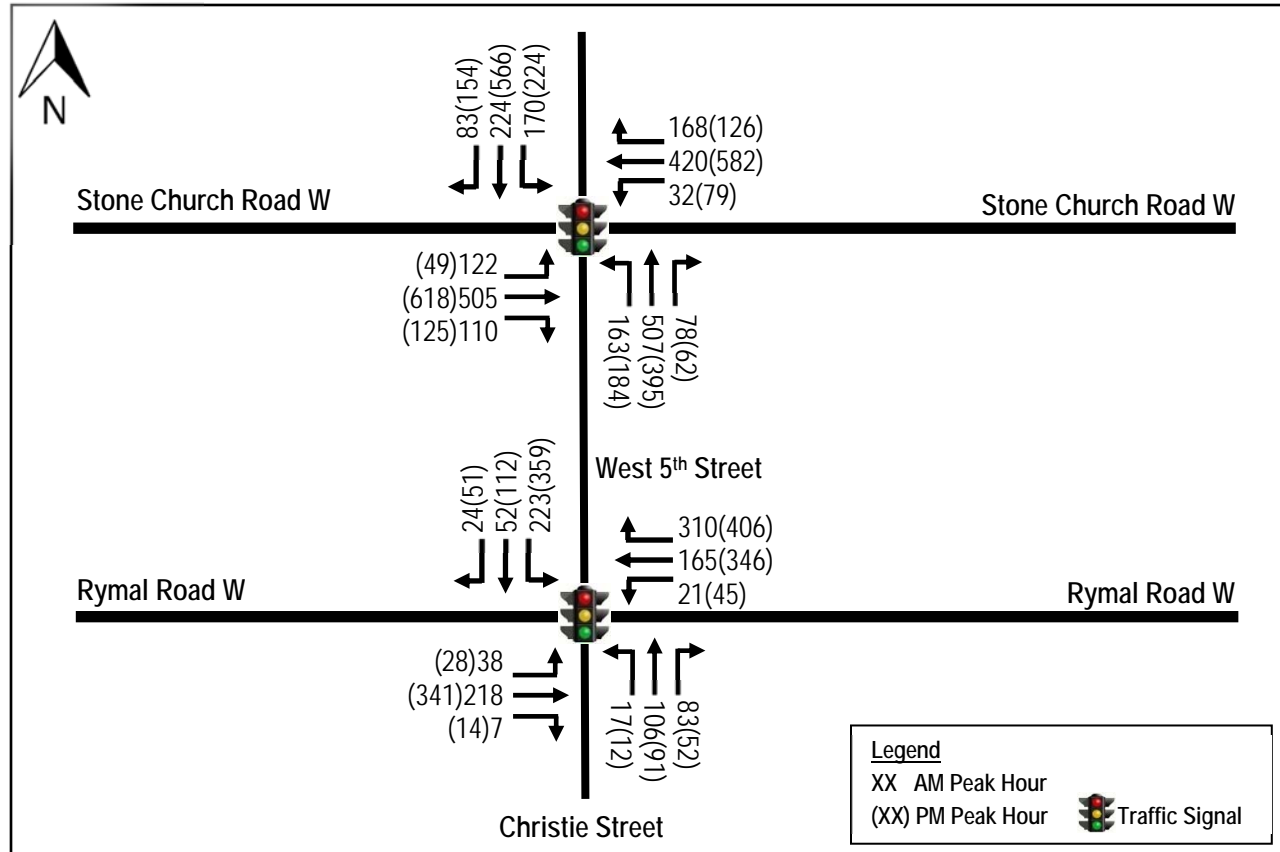
4.4. Future Background Traffic Assessment

The estimated 2029 future background traffic volumes are illustrated in Figure 9 and were analyzed using Synchro Version 10 software. The detailed calculations are provided in Appendix D and summarized in Table 3.

Table 3 – 2029 Future Background Levels of Service

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length (m)
		LOS (v/c)	Delay (s)	95 th Queue (m)	LOS (v/c)	Delay (s)	95 th Queue (m)	
Rymal Road W/ West 5 th Street/ Christie Street (Signalized)	OVERALL	C (0.87)	25		C (0.94)	27		
	EB – L	A (0.06)	9	9	B (0.07)	11	7	40
	EB – TR	C (0.17)	20	26	C (0.26)	22	40	330
	WB – L	A (0.03)	9	6	B (0.08)	11	10	35
	WB – TR	A (0.34)	8	24	B (0.53)	15	58	320
	NB – L	C (0.06)	26	8	C (0.03)	23	6	15
	NB – TR	C (0.41)	27	44	C (0.24)	21	34	120
	SB – L	E (0.87)	70	71	E (0.94)	68	140	20
	SB – TR	C (0.16)	27	18	C (0.27)	23	40	350
Stone Church Road W/ West 5 th Street (Signalized)	OVERALL	D (1.07)	53		E (1.09)	76		
	EB – L	C (0.54)	22	25	C (0.35)	27	16	55
	EB – TR	D (0.83)	38	208	F (1.09)	101	331	320
	WB – L	B (0.17)	15	9	D (0.57)	38	25	55
	WB – TR	D (0.87)	43	193	E (1.01)	79	310	350
	NB – L	D (0.52)	43	57	F (0.97)	92	91	30
	NB – TR	F (1.07)	99	229	D (0.62)	36	144	350
	SB – L	E (0.91)	68	67	D (0.70)	37	56	55
	SB – TR	D (0.45)	24	75	F (1.05)	90	315	350

Figure 9 – 2029 Future Background Traffic Volumes



Based on the intersection capacity analysis, under the future background traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service.

The Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed, however, some cannot under this horizon year due to high growth rate. There are several explanations for these critical movements:

- The area is located adjacent to a big box shopping centre. It is expected that the afternoon peak hour traffic volumes will be high due to discretionary trips;
- The anticipated growth of 2% per annum is high for the area given that immediate background development traffic volumes have been added to the intersection as well;
- As the total growth would be 22% from 2018 to 2029 plus the background development which will add 5% to 10%, the total growth could be up to 30%. Therefore, it is recommended that the City monitors the growth rate at this intersection in the future; and
- There is only one through lane per direction for both Stone Church Road W and West 5th Street.

For illustration purposes, Nexttrans has conducted both signal timing optimization for this intersection, as well as potential widening of Stone Church Road W from 2 lanes to 4 lanes cross-section. **Table 4** summarizes the intersection operational results for both signal timing optimization and geometric improvement scenarios.

Table 4 – 2029 Future Background Levels of Service with Signal Timing Optimization and Improvements

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length (m)
		LOS (v/c)	Delay (s)	95 th Queue (m)	LOS (v/c)	Delay (s)	95 th Queue (m)	
Stone Church Road W/ West 5 th Street (Signalized) With signal timing optimization	OVERALL	D (0.96)	52		E (1.09)	76		
	EB – L	D (0.66)	35	38	C (0.35)	27	16	55
	EB – TR	D (0.91)	50	227	F (1.09)	101	331	320
	WB – L	B (0.21)	18	10	D (0.57)	38	25	55
	WB – TR	E (0.96)	61	212	E (1.01)	79	310	350
	NB – L	C (0.41)	22	40	F (0.97)	92	91	30
	NB – TR	E (0.96)	65	209	D (0.62)	36	144	350
	SB – L	E (0.91)	68	66	D (0.70)	37	56	55
SB – TR	C (0.51)	29	81	F (1.05)	90	315	350	
Stone Church Road W/ West 5 th Street (Signalized) With widening of Stone Church Road W from 2 to 4 lane	OVERALL	D (0.96)	37		D (0.97)	43		
	EB – L	B (0.38)	19	28	C (0.20)	24	16	55
	EB – TR	C (0.48)	25	77	D (0.63)	38	113	320
	WB – L	B (0.12)	16	10	C (0.34)	27	24	55
	WB – TR	C (0.50)	26	69	D (0.61)	37	107	350
	NB – L	C (0.42)	22	40	E (0.89)	69	78	30
	NB – TR	E (0.96)	65	209	C (0.57)	29	124	350
	SB – L	E (0.91)	68	66	C (0.60)	25	47	55
SB – TR	C (0.51)	29	81	E (0.97)	63	273	350	

Traffic Signal Optimization Scenario

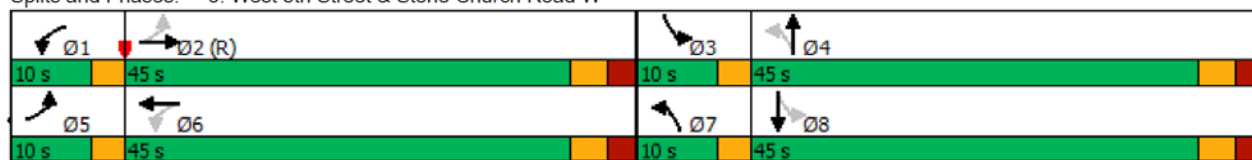
Under the scenario with traffic signal optimization, the morning peak hour operations can be improved significantly. However, during the afternoon peak hour, the analysis shows that some movements are expected to operate at higher delays. It is Nextrans’ opinion that it is still acceptable from overall intersection operation perspective and this is the conditions along major intersections located adjacent to shopping centres during the afternoon peak hour.

It should be noted that, regardless of Nextrans suggestions for the signal timing plan optimization, it is in the City’s discretion to review and optimize the signal timing plans at the City’s intersections as required to serve their best interests and objectives for the City. It is Nextrans’ opinion that the intersection overall levels of service for these intersections are acceptable without signal timing optimization or physical improvements given that these are major intersections and they are expected to carry a significant amount of inter-city traffic. The suggested signal timing optimization will be carried for the future total conditions. In addition, as it is anticipated that the traffic conditions will change in the next 5 to 10 years, it intuitive that the City will be required to review the signal timing plan periodically to ensure that the intersections are operating at their optimum conditions.

The suggested signal timing optimization plans are illustrated below:

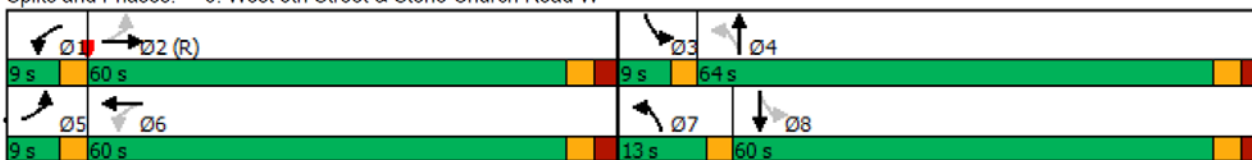
AM Peak Hour

Splits and Phases: 6: West 5th Street & Stone Church Road W



PM Peak Hour

Splits and Phases: 6: West 5th Street & Stone Church Road W



Road Widening Scenario

The analysis indicates that the potential widening of Stone Church Road W from 2 to 4 lanes (i.e. to provide two through lanes per direction on Stone Church Road W) would provide some operational improvements for the critical movements. However, it is a significant cost to the City and tax payer to widening this road given the property constraints and other social/environmental impacts.

It is Nextrans' opinion that physical improvements such as road widenings are not always the best solutions to solve congestion and delay at existing intersections as road widenings may create some capacity, however, this capacity will be utilized as soon as it becomes available to other drivers and support increased traffic usage. This called induced traffic demand. As Stone Church Road W currently has dedicated cycling lanes, road widenings will impact pedestrian and cyclist crossing distance at the intersection, which will result in operational and safety concerns for pedestrian and cyclist.

With the current climate change, it is Nextrans' opinion that the City must invest in public transit for the future transportation sustainability of the City of Hamilton and to shift the mode of transportation from single-occupant-vehicle trips to transit and active transportation trips. This has been effectively proven in larger cities in the Greater Toronto Area such as Toronto and Mississauga.

In addition, with the ongoing COVID-19 pandemic, more residents are working from home and reduce the need to travel into the office. This trend will continue even after all restrictions are lifted because both employers and employees have invested in working from home equipment and conditions. It is Nextrans' opinion that there will be a significant reduction in the need to travel to the office during the peak hours in the future.

For the reasons noted above, Nextrans does not recommend the road widening option for the intersection of Stone Church Road W/West 5th Street. Nextrans recommends that the City considers the signal timing optimization options provided in this Study as it is the most intuitive and responsible improvements that save the City and tax payer monies moving forward.

5.0 SITE TRAFFIC

5.1. Proposed Development

The proposed development includes one mid-rise building (6-storey) with approximately 65 residential dwelling units. A full moves access will be provided onto West 5th Street to service the proposed development.

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

5.2. Site Trip Generation

The trip generation forecasts were undertaken using the information contained in the *Trip Generation Manual, 11th Edition* published by the Institute of Transportation Engineers (ITE).

For the purposes of this assessment, the ITE Land Use Codes (LUC) 221 "Multifamily Housing (Mid-Rise) Not Close to Rail Transit" fitted curve equations have been utilized for the proposed development. The site trip generation is summarized in **Table 5**.

Table 5 – Site Traffic Trip Generation

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise) LUC 221 Not Close to Rail Transit	215	Trip Rates AM - T = 0.44(X) - 11.61 PM - T = 0.39(X) + 0.34	0.09	0.30	0.39	0.24	0.15	0.39
		Total Trips	19	64	83	51	33	84

The proposed development is expected to generate 83 total two-way trips (19 inbound and 64 outbound) and 84 total two-way trips (51 inbound and 33 outbound) during the morning and afternoon peak hours, respectively. The analysis indicates that the proposed development generates very little auto trips, at most 1 vehicle every minute in the peak direction (i.e. morning inbound trip).

5.3. Site Trip Distribution Based on 2016 TTS Data

The 2016 Transportation Tomorrow Survey (TTS) data was reviewed for Traffic Zones 5021, 5026, 5032, 5037, 5242, 5243, 5244 and 5245 in order to estimate the general trip distribution for the proposed development.

Table 6 summarizes general distribution based on the 2016 TTS data for the proposed development, with Table 7 summarizing the site traffic assignment. It should be noted that the auto site trip distribution and assignment have been taken into consideration the TTS information, existing intersection operations and capacity constraints.

Table 6 – General Site Trip Distribution

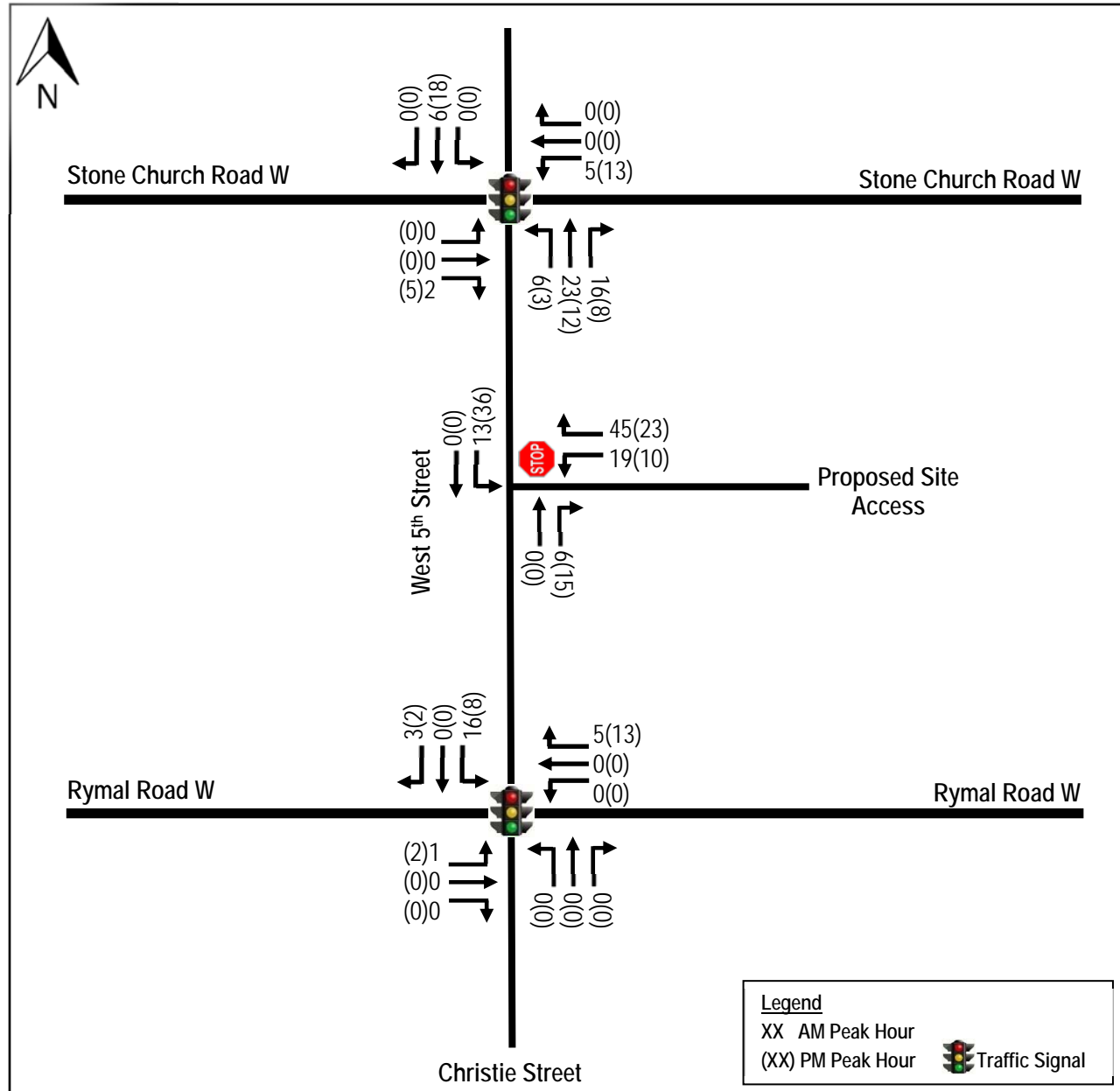
Toronto	Peel Region	York Region	Halton Region	City of Hamilton	Hamilton Area	Niagara Region	Waterloo Region	Glanbrook
1%	1%	1%	5%	65%	7%	8%	6%	6%

Table 7 – Site Trip Assignment

General Direction (To/From)	Inbound	Outbound
North (West 5 th Street, Upper James St)	38%	38%
South (West 5 th Street, Christie Street, Upper James St)	18%	18%
East (Rymal Road W, Stone Church Road W)	32%	32%
West (Rymal Road W, Stone Church Road W)	12%	12%
Total	100%	100%

Figure 10 illustrates the proposed development generated traffic volumes for the proposed development.

Figure 10 – Site Traffic Volumes

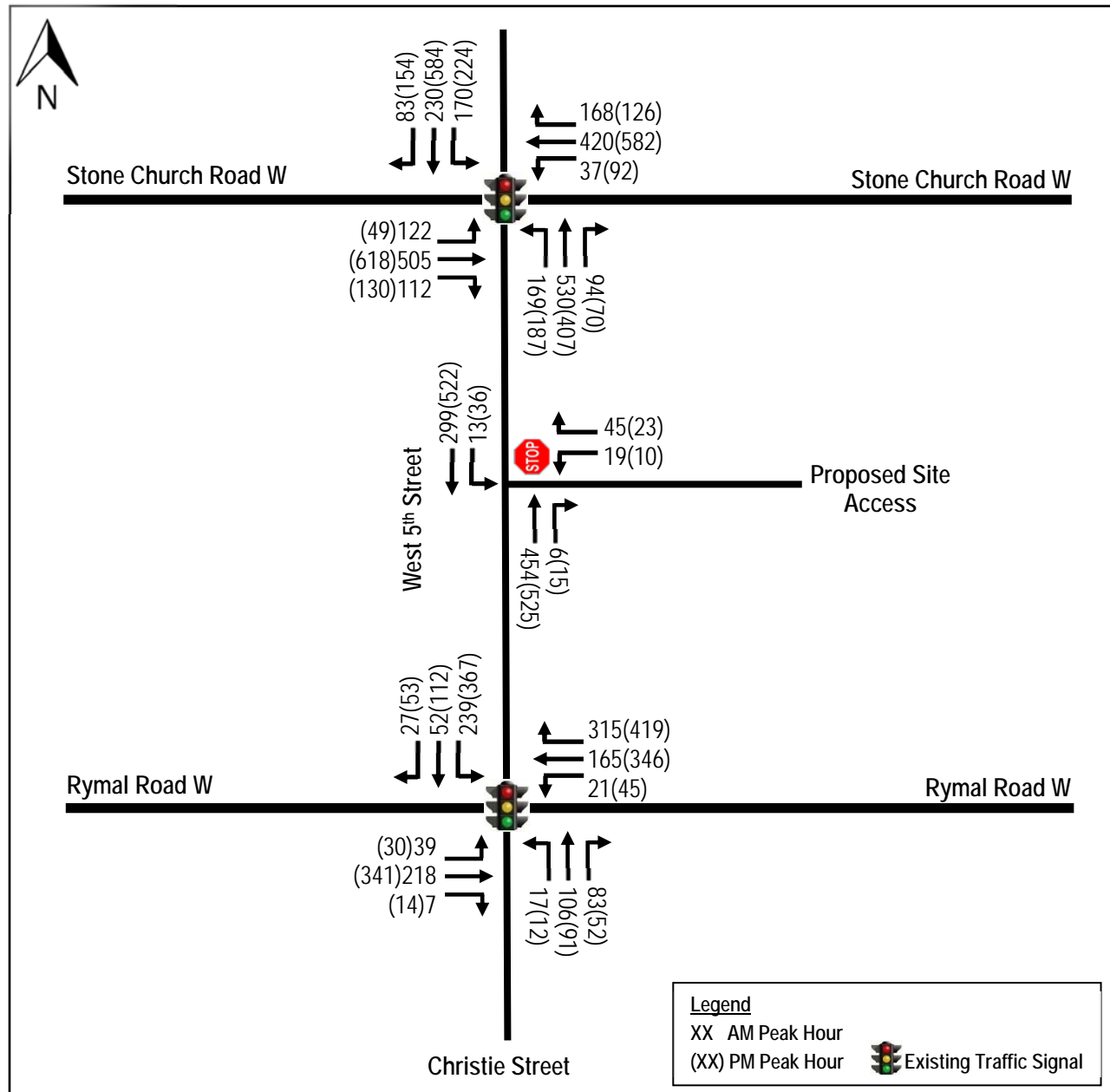


6.0 FUTURE TOTAL TRAFFIC CONDITIONS

6.1. Future Total Traffic Assessment for Auto Mode

The estimated future total traffic volumes (future background traffic volumes plus site generated traffic volumes) are illustrated in **Figure 11**, and were analyzed using Synchro Version 10 software. The detailed calculations are provided in **Appendix E** and summarized in **Table 8**.

Figure 11 – 2029 Future Total Traffic Volumes



Based on the intersection capacity analysis, similar to the future background conditions, under the future total traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service.

Similar to the future background conditions, under the future total traffic conditions, the Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed.

Table 8 – 2029 Future Total Levels of Service

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour			Available Storage Length (m)
		LOS (v/c)	Delay (s)	95 th Queue (m)	LOS (v/c)	Delay (s)	95 th Queue (m)	
Rymal Road W/ West 5 th Street/ Christie Street (Signalized)	OVERALL	C (0.88)	25		C (0.95)	28		
	EB – L	A (0.06)	9	9	B (0.08)	11	7	40
	EB – TR	C (0.17)	20	26	C (0.26)	22	40	330
	WB – L	A (0.03)	9	6	B (0.08)	11	10	35
	WB – TR	A (0.34)	8	24	B (0.53)	15	59	320
	NB – L	C (0.06)	25	8	C (0.03)	23	6	15
	NB – TR	C (0.39)	26	44	C (0.24)	21	34	120
	SB – L	E (0.88)	66	75	E (0.95)	69	144	20
SB – TR	C (0.16)	23	17	C (0.27)	23	41	350	
Stone Church Road W/ West 5 th Street (Signalized) With signal timing optimization	OVERALL	D (0.99)	54		E (1.08)	78		
	EB – L	D (0.72)	42	42	C (0.34)	26	16	55
	EB – TR	D (0.91)	50	224	F (1.08)	97	328	320
	WB – L	B (0.26)	20	11	D (0.65)	44	35	55
	WB – TR	E (0.95)	58	208	E (1.00)	75	303	350
	NB – L	C (0.43)	21	40	F (1.04)	112	94	30
	NB – TR	E (0.98)	68	223	D (0.66)	38	153	350
SB – L	E (0.99)	90	71	D (0.75)	42	62	55	
SB – TR	C (0.51)	28	82	F (1.08)	98	323	350	
West 5 th Street/ Site Access (Unsignalized)	WB – LR	B (0.15)	14	4	C (0.11)	17	3	35
	NB – TR	B (0.29)	0	0	A (0.35)	0	0	150
	SB – TL	A (0.01)	1	0	A (0.04)	1	1	150

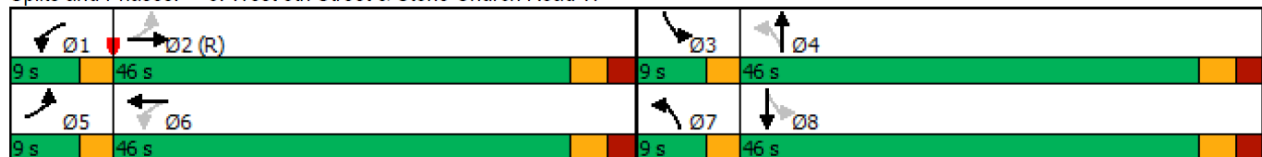
Under the scenario with traffic signal optimization, the morning peak hour operations can be improved significantly. However, during the afternoon peak hour, the analysis shows that some movements are expected to operate at higher delays. It is Nextrans' opinion that it is still acceptable from overall intersection operation perspective and this is the conditions along major intersections located adjacent to shopping centres during the afternoon peak hour.

It should be noted that, regardless of Nextrans suggestions for the signal timing plan optimization, it is in the City's discretion to review and optimize the signal timing plans at the City's intersections as required to serve their best interests and objectives for the City. It is Nextrans' opinion that the intersection overall levels of service for these intersections are acceptable without signal timing optimization or physical improvements given that these are major intersections and they are expected to carry a significant amount of inter-city traffic. The suggested signal timing optimization will be carried for the future total conditions. In addition, as it is anticipated that the traffic conditions will change in the next 5 to 10 years, it intuitive that the City will be required to review the signal timing plan periodically to ensure that the intersections are operating at their optimum conditions.

The suggested signal timing optimization plans are illustrated below:

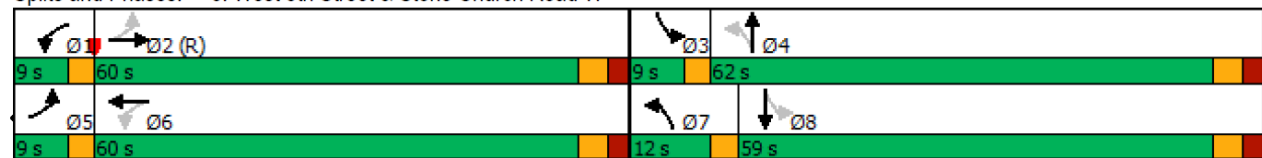
AM Peak Hour

Splits and Phases: 6: West 5th Street & Stone Church Road W



PM Peak Hour

Splits and Phases: 6: West 5th Street & Stone Church Road W



Under the future background conditions, Nextrans has conducted the analysis with the potential widening of Stone Church Road W from 2 to 4 lanes (i.e. to provide two through lanes per direction on Stone Church Road W) would provide some operational improvements for the critical movements. However, it is a significant cost to the City and tax payer to widening this road given the property constrains and other social/environmental impacts.

It is Nextrans' opinion that physical improvements such as road widenings are not always the best solutions to solve congestion and delay at existing intersections as road widenings may create some capacity, however, this capacity will be utilized as soon as it becomes available to other drivers and support increased traffic usage. This is induced traffic demand. As Stone Church Road W currently has dedicated cycling lanes, road widenings will impact pedestrian and cyclist crossing distance at the intersection, which will result in operational and safety concerns for pedestrian and cyclist.

With the current climate change, it is Nextrans' opinion that the City must invest in public transit for the future transportation sustainability of the City of Hamilton and to shift the mode of transportation from single-occupant-vehicle trips to transit and active transportation trips. This has been effectively proven in larger cities in the Greater Toronto Area such as Toronto and Mississauga.

In addition, with the ongoing COVID-19 pandemic, more residents are working from home and reduce the need to travel into the office. This trend will continue even after all restrictions are lifted because both employers and employees have invested in working from home equipment and conditions. It is Nextrans' opinion that there will be a significant reduction in the need to travel to the office during the peak hours in the future.

For the reasons noted above, Nextrans does not recommend the road widening option for the intersection of Stone Church Road W/West 5th Street. Nextrans recommends that the City considers the signal timing optimization options provided in this Study as it is the most intuitive and responsible improvements that save the City and tax payer monies moving forward.

The analysis indicates the proposed site access is expected to operate at acceptable levels of service with negligible delays or queues. Therefore, the proposed access arrangement is reasonable and acceptable as it is optimized the developable lands and consistent with the context of the area and help eliminate any potential conflicts between pedestrians/cyclists and turning vehicles. The proposed access lane configuration includes:

- One inbound lane (3.0 m);
- One shared left/right outbound lane (3.0 m);
- A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street

6.2. Left Turn Warrant Analysis

The Ontario Ministry of Transportation (MTO) Left Turn Warrant analysis for at grade intersection was conducted to examine the need for an exclusive southbound exclusive left turn from West 5th Street to the proposed site access. **Figure 12** illustrates the MTO warrant guidelines.

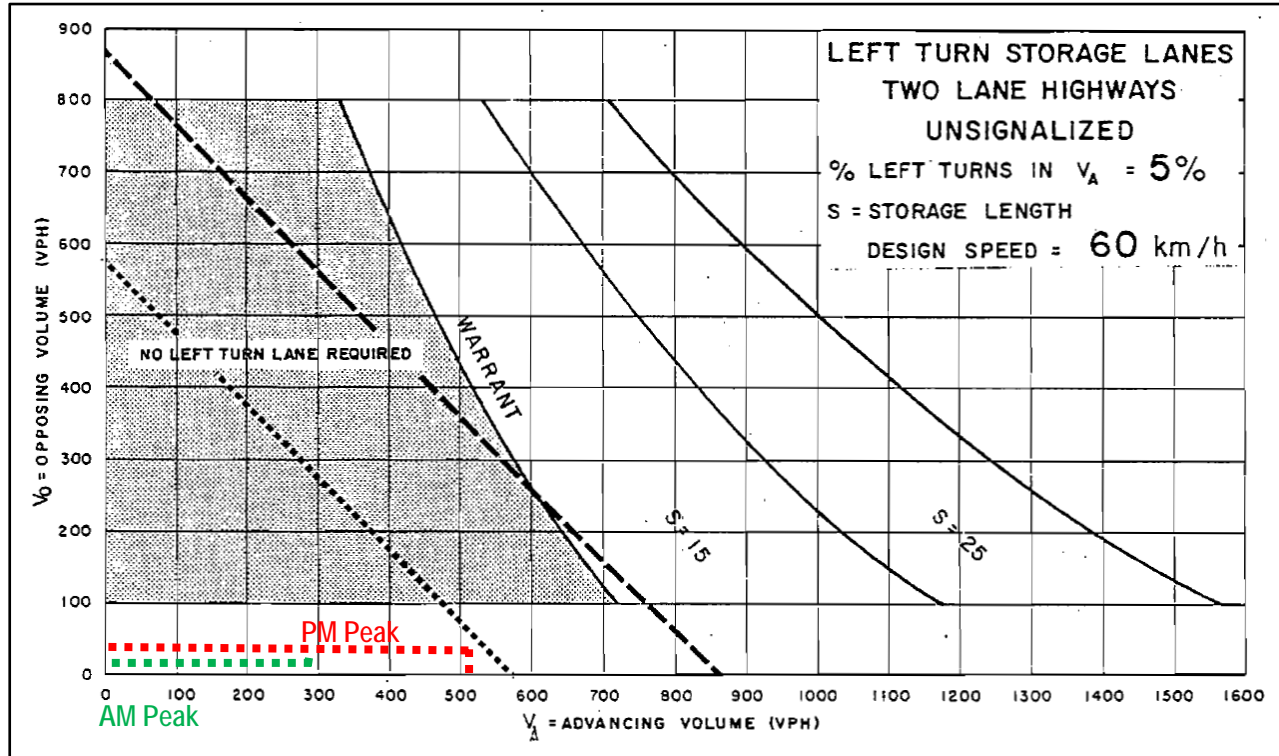
It should be noted that the left turning volume is only 4.3% and 6.9% during the morning and afternoon peak hour, respectively.

Calculations:

- Morning - $13 \text{ left turns} \times 100\% / 299 \text{ advancing traffic volumes} = 4.3\%$
- Afternoon - $36 \text{ left turns} \times 100\% / 522 \text{ advancing traffic volumes} = 6.9\%$

Based on the analysis, it is anticipated that the westbound left turn volumes onto the proposed development east access does not numerically meet the MTO warrant guidelines under the 2029 horizon.

Figure 12 – MTO Left Turn Storage Warrant Analysis



6.3. Active Transportation Mode Assessment

Walking

As indicated, West 5th Street between Rymal Road W and Stone Church Road W is semi-urban with curb and gutter along the east side, with rural treatment on the west side. The sidewalk located on the east side of West 5th Street from the subject site to Rymal Road W is appeared to be asphalt and generally not in the best condition.

As part of the proposed development, it is recommended that concrete sidewalk be provided from the north limit of the site to the southerly limit of the site, i.e. along the frontage of the proposed development. The City can improve the rest of the sidewalk along the east side of West 5th Street in the future as part of future developments or through the City capital projects.

Cycling

Currently, there are dedicated bike lanes along Stone Church Road W from Golf Link Road to Paramount Drive/Mud Street W, along Rymal Road W from Hazelton Avenue to Spadara Drive and West 5th Street from Stone Church Road W to Marlowe Drive. Th section of West 5th Street and Christie Street from Stone Church Road W to Malton Drive is a signed bicycle route. There are also dedicated cycling lanes for a short section of Upper Wellington south of Stone Church Road E and Rymal Road E, as well as along Garth Street between Stone Church Road W and Twenty Road W.

It is Nextrans' opinion that the cycling network in the area could be improved in the future, especially along West 5th Street and Christie Street to encourage more cycling trips to and from this area. These cycling facilities can be implemented as part of the future capital projects by the City of Hamilton. These facilities are beyond the scope of this Study.

To support active transportation and Transportation Demand Management (TDM), the proposed development will provide a total of 5 short-term bicycle parking spaces, which is not required by the current Zoning By-law for areas located outside the Downtown area. This provision will encourage residents and visitors to use active transportation mode.

6.4. Transit Mode Assessment

If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 3 two-way transit trips (1 inbound and 2 outbound) and 3 two-way transit trips (2 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

The proposed development is located approximately 350 m (about 5-minute walk) to Bus Routes 44 Rymal and 35 College stops located at the Rymal Road E/West 5th Street/Christie Street intersection, and about 650 m (about 10-minute walk) to Bus Route 43 Stone Church stops located at the Stone Church Road W/West 5th Street intersection.

It is Nextrans' opinion that the proposed development potential transit ridership (maximum of 3 customers) can be accommodated by the existing transit service in the area and no improvements are required to the existing transit network to accommodate the proposed development.

7.0 SITE PLAN REVIEW

7.1. Loading Requirement

As indicated, the proposed development includes one mid-rise building (10-storey) with approximately 215 residential dwelling units. The proposed development will provide one loading space for the condominium. AutoTURN software was used to generate the turning movement templates and demonstrate the turning movement requirements for garbage pick-up and delivery vehicles at the proposed loading area access onto West 5th Street. The turning templates are illustrated in Figures 13 and 14.

7.2. Driveway Location and Configuration

Under the existing conditions, the two existing residential units have two separate accesses onto West 5th Street. As part of the proposed development, one consolidated full moves access will be provided onto West 5th Street to accommodate the proposed development.

Based on the findings of this Study and Nextrans' assessment, the proposed access arrangement is reasonable and acceptable as it is optimized the developable lands and consistent with the context of the area and help eliminate any potential conflicts between pedestrians/cyclists and turning vehicles. The analysis indicates the proposed site access is expected to operate at acceptable levels of service with negligible delays or queues.

The proposed access lane configuration includes:

- One inbound lane (3.0 m);
- One shared left/right outbound lane (3.0 m);
- A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street

7.3. Traffic Calming

Nextrans has reviewed the context of the area and West 5th Street between Stone Church Road W and Rymal Road W. Currently, West 5th Street is mostly rural cross-section with vacant lands on the west side and east side. Although West 5th Street is currently designated as local road under the City's current Official Plan, it is functioning as a collector road at this time.

At this time and interim conditions, it is Nextrans' opinion that no traffic calming measures are required, similar to other public roads in the area. It is suggested that the City monitor West 5th Street in the future and install speed cushion if required at that time.

8.0 PARKING ASSESSMENT

8.1. Vehicle Parking Requirement

For the purpose of this assessment, Zoning By-law No. 05-200 Section 5.6 (Consolidated as of September, 2019) has been reviewed and applied in the analysis. **Table 9** summarizes the vehicle parking requirement, based on the City's Zoning By-law No. 05-200, Sections 5.6.

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

Type	No. Unit Greater than 50 m ²	Ratio	Required
Residential	1-14 units	0.70 space/unit = 14 x 0 = 10 spaces	206 spaces
	15-50 units	0.85 spaces/unit = 35 x 0.3 = 30 spaces	
	50+ units	1.00 space/unit = 166 x 1.0 = 166 spaces	

Based on the City's By-Law No. 05-200, a total of 206 vehicle parking spaces are required for the proposed development. The proposed development will provide a total of 232 vehicle parking spaces, which slightly exceeds the minimum Zoning By-law requirement, but significantly less than the maximum. It is Nextrans' opinion that given the context of the area, this provision is acceptable.

8.2. Bicycle Parking

Table 9 summarizes the bicycle parking requirements based on the Zoning By-law No. 05-200 Sections 5.7.

Table 10 – Zoning By-law No. 05-200 Bicycle Parking Requirement

Type	Number of Unit	Short-Term Bicycle Parking Requirement	Long-Term Bicycle Parking Requirement	Required
Residential - Condominium	215 units	5 spaces	0.5 space/unit = 108	113 spaces

Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 113 bicycle parking spaces, which include 5 short-term and 108 long-term spaces.

The proposed development will provide a total of 222 bicycle parking spaces, inclusive of short-term and long-term spaces, which almost double the minimum Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision will support and encourage new residents to take active modes of transportation instead of driving private vehicles.

9.0 TRANSPORTATION DEMAND MANAGEMENT

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

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

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

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

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

9.1.1. Increase Density and Compact Site Design

As indicated in previous sections of this report, currently, the subject site is mostly vacant with two single-family detached residential units. The proposed development includes one mid-rise building (6-storey) with approximately 65 residential dwelling units.

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

9.1.2. Site Design Elements

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

- The proposed development access will meet the City's minimum width requirement with continuous sidewalks on the east side of West 5th Street along the frontage of the proposed development; and
- Provide direct pedestrian access to West 5th Street;

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

9.1.3. Sidewalks and Pathways

The proposed development provides continuous sidewalks internally and direct connections to West 5th Street, as illustrated the proposed site plan.

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

It is Nextrans' understanding that, based on the Zoning By-law No. 05-200 Sections 5.7, bicycle parking is not required for the development located outside the Downtown Zones. However, to support active transportation and Transportation Demand Management, 5 short-term bicycle parking spaces will be provided for the proposed development to be located at a convenient location.

It is Nextrans' opinion that this provision will encourage future residents to take active modes of transportation instead of driving private vehicles.

9.1.5. Direct Connections to Transit

The proposed development is located approximately 350 m (about 5-minute walk) to Bus Routes 44 Rymal and 35 College stops located at the Rymal Road E/West 5th Street/Christie Street intersection, and about 650 m (about 10-minute walk) to Bus Route 43 Stone Church stops located at the Stone Church Road W/West 5th Street intersection.

It is Nextrans' opinion that the proposed development potential transit ridership (maximum of 3 customers) can be accommodated by the existing transit service in the area and no improvements are required to the existing transit network to accommodate the proposed development.

9.1.6. Opportunities for Reduced Parking Requirements

Based on the City's By-Law No. 05-200, a total of 81 vehicle parking spaces are required for the proposed development. The proposed development will provide a total of 80 parking spaces, which has one less parking space than the Zoning By-law requirement.

It is Nextrans' opinion that one less parking space is acceptable given that less vehicle parking space will support active transportation and Transportation Demand Management. Therefore, on this basis, the proposed development meets the Zoning By-law requirement.

9.1.7. Unbundle Parking

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

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

It is Nextrans' opinion that this requirement is more appropriate for larger scale development in the Downtown or Transit Oriented Corridor setting where carshare is economically viable.

It is not appropriate for the small development like this and without other high-rise/mid-rise buildings near-by to share the use or carrying costs. As such, it is Nextrans' opinion that this requirement is not appropriate or necessary for the proposed development given the proposed development context and location.

9.1.9. On-Site Bikeshare

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

9.1.10. Wayfinding Signage

Given that the proposed development is an infill development located on the east side of West 5th Street, it is Nextrans' opinion that wayfinding signage is not required for the proposed development as it is visible to the public, visitors and future residents living in the buildings.

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

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

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

It is Nextrans' opinion that this incentive is not required for this area given the existing context. In addition, as the proposed development is a compact and efficient housing unit design, it will attract young professionals and young family that will use active mode of transportation to make housing more affordable as they can work from home and do not need to drive that often.

9.1.13. Proposed Monitoring Evaluation of TDM Measures

Based on our previous experience, monitoring and evaluation of TDM measure are important but very onerous for the Applicant. When project is completed and the Applicant transfers the ownership to Condominium Board, the Board will have the full control of the proposed development and there are certain conditions and requirements the Condominium Board may not agree with.

It is Nextrans' opinion that TDM measures and incentives provided in this report are sufficient and appropriate, as such, monitoring for the proposed development is not required.

9.2. Recommended TDM Measures and Incentives for the Proposed Development

Based on the review of the context of the proposed development in relation to the TDM requirements by the City of Hamilton, a number of TDM measures and incentives are identified for the proposed development to consider, given the limited transit service and active transportation network in the area. **Table 9** summarizes the recommended TDM measures and incentives.

Table 11 – Recommended TDM Measures for the Proposed Development

Category	TDM Initiative required by the City or suggested by Nextrans	Recommended Actions	Responsibility
Cycling	<ul style="list-style-type: none"> Visible, well-lit, short-term bicycle parking for visitors (above minimum provisions or recommendations) Secure, indoor bicycle parking storage spaces for tenants/residents Ensure development connects to bicycle network 	<ul style="list-style-type: none"> Provide 222 bicycle parking spaces including short-term and long-term bicycle parking spaces 	Applicant
Walking	<ul style="list-style-type: none"> Safe, attractive and direct walkways for pedestrians linking building entrances with public sidewalks and with key destinations such as schools Enhanced pedestrian amenities on-site (benches, landscaping, lighting) 	<ul style="list-style-type: none"> Provide direct shared pedestrian and cycling connections from the proposed development to West 5th Street 	Applicant
Transit	<ul style="list-style-type: none"> Enhance walking routes between main building entrance(s) and transit stops/stations Bicycle parking located at or near transit stops Implement transit priority measures (queue jump lanes, traffic signal priority, bus only lanes) 	<ul style="list-style-type: none"> The proposed development provides a shared pedestrian/cycling connection to West 5th Street 	Applicant
Parking	<ul style="list-style-type: none"> Reduced minimum parking requirements based on proximity to transit Shared parking with nearby developments or on-street spaces Unbundle parking costs from unit costs 	<ul style="list-style-type: none"> Consider unbundle parking sell with the unit 	Applicant
Information Brochure/ Letter	<ul style="list-style-type: none"> Provide an information brochure/letter for each residential unit that include HSR Transit System schedules, GO Transit schedules, cycling maps and community maps. 	<ul style="list-style-type: none"> Provide a brochure (or a letter) to new residents that include all website links to Hamilton Transit System schedules, community maps and cycling maps. The information package can be distributed at the sale office. 	Applicant
Transit Incentive	<ul style="list-style-type: none"> Provide transit incentives 	<ul style="list-style-type: none"> Not required 	Applicant

10.0 CONCLUSIONS / FINDINGS

10.1. Study Conclusions

The findings and conclusions of the analysis are as follows:

- The proposed development is expected to generate 83 total two-way trips (19 inbound and 64 outbound) and 84 total two-way trips (51 inbound and 33 outbound) during the morning and afternoon peak hours, respectively. The analysis indicates that the proposed development generates very little auto trips, at most 1 vehicle every minute in the peak direction (i.e. morning inbound trip).

- Based on the intersection capacity analysis, under the existing traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is currently operating at acceptable levels of service. The Stone Church Road W/West 5th Street is currently operating at acceptable level of service during the morning and only the northbound left turn is operating over capacity during the afternoon peak hour. With signal timing optimization, this movement is expected to operate at acceptable level of service.

Based on the intersection capacity analysis, under the future background traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service. The Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed. The analysis indicates that the potential widening of Stone Church Road W from 2 to 4 lanes (i.e. to provide two through lanes per direction on Stone Church Road W) would provide some operational improvements for the critical movements. However, it is a significant cost to the City and tax payer to widening this road given the property constrains and other social/environmental impacts.

Similar to the future background conditions, under the future total traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of service. Similar to the future background conditions, under the future total traffic conditions, the Stone Church Road W/West 5th Street is expected to operate at acceptable level of service from overall intersection operation perspective during both the morning and afternoon peak hours. However, there are critical movements in the through movements on both Stone Church Road W and West 5th Street due to the availability of one through lane on both roads. With signal timing optimization, some of these critical movements can be addressed.

With the current climate change, it is Nextrans' opinion that the City must invest in public transit for the future transportation sustainability of the City of Hamilton and to shift the mode of transportation from single-occupant-vehicle trips to transit and active transportation trips. This has been effectively proven in larger cities in the Greater Toronto Area such as Toronto and Mississauga.

In addition, with the ongoing COVID-19 pandemic, more residents are working from home and reduce the need to travel into the office. This trend will continue even after all restrictions are lifted because both employers and employees have invested in working from home equipment and conditions. It is Nextrans' opinion that there will be a significant reduction in the need to travel to the office during the peak hours in the future.

For the reasons noted above, Nextrans does not recommend the road widening option for the intersection of Stone Church Road W/West 5th Street. Nextrans recommends that the City considers the signal timing optimization options provided in this Study as it is the most intuitive and responsible improvements that save the City and tax payer monies moving forward.

- If a 10% transit modal split is applied to the site trip generation, the proposed development is expected to generate 3 two-way transit trips (1 inbound and 2 outbound) and 3 two-way transit trips (2 inbound and 1 outbound) during the morning and afternoon peak hours, respectively.

The proposed development is located approximately 350 m (about 5-minute walk) to Bus Routes 44 Rymal and 35 College stops located at the Rymal Road E/West 5th Street/Christie Street intersection, and about 650 m (about 10-minute walk) to Bus Route 43 Stone Church stops located at the Stone Church Road W/West 5th Street intersection.

It is Nextrans' opinion that the proposed development potential transit ridership (maximum of 3 customers) can be accommodated by the existing transit service in the area and no improvements are required to the existing transit network to accommodate the proposed development.

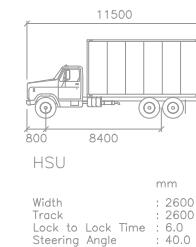
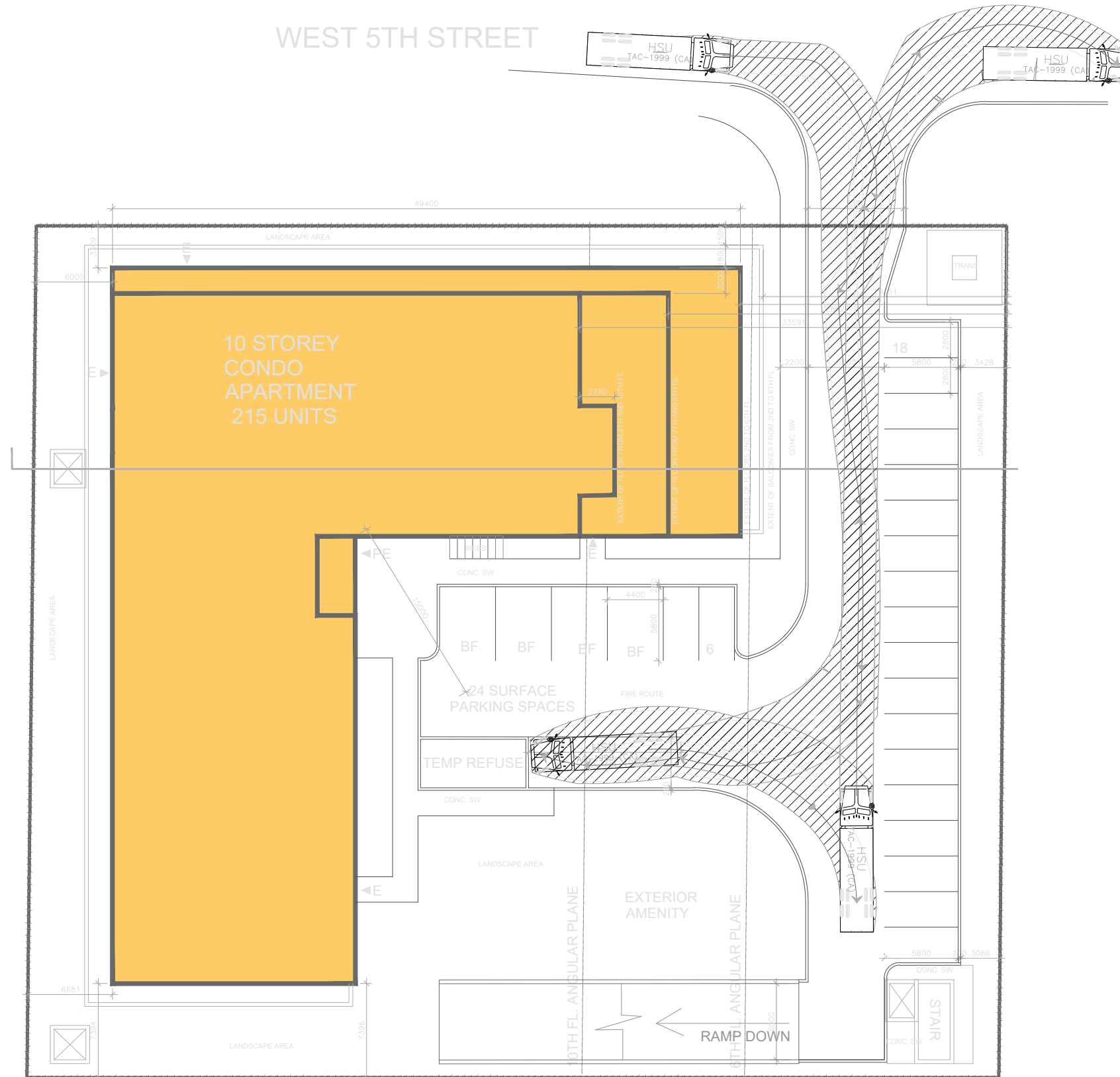
- Based on the City's By-Law No. 05-200, a total of 206 vehicle parking spaces are required for the proposed development. The proposed development will provide a total of 232 vehicle parking spaces, which slightly exceeds the minimum Zoning By-law requirement, but significantly less than the maximum. It is Nextrans' opinion that given the context of the area, this provision is acceptable.
- Based on the Zoning By-law No. 05-200, the proposed development should provide a total of 113 bicycle parking spaces, which include 5 short-term and 108 long-term spaces. The proposed development will provide a total of 222 bicycle parking spaces, inclusive of short-term and long-term spaces, which almost double the minimum Zoning By-law No. 05-200 requirements. It is Nextrans' opinion that this provision will support and encourage new residents to take active modes of transportation instead of driving private vehicles.
- The analysis indicates the proposed site access is expected to operate at acceptable levels of service with negligible delays or queues. The proposed access lane configuration includes:
 - One inbound lane (3.0 m);
 - One shared left/right outbound lane (3.0 m);
 - A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street
- The proposed development will provide one loading space for the condominium. AutoTURN software was used generate turning movement templates and to demonstrate the turning movement requirements for garbage pick-up and delivery vehicles at the proposed loading area and access onto West 5th Street.

10.2. Study Recommendations

Based on the findings of this Study, the following recommendations are provided:

- The proposed development implements the TDM measures and incentives identified in this report to support active transportation and transit and to reduce the numbers of single-occupant-vehicle trips to and from the proposed development;
- The proposed access lane configuration includes:
 - One inbound lane (3.0 m);
 - One shared left/right outbound lane (3.0 m);
 - A shared northbound through/right lane and a shared southbound through/left lane on West 5th Street
- The proposed development provides concrete sidewalk along the frontage of the proposed development on east side of West 5th Street. Direct sidewalk connections from the proposed development to West 5th Street should be provided; and
- No additional physical improvements for the area at this time to accommodate the proposed development, under the future background and future total conditions.

WEST 5TH STREET



KEY PLAN

BENCHMARK

REVISIONS

NO	REVISION	DATE	BY

STAMP

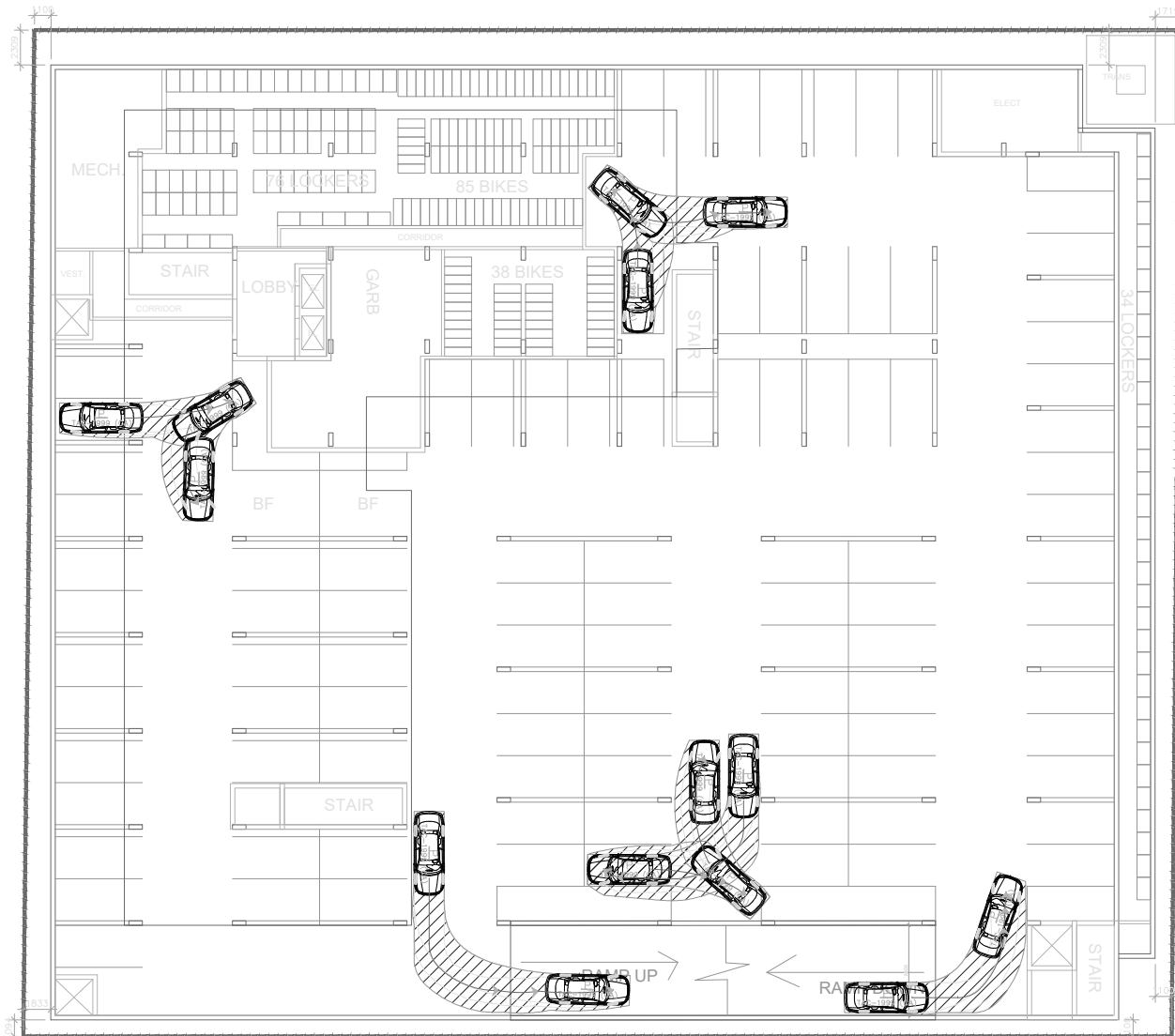


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1177-1187 West 5th Street
(City of Hamilton)

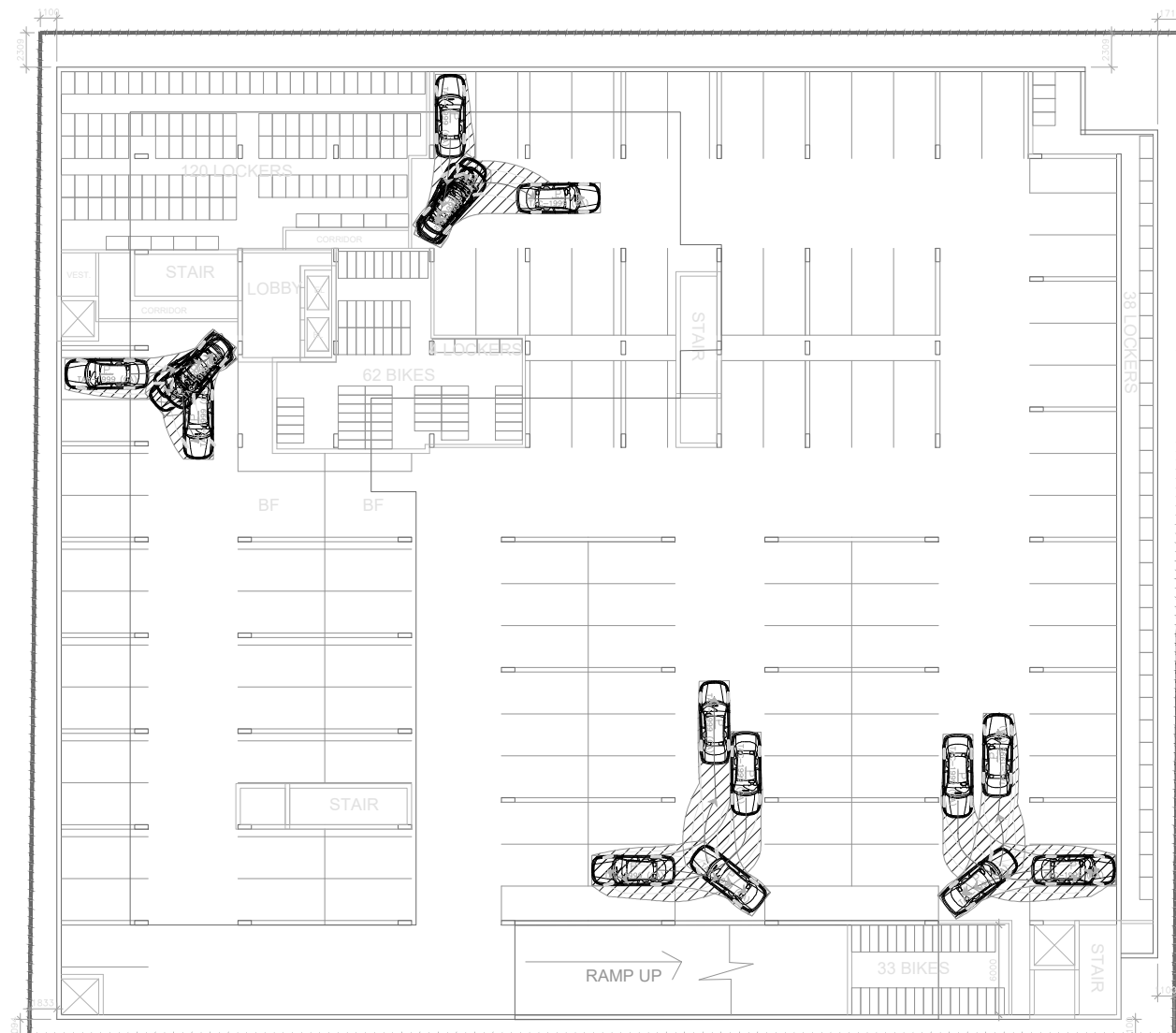
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AutoTURN Analysis
(HSU TAC-2017)

DESIGN BY: K.A.	DATE: April 18, 2022
CHECKED BY: R.P.	PROJECT NO. NT-21-303
DRAWN BY: K.A.	DRAWING NO. Figure 13
SCALE: NTS	

BENCHMARK



U/G LEVEL 1



U/G LEVEL 2

REVISIONS

NO	REVISION	DATE	BY

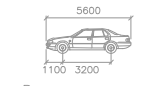
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PROJECT NAME:
RESIDENTIAL DEVELOPMENT
1177-1187 West 5th Street
(City of Hamilton)

DRAWING TITLE:
AutoTURN Analysis
(P TAC-2017)

DESIGN BY: K.A.	DATE: April 18, 2022
CHECKED BY: R.P.	PROJECT NO: NT-21-303
DRAWN BY: K.A.	DRAWING NO: Figure 14
SCALE: NTS	



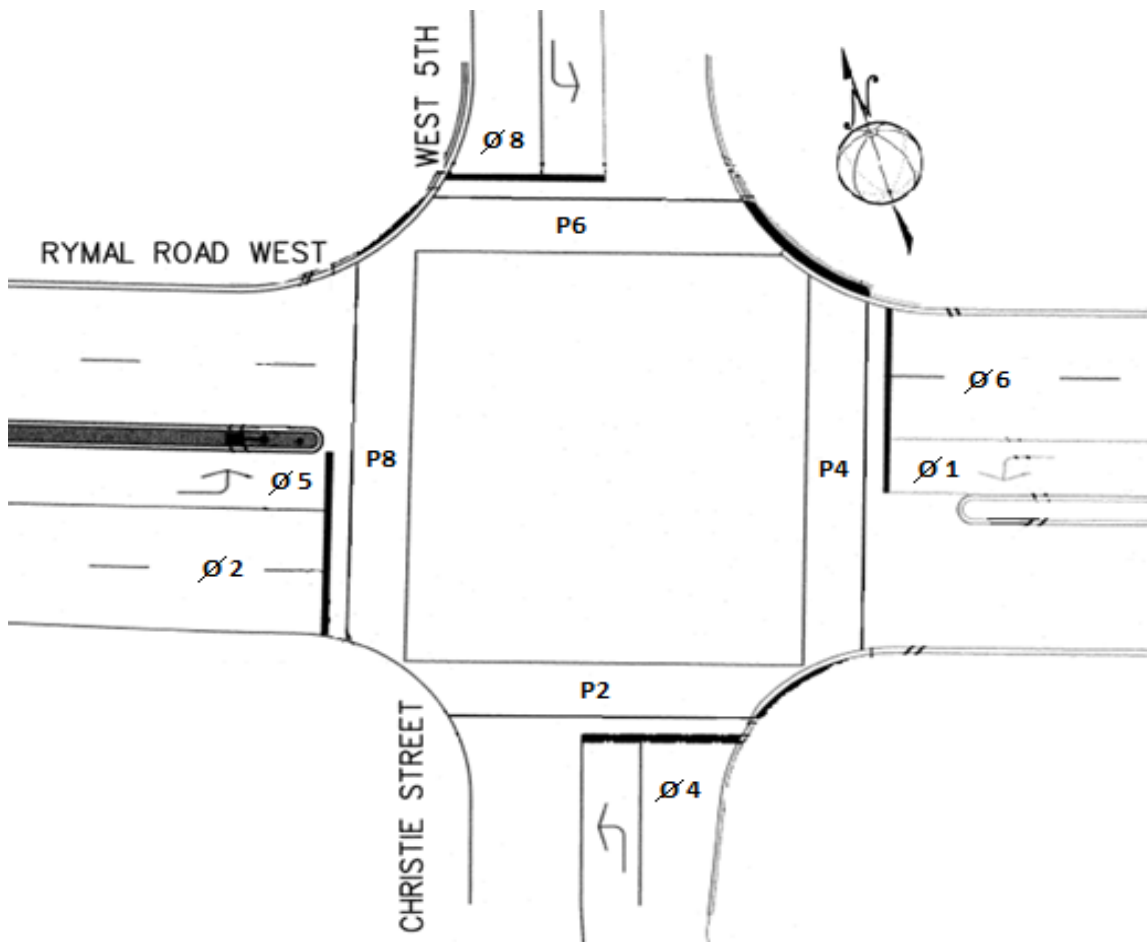
P
Width : 2000
Track : 2000
Lock to Lock Time : 6.0
Steering Angle : 35.9

Appendix A

Existing Traffic Data and Signal Timing Plans

City of Hamilton - Traffic Traffic Signal Controller Timing Data

Intersection: **Christie & Rymal & West 5th**
Controller Type: **3000E** Page 1 of 16
Programmed By: **DLB** Installed By: _____
Date: **02-May-19** Date: _____



- φ1: Rymal - WBLT
- φ2: Rymal - EB, North Xwalk
- φ3:
- φ4: Christie - NB, East Xwalk
- φ5: Rymal - EBLT
- φ6: Rymal - WB, South Xwalk
- φ7:
- φ8: West 5th - SB, West Xwalk

Flash Operation: Red: Rymal
Red: Christie / West 5th

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

START-UP PHASES/INTERVAL/SEQUENCE

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

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

PHASE RING ASSIGNMENTS

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

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

CO-PHASE GRP 1-4 ASSIGNMENTS

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

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

		(X = ENABLE)															
		TP1 PHASE RECALLS															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK	X				X											
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

		(X = ENABLE)															
		TP2 PHASE RECALLS															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE RECALLS	MIN RCL																
	MAX RCL																
	PED RCL																
	SOFT REC																
	NON-LOCK	X				X											
	VEH OMIT																
	PED OMIT																
	WLK REST																
	MAX II																
	RED REST																
	NO SKIP																

(X = ENABLE)

TP3 PHASE RECALLS

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

(X = ENABLE)

TP4 PHASE RECALLS

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

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

ONLY 1 PLAN PER UNIT

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

PHASE TIMES (MM-3-1-3-PGDN, etc.)

USE 1 TO ALL 4 TIMING PLANS

TP1																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial	5	35		10	5	35		10								
	Passage	1.0			3.0	1.0			3.0								
	Yellow	3.0	3.7		3.3	3.0	3.7		3.3								
	Red		1.7		2.5		1.7		2.5								
	Walk		10		10		10		10								
	Ped Clr		11		17		11		17								
	Max 1	15	50		45	15	50		45								
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
Max In																	

CONTROLLER DATA

		TP2															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial	5	35		10	5	35		10								
	Passage	1.0			3.0	1.0			3.0								
	Yellow	3.0	3.7		3.3	3.0	3.7		3.3								
	Red		1.7		2.5		1.7		2.5								
	Walk		10		10		10		10								
	Ped Clr		11		17		11		17								
	Max 1	15	60		45	15	60		45								
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
Max In																	

		TP3															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial	5	35		10	5	35		10								
	Passage	1.0			3.0	1.0			3.0								
	Yellow	3.0	3.7		3.3	3.0	3.7		3.3								
	Red		1.7		2.5		1.7		2.5								
	Walk		10		10		10		10								
	Ped Clr		11		17		11		17								
	Max 1	15	60		45	15	60		45								
	Max 2																
	Mx 3 Lim																
	Mx 3 Adh																
	TBR																
	TTR																
	Min Gap																
	AI/Act																
Max In																	

		TP4																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
PHASE TIMES	Initial	5	35		10	5	35		10									
	Passage	1.0			3.0	1.0			3.0									
	Yellow	3.0	3.7		3.3	3.0	3.7		3.3									
	Red		1.7		2.5		1.7		2.5									
	Walk		10		10		10		10									
	Ped Clr		11		17		11		17									
	Max 1	15	50		35	15	50		35									
	Max 2																	
	Mx 3 Lim																	
	Mx 3 Adh																	
	TBR																	
	TTR																	
	Min Gap																	
	AI/Act																	
Max In																		

DUAL ENTRY ENABLE:	Y	Y/N: Y=Enable Dual Entry. Note this is only one setting even though it appears on each controller screen.
--------------------	----------	---

PG1	PH/CALLS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DUAL ENTRY ASSIGN- MENTS	1						X										
	2						X										
	3																
	4								X								
	5	X															
	6	X															
	7																
	8					X											

VEHICLE DETECTOR ASSIGNMENTS (MM-3-1-4-1, PGDN etc.)

(X = ASSIGN VEH DETECTOR TO THAT PHASE)

	DET/PH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VEH DET ASSIGN- MENTS	1	X															
	2																
	3																
	4																
	5					X											
	6																
	7																
	8																

PED DETECTOR ASSIGNMENTS (MM-3-1-4-2)

(X = ASSIGN PED DETECTOR TO THAT PHASE)

	DET/PH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PED DET ASSIGN- MENTS	1																
	2																
	3																
	4				X				X								
	5																
	6																
	7																
	8					X				X							

DETECTOR MODES (MM-3-1-4-3)

	DET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VEH DET MODES	Mode	0	0	0	0	0	0	0	0								

	DET	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VEH DET LOCKS	Lock																

DETECTOR TIMES (MM-3-1-4-4)

	DET	1	2	3	4	5	6	7	8
DET TIMES	Delay	0	0	0	0	0	0	0	0
	Str/Stp								

	DET	9	10	11	12	13	14	15	16
DET TIMES	Delay	0	0	0	0	0	0	0	0
	Str/Stp								

SELECTION SOURCE (MM-3-2-2)

Entries determine how parameters get selected

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

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

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

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

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

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

USE THIS CHART WHEN 4 SPLITS/CYCLE = Y

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

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

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

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

CYCLE & OFFSETS	Cycle #	1/1	2/1	3/1	4/1		
	Length	110	110	110	90		
	Offset 1	20	24	15	55		Secs
	Offset 2						
	Offset 3						
	Offset 4						
	Offset 5						
	Max Dwell	32	32	32	32		

COORD PHASES (MM-3-2-5)

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

PHASE ALLOCATION (MM-3-2-6)

ENTRY IN: **Secs** % or Secs: Not a controller entry--for reference only. Controller entry is under

PHASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE ALLO- CATION	C1 S1	9	57		44	9	57		44							
	C1 S2															
	C1 S3															
	C1 S4															
	C2 S1	9	62		39	9	62		39							
	C2 S2															
	C2 S3															
	C2 S4															
	C3 S1	9	51		50	9	51		50							
	C3 S2															
	C3 S3															
	C3 S4															
	C4 S1		55		35		55		35							
	C4 S2															
	C4 S3															
	C4 S4															

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

Offset Seeking Mode: **0**

Mode

- 0 Add only, cycle times 20% slow only to get in sync
- 1 Dwell, cycle timer stops at cycle 0 up to max dwell time to get in step
- 2 Short Route, cycle times 20% fast or slow--whichever gets in step fastest

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

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

Yield Percent	1	0-10%: See note
EGB%	0	0-100%: See note
RGB%	0	0-100%: See note
# Cycles to out of step:	0	0-255: 0=Disable

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

Sync Source:	0	0-2, 0=TOD/CL/Interconnect, 1= City Zero, 2= Absolute
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Charts below only For City Zero offsets or Absolute (0's). These are not daily reference times for Sync Source Option 0 (see TOD).

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

MANUAL/AUTO FORCE OFFS & PERMS

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

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

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

	HH	MM	CIRCUIT PLAN	C	O	S	CKT	ON/OFF
1	00	00					11(FRE)	OFF
	00	00		4	1	1		
	06	00		1	1	1		
	23	00		4	1	1		
2	00	00					11(FRE)	OFF
	00	00		4	1	1		
	06	00		2	1	1		
	10	00		1	1	1		
	14	30		3	1	1		
	18	30		1	1	1		
	23	00		4	1	1		

WEEK PLANS (MM-3-3-3)

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

CIRCUIT OVERRIDES (MM-3-3-6)

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

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

DAYLIGHT SAVINGS (MM-3-3-7)

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

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

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

Mode:	0	0 = Time dependent, 1 = C/O/S Event
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	HH	MM	
Time Clock Reset:	00	00	TOD clock reset to by TBC input
Interrupter:	N		Y/N; Y = Interrupter pulses provided
Pulses:	0		0-6 = Number of interrupter pulses

TIME DEPENDENT CYCLE REFERENCES

	HH	MM
CYC 1:	00	00
CYC 4:	00	00

	HH	MM
CYC 2:	00	00
CYC 5:	00	00

	HH	MM
CYC 3:	00	00
CYC 6:	00	00

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

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

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

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

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

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

PG4	Modem Set-up String:		Up to 40 charaters; A-Z, or # @ = , ! ; % \ &
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PHONE NUMBERS (MM-3-5-3)

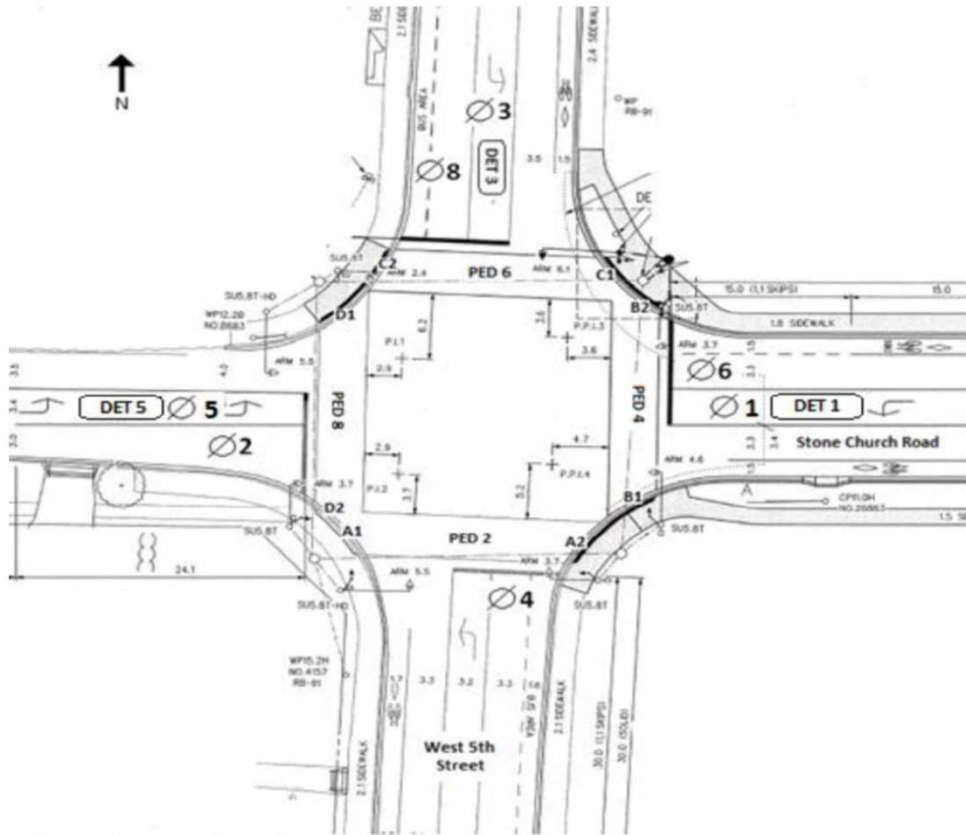
PHONE NUMBERS	Tone:		Y/N
	Phone 1:		Number & control characters (W , ; # ' / T P) if used
	Phone 2:		Number & control characters (W , ; # ' / T P) if used

LOG DATA (MM-3-5-5)

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

City of Hamilton - Traffic
Traffic Signal Controller Timing Data

Intersection: Stone Church & West 5th - Int # 340	
Controller Type: Intelight D4	Revision: 10032
Converted By: SC	Installed By: _____
Date: 30-Jun-20	Date: _____
Reason for Timing Change: D4 Controller Swap	
Communication: Radio	System: KITS
Operation Type: LT - Actuated	UPS: _____
APS: _____	IP Address: 10.240.115.53



- φ1: Stone Church - WBL
- φ2: Stone Church- EB, South Xwalk
- φ3: West 5th - SBL
- φ4: West 5th - NB, East Xwalk
- φ5: Stone Church - EBL
- φ6: Stone Church - WB, North Xwalk
- φ7:
- φ8: West 5th - SB, West Xwalk

Flash Operation: Red/Red

West 5th @ Stone Church

Phase Startup Options

6/30/20 11:56:27 AM

Startup Flash Mode
 Startup All Red Yellow

Phases	1-8								9-16								
Startup Phases				4													8
Startup Yellow																	
Startup Red				4													8
Startup No Walk																	
Startup Next																	
Startup Yel Fls																	
Startup FYA																	
No Veh Call																	
No Ped Call																	

Phase Startup Timing

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Start Walk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Start Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Start Max Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Unit

Red Revert Ped Protect AdvFls in Flash

West 5th @ Stone Church

TOD Pattern Events

6/30/20 11:56:27 AM

	Time	DOW							Holidays							Mode	Pattern	Offset
Event 1	00:00	S						S								Sched	4	1
Event 2	06:00	S						S								Sched	1	1
Event 3	23:00	S						S								Sched	4	1
Event 4	00:00		M	T	W	T	F									Sched	4	1
Event 5	06:00		M	T	W	T	F									Sched	2	1
Event 6	10:00		M	T	W	T	F									Sched	1	1
Event 7	14:30		M	T	W	T	F									Sched	3	1
Event 8	18:30		M	T	W	T	F									Sched	1	1
Event 9	23:00		M	T	W	T	F									Sched	4	1
Event 10	00:00															Sched	0	0
Event 11	00:00															Sched	0	0
Event 12	00:00															Sched	0	0
Event 13	00:00															Sched	0	0
Event 14	00:00															Sched	0	0
Event 15	00:00															Sched	0	0
Event 16	00:00															Sched	0	0
Event 17	00:00															Sched	0	0
Event 18	00:00															Sched	0	0
Event 19	00:00															Sched	0	0
Event 20	00:00															Sched	0	0
Event 21	00:00															Sched	0	0
Event 22	00:00															Sched	0	0
Event 23	00:00															Sched	0	0
Event 24	00:00															Sched	0	0
Event 25	00:00															Sched	0	0
Event 26	00:00															Sched	0	0
Event 27	00:00															Sched	0	0
Event 28	00:00															Sched	0	0
Event 29	00:00															Sched	0	0
Event 30	00:00															Sched	0	0
Event 31	00:00															Sched	0	0
Event 32	00:00															Sched	0	0



Turning Movement Count (1 . WEST 5TH ST & STONE CHURCH RD W)

Start Time	N Approach WEST 5TH ST						E Approach STONE CHURCH RD W						S Approach WEST 5TH ST						W Approach STONE CHURCH RD W						Int. Total (15 min)	Int. Total (1 hr)
	Right N-W	Thru N-S	Left N-E	U-Turn N-N	Peds N:	Approach Total	Right E-N	Thru E-W	Left E-S	U-Turn E-E	Peds E:	Approach Total	Right S-E	Thru S-N	Left S-W	U-Turn S-S	Peds S:	Approach Total	Right W-S	Thru W-E	Left W-N	U-Turn W-W	Peds W:	Approach Total		
07:00:00	14	21	22	0	0	57	18	34	3	0	0	55	3	49	15	0	0	67	6	37	21	0	0	64	243	
07:15:00	13	37	23	0	0	73	18	46	3	0	0	67	7	74	17	0	0	98	15	64	24	0	0	103	341	
07:30:00	30	28	23	0	2	81	31	73	2	0	3	106	10	103	29	0	5	142	15	90	37	0	1	142	471	
07:45:00	23	34	28	0	1	85	35	81	7	0	3	123	13	96	27	0	5	136	18	98	36	0	2	152	496	1551
08:00:00	24	35	24	0	1	83	34	94	3	0	1	131	6	103	28	0	1	137	22	101	34	0	0	157	508	1816
08:15:00	18	35	32	0	0	85	64	73	3	0	0	140	8	107	43	0	0	158	26	120	42	0	0	188	571	2046
08:30:00	25	45	46	0	0	116	43	76	5	0	0	124	6	101	29	0	0	136	25	86	23	0	2	134	510	2085
08:45:00	16	58	68	0	1	142	27	95	9	0	3	131	10	73	40	0	3	123	29	99	23	0	2	151	547	2136
09:00:00	19	48	44	0	1	111	30	84	3	0	3	117	8	65	33	0	2	106	30	117	23	0	0	170	504	2132
09:15:00	16	39	48	0	2	103	23	99	2	0	1	124	3	53	29	0	5	85	36	94	20	0	3	150	462	2023
09:30:00	15	46	31	0	0	92	18	84	6	0	2	108	8	51	32	0	3	91	21	108	21	0	0	150	441	1954
09:45:00	10	36	32	0	0	78	20	72	6	0	2	98	7	60	32	0	1	99	21	111	23	0	0	155	430	1837
BREAK																										
16:00:00	40	91	52	0	1	183	24	124	6	0	1	154	6	69	41	0	3	116	31	141	15	0	1	187	640	
16:15:00	36	107	44	0	2	187	34	125	5	0	2	164	10	36	36	0	7	82	27	136	9	0	1	172	605	
16:30:00	39	95	63	0	5	197	31	122	9	0	2	162	7	79	50	0	5	136	24	135	8	0	2	167	662	
16:45:00	37	115	58	0	0	210	29	115	8	0	2	152	10	74	42	0	0	126	28	112	20	0	0	160	648	2555
17:00:00	45	118	46	0	2	209	35	117	5	0	1	157	12	81	39	0	1	132	39	113	13	0	2	165	663	2578
17:15:00	33	98	57	0	2	188	31	114	13	0	0	158	11	69	44	0	0	124	19	137	8	0	3	164	634	2607
17:30:00	38	87	47	0	1	172	31	127	12	0	1	170	7	56	32	0	2	95	30	133	15	0	1	178	615	2560
17:45:00	22	76	49	0	1	147	18	103	11	0	1	132	11	77	58	0	2	146	20	133	22	0	2	175	600	2512
18:00:00	23	71	52	0	2	146	23	113	9	0	0	145	8	65	48	0	1	121	30	128	11	0	2	169	581	2430
18:15:00	37	85	56	0	4	178	22	99	15	0	0	136	9	77	48	0	1	134	31	126	13	0	2	170	618	2414
18:30:00	17	47	38	0	1	102	27	122	9	0	3	158	9	58	38	0	0	105	31	134	25	0	1	190	555	2354
18:45:00	24	52	40	0	2	116	25	93	4	0	0	122	5	49	43	0	5	97	20	128	9	0	2	157	492	2246
Grand Total	614	1504	1023	0	31	3141	691	2285	158	0	31	3134	194	1725	873	0	52	2792	594	2681	495	0	29	3770	12837	-
Approach%	19.5%	47.9%	32.6%	0%		-	22%	72.9%	5%	0%		-	6.9%	61.8%	31.3%	0%		-	15.8%	71.1%	13.1%	0%		-	-	-
Totals %	4.8%	11.7%	8%	0%		24.5%	5.4%	17.8%	1.2%	0%		24.4%	1.5%	13.4%	6.8%	0%		21.7%	4.6%	20.9%	3.9%	0%		29.4%	-	-
Heavy	14	17	14	0		-	14	71	5	0		-	7	17	7	0		-	5	71	3	0		-	-	-
Heavy %	2.3%	1.1%	1.4%	0%		-	2%	3.1%	3.2%	0%		-	3.6%	1%	0.8%	0%		-	0.8%	2.6%	0.6%	0%		-	-	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-



Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (22.6 °C)

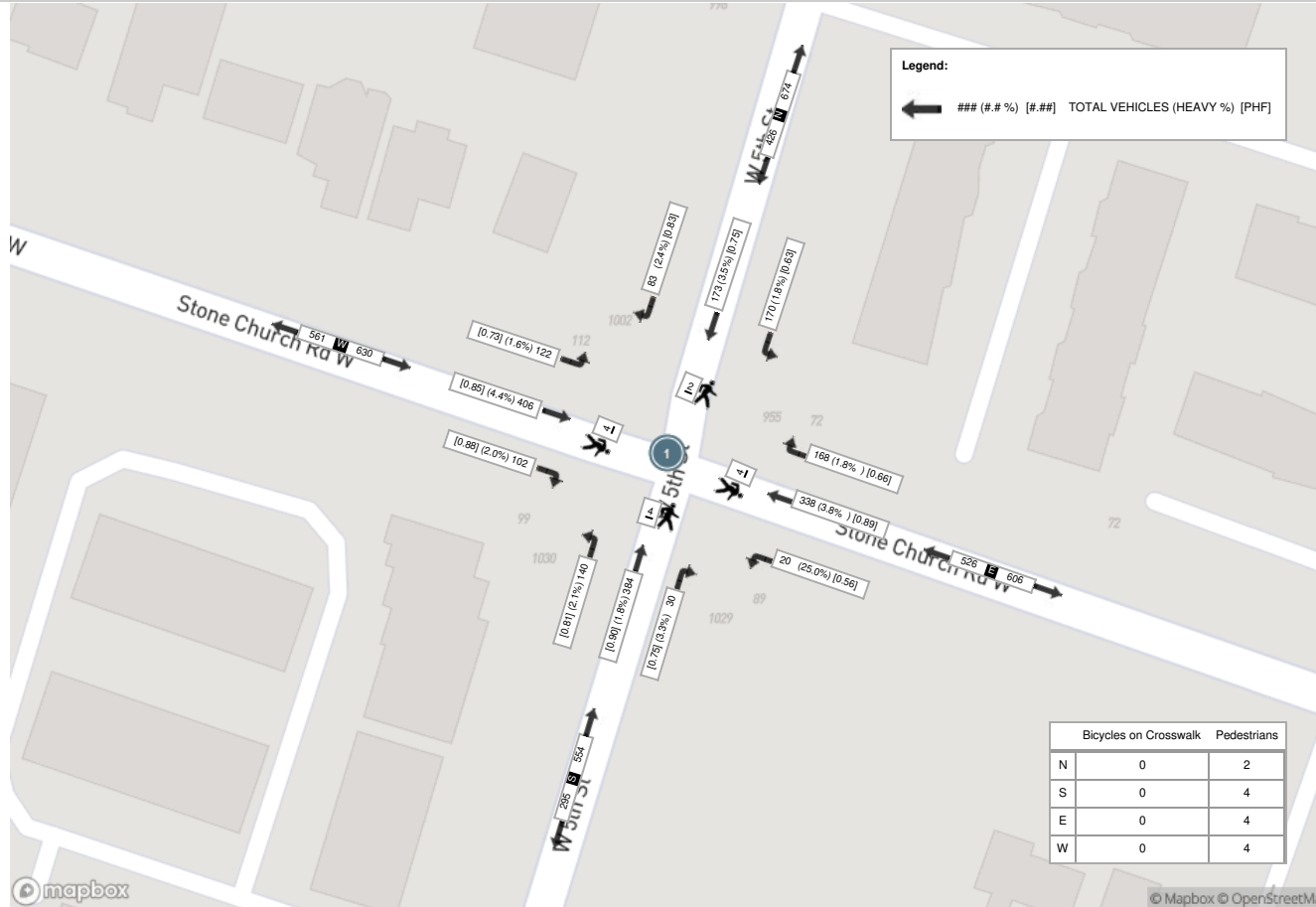
Start Time	N Approach WEST 5TH ST						E Approach STONE CHURCH RD W						S Approach WEST 5TH ST						W Approach STONE CHURCH RD W						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
08:00:00	24	35	24	0	1	83	34	94	3	0	1	131	6	103	28	0	1	137	22	101	34	0	0	157	508
08:15:00	18	35	32	0	0	85	64	73	3	0	0	140	8	107	43	0	0	158	26	120	42	0	0	188	571
08:30:00	25	45	46	0	0	116	43	76	5	0	0	124	6	101	29	0	0	136	25	86	23	0	2	134	510
08:45:00	16	58	68	0	1	142	27	95	9	0	3	131	10	73	40	0	3	123	29	99	23	0	2	151	547
Grand Total	83	173	170	0	2	426	168	338	20	0	4	526	30	384	140	0	4	554	102	406	122	0	4	630	2136
Approach%	19.5%	40.6%	39.9%	0%	-	-	31.9%	64.3%	3.8%	0%	-	-	5.4%	69.3%	25.3%	0%	-	-	16.2%	64.4%	19.4%	0%	-	-	-
Totals %	3.9%	8.1%	8%	0%	19.9%	19.9%	7.9%	15.8%	0.9%	0%	24.6%	24.6%	1.4%	18%	6.6%	0%	25.9%	25.9%	4.8%	19%	5.7%	0%	29.5%	29.5%	-
PHF	0.83	0.75	0.63	0	0.75	0.75	0.66	0.89	0.56	0	0.94	0.94	0.75	0.9	0.81	0	0.88	0.88	0.88	0.85	0.73	0	0.84	0.84	-
Heavy	2	6	3	0	11	11	3	13	5	0	21	21	1	7	3	0	11	11	2	18	2	0	22	22	-
Heavy %	2.4%	3.5%	1.8%	0%	2.6%	2.6%	1.8%	3.8%	25%	0%	4%	4%	3.3%	1.8%	2.1%	0%	2%	2%	4.4%	1.6%	0%	0%	3.5%	3.5%	-
Lights	81	167	167	0	415	415	164	325	15	0	504	504	29	377	137	0	543	543	100	387	119	0	606	606	-
Lights %	97.6%	96.5%	98.2%	0%	97.4%	97.4%	97.6%	96.2%	75%	0%	95.8%	95.8%	96.7%	98.2%	97.9%	0%	98%	98%	95.3%	97.5%	0%	0%	96.2%	96.2%	-
Single-Unit Trucks	0	1	1	0	2	2	0	2	1	0	3	3	0	3	1	0	4	4	0	2	0	0	2	2	-
Single-Unit Trucks %	0%	0.6%	0.6%	0%	0.5%	0.5%	0%	0.6%	5%	0%	0.6%	0.6%	0%	0.8%	0.7%	0%	0.7%	0.7%	0%	0.5%	0%	0%	0.3%	0.3%	-
Buses	2	4	2	0	8	8	3	10	4	0	17	17	1	4	2	0	7	7	2	15	2	0	19	19	-
Buses %	2.4%	2.3%	1.2%	0%	1.9%	1.9%	1.8%	3%	20%	0%	3.2%	3.2%	3.3%	1%	1.4%	0%	1.3%	1.3%	3.7%	1.6%	0%	0%	3%	3%	-
Articulated Trucks	0	1	0	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	1	-
Articulated Trucks %	0%	0.6%	0%	0%	0.2%	0.2%	0%	0.3%	0%	0%	0.2%	0.2%	0%	0%	0%	0%	0%	0%	0%	0.2%	0%	0%	0%	0%	-
Bicycles on Road	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	2	2	-
Bicycles on Road %	0%	0%	0%	0%	0%	0%	0.6%	0%	0%	0%	0.2%	0.2%	0%	0%	0%	0%	0%	0%	0.2%	0.8%	0%	0%	0.3%	0.3%	-
Pedestrians	-	-	-	-	2	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-
Pedestrians %	-	-	-	-	14.3%	-	-	-	-	-	28.6%	-	-	-	-	-	28.6%	-	-	-	-	-	28.6%	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-
Bicycles on Crosswalk %	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-	-	-	-	0%	-	-



Peak Hour: 04:30 PM - 05:30 PM Weather: Clear (18.3 °C)

Start Time	N Approach WEST 5TH ST						E Approach STONE CHURCH RD W						S Approach WEST 5TH ST						W Approach STONE CHURCH RD W						Int. Total (15 min)
	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	Right	Thru	Left	U-Turn	Peds	Approach Total	
16:30:00	39	95	63	0	5	197	31	122	9	0	2	162	7	79	50	0	5	136	24	135	8	0	2	167	662
16:45:00	37	115	58	0	0	210	29	115	8	0	2	152	10	74	42	0	0	126	28	112	20	0	0	160	648
17:00:00	45	118	46	0	2	209	35	117	5	0	1	157	12	81	39	0	1	132	39	113	13	0	2	165	663
17:15:00	33	98	57	0	2	188	31	114	13	0	0	158	11	69	44	0	0	124	19	137	8	0	3	164	634
Grand Total	154	426	224	0	9	804	126	468	35	0	5	629	40	303	175	0	6	518	110	497	49	0	7	656	2607
Approach%	19.2%	53%	27.9%	0%	-	-	20%	74.4%	5.6%	0%	-	-	7.7%	58.5%	33.8%	0%	-	-	16.8%	75.8%	7.5%	0%	-	-	-
Totals %	5.9%	16.3%	8.6%	0%	30.8%	30.8%	4.8%	18%	1.3%	0%	24.1%	24.1%	1.5%	11.6%	6.7%	0%	19.9%	19.9%	4.2%	19.1%	1.9%	0%	25.2%	25.2%	-
PHF	0.86	0.9	0.89	0	0.96	0.96	0.9	0.96	0.67	0	0.97	0.97	0.83	0.94	0.88	0	0.95	0.95	0.71	0.91	0.61	0	0.98	0.98	-
Heavy	3	2	0	0	5	5	1	13	0	0	14	14	2	2	0	0	4	4	1	8	0	0	9	9	-
Heavy %	1.9%	0.5%	0%	0%	0.6%	0.6%	0.8%	2.8%	0%	0%	2.2%	2.2%	5%	0.7%	0%	0%	0.8%	0.8%	0.9%	1.6%	0%	0%	1.4%	1.4%	-
Lights	151	424	223	0	798	798	125	455	35	0	615	615	38	301	175	0	514	514	109	488	49	0	646	646	-
Lights %	98.1%	99.5%	99.6%	0%	99.3%	99.3%	99.2%	97.2%	100%	0%	97.8%	97.8%	95%	99.3%	100%	0%	99.2%	99.2%	99.1%	98.2%	100%	0%	98.5%	98.5%	-
Single-Unit Trucks	2	2	0	0	4	4	0	7	0	0	7	7	2	0	0	0	2	2	0	4	0	0	4	4	-
Single-Unit Trucks %	1.3%	0.5%	0%	0%	0.5%	0.5%	0%	1.5%	0%	0%	1.1%	1.1%	5%	0%	0%	0%	0.4%	0.4%	0%	0.8%	0%	0%	0.6%	0.6%	-
Buses	0	0	0	0	0	0	1	5	0	0	6	6	0	2	0	0	2	2	0	4	0	0	4	4	-
Buses %	0%	0%	0%	0%	0%	0%	0.8%	1.1%	0%	0%	1%	1%	0%	0.7%	0%	0%	0.4%	0.4%	0%	0.8%	0%	0%	0.6%	0.6%	-
Articulated Trucks	1	0	0	0	1	1	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	-
Articulated Trucks %	0.6%	0%	0%	0%	0.1%	0.1%	0%	0.2%	0%	0%	0.2%	0.2%	0%	0%	0%	0%	0%	0%	0.9%	0%	0%	0%	0.2%	0.2%	-
Bicycles on Road	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	-
Bicycles on Road %	0%	0%	0.4%	0%	0.1%	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.2%	0%	0%	0.2%	0.2%	-
Pedestrians	-	-	-	-	9	9	-	-	-	-	4	4	-	-	-	-	4	4	-	-	-	-	5	5	-
Pedestrians %	-	-	-	-	33.3%	33.3%	-	-	-	-	14.8%	14.8%	-	-	-	-	14.8%	14.8%	-	-	-	-	18.5%	18.5%	-
Bicycles on Crosswalk	-	-	-	-	0	0	-	-	-	-	1	1	-	-	-	-	2	2	-	-	-	-	2	2	-
Bicycles on Crosswalk %	-	-	-	-	0%	0%	-	-	-	-	3.7%	3.7%	-	-	-	-	7.4%	7.4%	-	-	-	-	7.4%	7.4%	-

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast (22.6 °C)



Peak Hour: 04:30 PM - 05:30 PM Weather: Clear (18.3 °C)

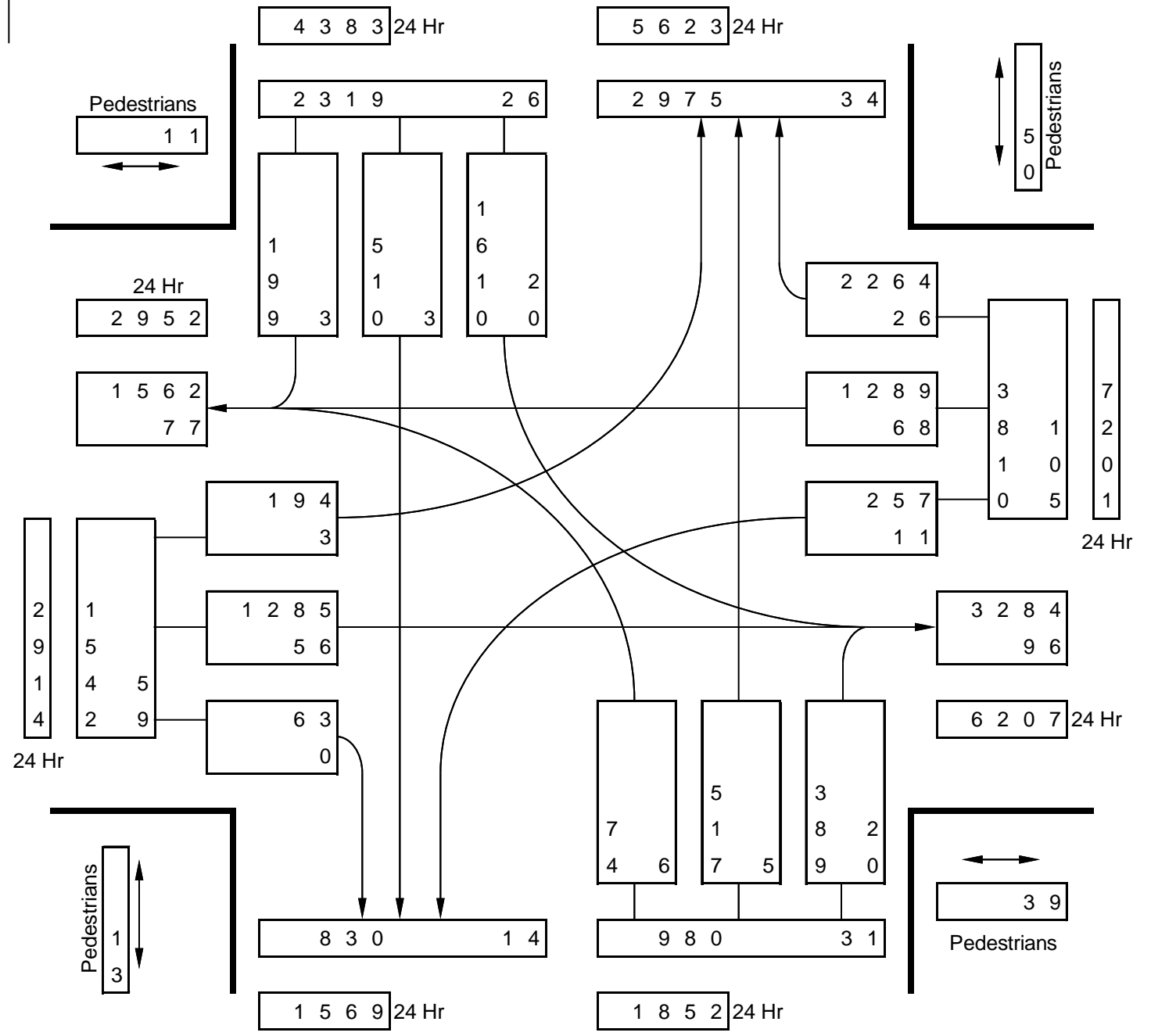
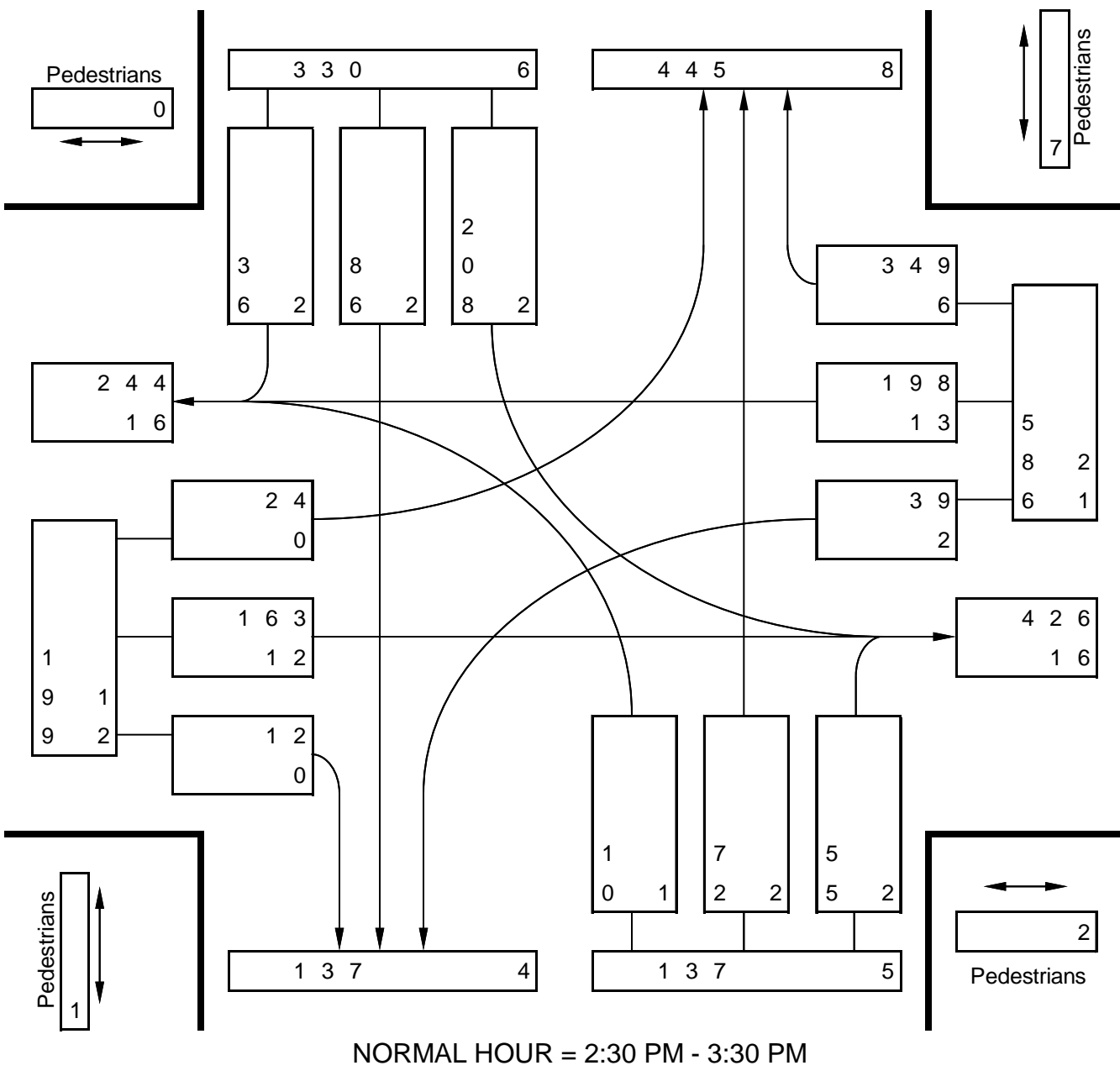
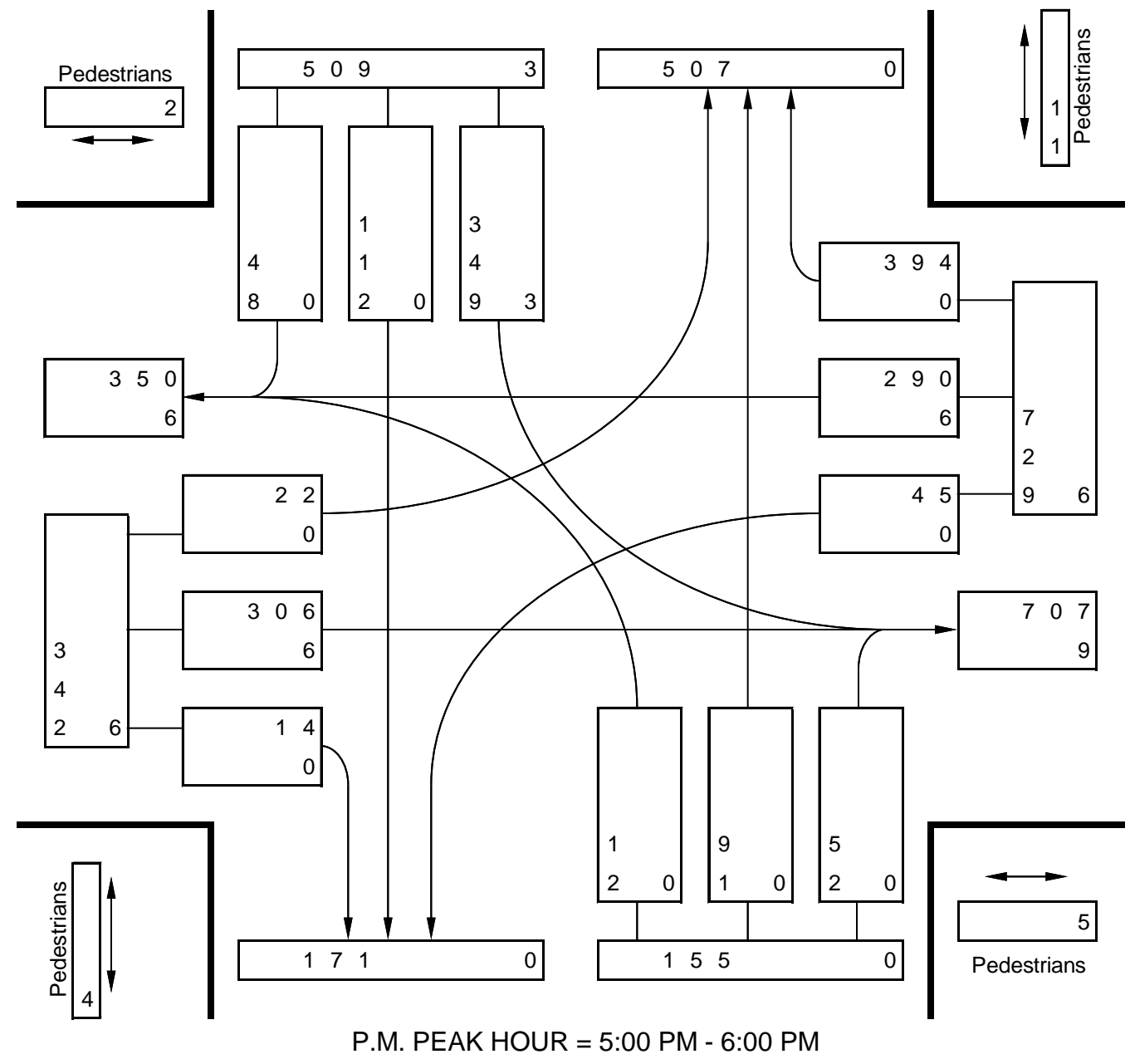
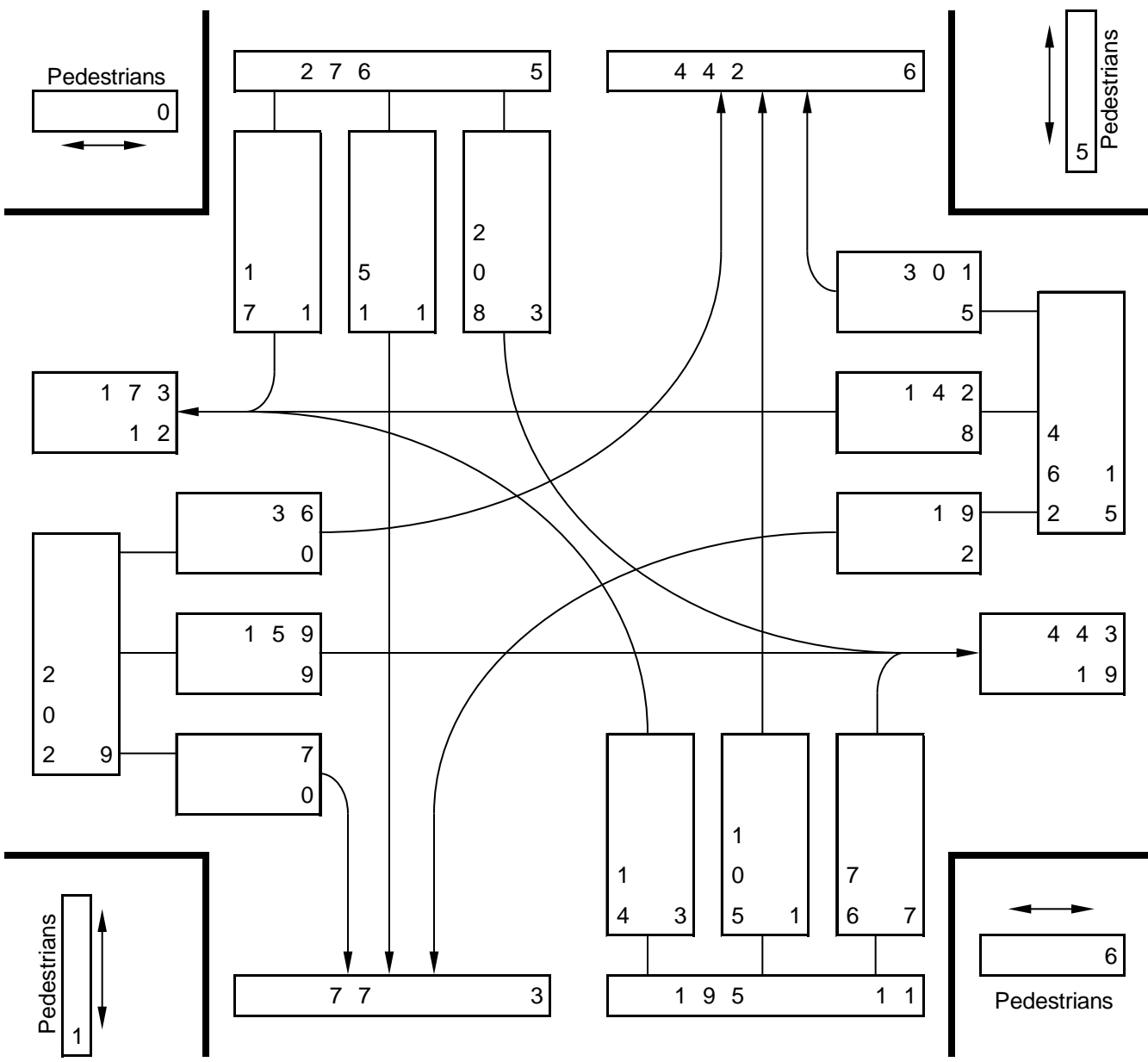


Intersection: Rymal Rd (East/West)
Direction:
Road Condition: Dry
Comments:

at Christie St (North/South)
Weather: Clear

Total Vehicles: 8,651
M.V.E./Year: 5.559
AWDT Factor: 1.89

Date: Thursday
Jun 28, 2018
Period: 7 hours



Appendix B

Existing Traffic Level of Service Calculations

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	168	7	21	150	306	17	106	83	211	52	18
Future Volume (vph)	36	168	7	21	150	306	17	106	83	211	52	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3381	0	1623	3116	0	1513	1673	0	1767	1747	0
Flt Permitted	0.414			0.636			0.709			0.520		
Satd. Flow (perm)	778	3381	0	1073	3116	0	1128	1673	0	963	1747	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			322			40				18
Link Speed (k/h)		60			60			40				50
Link Distance (m)		299.9			345.3			140.0				998.4
Travel Time (s)		18.0			20.7			12.6				71.9
Confl. Peds. (#/hr)			6	6			1		5	5		1
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	5%	0%	10%	5%	2%	18%	1%	8%	1%	2%	6%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	184	0	22	480	0	18	199	0	222	74	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5				3.5
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm		NA
Protected Phases	5	2		1	6			4				8
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8		8
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0		10.0
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8		32.8
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0		45.0
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%		40.9%
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2		39.2
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3		3.3
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5		2.5
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0		-1.0
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8		4.8

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

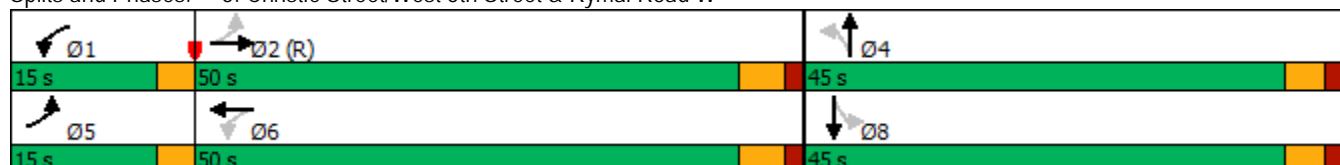


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	71.8	45.6		71.8	45.6		29.4	29.4		29.4	29.4	
Actuated g/C Ratio	0.65	0.41		0.65	0.41		0.27	0.27		0.27	0.27	
v/c Ratio	0.05	0.13		0.03	0.32		0.06	0.42		0.86	0.15	
Control Delay	8.5	19.8		8.5	7.4		26.4	27.3		70.5	26.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.5	19.8		8.5	7.4		26.4	27.3		70.5	26.9	
LOS	A	B		A	A		C	C		E	C	
Approach Delay		17.9			7.4			27.2			59.6	
Approach LOS		B			A			C			E	
Queue Length 50th (m)	2.7	13.0		1.5	11.3		3.0	29.2		51.8	10.9	
Queue Length 95th (m)	8.2	20.6		5.6	22.3		7.8	44.2		70.8	m17.1	
Internal Link Dist (m)		275.9			321.3			116.0			974.4	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	725	1403		818	1480		412	636		351	649	
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	0.05	0.13		0.03	0.32		0.04	0.31		0.63	0.11	

Intersection Summary






















Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.86
 Intersection Signal Delay: 25.3
 Intersection LOS: C
 Intersection Capacity Utilization 61.0%
 ICU Level of Service B
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W



Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	406	102	20	338	168	140	384	30	170	173	83
Future Volume (vph)	122	406	102	20	338	168	140	384	30	170	173	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1750	1749	0	1428	1713	0	1750	1817	0	1750	1713	0
Flt Permitted	0.249			0.323			0.592			0.159		
Satd. Flow (perm)	458	1749	0	484	1713	0	1084	1817	0	292	1713	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			28			4			27	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	2		4	4		2	4		4	4		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	4%	2%	25%	4%	2%	2%	2%	3%	2%	4%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	541	0	21	539	0	149	441	0	181	272	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2		1	6			4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		31.8	31.8		9.0	31.8	
Total Split (s)	10.0	50.0		10.0	50.0		40.0	40.0		10.0	50.0	
Total Split (%)	9.1%	45.5%		9.1%	45.5%		36.4%	36.4%		9.1%	45.5%	
Maximum Green (s)	7.0	44.1		7.0	44.1		34.2	34.2		7.0	44.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.3	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		2.5	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		4.8	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

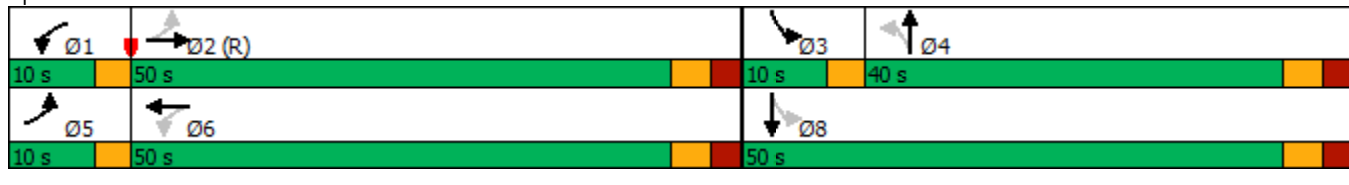


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0		12.0	12.0				12.0
Flash Dont Walk (s)		14.0			14.0		14.0	14.0				14.0
Pedestrian Calls (#/hr)		0			0		0	0				0
Act Effect Green (s)	61.3	55.2		58.7	48.5		31.2	31.2		44.0	41.2	
Actuated g/C Ratio	0.56	0.50		0.53	0.44		0.28	0.28		0.40	0.37	
v/c Ratio	0.37	0.61		0.07	0.70		0.49	0.85		0.82	0.41	
Control Delay	15.4	25.2		12.7	30.5		44.1	58.8		50.8	24.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	15.4	25.2		12.7	30.5		44.1	58.8		50.8	24.1	
LOS	B	C		B	C		D	E		D	C	
Approach Delay		23.3			29.8			55.0			34.8	
Approach LOS		C			C			E			C	
Queue Length 50th (m)	13.6	78.4		2.1	97.0		30.1	97.7		26.3	39.3	
Queue Length 95th (m)	24.8	143.8		6.2	141.3		50.5	133.4		#52.4	59.7	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	357	884		330	771		346	584		222	719	
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	0.36	0.61		0.06	0.70		0.43	0.76		0.82	0.38	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.85
 Intersection Signal Delay: 35.4 Intersection LOS: D
 Intersection Capacity Utilization 81.1% ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	22	312	14	45	296	394	12	91	52	352	112	48
Future Volume (vph)	22	312	14	45	296	394	12	91	52	352	112	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3477	0	1785	3189	0	1785	1761	0	1767	1785	0
Flt Permitted	0.265			0.509			0.604			0.629		
Satd. Flow (perm)	497	3477	0	949	3189	0	1131	1761	0	1158	1785	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			372			29			22	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		299.9			345.3			140.0			998.4	
Travel Time (s)		18.0			20.7			12.6			71.9	
Confl. Peds. (#/hr)	2		5	5		2	4		11	11		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	347	0	48	734	0	13	152	0	374	170	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4				8
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8		8
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8	32.8	
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%	40.9%	
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2	39.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8	4.8	

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

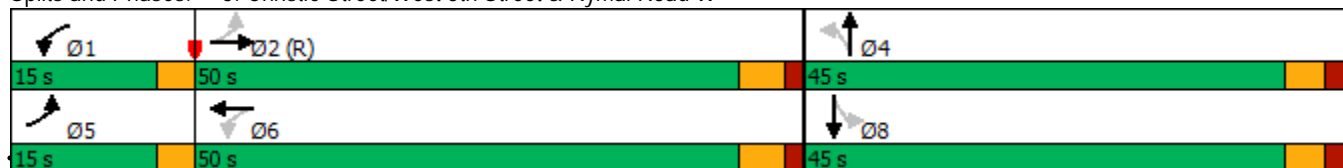


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	63.1	45.6		63.1	45.6		38.1	38.1		38.1	38.1	
Actuated g/C Ratio	0.57	0.41		0.57	0.41		0.35	0.35		0.35	0.35	
v/c Ratio	0.05	0.24		0.07	0.48		0.03	0.24		0.93	0.27	
Control Delay	10.5	21.2		10.6	12.0		22.9	21.0		70.1	33.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.5	21.2		10.6	12.0		22.9	21.0		70.1	33.2	
LOS	B	C		B	B		C	C		E	C	
Approach Delay		20.5			11.9			21.1			58.6	
Approach LOS		C			B			C			E	
Queue Length 50th (m)	2.1	25.8		4.5	28.6		1.9	18.8		87.5	30.0	
Queue Length 95th (m)	5.8	36.7		9.9	45.5		6.2	34.4		m#125.0	m39.9	
Internal Link Dist (m)		275.9			321.3			116.0			974.4	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	461	1444		659	1539		413	661		423	666	
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	0.05	0.24		0.07	0.48		0.03	0.23		0.88	0.26	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 28.1 Intersection LOS: C
 Intersection Capacity Utilization 72.4% ICU Level of Service C
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W
























Existing PM Peak 01-20-2022 Baseline

Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	497	110	35	468	126	175	303	40	224	426	154
Future Volume (vph)	49	497	110	35	468	126	175	303	40	224	426	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	1785	0	1785	1759	0	1785	1812	0	1785	1765	0
Flt Permitted	0.176			0.188			0.229			0.325		
Satd. Flow (perm)	331	1785	0	353	1759	0	428	1812	0	608	1765	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			15			6			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	619	0	36	607	0	179	350	0	229	592	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2		1	6			4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		31.8	31.8		9.0	31.8	
Total Split (s)	10.0	50.0		10.0	50.0		40.0	40.0		10.0	50.0	
Total Split (%)	9.1%	45.5%		9.1%	45.5%		36.4%	36.4%		9.1%	45.5%	
Maximum Green (s)	7.0	44.1		7.0	44.1		34.2	34.2		7.0	44.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.3	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		2.5	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		4.8	4.8		2.0	4.8	

Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

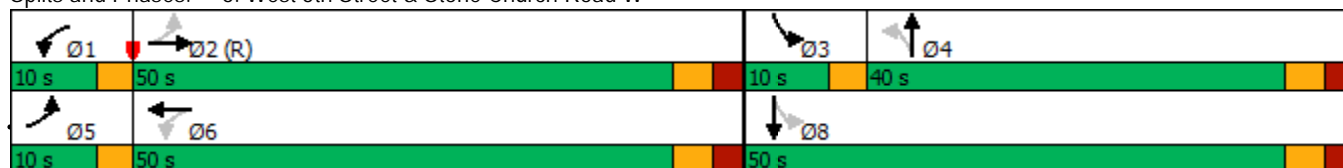


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0		12.0	12.0				12.0
Flash Dont Walk (s)		14.0			14.0		14.0	14.0				14.0
Pedestrian Calls (#/hr)		0			0		0	0				0
Act Effect Green (s)	56.9	49.2		56.3	47.3		35.2	35.2		48.0	45.2	
Actuated g/C Ratio	0.52	0.45		0.51	0.43		0.32	0.32		0.44	0.41	
v/c Ratio	0.18	0.77		0.13	0.79		1.32	0.60		0.65	0.80	
Control Delay	14.3	34.1		13.7	36.5		223.1	50.2		30.9	37.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.3	34.1		13.7	36.5		223.1	50.2		30.9	37.4	
LOS	B	C		B	D		F	D		C	D	
Approach Delay		32.7			35.3			108.7				35.6
Approach LOS		C			D			F				D
Queue Length 50th (m)	5.3	120.4		3.8	117.8		-53.1	74.0		32.7	112.1	
Queue Length 95th (m)	11.4	#186.4		8.9	#181.9		#100.4	107.3		51.1	#162.1	
Internal Link Dist (m)		293.7			302.9			974.4				161.1
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	277	804		285	764		136	583		350	737	
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	0.18	0.77		0.13	0.79		1.32	0.60		0.65	0.80	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 95
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.32
 Intersection Signal Delay: 49.3
 Intersection LOS: D
 Intersection Capacity Utilization 94.2%
 ICU Level of Service F
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.






















Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	497	110	35	468	126	175	303	40	224	426	154
Future Volume (vph)	49	497	110	35	468	126	175	303	40	224	426	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%				0%
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	1785	0	1785	1759	0	1785	1812	0	1785	1765	0
Flt Permitted	0.135			0.149			0.103			0.375		
Satd. Flow (perm)	254	1785	0	280	1759	0	194	1812	0	701	1765	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			14			7				19
Link Speed (k/h)		50			50			50				50
Link Distance (m)		317.7			326.9			998.4				185.1
Travel Time (s)		22.9			23.5			71.9				13.3
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	619	0	36	607	0	179	350	0	229	592	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5				3.5
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	10.0	45.0		10.0	45.0		10.0	45.0		10.0	45.0	
Total Split (%)	9.1%	40.9%		9.1%	40.9%		9.1%	40.9%		9.1%	40.9%	
Maximum Green (s)	7.0	39.1		7.0	39.1		7.0	39.2		7.0	39.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

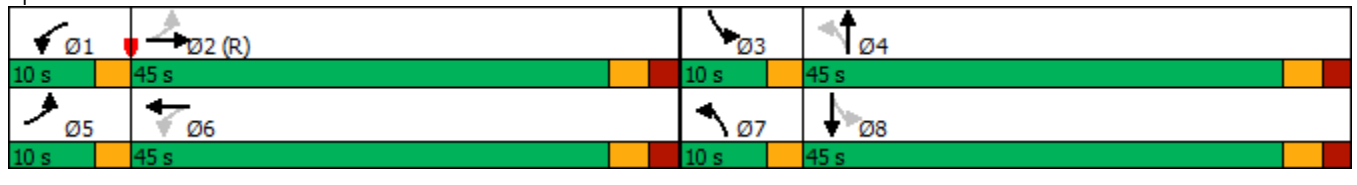


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	53.3	45.6		52.6	43.6		49.6	38.8		49.6	38.8	
Actuated g/C Ratio	0.48	0.41		0.48	0.40		0.45	0.35		0.45	0.35	
v/c Ratio	0.22	0.83		0.15	0.86		0.88	0.54		0.58	0.93	
Control Delay	17.6	41.4		16.6	45.1		69.9	45.1		24.8	56.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	17.6	41.4		16.6	45.1		69.9	45.1		24.8	56.2	
LOS	B	D		B	D		E	D		C	E	
Approach Delay		39.6			43.5			53.5			47.4	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	5.8	131.1		4.2	128.3		31.7	71.4		29.8	121.9	
Queue Length 95th (m)	12.6	#206.2		9.9	#201.4		#65.2	104.1		46.6	#191.3	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	234	745		244	705		203	666		394	657	
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	0.21	0.83		0.15	0.86		0.88	0.53		0.58	0.90	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.93
 Intersection Signal Delay: 45.7
 Intersection LOS: D
 Intersection Capacity Utilization 93.6%
 ICU Level of Service F
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Appendix C

Background Development Applications

1029 West 5th Street

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Mid-Rise) LUC 221 General Urban/Suburban	216	Trip Rates AM - $\text{Ln}(T) = 0.98\text{Ln}(X) - 0.98$ PM - $\text{Ln}(T) = 0.96\text{Ln}(X) - 0.63$	0.09	0.25	0.34	0.26	0.17	0.43
		Total Trips	19	54	73	57	36	93

1125 West 5th Street

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise) LUC 220 General Urban/Suburban	130	Trip Rates AM - $\text{Ln}(T) = 0.95\text{Ln}(X) - 0.51$ PM - $\text{Ln}(T) = 0.89\text{Ln}(X) - 0.02$	0.11	0.36	0.47	0.37	0.21	0.58
		Total Trips	14	47	61	47	28	75

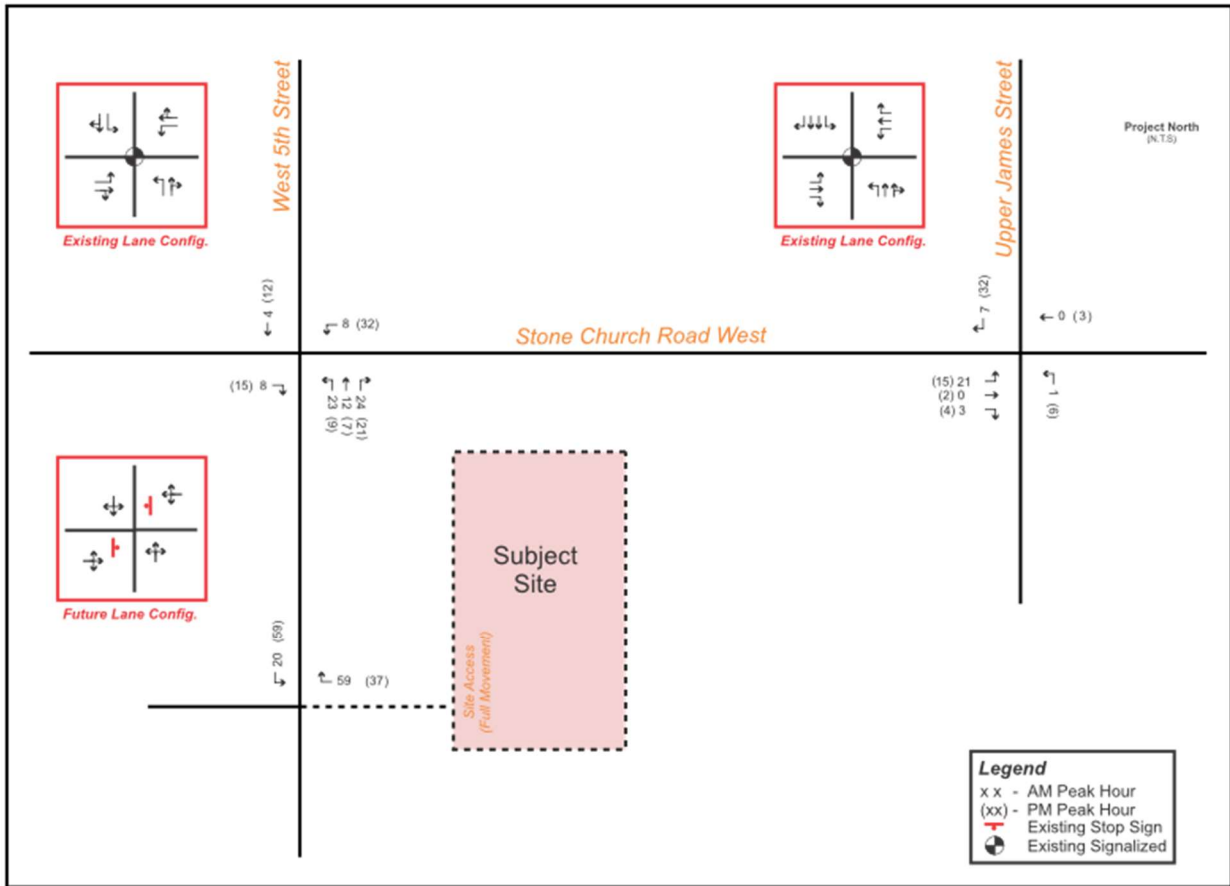
172,178 and 186 Rymal Road W

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise) LUC 220 General Urban/Suburban	153	Trip Rates AM - $\text{Ln}(T) = 0.95\text{Ln}(X) - 0.51$ PM - $\text{Ln}(T) = 0.89\text{Ln}(X) - 0.02$	0.11	0.35	0.46	0.35	0.21	0.56
		Total Trips	16	55	71	54	32	86

26 Rymal Road W

ITE Land Use	Magnitude (units)	Parameters	Morning Peak Hour			Afternoon Peak Hour		
			In	Out	Total	In	Out	Total
Multifamily Housing (Low-Rise) LUC 220 General Urban/Suburban	44	Trip Rates AM - $\text{Ln}(T) = 0.95\text{Ln}(X) - 0.51$ PM - $\text{Ln}(T) = 0.89\text{Ln}(X) - 0.02$	0.12	0.38	0.50	0.4	0.24	0.64
		Total Trips	5	17	22	18	10	28

Figure 4-1 – Revised Site Generated Traffic Assignments



5.0 FUTURE TOTAL CONDITIONS

The forecasted 2023 future total traffic volumes (future background volumes plus site generated traffic volumes) are illustrated in **Figure 5-1** and were analyzed using Synchro 9 software with stopped controlled at the proposed site access. The detailed calculations are provided in **Appendix F** and summarized in **Table 5.1**.

Appendix D

Future Background Level of Service Calculations

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

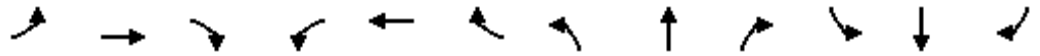


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	38	218	7	21	165	310	17	106	83	223	52	24
Future Volume (vph)	38	218	7	21	165	310	17	106	83	223	52	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3388	0	1623	3125	0	1513	1673	0	1767	1727	0
Flt Permitted	0.401			0.600			0.705			0.527		
Satd. Flow (perm)	753	3388	0	1013	3125	0	1121	1673	0	976	1727	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			326			40			23	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		299.9			345.3			140.0			998.4	
Travel Time (s)		18.0			20.7			12.6			71.9	
Confl. Peds. (#/hr)			6	6			1		5	5		1
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	5%	0%	10%	5%	2%	18%	1%	8%	1%	2%	6%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	40	236	0	22	500	0	18	199	0	235	80	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8	32.8	
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%	40.9%	
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2	39.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8	4.8	

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

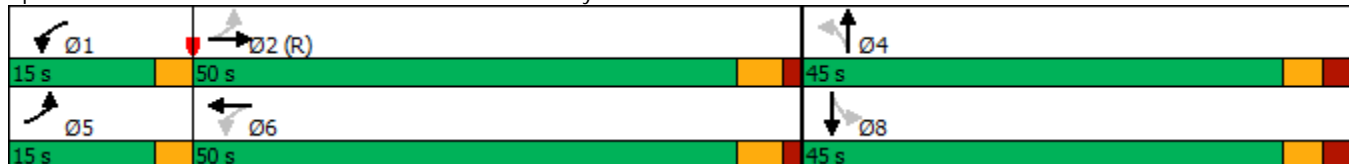


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	70.8	45.6		70.8	45.6		30.4	30.4		30.4	30.4	
Actuated g/C Ratio	0.64	0.41		0.64	0.41		0.28	0.28		0.28	0.28	
v/c Ratio	0.06	0.17		0.03	0.34		0.06	0.41		0.87	0.16	
Control Delay	8.8	20.4		8.8	7.8		25.8	26.5		70.3	27.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	8.8	20.4		8.8	7.8		25.8	26.5		70.3	27.2	
LOS	A	C		A	A		C	C		E	C	
Approach Delay		18.7			7.9			26.4			59.4	
Approach LOS		B			A			C			E	
Queue Length 50th (m)	2.9	17.1		1.6	12.5		3.0	28.7		50.9	9.6	
Queue Length 95th (m)	8.6	25.7		5.6	24.0		7.7	44.1		m71.2	m17.6	
Internal Link Dist (m)		275.9			321.3			116.0			974.4	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	698	1406		778	1486		409	636		356	645	
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	0.17		0.03	0.34		0.04	0.31		0.66	0.12	

Intersection Summary






















Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.87
 Intersection Signal Delay: 25.3
 Intersection LOS: C
 Intersection Capacity Utilization 61.7%
 ICU Level of Service B
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W



Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Future Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1750	1755	0	1428	1726	0	1750	1796	0	1750	1730	0
Flt Permitted	0.140			0.162			0.563			0.108		
Satd. Flow (perm)	258	1755	0	244	1726	0	1032	1796	0	199	1730	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			22			7			21	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	2		4	4		2	4		4	4		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	4%	2%	25%	4%	2%	2%	2%	3%	2%	4%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	654	0	34	626	0	173	622	0	181	326	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		pm+pt	NA	
Protected Phases	5	2		1	6			4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		31.8	31.8		9.0	31.8	
Total Split (s)	10.0	50.0		10.0	50.0		40.0	40.0		10.0	50.0	
Total Split (%)	9.1%	45.5%		9.1%	45.5%		36.4%	36.4%		9.1%	45.5%	
Maximum Green (s)	7.0	44.1		7.0	44.1		34.2	34.2		7.0	44.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.3	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		2.5	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		4.8	4.8		2.0	4.8	

Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

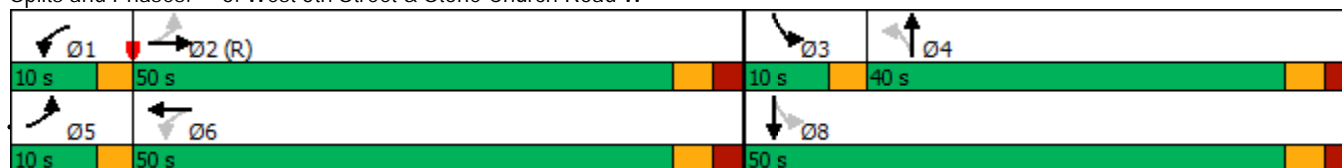


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0		12.0	12.0				12.0
Flash Dont Walk (s)		14.0			14.0		14.0	14.0				14.0
Pedestrian Calls (#/hr)		0			0		0	0				0
Act Effect Green (s)	56.9	49.2		55.5	45.1		35.2	35.2		48.0	45.2	
Actuated g/C Ratio	0.52	0.45		0.50	0.41		0.32	0.32		0.44	0.41	
v/c Ratio	0.54	0.83		0.17	0.87		0.52	1.07		0.91	0.45	
Control Delay	22.0	38.0		14.6	43.1		42.7	99.0		67.8	24.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	22.0	38.0		14.6	43.1		42.7	99.0		67.8	24.3	
LOS	C	D		B	D		D	F		E	C	
Approach Delay		35.4			41.7			86.7				39.8
Approach LOS		D			D			F				D
Queue Length 50th (m)	14.4	133.1		3.6	123.6		33.7	~157.0		25.1	48.8	
Queue Length 95th (m)	24.8	#207.6		8.7	#192.8		57.0	#229.0		#66.5	74.5	
Internal Link Dist (m)		293.7			302.9			974.4				161.1
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	241	791		210	720		330	579		199	723	
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	0.54	0.83		0.16	0.87		0.52	1.07		0.91	0.45	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 105
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.07
 Intersection Signal Delay: 52.6
 Intersection LOS: D
 Intersection Capacity Utilization 94.8%
 ICU Level of Service F
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.






















Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Future Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%				0%
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1750	1755	0	1428	1726	0	1750	1796	0	1750	1730	0
Flt Permitted	0.094			0.107			0.410			0.101		
Satd. Flow (perm)	173	1755	0	161	1726	0	752	1796	0	186	1730	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		11			21			8			19	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	2		4	4		2	4		4	4		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	4%	2%	25%	4%	2%	2%	2%	3%	2%	4%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	654	0	34	626	0	173	622	0	181	326	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		4.5	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	10.0	45.0		10.0	45.0		10.0	45.0		10.0	45.0	
Total Split (%)	9.1%	40.9%		9.1%	40.9%		9.1%	40.9%		9.1%	40.9%	
Maximum Green (s)	7.0	39.1		7.0	39.1		7.0	39.2		7.0	39.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

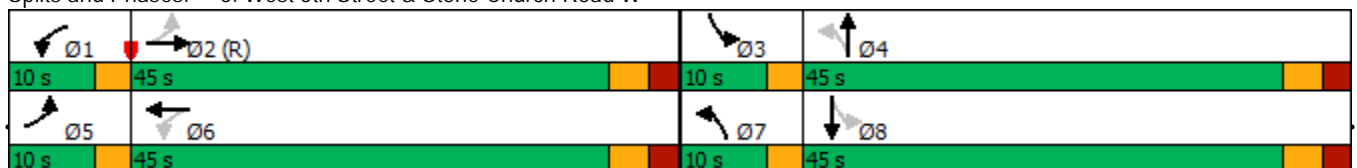


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	52.5	44.8		51.1	40.7		50.4	39.6		50.4	39.6	
Actuated g/C Ratio	0.48	0.41		0.46	0.37		0.46	0.36		0.46	0.36	
v/c Ratio	0.66	0.91		0.21	0.96		0.41	0.96		0.91	0.51	
Control Delay	35.2	49.9		18.4	60.8		21.5	65.2		68.4	29.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	35.2	49.9		18.4	60.8		21.5	65.2		68.4	29.2	
LOS	D	D		B	E		C	E		E	C	
Approach Delay		47.4			58.6			55.7			43.2	
Approach LOS		D			E			E			D	
Queue Length 50th (m)	15.9	~146.6		4.0	134.4		23.2	138.6		23.2	53.3	
Queue Length 95th (m)	#38.1	#227.2		9.6	#211.8		40.4	#208.9		#66.3	81.2	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	197	720		167	652		417	661		198	644	
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	0.66	0.91		0.20	0.96		0.41	0.94		0.91	0.51	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 105
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.96
 Intersection Signal Delay: 51.7 Intersection LOS: D
 Intersection Capacity Utilization 94.8% ICU Level of Service F
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-21-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Future Volume (vph)	122	505	110	32	420	168	163	507	78	170	224	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%				0%
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1750	3334	0	1428	3280	0	1750	1799	0	1750	1735	0
Flt Permitted	0.292			0.324			0.410			0.101		
Satd. Flow (perm)	537	3334	0	486	3280	0	753	1799	0	186	1735	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		27			61			8				19
Link Speed (k/h)		50			50			50				50
Link Distance (m)		317.7			326.9			998.4				185.1
Travel Time (s)		22.9			23.5			71.9				13.3
Confl. Peds. (#/hr)	2		4	4		2	4		4	4		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	4%	2%	25%	4%	2%	2%	2%	3%	2%	4%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	654	0	34	626	0	173	622	0	181	326	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5				3.5
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		4.5	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	10.0	45.0		10.0	45.0		10.0	45.0		10.0	45.0	
Total Split (%)	9.1%	40.9%		9.1%	40.9%		9.1%	40.9%		9.1%	40.9%	
Maximum Green (s)	7.0	39.1		7.0	39.1		7.0	39.2		7.0	39.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
 6: West 5th Street & Stone Church Road W

01-21-2022

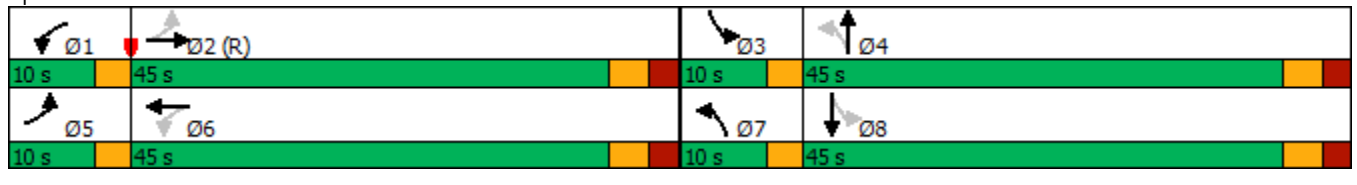


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	52.5	44.8		51.2	40.8		50.3	39.5		50.3	39.5	
Actuated g/C Ratio	0.48	0.41		0.47	0.37		0.46	0.36		0.46	0.36	
v/c Ratio	0.38	0.48		0.12	0.50		0.42	0.96		0.91	0.51	
Control Delay	19.2	25.4		16.2	25.7		21.5	65.1		68.4	29.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	19.2	25.4		16.2	25.7		21.5	65.1		68.4	29.2	
LOS	B	C		B	C		C	E		E	C	
Approach Delay		24.3			25.2			55.6			43.2	
Approach LOS		C			C			E			D	
Queue Length 50th (m)	15.9	57.8		4.0	51.6		23.2	138.5		23.2	53.3	
Queue Length 95th (m)	27.5	76.5		9.6	69.3		40.4	#208.6		#66.3	81.3	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	344	1374		296	1254		416	662		198	646	
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	0.38	0.48		0.11	0.50		0.42	0.94		0.91	0.50	

Intersection Summary





















Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.96
 Intersection Signal Delay: 37.1
 Intersection LOS: D
 Intersection Capacity Utilization 84.1%
 ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings
 5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	28	341	14	45	346	406	12	91	52	359	112	51
Future Volume (vph)	28	341	14	45	346	406	12	91	52	359	112	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3477	0	1785	3207	0	1785	1761	0	1767	1781	0
Flt Permitted	0.232			0.486			0.601			0.630		
Satd. Flow (perm)	435	3477	0	907	3207	0	1125	1761	0	1160	1781	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			331			29			23	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		299.9			345.3			140.0			998.4	
Travel Time (s)		18.0			20.7			12.6			71.9	
Confl. Peds. (#/hr)	2		5	5		2	4		11	11		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	30	378	0	48	800	0	13	152	0	382	173	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8	32.8	
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%	40.9%	
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2	39.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8	4.8	

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

01-20-2022

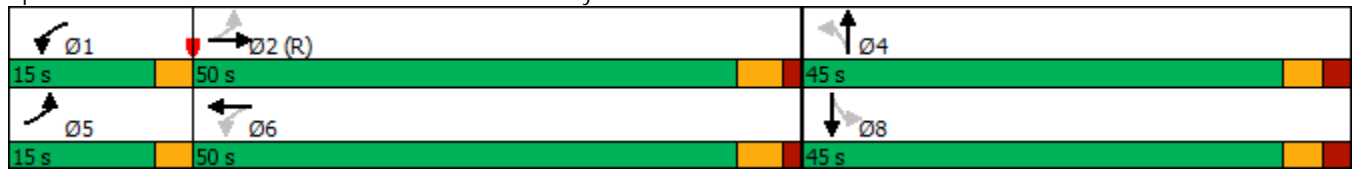


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	62.6	45.6		62.6	45.6		38.6	38.6		38.6	38.6	
Actuated g/C Ratio	0.57	0.41		0.57	0.41		0.35	0.35		0.35	0.35	
v/c Ratio	0.07	0.26		0.08	0.53		0.03	0.24		0.94	0.27	
Control Delay	10.6	21.5		10.7	14.8		22.9	20.8		67.5	22.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.6	21.5		10.7	14.8		22.9	20.8		67.5	22.8	
LOS	B	C		B	B		C	C		E	C	
Approach Delay		20.7			14.5			21.0			53.6	
Approach LOS		C			B			C			D	
Queue Length 50th (m)	2.8	28.5		4.5	39.5		1.9	18.8		80.8	23.3	
Queue Length 95th (m)	7.0	39.9		9.9	57.8		6.2	34.4		#140.0	40.4	
Internal Link Dist (m)		275.9			321.3			116.0			974.4	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	427	1444		633	1523		411	661		423	665	
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	0.07	0.26		0.08	0.53		0.03	0.23		0.90	0.26	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.94
 Intersection Signal Delay: 27.3
 Intersection LOS: C
 Intersection Capacity Utilization 74.5%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Future Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	1788	0	1785	1767	0	1785	1805	0	1785	1782	0
Flt Permitted	0.073			0.071			0.070			0.315		
Satd. Flow (perm)	137	1788	0	133	1767	0	132	1805	0	589	1782	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			9			7			11	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	759	0	81	723	0	188	466	0	229	735	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	9.0	60.0		9.0	60.0		13.0	64.0		9.0	60.0	
Total Split (%)	6.3%	42.3%		6.3%	42.3%		9.2%	45.1%		6.3%	42.3%	
Maximum Green (s)	6.0	54.1		6.0	54.1		10.0	58.2		6.0	54.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

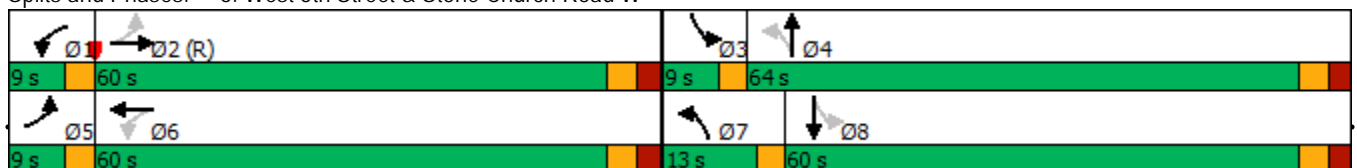


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	64.9	55.1		65.4	56.9		71.0	59.2		65.0	55.2	
Actuated g/C Ratio	0.46	0.39		0.46	0.40		0.50	0.42		0.46	0.39	
v/c Ratio	0.35	1.09		0.57	1.01		0.97	0.62		0.70	1.05	
Control Delay	27.4	100.9		37.8	78.9		91.5	36.3		37.1	89.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.4	100.9		37.8	78.9		91.5	36.3		37.1	89.6	
LOS	C	F		D	E		F	D		D	F	
Approach Delay		96.3			74.7			52.2			77.1	
Approach LOS		F			E			D			E	
Queue Length 50th (m)	7.9	~250.3		13.0	~230.1		38.7	105.4		38.0	~234.6	
Queue Length 95th (m)	15.9	#330.6		25.0	#309.8		#90.5	144.4		56.1	#314.9	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	143	698		142	713		194	756		328	699	
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	0.35	1.09		0.57	1.01		0.97	0.62		0.70	1.05	

Intersection Summary

Area Type: Other
 Cycle Length: 142
 Actuated Cycle Length: 142
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 135
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.09
 Intersection Signal Delay: 76.3 Intersection LOS: E
 Intersection Capacity Utilization 108.9% ICU Level of Service G
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-21-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Future Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%				0%
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	1788	0	1785	1767	0	1785	1805	0	1785	1782	0
Flt Permitted	0.073			0.071			0.070			0.315		
Satd. Flow (perm)	137	1788	0	133	1767	0	132	1805	0	589	1782	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			9			7				11
Link Speed (k/h)		50			50			50				50
Link Distance (m)		317.7			326.9			998.4				185.1
Travel Time (s)		22.9			23.5			71.9				13.3
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	759	0	81	723	0	188	466	0	229	735	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5				3.5
Link Offset(m)		0.0			0.0			0.0				0.0
Crosswalk Width(m)		4.8			4.8			4.8				4.8
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	9.0	60.0		9.0	60.0		13.0	64.0		9.0	60.0	
Total Split (%)	6.3%	42.3%		6.3%	42.3%		9.2%	45.1%		6.3%	42.3%	
Maximum Green (s)	6.0	54.1		6.0	54.1		10.0	58.2		6.0	54.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-21-2022

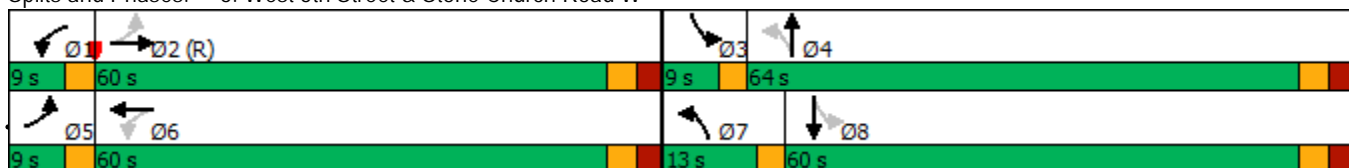


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	64.9	55.1		65.4	56.9		71.0	59.2		65.0	55.2	
Actuated g/C Ratio	0.46	0.39		0.46	0.40		0.50	0.42		0.46	0.39	
v/c Ratio	0.35	1.09		0.57	1.01		0.97	0.62		0.70	1.05	
Control Delay	27.4	100.9		37.8	78.9		91.5	36.3		37.1	89.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.4	100.9		37.8	78.9		91.5	36.3		37.1	89.6	
LOS	C	F		D	E		F	D		D	F	
Approach Delay		96.3			74.7			52.2			77.1	
Approach LOS		F			E			D			E	
Queue Length 50th (m)	7.9	~250.3		13.0	~230.1		38.7	105.4		38.0	~234.6	
Queue Length 95th (m)	15.9	#330.6		25.0	#309.8		#90.5	144.4		56.1	#314.9	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	143	698		142	713		194	756		328	699	
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	0.35	1.09		0.57	1.01		0.97	0.62		0.70	1.05	

Intersection Summary

Area Type: Other
 Cycle Length: 142
 Actuated Cycle Length: 142
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 135
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.09
 Intersection Signal Delay: 76.3 Intersection LOS: E
 Intersection Capacity Utilization 108.9% ICU Level of Service G
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.





















Splits and Phases: 6: West 5th Street & Stone Church Road W



Lanes, Volumes, Timings

6: West 5th Street & Stone Church Road W

01-20-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Future Volume (vph)	49	618	125	79	582	126	184	395	62	224	566	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3398	0	1785	3359	0	1785	1809	0	1785	1788	0
Flt Permitted	0.227			0.207			0.071			0.348		
Satd. Flow (perm)	424	3398	0	388	3359	0	133	1809	0	652	1788	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20			21			8			13	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			998.4			185.1	
Travel Time (s)		22.9			23.5			71.9			13.3	
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	759	0	81	723	0	188	466	0	229	735	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	9.0	48.0		9.0	48.0		13.0	64.0		9.0	60.0	
Total Split (%)	6.9%	36.9%		6.9%	36.9%		10.0%	49.2%		6.9%	46.2%	
Maximum Green (s)	6.0	42.1		6.0	42.1		10.0	58.2		6.0	54.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

01-20-2022

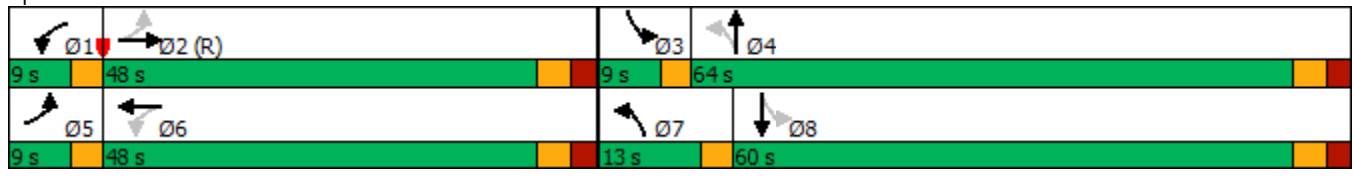


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	54.1	45.6		54.1	45.6		70.3	58.5		64.3	54.5	
Actuated g/C Ratio	0.42	0.35		0.42	0.35		0.54	0.45		0.49	0.42	
v/c Ratio	0.20	0.63		0.34	0.61		0.89	0.57		0.60	0.97	
Control Delay	24.3	37.7		26.8	37.1		68.8	29.1		25.0	63.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	24.3	37.7		26.8	37.1		68.8	29.1		25.0	63.0	
LOS	C	D		C	D		E	C		C	E	
Approach Delay		36.9			36.0			40.5			53.9	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	7.9	89.8		13.0	84.5		33.0	88.7		31.0	187.2	
Queue Length 95th (m)	16.3	112.5		23.9	106.5		#77.9	123.6		46.7	#273.1	
Internal Link Dist (m)		293.7			302.9			974.4			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	249	1204		237	1191		211	828		383	766	
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	0.20	0.63		0.34	0.61		0.89	0.56		0.60	0.96	

Intersection Summary

Area Type: Other
 Cycle Length: 130
 Actuated Cycle Length: 130
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.97
 Intersection Signal Delay: 42.5 Intersection LOS: D
 Intersection Capacity Utilization 90.3% ICU Level of Service E
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



Appendix E

2016 Transportation Tomorrow Survey (TTS)

Data Analysis

Auto Trip Distribution - External Hamilton

Cross Tabulation Query Form - Trip - 2016 v1.1

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

Filters:

Primary travel mode of trip - mode_prime In D
 and
 Start time of trip - start_time In 600-900
 and
 2006 GTA zone of origin - gta06_orig In 5056

	M	P	T	U
2006 GTA zone of origin - gta06_orig In 5056		5058	5066	

Trip 2016

Table:

	PD 11 of Toronto	Vaughan	Mississauga	Milton	Oakville	Burlington	Flamborough	Dundas	Ancaster	Glanbrook	Stoney Creek	Hamilton	Grimsby	Lincoln	Waterloo	Kitchener	Cambridge	City of Guelph	Haldimand-Norfolk	Brantford	External	
5056	46	0	0	0	33	17	0	32	69	263	0	499	0	0	0	0	0	0	0	0	0	
5058	0	55	53	0	37	0	0	0	15	0	147	658	0	0	0	19	37	50	48	19	12	
5066	0	0	0	36	0	145	26	58	119	53	0	2006	48	59	57	0	0	27	0	100	57	
	46	55	53	36	70	162	26	90	203	316	147	3163	48	59	57	19	37	77	48	119	69	4900
	1%	1%	1%	1%	1%	3%	1%	2%	4%	6%	3%	65%	1%	1%	1%	0%	1%	2%	1%	2%	1%	100%

Hamilton	65%
Toronto	1%
York Region	1%
Peel Region	1%
Halton Region	5%
Waterloo Area	6%
Hamilton North	7%
Niagara Area	8%
Glanbrook	6%
	100%

Auto Trip Distribution - Internal Hamilton

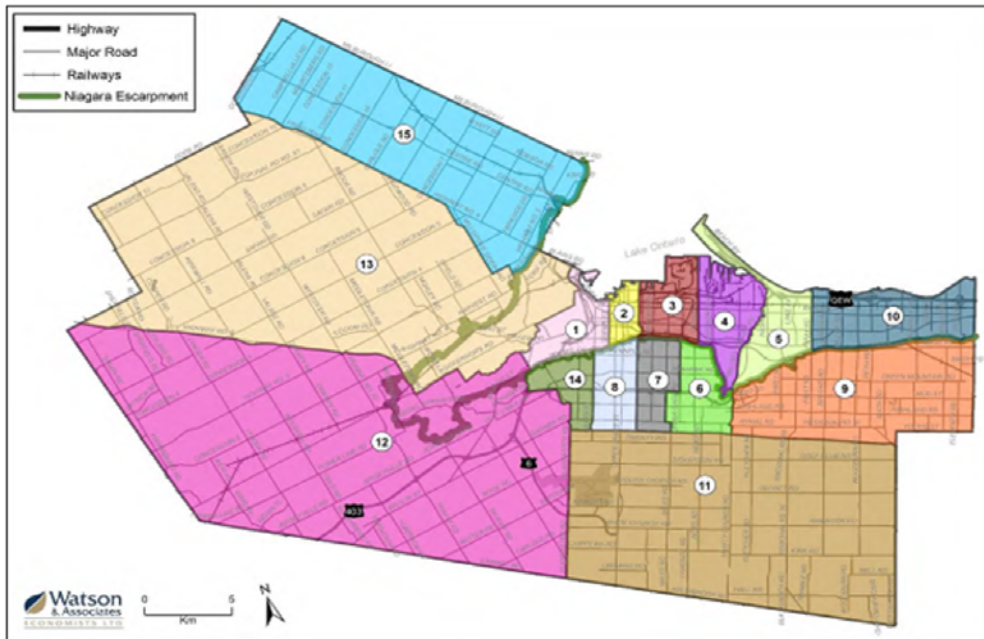
Cross Tabulation Query Form - Trip - 2016 v1.1

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

Filters:
 Primary travel mode of trip - mode_prime In D
 and
 Start time of trip - start_time In 600-900
 and
 2006 GTA zone of origin - gta06_orig In 5056
 and
 Ward number of destination - ward_dest In 171-185

Trip 2016

Ward	1	2	3	4	5	6	7	8	10	11	12	13	15		
5056	171	172	173	174	175	176	177	178	180	181	182	183	185		
5058	0	81	28	0	0	55	335	0	0	263	69	32	0		
5066	0	0	0	57	37	122	228	215	126	21	15	0	0		
	711	53	258	0	49	163	99	673	0	53	119	58	26		
	711	134	286	57	86	340	662	888	126	337	203	90	26	3946	
	18%	3%	7%	1%	2%	9%	17%	23%	3%	9%	5%	2%	1%	100%	
Hamilton	65%														
				North	36%	23%									
				South	19%	12%									
				East	36%	23%									
				West	9%	6%									
					100%	65%									























Appendix F

Future Total Level of Service Calculations

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

04-14-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	218	7	21	165	315	17	106	83	239	52	27
Future Volume (vph)	39	218	7	21	165	315	17	106	83	239	52	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3388	0	1623	3125	0	1513	1673	0	1767	1718	0
Flt Permitted	0.397			0.600			0.703			0.534		
Satd. Flow (perm)	746	3388	0	1013	3125	0	1118	1673	0	989	1718	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3			332			40			26	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		299.9			345.3			140.0			361.2	
Travel Time (s)		18.0			20.7			12.6			26.0	
Confl. Peds. (#/hr)			6	6			1		5	5		1
Confl. Bikes (#/hr)												
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	5%	0%	10%	5%	2%	18%	1%	8%	1%	2%	6%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	41	236	0	22	506	0	18	199	0	252	83	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8	32.8	
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%	40.9%	
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2	39.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8	4.8	

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

04-14-2022

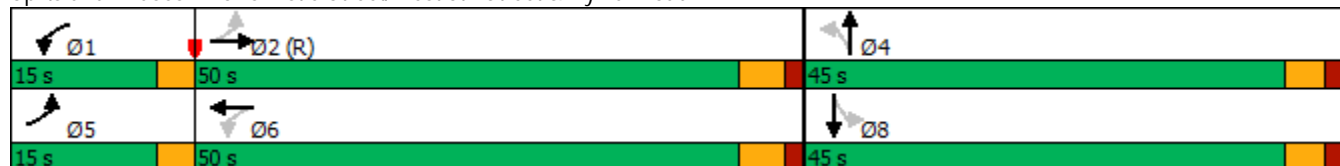


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	69.5	45.6		69.5	45.6		31.7	31.7		31.7	31.7	
Actuated g/C Ratio	0.63	0.41		0.63	0.41		0.29	0.29		0.29	0.29	
v/c Ratio	0.06	0.17		0.03	0.34		0.06	0.39		0.88	0.16	
Control Delay	9.2	20.4		9.2	7.7		25.1	25.5		66.2	22.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.2	20.4		9.2	7.7		25.1	25.5		66.2	22.6	
LOS	A	C		A	A		C	C		E	C	
Approach Delay		18.7			7.8			25.5			55.4	
Approach LOS		B			A			C			E	
Queue Length 50th (m)	3.1	17.1		1.7	12.5		2.9	28.0		54.4	9.3	
Queue Length 95th (m)	8.8	25.7		5.6	24.1		7.7	44.1		m74.8	m16.6	
Internal Link Dist (m)		275.9			321.3			116.0			337.2	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	674	1406		758	1489		408	636		361	644	
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	0.17		0.03	0.34		0.04	0.31		0.70	0.13	

Intersection Summary






















Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.88
 Intersection Signal Delay: 24.6
 Intersection LOS: C
 Intersection Capacity Utilization 62.6%
 ICU Level of Service B
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W



Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

04-14-2022

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	505	112	37	420	168	169	530	94	170	230	83
Future Volume (vph)	122	505	112	37	420	168	169	530	94	170	230	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1750	1755	0	1428	1726	0	1750	1789	0	1750	1730	0
Flt Permitted	0.093			0.104			0.413			0.097		
Satd. Flow (perm)	171	1755	0	156	1726	0	758	1789	0	179	1730	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		12			21			9			19	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			637.2			185.1	
Travel Time (s)		22.9			23.5			45.9			13.3	
Confl. Peds. (#/hr)	2		4	4		2	4		4	4		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	2%	4%	2%	25%	4%	2%	2%	2%	3%	2%	4%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	656	0	39	626	0	180	664	0	181	333	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		4.5	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	9.0	46.0		9.0	46.0		9.0	46.0		9.0	46.0	
Total Split (%)	8.2%	41.8%		8.2%	41.8%		8.2%	41.8%		8.2%	41.8%	
Maximum Green (s)	6.0	40.1		6.0	40.1		6.0	40.2		6.0	40.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

04-14-2022

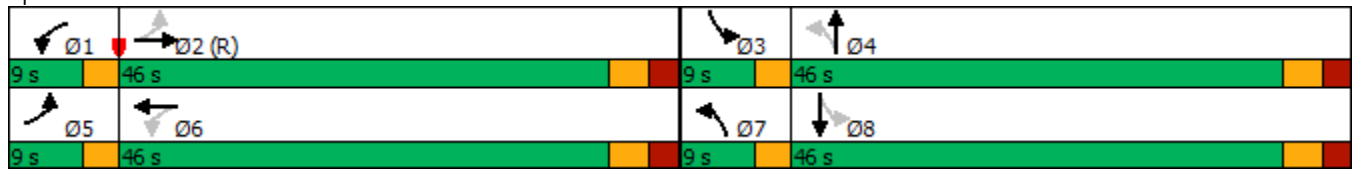


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	51.8	44.7		50.9	41.1		51.0	41.2		51.0	41.2	
Actuated g/C Ratio	0.47	0.41		0.46	0.37		0.46	0.37		0.46	0.37	
v/c Ratio	0.72	0.91		0.26	0.95		0.43	0.98		0.99	0.51	
Control Delay	41.5	50.0		19.5	58.3		21.1	68.2		89.7	28.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	41.5	50.0		19.5	58.3		21.1	68.2		89.7	28.2	
LOS	D	D		B	E		C	E		F	C	
Approach Delay		48.6			56.1			58.1			49.8	
Approach LOS		D			E			E			D	
Queue Length 50th (m)	15.9	143.6		4.6	132.2		23.2	146.0		24.0	54.0	
Queue Length 95th (m)	#41.6	#223.5		10.6	#208.0		40.4	#223.3		#70.8	82.3	
Internal Link Dist (m)		293.7			302.9			613.2			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	180	720		153	658		414	675		182	659	
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	0.72	0.91		0.25	0.95		0.43	0.98		0.99	0.51	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 115
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.99
 Intersection Signal Delay: 53.5 Intersection LOS: D
 Intersection Capacity Utilization 97.0% ICU Level of Service F
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



HCM Unsignalized Intersection Capacity Analysis

9: West 5th Street & Site Access

04-14-2022



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	19	45	454	6	13	299
Future Volume (Veh/h)	19	45	454	6	13	299
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)	21	49	493	7	14	325
Pedestrians	10					
Lane Width (m)	3.5					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)	361					
pX, platoon unblocked						
vC, conflicting volume	860	506			510	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	860	506			510	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	91			99	
cM capacity (veh/h)	322	565			1057	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	70	500	339			
Volume Left	21	0	14			
Volume Right	49	7	0			
cSH	461	1700	1057			
Volume to Capacity	0.15	0.29	0.01			
Queue Length 95th (m)	4.3	0.0	0.3			
Control Delay (s)	14.2	0.0	0.5			
Lane LOS	B		A			
Approach Delay (s)	14.2	0.0	0.5			
Approach LOS	B					
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			36.8%	ICU Level of Service	A	
Analysis Period (min)	15					

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

04-14-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	341	14	45	346	419	12	91	52	367	112	53
Future Volume (vph)	30	341	14	45	346	419	12	91	52	367	112	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%				0%
Storage Length (m)	40.0		0.0	35.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	3477	0	1785	3203	0	1785	1761	0	1767	1779	0
Flt Permitted	0.226			0.486			0.599			0.631		
Satd. Flow (perm)	424	3477	0	907	3203	0	1121	1761	0	1161	1779	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		5			342			29			24	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		299.9			345.3			140.0			361.2	
Travel Time (s)		18.0			20.7			12.6			26.0	
Confl. Peds. (#/hr)	2		5	5		2	4		11	11		4
Confl. Bikes (#/hr)												
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	0%	0%	2%	0%	0%	0%	0%	1%	0%	0%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%				0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	32	378	0	48	814	0	13	152	0	390	175	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4				8
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		4	4		8		8
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	13.0	26.4		9.5	26.4		32.8	32.8		32.8	32.8	
Total Split (s)	15.0	50.0		15.0	50.0		45.0	45.0		45.0	45.0	
Total Split (%)	13.6%	45.5%		13.6%	45.5%		40.9%	40.9%		40.9%	40.9%	
Maximum Green (s)	12.0	44.6		12.0	44.6		39.2	39.2		39.2	39.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		2.5	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.4		2.0	4.4		4.8	4.8		4.8	4.8	

Lanes, Volumes, Timings

5: Christie Street/West 5th Street & Rymal Road W

04-14-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	Max	C-Max		Max	Max		None	None		None	None	
Walk Time (s)		10.0			10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effect Green (s)	62.3	45.6		62.3	45.6		38.9	38.9		38.9	38.9	
Actuated g/C Ratio	0.57	0.41		0.57	0.41		0.35	0.35		0.35	0.35	
v/c Ratio	0.08	0.26		0.08	0.53		0.03	0.24		0.95	0.27	
Control Delay	10.7	21.5		10.7	14.7		22.9	20.7		68.9	22.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.7	21.5		10.7	14.7		22.9	20.7		68.9	22.6	
LOS	B	C		B	B		C	C		E	C	
Approach Delay		20.6			14.5			20.9			54.6	
Approach LOS		C			B			C			D	
Queue Length 50th (m)	3.0	28.5		4.5	40.0		1.9	18.8		83.3	23.4	
Queue Length 95th (m)	7.3	39.9		9.9	58.5		6.2	34.4		#144.2	40.6	
Internal Link Dist (m)		275.9			321.3			116.0			337.2	
Turn Bay Length (m)	40.0			35.0			15.0			20.0		
Base Capacity (vph)	416	1444		626	1528		409	661		424	665	
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	0.08	0.26		0.08	0.53		0.03	0.23		0.92	0.26	

Intersection Summary

Area Type: Other
 Cycle Length: 110
 Actuated Cycle Length: 110
 Offset: 24 (22%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.95
 Intersection Signal Delay: 27.6
 Intersection LOS: C
 Intersection Capacity Utilization 75.4%
 ICU Level of Service D
 Analysis Period (min) 15
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 5: Christie Street/West 5th Street & Rymal Road W



Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

04-14-2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	49	618	130	92	582	126	187	407	70	224	584	154
Future Volume (vph)	49	618	130	92	582	126	187	407	70	224	584	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Grade (%)		0%			0%			0%			0%	
Storage Length (m)	55.0		0.0	55.0		0.0	30.0		0.0	55.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.5			7.5			7.5			7.5		
Satd. Flow (prot)	1785	1786	0	1785	1767	0	1785	1800	0	1785	1784	0
Flt Permitted	0.073			0.071			0.071			0.282		
Satd. Flow (perm)	137	1786	0	133	1767	0	133	1800	0	528	1784	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			9			7			11	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		317.7			326.9			637.2			185.1	
Travel Time (s)		22.9			23.5			45.9			13.3	
Confl. Peds. (#/hr)	9		6	6		9	7		5	5		7
Confl. Bikes (#/hr)												
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	0%	2%	1%	0%	3%	1%	0%	1%	5%	0%	1%	2%
Bus Blockages (#/hr)	0	0	2	0	0	2	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Shared Lane Traffic (%)												
Lane Group Flow (vph)	50	764	0	94	723	0	191	486	0	229	753	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.5			3.5			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.8			4.8			4.8			4.8	
Two way Left Turn Lane												
Headway Factor	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Detector Phase	5	2		1	6		7	4		3	8	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	9.0	31.9		9.0	32.9		9.0	31.8		9.0	31.8	
Total Split (s)	9.0	60.0		9.0	60.0		12.0	62.0		9.0	59.0	
Total Split (%)	6.4%	42.9%		6.4%	42.9%		8.6%	44.3%		6.4%	42.1%	
Maximum Green (s)	6.0	54.1		6.0	54.1		9.0	56.2		6.0	53.2	
Yellow Time (s)	3.0	3.3		3.0	3.3		3.0	3.3		3.0	3.3	
All-Red Time (s)	0.0	2.6		0.0	2.6		0.0	2.5		0.0	2.5	
Lost Time Adjust (s)	-1.0	-1.0		-1.0	-1.0		-1.0	-1.0		-1.0	-1.0	
Total Lost Time (s)	2.0	4.9		2.0	4.9		2.0	4.8		2.0	4.8	

Lanes, Volumes, Timings
6: West 5th Street & Stone Church Road W

04-14-2022

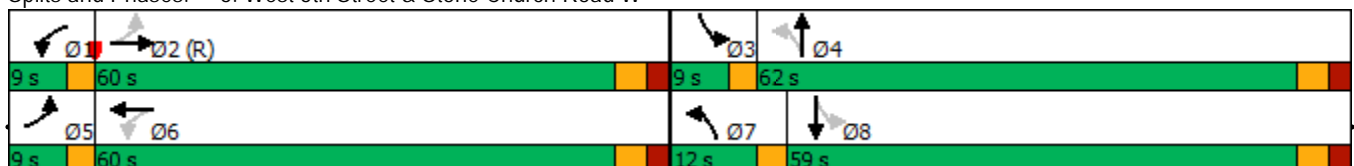


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Minimum Gap (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Time Before Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Time To Reduce (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Recall Mode	None	C-Max		None	Max		None	None		None	None	
Walk Time (s)		12.0			12.0			12.0			12.0	
Flash Dont Walk (s)		14.0			14.0			14.0			14.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effect Green (s)	64.9	55.1		65.4	56.9		69.0	57.2		64.0	54.2	
Actuated g/C Ratio	0.46	0.39		0.47	0.41		0.49	0.41		0.46	0.39	
v/c Ratio	0.34	1.08		0.65	1.00		1.04	0.66		0.75	1.08	
Control Delay	26.2	97.1		43.6	74.8		111.5	38.1		41.9	98.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	26.2	97.1		43.6	74.8		111.5	38.1		41.9	98.0	
LOS	C	F		D	E		F	D		D	F	
Approach Delay		92.8			71.2			58.8			84.9	
Approach LOS		F			E			E			F	
Queue Length 50th (m)	7.7	~246.6		14.8	~223.8		~42.6	111.8		38.0	~242.9	
Queue Length 95th (m)	15.5	#327.6		#34.9	#302.9		#94.2	152.9		#61.9	#323.2	
Internal Link Dist (m)		293.7			302.9			613.2			161.1	
Turn Bay Length (m)	55.0			55.0			30.0			55.0		
Base Capacity (vph)	146	708		144	723		183	739		304	697	
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	0.34	1.08		0.65	1.00		1.04	0.66		0.75	1.08	

Intersection Summary

Area Type: Other
 Cycle Length: 140
 Actuated Cycle Length: 140
 Offset: 1 (1%), Referenced to phase 2:EBTL, Start of Green
 Natural Cycle: 125
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.08
 Intersection Signal Delay: 78.1 Intersection LOS: E
 Intersection Capacity Utilization 111.0% ICU Level of Service H
 Analysis Period (min) 15
 ~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 6: West 5th Street & Stone Church Road W



HCM Unsignalized Intersection Capacity Analysis

9: West 5th Street & Site Access

04-14-2022



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	23	525	15	36	522
Future Volume (Veh/h)	10	23	525	15	36	522
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)	11	25	571	16	39	567
Pedestrians	10					
Lane Width (m)	3.5					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None		None	
Median storage veh						
Upstream signal (m)	361					
pX, platoon unblocked						
vC, conflicting volume	1234	589			597	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1234	589			597	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	95			96	
cM capacity (veh/h)	188	508			981	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	36	587	606			
Volume Left	11	0	39			
Volume Right	25	16	0			
cSH	334	1700	981			
Volume to Capacity	0.11	0.35	0.04			
Queue Length 95th (m)	2.9	0.0	1.0			
Control Delay (s)	17.1	0.0	1.1			
Lane LOS	C		A			
Approach Delay (s)	17.1	0.0	1.1			
Approach LOS	C					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			67.0%	ICU Level of Service		C
Analysis Period (min)	15					