Appendix A:
Multi-Modal Transportation Report

Multimodal Transportation Assessment

Municipal Class Environmental Assessment – West 5th Street
Hamilton, ON

Stantec

Prepared for:
City of Hamilton

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Executive Summary

Stantec has been retained to undertake a Municipal Class Environmental Assessment (EA) for the segment of West 5th Street between Stone Church Road West to Rymal Road West in the City of Hamilton. The goal is to create a "complete streets" solution to multimodal transportation and a framework for new economic, social, and cultural investment in the area. This segment of West 5th Street is approximately 1 kilometre long and serves a developing area of the city with an immediate need for accessible active transportation facilities. Providing multimodal access to key destinations such as Mohawk College, multiple campuses of St. Joseph's Healthcare, and William Connell City-Wide Park, West 5th Street provides access to important recreational, institutional and employment areas.

As a part of the overall EA, a transportation study to assess the multimodal transportation needs of the segment from traffic operational and safety perspectives and propose justifiable improvement options to be incorporated into the preferred preliminary design is provided in this report. Key findings and recommendations of this assessment are summarized below:

- The condition of the surface of West 5th Street is in a state of deterioration, with drainage issues identified at multiple locations within the corridor, requiring rehabilitation.
- The existing sidewalk network is in a state of deterioration and incomplete, with drainage and continuity issues identified throughout. Rehabilitation and completion of missing links in the sidewalk network is required.
- There is no controlled pedestrian crossing along West 5th Street between Stone Church Road West and Rymal Road West (1 kilometre length with no controlled crossing). A preferred location for a midblock crossing is in the general vicinity of William Connell City-Wide Park to improve pedestrian safety and increase the utility of the park to the community. Although a signalized midblock pedestrian signal (MPS) is not warranted due to insufficient projected pedestrian volumes, a Level 2 Type C or B PXO (depending on the ultimate roadway cross-section to be selected through the EA Study) is warranted for this corridor.
- There are no cycling facilities along this segment of West 5th Street. At a minimum, on-street bike lanes are recommended, with a separated (in-boulevard) facility being most desirable.
- Signal timing improvements are expected to be sufficient to maintain an acceptable level of service at both signalized intersections (at Stone Church Road West and at Rymal Road West) to the study's ultimate 2031 horizon year, without need for physical capacity improvements. Corridor widening (i.e., two general purpose lanes per direction) is not justified.
- There is a need to improve the multimodal level of service (MMLOS) for the study area for several modes of travel, which will be achieved through enhanced design and better accommodation for the following users of the corridor.
- A continuous two-way left-turn lane (TWLTL) is recommended on West 5th Street between Rymal Road West and Stone Church Road West.

The ultimate roadway cross-section and active transportation facilities will be determined as part of the evaluation of alternatives through this EA Study, after which point a preliminary design of the preferred solution will be developed.

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1 Introduction

1.1 Overview

Stantec has been retained to undertake a Municipal Class Environmental Assessment (EA) for the segment of West 5th Street between Stone Church Road West to Rymal Road West in the City of Hamilton. The goal is to create a "complete streets" solution to multimodal transportation and a framework for new economic, social, and cultural investment in the area. This segment of West 5th Street is approximately 1 km long and serves a developing area of the city with an immediate need for accessible active transportation facilities. Providing multimodal access to key destinations such as Mohawk College, multiple campuses of St. Joseph's Healthcare, and William Connell City-Wide Park, West 5th Street provides access to important recreational, institutional and employment areas.

As a part of the overall EA, a transportation study to assess the multimodal transportation needs of the segment from traffic operational and safety perspectives and propose justifiable improvement options to be incorporated into the preferred preliminary design is provided in this report.

1.2 Study Scope

The transportation study scope includes:

- Travel demand forecasting by incorporating traffic growth estimated to be generated by developments planned within or in proximity to the study corridor and application of an annualized traffic growth rate to the corridor based on the City's EMME model for the planning horizon year of 2031;
- Intersection capacity analysis using Synchro software for existing and future "Do Nothing" conditions during weekday AM and PM peak hours at the following two signalized study intersections:
    - » West 5th Street and Stone Church Road West and
    - » West 5th Street and Rymal Road West.
- Multimodal level of service (MMLOS) analysis in accordance with the Complete-Livable-Better (CLB) Streets policy framework;
- Identify opportunities for improved active transportation accommodation for pedestrians and cyclists, including crossing facilities;
- Review of existing and planned future transit operations and identify opportunities for improvement along the segment.

The study corridor and the study intersections within the context of the surrounding area are shown in Figure 1.1.

Figure 1.1) Study Area Map

2 Existing Transportation Environment

2.1 Roadway Network

2.1.1 West 5th Street

West 5th Street is a north-south oriented two-lane road classified as a minor arterial road with a speed limit of 50 km/h. The corridor has characteristics of both urban and rural cross-sections with curb and gutter along portions of the east side and swales, ditches, and culverts on the west side. This segment currently serves a recreational and open-space area with stormwater management facilities known as William Connell Park City-Wide Park and low-density residential properties.

Within the study area, West 5th Street has signalized intersections with both Stone Church Road West and Rymal Road West, featuring a centre two-way left-turn lane and an unsignalized intersection with Carmel Drive (stop-controlled). There are no controlled pedestrian crossing opportunities between Stone Church Road West and Rymal Road West. South of Rymal Road West, West 5th Street transitions into Christie Street and terminates about 500 m south of this intersection.

There are a series of shallow vertical curves along the corridor with a rolling profile. While this geometry does not contribute to visibility issues, deterioration of the road surface negatively affects the drainage capacity of the roadway, causing water retention and discomfort to road users. There are no notable horizontal curves along the corridor's alignment.

2.1.2 Stone Church Road West

Stone Church Road West is an east-west oriented three-lane road including a two-way left-turn lane classified as a minor arterial road with a speed limit of 50 km/h. Within the study area, it has a signalized intersection with West 5th Street, featuring auxiliary left-turn lanes in both directions. The alignment through this section has no significant horizontal or vertical curves that pose any safety concerns. The road has an urban cross-section with dedicated bike lanes and sidewalks provided on both sides of the roadway.

2.1.3 Rymal Road West

Rymal Road West is an east-west oriented five-lane road cross section including a two-way left-turn lane classified as a major arterial road with a speed limit of 60 km/h. Within the study area, it has signalized intersection with West 5th Street/Christie Street, featuring auxiliary left-turn lanes in both directions. The alignment through this section has no significant horizontal or vertical curves that pose any safety concerns. Sidewalks are provided on both sides of the roadway.

2.2 Active Transportation Network

2.2.1 Pedestrian Facilities

A sidewalk is provided along sections of the east side of West 5th Street within the study corridor. The surface of the majority of the sidewalk is asphalt concrete, which is typically reserved for temporary sidewalks or multi-use paths. The condition of this sidewalk resembles the condition of the roadway; there is poor drainage and ponding at multiple locations throughout the corridor caused by deterioration of the asphalt (see Figure 2.1 below). There are also several areas of localized fracturing, which may cause difficulty for individuals with certain kinds of personal mobility devices (see Figure 2.2 below).

Through much of the study area, the sidewalk is not separated from the roadway by a curb or gutter; in some locations, the sidewalk appears to be level and continuous with a gravel shoulder. There is no delineation separating the shoulder from the sidewalk. Additionally, a portion of the sidewalk immediately south of Stone Church Road West has been completely removed or destroyed. There is active construction on the southeast corner of the intersection of West 5th Street and Stone Church Road West; evidence of heavy vehicles driving over the sidewalk near this location was observed during a site visit on April 30, 2024 (see Figure 2.3 below).

Figure 2.1) West 5th Street Sidewalk Condition – Drainage

Figure 2.2) West 5th Street Sidewalk Condition – Surface Fracturing

Figure 2.3) West 5th Street Sidewalk Condition – Heavy Vehicle Damage

There is one segment of the sidewalk fronting 1137-1175 West 5th Street that is made of cementitious concrete and in good condition (see Figure 2.4 below). This segment is buffered from the road with curb, gutter, and a 7 m wide boulevard containing trees. This portion is also illuminated by lighting installed directly adjacent to the sidewalk; other portions of the sidewalk in the study area are illuminated by street lighting on the opposite side of the road.

Figure 2.4) West 5th Street Sidewalk Condition – 1137-1175 West 5th Street

Approaching the signalized study area intersections at the north and south limits of the study corridor, the sidewalk transitions into cementitious concrete in good condition. The deficiencies observed within the corridor were not observed at these intersections. Crosswalks are delineated for pedestrian crossings in all directions at both intersections. Pedestrian signals are also present, with all movements providing a button-actuated audible pedestrian signal. The existing curb depressions have not been designed to meet the standards set by the Accessibility for Ontarians with Disabilities Act (AODA), but surface treatment indicating the location and direction of each crosswalk is present (see Figure 2.5 and Figure 2.6 below).

Figure 2.5) West 5th Street and Stone Church Road West – Northwest Crosswalks

Figure 2.6) West 5th Street and Rymal Road West – Southeast Crosswalks

2.2.2 Cycling Facilities

As seen in the figures provided in the previous section, there is no dedicated cycling infrastructure within the study corridor. Since the paved path on the east side of the road is too narrow to be considered a multi-use path, cyclists using this corridor would be expected to share lanes with vehicles. The City's 2023 Bike Map recognizes this segment as a cautionary cycling route, indicating that this road may be less comfortable for some cyclists. The current state of the study corridor with its deteriorating pavement and drainage deficiencies makes it an undesirable and potentially unsafe route from cyclists' perspective.

Figure 2.7 below illustrates current cycling route network in and around study corridor retrieved from the 2023 City of Hamilton Bike Map.

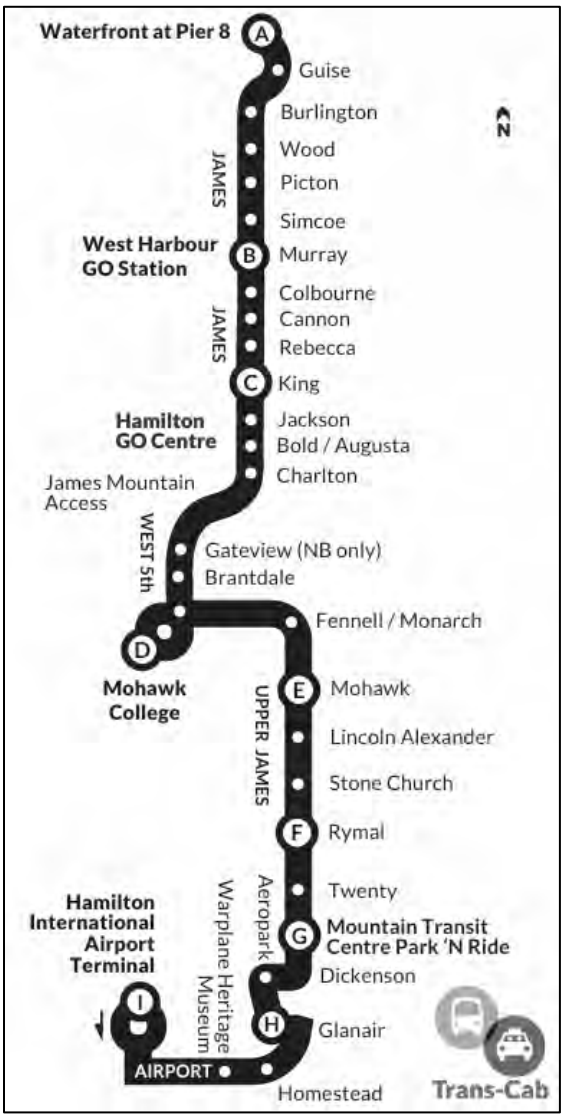
Figure 2.7) Existing Cycling Route Network

2.2.3 Public Transit Service

Local public transit in this area is provided by the Hamilton Street Railway (HSR) – a department of the Public Works division of the City of Hamilton. The study corridor is not served by any HSR transit routes and have no dedicated bus stops within its length; however, transit routes on Stone Church Road West, Rymal Road West, and Upper James Street are accessible from residences within the study corridor. The following transit routes are adjacent to or near the study area:

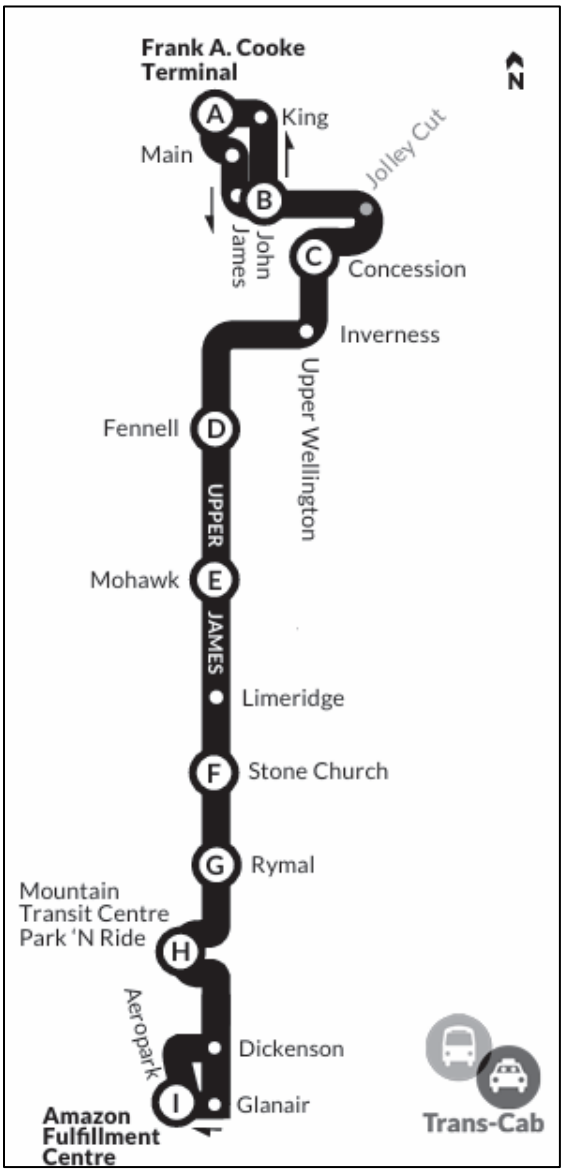
- Route 20 A-Line is one of the two HSR rapid transit routes in the City of Hamilton. It travels north-south along Upper James Street and James Street from Pier 8 to the Amazon Fulfilment Centre. The nearest transit stops are located on both sides of Upper James Street at Stone Church Road and Rymal Road for each direction of travel. Service for this route operates daily with a peak period headway of 10 minutes on weekdays and a 30-minute headway during weekday off-peak periods. On Saturdays and Sundays, the route operates at peak headways of 15 minutes and 20 minutes, respectively.

Figure 2.8) HSR Route Diagram – Route 20 A-Line



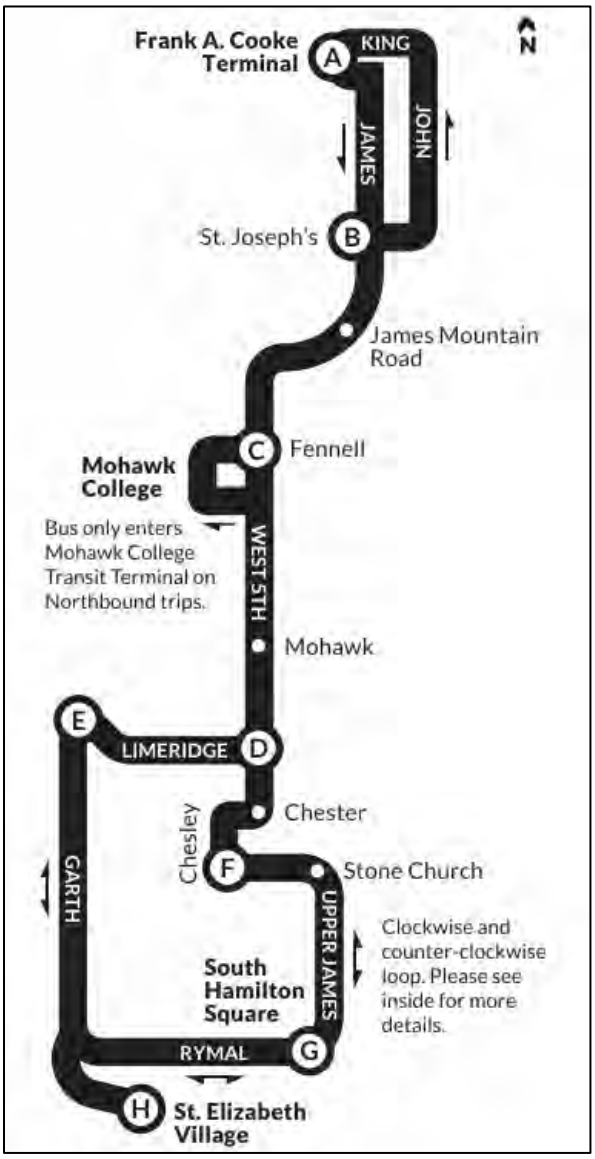
- Route 27 Upper James travels north-south along Upper James Street from Frank A. Cooke Terminal to the Amazon Fulfilment Centre. The nearest transit stops are located on both sides of Upper James Street at Stone Church Road and Rymal Road for each direction of travel. Service for this route operates daily with a peak period headway of 15 minutes on weekdays and a 30-minute headway during weekday off-peak periods and on weekends/holidays.

Figure 2.9) HSR Route Diagram – Route 27 Upper James



- Route 35 College travels north-south along West 5th Street from Frank A. Cooke Terminal to the St. Elizabeth Village. North of Stone Church Road West, the route turns away from West 5th Street where it splits into two patterns – one of which (35G) travels on Limeridge Road West away from the site. The other pattern (35J) travels through a neighbourhood north of the study area, eventually travelling east-west along Stone Church Road West towards Upper James Street. As a result of the split, the headway of the pattern running along Stone Church Road West is twice as long as the portion of the route north of the split. The nearest transit stops are located on both sides of Stone Church Road West at West 5th Street for each direction of travel. Service for this route operates daily with a peak period headway of 15 minutes on weekdays and a 20/30-minute headway during weekday off-peak periods and on weekends/holidays.

Figure 2.10) HSR Route Diagram – Route 35 College



- Route 43 Stone Church travels east-west along Stone Church Road from Valley Park to the Meadowlands Terminal. The nearest transit stops are located on both sides of Stone Church Road West at West 5th Street for each direction of travel. Service for this route operates daily with a peak period headway of 15 minutes on weekdays and a 30-minute headway during weekday off-peak periods and on weekends/holidays.

Figure 2.11) HSR Route Diagram – Route 43 Stone Church

- Route 44 Rymal travels east-west along Garner Road and Rymal Road and north-south along Centennial Parkway and Upper Centennial Parkway from Confederation Walmart Terminal to Ancaster Business Park Cormorant Road via Eastgate Square. The nearest transit stops are located on Rymal Road West at West 5th Street and at Christie Street for westbound and eastbound travel, respectively. Service for this route operates daily with a peak period headway of 15 minutes on weekdays and a 30-minute headway during weekday off-peak periods and on weekends/holidays.

Figure 2.12) HSR Route Diagram – Route 44 Rymal

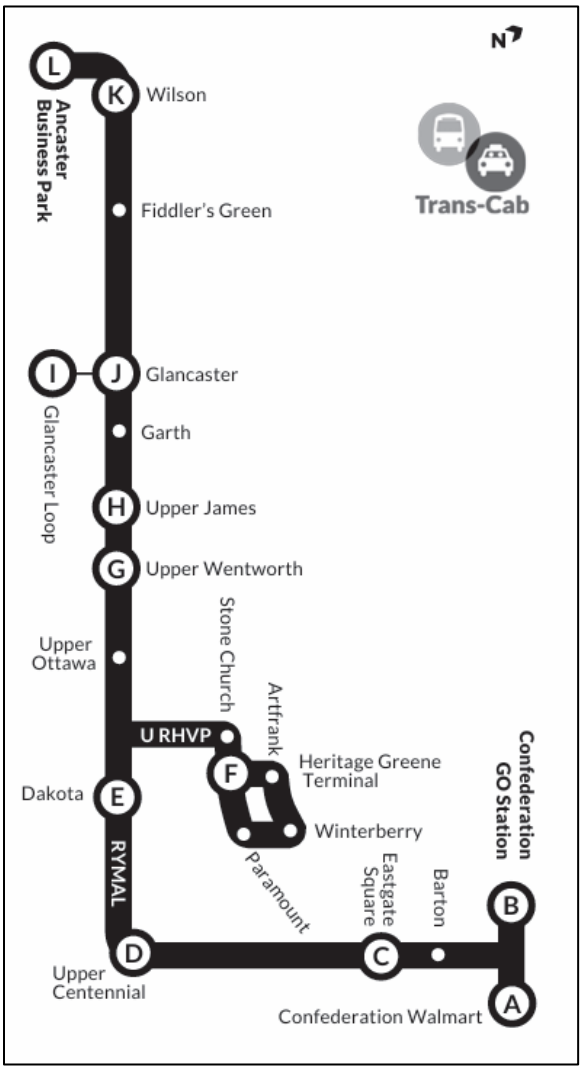
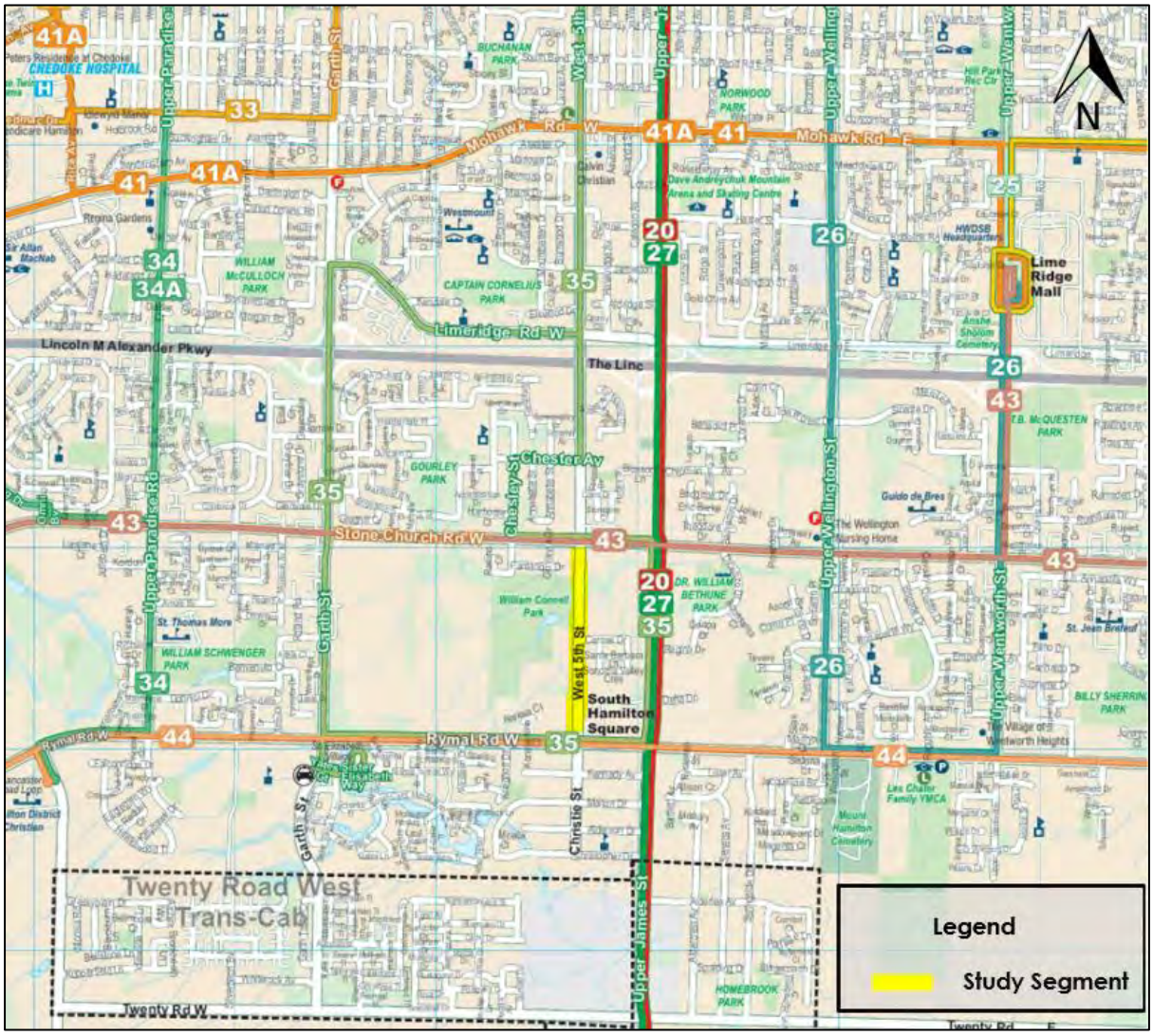


Figure 2.13 below retrieved from the HSR transit system map illustrates the bus routes around the vicinity of the study corridor.

Figure 2.13) HSR System Map



2.3 Study Intersections

2.3.1 Traffic Observations

Site visits were conducted at the two study intersections during AM and PM peak hours on April 30, 2024, and October 8, 2024, to assess their current characteristics and operating conditions. Key observations are included below:

- West 5th Street and Stone Church Road West:
  - » Left-turn storage is sufficient in all directions.
  - » All queued vehicles clear the intersection upon receiving green phases.
  - » Through/right-turn lanes in all directions experience longer queues compared to the auxiliary left-turn lanes, with the northbound through/right-turn lane having the longest queue of approximately 185 m (31 vehicles), reaching the William Connell City-Wide Park entrance.
  - » Figure 2.14 and Figure 2.15 below illustrate the northbound through/right-turn lane queue observed on West 5th Street at Stone Church Road West.

Figure 2.14) West 5th Street at Stone Church Road West – Northbound Through/Right-Turn Lane Queue (North End)

Figure 2.15) West 5th Street at Stone Church Road West – Northbound Through/Right-Turn Lane Queue (South End)

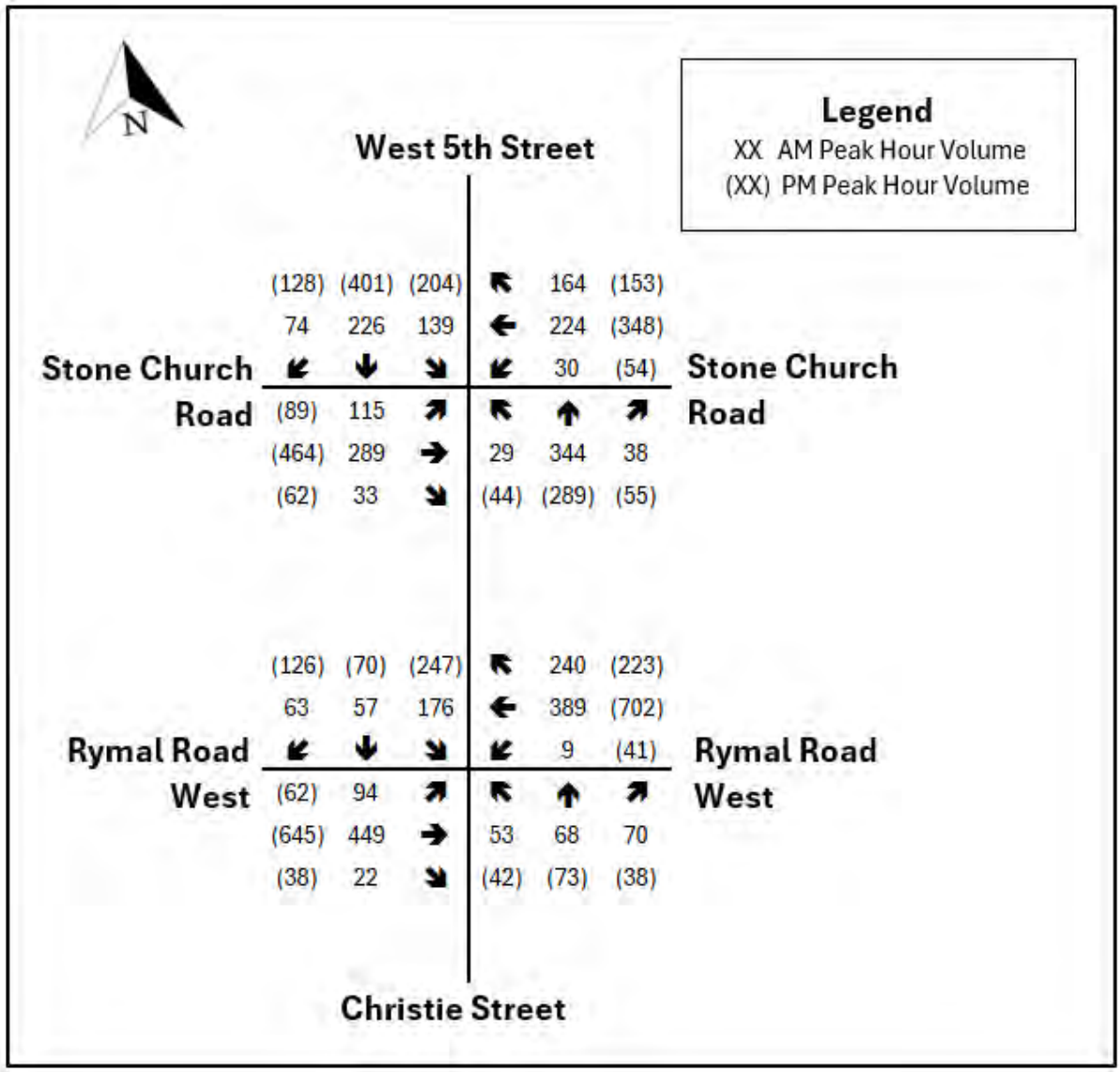
- West 5th Street at Rymal Road West:
  - » All queued vehicles clear the intersection upon receiving the green phases.
  - » Left-turn storage is adequate in all directions, except for the southbound left turn, where the auxiliary lane storage length is insufficient, causing overflow into the adjacent through-right lane, approximately 140 meters (or 20 vehicles) of queue.
  - » Figure 2.16 below illustrates the southbound left-turn lane queue observed on West 5th Street at Rymal Road West.

Figure 2.16) West 5th Street at Rymal Road West – Southbound Left-turn Lane Queue

2.3.2 Traffic Volumes

Traffic data collected on June 5th, 2024, for the two study area intersections were provided by the City and are shown in Appendix A. Using the provided data, the weekday AM peak hour for both intersections was determined to be 8:00 AM to 9:00 AM. The weekday PM peak hour was determined to be 4:45 PM to 5:45 PM. The existing weekday AM and PM peak hour traffic volumes are illustrated in Figure 2.17 below:

Figure 2.17) Weekday AM and PM Peak Hour Turning Movement Counts



3 Planned Development

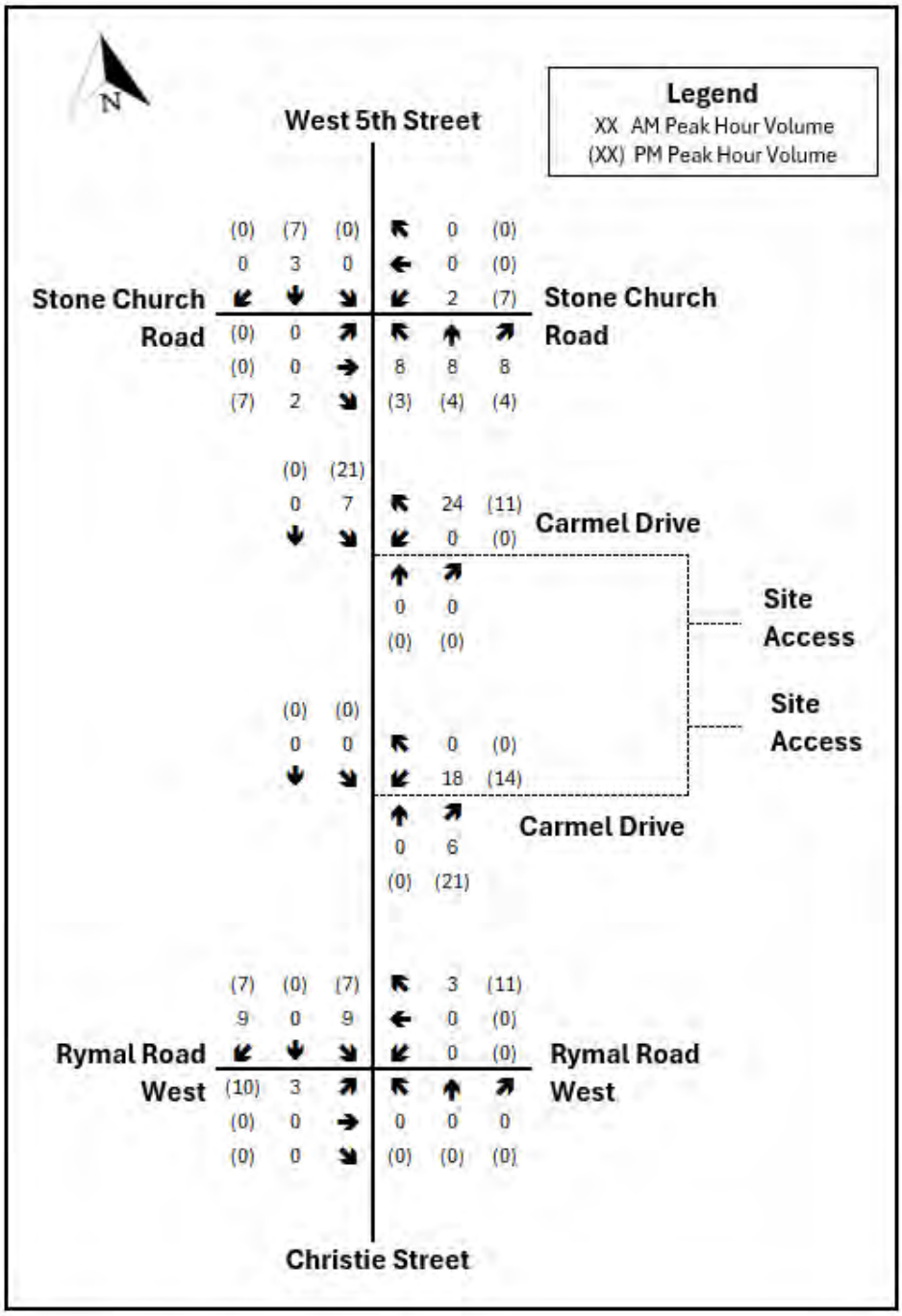
The following planned developments in the study corridor were reviewed and assessed to determine the effect of their trip generation on the study area intersections. Relevant sections from the transportation impact assessment (TIA) reports of these developments are provided in Appendix B.

3.1 1400 Upper James Street – Residential Development

1400 Upper James Street is a planned residential development located north of the intersection of Carmel Drive and Sonoma Valley Crescent on the east side of West 5th Street study corridor. The development is expected to consist of 116 townhouse units of various types. Vehicle access to the site is proposed from two private driveway connections to an extension of Carmel Drive. The site plan indicates that Carmel Drive will be extended to form a crescent resulting in a new intersection with West 5th Street located approximately 190 m north of the existing intersection of West 5th Street and Carmel Drive (about 290 m south of the intersection of West 5th Street and Stone Church Road West).

The estimated traffic to be generated by this development is 55 vehicle trips in AM peak hour (13 inbound and 42 outbound) and 67 vehicle trips in PM peak hour (42 inbound and 25 outbound). The distribution of this traffic to the relevant study area intersections is illustrated in Figure 3.1 below.

Figure 3.1) Study Area Development Trip Generation – 1400 Upper James Street

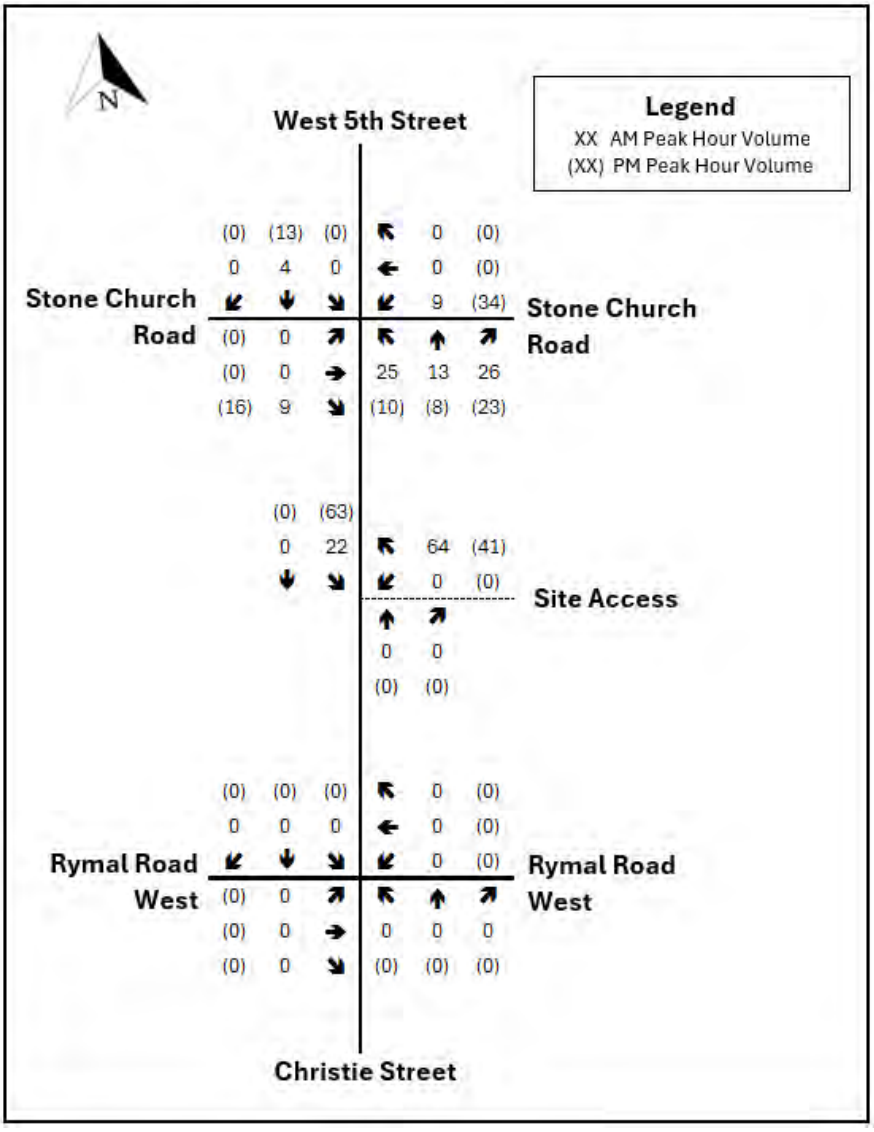


3.2 73-89 Stone Church Road West and 1029 West 5th Street – Residential Development

73-89 Stone Church Road West and 1029 West 5th Street is a planned residential development located at the southeast corner of West 5th Street and Stone Church Road West. The development is expected to consist of 237 residential units within 10-storey building with a total of 241 parking spaces. Vehicular access to the site is proposed from a driveway on West 5th Street.

The estimated traffic to be generated by this development is 86 vehicle trips in AM peak hour (22 inbound and 64 outbound) and 103 vehicle trips in PM peak hour (63 inbound and 40 outbound). The distribution of this traffic to the relevant study area intersections is illustrated in Figure 3.2 below.

Figure 3.2) Study Area Development Trip Generation – 73-89 Stone Church Road West and 1029 West 5th Street

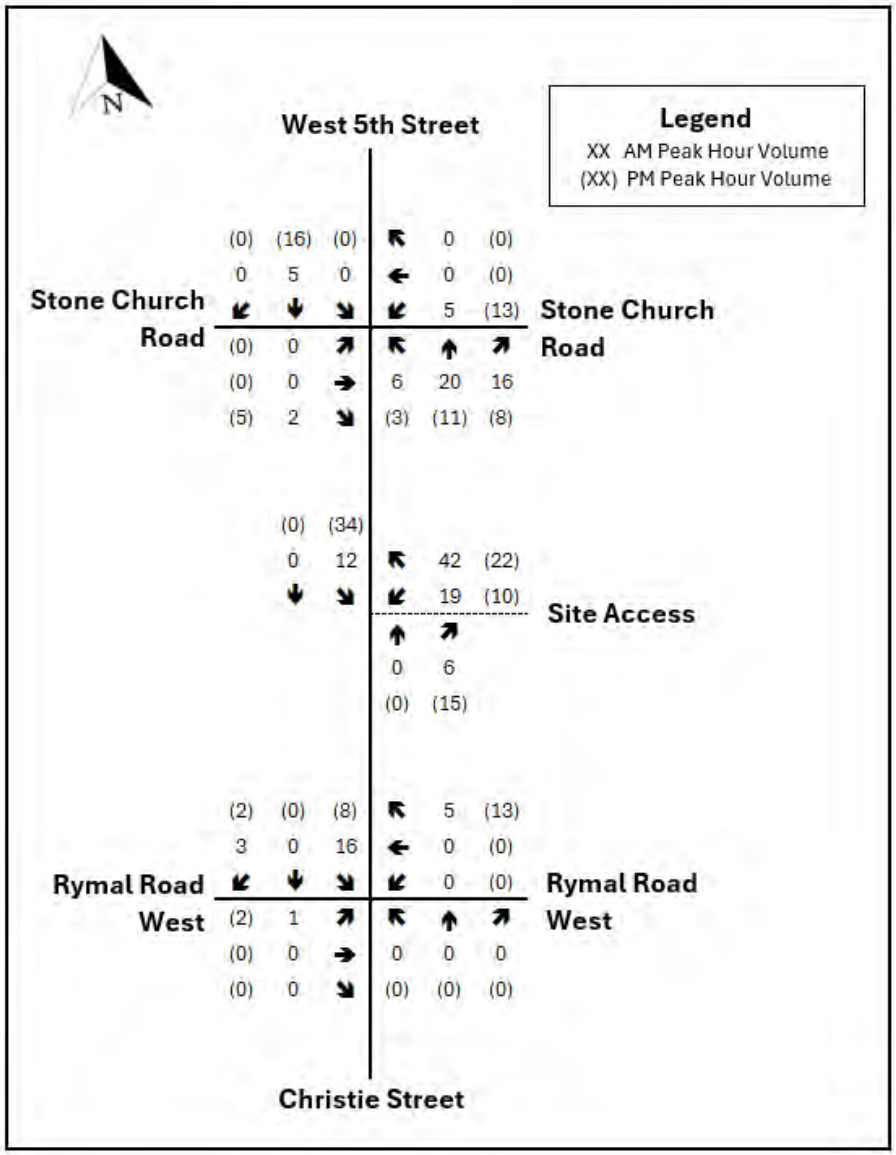


3.3 1187 West 5th Street – Residential Development

1187 West 5th Street is a planned residential development located approximately 200 m south of West 5th Street and Carmel Drive (about 300 m north of West 5th Street and Rymal Road West) on the east side of the study corridor. The development is expected to consist of 206 residential units within a 10-storey residential building with a total of 229 vehicle parking spaces and 108 bicycle parking spaces. Vehicular access to the site is proposed from a driveway on West 5th Street.

The estimated traffic to be generated by this development is 79 vehicle trips in AM peak hour (18 inbound and 61 outbound) and 81 vehicle trips in PM peak hour (49 inbound and 32 outbound). The distribution of this traffic to the relevant study area intersections is illustrated in Figure 3.3 below.

Figure 3.3) Study Area Development Trip Generation – 1187 West 5th Street



4 Travel Demand Forecasting

The planning horizon for this analysis is 2031, accounting for anticipated growth and developments within the study area, as well as background population and employment growth. Planned developments near the study corridor were cross-referenced with growth projections from the City's EMME model to estimate the number and distribution of future trips. Aligning with the 2031 planning horizon ensures consistency with the City-Wide Transportation Master Plan (TMP) and provides a framework for addressing long-term transportation needs of the corridor and surrounding network. The forecasted corridor growth and distribution to the study area intersections obtained using the City's EMME model is illustrated in Figure 4.1 below

The forecasted corridor traffic growth combined with the traffic that will be generated by the planned developments (see section 3) in the vicinity of the study corridor results in the total 2031 future traffic anticipated at the study area intersections, which is illustrated in Figure 4.2 on the following page.

Figure 4.1) Future Traffic Volume – Corridor Growth

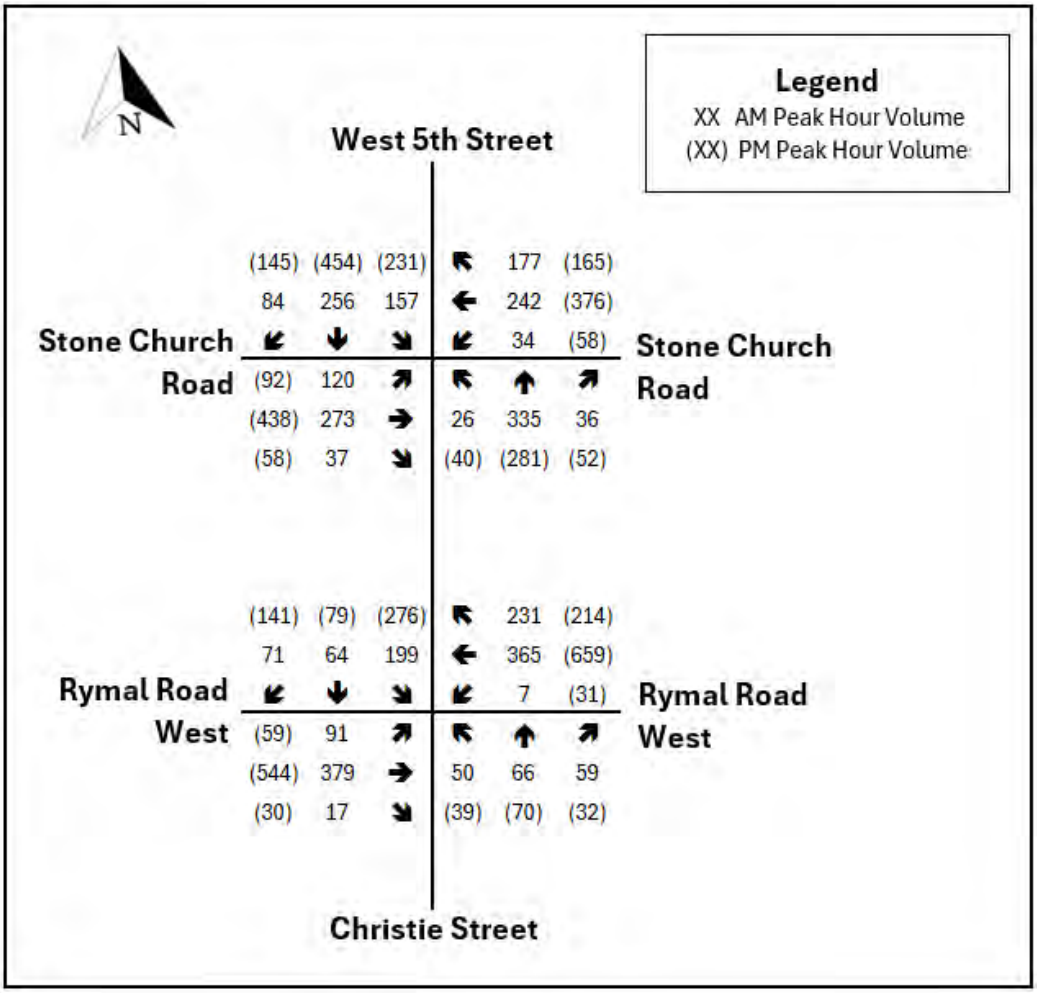
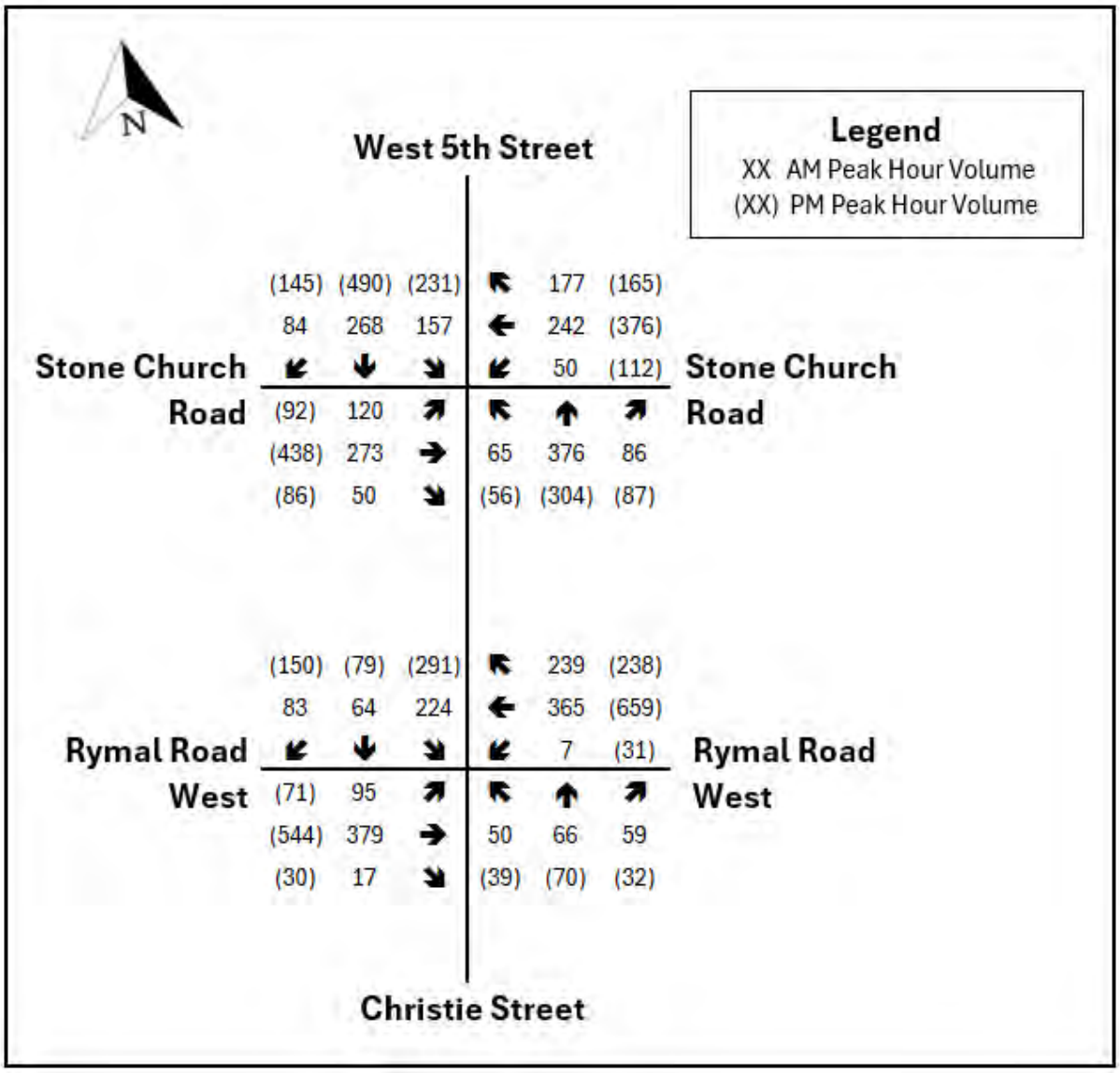


Figure 4.2) Future Traffic Volume – Corridor Growth and Study Area Development



5 Intersections Capacity Analysis

5.1 Analysis Methodology

The industry standard Synchro microscopic traffic analysis software was utilized to analyze the two signalized study area intersections. Current signal timing plans provided by the City staff are included in Appendix C. Key performance measures such as level of service (LOS), volume-to-capacity (v/c) ratio, and 95th percentile queue length was reported and are defined below:

- Average vehicle control delay is used to characterize level of service (LOS) and quantifies the variations in vehicle travel time. This is also a surrogate measure of driver discomfort and fuel consumption.
- V/c ratio quantifies the degree to which the capacity of a lane group is utilized. The *City of Hamilton Transportation Assessment Guidelines 2024* indicate v/c ratios of 0.85 or greater for through or shared/through movements and 0.90 or greater for exclusive turning movements represent capacity concerns.
- 95th percentile queue length is the peak extent line of vehicles reaches during the lowest performing 5% of the analysis period. It is common practice to identify preferred storage length requirements for auxiliary turn lanes at signalized intersections based on estimated peak hour 95th percentile queue lengths.

Table 5.1 identifies the control delay thresholds (seconds of delay per vehicle) for each LOS based on Highway Capacity Manual (HCM) methodology.

Table 5.1) HCM LOS Classification for Signalized and Unsignalized Intersections

Level of Service	Signalized Intersection	Unsignalized Intersection
A	≤ 10 seconds	≤ 10 seconds
B	> 10 to 20 seconds	> 10 to 15 seconds
C	> 20 to 35 seconds	> 15 to 25 seconds
D	> 35 to 55 seconds	> 25 to 35 seconds
E	> 55 to 80 seconds	> 35 to 50 seconds
F	> 80 seconds	> 50 seconds

5.2 Analysis Results

The following sections present the results of the capacity analysis for the study area intersections for both the 2024 existing conditions scenario and with the additional traffic growth anticipated up to this study's 2031 horizon year. Detailed output reports from Synchro are provided in Appendix D.

5.2.1 Capacity Analysis: West 5th Street and Stone Church Road West

Signalized capacity analysis for the duration of the weekday AM and PM peak hours of both existing conditions (2024) and future background conditions (2031) are summarized below in Table 5.2.

During 2024 existing conditions, the results of the analysis indicate that the intersection does not experience operational issues during this scenario requiring mitigation except for the eastbound and westbound through/right-turn movements. These movements exceed the maximum acceptable v/c ratio of 0.85 according to the City of Hamilton's *Transportation Assessment Guidelines* during the PM peak hour.

During 2031 future conditions, both the eastbound through/right-turn and westbound through/right-turn movements exceed the threshold of acceptable v/c ratios due to the future estimated increase in traffic volume on Stone Church Road West. Minor optimizations to the splits of the current signal timing plans can reduce improve the performance of the eastbound through/right-turn movement; however, the westbound through/right-turn movement remains above the v/c threshold of 0.85. Further mitigation in the future may be required.

Table 5.2) Capacity Analysis Results: West 5th Street and Stone Church Road West

Scenario	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c Ratio	LOS (Delay, s)	95th Percentile Queue Length (m)	v/c Ratio	LOS (Delay, s)	95th Percentile Queue Length (m)
2024 Existing Conditions	EB L	0.46	C (26)	28	0.44	C (24)	21
	EB TR	0.59	D (36)	91	**0.87**	D (48)	173
	WB L	0.10	B (19)	10	0.30	C (21)	14
	WB TR	0.73	D (39)	110	**0.85**	D (45)	161
	NB L	0.08	C (32)	13	0.23	D (36)	18
	NB TR	0.56	D (41)	108	0.58	D (42)	110
	SB L	0.38	B (17)	28	0.56	C (23)	43
	SB TR	0.36	B (18)	59	0.69	C (28)	133
2031 Future Conditions	EB L	0.54	C (29)	29	0.55	C (29)	22
	EB TR	0.60	D (36)	91	**0.87**	D (48)	172
	WB L	0.16	B (20)	14	0.61	C (32)	27
	WB TR	0.79	D (43)	130	**0.91**	D (53)	182
	NB L	0.18	C (32)	24	0.48	D (51)	23
	NB TR	0.68	D (42)	127	0.67	D (45)	123
	SB L	0.52	C (21)	31	0.72	C (31)	51
	SB TR	0.43	B (19)	71	0.83	D (36)	181
2031 Future Conditions Optimized	EB L	0.54	C (29)	29	0.52	C (27)	21
	EB TR	0.60	D (36)	91	0.83	D (43)	165
	WB L	0.16	B (20)	14	0.60	C (30)	25
	WB TR	0.79	D (43)	130	**0.87**	D (46)	174
	NB L	0.18	C (32)	22	0.52	D (53)	23
	NB TR	0.68	D (42)	127	0.62	D (41)	121
	SB L	0.52	C (21)	31	0.78	D (40)	59
	SB TR	0.43	B (19)	71	0.85	D (38)	193

EB	Eastbound traffic (west approach)	L	Left-turn lane group
WB	Westbound traffic (east approach)	T	Through lane group
NB	Northbound traffic (south approach)	R	Right-turn lane group
SB	Southbound traffic (north approach)		(Combinations of letters indicate shared lane groups)

5.2.2 Capacity Analysis: West 5th Street and Rymal Road West

Signalized capacity analysis for the duration of the weekday AM and PM peak hours of both existing conditions (2024) and future background conditions (2031) are summarized below in Table 5.3.

During 2024 existing conditions and 2031 future conditions, the intersection operates acceptably with no operational issues requiring mitigation except southbound and northbound left-turn movements. These movements could produce 95th percentile queue lengths longer than the available storage length in both AM and PM peak hours. Minor optimizations to the splits of the current signal timing plans resolve most of the extended queueing issue in future conditions. The queue for the southbound left-turn can be reduced in future conditions, but this lane may need to be extended in the future.

Table 5.3) Capacity Analysis Results: West 5th Street and Rymal Road West

Scenario	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		v/c Ratio	LOS (Delay, s)	95th Percentile Queue Length (m)	v/c Ratio	LOS (Delay, s)	95th Percentile Queue Length (m)
2024 Existing Conditions	EB L	0.23	A (10)	15	0.30	B (17)	14
	EB TR	0.28	B (15)	42	0.50	C (25)	77
	WB L	0.02	A (8)	3	0.14	B (14)	10
	WB TR	0.38	B (12)	45	0.70	C (28)	111
	NB L	0.15	C (30)	**19**	0.10	C (22)	14
	NB TR	0.27	C (21)	32	0.16	B (17)	24
	SB L	0.53	D (46)	**55**	0.53	D (45)	**77**
	SB TR	0.23	C (27)	30	0.29	C (28)	44
2031 Future Conditions	EB L	0.24	A (10)	15	0.33	B (17)	16
	EB TR	0.23	B (15)	35	0.42	C (24)	64
	WB L	0.01	A (8)	3	0.09	B (14)	8
	WB TR	0.38	B (12)	45	0.68	C (27)	106
	NB L	0.15	C (30)	**18**	0.10	C (22)	13
	NB TR	0.25	C (21)	30	0.15	B (17)	23
	SB L	0.65	D (53)	**77**	0.61	D (44)	**80**
	SB TR	0.25	C (31)	32	0.34	C (26)	43
2031 Future Conditions Optimized	EB L	0.24	B (10)	16	0.33	B (17)	16
	EB TR	0.24	B (16)	36	0.42	C (24)	64
	WB L	0.01	A (9)	3	0.09	B (14)	8
	WB TR	0.39	B (13)	45	0.68	C (27)	106
	NB L	0.17	C (35)	**20**	0.11	C (26)	14
	NB TR	0.30	C (26)	33	0.18	C (21)	26
	SB L	0.58	D (47)	**70**	0.57	D (38)	**71**
	SB TR	0.24	C (30)	32	0.34	C (27)	43

EB	Eastbound traffic (west approach)	L	Left-turn lane group
WB	Westbound traffic (east approach)	T	Through lane group
NB	Northbound traffic (south approach)	R	Right-turn lane group
SB	Southbound traffic (north approach)		(Combinations of letters indicate shared lane groups)

6 Multimodal Level of Service (MMLOS) Analysis

In addition to the Synchro capacity analysis of the study area intersections, an analysis of the existing accommodation for other modes of transportation was performed. The evaluation of the multimodal level of service (MMLOS) was completed according to the City of Hamilton's *Transportation Assessment Guidelines*, which prescribe the use of *Multi-Modal Level of Service Guidelines* created by the Ontario Traffic Council (OTC) in February 2022 as the method for analyzing service for different categories of road users. According to these guidelines, MMLOS is defined as, "…a methodology for analyzing the level of service experienced by users of different modes along street segments and at intersections." (Ontario Traffic Council, 2022) MMLOS is scored using letter grades from 'A' to 'F', indicating the most and least favourable conditions, respectively.

For this study, both the study area intersections of West 5th Street and Stone Church Road West, and West 5th Street and Rymal Road West, as well as the segment of West 5th Street between these two intersections were analyzed to determine their current MMLOS. The results of this analysis are included in Appendix E and are summarized in the following sections. The recommended MMLOS targets for each area type from the OTC's *Multi-Modal Level of Service Guidelines* are included in the following table:

Table 6.1) OTC Recommended MMLOS Targets (Retrieved from Multi-Modal Level of Service Guidelines*, Table 4.1)*

Table 4.1: Recommended MMLOS Targets

	LOS Target				
	Peds	Bikes	Transit	Trucks	Cars
Downtown avenue	B	C	D	D	D
Urban main street	C	C	D	D	D
Urban boulevard	C	B	D	n/a	E
Neighbourhood connector	E	D	B	D	D
Neighbourhood main street	C	C	D	D	D
Neighbourhood boulevard	D	B	D	n/a	E
Industrial connector	E	D	D	B	D
Industrial boulevard	D	D	D	B	E
Rural connector	E	E	n/a[1]	D	D
Custom	X	X	X	X	X

1 Rural roads typically do not serve as transit route corridors where buses stop, which is what the Transit LOS is based on

6.1 Intersection MMLOS: West 5th Street and Stone Church Road West

The intersection of West 5th Street and Stone Church Road West was evaluated as a signalized intersection according to the targets of a 'Neighbourhood Connector' area. This area type is defined as a corridor that carries high volumes of traffic between neighbourhoods with dedicated active transportation facilities. Though neither West 5th Street nor Stone Church Road West are classified as truck routes, both are classified as arterial roads which support a significant volume of traffic. Additionally, bike lanes are present on three of the four approaches at this intersection.

The results of the MMLOS evaluation for this intersection are included in Table 6.2 below:

Table 6.2) Intersection MMLOS Evaluation Results: West 5th Street and Stone Church Road West

Mode	Pedestrian	Cycling	Public Transit	Trucks	Cars
Target LOS	E	D	B	D	D
Actual LOS	E	**E**	**E**	B	C

Opportunities for Improvement:

- **Cycling:** The Actual LOS E could be improved to D by implementing any of the following improvements (independently, or desirably in combination):
  - » Having at least half of the intersection approaches include enhanced cycling features
  - » Decrease the average effective turning radius to below 14.9 metres
  - » Decrease the signal cycle length to 90 seconds or less
  - » Decrease the number of uncontrolled conflicts to 1.0 conflicts per approach
- **Public Transit:** The Actual LOS of E could be improved to B by the following improvements in combination (none are sufficient independently):
  - » Transit priority measures at a minimum of one but not all approaches for transit
  - » Reduced transit delay
  - » Improved pedestrian LOS

  (achieving public transit LOS B requires a combination of these improvements; maximizing the improvement for one feature, lessens the level of required improvement for other features)

The results of the MMLOS will be considered during the design phase of the preferred cross-section for the study corridor as part of the EA Study. Every effort will be made to have the corridor design reflect the multi-modal features sufficient to achieve OTC's target LOS score.

6.2 Intersection MMLOS: West 5th Street and Rymal Road West

The intersection of West 5th Street and Rymal Road West was also evaluated as a signalized intersection according to the targets of a 'Neighbourhood Connector' area. Unlike Stone Church Road West, Rymal Road West is classified as a full-time truck route with no time-based or vehicle-based restrictions. In addition to this intersection's proximity to nearby commercial areas, Rymal Road is also significant to several residential neighbourhoods to which it provides access. The connections to both commercial and residential areas indicate a significant portion of traffic on Rymal Road West is commuter-based. Bike lanes are not present on any of the approaches at this intersection.

The results of the MMLOS evaluation for this intersection are included in Table 6.3 below:

Table 6.3) Intersection MMLOS Evaluation Results: West 5th Street and Rymal Road West

Mode	Pedestrian	Cycling	Public Transit	Trucks	Cars
Target LOS	E	D	B	D	D
Actual LOS	E	D	**D**	D	C

Opportunities for Improvement:

- **Public Transit:** The Actual LOS of E could be improved to B by the following improvements in combination (none are sufficient independently):
  - » Transit priority measures at a minimum of one but not all approaches for transit
  - » Reduced transit delay
  - » Improved pedestrian LOS

  (achieving public transit LOS B requires a combination of these improvements; maximizing the improvement for one feature, lessens the level of required improvement for other features)

The results of the MMLOS will be considered during the design phase of the preferred cross-section for the study corridor as part of the EA Study. Every effort will be made to have the corridor design reflect the multi-modal features sufficient to achieve OTC's target LOS score.

6.3 Segment LOS: West 5th Street

The study corridor was evaluated as a 'Neighbourhood Boulevard' according to the definition included in the OTC's *Multi-Modal Level of Service Guidelines*. Segments with this classification are intended to provide access to a suburban neighbourhood for a variety of different modes of transportation. Traffic volume on these roads is lower than on 'Neighbourhood Connectors' as the priority for these segments is to balance the needs of pedestrian, cyclists, and vehicles.

The results of the MMLOS evaluation for this segment are included in Table 6.4 below:

Table 6.4) Segment MMLOS Evaluation Results: West 5th Street

Mode	Pedestrian	Cycling	Public Transit	Trucks	Cars
Target LOS	D	B	D	N/A	E
Actual LOS	**F**	**F**	N/A	C	C

Opportunities for Improvement:

- **Pedestrian:** The Actual LOS F could be improved to D by implementing any of the following improvements (independently, or desirably in combination):
  - » Filling in missing gaps in the sidewalk network by AODA compliant sidewalk (1.8 metres side) with at least 1.6-metre-wide buffer from the adjacent travelled lane
  - » Introduce a midblock pedestrian crossing
- **Cycling:** The Actual LOS F could be improved to D by implementing any of the following improvements:
  - » Introduce on-street bike lane with buffer
  - » In boulevard cycling facility

The results of the MMLOS will be considered during the design phase of the preferred cross-section for the study corridor as part of the EA Study. Every effort will be made to have the corridor design reflect the multi-modal features sufficient to achieve OTC's target LOS score.

7 Transportation Infrastructure Opportunities

The density of residential properties within the study area is expected to be increased by a series of ongoing and planned developments. To accommodate the additional demand, design strategies from the City of Hamilton's *Complete Streets Design Guidelines* can be adopted in the future design of this corridor. Using these guidelines and given the context of this segment of West 5th Street, an appropriate standard to which the rehabilitated corridor can be designed is that of a "Connector" to serve moderate volumes of traffic while accommodating the needs of all road users in a predominantly residential environment. The following sections present opportunities for improvement in the study area:

7.1 Pedestrian Infrastructure

The MMLOS evaluation in Section 6 highlighted several opportunities for improvement to pedestrian infrastructure within the study area. Identified deficiencies include:

- Poor condition of existing sidewalk,
- Gaps in the sidewalk network on the east side of the roadway,
- Absence of sidewalk on the west side of the roadway, and
- Lack of controlled pedestrian crossing(s) between the signalized intersections at the north and south extents of the study area (approximately 1 km separation).

7.1.1 Sidewalk Improvements

The reconstruction of West 5th Street between Stone Church Road West and Rymal Road West creates an opportunity to develop and complete and connected sidewalk network for the study corridor, by introducing sidewalk on the west side and completion of missing gaps in the sidewalk network on the east side. To meet applicable standards defined by the Accessibility for Ontarians with Disabilities Act (AODA), the east sidewalk surface would need to be redesigned. The future design of the sidewalk could accommodate a wider range of road users with enhanced capacity. This could also improve the pedestrian experience by resolving the observed drainage issues.

7.1.2 Midblock Crossing Facility

Controlled crossing facilities – either a pedestrian crossover (PXO) or a midblock pedestrian signal (MPS) – could be added to the future design of the corridor to accommodate both pedestrian and cyclist crossings at a midblock location, given the notable separation of approximately 1 kilometre between available east-west controlled crossings under existing conditions. The provision of such facilities has the potential to improve pedestrian safety in the corridor and increase the utility and accessibility of William Connell City-Wide Park.

As per Ontario Traffic Manual (OTM) Book 12 – Signals, a midblock pedestrian signal is warranted if minimum traffic volumes and pedestrian crossing volumes are achieved. At a minimum, the projected pedestrian crossing volumes would need to exceed 200 pedestrians during the peak 8-hours of the day. Currently, 16 pedestrians were observed crossing West 5th Street on the north side of Rymal

Road during the combined AM+PM peak hours, and similarly 12 on the south side of Stone Church Road. A proportion of these crossing pedestrians could desire to cross West 5th Street at a potential future midblock crossing between Rymal Road and Stone Church Road. As a worst-case scenario, assuming all 28 of these crossing pedestrians rerouted to a midblock location, it is estimated that could equate to approximately 140 daily crossings (based on assumption AM+PM peak hours represents 20% of daily demand), or 70-85 crossings during a peak 8-hour period (based on assumption 8-hour periods represents 50-60% of daily demand). It is evident these pedestrian crossing demand levels are short of the 200 crossings in an 8-hour period threshold recommended by OTM to warrant a signalized pedestrian signal. Even with planned development in the area, the 8-hour pedestrian crossing demand would need to increase by 115-130 pedestrians (or 215-230 daily pedestrians), a 165% increase from current levels. It is not expected that east-west pedestrian crossing demand across West 5th Street between Rymal Road and Stone Church Road will increase by an additional 115-130 daily pedestrian crossings. Therefore, it is recommended a fully signalized pedestrian crossing not be implemented, and a PXO be considered as an alternative option as discussed below.

Based on guidance provided by OTM Book 15 – Pedestrian Crossing Treatments, a **Level 2 Type C PXO** is warranted (push-button actuated roadside flashing beacons) due to a combination of the 50 km/h posted speed limit, existing 2-lane cross-section, and projected 2031 traffic volumes (estimated at approximately 10,000 ADT based on AM plus PM peak hour volumes representing 20% of ADT, equating to estimated peak 8-hour volume of 5,000-6,000 vehicles based on 8-hour volume typically representing 50-60% of ADT). However, should the crossing distance lengthen to a 3-lane cross-section, a **Level 2 Type B PXO** is warranted (similarly also push-button actuated roadside flashing beacons, but the additional of overhead mast arms for additional signage). Based on these results, it is recommended a PXO be provided along the study corridor to improve active transportation connectivity and safety, with the crossing configuration of either Level 2 Type C or Level 2 Type B be confirmed once the preferred cross-section (and thus crossing distance) has been determined as part of the EA Study.

Figure 7.1 below displays two potential locations for future controlled pedestrian crossing opportunities. These locations were selected based on their potential utility to users of the nearby park and the distribution of residences in the surrounding community. The vertical profile of the study corridor is expected to change through its rehabilitation; as such, these crossing locations should be reconfirmed to ensure sufficient sight distance is available on the preferred alignment. It is recommended wither a single PXO, or dual PXOs (as shown in Figure 7.1) be introduced, to be confirmed once the preferred cross-section has been determined and corridor profile developed as part of the EA Study.

Figure 7.1) Potential Controlled Crossing Locations

7.2 Cycling Infrastructure

The City's *Proposed Accelerated Active Transportation Implementation Plan* (November 2023) proposes a "Dedicated Facility" for this section of West 5th Street, which per the Plan means a facility that is within the roadway but has a delineation between the spaces dedicated to cyclists and traffic. This could be on-street bike lanes with delineation by way of painted buffer, painted line, or physical objects such as planters.

An enhanced safety treatment could be full separation, by way of in-boulevard bi-directional or uni-directional cycle track, or in-boulevard shared multi-use path. The City's *Complete Streets Design Guidelines* suggest that a separated facility is desirable for a 'Connector' street, which is appropriate for the context of the area. The goal of using this facility is to provide a safe and comfortable environment for children and less experienced cyclists as well as experienced and recreational cyclists.

Shared lanes with vehicles, which is the current accommodation in this corridor and are not a dedicated cycling facility, is not recommended as it is not consistent with the City's guidance for cyclist accommodation on Connector streets.

Existing cycling facilities connected to the study corridor that the proposed facility would need to integrate with via appropriate transition points include:

- On-street bike lanes on West 5th Street between Marlowe Drive and Stone Church Road West (curbside, both directions),
- On-street bike lanes on the entirety of Stone Church Road (curbside, both directions), and
- Multi-use paths within William Connell City-Wide Park.

Transition points between connecting active transportation facilities will be proposed in the preliminary design of the preferred solution as part of the EA study.

Together, these facilities provide cyclists with dedicated pathways into and out of the study area. To further improve the bicycle LOS of the corridor and the connectivity of the close-range cycling network, enhanced cycling facilities could be considered at the intersection of West 5th Street and Stone Church Road West. To preserve uniformity with the other existing cycling facilities, bike lanes could be installed in the study corridor. When accompanied by enhanced features at this intersection, such as crossrides, bicycle signals, leading bicycle intervals (LBIs), or a combination thereof to create a fully protected intersection, the bicycle LOS could be improved to a level more appropriate for the context of this area.

7.3 Public Transit Service and Infrastructure

As a part of the *(Re)envision the HSR* project, a local bus route is planned to travel on West 5th Street within the study corridor. Route 28 West 5th is a core route that will travel north-south along the West 5th Street from the Mountain Transit Centre to West Harbour GO Station. This route is planned to operate every 10 minutes during peak periods, connecting the study area with the planned King Street LRT, Hamilton GO Centre, two campuses of St. Joseph's Healthcare Hamilton, and Mohawk College.

The City requires minimum 3.3-metre-wide curbside lanes to accommodate transit, which will be reflected in the alternative cross-sections considered as part of this EA Study.

Potential locations for future transit stops within the study area are listed below (see Figure 7.2 below):

- West 5th Street at Rymal Road West (far side, northeast corner),
- West 5th Street at Carmel Drive (far side, northeast corner),
- West 5th Street opposite Carmel Drive (midblock, west side),
- West 5th Street opposite William Connell City-Wide Park (midblock, east side)
- West 5th Street at William Connell City-Wide Park (far side, southwest corner), and
- West 5th Street at Stone Church Road West (far side, southwest corner).

Based on the alignment of the route, its connections with other core and rapid routes in the area, and the distribution of commercial areas and major destinations relative to the study area, the northbound stops on this segment of West 5th Street will likely operate as boarding stops, where most transit users will be travelling downtown from this location. Conversely, the southbound stops will likely be alighting stops where the same users end their return commute trip. Due to this, transit amenities such as benches and shelters would be desirable for northbound stops, but not as useful for southbound stops.

In addition to route 28 West 5th, the following nearby and connecting routes will enhance transit access in the area:

- Route 20 A Line is a rapid route that is planned to operate along James Street and Upper James Street between the Hamilton Airport and Pier 8. Service is planned to operate with a peak headway shorter than 10 minutes.
- Route 26 Upper Wellington is a core route that is planned to operate along James Street, Upper Wellington Street, Rymal Road East, and Upper James Street between the Mountain Transit Centre and West Harbour GO Station. Service is planned to operate with a peak headway of 10 minutes.
- Route 27 Upper James is a core route that is planned to operate along Upper James Street, Victoria Avenue, Wellington Street, and Burlington Street between the Mountain Transit Centre and Pier 8. Service is planned to operate with a peak headway of 10 minutes.
- Route 30 S Line is a rapid route that is planned to operate along Rymal Road, Garner Road, and the Red Hill Valley Parkway between Ancaster Gateway and the Parkdale LRT Station. Service is planned to operate with a peak headway shorter than 10 minutes.
- Route 35 Stone Church is a core route that is planned to operate along Stone Church Road between the Meadowlands Terminal and Heritage Greene Terminal. Service is planned to operate with a peak headway of 10 minutes.
- Route 36 Rymal is a local route that is planned to operate along Rymal Road and Highland Road between the Meadowlands Terminal and Elfrida Gateway. Service is planned to operate with a peak headway of 15 minutes.

Figure 7.2) Potential Transit Stop Locations

7.4 Intersection Improvements

The capacity analysis contained in Section 5 of this report identified minor concerns with traffic operations at the study area intersections. The results of the capacity analysis showed that improvements to signal timing can mitigate these concerns and return v/c ratios below the threshold set by the City of Hamilton's *Transportation Assessment Guidelines*. However, when compared with the results of the MMLOS evaluation, it was observed that cars and trucks experienced levels of service higher than the targets for this area type. It was also observed that cyclists and public transit experienced levels of service lower than the targets for this area type.

Due to the imbalance in service provided to all road users in the study area, the most prudent approach to improving the study area intersections is to improve the experience for the road users that the MMLOS evaluation showed are not being accommodated at the target level of service. Specifically, the existing facilities provided for cyclists and public transit have potential for improvement. Improvements could include changes to signalization at the intersections to allow transit priority or separate signals for bicycles. Bicycle signals should be accompanied by the installation of crossrides to delineate the path through the intersection that is dedicated to bicycles.

However, some improvements can positively affect the transportation experience for some road users at the cost of others. For example, if the intersection of West 5th Street and Stone Church Road West were a protected intersection with no permissive movements allowed, this could improve the bicycle LOS score. Due to the longer cycle lengths often necessitated by protected intersections, this would increase delay to transit vehicles and cars, resulting in lower LOS scores for both. While pedestrians would benefit from the increased safety of a protected intersection, pedestrian delay could be increased by a longer cycle length as well. The resultant experience for pedestrians would likely yield a similar LOS score to the existing conditions. Caution should be taken when considering severe changes to intersection operations such as protected intersections and complicated signal phasing, as in this example, one type of road user would benefit at the cost of two others.

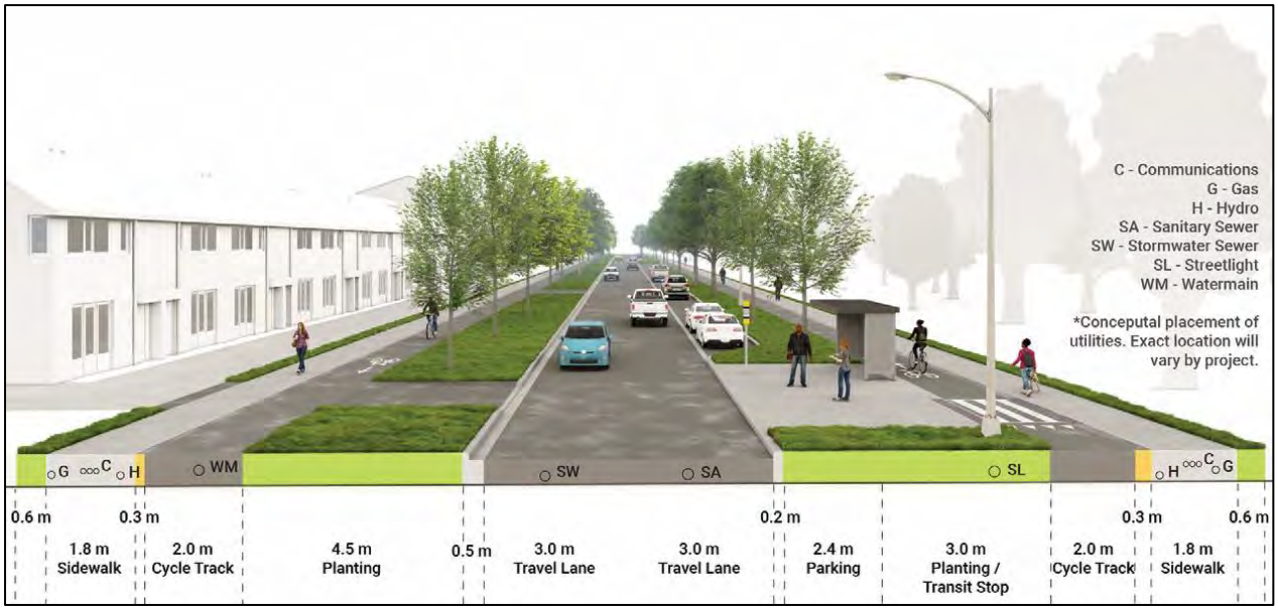
7.5 Corridor Lane Configurations

7.5.1 Typical Connector Cross-Section

Based on the volumes forecasted for the study corridor, the existing lane configuration of one lane per direction provides sufficient capacity for existing and future demand. The EMME plots provided by the City indicating the future v/c ratios of this segment of West 5th Street show the expected utilization of this corridor and its relative capacity to handle future demand for the years 2031, 2041, and 2051. The lowest v/c ratios for these three horizon years are shown in the EMME plot of 2041 conditions, which describe the northbound and southbound v/c ratios as 0.6 and 0.4, respectively. In the final horizon year or 2051, the v/c ratios for northbound and southbound traffic are 0.69 and 0.56, respectively.

With the volume being below 70% of the capacity of the roadway in its current configuration and no significant anticipated increase in traffic, an appropriate typical cross-section for this segment of West 5th Street is the ideal typical cross-section for a 'Connector' as shown in the City's *Complete Streets Design Guidelines* (see FIGURE below).

Figure 7.3) Typical Connector Cross-Section



This cross-section would address the needs of the corridor by providing the missing sidewalk on the west side of the road, unidirectional cycle tracks on each side, and preserving enough space within the boulevard for future transit stops. For section of the corridor where left-turn lanes are required, such as the two signalized study area intersections, the intersection with Carmel Drive, and the two-way left-turn lane (TWLTL) south of Carmel Drive, the boulevard could be narrowed slightly to accommodate the additional lanes.

7.5.2 Continuous Two-Way Left-Turn Lane

Where left turn volume is sufficient or where there is a history of rear-end collisions involving left turns, a continuous two-way left-turn lane (TWLTL) may be considered. A continuous TWLTL improves the consistency of the corridor's cross-section and lane alignment, compared to intermittent auxiliary left-turn lanes resulting in a "weaving" alignment of the general-purpose lanes. Some studies on Crash Modification Factors (CMF) indicate that when used as a countermeasure to an existing safety issue, TWLTLs can reduce the number of rear-end collisions experienced on some roads (although there are no technical industry thresholds (i.e., left-turn volumes or rear-end collisions) indicating when TWLTLs are warranted.

A continuous TWLTL would also protect for sufficient pavement width, so if future additional development is planned along the corridor introducing new driveways requiring left-turn lanes, the continuous TWLTL is already present and available. Furthermore, West 5th Street just north of the study area also includes a continuous TWLTL, resulting in a consistent cross-section along West 5th Street.

Should segments of the continuous TWLTL be determined to not be useful for left-turning traffic, that roadway space could be configured to raised centre median (potentially planted). During the design of the preferred solution for the EA study, the continuous TWLTL will be reviewed for opportunities to make best use of the pavement space.

A continuous TWLTL would consume more available space within the right-of-way (ROW). This can affect the space available for future transit stops, all of which are required to meet AODA standards which require certain dimensions of clear area for personal mobility devices (PMDs) and bus ramps. A continuous TWLTL would also introduce greater crossing distances for pedestrians at the proposed crossover locations. The feasibility of accommodating the additional pavement width to support a continuous TWLTL will be confirmed through the EA Study during the multi-criteria evaluation of the alternatives.

8 Conclusions

As a component of the municipal class environmental assessment for West 5th Street between Stone Church Road West and Rymal Road West, the multimodal transportation assessment examined the existing conditions of transportation operations within the corridor and future needs with considerations for projected traffic demands to a 2031 horizon year. The geometric properties of this corridor were evaluated with deficiencies and areas of improvement identified. Additionally, the future demand of the corridor and evolution of the surrounding context within the community and transportation network were analyzed to determine the objectives for the rehabilitation of West 5th Street.

Key findings and recommendations of this assessment are summarized below:

- The condition of the surface of West 5th Street is in a state of deterioration, with drainage issues identified at multiple locations within the corridor, requiring rehabilitation.
- The existing sidewalk network is in a state of deterioration and incomplete, with drainage and continuity issues identified throughout. Rehabilitation and completion of missing links in the sidewalk network is required.
- There is no controlled pedestrian crossing along West 5th Street between Stone Church Road West and Rymal Road West (1 kilometre length with no controlled crossing). A preferred location for a midblock crossing is in the general vicinity of William Connell City-Wide Park to improve pedestrian safety and increase the utility of the park to the community. Although a signalized midblock pedestrian signal (MPS) is not warranted due to insufficient projected pedestrian volumes, a Level 2 Type C or B PXO (depending on the ultimate roadway cross-section to be selected through the EA Study) is warranted for this corridor.
- There are no cycling facilities along this segment of West 5th Street. At a minimum, on-street bike lanes are recommended, with a separated (in-boulevard) facility being most desirable.
- Signal timing improvements are expected to be sufficient to maintain an acceptable level of service at both signalized intersections (at Stone Church Road West and at Rymal Road West) to the study's ultimate 2031 horizon year, without need for physical capacity improvements. Corridor widening (i.e., two general purpose lanes per direction) is not justified.
- There is a need to improve the multimodal level of service (MMLOS) for the study area for several modes of travel, which will be achieved through enhanced design and better accommodation for the following users of the corridor:
    - » For cyclists and public transit at the intersection of West 5th Street and Stone Church Road West;
    - » For public transit at the intersection of West 5th Street and Rymal Road West; and
    - » For pedestrians and cyclists for the West 5th Street corridor in general between Rymal Road West and Stone Church Road West.
- A continuous two-way left-turn lane (TWLTL) is recommended on West 5th Street between Rymal Road West and Stone Church Road West.

The ultimate roadway cross-section and active transportation facilities will be determined as part of the evaluation of alternatives through this EA Study, after which point a preliminary design of the preferred solution will be developed.

Appendices

Appendix A Traffic Volume Data

Rymal Rd W @ West 5th St

Morning Peak Diagram

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

One Hour Peak
From: 8:00:00
To: 9:00:00

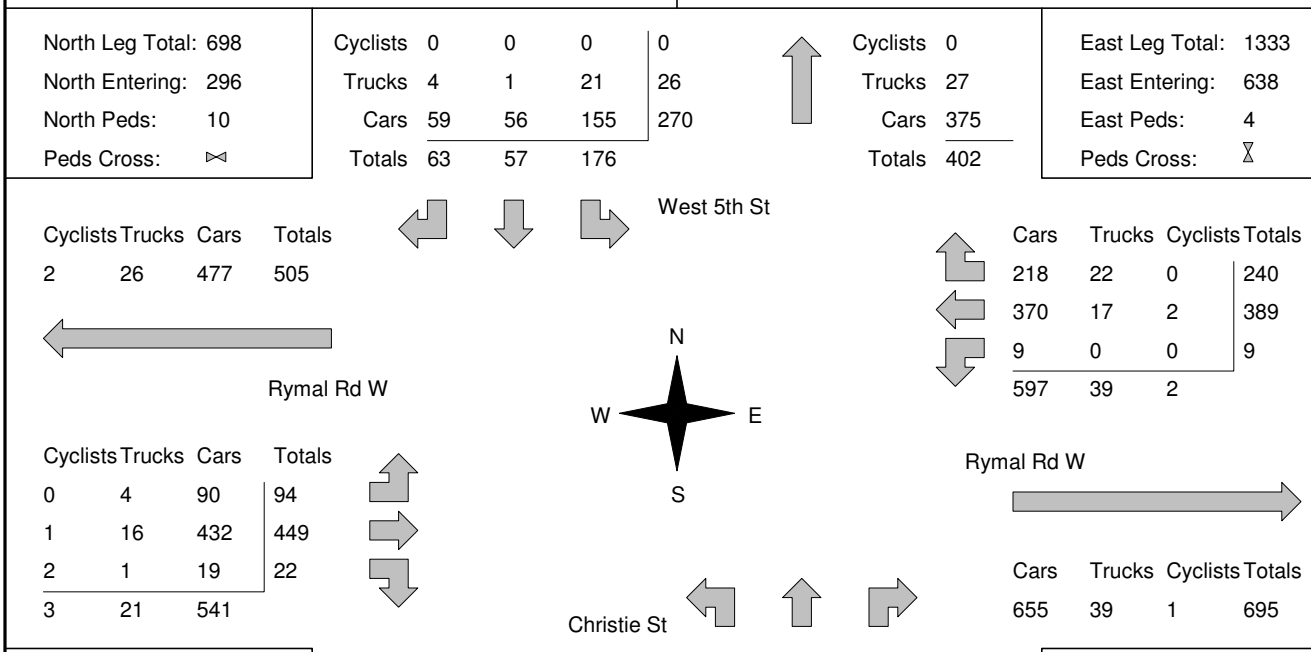
Municipality: Hamilton
Site #: 0000021704
Intersection: Rymal Rd W & West 5th St
TFR File #: 1
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Rymal Rd W runs W/E



Comments

Rymal Rd W @ West 5th St

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

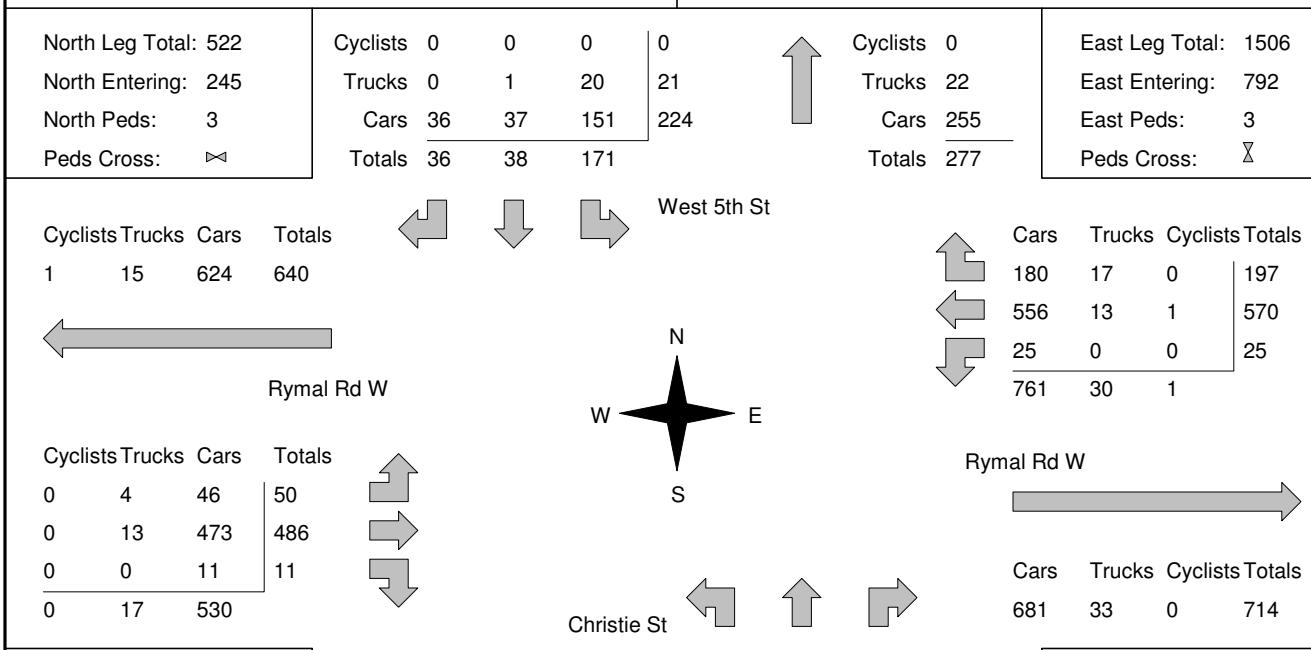
Municipality: Hamilton
Site #: 0000021704
Intersection: Rymal Rd W & West 5th St
TFR File #: 1
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Rymal Rd W runs W/E



Comments

Rymal Rd W @ West 5th St

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

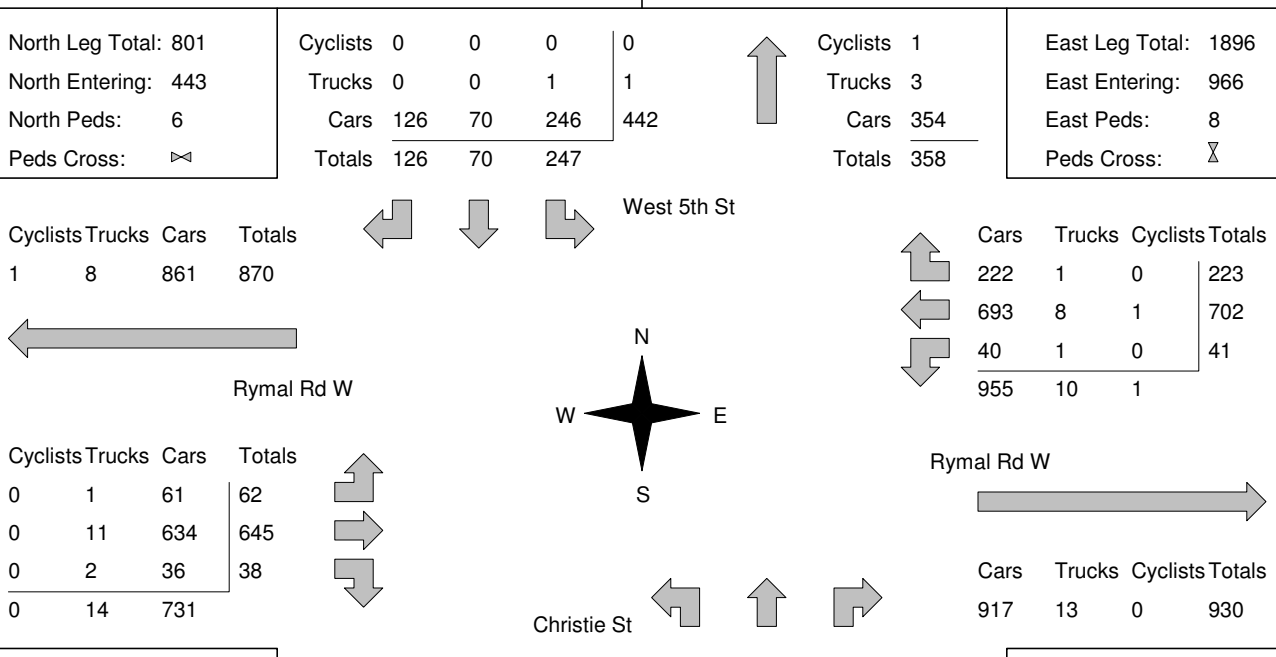
Municipality: Hamilton
Site #: 0000021704
Intersection: Rymal Rd W & West 5th St
TFR File #: 1
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Rymal Rd W runs W/E



Comments

Rymal Rd W @ West 5th St

Total Count Diagram

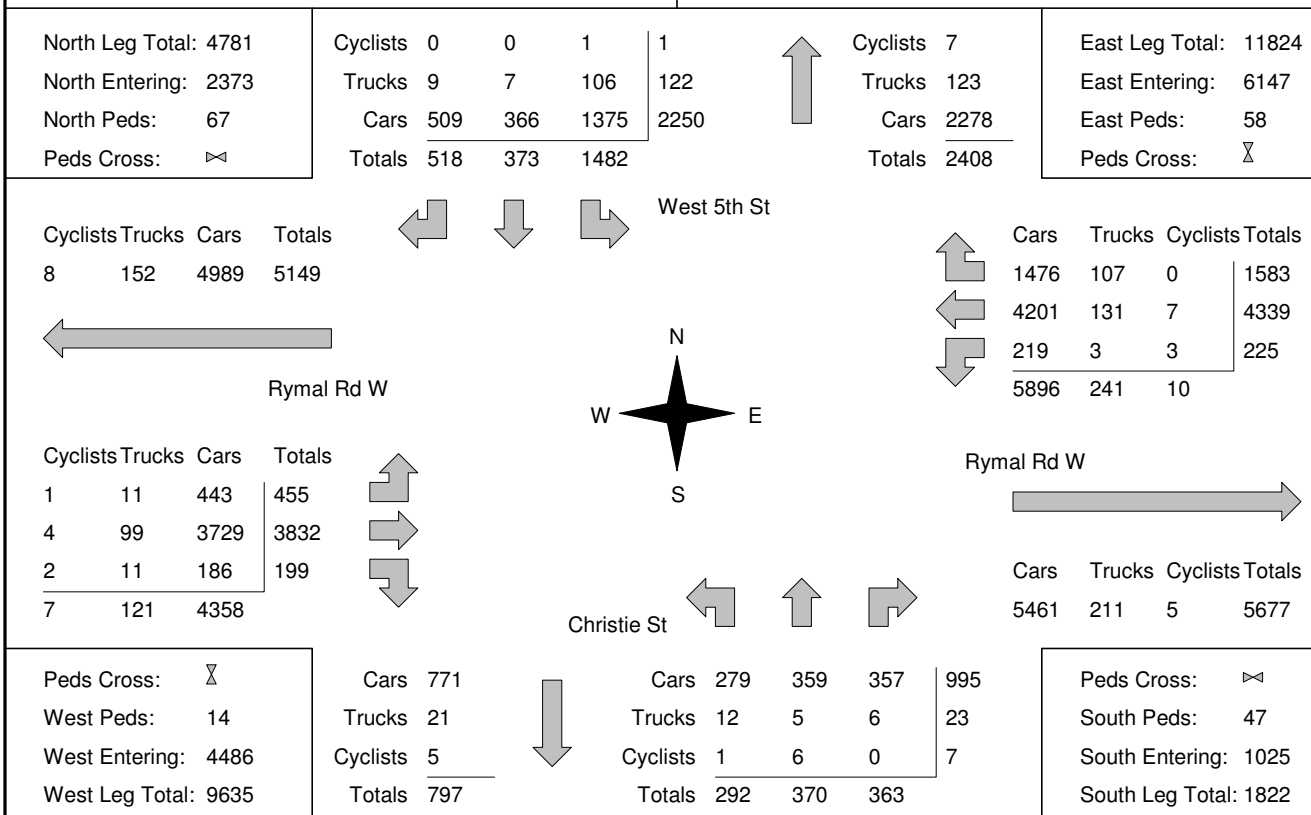
Municipality: Hamilton
Site #: 0000021704
Intersection: Rymal Rd W & West 5th St
TFR File #: 1
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Rymal Rd W runs W/E



Comments

Stone Church Rd W @ West 5th St

Morning Peak Diagram

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

One Hour Peak
From: 8:00:00
To: 9:00:00

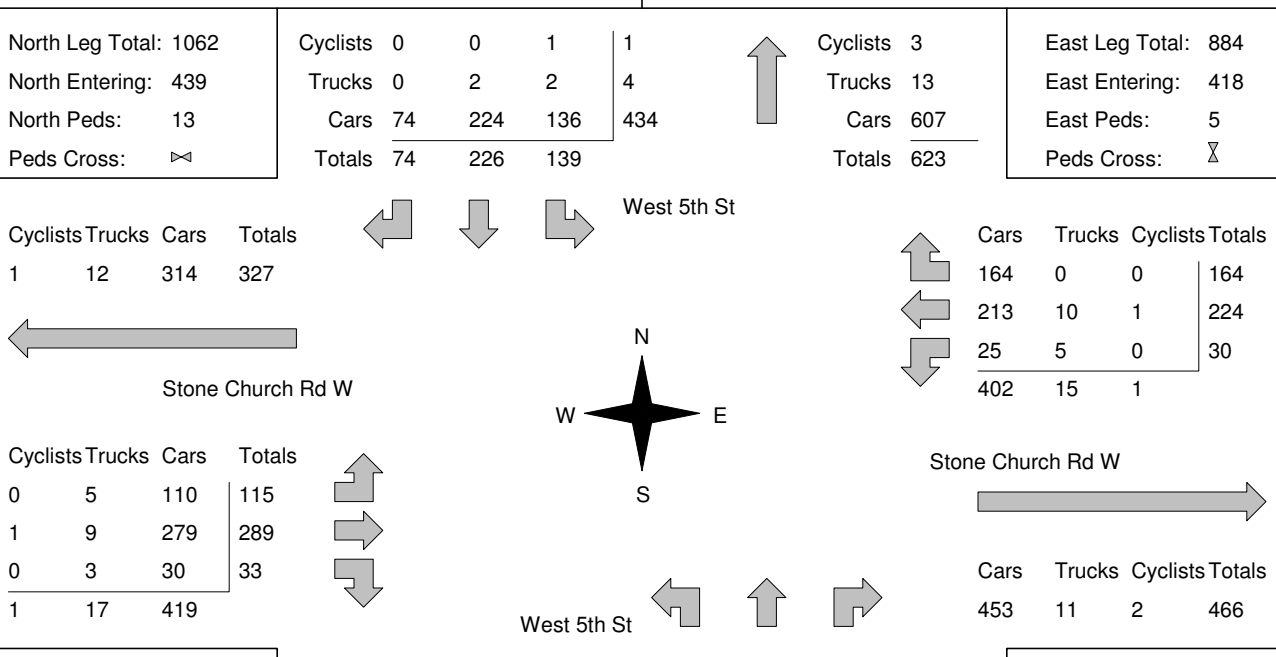
Municipality: Hamilton
Site #: 0000023074
Intersection: Stone Church Rd W & West 5th St
TFR File #: 2
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Stone Church Rd W runs W/E



Comments

Stone Church Rd W @ West 5th St

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 12:00:00
To: 13:00:00

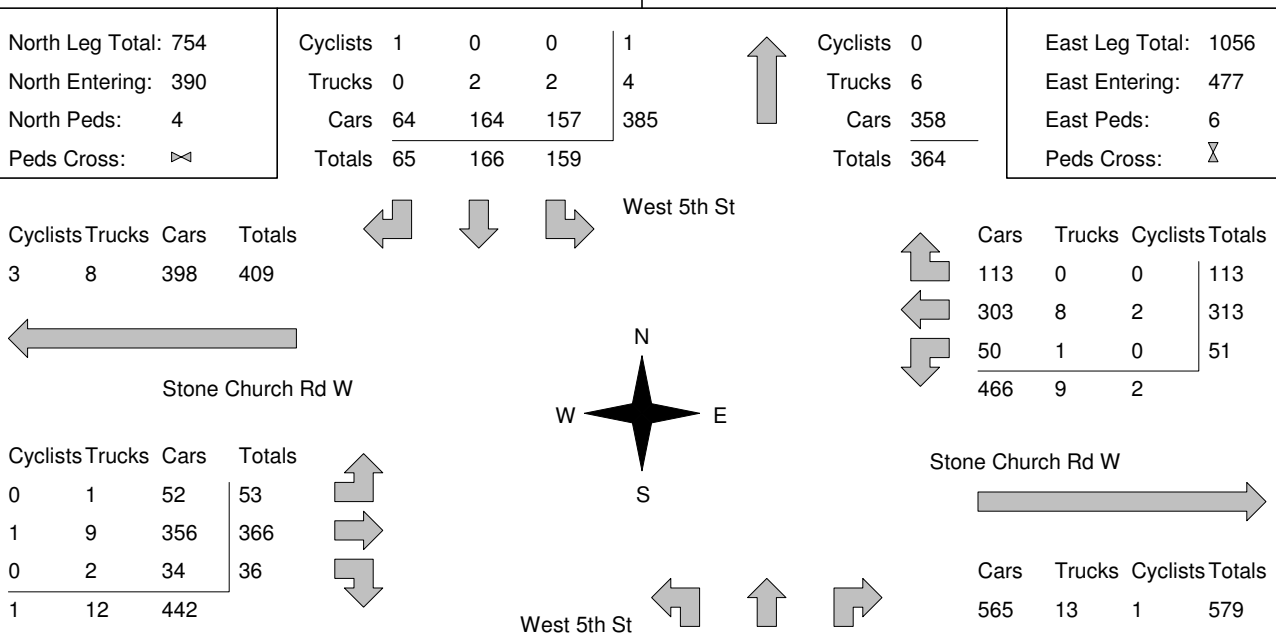
Municipality: Hamilton
Site #: 0000023074
Intersection: Stone Church Rd W & West 5th St
TFR File #: 2
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Stone Church Rd W runs W/E



Comments

Stone Church Rd W @ West 5th St

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:45:00
To: 17:45:00

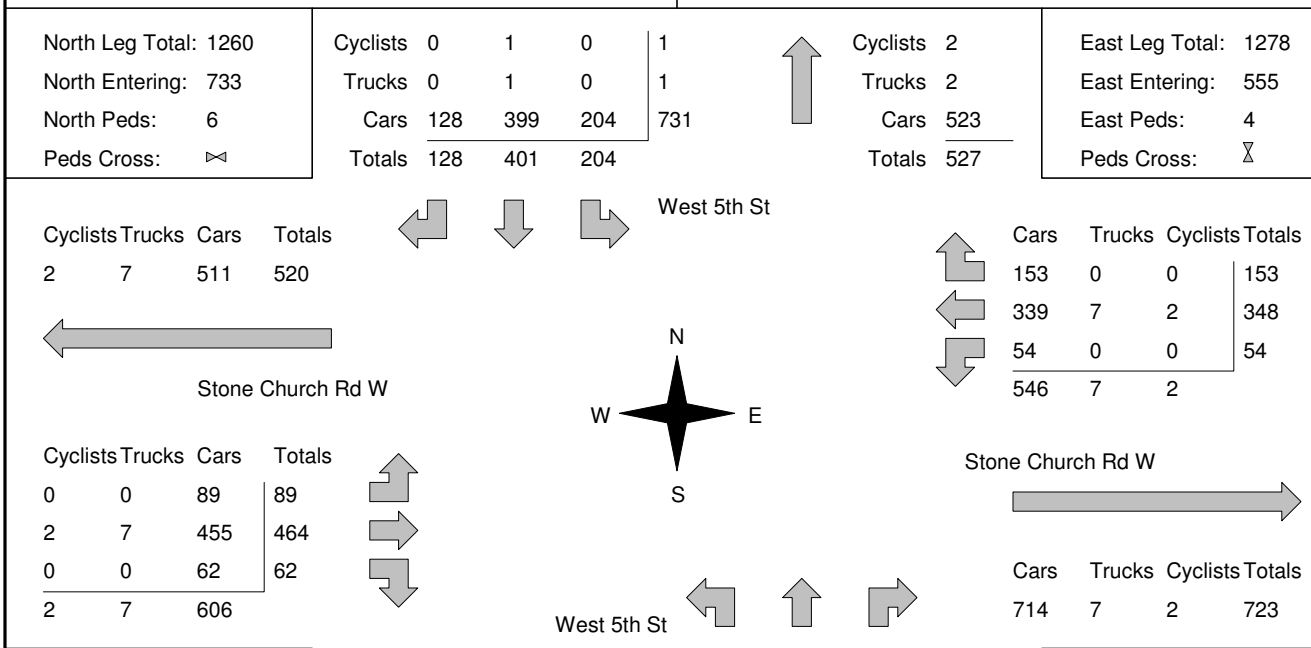
Municipality: Hamilton
Site #: 0000023074
Intersection: Stone Church Rd W & West 5th St
TFR File #: 2
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Stone Church Rd W runs W/E



Comments

Stone Church Rd W @ West 5th St

Total Count Diagram

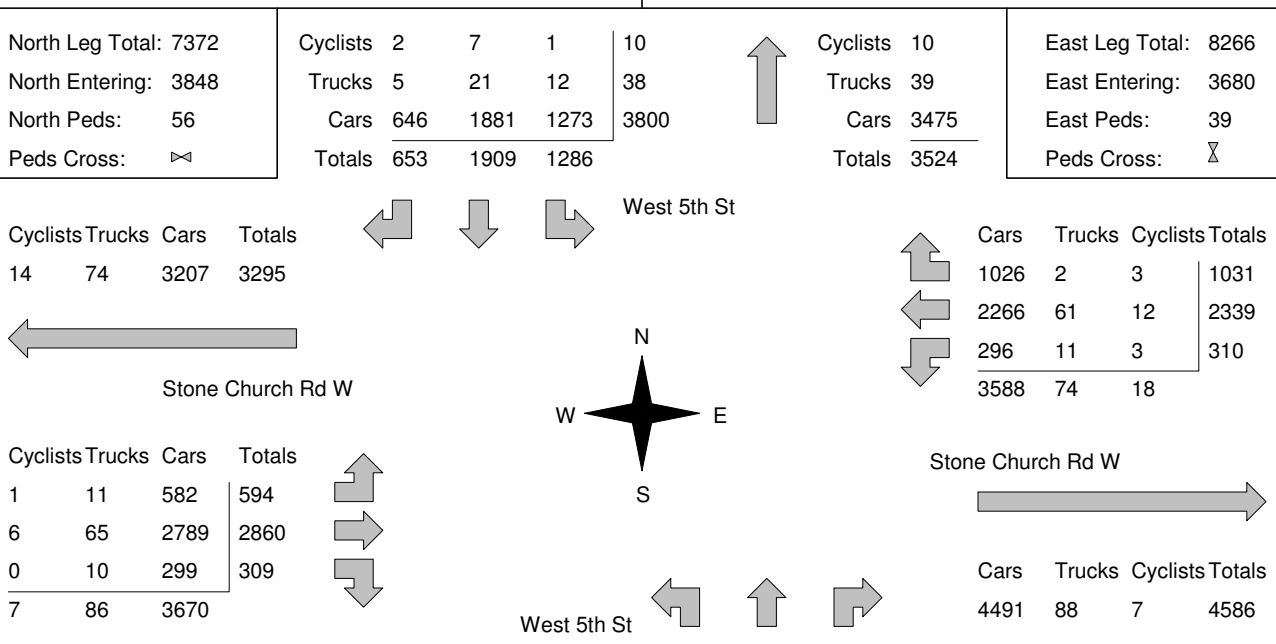
Municipality: Hamilton
Site #: 0000023074
Intersection: Stone Church Rd W & West 5th St
TFR File #: 2
Count date: 5-Jun-2024

Weather conditions:
Clear/Dry

Person(s) who counted:
Pyramid Traffic Inc

**** Signalized Intersection ****

Major Road: Stone Church Rd W runs W/E



Comments

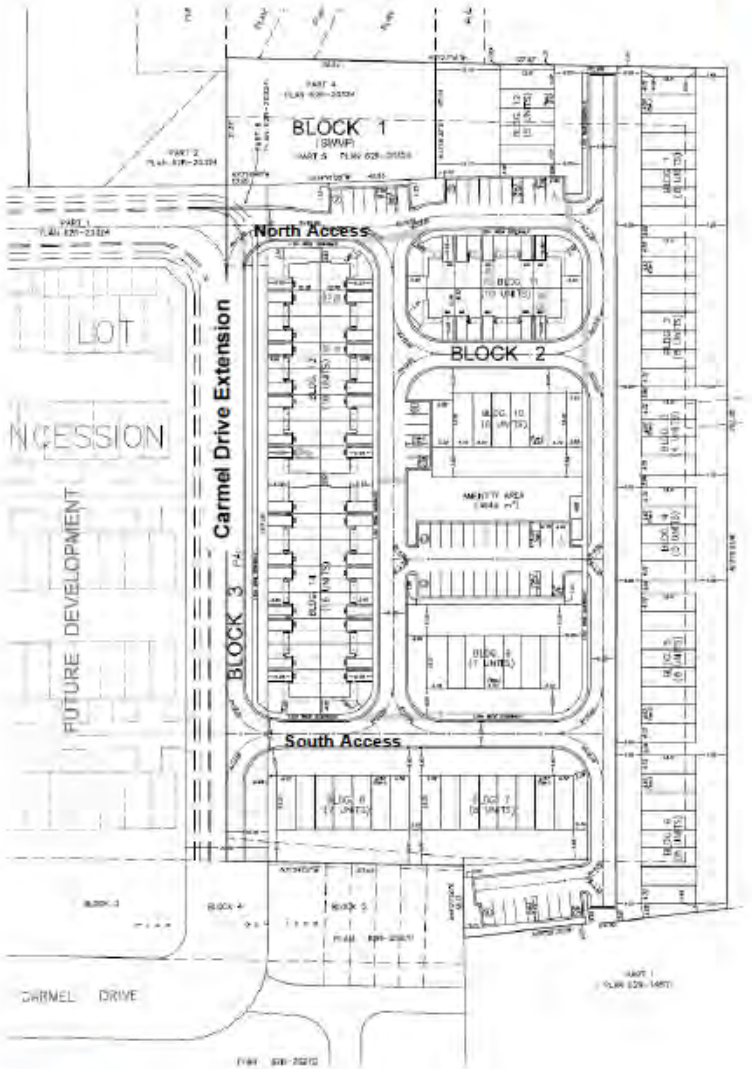
Appendix B Planned Study Area Developments

1460 Upper James Street, Hamilton, ON
Transportation Impact Study

Paradigm Transportation Solutions Limited

June 2021
200459

ptsl.com


BLOCK 1
(SWM)
North Access
BLOCK 2
Carmel Drive Extension
BLOCK 3
South Access
LOT
CONCESSION
FUTURE DEVELOPMENT
CARMEL DRIVE

paradigm

3.2 Site Generated Traffic

The Institute of Transportation Engineers (ITE) Trip Generation[4] methods predict the site trip generation. The following Land Use Code (LUC) was used to estimate the site trip generation:

- LUC 220 (Multifamily Housing, Low Rise)

Regression equation rates were used to calculate the trips generated by the residential use. **Table 3.1** summarizes the estimated trip generation. The site's base trip generation is estimated to be approximately 55 AM peak hour trips and 67 PM peak hour trips. No reductions for alternative modes of transportation were used in the calculation.

TABLE 3.1: TRIP GENERATION

ITE Land Use	Units	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
220 - Multifamily Housing (Low-Rise)	116	13	42	55	42	25	67

AM: Ln(T) = 0.95 Ln(X) - 0.51 | PM: Ln(T) = 0.89 Ln(X) - 0.02

The trip distribution used for this study was based on the existing distribution as the subject site is residential and will have similar travel characteristics of the existing traffic patterns. The trip distribution is shown in **Table 3.2**.

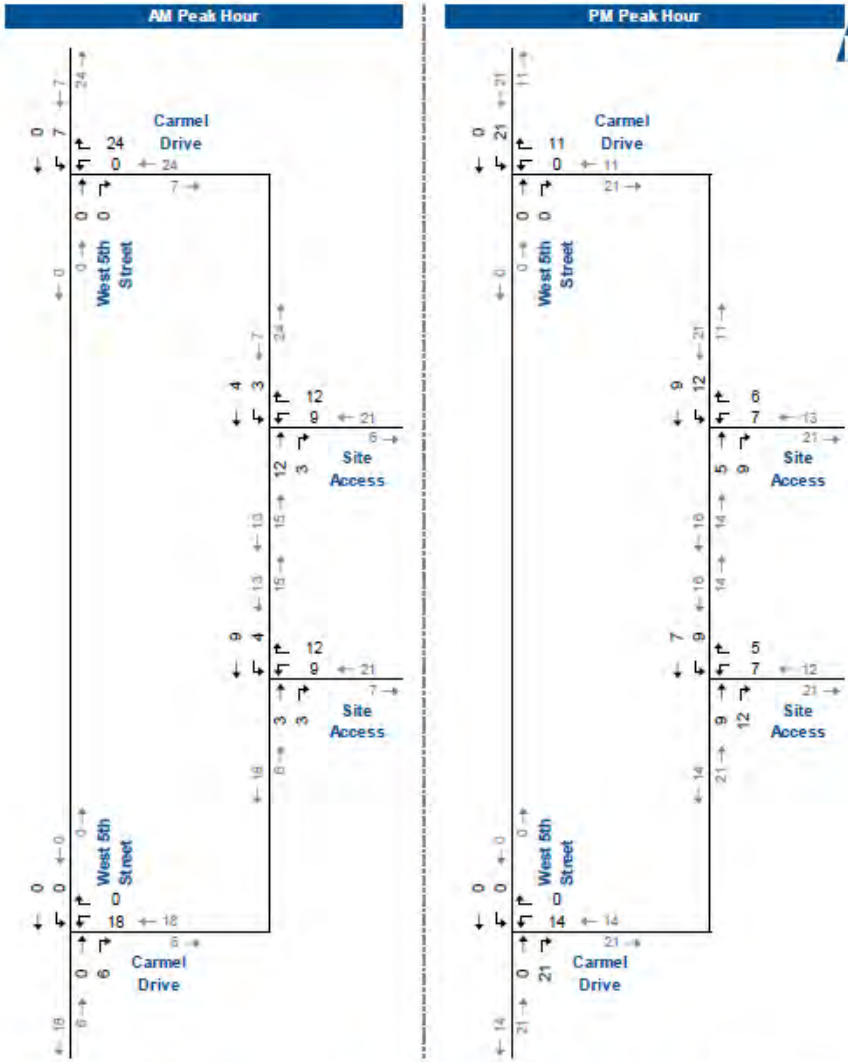
TABLE 3.2: TRIP DISTRIBUTION

Direction	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
North	43%	59%	57%	45%
South	57%	41%	43%	55%
Total	100%	100%	100%	100%

Figure 3.2 contains the AM and PM peak hour trip assignment for Scenario A were all site trips are assigned to the existing West 5th Street and Carmel Drive intersection.

Figure 3.3. contains the AM and PM peak hour trip assignment for Scenario B were the site trips are split between the existing West 5th Street and Carmel Drive intersection as well as the Carmel Drive extension intersection with West 5th Street.

[4] *Trip Generation Tenth Edition*, Institute of Transportation Engineers, Washington D.C., 2017



Site Generated Traffic Volumes Scenario B

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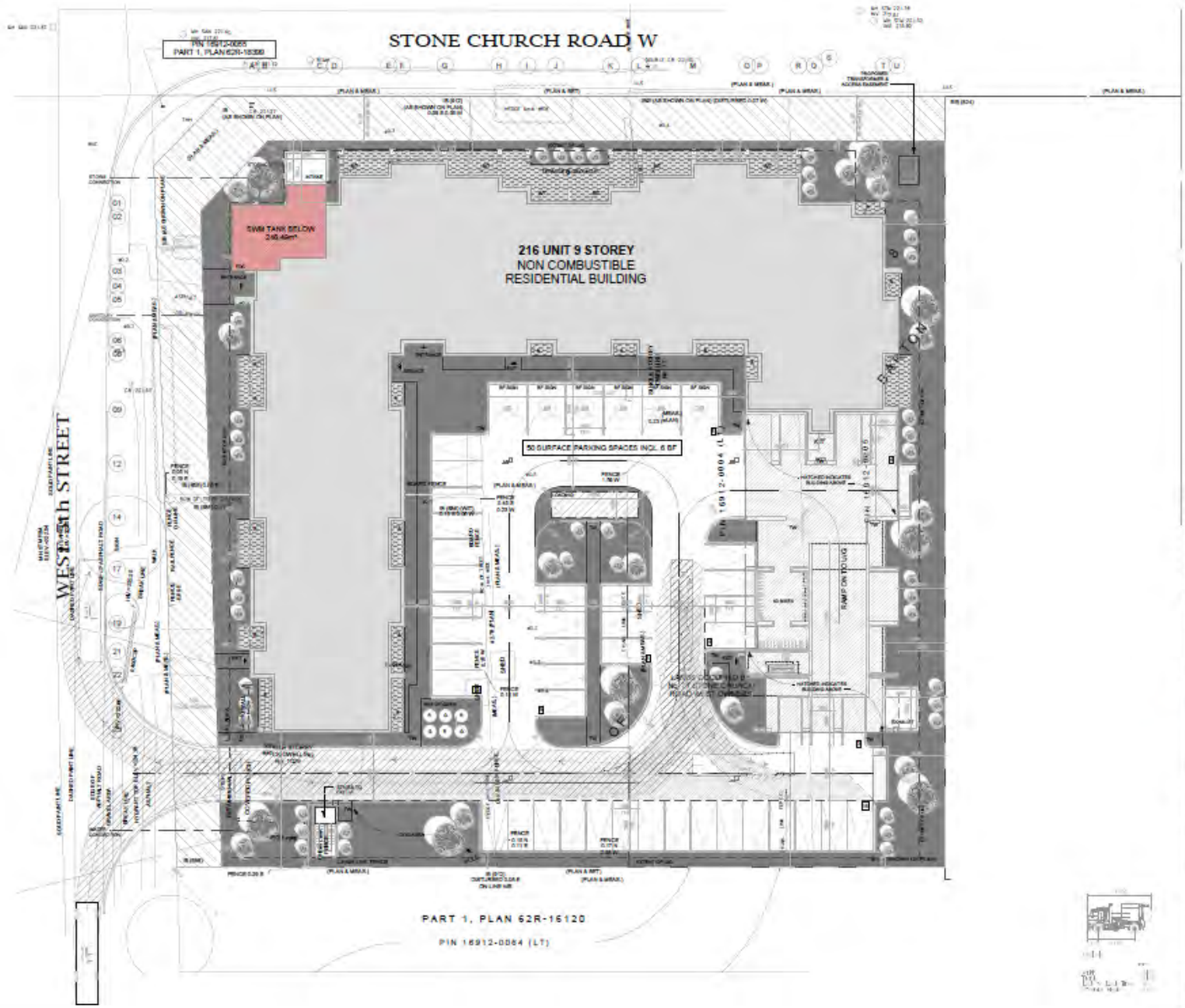
Transportation Impact Study Addendum Letter

PROPOSED RESIDENTIAL DEVELOPMENT

73-89 Stone Church Road & 1029 West 5th Street
City of Hamilton, ON

June 6, 2022
Project No: NT-22-027



KEY PLAN

nexTrans
CONSULTING ENGINEERS

RESIDENTIAL DEVELOPMENT
Stone Church Road & West 5th Street
(City of Hamilton)

AutoTURN Analysis
(Molok Waste Collection)

DESIGNED BY: K.K.	DATE: May 13, 2022
CHECKED BY: R.P.	PROJECT NO. NT-22-027
DRAWN BY: K.K.	DRAWING NO. Figure 2
SCALE: NTS	

Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
	LOS (v/c)	Delay (s)	95th Queue (m)	LOS (v/c)	Delay (s)	95th Queue (m)
West 5th Street & Stone Church Road West						
OVERALL	**E (1.10)**	**60.0**	-	**F (1.85)**	**110.4**	-
EBL	E (0.92)	76.2	33.7	C (0.44)	33.5	12.2
EBTR	D (0.86)	46.4	180.9	E (1.00)	69.7	273.4
WBL	C (0.22)	27.0	6.1	C (0.33)	34.0	9.5
WBTR	D (0.91)	53.3	224.8	D (0.90)	51.5	231.7
NBL	C (0.53)	34.4	48.6	**F (2.93)**	**943.3**	**116.1**
NBTR	C (0.66)	34.8	141.6	C (0.52)	30.7	105.2
SBL	**F (1.31)**	**208.0**	**83.5**	E (0.86)	61.0	105.9
SBTR	C (0.47)	29.6	69.7	D (0.91)	53.1	239.3
West 5th Street & Townhouse Access						
EBLR	C (0.06)	18.9	1.4	D (0.07)	30.7	1.8

As summarized in **Table 3.1**, it is shown that during future background traffic conditions the Upper James Street & Stone Church Road signalized intersection is operating at overall LOS 'D' during the AM and PM peak hours. Although the southbound-left movement is operating at a failing level of service, the v/c is under 1.00 and therefore acceptable for a left-turn lane during peak hours. The West 5th Street & Stone Church Road West continues to fail during the AM and PM peak hours.

4.0 SITE TRAFFIC

The development proposal is to redevelop the existing subject lands into a 237-unit apartment building. Trip rates and site generated trips were derived from the information contained in the *Trip Generation Manual, 10th Edition* published by the Institute of Transportation Engineers (ITE) for "Multifamily Housing (Mid-Rise)" (LUC 221). The trip generation summary is shown in **Table 4.1**.

Table 4.1 – Site Traffic Trip Generation (Based on ITE)

ITE Land Use	Parameter	Morning Peak Hour			Afternoon Peak Hour		
		In	Out	Total	In	Out	Total
Apartment (237 units)	Gross Trips	22	63	85	63	41	104
	Gross Rate	0.09	0.27	0.36	0.27	0.17	0.44
Total	**New Trips**	**22**	**64**	**86**	**63**	**40**	**103**

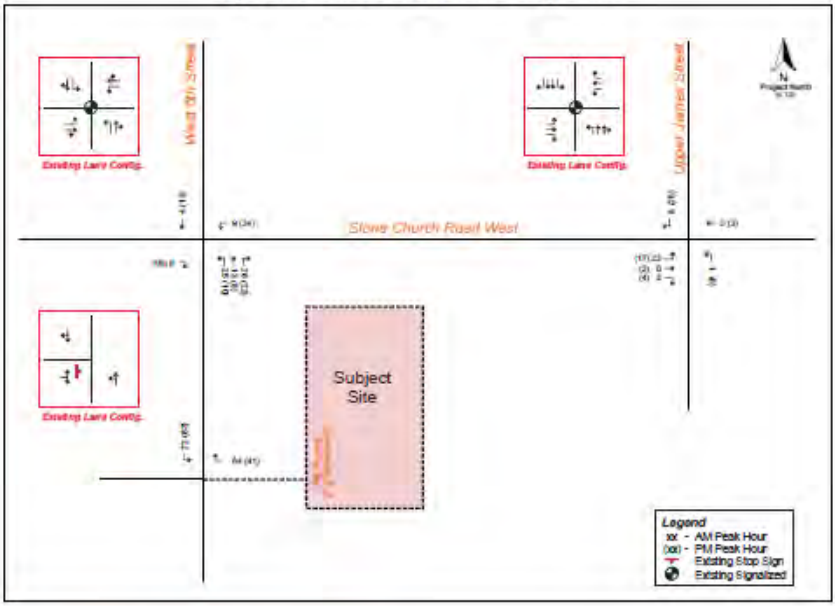
As shown in **Table 4.1**, the proposed development is anticipated to generate 86 two-way auto trips (22 inbound and 64 outbound) during the AM peak hours and 103 two-way auto trips (63 inbound and 40 outbound) during the PM peak hours.

The assumptions for the trip distribution rates are based on the information extracted from the 2016 Transportation Tomorrow Survey (TTS) and existing traffic patters and routes that drivers would likely take to access the subject site and engineering judgement based on ease of site access. As a result, site trip distribution is summarized for the inbound and outbound site traffic movements during the morning and afternoon peak hours in **Table 4.2** with the trip assignment illustrated in **Figure 4-1**.

Table 4.2 – Site Traffic Trip Distribution

Direction	Via	AM Peak Hour		PM Peak Hour	
		Inbound	Outbound	Inbound	Outbound
North	Upper James	35%	35%	40%	40%
North	West 5th	20%	20%	20%	20%
South	Upper James	5%	5%	10%	10%
East	Stone Church	-	-	5%	5%
West	Stone Church	40%	40%	25%	25%
Total		**100%**	**100%**	**100%**	**100%**

Figure 4-1 – Site Generated Traffic Assignments



5.0 FUTURE TOTAL TRAFFIC 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 E** and summarized in **Table 5.1**.

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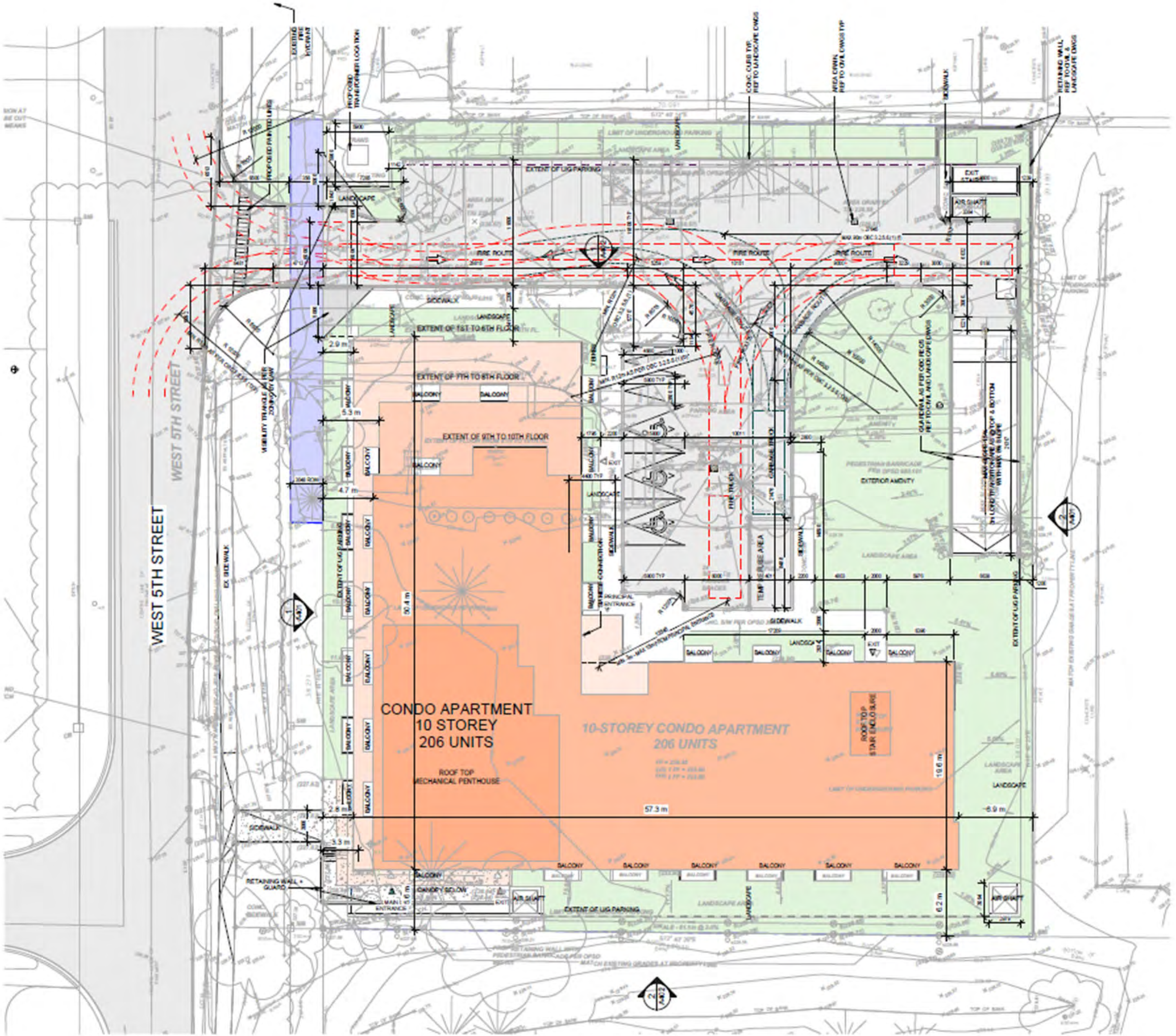
Transportation Impact Study Addendum

PROPOSED RESIDENTIAL DEVELOPMENT

1187 West 5th Street
HAMILTON, ONTARIO

March 2023
Project No: NT-21-303


WEST 5TH STREET
CONDO APARTMENT
10 STOREY
206 UNITS
10-STOREY CONDO APARTMENT
206 UNITS
ROOF TOP
MECHANICAL PENTHOUSE
EXTENT OF UG PARKING
EXTENT OF 1ST TO 6TH FLOOR
EXTENT OF 7TH TO 8TH FLOOR
EXTENT OF 9TH TO 10TH FLOOR
FIRE ROUTE
SIDEWALK
LANDSCAPE
BALCONY
EXTERIOR AMENITY
PRINCIPAL ENTRANCE
MAIN LVL ENTRANCE
CANOPY BELOW
AIR SHAFT
RETAINING WALL + GUARD
ROOF TOP STAIR ENCLOSURE
57.3 m
30.4 m
19.6 m
6.2 m
5.3 m
4.7 m
2.9 m
2.6 m
6.9 m

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 - General Urban/Suburban	206	Trip Rates AM - T = 0.44*(X) - 11.61 PM - T = 0.39*(X) + 0.34	0.09	0.29	0.38	0.24	0.15	0.39
		Total Trips	18	61	79	49	32	81

The proposed development is expected to generate 79 total two-way trips (18 inbound and 61 outbound) and 81 total two-way trips (49 inbound and 32 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 5th Street, Upper James St)	38%	38%
South (West 5th 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.

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**.

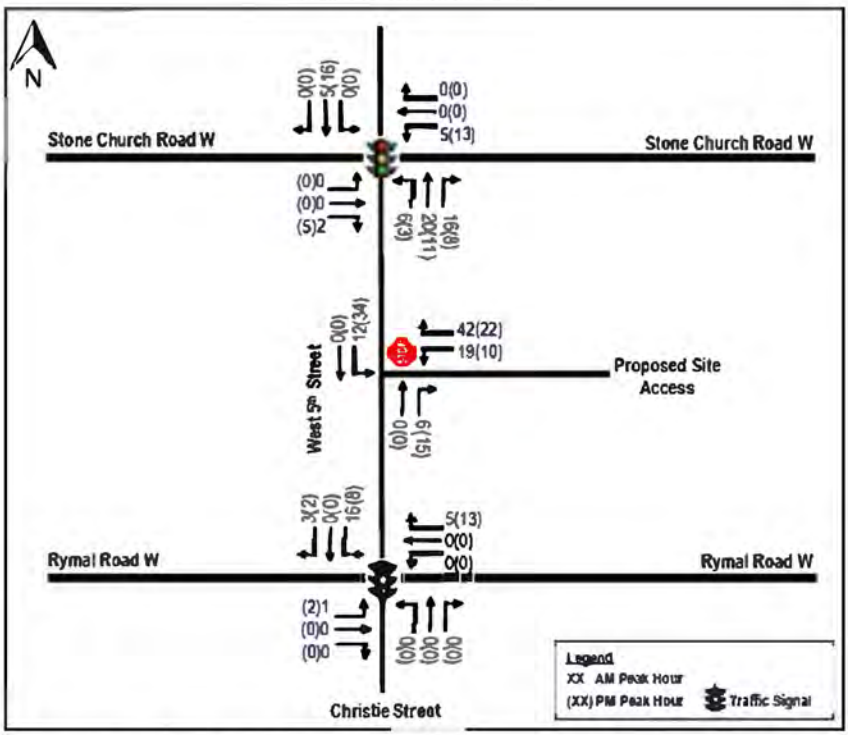
Based on the intersection capacity analysis, similar to the future background conditions, under the future total traffic conditions, the Rymal Road W/West 5th Street/Christie Street intersection is expected to operate at acceptable levels of

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.

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. The analysis indicates 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. The analysis indicates 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.

Figure 10 – Site Traffic Volumes



Appendix C Signal Timing Plans

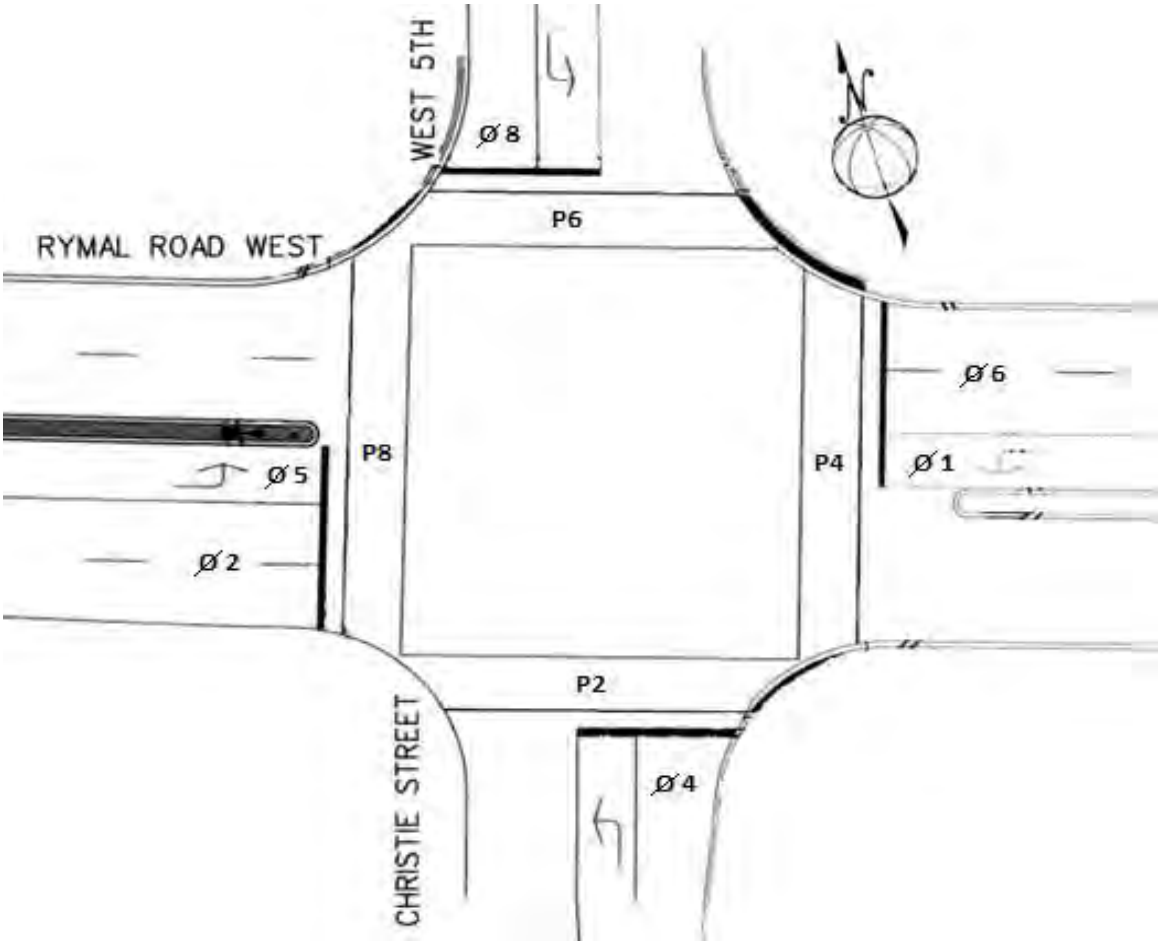
City of Hamilton - Traffic
Traffic Signal Controller Timing Data

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																

CONTROLLER DATA

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

TP1 PHASE RECALLS

(X = ENABLE)

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

TP2 PHASE RECALLS

(X = ENABLE)

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

CONTROLLER DATA

TP3 PHASE RECALLS

(X = ENABLE)

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

TP4 PHASE RECALLS

(X = ENABLE)

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

CONTROLLER DATA

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

(X = ENABLE)

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

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

TP1

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PHASE TIMES	Initial	**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																

CONTROLLER DATA

		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																
	Al/Act																
	Max In																

DUAL ENTRY (MM-3-1-6)

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	1						X										
ENTRY	2						X										
ASSIGN-	3																
MENTS	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	1	X															
DET	2																
ASSIGN-	3																
MENTS	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	1																
DET	2																
ASSIGN-	3																
MENTS	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	Mode	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**								
MODES																	

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

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

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

	DET	9	10	11	12	13	14	15	16
DET	Delay	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
TIMES	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

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

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

CONTROLLER DATA

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

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

	Cycle #	1/1	2/1	3/1	4/1			
	Length	**110**	**110**	**110**	**90**			
CYCLE	Offset 1	**20**	**24**	**15**	**55**			**Secs**
&	Offset 2							
OFFSETS	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
	1-1		**X**				**X**										
	2-1		**X**				**X**										
COORD	**3-1**		**X**				**X**										
PHASES	**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 Seeeling Mode:	0

Mode

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

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

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

ENHANCED OPTIONS

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

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

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

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

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

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

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

DAYLIGHT SAVINGS (MM-3-3-7)

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

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

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

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

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

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

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

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

CLOSED LOOP ID	Master Type:	**1**	0 = None, 1 = 3000 Series Master, 2 = 3800 EL master
	Intersection ID		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 # @ = , ! ; % \ &

PHONE NUMBERS (MM-3-5-3)

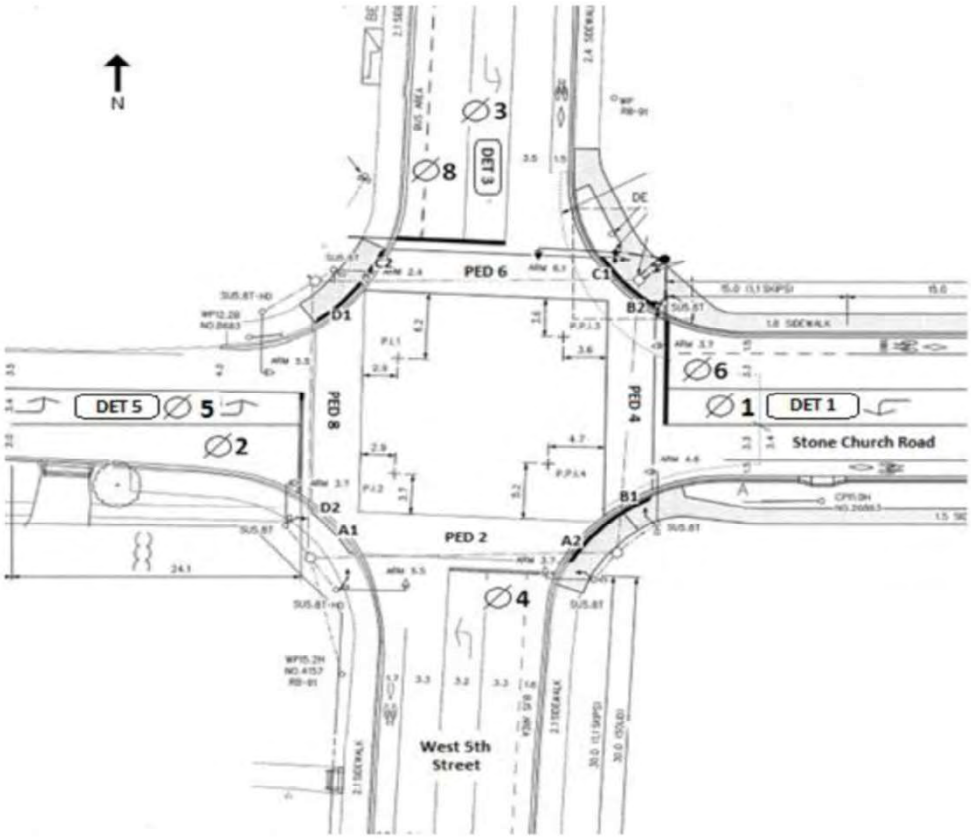
PHONE NUM-BERS	Tone:		Y/N
	Phone 1:		Number & control characters (W , ; # ' / T P) if used
	Phone 2:		Number & control characters (W , ; # ' / T P) if used

LOG DATA (MM-3-5-5)

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

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 Timing

6/30/20 11:56:27 AM

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Min Green	5	20	5	20	5	20	0	20	0	0	0	0	0	0	0	0
Veh Ext	2.0	0.0	2.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Green 1	10	60	10	60	10	60	0	60	0	0	0	0	0	0	0	0
Max Green 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Green 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Ext	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow	3.0	3.3	3.0	3.3	3.0	3.3	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Red Clr	0.0	2.6	0.0	2.5	0.0	2.6	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adv Flash	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bike MG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Walk	0	12	0	12	0	12	0	12	0	0	0	0	0	0	0	0
Ped Clr	0	14	0	14	0	14	0	14	0	0	0	0	0	0	0	0
Walk2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sol DW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Early Wlk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Delay Wlk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Added	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max Initial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Min Gap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reduce After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TTReduce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CS Max Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red Revert	4.0	4.0	4.0	4.0	4.0	4.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Neg Ped	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AP Disc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pmt Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pmt Walk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pmt Ped Clr	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Return Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

West 5th @ Stone Church

Phase Options

6/30/20 11:56:27 AM

Phases	1-8								9-16							
Min Recalls																
Max Recalls																
Ped Recalls		2		4		6		8								
Soft Recall																
Dual Entry		2		4		6		8								
Red Rest																
Walk Rest		2		4		6		8								
Walk Expand																
Ped Recycle		2		4		6		8								
Sim Ped Term																
PC Thru Clr																
Guar Passage																
No Simult Gap																
Yel Lock																
Red Lock																
PhaseNext Lock	1	2	3	4	5	6	7	8								
No Term Call	1	2	3	4	5	6	7	8								
Cond Serv																
CS Enable																
Cond Reserve																
Reserve																
Veh Omit																
Ped Omit																
Perm Phase		2		4		6		8								
Protect Calls																
Protect Calls 2																
Flash Entry																
Flash Exit																
Flash Exit Yel																
Flash Exit Red																
Ped Scramble																
No Min Yel																
No Min Red Rev																
Max Scramble Walk																
Flash Yellow																
Flash FYA																
CNA 1																
CNA 2																

West 5th @ Stone Church

Phase Startup Options

6/30/20 11:56:27 AM

Startup Flash	10	Mode	Yel->Red
Startup All Red	5	Yellow	0.0

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	0.0	Ped Protect	No	AdvFIs in Flash	No

West 5th @ Stone Church

Ring Sequence / Conflicting Phases

6/30/20 11:56:27 AM

Ringgroup 1

Ring 1	1	2	3	4	0	0	0	0	0	0	0	0	0	0	0	0
Ring 2	5	6	0	8	0	0	0	0	0	0	0	0	0	0	0	0

Ringgroup 2

Custom Sequences

Seq 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seq 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Conflicting Phases

	1-8							9-16							
Phase 1															
Phase 2															
Phase 3															
Phase 4															
Phase 5															
Phase 6															
Phase 7															
Phase 8															
Phase 9															
Phase 10															
Phase 11															
Phase 12															
Phase 13															
Phase 14															
Phase 15															
Phase 16															

West 5th @ Stone Church

Coordination Pattern 1

6/30/20 11:56:27 AM

Cycle	110	Ringgroup 1 - Offset 1	73	Offset 2	0	Offset 3	0
		Ringgroup 2 - Offset 1	0	Offset 2	0	Offset 3	0

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Splits	9	51	10	40	9	51	0	50	0	0	0	0	0	0	0	0
Split Ext	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Float Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perm Min Green	8	12	8	12	8	12	0	12	0	0	0	0	0	0	0	0
Min Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Split 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Before	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Permissive Mode	Sing Band	Max Mode	Max 1	Walk Rest	Opp Call
Ped Permissive	Yield				
Permissive Limit	10	Perm 2 Start	0	Perm 2 End	0
Alt Sequence		TOD Link	0		

Phases/Overlaps	1-8							9-16							
Coord Phases		2				6									
No Extend															
Float Enable															
Veh = Ped Perm															
Walk Rest															
Ped Recall															
Cond Ped Call															
Olap Ped Recall															
Ped Recycle															
Min Recall															
Max Recall															
Cond Serv															
Reservice															
Veh Omit															
Ped Omit															
Olap Omit															
Perm Reserve															
Perm 1 Phases															
Max Inhibit															
FYA Omit															
Adapt Phases															

Trans Mode	Best 2					
Offset Ref	Lag Grn					
Adaptive Mode	Disabled					
Disable Priority						
Progression Phases						
Priority Alt Seq						
Reserve Extend						

Priority Timing-Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Priority Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recovery Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

West 5th @ Stone Church

Coordination Pattern 2

6/30/20 11:56:27 AM

Cycle	110	Ringgroup 1 - Offset 1	0	Offset 2	0	Offset 3	0
		Ringgroup 2 - Offset 1	0	Offset 2	0	Offset 3	0

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Splits	9	41	10	50	9	41	0	60	0	0	0	0	0	0	0	0
Split Ext	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Float Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perm Min Green	8	12	8	12	8	12	0	12	0	0	0	0	0	0	0	0
Min Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Split 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Before	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Permissive Mode	Sing Band	Max Mode	Max 1	Walk Rest	Opp Call
Ped Permissive	Yield				
Permissive Limit	10	Perm 2 Start	0	Perm 2 End	0
Alt Sequence		TOD Link	0		

Phases/Overlaps	1-8							9-16							
Coord Phases		2				6									
No Extend															
Float Enable															
Veh = Ped Perm															
Walk Rest															
Ped Recall															
Cond Ped Call															
Olap Ped Recall															
Ped Recycle															
Min Recall															
Max Recall															
Cond Serv															
Reservice															
Veh Omit															
Ped Omit															
Olap Omit															
Perm Reserve															
Perm 1 Phases															
Max Inhibit															
FYA Omit															
Adapt Phases															

Trans Mode	Best 2					
Offset Ref	Lag Grn					
Adaptive Mode	Disabled					
Disable Priority						
Progression Phases						
Priority Alt Seq						
Reserve Extend						

Priority Timing-Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Priority Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recovery Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

West 5th @ Stone Church

Coordination Pattern 3

6/30/20 11:56:27 AM

Cycle	110	Ringgroup 1 - Offset 1	81	Offset 2	0	Offset 3	0
		Ringgroup 2 - Offset 1	0	Offset 2	0	Offset 3	0

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Splits	9	45	12	44	9	45	0	56	0	0	0	0	0	0	0	0
Split Ext	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Float Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perm Min Green	8	12	8	12	8	12	0	12	0	0	0	0	0	0	0	0
Min Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Split 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Before	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Permissive Mode	Sing Band	Max Mode	Max 1	Walk Rest	Opp Call
Ped Permissive	Yield				
Permissive Limit	10	Perm 2 Start	0	Perm 2 End	0
Alt Sequence		TOD Link	0		

Phases/Overlaps	1-8							9-16							
Coord Phases		2				6									
No Extend															
Float Enable															
Veh = Ped Perm															
Walk Rest															
Ped Recall															
Cond Ped Call															
Olap Ped Recall															
Ped Recycle															
Min Recall															
Max Recall															
Cond Serv															
Reservice															
Veh Omit															
Ped Omit															
Olap Omit															
Perm Reserve															
Perm 1 Phases															
Max Inhibit															
FYA Omit															
Adapt Phases															

Trans Mode	Best 2					
Offset Ref	Lag Grn					
Adaptive Mode	Disabled					
Disable Priority						
Progression Phases						
Priority Alt Seq						
Reserve Extend						

Priority Timing-Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Priority Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recovery Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

West 5th @ Stone Church

Coordination Pattern 4

6/30/20 11:56:27 AM

Cycle: 90 | Ringgroup 1 - Offset 1: 7 | Offset 2: 0 | Offset 3: 0

Ringgroup 2 - Offset 1: 0 | Offset 2: 0 | Offset 3: 0

Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Splits	0	48	0	42	0	48	0	42	0	0	0	0	0	0	0	0
Split Ext	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Float Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Perm Min Green	0	12	0	12	0	12	0	12	0	0	0	0	0	0	0	0
Min Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Max Trans Split	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Split 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA Before	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PA After	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Permissive Mode: Sing Band | Max Mode: Max 1 | Walk Rest: Opp Call

Ped Permissive: Yield

Permissive Limit: 10 | Perm 2 Start: 0 | Perm 2 End: 0

Alt Sequence: | TOD Link: 0

Phases/Overlaps	1-8							9-16							
Coord Phases		2				6									
No Extend															
Float Enable															
Veh = Ped Perm															
Walk Rest															
Ped Recall															
Cond Ped Call															
Olap Ped Recall															
Ped Recycle															
Min Recall															
Max Recall															
Cond Serv															
Reservice															
Veh Omit	1		3		5										
Ped Omit															
Olap Omit															
Perm Reserve															
Perm 1 Phases															
Max Inhibit															
FYA Omit															
Adapt Phases															

Trans Mode: Best 2

Offset Ref: Lag Grn

Adaptive Mode: Disabled

Disable Priority:

Progression Phases:

Priority Alt Seq:

Reserve Extend:

Priority Timing-Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Priority Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recovery Min Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

West 5th @ Stone Church

Vehicle Detector 1

6/30/20 11:56:27 AM

Delay	0.0	Extend	0.0	Carryover	0.0	Queue Limit	0
Mode	No Disc	Added	Disabled	System	Disabled		
Fail Mode	None	Max Pres	0	No Act	0	Erratic	0
Fail Time	0						
Delay 2	0.0						

Phases	1-8	9-16
Call Phases	1	
Yellow Lock Phases		
Red Lock Phases		
Extend Phases	1	
XSwitch Phases		
Bike Call Phases		

Vehicle Detector 3

Delay	0.0	Extend	0.0	Carryover	0.0	Queue Limit	0
Mode	No Disc	Added	Disabled	System	Disabled		
Fail Mode	None	Max Pres	0	No Act	0	Erratic	0
Fail Time	0						
Delay 2	0.0						

Phases	1-8	9-16
Call Phases	3	
Yellow Lock Phases		
Red Lock Phases		
Extend Phases	3	
XSwitch Phases		
Bike Call Phases		

West 5th @ Stone Church

Vehicle Detector 5

6/30/20 11:56:27 AM

Delay	0.0	Extend	0.0	Carryover	0.0	Queue Limit	0
Mode	No Disc	Added	Disabled	System	Disabled		
Fail Mode	None	Max Pres	0	No Act	0	Erratic	0
Fail Time	0						
Delay 2	0.0						

Phases	1-8							9-16							
Call Phases				5											
Yellow Lock Phases															
Red Lock Phases															
Extend Phases				5											
XSwitch Phases															
Bike Call Phases															

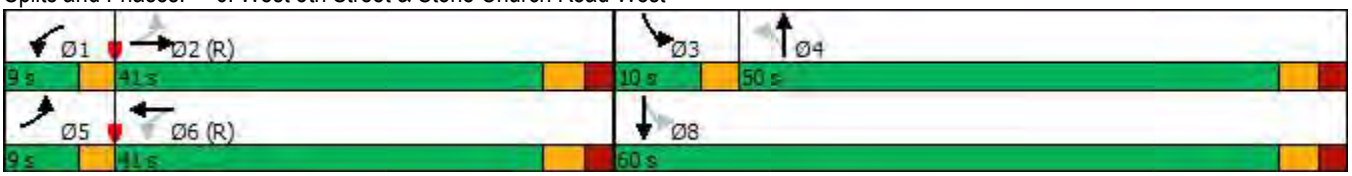
Appendix D Synchro Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	289	33	30	224	164	29	344	38	139	226	74
Future Volume (vph)	115	289	33	30	224	164	29	344	38	139	226	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		0.99	0.98		0.99	1.00		1.00	0.99	
Frt		0.985			0.937			0.985			0.963	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1847	0	1789	1730	0	1789	1850	0	1789	1797	0
Flt Permitted	0.267			0.360			0.563			0.333		
Satd. Flow (perm)	498	1847	0	671	1730	0	1049	1850	0	625	1797	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			35			6			21	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	125	314	36	33	243	178	32	374	41	151	246	80
Shared Lane Traffic (%)												
Lane Group Flow (vph)	125	350	0	33	421	0	32	415	0	151	326	0
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		
Minimum Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (%)	8.2%	37.3%		8.2%	37.3%		45.5%	45.5%		9.1%	54.5%	
Maximum Green (s)	6.0	35.1		6.0	35.1		44.2	44.2		7.0	54.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
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 Effct Green (s)	44.0	35.1		44.0	35.1		44.2	44.2		57.0	54.2	
Actuated g/C Ratio	0.40	0.32		0.40	0.32		0.40	0.40		0.52	0.49	
v/c Ratio	0.46	0.59		0.10	0.73		0.08	0.56		0.38	0.36	
Control Delay	26.0	35.7		19.2	39.1		31.7	40.6		17.0	17.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	26.0	35.7		19.2	39.1		31.7	40.6		17.0	17.5	
LOS	C	D		B	D		C	D		B	B	
Approach Delay		33.2			37.7			40.0			17.3	
Approach LOS		C			D			D			B	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	16.2	61.7		4.1	73.6		5.2	78.4		16.4	38.9	
Queue Length 95th (m)	28.2	91.2		9.8	110.1		13.2	107.6		27.5	59.2	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	269	593		329	575		421	746		397	896	
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	0.46	0.59		0.10	0.73		0.08	0.56		0.38	0.36	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 31.8		Intersection LOS: C	
Intersection Capacity Utilization 85.0%		ICU Level of Service E	
Analysis Period (min) 15			

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

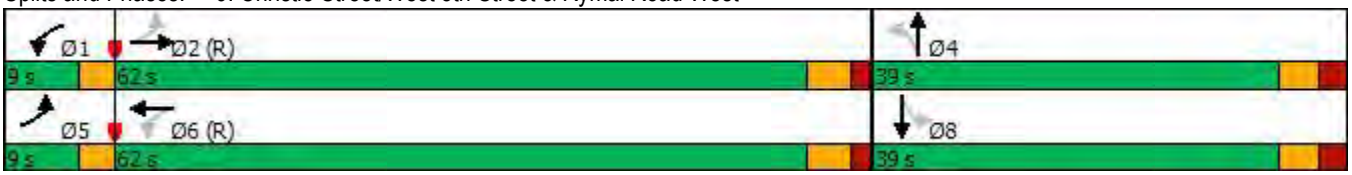


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	94	449	22	9	389	240	53	68	70	176	57	63
Future Volume (vph)	94	449	22	9	389	240	53	68	70	176	57	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		0.99	0.98		1.00	0.99		1.00	0.99	
Frt		0.993			0.943			0.924			0.922	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3548	0	1789	3316	0	1789	1725	0	1789	1723	0
Flt Permitted	0.337			0.430			0.670			0.638		
Satd. Flow (perm)	630	3548	0	805	3316	0	1259	1725	0	1197	1723	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			178			48			51	
Link Speed (k/h)		60			60			40			50	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			13.2			72.7	
Confl. Peds. (#/hr)	10		5	5		10	2		4	4		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	488	24	10	423	261	58	74	76	191	62	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	102	512	0	10	684	0	58	150	0	191	130	0
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	35.0		5.0	35.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	9.0	62.0		9.0	62.0		39.0	39.0		39.0	39.0	
Total Split (s)	9.0	62.0		9.0	62.0		39.0	39.0		39.0	39.0	
Total Split (%)	8.2%	56.4%		8.2%	56.4%		35.5%	35.5%		35.5%	35.5%	
Maximum Green (s)	6.0	56.6		6.0	56.6		33.2	33.2		33.2	33.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		5.8	5.8	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	1.0	0.2		1.0	0.2		3.0	3.0		3.0	3.0	
Recall Mode	Max	C-Max		Max	C-Max		Max	Max		Max	Max	
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 Effct Green (s)	65.0	56.6		65.0	56.6		33.2	33.2		33.2	33.2	
Actuated g/C Ratio	0.59	0.51		0.59	0.51		0.30	0.30		0.30	0.30	
v/c Ratio	0.23	0.28		0.02	0.38		0.15	0.27		0.53	0.23	
Control Delay	9.9	15.4		8.2	12.2		29.6	21.1		45.9	27.4	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	9.9	15.4		8.2	12.2		29.6	21.1		45.9	27.4	
LOS	A	B		A	B		C	C		D	C	
Approach Delay		14.5			12.2			23.5			38.4	
Approach LOS		B			B			C			D	
Queue Length 50th (m)	8.2	31.0		0.8	32.1		9.1	16.2		33.0	12.7	
Queue Length 95th (m)	15.0	41.6		2.8	44.8		19.3	32.4		55.4	29.6	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	435	1829		529	1792		379	554		361	555	
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	0.23	0.28		0.02	0.38		0.15	0.27		0.53	0.23	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 24 (22%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 18.8		Intersection LOS: B	
Intersection Capacity Utilization 84.1%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West

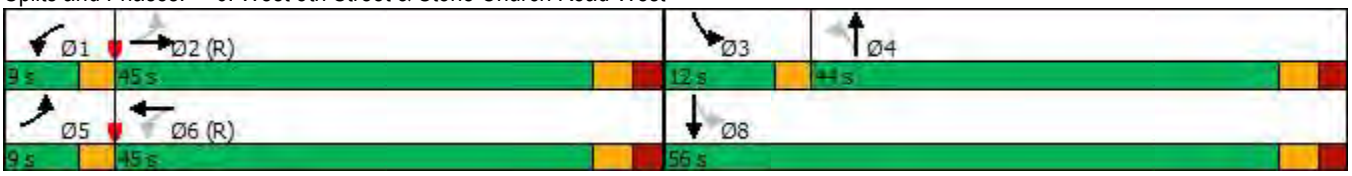


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	89	464	62	54	348	153	44	289	55	204	401	128
Future Volume (vph)	89	464	62	54	348	153	44	289	55	204	401	128
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00			0.99		0.99	1.00		1.00	0.99	
Frt		0.982			0.954			0.976			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1841	0	1789	1771	0	1789	1829	0	1789	1800	0
Flt Permitted	0.169			0.139			0.328			0.329		
Satd. Flow (perm)	316	1841	0	262	1771	0	614	1829	0	617	1800	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			22			10			19	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	97	504	67	59	378	166	48	314	60	222	436	139
Shared Lane Traffic (%)												
Lane Group Flow (vph)	97	571	0	59	544	0	48	374	0	222	575	0
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		
Minimum Split (s)	9.0	45.0		9.0	45.0		44.0	44.0		12.0	56.0	
Total Split (s)	9.0	45.0		9.0	45.0		44.0	44.0		12.0	56.0	
Total Split (%)	8.2%	40.9%		8.2%	40.9%		40.0%	40.0%		10.9%	50.9%	
Maximum Green (s)	6.0	39.1		6.0	39.1		38.2	38.2		9.0	50.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
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 Effct Green (s)	48.0	39.1		48.0	39.1		38.2	38.2		53.0	50.2	
Actuated g/C Ratio	0.44	0.36		0.44	0.36		0.35	0.35		0.48	0.46	
v/c Ratio	0.44	0.87		0.30	0.85		0.23	0.58		0.56	0.69	
Control Delay	23.5	48.0		20.5	45.2		36.0	41.9		23.3	28.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	23.5	48.0		20.5	45.2		36.0	41.9		23.3	28.3	
LOS	C	D		C	D		D	D		C	C	
Approach Delay		44.4			42.8			41.2			26.9	
Approach LOS		D			D			D			C	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	11.5	111.9		6.8	102.8		9.3	80.0		27.3	92.5	
Queue Length 95th (m)	21.2	#172.5		14.2	#160.6		m17.7	109.8		43.0	132.7	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	218	658		197	643		213	641		393	831	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.44	0.87		0.30	0.85		0.23	0.58		0.56	0.69	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 81 (74%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 37.9		Intersection LOS: D	
Intersection Capacity Utilization 96.6%		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.			
m Volume for 95th percentile queue is metered by upstream signal.			

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

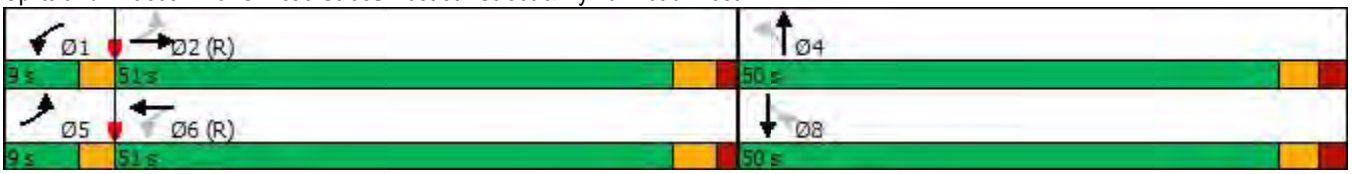


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	62	645	38	41	702	223	42	73	38	247	70	126
Future Volume (vph)	62	645	38	41	702	223	42	73	38	247	70	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		1.00	0.99		1.00	0.99		0.99	0.99	
Frt		0.992			0.964			0.949			0.904	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3543	0	1789	3420	0	1789	1774	0	1789	1687	0
Flt Permitted	0.151			0.269			0.582			0.680		
Satd. Flow (perm)	284	3543	0	505	3420	0	1094	1774	0	1270	1687	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			47			28			99	
Link Speed (k/h)		60			60			50			40	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			10.5			90.9	
Confl. Peds. (#/hr)	6		6	6		6	2		8	8		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	67	701	41	45	763	242	46	79	41	268	76	137
Shared Lane Traffic (%)												
Lane Group Flow (vph)	67	742	0	45	1005	0	46	120	0	268	213	0
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		
Minimum Split (s)	9.0	51.0		9.0	51.0		50.0	50.0		50.0	50.0	
Total Split (s)	9.0	51.0		9.0	51.0		50.0	50.0		50.0	50.0	
Total Split (%)	8.2%	46.4%		8.2%	46.4%		45.5%	45.5%		45.5%	45.5%	
Maximum Green (s)	6.0	45.6		6.0	45.6		44.2	44.2		44.2	44.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		5.8	5.8	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
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 Effct Green (s)	54.0	45.6		54.0	45.6		44.2	44.2		44.2	44.2	
Actuated g/C Ratio	0.49	0.41		0.49	0.41		0.40	0.40		0.40	0.40	
v/c Ratio	0.30	0.50		0.14	0.70		0.10	0.16		0.53	0.29	
Control Delay	17.0	25.1		14.2	28.3		21.5	16.7		45.0	27.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	17.0	25.1		14.2	28.3		21.5	16.7		45.0	27.5	
LOS	B	C		B	C		C	B		D	C	
Approach Delay		24.4			27.7			18.0			37.3	
Approach LOS		C			C			B			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	6.9	60.2		4.6	87.5		6.1	12.3		52.4	25.8	
Queue Length 95th (m)	13.9	77.3		10.2	110.7		13.8	24.2		m76.8	m43.6	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	221	1472		317	1445		439	729		510	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	0.30	0.50		0.14	0.70		0.10	0.16		0.53	0.29	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 15 (14%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 27.8		Intersection LOS: C	
Intersection Capacity Utilization 80.9%		ICU Level of Service D	
Analysis Period (min) 15			
m Volume for 95th percentile queue is metered by upstream signal.			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West

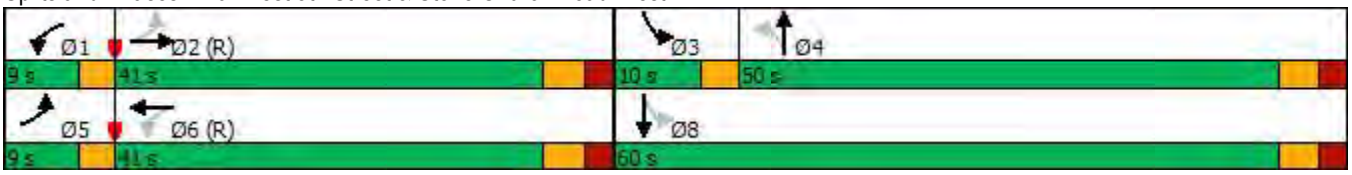


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	273	50	50	242	177	65	376	86	157	268	84
Future Volume (vph)	120	273	50	50	242	177	65	376	86	157	268	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	0.99		0.99	0.98		0.99	0.99		1.00	0.99	
Frt		0.977			0.937			0.972			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1829	0	1789	1730	0	1789	1820	0	1789	1800	0
Flt Permitted	0.223			0.359			0.535			0.249		
Satd. Flow (perm)	416	1829	0	669	1730	0	998	1820	0	468	1800	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			35			12			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	297	54	54	263	192	71	409	93	171	291	91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	351	0	54	455	0	71	502	0	171	382	0
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		
Minimum Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (%)	8.2%	37.3%		8.2%	37.3%		45.5%	45.5%		9.1%	54.5%	
Maximum Green (s)	6.0	35.1		6.0	35.1		44.2	44.2		7.0	54.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
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 Effct Green (s)	44.0	35.1		44.0	35.1		44.2	44.2		57.0	54.2	
Actuated g/C Ratio	0.40	0.32		0.40	0.32		0.40	0.40		0.52	0.49	
v/c Ratio	0.54	0.60		0.16	0.79		0.18	0.68		0.52	0.43	
Control Delay	29.1	35.6		20.0	42.9		31.6	41.7		20.6	18.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.1	35.6		20.0	42.9		31.6	41.7		20.6	18.7	
LOS	C	D		B	D		C	D		C	B	
Approach Delay		33.9			40.5			40.5			19.3	
Approach LOS		C			D			D			B	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	16.9	61.5		6.7	82.3		11.5	94.1		18.8	48.0	
Queue Length 95th (m)	29.1	91.2		14.2	#129.8		23.8	127.1		30.9	71.4	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	241	589		328	575		401	738		326	897	
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	0.60		0.16	0.79		0.18	0.68		0.52	0.43	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.79			
Intersection Signal Delay: 33.4		Intersection LOS: C	
Intersection Capacity Utilization 87.0%		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 West

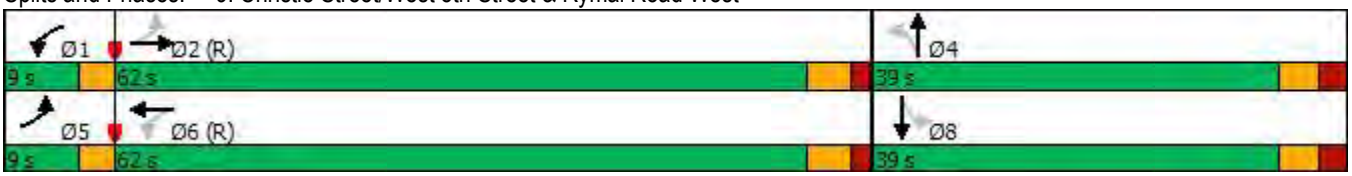


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	379	17	7	389	239	50	66	59	224	64	63
Future Volume (vph)	95	379	17	7	389	239	50	66	59	224	64	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		0.99	0.98		1.00	0.99		1.00	0.99	
Frt		0.994			0.943			0.929			0.926	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3552	0	1789	3316	0	1789	1736	0	1789	1732	0
Flt Permitted	0.337			0.481			0.657			0.660		
Satd. Flow (perm)	629	3552	0	900	3316	0	1235	1736	0	1238	1732	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			177			42			46	
Link Speed (k/h)		60			60			50			40	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			10.5			90.9	
Confl. Peds. (#/hr)	10		5	5		10	2		4	4		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	412	18	8	423	260	54	72	64	243	70	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	103	430	0	8	683	0	54	136	0	243	138	0
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		
Minimum Split (s)	9.0	62.0		9.0	62.0		39.0	39.0		39.0	39.0	
Total Split (s)	9.0	62.0		9.0	62.0		39.0	39.0		39.0	39.0	
Total Split (%)	8.2%	56.4%		8.2%	56.4%		35.5%	35.5%		35.5%	35.5%	
Maximum Green (s)	6.0	56.6		6.0	56.6		33.2	33.2		33.2	33.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		5.8	5.8	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
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 Effct Green (s)	65.0	56.6		65.0	56.6		33.2	33.2		33.2	33.2	
Actuated g/C Ratio	0.59	0.51		0.59	0.51		0.30	0.30		0.30	0.30	
v/c Ratio	0.24	0.23		0.01	0.38		0.15	0.25		0.65	0.25	
Control Delay	10.0	14.9		8.1	12.2		29.5	21.1		52.6	30.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.0	14.9		8.1	12.2		29.5	21.1		52.6	30.5	
LOS	A	B		A	B		C	C		D	C	
Approach Delay		14.0			12.2			23.5			44.6	
Approach LOS		B			B			C			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	8.3	25.3		0.6	32.1		8.5	14.9		50.9	17.4	
Queue Length 95th (m)	15.1	34.8		2.5	44.8		18.2	30.0		77.2	32.0	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	434	1830		580	1792		372	553		373	554	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.24	0.23		0.01	0.38		0.15	0.25		0.65	0.25	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 24 (22%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.65			
Intersection Signal Delay: 20.8		Intersection LOS: C	
Intersection Capacity Utilization 86.8%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West



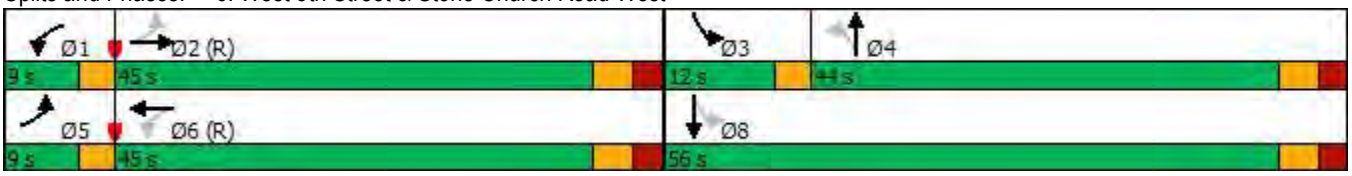
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	92	438	86	112	376	165	56	304	87	231	490	145
Future Volume (vph)	92	438	86	112	376	165	56	304	87	231	490	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		1.00	0.99		1.00	0.99	
Frt		0.975			0.954			0.966			0.966	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1824	0	1789	1771	0	1789	1807	0	1789	1804	0
Flt Permitted	0.120			0.141			0.197			0.272		
Satd. Flow (perm)	226	1824	0	266	1771	0	370	1807	0	510	1804	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			22			14			18	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	476	93	122	409	179	61	330	95	251	533	158
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	569	0	122	588	0	61	425	0	251	691	0
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		
Minimum Split (s)	9.0	45.0		9.0	45.0		44.0	44.0		12.0	56.0	
Total Split (s)	9.0	45.0		9.0	45.0		44.0	44.0		12.0	56.0	
Total Split (%)	8.2%	40.9%		8.2%	40.9%		40.0%	40.0%		10.9%	50.9%	
Maximum Green (s)	6.0	39.1		6.0	39.1		38.2	38.2		9.0	50.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
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 Effct Green (s)	48.0	39.1		48.0	39.1		38.2	38.2		53.0	50.2	
Actuated g/C Ratio	0.44	0.36		0.44	0.36		0.35	0.35		0.48	0.46	
v/c Ratio	0.55	0.87		0.61	0.91		0.48	0.67		0.72	0.83	
Control Delay	28.5	48.1		31.8	53.3		50.9	44.6		31.1	35.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	28.5	48.1		31.8	53.3		50.9	44.6		31.1	35.8	
LOS	C	D		C	D		D	D		C	D	
Approach Delay		45.2			49.6			45.4			34.5	
Approach LOS		D			D			D			C	

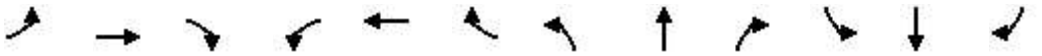
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	11.9	111.1		14.7	115.7		12.9	90.5		31.5	123.6	
Queue Length 95th (m)	21.8	#172.1		#26.5	#182.0		m23.2	122.7		#51.1	#180.8	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	183	654		199	643		128	636		350	833	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.55	0.87		0.61	0.91		0.48	0.67		0.72	0.83	

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 81 (74%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 110
Control Type: Pretimed
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 42.8 Intersection LOS: D
Intersection Capacity Utilization 104.7% ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

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



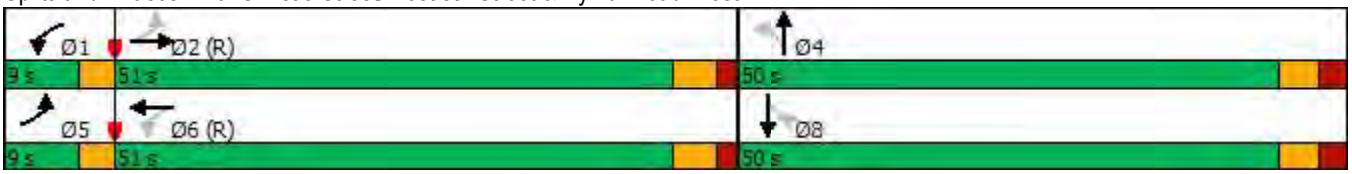


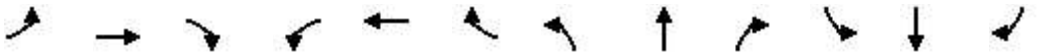
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	544	30	31	659	238	39	70	32	291	79	150
Future Volume (vph)	71	544	30	31	659	238	39	70	32	291	79	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Frt		0.992			0.960			0.953			0.902	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3544	0	1789	3394	0	1789	1785	0	1789	1683	0
Flt Permitted	0.163			0.334			0.539			0.685		
Satd. Flow (perm)	306	3544	0	626	3394	0	1014	1785	0	1285	1683	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			57			25			104	
Link Speed (k/h)		60			60			50			40	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			10.5			90.9	
Confl. Peds. (#/hr)	10		5	5		10	2		4	4		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	591	33	34	716	259	42	76	35	316	86	163
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	624	0	34	975	0	42	111	0	316	249	0
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		
Minimum Split (s)	9.0	51.0		9.0	51.0		50.0	50.0		50.0	50.0	
Total Split (s)	9.0	51.0		9.0	51.0		50.0	50.0		50.0	50.0	
Total Split (%)	8.2%	46.4%		8.2%	46.4%		45.5%	45.5%		45.5%	45.5%	
Maximum Green (s)	6.0	45.6		6.0	45.6		44.2	44.2		44.2	44.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		5.8	5.8	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
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 Effct Green (s)	54.0	45.6		54.0	45.6		44.2	44.2		44.2	44.2	
Actuated g/C Ratio	0.49	0.41		0.49	0.41		0.40	0.40		0.40	0.40	
v/c Ratio	0.33	0.42		0.09	0.68		0.10	0.15		0.61	0.34	
Control Delay	17.4	23.7		13.7	27.4		21.5	16.8		43.8	25.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	17.4	23.7		13.7	27.4		21.5	16.8		43.8	25.9	
LOS	B	C		B	C		C	B		D	C	
Approach Delay		23.0			27.0			18.1			35.9	
Approach LOS		C			C			B			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	8.0	48.6		3.5	83.0		5.5	11.4		63.6	30.8	
Queue Length 95th (m)	15.6	63.6		8.3	105.6		12.9	22.8		m80.1	m42.5	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	231	1472		370	1440		407	732		516	738	
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	0.33	0.42		0.09	0.68		0.10	0.15		0.61	0.34	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 15 (14%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 27.4		Intersection LOS: C	
Intersection Capacity Utilization 78.4%		ICU Level of Service D	
Analysis Period (min) 15			
m Volume for 95th percentile queue is metered by upstream signal.			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West



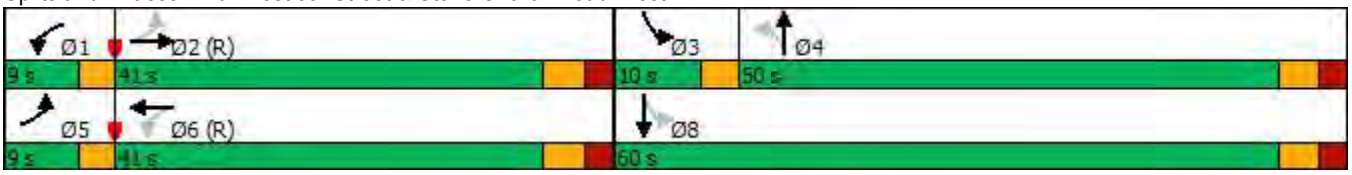


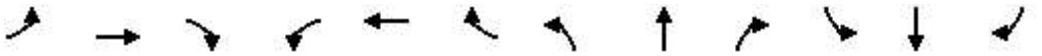
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	273	50	50	242	177	65	376	86	157	268	84
Future Volume (vph)	120	273	50	50	242	177	65	376	86	157	268	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	0.99		0.99	0.98		0.99	0.99		1.00	0.99	
Frt		0.977			0.937			0.972			0.964	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1829	0	1789	1730	0	1789	1820	0	1789	1800	0
Flt Permitted	0.223			0.359			0.535			0.249		
Satd. Flow (perm)	416	1829	0	669	1730	0	998	1820	0	468	1800	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			35			12			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	297	54	54	263	192	71	409	93	171	291	91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	351	0	54	455	0	71	502	0	171	382	0
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		
Minimum Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (s)	9.0	41.0		9.0	41.0		50.0	50.0		10.0	60.0	
Total Split (%)	8.2%	37.3%		8.2%	37.3%		45.5%	45.5%		9.1%	54.5%	
Maximum Green (s)	6.0	35.1		6.0	35.1		44.2	44.2		7.0	54.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
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 Effct Green (s)	44.0	35.1		44.0	35.1		44.2	44.2		57.0	54.2	
Actuated g/C Ratio	0.40	0.32		0.40	0.32		0.40	0.40		0.52	0.49	
v/c Ratio	0.54	0.60		0.16	0.79		0.18	0.68		0.52	0.43	
Control Delay	29.1	35.6		20.0	42.9		31.3	41.4		20.6	18.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.1	35.6		20.0	42.9		31.3	41.4		20.6	18.7	
LOS	C	D		B	D		C	D		C	B	
Approach Delay		33.9			40.5			40.1			19.3	
Approach LOS		C			D			D			B	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	16.9	61.5		6.7	82.3		11.1	93.8		18.8	48.0	
Queue Length 95th (m)	29.1	91.2		14.2	#129.8		21.7	126.9		30.9	71.4	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	241	589		328	575		401	738		326	897	
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	0.60		0.16	0.79		0.18	0.68		0.52	0.43	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.79			
Intersection Signal Delay: 33.3		Intersection LOS: C	
Intersection Capacity Utilization 87.0%		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 West



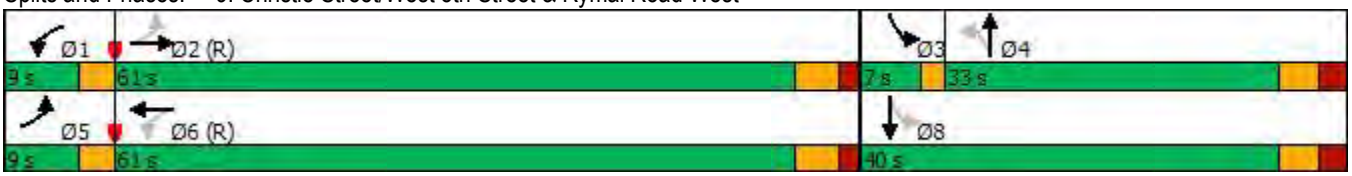


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	95	379	17	7	389	239	50	66	59	224	64	63
Future Volume (vph)	95	379	17	7	389	239	50	66	59	224	64	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99	1.00		0.99	0.98		1.00	0.99		1.00	0.99	
Frt		0.994			0.943			0.929			0.926	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3552	0	1789	3316	0	1789	1736	0	1789	1732	0
Flt Permitted	0.334			0.480			0.669			0.602		
Satd. Flow (perm)	624	3552	0	898	3316	0	1257	1736	0	1129	1732	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			174			39			46	
Link Speed (k/h)		60			60			50			40	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			10.5			90.9	
Confl. Peds. (#/hr)	10		5	5		10	2		4	4		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	412	18	8	423	260	54	72	64	243	70	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	103	430	0	8	683	0	54	136	0	243	138	0
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		
Minimum Split (s)	9.0	40.4		9.0	40.4		32.8	32.8		7.0	39.0	
Total Split (s)	9.0	61.0		9.0	61.0		33.0	33.0		7.0	40.0	
Total Split (%)	8.2%	55.5%		8.2%	55.5%		30.0%	30.0%		6.4%	36.4%	
Maximum Green (s)	6.0	55.6		6.0	55.6		27.2	27.2		5.0	34.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		2.0	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		0.0	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		2.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Walk Time (s)		10.0			10.0		10.0	10.0			10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0			17.0	
Pedestrian Calls (#/hr)		0			0		0	0			0	
Act Effct Green (s)	64.0	55.6		64.0	55.6		27.2	27.2		38.0	34.2	
Actuated g/C Ratio	0.58	0.51		0.58	0.51		0.25	0.25		0.35	0.31	
v/c Ratio	0.24	0.24		0.01	0.39		0.17	0.30		0.58	0.24	
Control Delay	10.4	15.5		8.6	12.8		34.5	25.8		46.8	29.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.4	15.5		8.6	12.8		34.5	25.8		46.8	29.8	
LOS	B	B		A	B		C	C		D	C	
Approach Delay		14.5			12.7			28.2			40.6	
Approach LOS		B			B			C			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	8.5	25.8		0.6	33.1		9.2	16.7		46.6	17.4	
Queue Length 95th (m)	15.6	35.5		2.6	46.1		19.8	33.2		70.4	32.0	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	426	1798		571	1762		310	458		420	570	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.24	0.24		0.01	0.39		0.17	0.30		0.58	0.24	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 24 (22%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 90			
Control Type: Pretimed			
Maximum v/c Ratio: 0.58			
Intersection Signal Delay: 20.8		Intersection LOS: C	
Intersection Capacity Utilization 85.3%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West

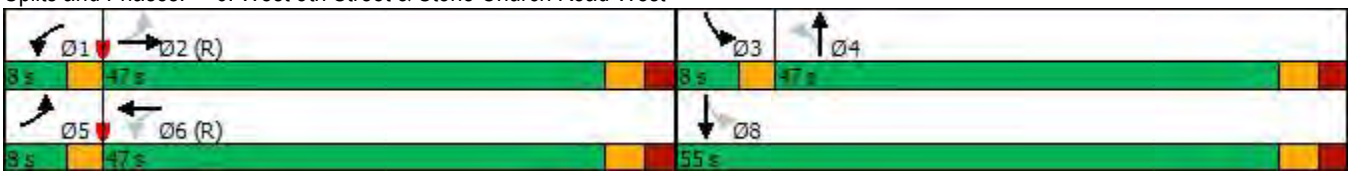


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	92	438	86	112	376	165	56	304	87	231	490	145
Future Volume (vph)	92	438	86	112	376	165	56	304	87	231	490	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	55.0		0.0	55.0		0.0	45.0		0.0	80.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99		1.00	0.99			0.99		1.00	0.99	
Frt		0.975			0.954			0.966			0.966	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1824	0	1789	1771	0	1789	1806	0	1789	1803	0
Flt Permitted	0.146			0.166			0.167			0.300		
Satd. Flow (perm)	275	1824	0	311	1771	0	315	1806	0	563	1803	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			23			15			18	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		327.0			365.4			1010.0			225.0	
Travel Time (s)		23.5			26.3			72.7			16.2	
Confl. Peds. (#/hr)	13		10	10		13	8		5	5		8
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	100	476	93	122	409	179	61	330	95	251	533	158
Shared Lane Traffic (%)												
Lane Group Flow (vph)	100	569	0	122	588	0	61	425	0	251	691	0
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		
Minimum Split (s)	8.0	47.0		8.0	47.0		47.0	47.0		8.0	55.0	
Total Split (s)	8.0	47.0		8.0	47.0		47.0	47.0		8.0	55.0	
Total Split (%)	7.3%	42.7%		7.3%	42.7%		42.7%	42.7%		7.3%	50.0%	
Maximum Green (s)	5.0	41.1		5.0	41.1		41.2	41.2		5.0	49.2	
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)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.9		3.0	5.9		5.8	5.8		3.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Walk Time (s)		12.0			12.0		7.0	7.0			7.0	
Flash Dont Walk (s)		14.0			14.0		14.0	14.0			14.0	
Pedestrian Calls (#/hr)		0			0		0	0			0	
Act Effct Green (s)	49.0	41.1		49.0	41.1		41.2	41.2		52.0	49.2	
Actuated g/C Ratio	0.45	0.37		0.45	0.37		0.37	0.37		0.47	0.45	
v/c Ratio	0.52	0.83		0.60	0.87		0.52	0.62		0.78	0.85	
Control Delay	27.0	42.6		30.4	45.9		53.1	40.6		39.8	37.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	27.0	42.6		30.4	45.9		53.1	40.6		39.8	37.9	
LOS	C	D		C	D		D	D		D	D	
Approach Delay		40.3			43.3			42.1			38.4	
Approach LOS		D			D			D			D	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	11.7	107.7		14.4	111.9		12.9	89.5		32.1	125.9	
Queue Length 95th (m)	21.3	#164.5		25.2	#174.4		m23.4	121.4		#59.4	#193.1	
Internal Link Dist (m)		303.0			341.4			986.0			201.0	
Turn Bay Length (m)	55.0			55.0			45.0			80.0		
Base Capacity (vph)	191	687		205	676		117	685		321	816	
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	0.52	0.83		0.60	0.87		0.52	0.62		0.78	0.85	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 81 (74%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 110			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 40.7		Intersection LOS: D	
Intersection Capacity Utilization 104.7%		ICU Level of Service G	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			
m Volume for 95th percentile queue is metered by upstream signal.			

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

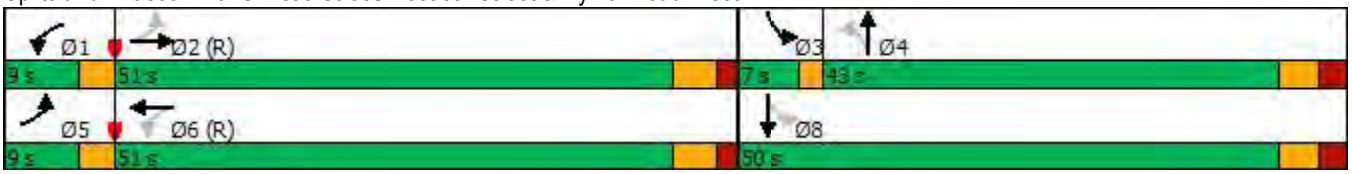


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	544	30	31	659	238	39	70	32	291	79	150
Future Volume (vph)	71	544	30	31	659	238	39	70	32	291	79	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	60.0		0.0	30.0		0.0	15.0		0.0	20.0		0.0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (m)	7.6			7.6			7.6			7.6		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	0.99		1.00	0.99		1.00	0.99	
Frt		0.992			0.960			0.953			0.902	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	3544	0	1789	3394	0	1789	1785	0	1789	1683	0
Flt Permitted	0.163			0.334			0.605			0.650		
Satd. Flow (perm)	306	3544	0	626	3394	0	1138	1785	0	1219	1683	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		6			57			23			104	
Link Speed (k/h)		60			60			50			40	
Link Distance (m)		421.9			352.0			146.2			1010.0	
Travel Time (s)		25.3			21.1			10.5			90.9	
Confl. Peds. (#/hr)	10		5	5		10	2		4	4		2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	77	591	33	34	716	259	42	76	35	316	86	163
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	624	0	34	975	0	42	111	0	316	249	0
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		
Minimum Split (s)	9.0	40.4		9.0	40.4		32.8	32.8		7.0	50.0	
Total Split (s)	9.0	51.0		9.0	51.0		43.0	43.0		7.0	50.0	
Total Split (%)	8.2%	46.4%		8.2%	46.4%		39.1%	39.1%		6.4%	45.5%	
Maximum Green (s)	6.0	45.6		6.0	45.6		37.2	37.2		5.0	44.2	
Yellow Time (s)	3.0	3.7		3.0	3.7		3.3	3.3		2.0	3.3	
All-Red Time (s)	0.0	1.7		0.0	1.7		2.5	2.5		0.0	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	3.0	5.4		3.0	5.4		5.8	5.8		2.0	5.8	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes		
Walk Time (s)		10.0			10.0		10.0	10.0			10.0	
Flash Dont Walk (s)		11.0			11.0		17.0	17.0			17.0	
Pedestrian Calls (#/hr)		0			0		0	0			0	
Act Effct Green (s)	54.0	45.6		54.0	45.6		37.2	37.2		48.0	44.2	
Actuated g/C Ratio	0.49	0.41		0.49	0.41		0.34	0.34		0.44	0.40	
v/c Ratio	0.33	0.42		0.09	0.68		0.11	0.18		0.57	0.34	
Control Delay	17.4	23.7		13.7	27.4		26.1	21.1		37.8	27.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	17.4	23.7		13.7	27.4		26.1	21.1		37.8	27.0	
LOS	B	C		B	C		C	C		D	C	
Approach Delay		23.0			27.0			22.5			33.0	
Approach LOS		C			C			C			C	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 50th (m)	8.0	48.6		3.5	83.0		6.2	13.1		57.9	32.3	
Queue Length 95th (m)	15.6	63.6		8.3	105.6		14.3	25.9		m70.8	m42.7	
Internal Link Dist (m)		397.9			328.0			122.2			986.0	
Turn Bay Length (m)	60.0			30.0			15.0			20.0		
Base Capacity (vph)	231	1472		370	1440		384	618		557	738	
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	0.33	0.42		0.09	0.68		0.11	0.18		0.57	0.34	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 15 (14%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green			
Natural Cycle: 100			
Control Type: Pretimed			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 27.0		Intersection LOS: C	
Intersection Capacity Utilization 78.4%		ICU Level of Service D	
Analysis Period (min) 15			
m Volume for 95th percentile queue is metered by upstream signal.			

Splits and Phases: 9: Christie Street/West 5th Street & Rymal Road West



Appendix E OTC MMLOS Evaluation Results

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

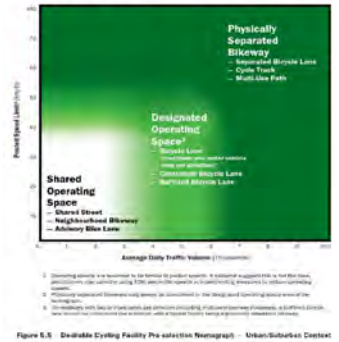
Actual	E	D	D	D	C
SCENARIO:	*West 5th Street and Rymal Road West*				
Area Type:	*Neighbourhood Connector*				
MODE					
Type	**SIGNALIZED INTERSECTIONS**				
Target (Custom if necessary)	E	D	B	D	D
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	D	D	D	C

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	

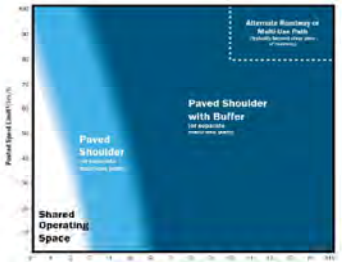
MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0	No transit priority measures at any approaches for transit	11 - 12	35 - 59%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	11.0 - 12.9	11.0 - 12.9	11 - 20	C	36 - 55
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	106 -120	106 - 120	E		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	1.1 - 1.5			

Desirable Cycling Facility Pre-Selection Nomograph
Urban/Suburban Context



Desirable Cycling Facility Pre-Selection Nomograph
Rural Context[1]



LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	E	E	E	B	C
SCENARIO:	*West 5th Street and Stone Church Road West*				
Area Type:	*Neighbourhood Connector*				
MODE					
Type	**SIGNALIZED INTERSECTIONS**				
Target (Custom if necessary)	E	D	B	D	D
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	E	E	E	B	C

Active Transportation Design Check	
Are marked pedestrian crossings provided to connect all approaching pedestrian facilities?	
Does the approaching bike facility continue at a consistent width up to the edge of the intersection (crosswalk or curb edge of intersecting roadway)?	
Is a continuous amount of space and accompanying pavement makings delineated for cyclists through the intersection?	
Does the intersection design provide features which facilitate all the intended turn movements for cyclists (e.g. bike boxes, queuing space, protected intersection, etc)?	
Have Accessibility for Ontarians with Disabilities Act (AODA) and municipal accessibility standards (if applicable) been considered?	

MMLOS Evaluation

Measure 1	Enhanced Pedestrian Measures	Enhanced Bicycle Facilities	Transit Priority Measures	Average Effective Turning Radius (m)	% of Movements with Dedicated Turn Lanes
	0	0	No transit priority measures at any approaches for transit	Greater than 18	35 - 59%
Measure 2	Average Effective Turning Radius (m)	Average Effective Turning Radius (m)	Transit Movement Delay (s)	Car Level of Service	Intersection Delay (s)
	Greater than or Equal to 18	Greater than or Equal to 18	36 - 55	C	21 - 35
Measure 3	Signal Cycle Length (s)	Signal Cycle Length (s)	Pedestrian Level of Service	-	-
	106 -120	106 - 120	E		
Measure 4	Number of Uncontrolled Conflicts (conflicts/approach)	Number of Uncontrolled Conflicts (conflicts/approach)	-	-	-
	2.6 - 3.0	1.6 - 2.0			

Desirable Cycling Facility Pre-Selection Nomograph
Urban/Suburban Context

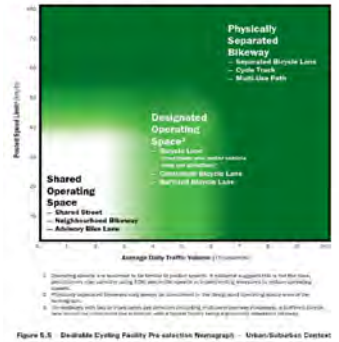


Figure 5.5 – Desirable Cycling Facility Pre-selection Nomograph – Urban/Suburban Context

Desirable Cycling Facility Pre-Selection Nomograph
Rural Context[1]

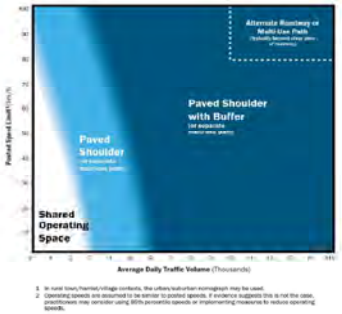


Figure 3.6 – Desirable Cycling Facility Pre-selection Nomograph – Rural Context

LOS AND DATA ENTRY - Use this to enter what you know and for detailed or summary results presentation

Actual	F	F		C	C
SCENARIO:	*West 5th Street between Stone Church Road West and Rymal Road West*				
Area Type:	*Neighbourhood Boulevard*				
MODE					
Type	**SEGMENTS**				
Target (Custom if necessary)	D	B	D		E
Adjustment for Planning Direction	None	None	None	None	None
Reasons for adjustment (if applicable)					
Adjustment for Strategic Policy	None	None	None	None	None
Reasons for adjustment (if applicable)					
Actual	F	F		C	C

Active Transportation Design Check	
Do the pedestrian facilities provide direct access to all properties along the segment? (Direct access can be provided by an adjacent facility or designated crossing to the property in question)	
Does the bicycle facility selected correspond with the minimum appropriate facility type identified in the context appropriate nomograph (Figure 6.1, 6.2)?	
-	
-	
-	

MMLOS Evaluation

Measure 1	Pedestrian Facility Width (m)	Bike Facility Width per Direction (m)	Transit Facility Type	Width of Curb Lane (m)	Mid-block V/C Ratio
	Less than 1.5	Less than 1.2		3.4 - 3.6	Less than 0.60
Measure 2	Pedestrian Buffer Width (m)	Bike Buffer Width (m)	Transit Passenger Amenities	Car Level of Service	Curb Lane Conflicts
	Less than 1.0	Has no physical measures and buffer width is < 0.5		C	9+
Measure 3	Max Distance Between Controlled Crossings (m)	Conflicts with Other Modes (in-lane conflicts and cross point conflicts)	Pedestrian Level of Service	-	-
	Greater than 320	Two "high" conflict indicators	F		
Measure 4		-	-	-	-

Desirable Cycling Facility Pre-Selection Nomograph
Urban/Suburban Context

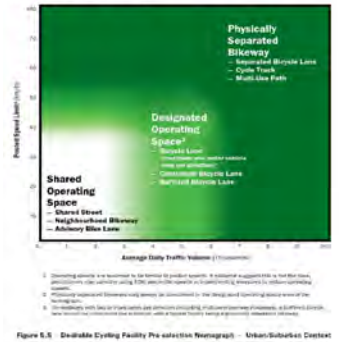


Figure 5.5 – Desirable Cycling Facility Pre-selection Nomograph – Urban/Suburban Context

Desirable Cycling Facility Pre-Selection Nomograph
Rural Context[1]

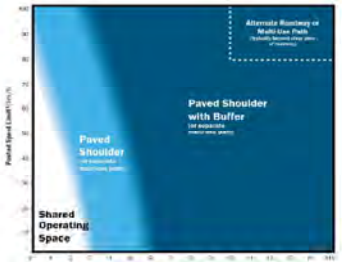


Figure 3.6 – Desirable Cycling Facility Pre-selection Nomograph – Rural Context

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Stantec is a global leader in sustainable architecture, engineering, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.