

JULY 31, 2020

REFER TO FILE: 1838-5493

31 Huron Street Inc. (Streetcar)
1230 Dundas Street East
Toronto, Ontario M4M 1S3

Attention: Les Mallins, President

**RE: HARBOUR HOUSE DEVELOPMENT
TRAFFIC OPINION LETTER
TOWN OF COLLINGWOOD, COUNTY OF SIMCOE**

Dear Les,

This letter has been prepared to support the Zoning By-law Amendment and Site Plan Applications and address the transportation aspects relating to the proposed mixed-use development at 31 Huron Street in the Town of Collingwood. The development is part of The Shipyards Development Area in the Town of Collingwood.

This letter forecasts the expected trip generation of the development and reviews the proposed access configuration from a spacing, sight distance and queuing perspective.

Background

The site is approximately 0.47 hectares (1.16 acres) in size and is located in the northwest quadrant of the intersection of Huron Street and Heritage Drive in the Town of Collingwood. The site is bounded by Side Launch Way to the north, Heritage Drive to the east, Huron Street to the south, and a vacant block to the west.

The site is located within the Shipyards Development Area, which is located at the north end of downtown Collingwood, fronting the Georgian Bay shoreline. The Shipyards Development Area is bounded by Heritage Drive to the east, Huron Street to the south, and an unopened road allowance for Beech Street to the west.

R.J. Burnside & Associates Limited (Burnside) issued a Traffic Impact Study, dated October 2003, for the entirety of The Shipyards development. A subsequent Addendum was prepared in February 2004 to address comments received from the Town and provide a revised analysis based on changes to the overall concept plan.

The recommendations that came from the studies have been implemented including the signalization of Huron Street and Heritage Drive, a two-way centre left-turn from High Street to east of Heritage Drive, a one-way northbound extension of Hurontario Street (north of Huron Street), northbound and southbound left-turn lanes on Pine Street, Hurontario Street and Heritage Drive, and the optimization of the existing signalized intersections.

Development Proposal

The proposed development consists of one six-storey mid-rise building with 130 residential units and 11,362 square feet of retail space. The development also includes 32 ground floor retail parking spaces, 33 underground visitor parking spaces (P1) and 139 residential parking spaces divided between two underground parking levels (P1/P2). 200 long-term bicycle spaces are proposed in the first level of underground parking (P1).

These details are summarized in the development Site Statistics table included as **Attachment A**. The Site Plan dated July 31, 2020, prepared by Streetcar, has also been included with **Attachment A**.

Access to the site is proposed through a full moves entrance to Side Launch Way and a second full moves entrance to Heritage Drive. The proposed entrance to Side Launch Way is approximately 30 metres (curb radii to curb radii) from the intersection of Heritage Drive and Side Launch Way. The proposed entrance to Heritage Drive is approximately 30 metres from the intersection of Huron Street and Heritage Drive and 17 metres from the intersection of Heritage Drive and Side Launch Way.

Sidewalks are proposed along the perimeter of the site, including the east side of the existing commercial plaza entrance to the west of the site.

Boundary Road Network

The boundary road network is described in **Table 1** below.

Table 1: Boundary Road Network

Roadway	Huron Street/First Street	Side Launch Way	Heritage Drive
Direction	East-West	East-West	North-South
Classification	Arterial Road	Local Road	Local Road
Jurisdiction	Town of Collingwood ¹	Town of Collingwood, however roadway is unassumed	Town of Collingwood
Posted Speed Limit (km/h)	50 km/h	40 km/h (Assumed)	40 km/h
Total Number of Lanes	5	2	2
Pedestrian/ Cycling Facilities	3m sidewalk on north side of roadway with 3m grass boulevard (varies) 1.5m sidewalk on south side of roadway	1.5m sidewalk with a 3m multi-use pathway on south side of roadway	2.5m sidewalk with a 2m grass boulevard on the west side of the roadway

Note¹: Huron Street/First Street is a segment of Highway 26, which is part of the MTO's connecting link program through the Town of Collingwood.

Existing Operations

In August 2019, Burnside produced the Collingwood Transportation Study Update (TSU) on behalf of the Town of Collingwood. The TSU is an update to the Town of Collingwood Transportation Study that was completed by C.C. Tatham & Associates Ltd. (Tatham) in July 2012. The purpose of the TSU was to estimate the future traffic volumes to be generated by the many proposed developments in the Town, and to review the anticipated impacts of the traffic growth on 20 key intersections in the Town's road network over the medium-term (2031) and long-term (2041) horizons. Relevant excerpts from the 2019 Collingwood Transportation Study Update have been included as **Attachment B**.

The anticipated impacts on the traffic operations were used to determine any infrastructure improvements that may be required at Town intersections in the 2031 and 2041 horizon years. Turning movement counts at the 20 key intersections were undertaken in December 2018 and were increased using a seasonal adjustment factor of 5% to reflect typical weekday summer conditions.

The intersections of First Street and Pine Street and First Street/Huron Street and Hurontario Street were included in TSU analysis. While the intersection of Huron Street and Heritage Drive was not assessed in the TSU, the Burnside Shipyards TIS Addendum forecasted that by 2013, the intersection would operate with a LOS "B" assuming signalized conditions with eastbound and southbound left-turn lanes, which is the current geometric configuration of the intersection. The traffic operations under seasonally adjusted 2018 traffic volume conditions are summarized in **Table 2**.

Table 2: Existing Intersection Operations

Intersection	Movement	Roadway Peak Hour	Delay	LOS	v/c ratio
First Street & Pine Street	Overall	Weekday A.M.	13 s	B	0.42
		Weekday P.M.	17 s	B	0.58
First Street/Huron Street & Hurontario Street	Overall	Weekday A.M.	10 s	A	0.37
		Weekday P.M.	11 s	B	0.50

Note: These operations were obtained from Section 2.5.1 (Table 6) of the Transportation Study Update (Burnside, August 2019)

It can be seen that the intersections are operating very well under existing conditions with reserve capacity for increases in traffic volumes. Given the level of development adjacent to these intersections in comparison to the areas surrounding Heritage Drive, it can reasonably be assumed that the intersection of Huron Street & Heritage Drive is also operating well under current traffic volume conditions.

Trip Generation

The trip generation of the proposed development was forecasted using the rates provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The residential dwelling units were assessed using Land Use Category (LUC) 221 "Multifamily Housing (Mid-Rise)" and the commercial space was assessed using LUC 820 "Shopping Centre". The forecasted trip generation of the proposed development is summarized in **Table 3**. Relevant excerpts from the ITE Trip Generation Manual, 10th Edition have been included as **Attachment C**.

Table 3: Trip Generation (Peak Hour)

Land Use	No. of Units/ GFA	Roadway Peak Hour	Number of Trips		
			Inbound	Outbound	Total
LUC 221: Multifamily Housing (Mid-Rise)	130	Weekday A.M.	11	33	44
		Weekday P.M.	35	22	57
LUC 820: Shopping Centre	11,362 ft²	Weekday A.M.	7	4	11
		Weekday P.M.	20	23	43
Total		Weekday A.M.	18	37	55
		Weekday P.M.	55	45	100

As defined by the ITE Trip Generation Handbook, 3rd Edition, primary trips are made for the specific purpose of visiting the generator. Pass-by trips are made as intermediate stops on the way from an origin to a primary destination without a route diversion. Accordingly, these vehicles do not increase the volume of vehicles on the roadway. The pass-by percentage for commercial uses in the a.m. peak hour is typically assumed to be zero, as most trips would represent employees going into work. In the p.m. peak hour, the average pass-by percentage is 34 percent. Accordingly, based on the trip generation estimate summarized in **Table 3**, the development is expected to generate 15 pass-by trips and 28 primary trips.

Future Traffic Operations

As noted previously, the TSU assessed the operations of the Town's road network over the medium-term (2031) and long-term (2041) horizons. The future operations were assessed under future background conditions and future development conditions. The background conditions were based purely on growth within the Town and surrounding areas, not attributed to new developments proposed within Town. The future development conditions included the background growth as well as the proposed developments within the Town of Collingwood. Relevant excerpts from the 2019 Collingwood Transportation Study Update have been included as **Attachment B**.

The 2031 and 2041 background intersection operations are summarized in **Table 4** and **Table 5**.

Table 4: 2031 Background Intersection Operations

Intersection	Movement	Roadway Peak Hour	Delay	LOS	v/c ratio
First Street & Pine Street	Overall	Weekday A.M.	13 s	B	0.45
		Weekday P.M.	18 s	B	0.62
First Street/Huron Street & Hurontario Street	Overall	Weekday A.M.	10 s	A	0.40
		Weekday P.M.	12 s	B	0.53

Note: These operations were obtained from Section 4.1.1 (Table 9) of the Transportation Study Update (Burnside, August 2019)

Table 5: 2041 Background Intersection Operations

Intersection	Movement	Roadway Peak Hour	Delay	LOS	v/c ratio
First Street & Pine Street	Overall	Weekday A.M.	13 s	B	0.47
		Weekday P.M.	18 s	B	0.66
First Street/Huron Street & Hurontario Street	Overall	Weekday A.M.	10 s	B	0.42
		Weekday P.M.	12 s	B	0.56

Note: These operations were obtained from Section 4.2.1 (Table 12) of the Transportation Study Update (Burnside, August 2019)

It can be seen that the background increase in traffic volumes is anticipated to have a negligible impact on the operations of the intersections of First Street & Pine Street and First Street/Huron Street and Hurontario Street.

To assess the impact of the various proposed developments on the operations of the Town's road network, Burnside referenced future development locations and estimated development statistics and occupancy percentages based on information available and confirmed by Town staff. While the

development assumptions did not include the subject site, it did include the additional lands in the Shipyards Development Area.

The 2031 and 2041 future intersection operations are summarized in **Table 4** and **Table 5**.

Table 6: 2031 Total Intersection Operations

Intersection	Movement	Roadway Peak Hour	Delay	LOS	v/c ratio
First Street & Pine Street	Overall	Weekday A.M.	13 s	B	0.54
		Weekday P.M.	22 s	C	0.85
First Street/Huron Street & Hurontario Street	Overall	Weekday A.M.	13 s	B	0.54
		Weekday P.M.	17 s	B	0.77

Note: These operations were obtained from Section 7.1.1 (Table 18) of the Transportation Study Update (Burnside, August 2019)

Table 7: 2041 Total Intersection Operations

Intersection	Movement	Roadway Peak Hour	Delay	LOS	v/c ratio
First Street & Pine Street	Overall	Weekday A.M.	13 s	B	0.61
		Weekday P.M.	27 s	C	0.96
First Street/Huron Street & Hurontario Street	Overall	Weekday A.M.	14 s	B	0.62
		Weekday P.M.	21 s	C	0.87

Note: These operations were obtained from Section 7.2.1 (Table 22) of the Transportation Study Update (Burnside, August 2019)

Based on the above, it is concluded that the study intersections can accommodate the growth in traffic attributed to the proposed development.

Underground Parking Garage Queuing Analysis

As requested by the Town, an analysis of the future operations of the underground parking garage entrance was undertaken to determine whether the proposed queuing area is sufficient to accommodate the future vehicular demand.

M/D/1 queue analysis assumes exponentially distributed times between the arrivals of successive vehicles, which is a more realistic representation than the assumption of uniformly distributed arrival times and will predict queuing when the arrival rate is less than the service rate.

Per the Site Plan dated July 31, 2020 the access to the parking garage is approximately 8 metres long between the building façade and the main internal driveway, which can accommodate one passenger vehicle. From that point, there is also an additional 7 metres of the main internal driveway to the north prior to Side Launch Way to accommodate one additional passenger vehicle, and to the south the driveway is approximately 13 metres long along the north/south portion and 40 metres long along the east/west portion prior to Heritage Drive.

It was confirmed by the architect that the entry to the proposed underground parking garage will be a traditional overhead garage door which would be activated by a unique FOB provided to each resident. To determine the service rate, a local commercial/residential garage door supplier/installer was contacted to understand typical door speeds.

On average, a typical trolley operator garage door opens at a speed of 10 inches per second. With a typical door height of seven feet, that equates to total time of approximately 10 seconds for the door to open. The door has a timer for how long the door will stay open and a sensor for detecting cars in the doorway. The sensor is required for safety. If a vehicle is detected, the timer will re-set so the door does not close while a vehicle is proceeding through the entryway. The length of the timer will be determined by the building/property manager.

As noted above, a FOB will be required to open the door. In reality, multiple vehicles could proceed through the open doorway if they are detected by the sensor or use their FOB while the door is still open, both would reset the timer. However, to provide a conservative analysis, it was assumed that each vehicle would have to activate the doorway with their FOB and wait for the door to open.

Factoring in the time it takes for a driver to stop and utilize their FOB, the door to roll up and the vehicle to clear the entry, it is assumed it will take a vehicle approximately 25 seconds to clear the entryway in total. These 25 seconds consists of 15 seconds for a driver to stop and activate the garage door, and 10 seconds for the door to open. Using the M/D/1 methodology, this is considered the service rate, and equates to 2.4 vehicles per minute.

To determine the average arrival rate, the trip generation of the residential component was referenced. It is highlighted that the retail parking spaces are provided exclusively within the surface lot. The p.m. peak hour represents the highest inbound trip generation equating to 35 vehicles per hour. This converts to 0.58 vehicles per minute.

M/D/1 queue analysis was undertaken using the above arrival and service rates. Queuing analysis worksheet is included in **Attachment D**. The average queue length under these conditions will be one vehicle.

A sensitivity analysis was undertaken to determine the effects of higher arrival rates and lower service rates. Under scenarios where the arrival rate is doubled and the service is constant, and vice versa, the average queue was calculated to be one vehicle.

Under the scenario where both the arrival rate is assumed to be 60 vehicles per hour (1 vehicle per minute), and the service rate is halved to one vehicle every 50 seconds (1.2 vehicles per minute), the average queue was calculated to be 3 vehicles. This queue exceeds the length of the underground parking garage access, however there is sufficient queuing space within the internal roadway to accommodate the two additional vehicle on-site. Accordingly, no interference with Side Launch Way and Heritage Drive operations will result from queuing, even under an improbable scenario where it takes each driver 50 seconds to proceed into the underground garage.

As noted previously, if vehicles arrive sequentially, the service time will decrease because vehicles will not have wait for the garage door to open once the first vehicle triggers the door with their FOB. After that, a vehicle only needs to utilize their FOB to re-set the timer and allow the door to stay open.

Therefore, the proposed underground parking entrance is expected to operate with minimal queues under normal conditions, with excess queuing space available should arrival rates increase and/or service rates decrease.

Entrance Locations

As noted previously, access to the site is proposed through moves entrances to Side Launch Way and Heritage Drive. As illustrated in Figure 8.8.2 of the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR), the corner clearance to accesses at major intersections is measured between the edge of curb of the crossroad and the driveway.

The minimum corner clearance was assessed between the Side Launch Way entrance and the intersection of Side Launch Way and Heritage Drive, and between the Heritage Drive entrance and intersections of Heritage Drive with Huron Street and Side Launch Way. The minimum corner clearance requirements, per TAC GDGCR Figure 8.8.2, are summarized in **Table 8**. Relevant excerpts from TAC GDGCR have been included as **Attachment E**.

Table 8: Minimum Corner Clearance Requirements

Access	Roadway Classification	Intersecting Roadway	Control Type	Minimum Clearance	Proposed Separation
Side Launch Way	Local	Heritage Drive	Stop	15 m	40 m
Heritage Drive	Local	Side Launch Way	Stop	15 m	30 m
	Local	Huron Street	Signals	15 m	45 m

As summarized above, the proposed spacing between the site accesses and the nearby intersections meets the minimum requirements described in TAC GDGCR.

Sight Distance Measurement

A sight distance analysis was conducted to confirm that there is sufficient sight distance for drivers approaching and exiting the proposed site accesses. As described previously, Heritage Drive has a posted speed limit of 40 km/h. While Side Launch Way does not currently have a posted speed limit, it was assumed to be 40 km/h as well since the Town of Collingwood's Design Standards specify that local urban roadways have a speed limit of 40 km/h. The Town's Design Standards also specify that 40 km/h posted speed limit roadways have a design speed of 50 km/h.

Stopping Sight Distance

Per the Town's Design Standards, the minimum stopping sight distance for roadways with a design speed of 50 km/h is 65 metres. Side Launch Way intersects with Heritage Drive at a T-intersection approximately 40 metres east of the proposed accesses. While this does not meet the minimum of 65 metres, vehicles approaching from the east will be doing so via a turning movement and will not have attained operating speeds in advance of the accesses. To the west of the proposed access there is more than 65 metres of sight distance available.

Similarly, the intersection of Huron Street and Heritage Drive is approximately 40 metres south of the proposed Heritage Drive access. While this does not meet the minimum requirements, vehicles approaching the access will do so via turning movements and will not have attained operating speeds. To the north of the proposed accesses there is more than 65 metres of stopping sight distance available. Accordingly, the site accesses can be supported from a stopping sight distance perspective.

Relevant excerpts from the Town's Design Standards have been included as **Attachment F**.

Intersection Sight Distance

Section 9.9 of the TAC GDGCR provides intersection sight distance for different intersection control types. For these accesses, the applicable cases include "Case B1 – Left turns from the minor road", "Case B2 – Right turns from the minor road" and "Case F – Left turns from the major road". Comparing all three cases, Case B1 has the greatest sight distance requirement of 105 metres for 50 km/h design speed roads.

As noted above, the Side Launch Way and Heritage Drive accesses are limited in available sight distance to the west and south, respectively, due to T-intersections. As noted previously, vehicles approaching the site will do so via turning movements and will therefore not have attained operating speeds in advance of the accesses. In the other directions, more than 105 metres of sight distance is available for vehicles exiting the accesses. Accordingly, the site accesses can be supported from an intersection sight distance perspective.

Relevant excerpts from TAC GDGCR have been included as **Attachment E**.

Conclusions

The proposed development is forecasted to generate 55 and 100 two-way trips during the weekday a.m. and p.m. peak hours, respectively. Of the 100 trips in the p.m. peak hour, 15 trips are anticipated to be pass-by commercial trips. These are trips that are made as intermediate stops on the way from an origin to a primary destination.

The 2019 Transportation Study Update completed by Burnside assessed the existing (2019), background and total intersection operations at 20 intersections within the Town of Collingwood. This analysis included the signalized intersections of First Street and Pine Street and First Street/Huron Street and Hurontario Street. The future background and total analyses were completed for the 2031 and 2041 horizon years. The total conditions included the background growth as well as proposed developments within the Town of Collingwood, including sites within the Shipyards Development Area.

Under existing traffic volume conditions the intersections of First Street and Pine Street and First Street/Huron Street and Hurontario Street are operating with a LOS "B" or better in the weekday a.m. and p.m. peak hours, and a maximum control delay of 17 seconds. Under 2031 and 2041 total traffic volume conditions, the intersections are anticipated to continue operating well with a LOS "C" or better and maximum control delay of 27 seconds.

These operations indicate that the boundary road network has reserve capacity for increases in traffic volumes. These operations do not indicate that the addition of the development traffic will have a negative impact on the boundary road network. Given the similar level of development adjacent to Heritage Drive, it can reasonably be expected that the intersection can accommodate the increases in traffic volumes generated by the proposed development.

A queuing analysis was undertaken for the operations of the underground parking garage entrance. It was determined that under normal operating conditions, the two vehicle stacking spaces provided within the internal driveway would be sufficient to accommodate the expected average queue of one vehicle. A sensitivity analysis was undertaken to determine the effects of higher arrival rates and lower service rates. Under scenarios where the arrival rate is doubled and the service is constant, and vice versa, the average queue was calculated to be one vehicle. Therefore, the proposed underground parking entrance is expected to operate with minimal queues under normal conditions, with excess queuing space available should arrival rates increase and/or service rates decrease.

The locations of the proposed entrances were reviewed and compared with the TAC GDGCR minimum corner clearance requirements. For both accesses, the minimum corner clearance is 15 metres. The proposed Side Launch Way entrance is approximately 40 metres from Heritage Drive, and the proposed Heritage Drive entrance is approximately 30 and 45 metres from Side Launch Way and Huron Street, respectively. As such, the minimum corner clearance is satisfied.

Stopping sight distance and intersection sight distance requirements were also reviewed based on the Town's Design Standards and the TAC GDGCR standards. The review concluded that there is sufficient stopping and intersection sight distance available for vehicles approaching and exiting both site accesses.

Should you have any questions or require any further information, please don't hesitate to contact the undersigned.

Yours truly,

C.F. CROZIER & ASSOCIATES INC.



Alexander J.W. Fleming, MBA, P.Eng.
Associate
AJWF/mf

C.F. CROZIER & ASSOCIATES INC.



Madeleine Ferguson, P.Eng.
Transportation

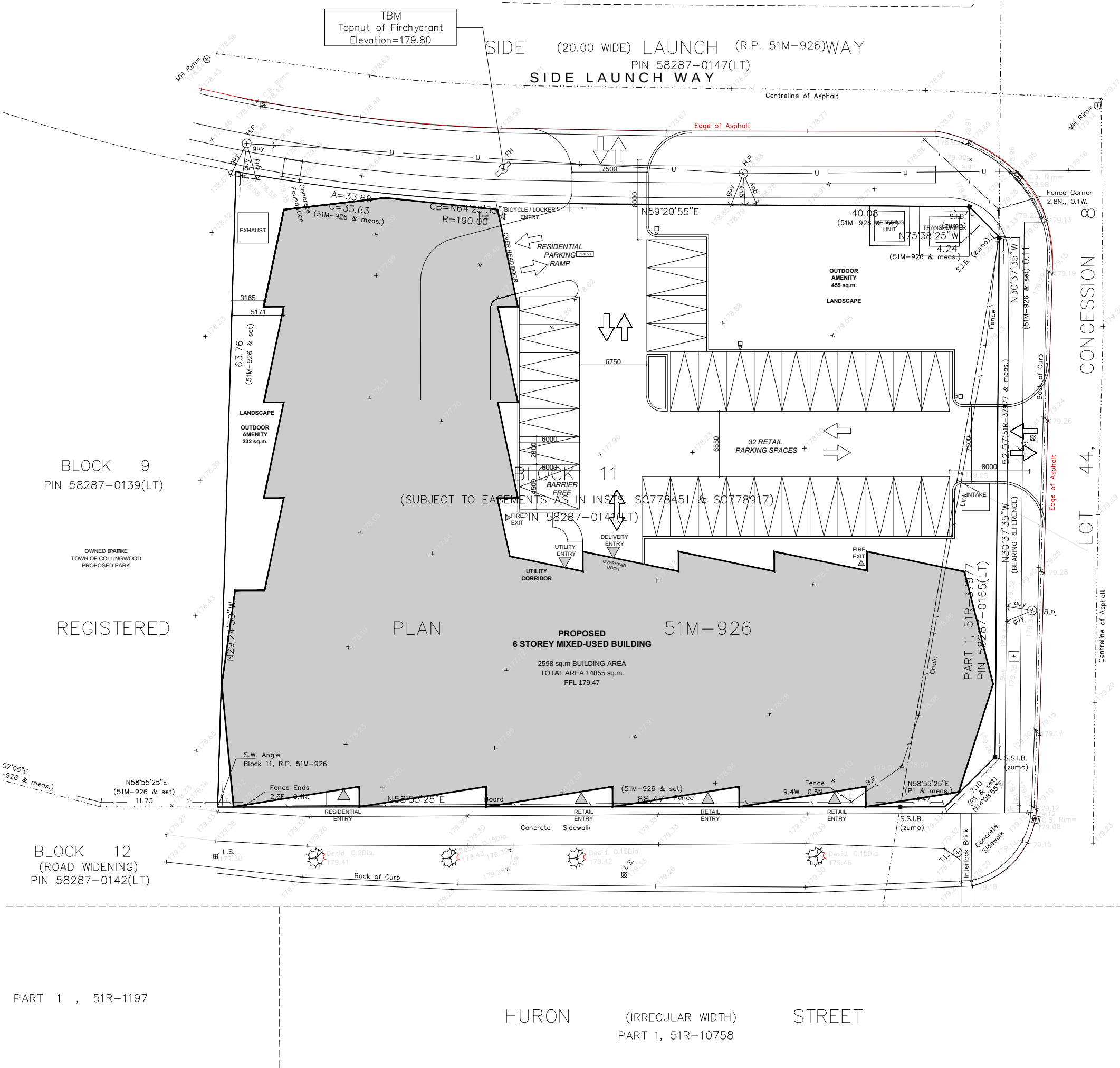
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Encl.

- Attachment A:** Site Plan & Site Stats (Streetcar, July 2020)
- Attachment B:** Collingwood Transportation Study Update (Burnside, August 2019) Excerpts
- Attachment C:** ITE Trip Generation Excerpts
- Attachment D:** M/D/1 Queuing Analysis
- Attachment E:** TAC GDGCR Excerpts
- Attachment F:** Town of Collingwood Design Standards Excerpts

Attachment A

Site Plan (Streetcar, July 2020)



SITE STATISTICS AND ZONING REQUIREMENTS:			
PROPERTY LEGAL	31 HURON STREET, TOWN OF COLLINGWOOD		
ZONING	IN PROCESS OF BEING REZONED TO SITE SPECIFIC ZONING (C1-V) IN ACCORDANCE WITH THE TOWN OF COLLINGWOOD ZONING BY-LAW 2010-40.		
DESCRIPTION			
AREA	TOTAL	%COVERAGE	
BUILDING AREA (GROUND FLOOR)	2598 sq.m.	55%	
ASPHALT PARKING & DRIVEWAY AREAS	1138 sq.m.	24%	
SIDEWALKS & OTHER HARD SURFACES	216 sq.m.	5%	
LANDSCAPES OPEN SPACE	757 sq.m.	16%	
TOTAL LOT AREA	4690 sq.m.	1.158 ACRES	
LAND USE	MIXED USE, RESIDENTIAL AND COMMERCIAL		
ZONING	IN PROCESS OF BEING REZONED TO SITE SPECIFIC ZONING IN ACCORDANCE TO THE TOWN OF COLLINGWOOD ZONING BY-LAW		
BUILDING SETBACKS	REQUIRED	PROVIDED	
FRONT YARD (HERITAGE DRIVE)	0m	0m	
REAR YARD	7.5m	0m - 5.17m	
EXTERIOR SIDE YARD SET BACK	0m	0m	
PARKING & BICYCLES	REQUIRED	PROVIDED	
COMMERCIAL (3 spaces per 100sq.m.)	32	32	
VISITOR (0.25 space per unit)	33	33	
RESIDENTIAL (1 space per unit)	130	139	
BARRIER FREE (2% of total required spaces)	4	4	
DELIVERY SPACE	1	1	
BICYCLES	15	200	
BUILDING HEIGHT	BUILDING HEIGHT PROPOSED 6 STOREY BUILDING 26.0m FROM GROUND FLOOR TO TOP OF PEAKED ROOM		

- GENERAL NOTES:
- THE "LIMITS OF CONSTRUCTION" SHALL BE ASSUMED TO BE THE PROPERTY LINE UNLESS OTHERWISE NOTED
 - FIRE ACCESS ROUTE TO BE POSTED AND DESIGNATED UNDER MUNICIPAL BY-LAW (FIRE ACCESS ROUTE TO BE MIN. 6m WIDE WITH A MIN. 12m CENTRELINE TURNING RADIUS AND MAX. 6% SLOPE)
 - COORD. W/ MECH. & SITE PLANS FOR ALL EXISTING & NEW LOCATIONS OF SERVICES & ENTRY OF SERVICES INTO THE BUILDING ENVELOPE. (ALL MECH. ELECT. INFO INDICATED ON ARCHITECTURAL SITE DWG. ALL IS FOR GENERAL REFERENCE & COORD. ONLY)
 - COORD. W/ SITE GRADING PLAN FOR PROPOSED FINAL FINISH GRADE ELEV.'S & DRAINAGE SLOPES
 - TYP. DRIVEWAY & PARKING LOT CONC. CURBS AS INDICATED ON DRAWING. W/ OPS DETAILS & SPECS. FOR TYPICAL CURB TYPES. SITE DIMENSIONS ARE TYPICALLY DIMENSIONED TO FACE OF CURB
 - THE SUB-GRADE SOILS EXPOSED AFTER EXCAVATION SHALL BE INSPECTED AND CERTIFIED BY A QUALIFIED REGISTERED PROFESSIONAL SOILS ENGINEER AND A COPY OF THE REPORT SHALL BE FORWARDED TO THE MUNICIPALITY
 - ALL FILL PLACED ON THE SITE SHALL BE COMPACTED TO A MINIMUM OF 98-100% STANDARD PROCTOR DENSITY. A SUFFICIENT NUMBER OF TESTS SHALL BE TAKEN AT VARIOUS LEVELS SATISFACTORY TO THE DIRECTOR OF ENGINEERING. TEST RESULTS SHALL BE SENT TO THE MUNICIPALITY WITH A LETTER, SIGNED AND STAMPED BY THE SOILS ENGINEER, STATING THAT A SUFFICIENT NUMBER OF TESTS HAVE BEEN TAKEN AND THE MINIMUM DEGREE OF COMPACTION HAS BEEN REACHED
 - APPROVAL OF THIS DRAWING IS FOR MATERIAL ACCEPTABILITY AND COMPLIANCE WITH MUNICIPAL AND PROVINCIAL SPECIFICATIONS AND STANDARDS ONLY. APPROVAL AND INSPECTION BY THE MUNICIPALITY OF THE WORKS DOES NOT CERTIFY THE LINE AND GRADE OF THE WORKS AND IT IS THE OWNER'S RESPONSIBILITY TO HAVE THEIR ENGINEER CERTIFY THIS ACCORDINGLY
 - STATION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO WORKS COMMENCING ON THE SITE AND SHALL BE MAINTAINED FOR THE DURATION OF CONSTRUCTION, TO THE SATISFACTION OF THE MUNICIPALITY
 - PROJECT SIGN TO BE ERRECTED @ BEGINNING OF PROJECT. FINAL LOCATION TO BE COORDINATED WITH ARCHITECT ON SITE
 - EARTH BERMS SHOWN ARE DIAGRAMMATIC ONLY. REFER TO GRADING PLAN FOR ACCURATE AND COMPLETE INFORMATION
 - PROVIDE HEAVY DUTY (ASPHALT @ ENTIRE TRUCK ACCESS ROUTE PROVIDE MEDIUM DUTY (MD) ASPHALT @ ALL OTHER DRIVEWAYS AND PARKING SPACES
- GENERAL NOTES - MUNICIPAL
- ALL WORK INVOLVED IN THE CONSTRUCTION, RELOCATION, REPAIR OF MUNICIPAL SERVICES FOR THE PROPOSED DEVELOPMENT SHALL BE TO THE SATISFACTION OF THE MUNICIPALITY
 - STREET EXCAVATION PERMITS ARE REQUIRED FOR ANY WORK IN MUNICIPAL RIGHT OF WAY BY ANY CONTRACTOR
 - CONTRACTOR IS RESPONSIBLE FOR ALL SERVICING, UTILITIES, AND COSTS
 - STORM WATER DRAINAGE MUST NOT HAVE A NEGATIVE IMPACT ON ADJACENT PROPERTIES
 - FIRE ROUTE SIGNS AND 5-WAY FIRE HYDRANTS SHALL BE ESTABLISHED TO THE SATISFACTION OF THE FIRE DEPARTMENT AND AT THE EXPENSE OF THE CONTRACTOR
 - ALL DRIVEWAYS FROM PROPERTY LINES FOR THE FIRST 7.5m SHALL BE WITHIN 5% MAXIMUM GRADE. THEREAFTER, ALL DRIVEWAYS SHALL BE WITHIN 10% MAXIMUM GRADES
 - THE MUNICIPAL APPROVAL OF THIS SITE PLAN DOES NOT EXEMPT THE CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING:
 - BUILDING PERMIT
 - SEWER AND WATER PERMITS
 - ROAD CUT PERMITS
 - RELOCATION OF SERVICES
 - APPROACH APPROVAL PERMITS
 - ENCROACHMENT AGREEMENTS
 - COMMITTEE OF ADJUSTMENT
 - ANY ABANDONED ACCESSSES MUST BE REMOVED AND THE CURB AND BOULEVARD RESTORED WITH SOD AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE MUNICIPALITY

- BEFORE STARTING WORK
- THE CONTRACTOR SHALL NOTIFY THE MUNICIPALITY, ARCHITECT & CONSULTANTS AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION
 - THE POSITION OF THE POLE LINES, CONDUITS, WATER MAINS, SEWERS, AND OTHER UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. CONTRACTOR TO VERIFY EXISTING CONDITIONS
 - ALL EXISTING UNDERGROUND UTILITIES WITHIN THE LIMITS OF CONSTRUCTION SHALL BE LOCATED, MARKED AND PROTECTED. ANY UTILITIES DAMAGED OR DISTURBED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED TO THE SATISFACTION OF THE ENGINEER, AT THE CONTRACTOR'S EXPENSE
 - PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, ALL BENCHMARKS, ELEVATIONS, DIMENSIONS, AND GRADES MUST BE CHECKED BY THE CONTRACTOR AND ANY DISCREPANCIES REPORTED TO THE ENGINEER
 - AT LEAST TWO DIFFERENT BENCHMARKS MUST BE REFERRED TO AT ALL TIMES

ALL DRAWINGS AND RELATED DOCUMENTS ARE THE PROPERTY OF STREETCAR DEVELOPMENT INC. AND MAY NOT BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE DEVELOPERS PERMISSION. THIS DRAWING SHOULD NOT BE USED TO CALCULATE AREAS. DO NOT SCALE THIS DRAWING. ALL DIMENSIONS TO BE CHECKED ON SITE BY THE CONTRACTOR AND SUCH DIMENSIONS TO BE THEIR RESPONSIBILITY. ALL WORK MUST COMPLY WITH THE RELEVANT BUILDING CODE BY LAW AND RELATED DOCUMENTS. DRAWING ERRORS AND OMISSIONS MUST BE IMMEDIATELY REPORTED TO THE DEVELOPER.

NO.	DATE	REVISION
01.	07 / 31 / 2020	ISSUED FOR SPA

STREETCAR™
RETHINK URBAN LIVING

1230 DUNDAS ST E TORONTO ONTARIO M4M 1S3 416-466-2361

DRAWING:
PROPOSED SITE PLAN

PROJECT:
31 HURON STREET
COLLINGWOOD

SCALE:
1:200

ISSUE DATE:
30 / 07 / 2020

D-001

		TOTAL GFA		RETAIL GFA		RESIDENTIAL GFA		RESIDENTIAL UNITS GFA		1BD	2BD	3BD	4BD	TOTAL UNITS
		sq.ft.	sq.m.	sq.ft.	sq.m.	sq.ft.	sq.m.	sq.ft.	sq.m.					
M	Mezzanine / Mechanical	8,077	750.35	-	-	8,077	750.35	8,077	750.35	-	-	-	-	-
6	Residential / Mechanical	22,406	2,081.52	-	-	22,406	2,081.52	20,000	1,858.00	3	12	11	-	26
5	Residential	25,363	2,356.22	-	-	25,363	2,356.22	22,320	2,073.53	6	14	5	-	25
4	Residential	25,363	2,356.22	-	-	25,363	2,356.22	22,320	2,073.53	6	14	5	-	25
3	Residential	25,363	2,356.22	-	-	25,363	2,356.22	22,320	2,073.53	6	14	5	-	25
2	Residential	25,363	2,356.22	-	-	25,363	2,356.22	22,320	2,073.53	6	14	5	-	25
GF	Lobby, Retail, Residential	27,962	2,597.67	11,362	1,055.53	16,600	1,542.14	8,871	824.12	-	-	-	4	4
TOTALS		159,897	14,854	11,362	1,056	148,535	13,799	126,228	11,727	27	68	31	4	130
SUMMARY														
Total GFA		159,897	sq.ft.	14,854.43	sq.m.	SITE AREA		4,690.0		sq.m.				
Total Retail GFA		11,362	sq.ft.	1,055.53	sq.m.	FSI		3.2						
Total Residential GFA		148,535	sq.ft.	13,798.90	sq.m.									
Total Residential Unit GFA		126,228	sq.ft.	11,726.58	sq.m.	Bicycle Spaces (P1)				200				
Total Residenital Units				130		Retail Parking Spaces (G)				32				
Storage Lockers				117		Visitor Parking Spaces (P1)				33				
Total Indoor Amenity		2,214	sq.ft.	205.68	sq.m.	Residential Parking Spaces (P1, P2)				139				
Total Outdoor Amenity		7,119	sq.ft.	661.36	sq.m.	TOTAL PARKING SPACES				204				
Total Private Terrace/Balcony		12,080	sq.ft.	1,122.23	sq.m.									
Total Mechanical (excluded from GFA)		2,924	sq.ft.	271.64	sq.m.									

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NO.	DATE	REVISION
01.	07 / 31 / 2020	ISSUED FOR SPA

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DRAWING:
SITE STATISTICS

PROJECT:
31 HURON STREET
COLLINGWOOD

SCALE:
NTS

ISSUE DATE:
30 / 07 / 2020

D-002

Attachment B

Collingwood Transportation Study Update (Burnside, August 2019) Excerpts



BURNSIDE

Collingwood Transportation Study Update

**Town of Collingwood
97 Hurontario Street
Collingwood, ON L9Y 3Z5**

**R.J. Burnside & Associates Limited
3 Ronell Crescent
Collingwood ON L9Y 4J6 CANADA**

**August 2019
300043606.0000**

Distribution List

No. of Hard Copies	PDF	Email	Organization Name
3	Yes	Yes	Town of Collingwood

Record of Revisions

Revision	Date	Description
0	April 25, 2019	Initial Draft Submission to Town of Collingwood
1	August 27, 2019	Final Submission to Town of Collingwood

R.J. Burnside & Associates Limited**Report Prepared By:**Cody Raposo, P.Eng.
Transportation Engineer
CR:lsJonah Lester
Transportation Planner
JL:ls**Report Reviewed By:**Henry Centen, P.Eng.
Senior Transportation Engineer
HC:ls

Executive Summary

A multitude of developments varying in size and complexity are proposed in the Town of Collingwood (Town) over the next few decades. The Town has retained R.J. Burnside & Associates Limited (Burnside) to estimate the total traffic volumes to be generated by the proposed developments and the corresponding impacts on the Town's road network over the medium-term (2031) and long-term (2041). A total of 20 primary intersections in the Town were assessed.

This Transportation Study Update (TSU) is an update to the *Town of Collingwood Transportation Study*, completed by C.C. Tatham & Associates Ltd. (Tatham) in July 2012. The Study completed by Tatham assessed a total of 16 intersections in the Town, of which 14 are also considered in this TSU. Tatham's Study considered traffic impacts in future horizon years 2020 and 2030.

The impacts from increased development traffic on the Town's road network were subsequently used to determine any infrastructure improvements that may be required at Town intersections and road segments in horizon years 2031 and 2041, to accommodate total forecast traffic volumes. Burnside has provided preliminary cost estimates for each of the forecasted required improvements, in order to assist the Town in determining future development charge rates for roads and related infrastructure.

Traffic impacts were assessed under existing, 2031/2041 background, and 2031/2041 total traffic conditions. Turning movement traffic volume data was obtained at the 20 intersections studied in December 2018, with the traffic volumes increased marginally by a seasonal factor for use in this TSU. Background traffic volumes were estimated by applying a general annual growth rate to the existing traffic volumes, to account for non-development related traffic growth occurring in the Town as well as traffic growth originating in areas beyond the Town's boundaries and that may impact volumes in the Town. Total traffic consists of the background traffic volumes plus the traffic volumes forecasted to be generated by the developments which are anticipated for completion within the time horizons considered.

Based on the volumes of future traffic forecasted, as well as network connectivity and land use considerations, the following roads have been identified for potential classification upgrade, within the time horizons considered:

- Old Mountain Road – may warrant upgrading from a local road to a collector road classification by 2031.
- Cranberry Trail East and West – may warrant upgrading from a local road to a collector road by 2041.
- Tenth Line – may warrant upgrading from a collector road to an arterial road by 2031.

- Cambridge Street – may warrant upgrading from a local road to a collector road by 2031.
- Campbell Street – may warrant upgrading from a local road to a collector road by 2031.

Based on the analysis completed, the short-term, medium-term, and long-term improvement recommendations are summarized below in Table (i), Table (ii), and Table (iii), respectively. The recommended intersection improvements in the medium-term (2031) and long-term (2041) are also illustrated below in Figure (i) and Figure (ii), respectively.

Table (i): Existing Recommendations (2019)

Intersection / Road Segment	Recommended Improvement(s)	Cost Estimate	EA
Intersections			
All movements at all intersections in the Study Area operate with sufficient capacity and a LOS E or better. Therefore, no intersection improvements are required in the short term.			
Road Segments			
The capacity of all road segments studied adequately supports existing traffic volumes. Therefore, no road segment improvements are required under existing conditions.			

Table (ii): Medium-Term Recommendations (By Horizon Year 2031)

Intersection / Road Segment	Recommended Improvement(s)	Cost Estimate	EA
Intersections			
Highway 26 & Cranberry Trail E/Gun Club Road	- Addition of traffic signals. - Addition of westbound left-turn lane. - Addition of eastbound left-turn lane.	\$500,000	A+
First Street & High Street / Balsam Street	- Addition of southbound left-turn lane. - Addition of eastbound right-turn lane.	\$500,000	A+
Tenth Line & Mountain Road	- Addition of a dedicated left-turn lane to all four approaches. - Addition of an eastbound right-turn lane. - Addition of a westbound right-turn lane. - Addition of a northbound right-turn lane.	\$1.3M	A+
	<i>Option #2 ¹:</i> Construct two-lane roundabout.	\$1.2M	A+
Mountain Road & Old Mountain Road/Cambridge Street	- Addition of a northbound right-turn lane. - Addition of a southbound right-turn lane. - Convert existing westbound right-turn into a shared westbound through/right-turn lane.	\$550,000	A+
High Street & Third Street/Cambridge Street	- Addition of traffic signals. - Addition of a dedicated left-turn lane to all four approaches.	\$1.2M	A+
High Street & Campbell Street ²	<i>Option #1:</i> - Addition of traffic signals. - Addition of westbound left-turn lane. - Addition of northbound right-turn lane.	\$500,000	A+
	<i>Option #2:</i> Construct two-lane roundabout.	\$1M	A+
Tenth Line & Sixth Street (Simcoe County Jurisdiction)	<i>Option #1:</i> - Addition of traffic signals. - Addition of a dedicated left-turn lane to all four approaches.	\$1M	A+
	<i>Option #2 ¹:</i>	\$1M	A+

	Construct single lane roundabout.		
Raglan Street & Poplar Sideroad (Simcoe County Jurisdiction)	Addition of a southbound left-turn lane.	\$150,000	A+
Road Segments			
Mountain Road (Tenth Line to Cambridge Street)	- Widen to include two travel lanes per direction plus a centre two-way left-turn lane (TWLTL). - Widen the bridge structure approximately 150 metres west of Cambridge Street. - Urban cross section.	\$8.3M	C

1. A roundabout alternative has been recommended in the *Tenth Line and Mountain Road Improvements Class EA* (Ainley Group, April 2019).

2. Further detailed studies and cost-benefit analyses required to determine preferred option.

Table (iii): Long-Term Recommendations (By Horizon Year 2041)

Intersection / Road Segment	Recommended Improvement(s)	Cost Estimate	EA
Intersections			
Balsam Street/Harbour Street W & Highway 26	- Addition of a northbound left-turn lane (on Highway 26). - Addition of a southbound left-turn lane (on Highway 26).	\$600,000	A+
First Street & High Street/Balsam Street	Addition of northbound right-turn lane.	\$250,000	A+
Tenth Line & Mountain Road	<i>If Option #1 were selected in Medium Term:</i> - Addition of an eastbound through lane. - Addition of a westbound through lane.	\$600,000	A+
Mountain Road & Old Mountain Road/Cambridge Street	Addition of an eastbound right-turn lane.	\$250,000	A+
High Street & Sixth Street	- Addition of an eastbound right-turn lane. - Addition of a westbound right-turn lane.	\$500,000	A+
Tenth Line & Sixth Street (Simcoe County Jurisdiction)	<i>If Option #1 were selected in Medium Term:</i> Addition of a southbound left-turn lane.	\$250,000	A+
Raglan Street & Poplar Sideroad ¹ (Simcoe County Jurisdiction)	<i>Option #1:</i> - Addition of traffic signals. - Addition of an eastbound left-turn lane. - Addition of a westbound right-turn lane.	\$600,000	A+
	<i>Option #2:</i> Construct two-lane roundabout.	\$1M	A+
Poplar Sideroad & Concession 10	Addition of a southbound left-turn lane.	\$250,000	A+

(Simcoe County Jurisdiction)			
Road Segments			
Highway 26 (Harbour Street West to Grey Road 21) ²	- Widen to include two travel lanes per direction plus a centre TWLTL.³ - Rural cross section.	\$11.7M	C
High Street (Tenth Street to Poplar Sideroad)	- Widen to include two travel lanes per direction. - Urban cross section.	\$3.5M	C

1. Further detailed studies and cost-benefit analyses required to determine preferred option.
2. For the purposes of this study, it is assumed that the widening of Highway 26 would extend from Harbour Street West to Grey Road 21 (i.e., the boundary road between Collingwood and The Blue Mountains).
3. The recommendation to widen Highway 26 to a five-lane cross section assumes that the Highway 26 Bypass around Collingwood is not constructed prior to horizon year 2041.

Even with the recommended improvements noted above, the traffic forecasts indicate that there will still be a need for additional east/west capacity through Collingwood in the medium to long-term (First Street is forecast to have a volume to capacity ratio of 1.0 by 2031) as the First Street corridor and First Street / High Street intersection reach their practical limits for expansion. Acting as an alternative route into and around Collingwood, Poplar Sideroad (County Road 32) is also expected to reach its practical capacity in the long-term. Therefore, it is recommended that the Town encourage the Ministry of Transportation of Ontario (MTO) to advance their planning for a new highway around Collingwood (i.e. Collingwood Bypass).

Figure (i): 2031 Intersection Lane Configuration and Traffic Control Recommendations

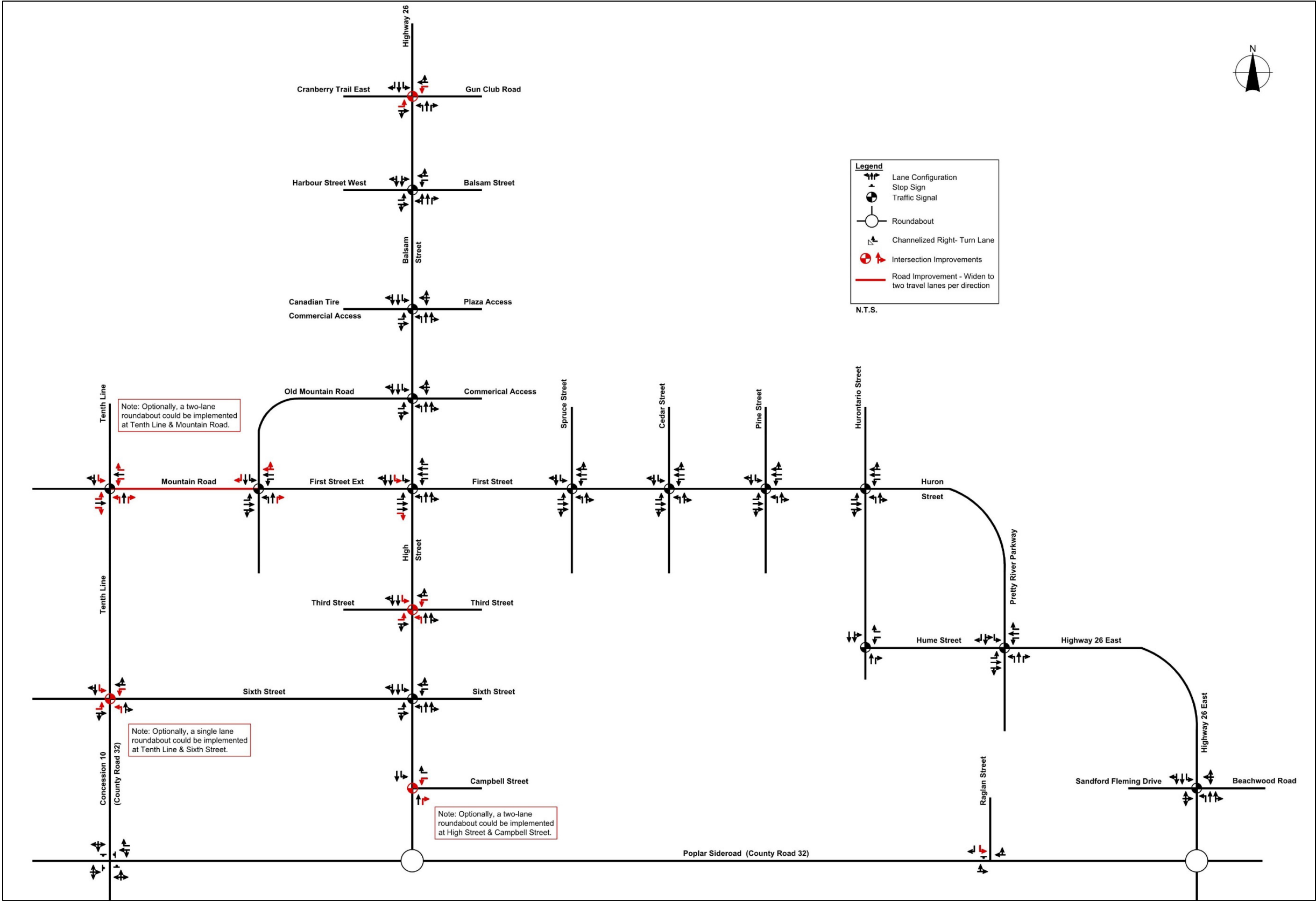
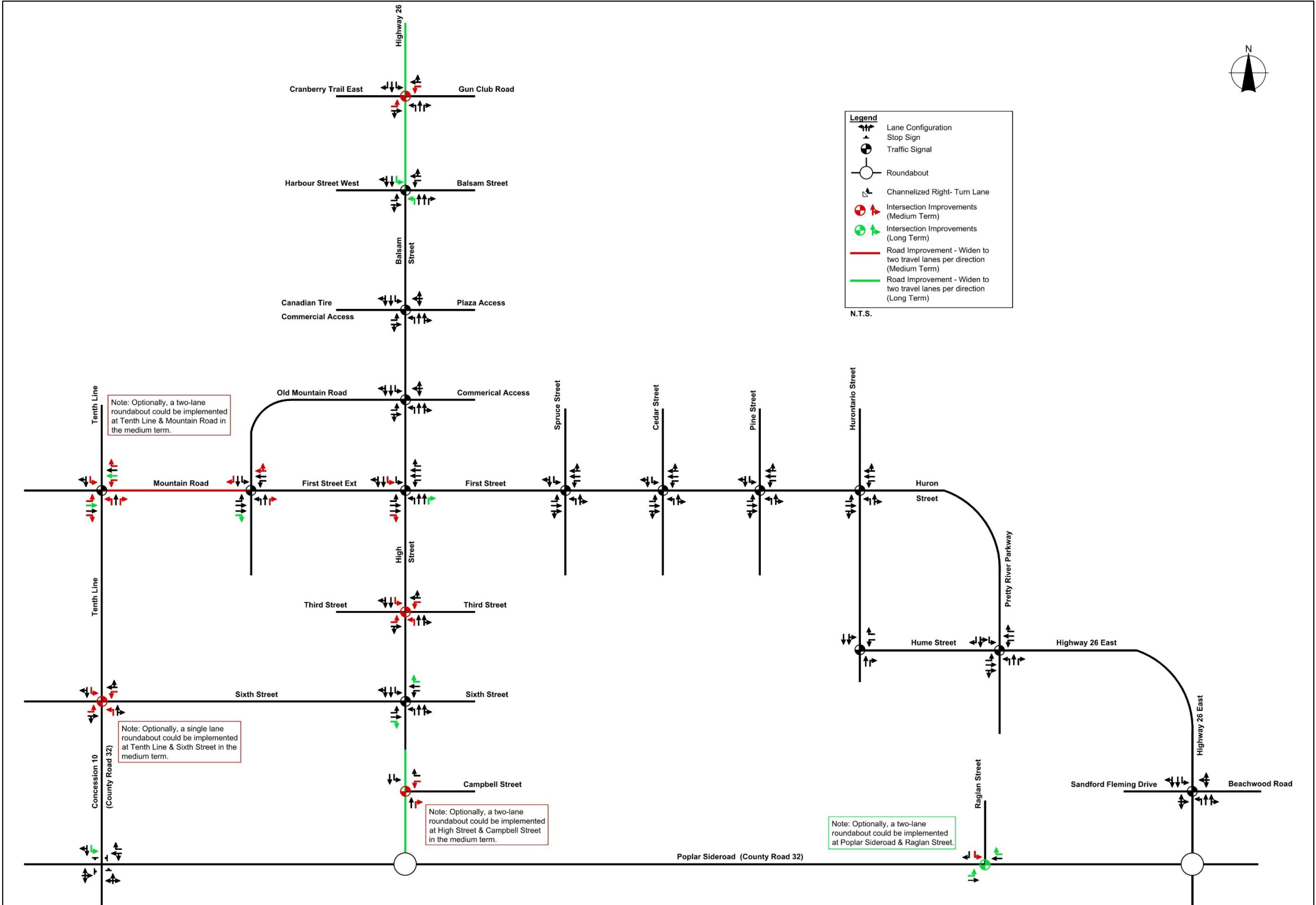


Figure (ii): 2041 Intersection Lane Configuration and Traffic Control Recommendations



1.0 Introduction

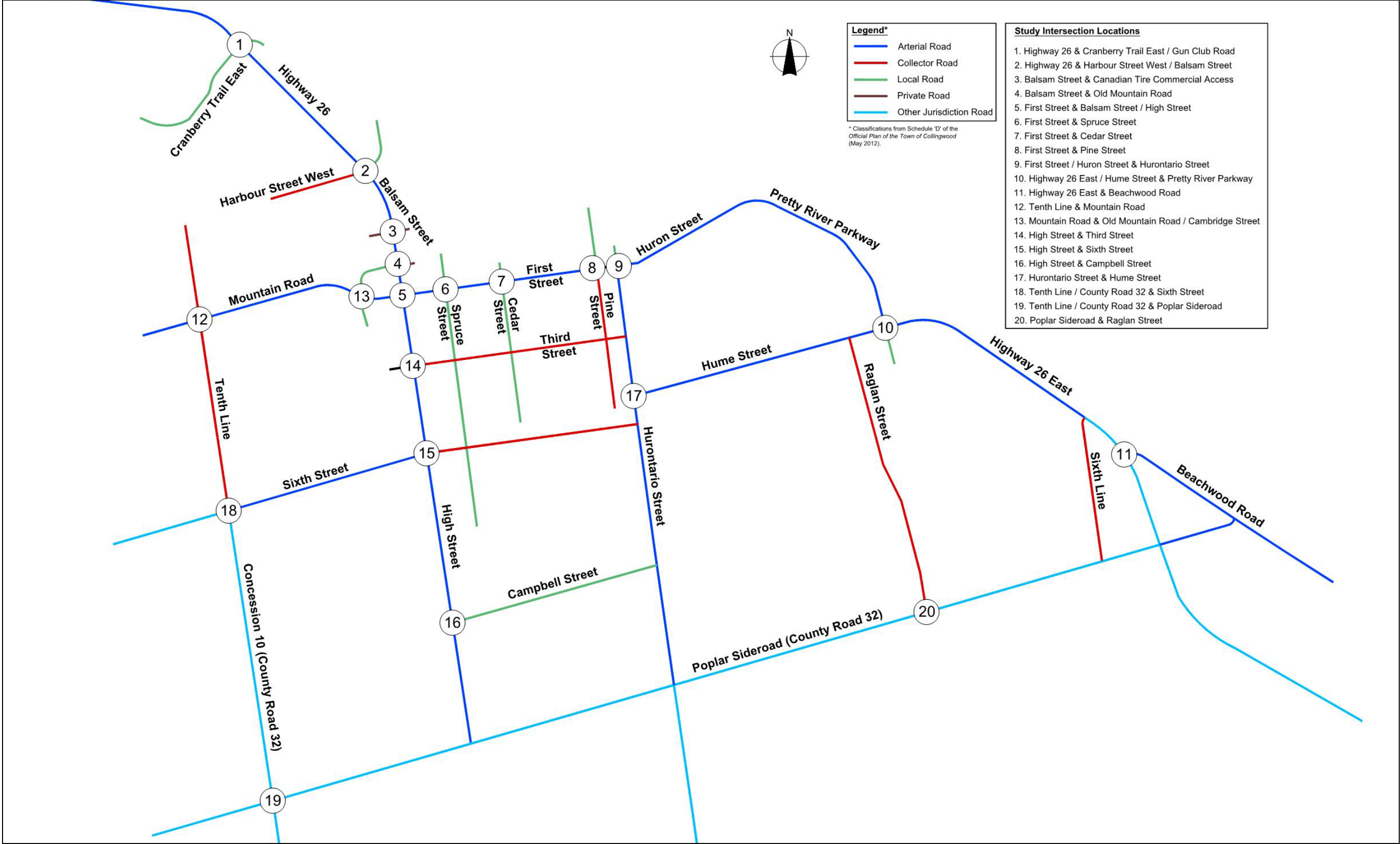
1.1 Project Background

A multitude of developments in and around the Town of Collingwood (Town) are anticipated over the next 20 years. R.J. Burnside & Associates Limited (Burnside) has been retained by the Town to conduct a Transportation Study Update (TSU) which reviews the impacts that future traffic growth will have on the Town's road network and transportation infrastructure needs through horizon year 2041.

This TSU is an update to the *Town of Collingwood Transportation Study* submitted by C.C. Tatham & Associates Ltd. on July 9, 2012, which is herein referred to as the *2012 Transportation Study*. A total of 20 intersections in the Town are reviewed in this TSU, with the intersection locations illustrated in Figure 1.

Similar to the *2012 Transportation Study*, it is noted that the focus of this TSU is on existing and future vehicular traffic operations within Collingwood and the related infrastructure. While other modes of travel such as transit, cycling, and walking are important components of the overall transportation system, the assessment of their needs is not included in the TSU scope.

Figure 1: Study Intersection Locations



2.4 Existing Traffic Volumes

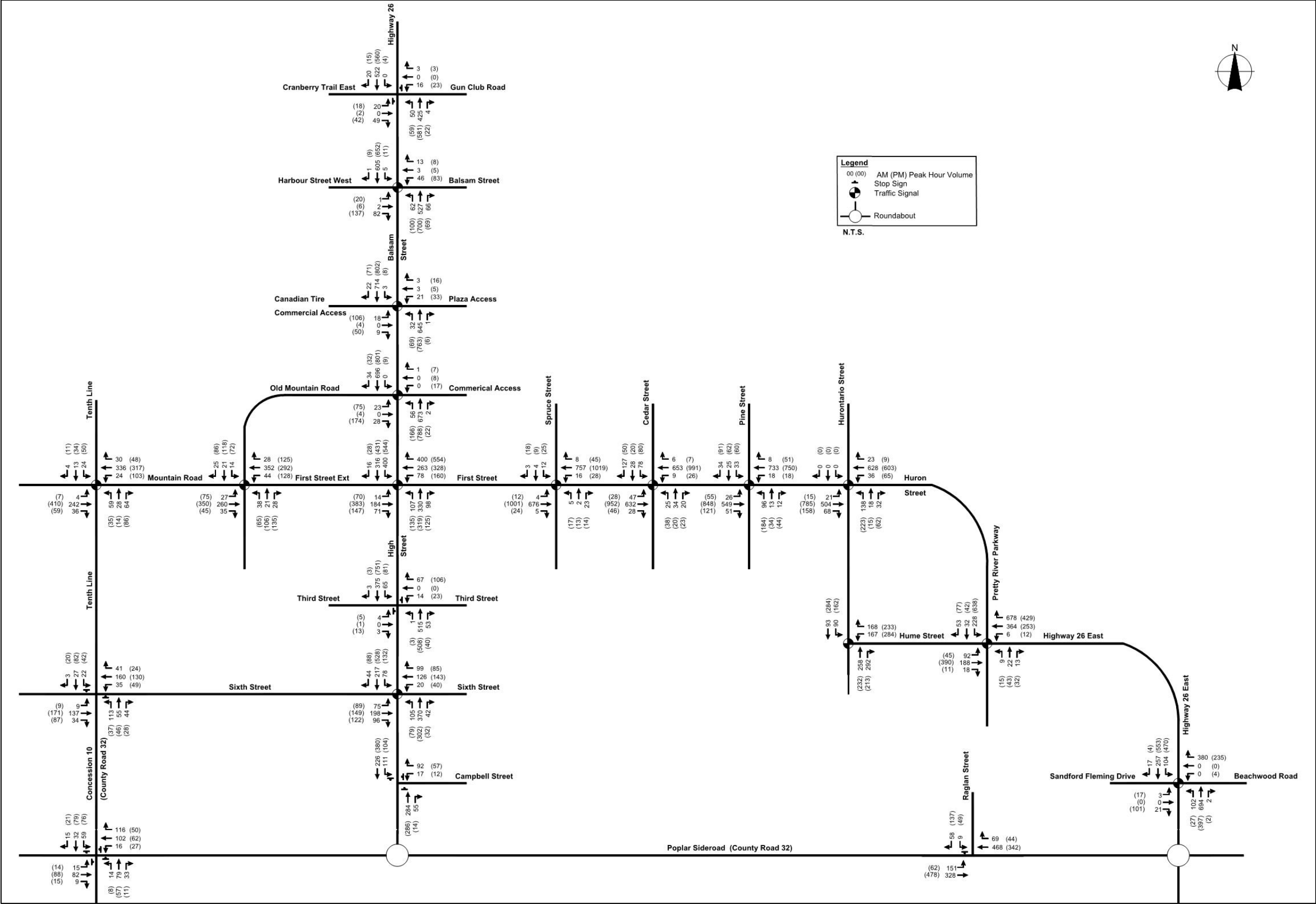
Turning Movement Counts (TMCs) were conducted on behalf of Burnside by Ontario Traffic Inc. (OTI) at the 20 key intersections in the Study Area on Wednesday, December 12, 2018. Data was collected at each intersection between 7:00 AM to 9:00 AM, 11:00 AM to 2:00 PM, and 3:00 PM to 6:00 PM. The TMC data for the AM and PM peak periods is provided in Appendix A (data for the 11:00 AM to 2:00 PM period will be provided to the Town digitally).

Since the proposed Sandford Fleming Drive connection to the Beachwood Road/Highway 26 intersection has been included as an existing condition, minor turning volumes were added to the Sandford Fleming Drive leg of the intersection based on assumed traffic generation and distribution for the surrounding land uses.

The weekday AM and PM peak periods were selected for analysis purposes as these time periods represent the typical peak periods throughout the Town's road network. Often, for tourist/recreational locations such as Collingwood, traffic volumes are highest in the summer months. Since the TMCs for this study were collected on December 12, the data was compared with historic summer and winter traffic counts from various sources (e.g. Town, County, traffic studies from other consultants) to determine what overall seasonal adjustment factor should be applied. The results of our comparisons indicated that the application of a 5.0% adjustment factor would be most reasonable, therefore the TMC volumes were increased by 5.0% to represent existing summer weekday conditions.

The existing traffic volumes, which include the application of the seasonal adjustment factor outlined above, are illustrated in Figure 4.

Figure 4: Existing Traffic Volumes



2.4.1 Alternate Route and Traffic Diversion

The *2012 Transportation Study* identified potential diversion of through traffic to use Poplar Sideroad as an alternate route through Collingwood, providing relief to critical locations along Highway 26, such as the First Street and High Street intersection. As noted in the previous section, Poplar Sideroad and Concession 10 were upgraded in 2012 and transferred to Simcoe County as County Road 32 in 2014. With the opening of the Highway 26 realignment in 2012, destination signs now direct traffic to The Blue Mountains to follow Poplar Sideroad in order to promote the use of this alternate route. Historical traffic volumes were reviewed to provide insight into the extent of use of County Road 32 as an alternate route through Collingwood. These volumes are summarized in Table 5 for various sections of County Road 32.

Table 5: Historical Traffic Volumes on County Road 32

Segment of County Road 32	Summer Average Daily Traffic			
	2008	2013	2015	2018 ¹
Poplar Sideroad Highway 26 to Hurontario Street	2600	6000	7800	9000
Poplar Sideroad Hurontario Street to High Street	5400	7000	7500 ²	NA
Poplar Sideroad High Street to Concession 10	NA	NA	3200	4250
Concession 10 Poplar Sideroad to Sixth Street	1600	3200	3500	4400

1. It is noted that Highway 26 was being reconstructed between Poplar Sideroad and Pretty River Parkway during the summer of 2018, which could have increased traffic along County Road 32.

2. Estimated based on 2014 traffic volume

NA – Not Available

Although the historical data is somewhat limited, it shows that there was a significant increase in traffic on County Road 32 between 2008 and 2013, after the road was upgraded. Considerable growth continues until 2018, however, it is noted that there was construction on Highway 26 north of Poplar Sideroad during the summer of 2018, therefore, the 2018 volumes could have been influenced by traffic temporarily detouring along County Road 32. In general, this traffic growth seems to indicate that County Road 32 has started to take on a role as an alternate route into and around Collingwood and it stands to reason that this role will become increasingly important as traffic grows throughout the Town.

2.5 Existing Traffic Operations

2.5.1 Intersection Operations

Existing traffic operations were assessed at the 20 Study Area intersections based on the lane configurations shown in Figure 3 and the traffic volumes shown in Figure 4.

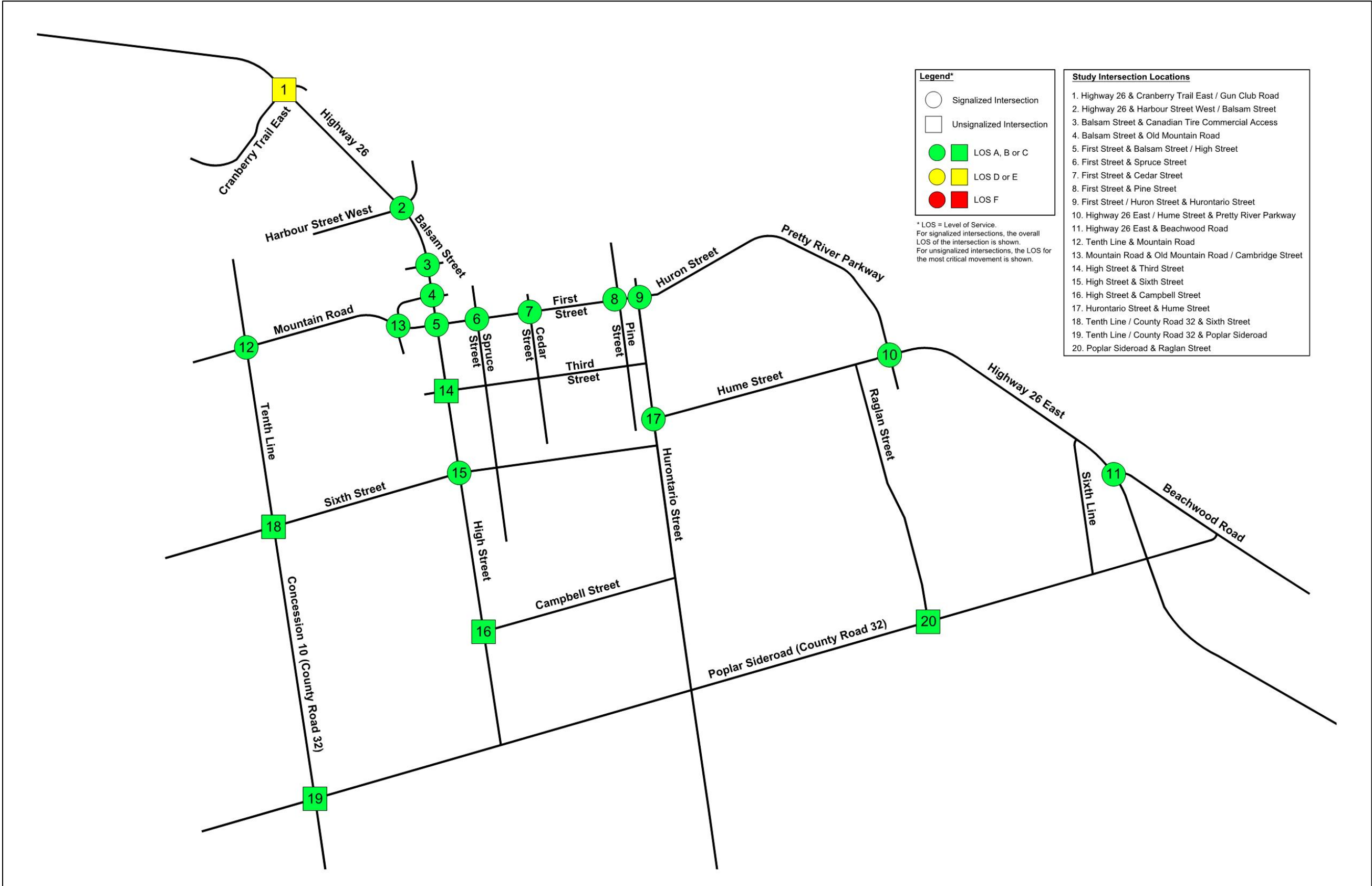
Existing signal timings were applied in the analysis. The existing Synchro analyses are included in Appendix B, and the traffic operations are summarized in Table 6 and Table 7 for signalized and unsignalized intersections, respectively. Figure 5 provides a visual representation of the existing level of service at the study area intersections.

For the purposes of this study, movements at signalized intersections shown in the traffic operations summary tables throughout this report are individual movements with a v/c ratio at or above 0.85 and/or a LOS F.

Table 6: Existing (2019) Signalized Intersection Operations

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		Delay (s)	LOS	v/c ratio	Delay (s)	LOS	v/c ratio
Balsam Street/Harbour Street W & Highway 26	Overall	10	A	0.39	12	B	0.47
Balsam Street & CT Entrance/Plaza Access	Overall	6	A	0.35	11	B	0.44
Balsam Street & Old Mountain Road/Commercial Access	Overall	5	A	0.37	11	B	0.44
First Street & Balsam Street/High Street	Overall	31	C	0.59	35	C	0.70
First Street & Spruce Street	Overall	5	A	0.32	7	A	0.39
First Street & Cedar Street	Overall	12	B	0.35	9	A	0.43
First Street & Pine Street	Overall	13	B	0.42	17	B	0.58
First Street/Huron Street & Hurontario Street	Overall	10	A	0.37	11	B	0.50
Hume Street/Highway 26 E & Pretty River Parkway	Overall	17	B	0.50	36	C	0.56
Highway 26 E & Beachwood Road/Sandford Fleming Drive	Overall	16	B	0.53	13	B	0.71
Tenth Line & Mountain Road	Overall	10	A	0.44	10	A	0.51
Mountain Road & Old Mountain Road/Cambridge Street	Overall	13	B	0.36	21	C	0.44
High Street & Sixth Street	Overall	18	B	0.48	16	B	0.46
Hurontario Street & Hume Street	Overall	16	B	0.40	16	B	0.45

Figure 5: Existing Level of Service



3.0 Future Background Traffic Conditions

For the purposes of this study, future background traffic consists of existing traffic volumes plus the addition of a background traffic growth rate(s). 2031 and 2041 have been selected for future traffic projections and analysis in this study, to consider the medium and long-term traffic operation impacts of proposed developments throughout the Town. This analysis will be used to identify potential road and intersection improvement requirements in the Town resulting from background traffic volumes (i.e., excluding traffic from developments in the Town but including general traffic growth on the Town's roads that may result from other areas).

3.1 Road Network

The road network considered under the future background traffic conditions is essentially the same as the existing road network, as described in Section 2.3. No planned or potential improvements within or surrounding Collingwood have been accounted for in the modelled road network.

- The Ministry of Transportation of Ontario (MTO) has been assessing the potential need for a Highway 26 bypass around Collingwood for many years. Most recently, the MTO published the Highway 26 Transportation Study Needs Assessment Report (AECOM, 2015), which identified the need for a new four-lane highway around Collingwood (Collingwood Bypass) by 2031 and recommended the initiation of a Route Planning Class EA. The Collingwood Bypass would have the potential to significantly reduce traffic volumes on Highway 26, however, given the uncertainty regarding the status and timing of this new route, it has been assumed that the Bypass will not be implemented within the 2031 or 2041 horizon periods in this study.

3.2 Background Traffic Growth Rate

Historical Annual Average Daily Traffic (AADT) data on Highway 26, immediately west of the boundary between the Town of Collingwood and the Town of The Blue Mountains (i.e., west of Grey Road 21), was reviewed to estimate historical traffic growth on the corridor. Between 2000 and 2016, the AADT on Highway 26 between Grey Road 21 and Grey Road 19 increased by approximately 9.43%, or an average of 0.57% per annum.

As indicated previously, the population of the Town grew by approximately 13.3% between 2011 and 2016 (Statistics Canada). This represents an average annual growth rate of approximately 2.53%.

In the *Growth Plan for the Greater Golden Horseshoe* (Government of Ontario, May 2017), Collingwood has a population allocation of 33,400 for horizon year 2031. The population of the Town in 2016 was 21,793 (Statistics Canada). Therefore, this represents a projected annual increase in population of 2.89% per annum.

Based on the above, an overall population growth rate in the Town in the neighbourhood of 2.5% to 3.0% per annum appears to be reasonable to apply for future traffic projections. However, traffic to be generated by individual developments in the Town will be included in the total traffic scenarios, whereas the Background Traffic scenarios will consider only general traffic volume growth in the Town that results from increases in traffic which are not generated by developments in the Town. In other words, the Background Traffic scenarios in this study will review the traffic impacts resulting from growth in traffic due to developments occurring outside of the Town (e.g., in adjacent municipalities such as The Blue Mountains, Stayner, and Wasaga Beach) as well as existing local traffic growth in the Town (i.e., residents and children of existing residential properties in the Town who will begin driving prior to or during horizon year 2031 or 2041).

The *2012 Transportation Study* estimated that about 25% of the traffic on the major routes in Collingwood can be considered as through traffic (based on the *Highway 26 Transportation Study – Summer Origin-Destination Survey Results* prepared by Paradigm Transportation Solutions Ltd. in June 2010) and that it could be assumed that such through traffic will grow at 2% per annum. Therefore, to capture external and existing local traffic growth in the Town, a 0.5% annual growth rate (compounded) has been applied to the entire road network (i.e., $2\% \times 25\%$). For context, this translates into overall background traffic growth rates for each individual movement of approximately 6.2% and 11.6% from 2019 to horizon years 2031 and 2041, respectively.

3.3 Background Traffic Volumes

Background traffic volumes have been calculated through the application of the 0.5% traffic growth rate to all existing traffic volumes (up to horizon years 2031 and 2041). The background traffic volumes in horizon years 2031 and 2041 are illustrated in Figure 6 and Figure 7, respectively.

Figure 6: 2031 Background Traffic Volumes

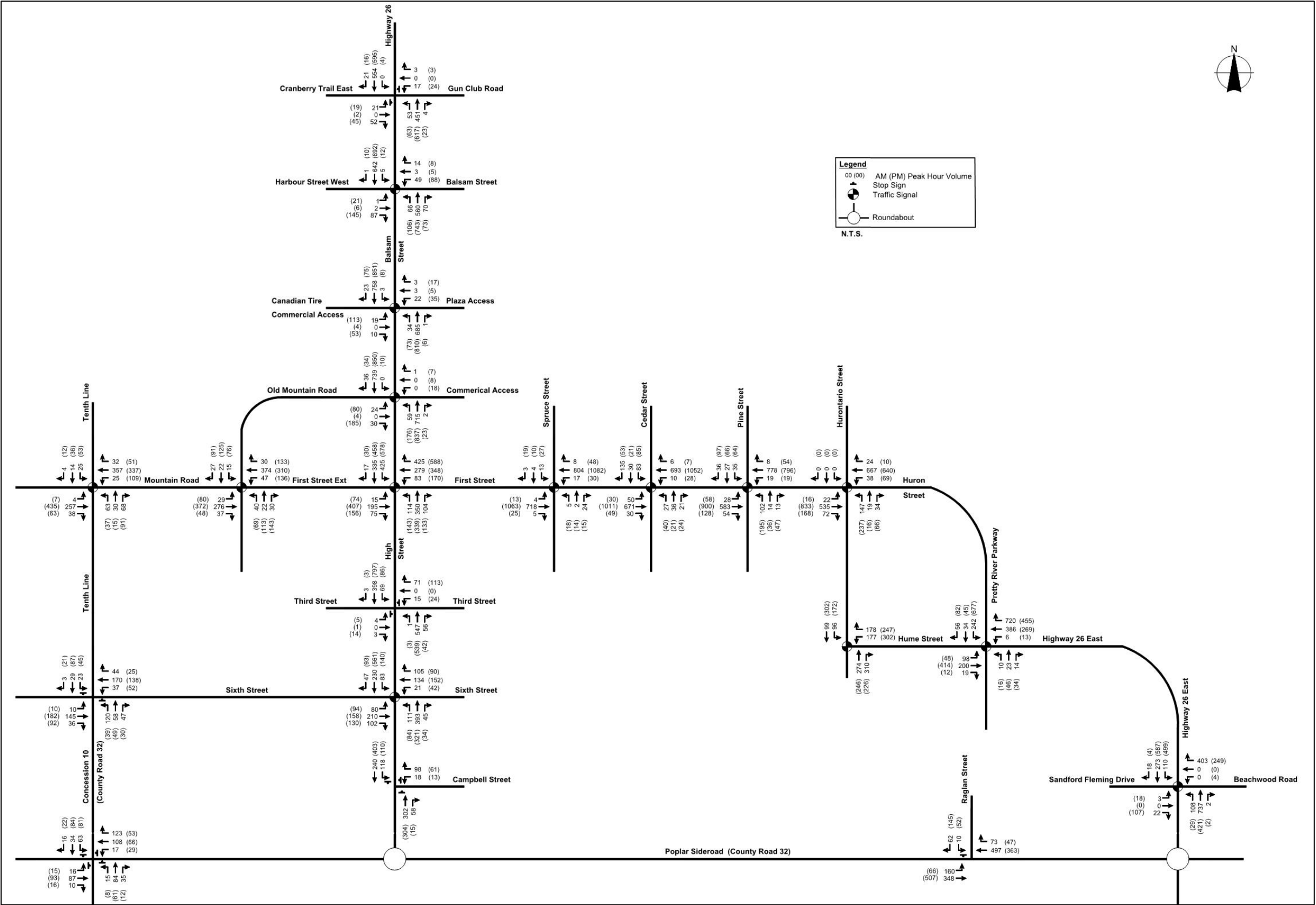
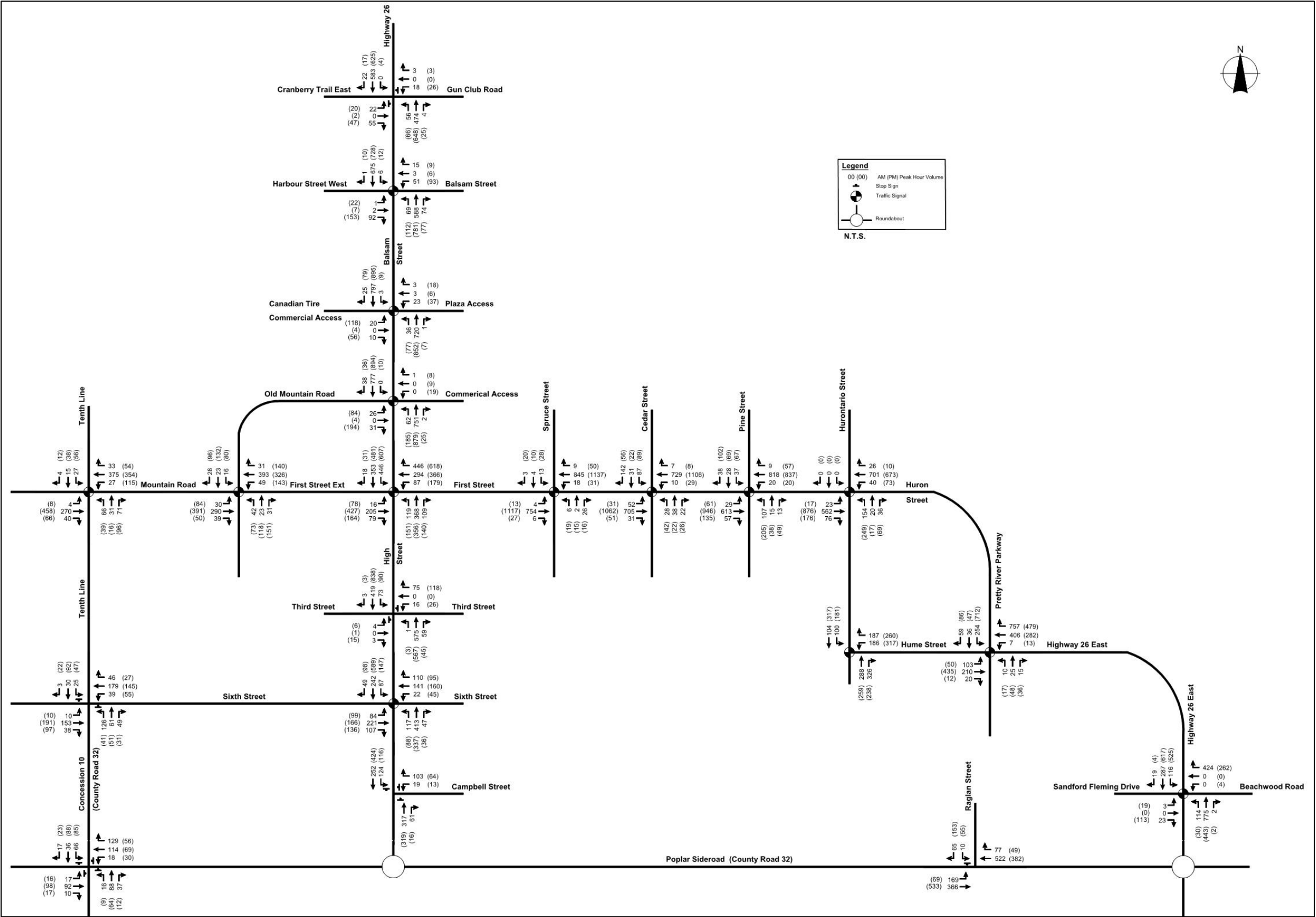


Figure 7: 2041 Background Traffic Volumes



4.0 Background Traffic Operations

This section reviews background traffic operations in the Study Area in horizon years 2031 and 2041. Background traffic volumes in each horizon year consist of a 0.5% compound annual growth rate applied to the existing traffic volumes shown in Figure 4.

4.1 2031 Background Traffic Operations

4.1.1 Intersection Operations

Forecasted background traffic volumes at intersections in the Study Area in horizon year 2031 were analyzed using Synchro software, based on the traffic volumes shown in Figure 6 and the lane configurations and traffic controls shown in Figure 3. The signal timings at the Highway 26 East/Pretty River Parkway intersection were optimized, however the applied signal timings at all other intersections in the Study Area remained the same as in existing conditions.

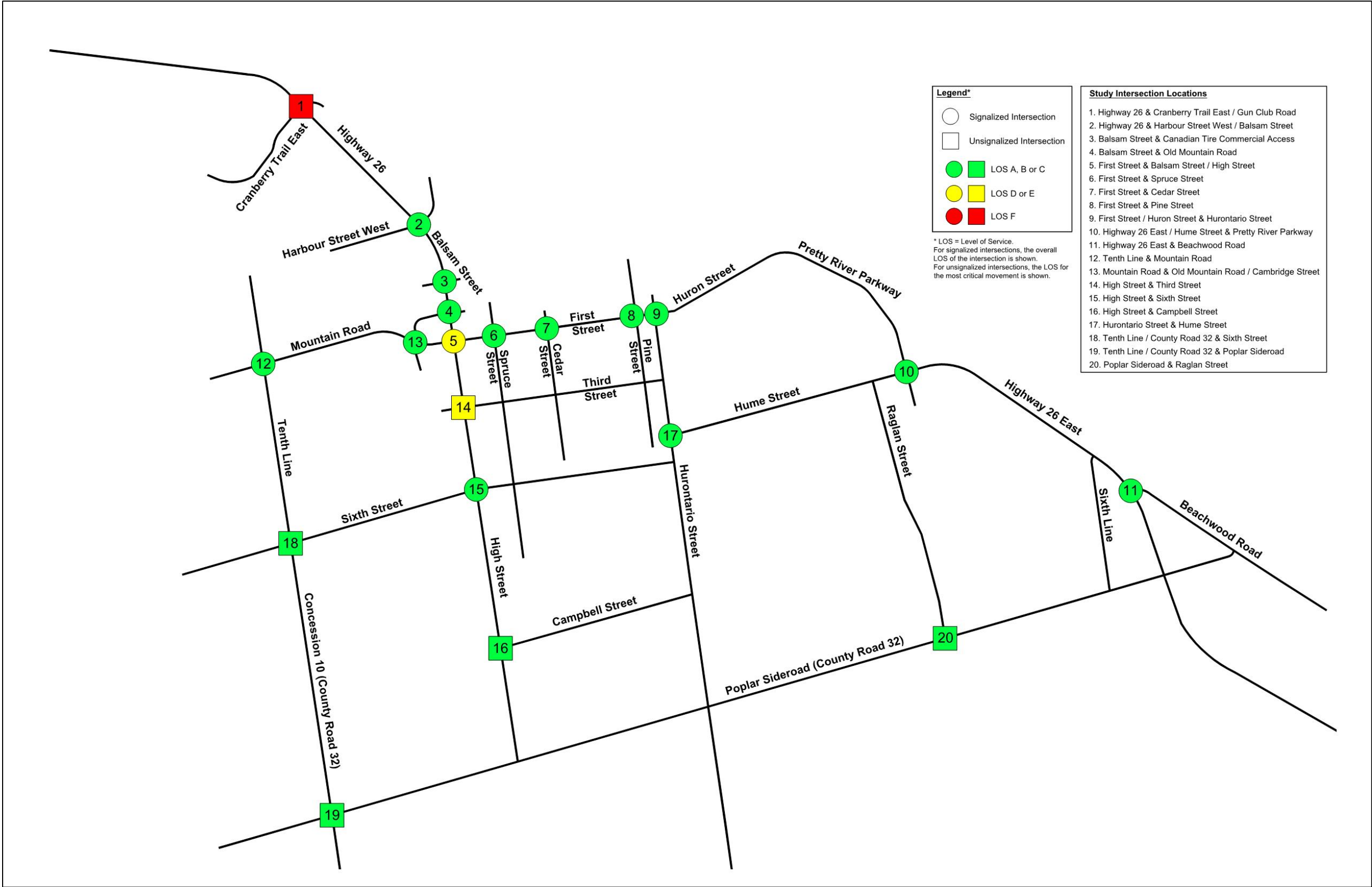
The 2031 background traffic operations are summarized in Table 9 and Table 10 for signalized and unsignalized intersections in the Study Area, respectively and also illustrated in Figure 8. Detailed Synchro reports for the 2031 background traffic conditions are provided in Appendix C.

Table 9: 2031 Background Signalized Intersection Operations

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		Delay (s)	LOS	v/c ratio	Delay (s)	LOS	v/c ratio
Balsam Street/Harbour Street W & Highway 26	Overall	10	A	0.41	12	B	0.51
Balsam Street & CT Entrance/Plaza Access	Overall	6	A	0.37	11	B	0.47
Balsam Street & Old Mountain Road/Commercial Access	Overall	6	A	0.40	11	B	0.47
First Street & Balsam Street/High Street	Overall	32	C	0.63	37	D	0.74
First Street & Spruce Street	Overall	5	A	0.34	8	A	0.42
First Street & Cedar Street	Overall	12	B	0.37	10	A	0.46
First Street & Pine Street	Overall	13	B	0.45	18	B	0.62
First Street/Huron Street & Hurontario Street	Overall	10	A	0.40	12	B	0.53
Hume Street/Highway 26 E & Pretty River Parkway ¹	Overall	17	B	0.53	24	C	0.59
Highway 26 E & Beachwood Road/Sandford Fleming Drive	Overall	17	B	0.58	14	B	0.76
	SBL	9	A	0.37	18	B	0.86
Tenth Line & Mountain Road	Overall	10	B	0.48	10	B	0.55
Mountain Road & Old Mountain Road/Cambridge Street	Overall	13	B	0.38	21	C	0.46
High Street & Sixth Street	Overall	19	B	0.51	17	B	0.49
Hurontario Street & Hume Street	Overall	16	B	0.42	17	B	0.48

1. Signal timings improved in both the AM and PM peak hour scenarios.

Figure 8: 2031 Background Conditions Level of Service



Road	Location	Lanes per Direction	Capacity (vph)	Traffic Volumes		Volume to Capacity (v/c)	
			NB/EB	NB/EB	SB/WB	NB/EB	SB/WB
Cambridge Street	S of Mountain Road	1	500	325	309	0.65	0.62
	W of High Street	1	500	20	6	0.04	0.01
Third Street	E of High Street	1	700	129	137	0.18	0.20
Sixth Street	E of High Street	1	700	332	284	0.47	0.41
	W of High Street	1	900	382	329	0.42	0.37
Campbell Street	E of High Street	1	500	125	74	0.25	0.15

As shown in Table 11, all road segments reviewed are operating at less than 86% of the assumed road capacity. Therefore, the number of lanes on the road segments outlined in Table 11 are operationally acceptable under 2031 background traffic conditions, from a link capacity perspective, under these traffic conditions.

4.2 2041 Background Traffic Operations

4.2.1 Intersection Operations

Forecast background traffic volumes at intersections in the Study Area in horizon year 2041 were analyzed using Synchro software, based on the traffic volumes shown in Figure 7 and the existing lane configurations and traffic controls shown in Figure 3. The signal timings at the Highway 26 East/Pretty River Parkway intersection were optimized, however the applied signal timings at all other intersections in the Study Area remained the same as in existing conditions.

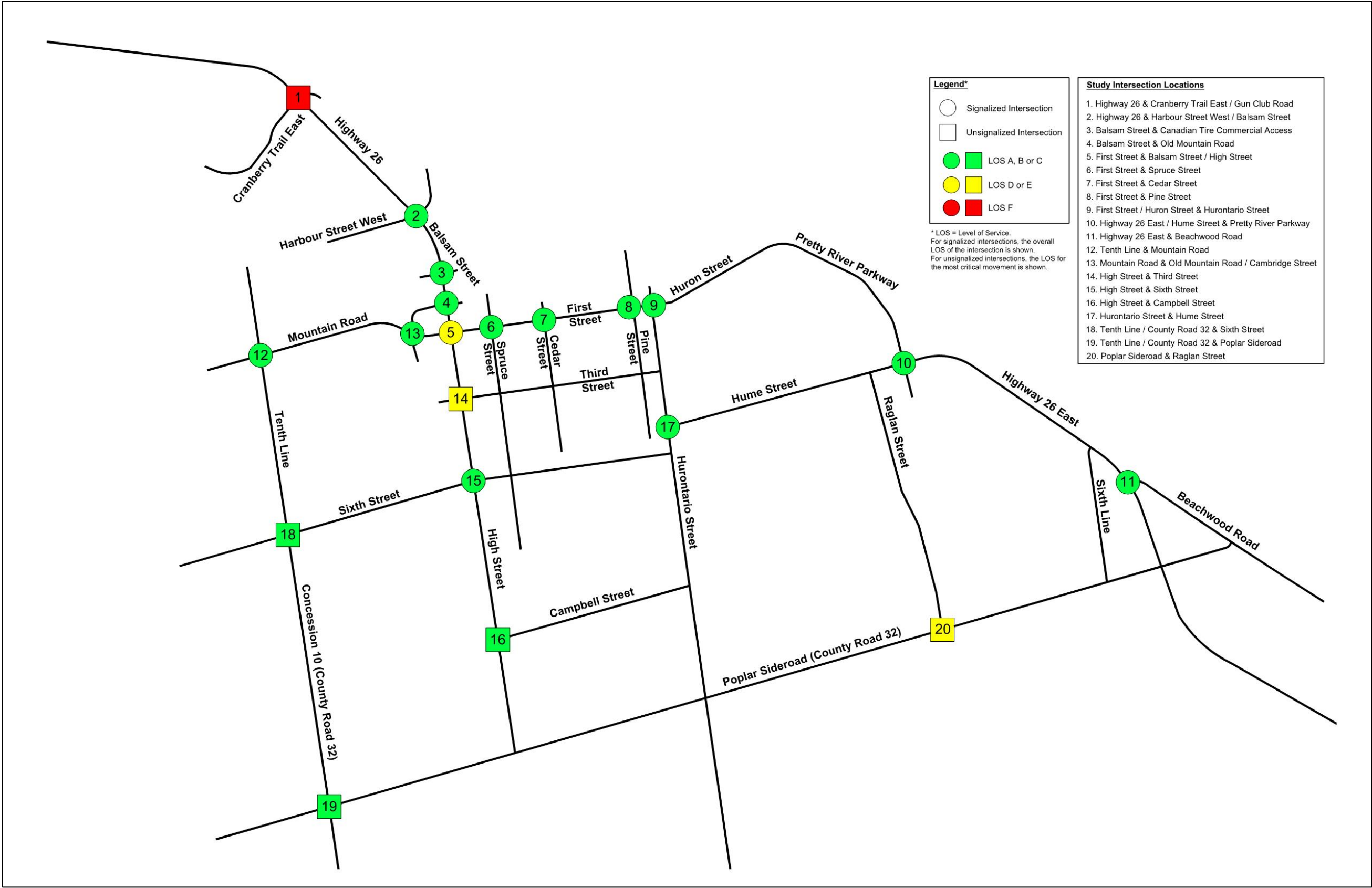
The 2041 background traffic operations are summarized in Table 12 and Table 13 for signalized and unsignalized intersections in the Study Area, respectively, and also illustrated in Figure 9. Detailed Synchro reports for the 2041 background traffic conditions are provided in Appendix D.

Table 12: 2041 Background Signalized Intersection Operations

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		Delay (s)	LOS	v/c ratio	Delay (s)	LOS	v/c ratio
Balsam Street/Harbour Street W & Highway 26	Overall	10	A	0.44	13	B	0.55
Balsam Street & CT Entrance/Plaza Access	Overall	6	A	0.39	12	B	0.50
Balsam Street & Old Mountain Road/Commercial Access	Overall	6	A	0.42	12	B	0.49
First Street & Balsam Street/High Street	Overall	34	C	0.67	39	D	0.79
	SBL	41	D	0.75	55	E	0.87
	SBLTR	38	D	0.75	46	D	0.86
First Street & Spruce Street	Overall	5	A	0.35	8	A	0.44
First Street & Cedar Street	Overall	12	B	0.39	10	B	0.48
First Street & Pine Street	Overall	13	B	0.47	18	B	0.66
First Street/Huron Street & Huronario Street	Overall	10	B	0.42	12	B	0.56
Hume Street/Highway 26 E & Pretty River Parkway ¹	Overall	18	B	0.57	27	C	0.62
Highway 26 E & Beachwood Road/Sandford Fleming Drive	Overall	18	B	0.62	17	B	0.82
	SBL	10	A	0.41	27	C	0.92
Tenth Line & Mountain Road	Overall	11	B	0.50	11	B	0.59
Mountain Road & Old Mountain Road/Cambridge Street	Overall	13	B	0.40	22	C	0.49
High Street & Sixth Street	Overall	20	C	0.53	18	B	0.51
Huronario Street & Hume Street	Overall	16	B	0.44	17	B	0.51

1. Signal timings improved in both the AM and PM peak hour scenarios.

Figure 9: 2041 Background Conditions Level of Service



5.0 Town of Collingwood Future Developments

5.1 Proposed Development Details

To more precisely estimate traffic growth in specific locations in the Town, the type, size, location, status, and phasing of various developments have been considered. A map of the future development locations, prepared by Cole Engineering, is illustrated in Figure 10.

Developments anticipated to be completed and occupied by horizon years 2031 and 2041 were considered in this study. The assumed percentage occupancy of each development within the 2031 and 2041 time periods was estimated by Burnside based on the most recent information available and confirmed by Town staff. Details on all developments considered in the traffic volume projections and analysis in this study, including the assumed percentage occupancy and corresponding numerical identifiers in relation to the map in Figure 10, have been summarized in Table 15 and Table 16 for horizon years 2031 and 2041, respectively.

Figure 10: Town of Collingwood Future Development Map (Cole Engineering)

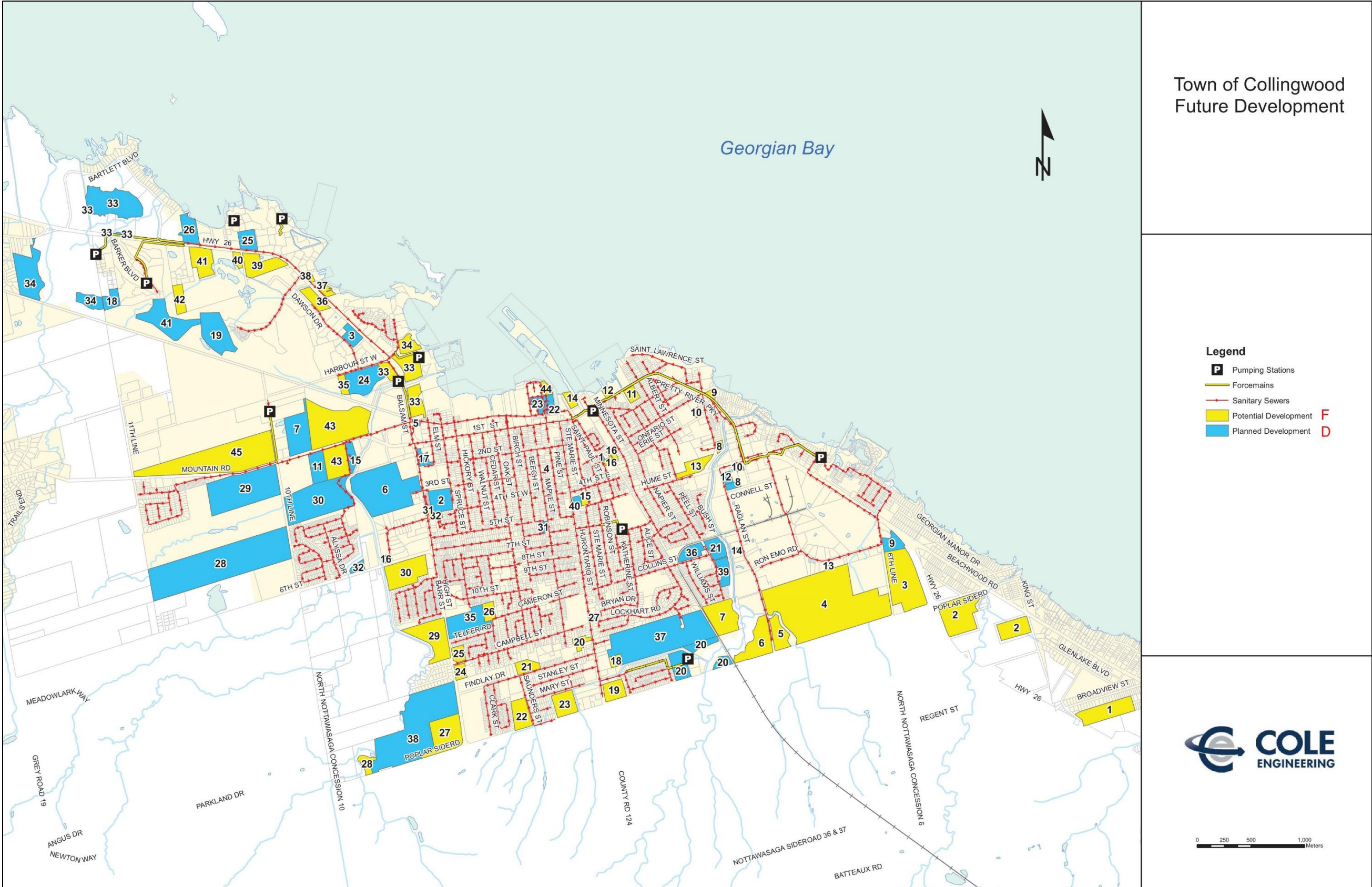


Table 15: Town of Collingwood Medium-Term Developments (Horizon Year 2031)

ID	Name	Land Use	Area (HA)	Number of Residential Units	ICI Development	Estimated Residential Population	Estimated Occupancy 2018	Forecasted Occupancy 2031	Forecasted Occupancy 2041
7F	King (452 Raglan)	Residential	7.44	57 - singles, 205 townhouses		657		100%	
11F	Parkridge	Office	1.40		40,000 sq.ft. commercial			100%	
14F	Duncap Waterfront Hotel	Residential and Hotel	1.15	80 apartments	40 hotel rooms	152		100%	
20F	Blackmoor Gate Property	Residential	1.35	34 - singles and semis		99		100%	
30F	580 Sixth Street and adjacent property	Residential	8.42	114 - townhouses, 128 apartments		517		50%	100%
39F	Silvercreek Development	Residential	5.57	267 apartments		507		100%	
43F	Mountain Street Industrial Property	Commercial / Industrial	24.16		9,097 sq.m. commercial / industrial			100%	
44F	Huronic Village	Residential		13 - townhouses		31		100%	
45F-A	Panorama North	Residential	20.10	122 - singles, 580 - townhouses, 219 - apartments		2162		50%	100%
1D	Ambulance Station	Community Services	0.15					100%	
2D	Mountainview Public School	Community Services	4.11					100%	
3D	Cranberry Inn extension	Commercial	2.20					100%	
4D	Third Street	Commercial	0.06					100%	
5D	10 Balsam Commercial Plaza	Commercial	0.40					100%	
6D	Regional Commercial District	Commercial	21.07					100%	
7D	Van Dolder's	Industrial	8.09		12,806 sq.m commercial / industrial		20%	100%	
8D	Ace Cabs	Industrial	0.78					100%	
9D	BMC Automotive	Industrial	2.50					100%	
10D	Collingwood Service Station	Industrial	0.38					100%	
11D	Georgian Bay Biomed	Industrial	4.00		8,700 sq.m. marijuana grow-op			100%	
12D	Dunn Hotel	Industrial	0.88					100%	
13D	Isowater	Industrial	0.41					100%	
14D	360 Raglan	Industrial	0.40					100%	
15D	100 Mountain Road	Commercial / Industrial	2.12		1,784 sq.m. commercial / industrial			100%	
16D	Stewart Road Reservoir	Other	0.50					100%	
17D	Affordable Housing Project	Residential	1.32	147 - apartments		279		100%	
18D	Silver Glen	Residential	2.27	50 - townhouses		120		100%	
19D	Blue Fairways	Residential	8.49	262 - townhouses		629	80%	100%	
20D	Pretty River Estates Phase 2	Residential	7.19	21 - singles and semis, 152 - townhouses		426		100%	
21D	Riverside Midrise	Residential	2.85	156 - townhouses		374		100%	
22D	Shipyards Condo E	Residential	1.48	28 - townhouses		67		100%	
23D	Mackinaw Village	Residential	1.21	28 - townhouses		67	15%	100%	
24D	Balmoral	Residential and Commercial	6.95	54 - semis, 199 townhouses	2,800 sq.m.	624	50%	100%	
28D	Linksvew	Residential and School	40.68	439 - singles, 8 - townhouses, 190 - apartments	School	1653		80%	100%
29D	Mair Mills Village	Residential	19.70	127 - singles, 192 - apartments	1,130 sq.m. commercial	733		100%	
30D	Red Maple (Consar Development)	Residential	17.89	131 - singles and semis, 147 - townhouses		733		100%	
33D	The Preserve at Georgian Bay (Bridgewater)	Residential	37.16	539 - townhouses, 116 - apartments		1514		100%	
36D	Riverside Townhomes	Residential	2.54	57 - townhouses		137		100%	
37D	Eden Oak McNabb	Residential	27.00	256 - singles and semis, 120 - townhouses		1,030		100%	
38D	Summitview Phases 1 and 2	Residential	31.58	233 - singles and semis, 173 - townhouses		1,091		100%	
39D	Harmony Living	Residential	2.45	80 - townhouses		192		100%	
40D	Monaco	Residential and Commercial	0.76	260 - condo apartments	2,600 sq.m.	494		100%	
42D	Mountaincroft Residential (Final Phase)	Residential		69 singles		200		100%	
43D	410 Raglan Street	Industrial	2.21		6,689 sq.m. warehouse			100%	
*	Windfall Medium Density	Residential		242 condo units				100%	
*	Windfall	Residential		571 - singles and townhouse units				100%	
*	Second Nature	Residential		236 - singles and townhouse units				100%	
*	Nederand Development	Residential		121 - singles				100%	

* Known Town of The Blue Mountains developments in close proximity to Collingwood that were specifically considered in the traffic projections and analysis in this study.

Table 16: Town of Collingwood Long-Term Developments (Horizon Year 2041)

ID	Name	Land Use	Area (HA)	Number of Residential Units	ICI Development	Estimated Residential Population	Estimated Occupancy 2018	Forecasted Occupancy 2031	Forecasted Occupancy 2041
1F	Braeside	Residential	7.26	15 - singles		44		0%	100%
2F	Batteaux Creek Subdivision (Beachwood Estates)	Residential	15.28	20 - singles		58		0%	100%
3F	2906 Sixth Street and 7026 Poplar Sideroad	Industrial	14.99					0%	100%
4F	Eden Oaks Industrial	Industrial	50.73					0%	100%
6F	Poplar and Raglan	Industrial	7.29					0%	100%
8F	Memory Care Facility	Hospital	0.61			72		0%	100%
9F	500 Ontario Street	Residential	0.64	60 - townhouses		144		0%	100%
10F	Legion Redevelopment	Residential	0.44			70		0%	100%
12F	Courthouse	Residential	0.57	68 - townhouses		163		0%	100%
13F	Hospital	Hospital	3.00					0%	100%
15F	282 Ste. Marie Street	Residential and Commercial	0.48	69 - condominiums	929 sq.m commercial	168		0%	100%
16F	Reinhart Warehouse	Residential	1.19	23 - singles and semis		67		0%	100%
18F	Church Severance	Residential	1.16	44 - singles and semis		128		0%	100%
19F	Poplar and Hurontario	Highway Commercial	3.26					0%	100%
21F	Findlay Property	Residential	2.20	22 - singles and semis		64		0%	100%
22F	50 Saunders Drive	Residential	4.17	74 - singles and semis		215		0%	100%
23F	Old Organic Farm	Residential	4.32	76 - singles and semis		221		0%	100%
24F	Collingwood Nursing Home	Residential	1.41	47 - singles and semis		136		0%	100%
25F	197 Campbell Street	Residential	1.62	32 - singles and semis		93		0%	100%
26F	Property adjacent to Helen Court Homes	Residential	1.84	59 - singles and semis		171		0%	100%
27F	Northwest corner of Poplar and High Street (Summitview Phase 3)	Residential	8.94	340 - singles and semis		986		0%	100%
28F	8070 Poplar Sideroad	Residential	1.56	30 - singles and semis		87		0%	100%
29F	Fumo property located on the west side of High Street	Residential	8.86	300 - singles and semis		870		0%	100%
31F	115 High Street	Residential	0.21	15 - townhouses		36		0%	100%
32F	121 High Street	Residential	0.75	6 - townhouses		15		0%	100%
33F	Commercial / hotel development	Commercial	9.63						
34F	Living Waters	Hotel	2.34	253 - hotel units (apartments)		481		0%	100%
35F	16 Harbour Street or Law property	Residential	1.18	23 - singles and semis		67		0%	100%
36F	Dawson Drive East property	Residential	2.46	48 - singles and semis		139		0%	100%
37F	White Street property	Residential	1.02	20 - singles and semis		58		0%	100%
38F	#38F - Gunn Club Road	Residential	0.49	10 - singles and semis		29		0%	100%
40F	Griffith's property	Residential	1.02	30 - singles and semis		87		0%	100%
41F	Greentree property	Residential	4.93	88 - singles and semis		255		0%	100%
42F	Georgian Manor Resorts	Residential	2.49	150 apartments		285		0%	100%
45F-B	Remainder of Mair Mills North	Residential	7.00	Assume same density as Panorama North development		750		0%	50%
25D	Harhay	Residential	2.81	154 - townhouses		370		0%	100%
27D	655 Hurontario Street Apartments	Residential	0.42	32 - apartments		77		0%	100%
31D	Victoria Annex	Residential	0.60	19 - townhouses		46		0%	100%
32D	Georgian Meadows	Residential	1.01	25 - townhouses		60		0%	100%
34D	Huntingwood	Residential	11.82	92 - singles and semis, 62 - townhouses		416		0%	100%
35D	Helen Court Homes	Residential	7.56	66 - singles and semis, 189 - townhouses		645		0%	100%
41D	Cranberry	Residential	9.14	314 - townhouses		754		0%	100%

5.2 Development Traffic Generation

The Town provided numerous transportation impact study (TIS) reports for various proposed developments. Where available, Burnside applied traffic generation and distribution projections from available reports in the total traffic scenarios in this study. Where TIS reports were not available, the size (for industrial, commercial, and institutional developments) or number of units (for residential developments) were used, in conjunction with trip rate information contained in the *Trip Generation Manual 10th Edition* (Institute of Transportation Engineers [ITE], September 2017), in order to estimate the volume of vehicles travelling to/from each development during the AM and PM peak hours. Estimated trip generation volumes for each development were distributed based on existing travel patterns and origin/destination considerations.

Table 17 below provides a summary of the trip generation volumes applied for each development, in addition to the source of the trip generation estimates (i.e., either from TIS reports received from the Town or ITE trip generation rates) and the percentage of the development traffic applied in the 2031 and/or 2041 total traffic scenarios. The total development traffic volumes that were applied in the 2031 and 2041 total traffic scenarios are summarized at the bottom of Table 17.

Table 17: Proposed Development Trip Generations Estimates

Map ID	Development Name	TIS or ITE	AM Peak Hour			PM Peak Hour			Assumed Occupancy	
			In	Out	Tot.	In	Out	Tot.	2031	2041
7F	King (452 Raglan)	TIS	33	106	139	108	63	171	100%	
11F	Parkridge	TIS	80	10	90	14	82	96	100%	
14F	Duncap Waterfront Hotel	ITE	19	29	48	34	26	60	100%	
20F	Blackmoor Gate Property	TIS	9	26	35	25	14	39	100%	
30F	580 Sixth Street and adjacent property	TIS	37	115	152	114	70	184	50%	100%
39F	Silvercreek Development	ITE	25	71	96	71	46	117	100%	
43F	Mountain Street Industrial Property	ITE	45	21	66	94	113	207	100%	
44F	Huronic Village	ITE	2	5	7	6	4	10	100%	
45F-A	Panorama North	TIS	144	453	597	431	286	717	50%	100%
2D	Mountainview Public School	ITE	36	31	67	8	9	17	100%	
3D	Cranberry Inn extension	ITE	5	4	9	6	6	12	100%	
6D	Regional Commercial District	TIS	213	130	343	685	742	1427	100%	
7D	Van Dolder's	TIS	97	15	112	16	102	119	100%	
8D	Ace Cabs	TIS	163	77	240	98	165	263	100%	
10D	Collingwood Service Station									
12D	Dunn Hotel									
9D	BMC Automotive	ITE	57	12	69	17	62	79	100%	
11D	Georgian Bay Biomed	TIS	23	13	36	14	24	38	100%	
13D	Isowater	ITE	14	3	17	5	17	22	100%	
14D	360 Raglan	ITE	14	3	17	4	17	21	100%	
15D	100 Mountain Road	ITE	9	4	13	19	22	41	100%	
17D	Affordable Housing Project	TIS	31	34	65	37	40	77	100%	

Collingwood Transportation Study Update
August 2019

Map ID	Development Name	TIS or ITE	AM Peak Hour			PM Peak Hour			Assumed Occupancy	
			In	Out	Tot.	In	Out	Tot.	2031	2041
18D	Silver Glen	ITE	6	19	25	20	12	32	100%	
19D	Blue Fairways	ITE	28	93	121	93	54	147	100%	
20D	Pretty River Estates Phase 2	ITE	18	62	80	61	36	97	100%	
21D	Riverside Midrise	TIS	12	35	47	37	24	61	100%	
22D	Shipyards Condo E	ITE	3	11	14	12	7	19	100%	
23D	Mackinaw Village	ITE	3	11	14	12	7	19	100%	
24D	Balmoral	TIS	78	147	225	151	118	269	100%	
28D	Linksvie	TIS	104	391	495	404	217	621	80%	100%
29D	Mair Mills Village	TIS	40	144	184	150	84	234	100%	
30D	Red Maple (Consar Development)	TIS	37	130	167	137	75	212	100%	
33D	The Preserve at Georgian Bay (Bridgewater)	TIS	64	212	276	198	118	316	100%	
36D	Riverside Townhomes	ITE	6	22	28	23	13	36	100%	
37D	Eden Oak McNabb	TIS	68	208	276	218	133	351	100%	
38D	Summitview Phases 1 and 2	TIS	67	201	268	216	132	348	100%	
39D	Hamony Living	ITE	9	30	39	30	18	48	100%	
40D	Monaco	TIS	30	70	100	75	65	140	100%	
42D	Mountaincroft Residential (Final Phase)	TIS	71	209	280	243	135	378	100%	
43D	410 Raglan Street	TIS	26	8	34	10	27	37	100%	
*	Windfall Medium Density	TIS	27	5	32	12	25	37	100%	
*	Windfall	TIS	96	32	128	64	109	173	100%	
*	Second Nature	TIS	27	9	36	18	31	49	100%	
*	Nederand Development	TIS	35	11	46	21	38	59	100%	
1F	Braeside	ITE	4	11	15	10	6	16	0%	100%
2F	Batteaux Creek Subdivision (Beachwood Estates)	ITE	5	14	19	14	8	22	0%	100%
3F	2906 Sixth Street and 7026 Poplar Sideroad	ITE	233	48	281	60	227	287	0%	100%
4F	Eden Oaks Industrial	ITE	603	124	727	145	546	691	0%	100%
6F	Poplar and Raglan	ITE	133	27	160	36	135	171	0%	100%
8F	Memory Care Facility	ITE	6	2	8	2	6	8	0%	100%
9F	500 Ontario Street	ITE	6	16	22	16	11	27	0%	100%
10F	Legion Redevelopment	ITE	3	8	11	9	5	14	0%	100%
12F	Courthouse	ITE	6	18	24	19	12	31	0%	100%
13F	Hospital	ITE	20	7	27	8	20	28	0%	100%
15F	282 Ste. Marie Street	TIS	17	38	55	42	36	78	0%	100%
18F	Church Severance	ITE	9	27	36	29	17	46	0%	100%
19F	Poplar and Hurontario	ITE	43	39	82	49	46	95	0%	100%
21F	Findlay Property	ITE	5	15	20	15	9	24	0%	100%
22F	50 Saunders Drive	ITE	14	43	57	48	28	76	0%	100%
23F	Old Organic Farm	ITE	15	44	59	49	29	78	0%	100%
24F	Collingwood Nursing Home	ITE	10	28	38	31	18	49	0%	100%
25F	197 Campbell Street	ITE	7	21	28	21	13	34	0%	100%
26F	Property adjacent to Helen Court Homes	ITE	12	35	47	38	23	61	0%	100%
27F	Northwest corner of Poplar and High Street (Summitview Phase 3)	ITE	63	189	252	212	125	337	0%	100%
28F	8070 Poplar Sideroad	ITE	7	19	26	20	12	32	0%	100%

Collingwood Transportation Study Update
August 2019

Map ID	Development Name	TIS or ITE	AM Peak Hour			PM Peak Hour			Assumed Occupancy	
			In	Out	Tot.	In	Out	Tot.	2031	2041
29F	Fumo property located on the west side of High Street	ITE	56	166	222	187	110	297	0%	100%
31F	115 High Street	ITE	2	6	8	7	4	11	0%	100%
32F	121 High Street	ITE	1	2	3	3	2	5	0%	100%
33F	Commercial / hotel development	ITE	76	46	122	153	173	326	0%	100%
34F	Living Waters	ITE	71	50	121	62	59	121	0%	100%
35F	16 Harbour Street or Law property	ITE	5	16	21	16	9	25	0%	100%
36F	Dawson Drive East property	ITE	10	29	39	32	18	50	0%	100%
37F	White Street property	ITE	5	14	19	14	8	22	0%	100%
38F	#38F - Gunn Club Road	ITE	3	9	12	7	4	11	0%	100%
40F	Griffith's property	ITE	7	19	26	20	12	32	0%	100%
41F	Greentree property	ITE	17	50	67	57	33	90	0%	100%
42F	Georgian Manor Resorts	ITE	14	40	54	40	26	66	0%	100%
45F-B	Remainder of Mair Mills North	TIS	72	227	299	216	143	359	0%	100%
25D	Harhay	ITE	14	41	55	41	27	68	0%	100%
27D	655 Hurontario Street Apartments	ITE	3	9	12	9	6	15	0%	100%
31D	Victoria Annex	ITE	2	5	7	5	3	8	0%	100%
32D	Georgian Meadows	ITE	3	10	13	11	6	17	0%	100%
34D	Huntingwood	ITE	25	74	99	84	49	133	0%	100%
35D	Helen Court Homes	ITE	33	106	139	110	64	174	0%	100%
41D	Cranberry	ITE	33	111	144	111	65	176	0%	100%
-			AM Peak Hour			PM Peak Hour				
			In	Out	Tot.	In	Out	Tot.		
2031 Total Development Traffic**			1,800	2,861	4,661	3,658	3,167	6,825		
2041 Total Development Traffic**			3,584	5,025	8,609	6,069	5,541	11,610		

* Town of The Blue Mountains developments in close proximity to Collingwood that were specifically considered in the traffic projections and analysis in this study.

** Includes 2031 Total Development Traffic amounts.

As shown in Table 17, planned developments in the Town of Collingwood are forecast to generate a total of 4,661 and 6,825 trips during the 2031 weekday AM and PM peak hours, respectively, assuming the occupancy percentages outlined in Table 17 are realized by horizon year 2031. By horizon year 2041, assuming full occupancy of all developments outlined in Table 17, the total number of trips to be generated are 8,609 and 11,610 trips during the 2041 weekday AM and PM peak hours, respectively.

Note that the turning movement counts (TMCs) conducted in December 2018 have captured traffic from some of the developments outlined in Table 17 that have already been partially built-out and occupied at the time the TMCs were conducted. Any developments that were partially occupied and captured in the December 2018 TMCs were adjusted accordingly for analysis purposes (e.g., if a specific development was 40% occupied in December 2018, then 60% of the traffic volume amounts shown in Table 17 were applied in the total traffic scenarios in this study).

For developments that TIS reports were not available, traffic volumes were distributed amongst the Study Area intersections according to the logical routing of vehicles to/from various locations within and outside of the Town (e.g., Stayner). Traffic volumes were primarily distributed on arterial and collector roads near a proposed development, with some traffic being distributed to local/collector roads not reviewed in this study. In general, traffic volumes were reduced as distances increased between the traffic generator and any particular intersection, due to overall dispersal of traffic throughout the network.

The total development traffic, that was added to the road network in the total traffic scenarios considered later in this study, are illustrated in Figure 11 and Figure 12 for the medium-term (2031) and long-term (2041) horizons, respectively.

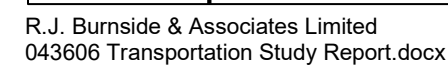
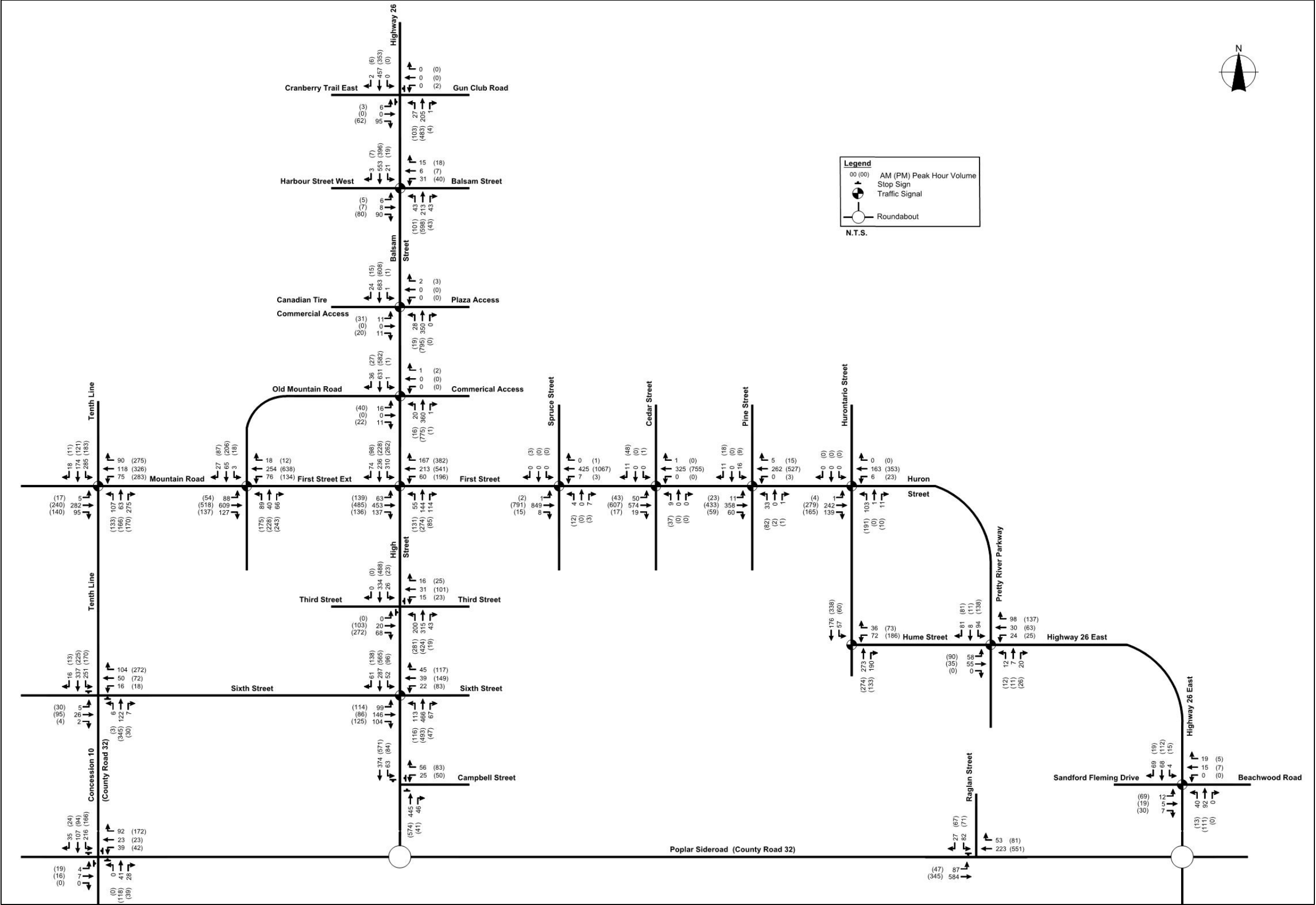


Figure 12: Long-Term (2041) Development Traffic Volumes



6.0 Future Total Traffic Conditions

Future total traffic consists of background traffic volumes plus the addition of the corresponding development traffic that has been forecasted for each horizon year (i.e., 2031 to represent medium term impacts and 2041 to represent long term impacts). This analysis will be used to identify potential road and intersection improvement requirements in the Town resulting from total traffic volumes (i.e., including general traffic growth on the Town's roads in addition to traffic from all identified proposed developments in the Town, as indicated in Figure 10 above).

6.1 Road Network

For the analysis of the future total traffic conditions, there are certain development-related network and intersection improvements that have been assumed to be in place, including the following:

- Tracey Lane will be realigned and connected to Dey Drive and Portland Street via the Eden Oak subdivision (prior to 2031).
- Findlay Drive and Hurontario Street intersection to be signalized after the Eden Oak development is built-out and Tracey Lane is realigned (prior to 2031).
- Findlay Drive will be extended to intersect High Street in 2019.
- Cambridge Street will be extended to the High Street and Third Street intersection. In conjunction with this improvement, the existing traffic signals at the Home Depot Access on High Street will be moved to the new Cambridge Street/Third Street/High Street intersection (prior to 2031).
- Cranberry Trail East and Cranberry Trail West are proposed to be connected, at which point traffic signals will be installed at the Highway 26 and Cranberry Trail East intersection, including the construction of left-turn lanes on the minor street approaches (prior to 2031).

The Town recently completed a Schedule 'C' Municipal Class Environmental Assessment (EA) to review various improvement options on Mountain Road between Cambridge Street and Tenth Line and on Tenth Line between Mountain Road and Sixth Street. Mountain Road currently consists of a two-lane cross section. The Environmental Study Report (ESR) for the *Tenth Line and Mountain Road Improvements Class EA* (Ainley Group, April 2019) recommends that the subject section of Mountain Road be widened to a five-lane cross section (i.e., a centre two-way left-turn lane plus two travel lanes in each direction). The EA considered both signals and roundabout options for the Tenth Line / Mountain Road and Tenth Line / Sixth Street intersections, with roundabouts being the preferred alternative in both cases. The ESR recommends a two-lane roundabout for Tenth Line / Mountain Road and a single lane roundabout for Tenth Line / Sixth Street. These recommended improvements from the EA have not been assumed to be in place in the future road network, but have been analyzed as potential

future improvements. Since this study was substantially completed prior the completion of the EA (i.e. prior to the recommendation for roundabouts), both signalized and roundabout intersection improvements have been considered for the Tenth Line / Mountain Road and Tenth Line / Sixth Street intersections.

6.2 Total Traffic Volumes

The development traffic forecasts in horizon years 2031 and 2041, as outlined in Figure 11 and Figure 12, respectively, are added to the background traffic volumes in 2031 and 2041, as outlined in Figure 6 and Figure 7, respectively, in order to obtain the forecasted total turning movement traffic volumes in 2031 and 2041. The forecasted 2031 and 2041 total traffic volumes are summarized in Figure 13 and Figure 14, respectively.

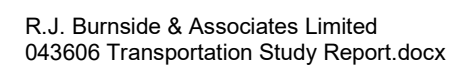
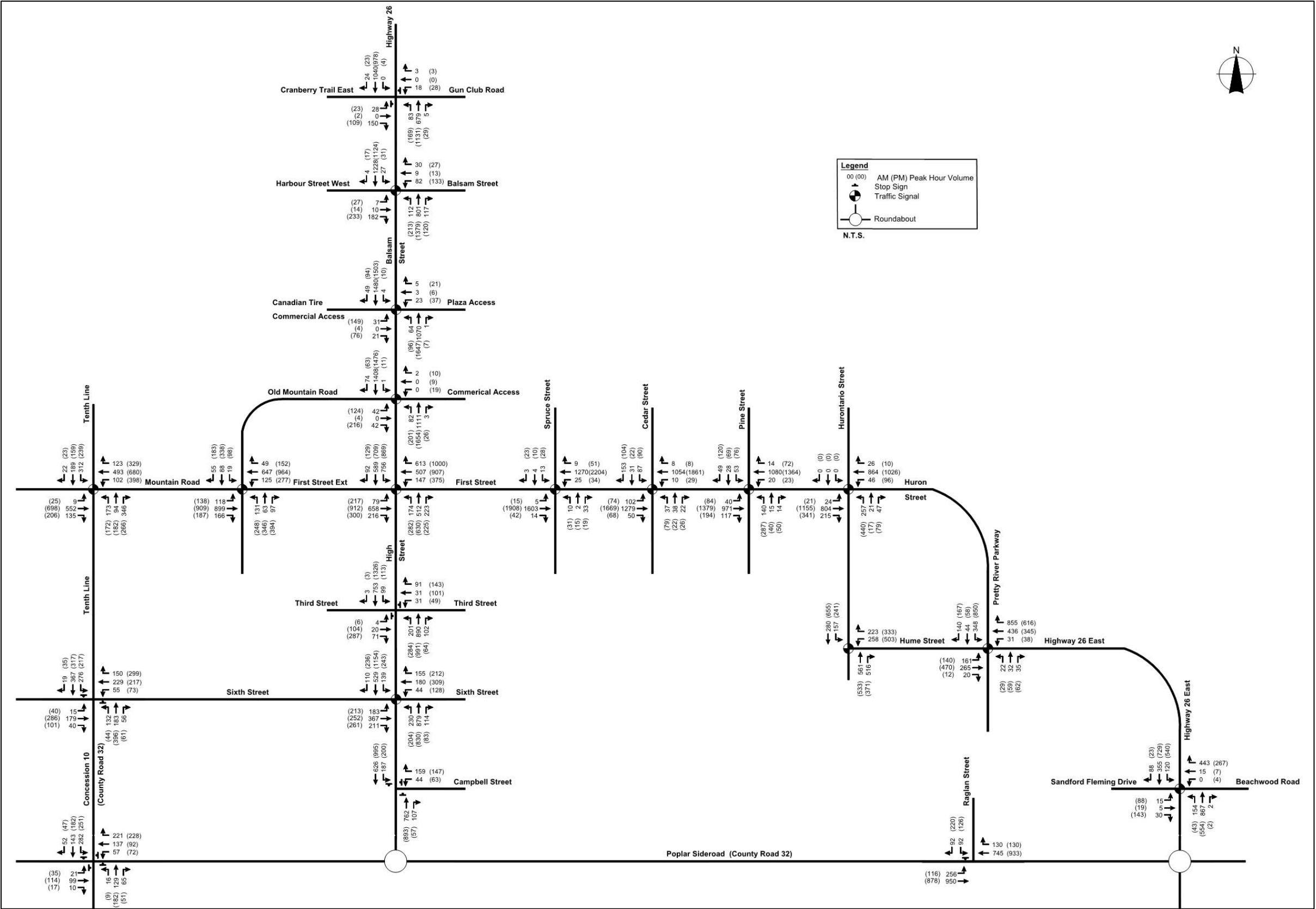


Figure 14: 2041 Total Traffic Volumes



7.0 Total Traffic Operations

This section reviews total traffic operations in the Study Area in horizon years 2031 and 2041. Total traffic volumes in each horizon year consist of the addition of the 2031/2041 development traffic forecasts to the 2031/2041 background traffic volumes.

7.1 2031 Total Traffic Operations

7.1.1 Intersection Operations

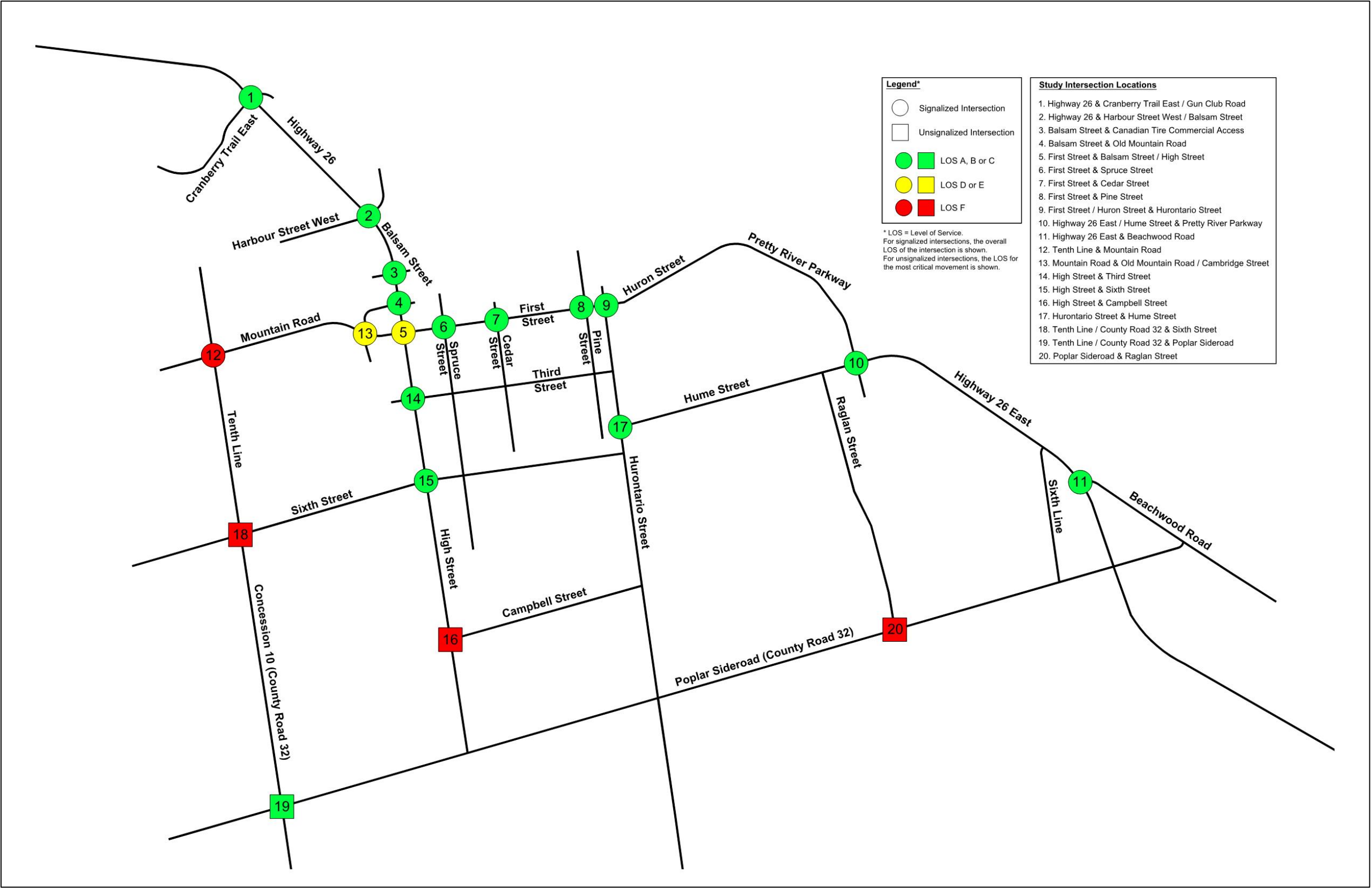
Forecasted total traffic volumes at intersections in the Study Area in horizon year 2031 were analyzed using Synchro software, based on the traffic volumes shown in Figure 13. Optimized signal timings were applied at the signalized intersections in the Study Area to ensure that traffic operations were optimized.

The 2031 total traffic operations are summarized in Table 18 and Table 19 for signalized and unsignalized intersections in the Study Area, respectively, and also displayed in Figure 15. Detailed Synchro reports for the 2031 total traffic conditions are provided in Appendix E.

Table 18: 2031 Total Signalized Intersection Operations

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		Delay (s)	LOS	v/c ratio	Delay (s)	LOS	v/c ratio
Highway 26 & Cranberry Trail E/Gun Club Road	Overall	10	B	0.65	9	A	0.62
Balsam Street/Harbour Street W & Highway 26	Overall	13	B	0.58	17	B	0.82
Balsam Street & CT Entrance/Plaza Access	Overall	8	A	0.53	12	B	0.58
Balsam Street & Old Mountain Road/Commercial Access	Overall	8	A	0.55	13	B	0.61
First Street & Balsam Street/High Street	Overall	53	D	0.92	80	E	1.12
	EBTR	57	E	0.91	104	F	1.09
	WBL	46	D	0.74	137	F	1.14
	NBTR	68	E	0.94	107	F	1.05
	SBL	74	E	0.96	109	F	1.06
	SBLTR	64	E	0.96	87	F	1.03
First Street & Spruce Street	Overall	6	A	0.49	10	A	0.64
First Street & Cedar Street	Overall	11	B	0.51	11	B	0.64
First Street & Pine Street	Overall	13	B	0.54	22	C	0.85
First Street/Huron Street & Hurontario Street	Overall	13	B	0.54	17	B	0.77
	NBL	49	D	0.78	56	E	0.89
Hume Street/Highway 26 E & Pretty River Parkway	Overall	22	C	0.66	27	C	0.70
Highway 26 E & Beachwood Road/Sandford Fleming Drive	Overall	18	B	0.64	18	B	0.84
	SBL	10	A	0.42	32	C	0.94
Tenth Line & Mountain Road	Overall	69	E	1.07	256	F	1.77
	WBLTR	47	D	0.98	386	F	1.80
	NBLTR	145	F	1.22	355	F	1.65
	SBLTR	79	E	0.99	262	F	1.41
Mountain Road & Old Mountain Road/Cambridge Street	Overall	19	B	0.59	76	E	1.16
	EBTR	21	C	0.63	78	E	1.02
	WBL	14	B	0.40	132	F	1.14
	NBL	26	C	0.48	76	E	0.95
	NBTR	25	C	0.27	72	F	1.12
	SBTR	36	D	0.56	67	E	0.95
High Street & Third Street/Cambridge Street	Overall	11	B	0.37	19	B	0.72
High Street & Sixth Street	Overall	27	C	0.73	31	C	0.89
	EBL	37	D	0.77	79	E	0.96
	EBTR	39	D	0.88	23	C	0.59
	SBTR	23	C	0.49	37	D	0.90
Hurontario Street & Hume Street	Overall	18	B	0.61	20	B	0.69

Figure 15: 2031 Total Conditions Level of Service



local road and may be reclassified as a collector or arterial road in the future, which would increase the roads assumed capacity, if road designs support such classifications. Therefore, the capacity of Old Mountain Road is considered sufficient to accommodate 2031 total traffic volumes.

Cambridge Street (South of Mountain Road)

The v/c ratio on Cambridge Street, south of Mountain Road under 2031 total traffic conditions, is forecasted to be 1.37 and 1.09 in the northbound and southbound directions, respectively, assuming that Cambridge Street is reclassified as a collector road by 2031 and assuming that road designs support such a reclassification.

Localized traffic volumes on Cambridge Street, immediately south of Mountain Road, are forecasted to be significantly higher than the volumes on Cambridge Street immediately west of High Street, due to the location of developments and commercial driveways on Cambridge Street. Given that the v/c ratio on Cambridge Street immediately west of High Street is only 0.45 and 0.48 in the eastbound and westbound directions, respectively, it is probable that volumes may only exceed the assumed capacity near the Mountain Road intersection. A northbound right-turn lane has been recommended under 2031 total traffic conditions at the Mountain Road and Cambridge Street intersection, in addition to the existing northbound through and northbound left-turn lanes, which is considered sufficient to accommodate the increased northbound traffic at this location. Also, a centre TWLTL currently extends along the length of Cambridge Street, further increasing the assumed road capacity. Therefore, the capacity of Cambridge Street is considered sufficient to accommodate 2031 total traffic volumes.

7.2 2041 Total Traffic Operations

7.2.1 Intersection Operations

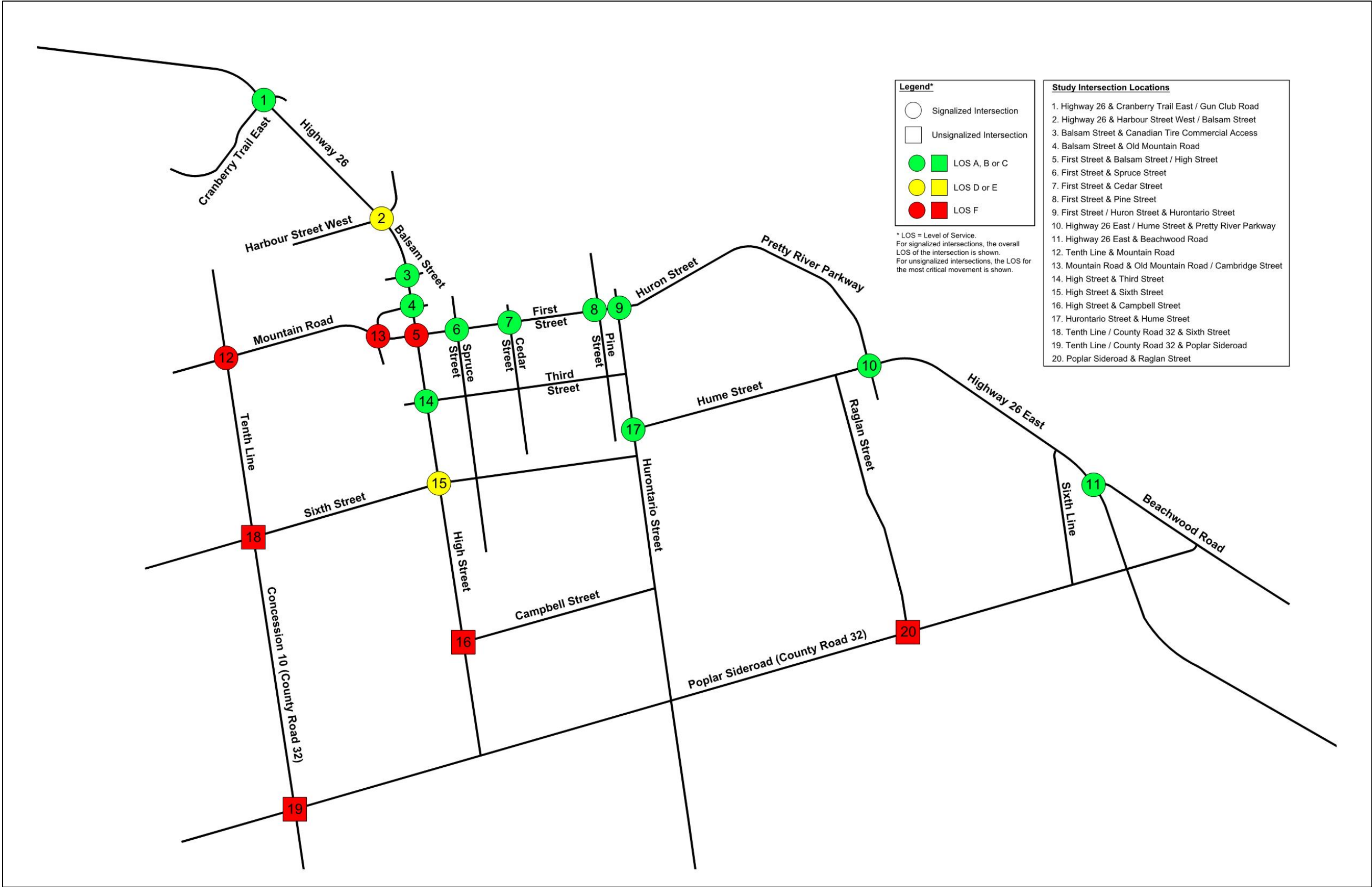
Forecast total traffic volumes at intersections in the Study Area in horizon year 2041 were analyzed using Synchro software, based on the traffic volumes shown in Figure 14. Optimized signal timings were applied at the signalized intersections in the Study Area to ensure that traffic operations were optimized.

The 2041 total traffic operations are summarized in Table 22 and Table 23 for signalized and unsignalized intersections in the Study Area, respectively, and also displayed in Figure 17. Detailed Synchro reports for the 2041 total traffic conditions are provided in Appendix H.

Table 22: 2041 Total Signalized Intersection Operations

Intersection	Movement	Weekday AM Peak Hour			Weekday PM Peak Hour		
		Delay (s)	LOS	v/c ratio	Delay (s)	LOS	v/c ratio
Highway 26 & Cranberry Trail E/Gun Club Road	Overall	19	B	0.85	16	B	0.81
	SBT	25	C	0.93	18	B	0.84
Balsam Street/Harbour Street W & Highway 26	Overall	18	B	0.80	52	D	1.14
	EBTR	143	F	1.00	56	E	1.00
	WBL	135	F	1.03	135	F	1.03
	NBLT	63	E	1.08	63	E	1.08
Balsam Street & CT Entrance/Plaza Access	Overall	11	B	0.74	19	B	0.79
	SBTR	12	B	0.81	20	C	0.86
Balsam Street & Old Mountain Road/Commercial Access	Overall	11	B	0.75	19	B	0.83
	SBTR	15	B	0.81	23	C	0.88
First Street & Balsam Street/High Street	Overall	119	F	1.20	174	F	1.47
	EBL	34	C	0.46	121	F	1.08
	EBTR	137	F	1.17	218	F	1.36
	WBL	156	F	1.14	295	F	1.53
	WBT	46	D	0.68	55	E	0.90
	WBR	31	C	0.83	114	F	1.16
	NBL	49	D	0.58	79	E	0.90
	NBTR	175	F	1.25	229	F	1.37
	SBL	162	F	1.22	226	F	1.36
	SBLTR	149	F	1.21	201	F	1.32
First Street & Spruce Street	Overall	8	A	0.65	14	B	0.81
	WBTR	5	A	0.55	14	B	0.88
First Street & Cedar Street	Overall	13	B	0.62	14	B	0.77
First Street & Pine Street	Overall	13	B	0.61	27	C	0.96
	EBTR	9	A	0.63	20	C	0.93
	WBTR	10	B	0.64	23	C	0.89
	NBL	41	D	0.60	34	C	0.94
First Street/Huron Street & Hurontario Street	Overall	14	B	0.62	21	C	0.87
	EBTR	5	A	0.60	12	B	0.88
	NBL	50	D	0.81	60	E	0.93
Hume Street/Highway 26 E & Pretty River Parkway	Overall	24	C	0.74	32	C	0.78
	SBL	29	C	0.53	45	D	0.90
	SBTL	29	C	0.52	48	D	0.91
Highway 26 E & Beachwood Road/Sandford Fleming Drive	Overall	20	B	0.70	27	C	0.91
	EBLTR	19	B	0.15	64	E	0.90
	SBL	12	B	0.50	25	C	0.86
Tenth Line & Mountain Road	Overall	257	F	1.80	533	F	2.68
	EBLTR	57	E	0.99	56	E	1.02
	WBLTR	285	F	1.55	921	F	2.98
	NBLTR	207	F	1.36	358	F	1.68

Figure 17: 2041 Total Conditions Level of Service





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Appendix A

Turning Movement Count (TMC) Data

Ontario Traffic Inc.

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: Collingwood

Site #: 1842000008

Intersection: First St & Pine St-N Pine St

TFR File #: 1

Count date: 12-Dec-18

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: First St runs W/E

North Leg Total: 132

North Entering: 87

North Peds: 17

Peds Cross: $\bowtie$

Heavys	0	0	0	0
Trucks	0	0	2	2
Cars	32	24	29	85
Totals	32	24	31	



Heavys	0
Trucks	0
Cars	45
Totals	45

East Leg Total: 1288

East Entering: 723

East Peds: 4

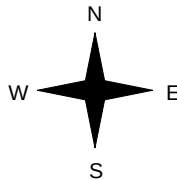
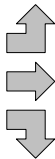
Peds Cross: $\bowtie$

Heavys	Trucks	Cars	Totals
2	32	787	821



First St

Heavys	Trucks	Cars	Totals
0	0	25	25
0	15	508	523
0	3	46	49
0	18	579	



Pine St



Cars	Trucks	Heavys	Totals
8	0	0	8
669	28	1	698
15	2	0	17
692	30	1	



First St



Cars	Trucks	Heavys	Totals
547	18	0	565

Peds Cross: $\bowtie$

West Peds: 3

West Entering: 597

West Leg Total: 1418

Cars	85	Cars	86	12	10	108
Trucks	5	Trucks	4	0	1	5
Heavys	0	Heavys	1	0	0	1
Totals	90	Totals	91	12	11	



Peds Cross: $\bowtie$

South Peds: 1

South Entering: 114

South Leg Total: 204

Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Collingwood

Site #: 1842000008

Intersection: First St & Pine St-N Pine St

TFR File #: 1

Count date: 12-Dec-18

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: First St runs W/E

North Leg Total: 336

North Entering: 203

North Peds: 11

Peds Cross: $\bowtie$

Heavys	0	0	0	0
Trucks	0	0	2	2
Cars	87	59	55	201
Totals	87	59	57	



Heavys 0

Trucks 1

Cars 132

Totals 133

East Leg Total: 1687

East Entering: 780

East Peds: 7

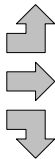
Peds Cross: $\bowtie$

Heavys	Trucks	Cars	Totals
1	17	958	976

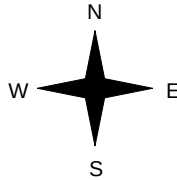


First St

Heavys	Trucks	Cars	Totals
0	0	52	52
1	18	789	808
0	3	112	115
1	21	953	



N Pine St



Pine St

Cars	Trucks	Heavys	Totals
49	0	0	49
699	15	0	714
17	0	0	17
765	15	0	

First St



Cars	Trucks	Heavys	Totals
885	21	1	907

Peds Cross: $\bowtie$

West Peds: 7

West Entering: 975

West Leg Total: 1951

Cars 188

Trucks 3

Heavys 0

Totals 191



Cars	172	31	41	244
Trucks	2	1	1	4
Heavys	1	0	0	1
Totals	175	32	42	

Peds Cross: $\bowtie$

South Peds: 8

South Entering: 249

South Leg Total: 440

Comments

Ontario Traffic Inc.

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: Collingwood

Site #: 1842000009

Intersection: First St (Hwy 26) & Hurontario St

TFR File #: 1

Count date: 12-Dec-18

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: First St (Hwy 26) runs W/E

North Leg Total: 59

North Entering: 0

North Peds: 3

Peds Cross: $\bowtie$

Heavys	0	0	0	0
Trucks	0	0	0	0
Cars	0	0	0	0
Totals	0	0	0	0



Heavys	0
Trucks	3
Cars	56
Totals	59

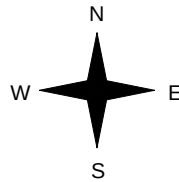
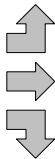
East Leg Total:	1164
East Entering:	654
East Peds:	5
Peds Cross:	$\bowtie$

Heavys	Trucks	Cars	Totals
1	20	708	729



First St (Hwy 26)

Heavys	Trucks	Cars	Totals
0	3	17	20
0	15	465	480
0	0	65	65
0	18	547	



Hurontario St

Hurontario St

Cars	Trucks	Heavys	Totals
22	0	0	22
578	19	1	598
34	0	0	34
634	19	1	

First St (Hwy 26)



Cars	Trucks	Heavys	Totals
495	15	0	510

Peds Cross: $\bowtie$

West Peds: 4

West Entering: 565

West Leg Total: 1294

Cars	99
Trucks	0
Heavys	0
Totals	99



Cars	130	17	30	177
Trucks	1	0	0	1
Heavys	0	0	0	0
Totals	131	17	30	

Peds Cross: $\bowtie$

South Peds: 6

South Entering: 178

South Leg Total: 277

Comments

Ontario Traffic Inc.

Afternoon Peak Diagram

Specified Period

From: 15:00:00

To: 18:00:00

One Hour Peak

From: 16:15:00

To: 17:15:00

Municipality: Collingwood

Site #: 1842000009

Intersection: First St (Hwy 26) & Hurontario St

TFR File #: 1

Count date: 12-Dec-18

Weather conditions:

Person(s) who counted:

**** Signalized Intersection ****

Major Road: First St (Hwy 26) runs W/E

North Leg Total: 37

North Entering: 0

North Peds: 16

Peds Cross: $\times$

Heavys	0	0	0	0
Trucks	0	0	0	0
Cars	0	0	0	0
Totals	0	0	0	0



Heavys 0

Trucks 2

Cars 35

Totals 37

East Leg Total: 1452

East Entering: 645

East Peds: 11

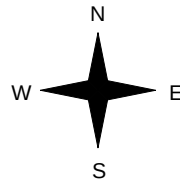
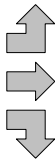
Peds Cross: $\times$

Heavys	Trucks	Cars	Totals
0	14	772	786



First St (Hwy 26)

Heavys	Trucks	Cars	Totals
0	1	13	14
1	17	730	748
0	1	149	150
1	19	892	



Hurontario St

Hurontario St



Cars	Trucks	Heavys	Totals
9	0	0	9
561	13	0	574
62	0	0	62
632	13	0	

First St (Hwy 26)



Cars	Trucks	Heavys	Totals
789	17	1	807

Peds Cross: $\times$

West Peds: 12

West Entering: 912

West Leg Total: 1698

Cars	211
Trucks	1
Heavys	0
Totals	212



Cars	211	13	59	283
Trucks	1	1	0	2
Heavys	0	0	0	0
Totals	212	14	59	

Peds Cross: $\times$

South Peds: 11

South Entering: 285

South Leg Total: 497

Comments



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Appendix B

Existing (2019) Traffic Operations (Synchro)

HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2019 Existing AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	47	632	28	9	653	6	25	34	20	78	28	127
Future Volume (vph)	47	632	28	9	653	6	25	34	20	78	28	127
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.98	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.95		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3522		1825	3500		1752	1760		1770	1613	
Flt Permitted	0.32	1.00		0.36	1.00		0.44	1.00		0.72	1.00	
Satd. Flow (perm)	618	3522		693	3500		811	1760		1334	1613	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	55	735	33	10	759	7	29	40	23	91	33	148
RTOR Reduction (vph)	0	2	0	0	0	0	0	20	0	0	130	0
Lane Group Flow (vph)	55	766	0	10	766	0	29	43	0	91	51	0
Confl. Peds. (#/hr)	11		1	1		11	1		9	9		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	3%	0%	0%	4%	17%	4%	3%	0%	1%	0%	4%
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		
Actuated Green, G (s)	76.1	71.0		68.3	67.1		12.1	12.1		12.1	12.1	
Effective Green, g (s)	76.1	71.0		68.3	67.1		12.1	12.1		12.1	12.1	
Actuated g/C Ratio	0.76	0.71		0.68	0.67		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	531	2500		486	2348		98	212		161	195	
v/s Ratio Prot	c0.01	c0.22		0.00	c0.22		0.02			0.03		
v/s Ratio Perm	0.07			0.01			0.04			c0.07		
v/c Ratio	0.10	0.31		0.02	0.33		0.30	0.20		0.57	0.26	
Uniform Delay, d1	3.3	5.4		5.1	6.9		40.1	39.6		41.5	39.9	
Progression Factor	1.00	1.00		0.40	0.54		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.3		0.0	0.3		1.7	0.5		4.5	0.7	
Delay (s)	3.4	5.7		2.0	4.1		41.8	40.1		46.0	40.6	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		5.5			4.0			40.6			42.4	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	11.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

2019 Existing AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	26	549	18	733	96	13	33	25
Future Volume (vph)	26	549	18	733	96	13	33	25
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	67.7	63.1	66.9	60.9	20.8	13.3	17.5	10.2
Actuated g/C Ratio	0.68	0.63	0.67	0.61	0.21	0.13	0.18	0.10
v/c Ratio	0.07	0.32	0.04	0.41	0.42	0.12	0.15	0.33
Control Delay	4.4	8.9	4.7	9.4	35.9	27.7	30.2	25.9
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.4	8.9	4.7	9.5	35.9	27.7	30.2	25.9
LOS	A	A	A	A	D	C	C	C
Approach Delay		8.7		9.4		34.2		27.4
Approach LOS		A		A		C		C

Intersection Summary

Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.42	
Intersection Signal Delay: 12.0	Intersection LOS: B
Intersection Capacity Utilization 48.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 8: Pine Street & First Street

Ø1	Ø2	Ø3	Ø4
11 s	50 s	13 s	26 s
Ø5	Ø6 (R)	Ø7	Ø8
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2019 Existing AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	31	706	21	871	113	29	39	69
v/c Ratio	0.07	0.32	0.04	0.41	0.42	0.12	0.15	0.33
Control Delay	4.4	8.9	4.7	9.4	35.9	27.7	30.2	25.9
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.4	8.9	4.7	9.5	35.9	27.7	30.2	25.9
Queue Length 50th (m)	1.7	35.3	0.9	61.6	17.6	2.6	5.8	5.2
Queue Length 95th (m)	2.1	41.7	2.4	37.8	29.8	10.2	13.0	16.3
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	441	2203	484	2135	266	358	286	377
Starvation Cap Reductn	0	0	0	324	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.32	0.04	0.48	0.42	0.08	0.14	0.18
Intersection Summary								

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2019 Existing AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	26	549	51	18	733	8	96	13	12	33	25	34
Future Volume (vph)	26	549	51	18	733	8	96	13	12	33	25	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1823	3484		1629	3504		1735	1689		1711	1729	
Flt Permitted	0.27	1.00		0.36	1.00		0.49	1.00		0.74	1.00	
Satd. Flow (perm)	519	3484		618	3504		888	1689		1330	1729	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	31	646	60	21	862	9	113	15	14	39	29	40
RTOR Reduction (vph)	0	5	0	0	0	0	0	12	0	0	37	0
Lane Group Flow (vph)	31	701	0	21	871	0	113	17	0	39	32	0
Confl. Peds. (#/hr)	17		1	1		17	3		4	4		3
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	0%	3%	6%	12%	4%	0%	5%	0%	9%	6%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	63.3	59.1		60.5	57.7		22.2	13.3		13.5	8.6	
Effective Green, g (s)	63.3	59.1		60.5	57.7		22.2	13.3		13.5	8.6	
Actuated g/C Ratio	0.63	0.59		0.60	0.58		0.22	0.13		0.14	0.09	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	383	2059		402	2021		278	224		198	148	
v/s Ratio Prot	c0.00	0.20		0.00	c0.25		c0.04	0.01		0.01	0.02	
v/s Ratio Perm	0.05			0.03			c0.05			0.02		
v/c Ratio	0.08	0.34		0.05	0.43		0.41	0.08		0.20	0.22	
Uniform Delay, d1	7.4	10.5		8.0	11.9		32.5	38.0		38.3	42.6	
Progression Factor	0.71	0.86		0.77	0.75		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.4		0.1	0.6		1.0	0.1		0.5	0.7	
Delay (s)	5.3	9.4		6.2	9.5		33.4	38.1		38.8	43.3	
Level of Service	A	A		A	A		C	D		D	D	
Approach Delay (s)		9.3			9.4			34.4			41.7	
Approach LOS		A			A			C			D	
Intersection Summary												
HCM 2000 Control Delay		13.1			HCM 2000 Level of Service			B				
HCM 2000 Volume to Capacity ratio		0.42										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)			19.9				
Intersection Capacity Utilization		48.6%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings

2019 Existing AM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖
Traffic Volume (vph)	21	504	36	628	138	18
Future Volume (vph)	21	504	36	628	138	18
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	73.4	67.7	74.5	69.8	14.4	14.4
Actuated g/C Ratio	0.73	0.68	0.74	0.70	0.14	0.14
v/c Ratio	0.05	0.29	0.07	0.31	0.64	0.21
Control Delay	1.5	2.0	4.0	7.4	50.9	19.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	2.0	4.0	7.4	50.9	19.0
LOS	A	A	A	A	D	B
Approach Delay		2.0		7.3		42.4
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 40

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.64

Intersection Signal Delay: 9.6

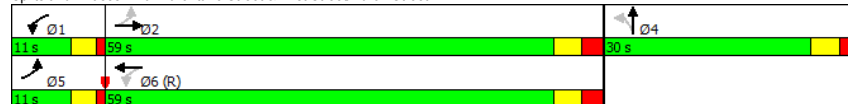
Intersection LOS: A

Intersection Capacity Utilization 42.1%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street



Queues

2019 Existing AM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	25	681	43	775	164	59
v/c Ratio	0.05	0.29	0.07	0.31	0.64	0.21
Control Delay	1.5	2.0	4.0	7.4	50.9	19.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	2.0	4.0	7.4	50.9	19.0
Queue Length 50th (m)	0.3	5.3	1.7	21.9	30.3	3.6
Queue Length 95th (m)	1.0	6.2	4.8	46.8	44.2	12.3
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	497	2367	609	2464	438	446
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.29	0.07	0.31	0.37	0.13

Intersection Summary

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2019 Existing AM

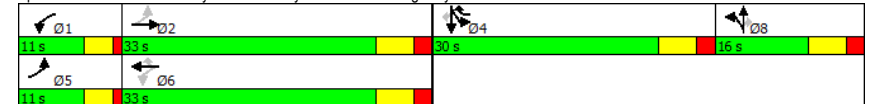
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	21	504	68	36	628	23	138	18	32	0	0	0
Future Volume (vph)	21	504	68	36	628	23	138	18	32	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.98		1.00	0.99		1.00	0.90				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1587	3487		1824	3526		1792	1709				
Flt Permitted	0.35	1.00		0.37	1.00		0.95	1.00				
Satd. Flow (perm)	578	3487		712	3526		1792	1709				
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	25	600	81	43	748	27	164	21	38	0	0	0
RTOR Reduction (vph)	0	7	0	0	2	0	0	33	0	0	0	0
Lane Group Flow (vph)	25	674	0	43	773	0	164	26	0	0	0	0
Confl. Peds. (#/hr)	3		6	6		3	4		5	5		4
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	15%	3%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6		4					
Permitted Phases	2			6			4					
Actuated Green, G (s)	68.7	66.1		71.3	67.4		14.4	14.4				
Effective Green, g (s)	68.7	66.1		71.3	67.4		14.4	14.4				
Actuated g/C Ratio	0.69	0.66		0.71	0.67		0.14	0.14				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	423	2304		551	2376		258	246				
v/s Ratio Prot	0.00	0.19		c0.00	c0.22			0.02				
v/s Ratio Perm	0.04			0.05			c0.09					
v/c Ratio	0.06	0.29		0.08	0.33		0.64	0.11				
Uniform Delay, d1	5.0	7.1		4.3	6.8		40.3	37.2				
Progression Factor	0.33	0.23		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.3		0.1	0.4		5.1	0.2				
Delay (s)	1.7	2.0		4.4	7.2		45.4	37.4				
Level of Service	A	A		A	A		D	D				
Approach Delay (s)		2.0			7.0		43.3			0.0		
Approach LOS		A			A		D			A		
Intersection Summary												
HCM 2000 Control Delay		9.6			HCM 2000 Level of Service		A					
HCM 2000 Volume to Capacity ratio		0.37										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)		15.6					
Intersection Capacity Utilization		42.1%			ICU Level of Service		A					
Analysis Period (min)		15										
c Critical Lane Group												

Timings
10: Pretty River Parkway & Hume Street/Highway 26 E

2019 Existing AM

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	92	188	6	364	678	9	22	13	228	32	53
Future Volume (vph)	92	188	6	364	678	9	22	13	228	32	53
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	33.0	11.0	33.0	30.0	16.0	16.0	16.0	30.0	30.0	30.0
Total Split (%)	12.2%	36.7%	12.2%	36.7%	33.3%	17.8%	17.8%	17.8%	33.3%	33.3%	33.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effect Green (s)	38.3	35.0	35.9	28.6	45.7	10.6	10.6	10.6	17.1	17.1	17.1
Actuated g/C Ratio	0.51	0.47	0.48	0.38	0.61	0.14	0.14	0.14	0.23	0.23	0.23
v/c Ratio	0.23	0.14	0.01	0.57	0.62	0.04	0.10	0.05	0.39	0.38	0.13
Control Delay	14.3	15.3	13.7	27.1	3.6	35.8	36.1	0.3	29.9	29.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.3	15.3	13.7	27.1	3.6	35.8	36.1	0.3	29.9	29.6	0.6
LOS	B	B	B	C	A	D	D	A	C	C	A
Approach Delay		15.0		11.8			25.3			24.8	
Approach LOS		B		B			C			C	
Intersection Summary											
Cycle Length: 90											
Actuated Cycle Length: 74.9											
Natural Cycle: 75											
Control Type: Semi Act-Uncoord											
Maximum v/c Ratio: 0.62											
Intersection Signal Delay: 15.1						Intersection LOS: B					
Intersection Capacity Utilization 69.6%						ICU Level of Service C					
Analysis Period (min) 15											

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E



HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2019 Existing PM

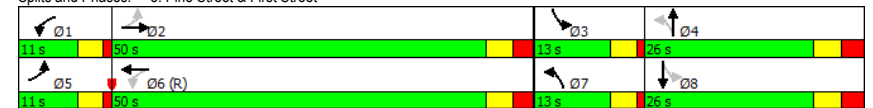
	←	→	↙	↘	←	→	↙	↘	←	→	↙	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔		↔	↔		↔	↔		↔	↔	
Traffic Volume (vph)	28	952	46	26	991	7	38	20	23	80	20	50
Future Volume (vph)	28	952	46	26	991	7	38	20	23	80	20	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00		0.98	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	3517		1754	3575		1762	1740		1777	1669	
Flt Permitted	0.24	1.00		0.24	1.00		0.71	1.00		0.73	1.00	
Satd. Flow (perm)	451	3517		451	3575		1315	1740		1361	1669	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	29	1002	48	27	1043	7	40	21	24	84	21	53
RTOR Reduction (vph)	0	2	0	0	0	0	0	22	0	0	48	0
Lane Group Flow (vph)	29	1048	0	27	1050	0	40	23	0	84	26	0
Confl. Peds. (#/hr)	12		8	8		12	2		6	6		2
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	4%	3%	2%	4%	2%	0%	3%	0%	0%	1%	0%	2%
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		
Actuated Green, G (s)	74.2	70.5		74.2	70.5		10.1	10.1		10.1	10.1	
Effective Green, g (s)	74.2	70.5		74.2	70.5		10.1	10.1		10.1	10.1	
Actuated g/C Ratio	0.74	0.70		0.74	0.70		0.10	0.10		0.10	0.10	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	382	2479		382	2520		132	175		137	168	
v/s Ratio Prot	c0.00	c0.30		0.00	0.29			0.01			0.02	
v/s Ratio Perm	0.05			0.05			0.03			c0.06		
v/c Ratio	0.08	0.42		0.07	0.42		0.30	0.13		0.61	0.16	
Uniform Delay, d1	3.7	6.2		3.7	6.2		41.7	41.0		43.1	41.1	
Progression Factor	1.00	1.00		0.74	0.61		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.5		0.1	0.5		1.3	0.3		7.9	0.4	
Delay (s)	3.8	6.7		2.8	4.2		43.0	41.3		51.0	41.5	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		6.6			4.2			42.1			46.5	
Approach LOS		A			A			D			D	
Intersection Summary												
HCM 2000 Control Delay		9.4			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.43										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)			15.7				
Intersection Capacity Utilization		48.7%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings
8: Pine Street & First Street

2019 Existing PM

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	55	848	18	750	184	34	60	62
Future Volume (vph)	55	848	18	750	184	34	60	62
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	63.3	58.4	61.1	53.7	24.7	15.4	22.5	12.3
Actuated g/C Ratio	0.63	0.58	0.61	0.54	0.25	0.15	0.22	0.12
v/c Ratio	0.15	0.50	0.05	0.45	0.67	0.28	0.20	0.60
Control Delay	3.9	10.7	5.8	12.9	42.1	21.9	28.0	33.7
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	3.9	10.7	5.8	13.0	42.1	21.9	28.0	33.7
LOS	A	B	A	B	D	C	C	C
Approach Delay		10.4		12.9		36.1		32.1
Approach LOS		B		B		D		C
Intersection Summary								
Cycle Length: 100								
Actuated Cycle Length: 100								
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green								
Natural Cycle: 80								
Control Type: Actuated-Coordinated								
Maximum v/c Ratio: 0.67								
Intersection Signal Delay: 16.2					Intersection LOS: B			
Intersection Capacity Utilization 69.3%					ICU Level of Service C			
Analysis Period (min) 15								

Splits and Phases: 8: Pine Street & First Street



Queues
8: Pine Street & First Street

2019 Existing PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	59	1031	19	852	196	83	64	163
v/c Ratio	0.15	0.50	0.05	0.45	0.67	0.28	0.20	0.60
Control Delay	3.9	10.7	5.8	12.9	42.1	21.9	28.0	33.7
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	3.9	10.7	5.8	13.0	42.1	21.9	28.0	33.7
Queue Length 50th (m)	1.2	12.1	0.9	39.1	31.5	6.4	9.5	18.0
Queue Length 95th (m)	2.7	100.2	m3.0	47.0	47.4	19.0	18.2	36.2
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	404	2047	358	1905	292	384	344	396
Starvation Cap Reductn	0	0	0	331	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	0.15	0.50	0.05	0.54	0.67	0.22	0.19	0.41
Intersection Summary								
m Volume for 95th percentile queue is metered by upstream signal.								

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2019 Existing PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	55	848	121	18	750	51	184	34	44	60	62	91
Future Volume (vph)	55	848	121	18	750	51	184	34	44	60	62	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.92		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3495		1825	3542		1785	1690		1743	1719	
Flt Permitted	0.25	1.00		0.22	1.00		0.45	1.00		0.70	1.00	
Satd. Flow (perm)	485	3495		427	3542		841	1690		1290	1719	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	59	902	129	19	798	54	196	36	47	64	66	97
RTOR Reduction (vph)	0	9	0	0	4	0	0	40	0	0	57	0
Lane Group Flow (vph)	59	1022	0	19	848	0	196	43	0	64	106	0
Confl. Peds. (#/hr)	11		8	8		11	7		7	7		7
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	0%	2%	3%	0%	2%	0%	2%	3%	2%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	61.1	55.2		54.9	52.1		24.4	15.4		19.8	13.1	
Effective Green, g (s)	61.1	55.2		54.9	52.1		24.4	15.4		19.8	13.1	
Actuated g/C Ratio	0.61	0.55		0.55	0.52		0.24	0.15		0.20	0.13	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	375	1929		273	1845		290	260		285	225	
v/s Ratio Prot	c0.01	c0.29		0.00	0.24		c0.06	0.03		0.02	0.06	
v/s Ratio Perm	0.09			0.04			c0.10			0.03		
v/c Ratio	0.16	0.53		0.07	0.46		0.68	0.17		0.22	0.47	
Uniform Delay, d1	8.8	14.2		10.8	15.1		32.4	36.7		33.4	40.2	
Progression Factor	0.44	0.73		0.74	0.80		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.0		0.1	0.8		6.1	0.3		0.4	1.5	
Delay (s)	4.1	11.3		8.1	12.8		38.5	37.0		33.8	41.8	
Level of Service	A	B		A	B		D	D		C	D	
Approach Delay (s)		10.9			12.7			38.1			39.5	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay		17.3										
HCM 2000 Volume to Capacity ratio		0.58										
Actuated Cycle Length (s)		100.0						19.9				
Intersection Capacity Utilization		69.3%										
Analysis Period (min)		15										
c Critical Lane Group												

Timings

2019 Existing PM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	15	785	65	603	223	15
Future Volume (vph)	15	785	65	603	223	15
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	68.4	61.7	70.9	66.1	18.2	18.2
Actuated g/C Ratio	0.68	0.62	0.71	0.66	0.18	0.18
v/c Ratio	0.03	0.46	0.17	0.27	0.72	0.23
Control Delay	2.1	3.9	5.9	8.8	50.5	12.7
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	3.9	5.9	8.8	50.5	12.7
LOS	A	A	A	A	D	B
Approach Delay		3.9		8.5		40.8
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 50

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay: 11.2

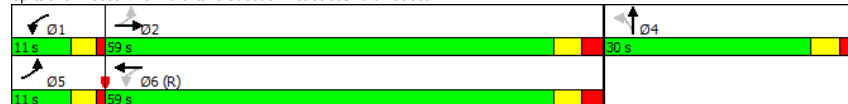
Intersection LOS: B

Intersection Capacity Utilization 56.4%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street



Queues

2019 Existing PM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	16	992	68	644	235	81
v/c Ratio	0.03	0.46	0.17	0.27	0.72	0.23
Control Delay	2.1	3.9	5.9	8.8	50.5	12.7
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	3.9	5.9	8.8	50.5	12.7
Queue Length 50th (m)	0.3	22.7	3.3	20.7	43.2	2.6
Queue Length 95th (m)	m0.6	12.5	8.5	46.5	63.2	13.7
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	571	2162	411	2360	438	447
Starvation Cap Reductn	0	170	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.50	0.17	0.27	0.54	0.18

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2019 Existing PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	15	785	158	65	603	9	223	15	62	0	0	0
Future Volume (vph)	15	785	158	65	603	9	223	15	62	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.88				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1702	3484		1825	3570		1789	1627				
Flt Permitted	0.41	1.00		0.23	1.00		0.95	1.00				
Satd. Flow (perm)	730	3484		444	3570		1789	1627				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	826	166	68	635	9	235	16	65	0	0	0
RTOR Reduction (vph)	0	14	0	0	1	0	0	53	0	0	0	0
Lane Group Flow (vph)	16	978	0	68	643	0	235	28	0	0	0	0
Confl. Peds. (#/hr)	16		11	11		16	12		11	11		12
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	63.4	60.9		69.0	63.7		18.2	18.2				
Effective Green, g (s)	63.4	60.9		69.0	63.7		18.2	18.2				
Actuated g/C Ratio	0.63	0.61		0.69	0.64		0.18	0.18				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	487	2121		379	2274		325	296				
v/s Ratio Prot	0.00	c0.28		c0.01	0.18			0.02				
v/s Ratio Perm	0.02			0.11			c0.13					
v/c Ratio	0.03	0.46		0.18	0.28		0.72	0.09				
Uniform Delay, d1	6.8	10.6		5.9	8.0		38.5	34.0				
Progression Factor	0.37	0.29		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.0	0.6		0.2	0.3		7.7	0.1				
Delay (s)	2.5	3.7		6.1	8.3		46.3	34.2				
Level of Service	A	A		A	A		D	C				
Approach Delay (s)		3.7			8.1		43.2			0.0		
Approach LOS		A			A		D			A		

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

2019 Existing PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	45	390	12	253	429	15	43	32	638	42	77
Future Volume (vph)	45	390	12	253	429	15	43	32	638	42	77
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	27.0	11.0	27.0	36.0	16.0	16.0	16.0	36.0	36.0	36.0
Total Split (%)	12.2%	30.0%	12.2%	30.0%	40.0%	17.8%	17.8%	17.8%	40.0%	40.0%	40.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	29.6	26.3	28.3	22.5	55.7	10.7	10.7	10.7	24.7	24.7	24.7
Actuated g/C Ratio	0.38	0.34	0.37	0.29	0.72	0.14	0.14	0.14	0.32	0.32	0.32
v/c Ratio	0.13	0.37	0.03	0.51	0.37	0.07	0.19	0.11	0.70	0.71	0.14
Control Delay	18.9	23.6	18.0	32.1	1.6	36.7	38.0	0.6	32.5	32.9	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	23.6	18.0	32.1	1.6	36.7	38.0	0.6	32.5	32.9	0.7
LOS	B	C	B	C	A	D	D	A	C	C	A
Approach Delay		23.1		13.0			24.5			29.4	
Approach LOS		C		B			C			C	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 77.5	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 22.0	Intersection LOS: C
Intersection Capacity Utilization 57.9%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E

↰ 01	↱ 02	↰ 04	↱ 08
11 s	27 s	36 s	16 s
↰ 05	↱ 06		
11 s	27 s		



BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

2031 Background Traffic Operations (Synchro)

HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2031 Background AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	50	671	30	10	693	6	27	36	21	83	30	135
Future Volume (vph)	50	671	30	10	693	6	27	36	21	83	30	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.98	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.95		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3522		1825	3501		1752	1761		1771	1613	
Flt Permitted	0.30	1.00		0.34	1.00		0.41	1.00		0.71	1.00	
Satd. Flow (perm)	580	3522		661	3501		757	1761		1331	1613	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	58	780	35	12	806	7	31	42	24	97	35	157
RTOR Reduction (vph)	0	2	0	0	0	0	0	21	0	0	137	0
Lane Group Flow (vph)	58	813	0	12	813	0	31	45	0	97	55	0
Confl. Peds. (#/hr)	11		1	1		11	1		9	9		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	3%	0%	0%	4%	17%	4%	3%	0%	1%	0%	4%
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		
Actuated Green, G (s)	75.8	70.6		67.8	66.6		12.5	12.5		12.5	12.5	
Effective Green, g (s)	75.8	70.6		67.8	66.6		12.5	12.5		12.5	12.5	
Actuated g/C Ratio	0.76	0.71		0.68	0.67		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	504	2486		462	2331		94	220		166	201	
v/s Ratio Prot	c0.01	c0.23		0.00	c0.23		0.03			0.03		
v/s Ratio Perm	0.08			0.02			0.04			c0.07		
v/c Ratio	0.12	0.33		0.03	0.35		0.33	0.20		0.58	0.27	
Uniform Delay, d1	3.4	5.6		5.2	7.3		39.9	39.3		41.3	39.6	
Progression Factor	1.00	1.00		0.40	0.55		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.4		0.0	0.4		2.1	0.5		5.2	0.7	
Delay (s)	3.5	6.0		2.1	4.4		42.0	39.7		46.5	40.4	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		5.8			4.3			40.5			42.4	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	11.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

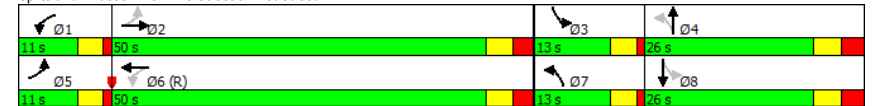
2031 Background AM

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	28	583	19	778	102	14	35	27
Future Volume (vph)	28	583	19	778	102	14	35	27
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	67.7	63.1	66.9	60.9	20.8	13.3	17.6	10.2
Actuated g/C Ratio	0.68	0.63	0.67	0.61	0.21	0.13	0.18	0.10
v/c Ratio	0.08	0.34	0.05	0.43	0.45	0.13	0.16	0.34
Control Delay	4.4	8.9	4.7	9.5	36.6	27.6	30.1	26.2
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.4	8.9	4.7	9.6	36.6	27.6	30.1	26.2
LOS	A	A	A	A	D	C	C	C
Approach Delay		8.7		9.5		34.8		27.6
Approach LOS		A		A		C		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 12.1
Intersection Capacity Utilization 48.9%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service A

Splits and Phases: 8: Pine Street & First Street



Queues
8: Pine Street & First Street

2031 Background AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	750	22	924	120	31	41	74
v/c Ratio	0.08	0.34	0.05	0.43	0.45	0.13	0.16	0.34
Control Delay	4.4	8.9	4.7	9.5	36.6	27.6	30.1	26.2
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.4	8.9	4.7	9.6	36.6	27.6	30.1	26.2
Queue Length 50th (m)	1.6	38.3	1.0	66.5	18.8	2.8	6.1	5.8
Queue Length 95th (m)	2.2	39.1	m2.5	39.9	31.3	10.5	13.3	17.2
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	417	2201	463	2134	266	358	286	379
Starvation Cap Reductn	0	0	0	290	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.34	0.05	0.50	0.45	0.09	0.14	0.20
Intersection Summary								
m Volume for 95th percentile queue is metered by upstream signal.								

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2031 Background AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	28	583	54	19	778	8	102	14	13	35	27	36
Future Volume (vph)	28	583	54	19	778	8	102	14	13	35	27	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3483		1629	3505		1736	1689		1711	1733	
Flt Permitted	0.25	1.00		0.34	1.00		0.48	1.00		0.74	1.00	
Satd. Flow (perm)	480	3483		583	3505		884	1689		1327	1733	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	33	686	64	22	915	9	120	16	15	41	32	42
RTOR Reduction (vph)	0	5	0	0	0	0	0	13	0	0	38	0
Lane Group Flow (vph)	33	745	0	22	924	0	120	18	0	41	36	0
Confl. Peds. (#/hr)	17		1	1		17	3		4	4		3
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	0%	3%	6%	12%	4%	0%	5%	0%	9%	6%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	63.3	59.1		60.5	57.7		22.2	13.3		13.5	8.6	
Effective Green, g (s)	63.3	59.1		60.5	57.7		22.2	13.3		13.5	8.6	
Actuated g/C Ratio	0.63	0.59		0.60	0.58		0.22	0.13		0.14	0.09	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	360	2058		382	2022		278	224		197	149	
v/s Ratio Prot	c0.00	0.21		0.00	c0.26		c0.04	0.01		0.01	0.02	
v/s Ratio Perm	0.05			0.03			c0.05			0.02		
v/c Ratio	0.09	0.36		0.06	0.46		0.43	0.08		0.21	0.24	
Uniform Delay, d1	7.5	10.6		8.0	12.1		32.6	38.0		38.3	42.6	
Progression Factor	0.68	0.84		0.76	0.73		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.5		0.1	0.7		1.1	0.2		0.5	0.8	
Delay (s)	5.2	9.4		6.2	9.6		33.7	38.1		38.9	43.5	
Level of Service	A	A		A	A		C	D		D	D	
Approach Delay (s)		9.2			9.5			34.6			41.8	
Approach LOS		A			A			C			D	
Intersection Summary												
HCM 2000 Control Delay				13.2			HCM 2000 Level of Service			B		
HCM 2000 Volume to Capacity ratio				0.45								
Actuated Cycle Length (s)				100.0			Sum of lost time (s)			19.9		
Intersection Capacity Utilization				48.9%			ICU Level of Service			A		
Analysis Period (min)				15								
c Critical Lane Group												

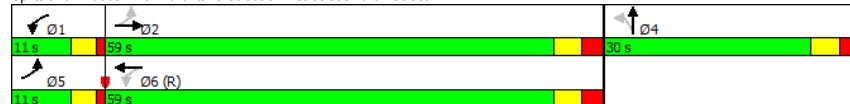
Timings 2031 Background AM
9: Hurontario Street & First Street/Huron Street

	↖	→	↙	←	↘	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	22	535	38	667	147	19
Future Volume (vph)	22	535	38	667	147	19
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	72.8	67.1	74.0	69.2	15.0	15.0
Actuated g/C Ratio	0.73	0.67	0.74	0.69	0.15	0.15
v/c Ratio	0.06	0.31	0.08	0.34	0.65	0.22
Control Delay	1.5	2.2	4.2	7.9	50.9	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	2.2	4.2	7.9	50.9	18.6
LOS	A	A	A	A	D	B
Approach Delay		2.2		7.7		42.3
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 45
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 9.9 Intersection LOS: A
Intersection Capacity Utilization 43.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street



Queues 2031 Background AM
9: Hurontario Street & First Street/Huron Street

	↖	→	↙	←	↘	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	26	723	45	823	175	63
v/c Ratio	0.06	0.31	0.08	0.34	0.65	0.22
Control Delay	1.5	2.2	4.2	7.9	50.9	18.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	2.2	4.2	7.9	50.9	18.6
Queue Length 50th (m)	0.3	5.6	1.8	24.4	32.4	3.9
Queue Length 95th (m)	1.0	6.5	5.0	51.3	46.5	12.7
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	470	2345	579	2443	438	449
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.31	0.08	0.34	0.40	0.14

Intersection Summary

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2031 Background AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	22	535	72	38	667	24	147	19	34	0	0	0
Future Volume (vph)	22	535	72	38	667	24	147	19	34	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.98		1.00	0.99		1.00	0.90				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1587	3487		1825	3526		1793	1712				
Flt Permitted	0.32	1.00		0.35	1.00		0.95	1.00				
Satd. Flow (perm)	542	3487		674	3526		1793	1712				
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	26	637	86	45	794	29	175	23	40	0	0	0
RTOR Reduction (vph)	0	8	0	0	2	0	0	34	0	0	0	0
Lane Group Flow (vph)	26	715	0	45	821	0	175	29	0	0	0	0
Confl. Peds. (#/hr)	3		6	6		3	4		5	5		4
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	15%	3%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	68.1	65.5		70.7	66.8		15.0	15.0				
Effective Green, g (s)	68.1	65.5		70.7	66.8		15.0	15.0				
Actuated g/C Ratio	0.68	0.66		0.71	0.67		0.15	0.15				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	396	2283		521	2355		268	256				
v/s Ratio Prot	0.00	0.21		c0.00	c0.23			0.02				
v/s Ratio Perm	0.04			0.06			c0.10					
v/c Ratio	0.07	0.31		0.09	0.35		0.65	0.11				
Uniform Delay, d1	5.2	7.5		4.5	7.2		40.0	36.7				
Progression Factor	0.33	0.23		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.3		0.1	0.4		5.6	0.2				
Delay (s)	1.8	2.1		4.6	7.6		45.7	36.9				
Level of Service	A	A		A	A		D	D				
Approach Delay (s)		2.1			7.4			43.4			0.0	
Approach LOS		A			A			D			A	
Intersection Summary												
HCM 2000 Control Delay		9.9			HCM 2000 Level of Service			A				
HCM 2000 Volume to Capacity ratio		0.40										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)			15.6				
Intersection Capacity Utilization		43.7%			ICU Level of Service			A				
Analysis Period (min)		15										
c Critical Lane Group												

Timings
10: Pretty River Parkway & Hume Street/Highway 26 E

2031 Background AM

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	98	200	6	386	720	10	23	14	242	34	56
Future Volume (vph)	98	200	6	386	720	10	23	14	242	34	56
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	34.0	11.0	34.0	29.0	16.0	16.0	16.0	29.0	29.0	29.0
Total Split (%)	12.2%	37.8%	12.2%	37.8%	32.2%	17.8%	17.8%	17.8%	32.2%	32.2%	32.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	39.2	35.9	36.9	29.5	46.8	10.6	10.6	10.6	17.3	17.3	17.3
Actuated g/C Ratio	0.52	0.47	0.49	0.39	0.62	0.14	0.14	0.14	0.23	0.23	0.23
v/c Ratio	0.26	0.15	0.01	0.59	0.66	0.05	0.11	0.05	0.41	0.40	0.14
Control Delay	14.4	15.1	13.5	27.5	4.6	36.2	36.5	0.4	30.9	30.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	15.1	13.5	27.5	4.6	36.2	36.5	0.4	30.9	30.6	0.6
LOS	B	B	B	C	A	D	D	A	C	C	A
Approach Delay		14.9		12.6			25.5			25.6	
Approach LOS		B		B			C			C	
Intersection Summary											
Cycle Length: 90											
Actuated Cycle Length: 76											
Natural Cycle: 75											
Control Type: Semi Act-Uncoord											
Maximum v/c Ratio: 0.66											
Intersection Signal Delay: 15.7						Intersection LOS: B					
Intersection Capacity Utilization 72.2%						ICU Level of Service C					
Analysis Period (min) 15											
Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E											
 Ø1	 Ø2					 Ø4			 Ø8		
11 s	34 s					29 s			16 s		
 Ø5	 Ø6										
11 s	34 s										

HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2031 Background PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↱		↰	↱	
Traffic Volume (vph)	30	1011	49	28	1052	7	40	21	24	85	21	53
Future Volume (vph)	30	1011	49	28	1052	7	40	21	24	85	21	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	3516		1755	3575		1764	1742		1781	1669	
Flt Permitted	0.22	1.00		0.22	1.00		0.71	1.00		0.73	1.00	
Satd. Flow (perm)	407	3516		408	3575		1311	1742		1362	1669	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	1064	52	29	1107	7	42	22	25	89	22	56
RTOR Reduction (vph)	0	2	0	0	0	0	0	22	0	0	49	0
Lane Group Flow (vph)	32	1114	0	29	1114	0	42	25	0	89	29	0
Confl. Peds. (#/hr)	12		8	8		12	2		6	6		2
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	4%	3%	2%	4%	2%	0%	3%	0%	0%	1%	0%	2%
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		
Actuated Green, G (s)	72.6	68.8		72.4	68.7		11.8	11.8		11.8	11.8	
Effective Green, g (s)	72.6	68.8		72.4	68.7		11.8	11.8		11.8	11.8	
Actuated g/C Ratio	0.73	0.69		0.72	0.69		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	346	2419		345	2456		154	205		160	196	
v/s Ratio Prot	c0.00	c0.32		0.00	0.31		0.01			0.02		
v/s Ratio Perm	0.06			0.06			0.03			c0.07		
v/c Ratio	0.09	0.46		0.08	0.45		0.27	0.12		0.56	0.15	
Uniform Delay, d1	4.3	7.1		4.3	7.1		40.2	39.5		41.6	39.6	
Progression Factor	1.00	1.00		0.73	0.61		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.6		0.1	0.5		1.0	0.3		4.1	0.3	
Delay (s)	4.4	7.8		3.2	4.9		41.2	39.7		45.8	39.9	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		7.7			4.8			40.4			43.0	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

2031 Background PM

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	58	900	19	796	195	36	64	66
Future Volume (vph)	58	900	19	796	195	36	64	66
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	62.9	58.0	60.6	53.2	25.1	15.8	23.0	12.7
Actuated g/C Ratio	0.63	0.58	0.61	0.53	0.25	0.16	0.23	0.13
v/c Ratio	0.16	0.54	0.06	0.48	0.72	0.28	0.20	0.62
Control Delay	4.1	10.9	5.9	13.4	44.7	21.4	27.7	35.1
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	4.1	10.9	5.9	13.5	44.7	21.4	27.7	35.1
LOS	A	B	A	B	D	C	C	D
Approach Delay		10.5		13.4		37.7		33.0
Approach LOS		B		B		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 16.7
Intersection Capacity Utilization 72.1%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service C

Splits and Phases: 8: Pine Street & First Street

⤴ 01	⤴ 02	⤴ 03	⤴ 04
11 s	50 s	13 s	26 s
⤴ 05	⤴ 06 (R)	⤴ 07	⤴ 08
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2031 Background PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	62	1093	20	904	207	88	68	173
v/c Ratio	0.16	0.54	0.06	0.48	0.72	0.28	0.20	0.62
Control Delay	4.1	10.9	5.9	13.4	44.7	21.4	27.7	35.1
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	4.1	10.9	5.9	13.5	44.7	21.4	27.7	35.1
Queue Length 50th (m)	1.3	13.2	1.0	41.5	33.2	6.7	10.1	19.8
Queue Length 95th (m)	2.8	109.7	m3.1	49.5	49.2	19.5	18.7	38.7
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	380	2034	332	1890	289	386	348	396
Starvation Cap Reductn	0	0	0	295	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.54	0.06	0.57	0.72	0.23	0.20	0.44
Intersection Summary								
m Volume for 95th percentile queue is metered by upstream signal.								

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2031 Background PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	58	900	128	19	796	54	195	36	47	64	66	97
Future Volume (vph)	58	900	128	19	796	54	195	36	47	64	66	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.91		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3496		1825	3542		1785	1690		1744	1719	
Flt Permitted	0.23	1.00		0.20	1.00		0.43	1.00		0.70	1.00	
Satd. Flow (perm)	443	3496		382	3542		802	1690		1285	1719	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	62	957	136	20	847	57	207	38	50	68	70	103
RTOR Reduction (vph)	0	9	0	0	4	0	0	42	0	0	57	0
Lane Group Flow (vph)	62	1084	0	20	900	0	207	46	0	68	116	0
Confl. Peds. (#/hr)	11		8	8		11	7		7	7		7
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	0%	2%	3%	0%	2%	0%	2%	3%	2%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	60.7	54.8		54.5	51.7		24.8	15.8		20.2	13.5	
Effective Green, g (s)	60.7	54.8		54.5	51.7		24.8	15.8		20.2	13.5	
Actuated g/C Ratio	0.61	0.55		0.54	0.52		0.25	0.16		0.20	0.14	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	350	1915		248	1831		287	267		290	232	
v/s Ratio Prot	c0.01	c0.31		0.00	0.25		c0.06	0.03		0.02	0.07	
v/s Ratio Perm	0.10			0.04			c0.11			0.03		
v/c Ratio	0.18	0.57		0.08	0.49		0.72	0.17		0.23	0.50	
Uniform Delay, d1	9.2	14.8		11.3	15.6		32.6	36.4		33.1	40.1	
Progression Factor	0.43	0.70		0.73	0.79		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.1		0.1	0.9		8.6	0.3		0.4	1.7	
Delay (s)	4.2	11.4		8.4	13.2		41.2	36.7		33.5	41.8	
Level of Service	A	B		A	B		D	D		C	D	
Approach Delay (s)		11.0			13.1			39.9			39.5	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay		17.7										
HCM 2000 Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		100.0						19.9				
Intersection Capacity Utilization		72.1%										
Analysis Period (min)		15										
c Critical Lane Group												

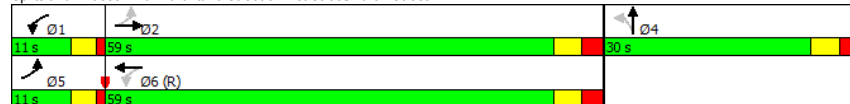
Timings 2031 Background PM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	16	833	69	640	237	16
Future Volume (vph)	16	833	69	640	237	16
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	67.8	61.0	70.4	65.5	18.8	18.8
Actuated g/C Ratio	0.68	0.61	0.70	0.66	0.19	0.19
v/c Ratio	0.03	0.49	0.19	0.29	0.74	0.24
Control Delay	2.1	4.3	6.3	9.1	51.3	12.4
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.3	6.3	9.1	51.3	12.4
LOS	A	A	A	A	D	B
Approach Delay		4.3		8.9		41.3
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green
 Natural Cycle: 55
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.74
 Intersection Signal Delay: 11.6 Intersection LOS: B
 Intersection Capacity Utilization 58.9% ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street



Queues 2031 Background PM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	17	1054	73	685	249	86
v/c Ratio	0.03	0.49	0.19	0.29	0.74	0.24
Control Delay	2.1	4.3	6.3	9.1	51.3	12.4
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.3	6.3	9.1	51.3	12.4
Queue Length 50th (m)	0.3	34.7	3.6	23.1	45.8	2.7
Queue Length 95th (m)	m0.6	13.2	9.1	50.0	67.3	14.2
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	547	2140	382	2341	438	450
Starvation Cap Reductn	0	130	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.52	0.19	0.29	0.57	0.19

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2031 Background PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	16	833	168	69	640	10	237	16	66	0	0	0
Future Volume (vph)	16	833	168	69	640	10	237	16	66	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.88				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1703	3484		1825	3569		1790	1628				
Flt Permitted	0.39	1.00		0.21	1.00		0.95	1.00				
Satd. Flow (perm)	697	3484		401	3569		1790	1628				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	17	877	177	73	674	11	249	17	69	0	0	0
RTOR Reduction (vph)	0	14	0	0	1	0	0	56	0	0	0	0
Lane Group Flow (vph)	17	1040	0	73	684	0	249	30	0	0	0	0
Confl. Peds. (#/hr)	16		11	11		16	12		11	11		12
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	62.7	60.2		68.5	63.1		18.8	18.8				
Effective Green, g (s)	62.7	60.2		68.5	63.1		18.8	18.8				
Actuated g/C Ratio	0.63	0.60		0.68	0.63		0.19	0.19				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	462	2097		351	2252		336	306				
v/s Ratio Prot	0.00	c0.30		c0.01	0.19			0.02				
v/s Ratio Perm	0.02			0.13			c0.14					
v/c Ratio	0.04	0.50		0.21	0.30		0.74	0.10				
Uniform Delay, d1	7.0	11.3		6.4	8.4		38.3	33.6				
Progression Factor	0.36	0.30		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.0	0.7		0.3	0.3		8.5	0.1				
Delay (s)	2.6	4.1		6.7	8.8		46.8	33.7				
Level of Service	A	A		A	A		D	C				
Approach Delay (s)		4.1			8.6		43.5			0.0		
Approach LOS		A			A		D			A		

Intersection Summary

HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

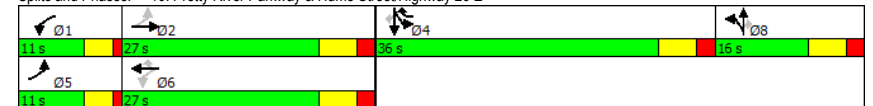
2031 Background PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	48	414	13	269	455	16	46	34	677	45	82
Future Volume (vph)	48	414	13	269	455	16	46	34	677	45	82
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	27.0	11.0	27.0	36.0	16.0	16.0	16.0	36.0	36.0	36.0
Total Split (%)	12.2%	30.0%	12.2%	30.0%	40.0%	17.8%	17.8%	17.8%	40.0%	40.0%	40.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effect Green (s)	29.5	26.2	28.1	22.3	56.9	10.6	10.6	10.6	26.2	26.2	26.2
Actuated g/C Ratio	0.37	0.33	0.36	0.28	0.72	0.13	0.13	0.13	0.33	0.33	0.33
v/c Ratio	0.15	0.40	0.04	0.56	0.39	0.08	0.21	0.11	0.71	0.72	0.15
Control Delay	19.3	24.3	18.1	33.5	1.6	36.9	38.6	0.7	32.8	33.3	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.3	24.3	18.1	33.5	1.6	36.9	38.6	0.7	32.8	33.3	1.0
LOS	B	C	B	C	A	D	D	A	C	C	A
Approach Delay		23.8		13.5			25.0			29.8	
Approach LOS		C		B			C			C	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 78.8	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 22.6	Intersection LOS: C
Intersection Capacity Utilization 59.9%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E





BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

2041 Background Traffic Operations (Synchro)

HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2041 Background AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	52	705	31	10	729	7	28	38	22	87	31	142
Future Volume (vph)	52	705	31	10	729	7	28	38	22	87	31	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.98	1.00	
Frft	1.00	0.99		1.00	1.00		1.00	0.94		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3523		1825	3500		1752	1759		1773	1612	
Flt Permitted	0.28	1.00		0.33	1.00		0.39	1.00		0.71	1.00	
Satd. Flow (perm)	547	3523		633	3500		723	1759		1328	1612	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	60	820	36	12	848	8	33	44	26	101	36	165
RTOR Reduction (vph)	0	2	0	0	0	0	0	23	0	0	144	0
Lane Group Flow (vph)	60	854	0	12	856	0	33	47	0	101	57	0
Confl. Peds. (#/hr)	11		1	1		11	1		9	9		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	3%	0%	0%	4%	17%	4%	3%	0%	1%	0%	4%
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		
Actuated Green, G (s)	75.3	70.1		67.2	66.0		13.0	13.0		13.0	13.0	
Effective Green, g (s)	75.3	70.1		67.2	66.0		13.0	13.0		13.0	13.0	
Actuated g/C Ratio	0.75	0.70		0.67	0.66		0.13	0.13		0.13	0.13	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	479	2469		439	2310		93	228		172	209	
v/s Ratio Prot	c0.01	c0.24		0.00	c0.24			0.03			0.04	
v/s Ratio Perm	0.09			0.02			0.05			c0.08		
v/c Ratio	0.13	0.35		0.03	0.37		0.35	0.21		0.59	0.27	
Uniform Delay, d1	3.7	5.9		5.4	7.7		39.7	38.9		41.0	39.2	
Progression Factor	1.00	1.00		0.40	0.55		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.4		0.0	0.4		2.3	0.5		5.0	0.7	
Delay (s)	3.8	6.3		2.2	4.7		42.0	39.4		46.0	40.0	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		6.1			4.6			40.2			42.0	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

2041 Background AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	29	613	20	818	107	15	37	28
Future Volume (vph)	29	613	20	818	107	15	37	28
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	67.6	63.0	66.8	60.8	20.8	13.3	17.7	10.3
Actuated g/C Ratio	0.68	0.63	0.67	0.61	0.21	0.13	0.18	0.10
v/c Ratio	0.09	0.36	0.05	0.46	0.48	0.14	0.17	0.36
Control Delay	4.3	8.8	4.8	9.1	37.3	28.0	30.2	25.9
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.3	8.8	4.8	9.1	37.3	28.0	30.2	25.9
LOS	A	A	A	A	D	C	C	C
Approach Delay		8.6		9.0		35.4		27.5
Approach LOS		A		A		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.48
Intersection Signal Delay: 11.9
Intersection Capacity Utilization 49.2%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service A

Splits and Phases: 8: Pine Street & First Street

Ø1	Ø2	Ø3	Ø4
11 s	50 s	13 s	26 s
Ø5	Ø6 (R)	Ø7	Ø8
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2041 Background AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	34	788	24	973	126	33	44	78
v/c Ratio	0.09	0.36	0.05	0.46	0.48	0.14	0.17	0.36
Control Delay	4.3	8.8	4.8	9.1	37.3	28.0	30.2	25.9
Queue Delay	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	4.3	8.8	4.8	9.1	37.3	28.0	30.2	25.9
Queue Length 50th (m)	1.6	40.5	1.1	37.4	19.8	3.2	6.6	6.0
Queue Length 95th (m)	2.2	30.6	m2.6	41.7	32.5	11.2	14.0	17.6
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	396	2199	444	2131	265	361	286	381
Starvation Cap Reductn	0	0	0	203	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	0.09	0.36	0.05	0.50	0.48	0.09	0.15	0.20

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2041 Background AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	29	613	57	20	818	9	107	15	13	37	28	38
Future Volume (vph)	29	613	57	20	818	9	107	15	13	37	28	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3484		1629	3504		1736	1702		1711	1730	
Flt Permitted	0.23	1.00		0.32	1.00		0.48	1.00		0.74	1.00	
Satd. Flow (perm)	446	3484		553	3504		884	1702		1325	1730	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	34	721	67	24	962	11	126	18	15	44	33	45
RTOR Reduction (vph)	0	5	0	0	0	0	0	13	0	0	41	0
Lane Group Flow (vph)	34	783	0	24	973	0	126	20	0	44	37	0
Confl. Peds. (#/hr)	17		1	1		17	3		4	4		3
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	0%	3%	6%	12%	4%	0%	5%	0%	9%	6%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	63.2	59.0		60.4	57.6		22.3	13.3		13.7	8.7	
Effective Green, g (s)	63.2	59.0		60.4	57.6		22.3	13.3		13.7	8.7	
Actuated g/C Ratio	0.63	0.59		0.60	0.58		0.22	0.13		0.14	0.09	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	339	2055		364	2018		278	226		200	150	
v/s Ratio Prot	c0.00	0.22		0.00	c0.28		c0.04	0.01		0.01	0.02	
v/s Ratio Perm	0.06			0.04			c0.06			0.02		
v/c Ratio	0.10	0.38		0.07	0.48		0.45	0.09		0.22	0.25	
Uniform Delay, d1	7.7	10.8		8.1	12.4		32.6	38.0		38.2	42.6	
Progression Factor	0.66	0.81		0.76	0.68		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.5		0.1	0.8		1.2	0.2		0.6	0.9	
Delay (s)	5.2	9.3		6.2	9.2		33.8	38.2		38.8	43.4	
Level of Service	A	A		A	A		C	D		D	D	
Approach Delay (s)		9.2			9.1			34.7			41.8	
Approach LOS		A			A			C			D	

Intersection Summary

HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings 2041 Background AM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	23	562	40	701	154	20
Future Volume (vph)	23	562	40	701	154	20
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	72.4	66.6	72.8	66.8	15.4	15.4
Actuated g/C Ratio	0.72	0.67	0.73	0.67	0.15	0.15
v/c Ratio	0.06	0.33	0.09	0.37	0.66	0.22
Control Delay	1.7	2.3	4.5	9.1	50.8	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.7	2.3	4.5	9.1	50.8	18.0
LOS	A	A	A	A	D	B
Approach Delay		2.3		8.9		42.0
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green
 Natural Cycle: 45
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.66
 Intersection Signal Delay: 10.5 Intersection LOS: B
 Intersection Capacity Utilization 45.1% ICU Level of Service A
 Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street

Ø1	Ø2	Ø4
11 s	59 s	30 s
Ø5	Ø6 (R)	
11 s	59 s	

Queues 2041 Background AM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	27	759	48	866	183	67
v/c Ratio	0.06	0.33	0.09	0.37	0.66	0.22
Control Delay	1.7	2.3	4.5	9.1	50.8	18.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.7	2.3	4.5	9.1	50.8	18.0
Queue Length 50th (m)	0.4	6.0	2.0	39.1	33.8	4.1
Queue Length 95th (m)	1.1	6.8	5.4	55.4	48.1	13.1
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	439	2329	559	2358	438	451
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.33	0.09	0.37	0.42	0.15

Intersection Summary

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2041 Background AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	23	562	76	40	701	26	154	20	36	0	0	0
Future Volume (vph)	23	562	76	40	701	26	154	20	36	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.98		1.00	0.99		1.00	0.90				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1587	3487		1825	3526		1793	1711				
Flt Permitted	0.30	1.00		0.34	1.00		0.95	1.00				
Satd. Flow (perm)	500	3487		654	3526		1793	1711				
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	27	669	90	48	835	31	183	24	43	0	0	0
RTOR Reduction (vph)	0	8	0	0	2	0	0	36	0	0	0	0
Lane Group Flow (vph)	27	751	0	48	864	0	183	31	0	0	0	0
Confl. Peds. (#/hr)	3		6	6		3	4		5	5		4
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	15%	3%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	68.8	65.0		69.2	65.2		15.4	15.4				
Effective Green, g (s)	68.8	65.0		69.2	65.2		15.4	15.4				
Actuated g/C Ratio	0.69	0.65		0.69	0.65		0.15	0.15				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	385	2266		499	2298		276	263				
v/s Ratio Prot	0.00	0.22		c0.00	c0.25			0.02				
v/s Ratio Perm	0.05			0.06			c0.10					
v/c Ratio	0.07	0.33		0.10	0.38		0.66	0.12				
Uniform Delay, d1	5.1	7.8		5.0	8.0		39.9	36.4				
Progression Factor	0.33	0.23		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.4		0.1	0.5		5.9	0.2				
Delay (s)	1.7	2.2		5.0	8.5		45.7	36.6				
Level of Service	A	A		A	A		D	D				
Approach Delay (s)		2.2			8.3			43.3			0.0	
Approach LOS		A			A			D			A	

Intersection Summary

HCM 2000 Control Delay	10.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings
10: Pretty River Parkway & Hume Street/Highway 26 E

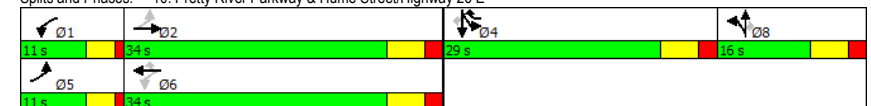
2041 Background AM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	103	210	7	406	757	10	25	15	254	36	59
Future Volume (vph)	103	210	7	406	757	10	25	15	254	36	59
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	34.0	11.0	34.0	29.0	16.0	16.0	16.0	29.0	29.0	29.0
Total Split (%)	12.2%	37.8%	12.2%	37.8%	32.2%	17.8%	17.8%	17.8%	32.2%	32.2%	32.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	39.2	35.9	36.9	29.5	47.3	10.6	10.6	10.6	17.8	17.8	17.8
Actuated g/C Ratio	0.51	0.47	0.48	0.39	0.62	0.14	0.14	0.14	0.23	0.23	0.23
v/c Ratio	0.29	0.16	0.02	0.63	0.70	0.05	0.12	0.06	0.42	0.41	0.14
Control Delay	14.9	15.3	13.4	28.8	5.8	36.3	36.8	0.3	30.9	30.6	0.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.9	15.3	13.4	28.8	5.8	36.3	36.8	0.3	30.9	30.6	0.6
LOS	B	B	B	C	A	D	D	A	C	C	A
Approach Delay		15.2		13.8			25.6			25.6	
Approach LOS		B		B			C			C	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 76.5	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.70	
Intersection Signal Delay: 16.5	Intersection LOS: B
Intersection Capacity Utilization 74.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E



HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2041 Background PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	31	1062	51	29	1106	8	42	22	26	89	22	56
Future Volume (vph)	31	1062	51	29	1106	8	42	22	26	89	22	56
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1754	3517		1755	3575		1764	1740		1782	1669	
Flt Permitted	0.20	1.00		0.20	1.00		0.70	1.00		0.72	1.00	
Satd. Flow (perm)	375	3517		376	3575		1307	1740		1359	1669	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	33	1118	54	31	1164	8	44	23	27	94	23	59
RTOR Reduction (vph)	0	3	0	0	0	0	0	24	0	0	52	0
Lane Group Flow (vph)	33	1169	0	31	1172	0	44	26	0	94	30	0
Confl. Peds. (#/hr)	12		8	8		12	2		6	6		2
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	4%	3%	2%	4%	2%	0%	3%	0%	0%	1%	0%	2%
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		
Actuated Green, G (s)	72.2	68.4		72.0	68.3		12.2	12.2		12.2	12.2	
Effective Green, g (s)	72.2	68.4		72.0	68.3		12.2	12.2		12.2	12.2	
Actuated g/C Ratio	0.72	0.68		0.72	0.68		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	323	2405		321	2441		159	212		165	203	
v/s Ratio Prot	c0.00	c0.33		0.00	0.33		0.02			0.02		
v/s Ratio Perm	0.07			0.07			0.03			c0.07		
v/c Ratio	0.10	0.49		0.10	0.48		0.28	0.12		0.57	0.15	
Uniform Delay, d1	4.6	7.5		4.6	7.5		39.9	39.1		41.4	39.3	
Progression Factor	1.00	1.00		0.72	0.62		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.7		0.1	0.6		1.0	0.3		4.5	0.3	
Delay (s)	4.7	8.2		3.4	5.2		40.8	39.4		45.9	39.6	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		8.1			5.2			40.1			43.0	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

2041 Background PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	61	946	20	837	205	38	67	69
Future Volume (vph)	61	946	20	837	205	38	67	69
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	62.6	57.7	60.3	52.9	25.4	16.1	23.3	13.0
Actuated g/C Ratio	0.63	0.58	0.60	0.53	0.25	0.16	0.23	0.13
v/c Ratio	0.18	0.57	0.07	0.51	0.76	0.29	0.21	0.64
Control Delay	4.3	11.3	6.2	13.9	48.1	21.2	27.5	36.1
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	4.3	11.3	6.2	14.0	48.1	21.2	27.5	36.1
LOS	A	B	A	B	D	C	C	D
Approach Delay		11.0		13.9		40.1		33.7
Approach LOS		B		B		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 17.4
Intersection Capacity Utilization 74.7%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service D

Splits and Phases: 8: Pine Street & First Street

01	02	03	04
11 s	50 s	13 s	26 s
05	06 (R)	07	08
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2041 Background PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	65	1150	21	951	218	92	71	182
v/c Ratio	0.18	0.57	0.07	0.51	0.76	0.29	0.21	0.64
Control Delay	4.3	11.3	6.2	13.9	48.1	21.2	27.5	36.1
Queue Delay	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	4.3	11.3	6.2	14.0	48.1	21.2	27.5	36.1
Queue Length 50th (m)	1.3	14.0	1.0	43.6	35.0	7.0	10.4	21.3
Queue Length 95th (m)	2.9	118.8	m3.1	51.8	#53.7	19.9	19.3	40.5
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	357	2023	310	1876	287	388	351	396
Starvation Cap Reductn	0	0	0	264	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.57	0.07	0.59	0.76	0.24	0.20	0.46

Intersection Summary

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.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2041 Background PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	61	946	135	20	837	57	205	38	49	67	69	102
Future Volume (vph)	61	946	135	20	837	57	205	38	49	67	69	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.92		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1824	3495		1825	3541		1785	1691		1744	1719	
Flt Permitted	0.21	1.00		0.18	1.00		0.41	1.00		0.70	1.00	
Satd. Flow (perm)	406	3495		343	3541		774	1691		1280	1719	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	65	1006	144	21	890	61	218	40	52	71	73	109
RTOR Reduction (vph)	0	9	0	0	4	0	0	44	0	0	58	0
Lane Group Flow (vph)	65	1141	0	21	947	0	218	48	0	71	124	0
Confl. Peds. (#/hr)	11		8	8		11	7		7	7		7
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	0%	2%	3%	0%	2%	0%	2%	3%	2%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	60.4	54.4		54.0	51.2		25.1	16.1		20.7	13.9	
Effective Green, g (s)	60.4	54.4		54.0	51.2		25.1	16.1		20.7	13.9	
Actuated g/C Ratio	0.60	0.54		0.54	0.51		0.25	0.16		0.21	0.14	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	330	1901		226	1812		285	272		296	238	
v/s Ratio Prot	c0.01	c0.33		0.00	0.27		c0.07	0.03		0.02	0.07	
v/s Ratio Perm	0.11			0.05			c0.12			0.03		
v/c Ratio	0.20	0.60		0.09	0.52		0.76	0.18		0.24	0.52	
Uniform Delay, d1	9.6	15.4		11.7	16.3		32.9	36.2		32.8	40.0	
Progression Factor	0.42	0.69		0.73	0.78		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.3		0.2	1.0		11.6	0.3		0.4	2.1	
Delay (s)	4.3	11.9		8.8	13.8		44.5	36.5		33.2	42.0	
Level of Service	A	B		A	B		D	D		C	D	
Approach Delay (s)		11.5			13.6			42.1			39.6	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Timings 2041 Background PM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	17	876	73	673	249	17
Future Volume (vph)	17	876	73	673	249	17
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	67.2	60.5	69.9	65.0	19.3	19.3
Actuated g/C Ratio	0.67	0.60	0.70	0.65	0.19	0.19
v/c Ratio	0.04	0.52	0.22	0.31	0.76	0.24
Control Delay	2.1	4.5	6.7	9.5	51.9	12.2
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.6	6.7	9.5	51.9	12.2
LOS	A	A	A	A	D	B
Approach Delay		4.5		9.2		41.7
Approach LOS		A		A		D

Intersection Summary

Cycle Length: 100
 Actuated Cycle Length: 100
 Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green
 Natural Cycle: 60
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.76
 Intersection Signal Delay: 11.9 Intersection LOS: B
 Intersection Capacity Utilization 61.0% ICU Level of Service B
 Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street

Ø1	Ø2	Ø4
11 s	59 s	30 s
Ø5	Ø6 (R)	
11 s	59 s	

Queues 2041 Background PM
9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	18	1107	77	719	262	91
v/c Ratio	0.04	0.52	0.22	0.31	0.76	0.24
Control Delay	2.1	4.5	6.7	9.5	51.9	12.2
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.6	6.7	9.5	51.9	12.2
Queue Length 50th (m)	0.3	45.3	4.0	25.2	48.1	2.9
Queue Length 95th (m)	m0.6	13.7	9.6	52.8	70.8	14.7
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	525	2120	358	2322	438	453
Starvation Cap Reductn	0	118	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.55	0.22	0.31	0.60	0.20

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2041 Background PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	17	876	176	73	673	10	249	17	69	0	0	0
Future Volume (vph)	17	876	176	73	673	10	249	17	69	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.98	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.88				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1703	3484		1825	3570		1791	1628				
Flt Permitted	0.37	1.00		0.19	1.00		0.95	1.00				
Satd. Flow (perm)	667	3484		366	3570		1791	1628				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	18	922	185	77	708	11	262	18	73	0	0	0
RTOR Reduction (vph)	0	15	0	0	1	0	0	59	0	0	0	0
Lane Group Flow (vph)	18	1092	0	77	718	0	262	32	0	0	0	0
Confl. Peds. (#/hr)	16		11	11		16	12		11	11		12
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	62.1	59.6		68.1	62.6		19.3	19.3				
Effective Green, g (s)	62.1	59.6		68.1	62.6		19.3	19.3				
Actuated g/C Ratio	0.62	0.60		0.68	0.63		0.19	0.19				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	440	2076		329	2234		345	314				
v/s Ratio Prot	0.00	c0.31		c0.01	0.20			0.02				
v/s Ratio Perm	0.02			0.15			c0.15					
v/c Ratio	0.04	0.53		0.23	0.32		0.76	0.10				
Uniform Delay, d1	7.3	11.9		6.9	8.8		38.2	33.2				
Progression Factor	0.36	0.30		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.0	0.8		0.4	0.4		9.3	0.1				
Delay (s)	2.6	4.4		7.3	9.1		47.4	33.4				
Level of Service	A	A		A	A		D	C				
Approach Delay (s)		4.3			9.0		43.8			0.0		
Approach LOS		A			A		D			A		

Intersection Summary

HCM 2000 Control Delay	12.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	61.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

2041 Background PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	50	435	13	282	479	17	48	36	712	47	86
Future Volume (vph)	50	435	13	282	479	17	48	36	712	47	86
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	28.0	11.0	28.0	35.0	16.0	16.0	16.0	35.0	35.0	35.0
Total Split (%)	12.2%	31.1%	12.2%	31.1%	38.9%	17.8%	17.8%	17.8%	38.9%	38.9%	38.9%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effect Green (s)	32.7	29.3	30.5	23.3	57.9	10.6	10.6	10.6	26.4	26.4	26.4
Actuated g/C Ratio	0.40	0.36	0.37	0.28	0.71	0.13	0.13	0.13	0.32	0.32	0.32
v/c Ratio	0.16	0.39	0.04	0.58	0.41	0.09	0.23	0.12	0.78	0.79	0.16
Control Delay	18.6	23.4	17.4	34.5	1.7	37.2	39.6	0.8	38.1	38.8	1.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.6	23.4	17.4	34.5	1.7	37.2	39.6	0.8	38.1	38.8	1.4
LOS	B	C	B	C	A	D	D	A	D	D	A
Approach Delay		22.9		13.9			25.5			34.7	
Approach LOS		C		B			C			C	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 82	
Natural Cycle: 75	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 24.4	Intersection LOS: C
Intersection Capacity Utilization 61.6%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E

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BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix E

2031 Total Traffic Operations (Synchro)

HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2031 Total AM

	←	→	↙	↘	←	→	↙	↘	←	→	↙	↘
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	83	1025	42	10	901	7	34	36	21	83	30	142
Future Volume (vph)	83	1025	42	10	901	7	34	36	21	83	30	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.98	1.00	
Frft	1.00	0.99		1.00	1.00		1.00	0.95		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3524		1825	3502		1752	1761		1772	1610	
Flt Permitted	0.22	1.00		0.20	1.00		0.39	1.00		0.71	1.00	
Satd. Flow (perm)	420	3524		389	3502		715	1761		1332	1610	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	97	1192	49	12	1048	8	40	42	24	97	35	165
RTOR Reduction (vph)	0	2	0	0	0	0	0	21	0	0	144	0
Lane Group Flow (vph)	97	1239	0	12	1056	0	40	45	0	97	56	0
Confl. Peds. (#/hr)	11		1	1		11	1		9	9		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	3%		0%	4%	17%	4%	3%	0%	1%	0%	4%
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		
Actuated Green, G (s)	75.6	70.4		67.1	65.9		12.7	12.7		12.7	12.7	
Effective Green, g (s)	75.6	70.4		67.1	65.9		12.7	12.7		12.7	12.7	
Actuated g/C Ratio	0.76	0.70		0.67	0.66		0.13	0.13		0.13	0.13	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	397	2480		278	2307		90	223		169	204	
v/s Ratio Prot	c0.01	c0.35		0.00	0.30			0.03			0.03	
v/s Ratio Perm	0.17			0.03			0.06			c0.07		
v/c Ratio	0.24	0.50		0.04	0.46		0.44	0.20		0.57	0.27	
Uniform Delay, d1	4.3	6.8		5.7	8.3		40.4	39.1		41.1	39.5	
Progression Factor	1.00	1.00		0.44	0.54		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.7		0.1	0.6		3.5	0.4		4.7	0.7	
Delay (s)	4.6	7.5		2.6	5.0		43.9	39.6		45.8	40.2	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		7.3			5.0			41.2			42.0	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

2031 Total AM

	←	→	↙	↘	←	→	↙	↘
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	35	820	19	969	124	14	51	27
Future Volume (vph)	35	820	19	969	124	14	51	27
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	67.6	63.0	66.8	60.8	17.3	10.5	19.2	10.3
Actuated g/C Ratio	0.68	0.63	0.67	0.61	0.17	0.10	0.19	0.10
v/c Ratio	0.12	0.49	0.07	0.54	0.55	0.17	0.20	0.38
Control Delay	3.7	8.6	4.6	9.7	42.0	28.0	30.7	24.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.7	8.6	4.6	9.7	42.0	28.0	30.7	24.4
LOS	A	A	A	A	D	C	C	C
Approach Delay		8.4		9.6		39.5		27.0
Approach LOS		A		A		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.55
Intersection Signal Delay: 12.1
Intersection Capacity Utilization 52.5%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service A

Splits and Phases: 8: Pine Street & First Street

⬅️ 01	➡️ 02	⬅️ 03	➡️ 04
11 s	50 s	13 s	26 s
⬅️ 05	➡️ 06 (R)	⬅️ 07	➡️ 08
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2031 Total AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	41	1077	22	1155	146	32	60	85
v/c Ratio	0.12	0.49	0.07	0.54	0.55	0.17	0.20	0.38
Control Delay	3.7	8.6	4.6	9.7	42.0	28.0	30.7	24.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.7	8.6	4.6	9.7	42.0	28.0	30.7	24.4
Queue Length 50th (m)	1.4	57.6	0.9	49.9	23.2	2.9	9.1	5.8
Queue Length 95th (m)	m1.8	34.2	m1.9	54.7	36.8	10.7	17.7	17.9
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	328	2191	329	2129	266	347	303	384
Starvation Cap Reductn	0	0	0	88	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	0.13	0.49	0.07	0.57	0.55	0.09	0.20	0.22

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2031 Total AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	35	820	95	19	969	13	124	14	14	51	27	45
Future Volume (vph)	35	820	95	19	969	13	124	14	14	51	27	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3470		1629	3503		1733	1676		1715	1715	
Flt Permitted	0.17	1.00		0.21	1.00		0.70	1.00		0.68	1.00	
Satd. Flow (perm)	331	3470		361	3503		1280	1676		1228	1715	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	41	965	112	22	1140	15	146	16	16	60	32	53
RTOR Reduction (vph)	0	7	0	0	1	0	0	15	0	0	48	0
Lane Group Flow (vph)	41	1070	0	22	1154	0	146	17	0	60	37	0
Confl. Peds. (#/hr)	17		1	1		17	3		4	4		3
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	0%	3%	6%	12%	4%	0%	5%	0%	9%	6%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	62.7	58.5		59.9	57.1		18.1	8.5		19.5	9.2	
Effective Green, g (s)	62.7	58.5		59.9	57.1		18.1	8.5		19.5	9.2	
Actuated g/C Ratio	0.63	0.58		0.60	0.57		0.18	0.08		0.20	0.09	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	270	2029		251	2000		275	142		289	157	
v/s Ratio Prot	c0.01	0.31		0.00	c0.33		c0.05	0.01		0.02	0.02	
v/s Ratio Perm	0.09			0.05			c0.05			0.02		
v/c Ratio	0.15	0.53		0.09	0.58		0.53	0.12		0.21	0.23	
Uniform Delay, d1	8.8	12.5		8.9	13.7		36.6	42.3		33.6	42.1	
Progression Factor	0.50	0.68		0.71	0.65		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.9		0.1	1.1		2.0	0.4		0.4	0.8	
Delay (s)	4.7	9.4		6.5	10.0		38.6	42.7		33.9	42.9	
Level of Service	A	A		A	B		D	D		C	D	
Approach Delay (s)		9.2			10.0			39.3			39.2	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	52.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Timings

2031 Total AM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖
Traffic Volume (vph)	23	707	41	773	237	20
Future Volume (vph)	23	707	41	773	237	20
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	66.9	59.9	68.0	62.0	20.1	20.1
Actuated g/C Ratio	0.67	0.60	0.68	0.62	0.20	0.20
v/c Ratio	0.07	0.49	0.13	0.43	0.78	0.19
Control Delay	2.1	4.4	6.3	12.0	52.8	14.7
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.5	6.3	12.0	52.8	14.7
LOS	A	A	A	B	D	B
Approach Delay		4.4		11.8		44.8
Approach LOS		A		B		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.78

Intersection Signal Delay: 13.4

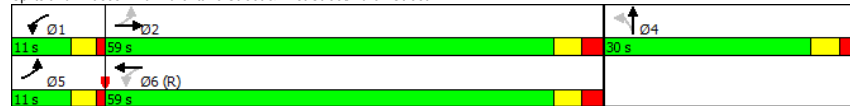
Intersection LOS: B

Intersection Capacity Utilization 55.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street



Queues

2031 Total AM

9: Hurontario Street & First Street/Huron Street

	↖	→	↗	←	↖	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	27	1029	49	949	282	74
v/c Ratio	0.07	0.49	0.13	0.43	0.78	0.19
Control Delay	2.1	4.4	6.3	12.0	52.8	14.7
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	4.5	6.3	12.0	52.8	14.7
Queue Length 50th (m)	0.4	67.7	2.6	52.2	51.7	3.8
Queue Length 95th (m)	m0.9	8.5	6.2	67.8	69.8	13.0
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	374	2086	385	2189	438	453
Starvation Cap Reductn	0	127	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.53	0.13	0.43	0.64	0.16

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2031 Total AM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	23	707	157	41	773	24	237	20	42	0	0	0
Future Volume (vph)	23	707	157	41	773	24	237	20	42	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.90				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1587	3456		1825	3528		1796	1703				
Flt Permitted	0.26	1.00		0.22	1.00		0.95	1.00				
Satd. Flow (perm)	436	3456		421	3528		1796	1703				
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	27	842	187	49	920	29	282	24	50	0	0	0
RTOR Reduction (vph)	0	16	0	0	2	0	0	40	0	0	0	0
Lane Group Flow (vph)	27	1013	0	49	947	0	282	34	0	0	0	0
Confl. Peds. (#/hr)	3		6	6		3	4		5	5		4
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	15%	3%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	63.0	59.1		65.6	60.4		20.1	20.1				
Effective Green, g (s)	63.0	59.1		65.6	60.4		20.1	20.1				
Actuated g/C Ratio	0.63	0.59		0.66	0.60		0.20	0.20				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	319	2042		349	2130		360	342				
v/s Ratio Prot	0.00	c0.29		c0.01	0.27			0.02				
v/s Ratio Perm	0.05			0.08			c0.16					
v/c Ratio	0.08	0.50		0.14	0.44		0.78	0.10				
Uniform Delay, d1	7.3	11.8		7.0	10.7		37.9	32.6				
Progression Factor	0.32	0.30		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	0.8		0.2	0.7		10.6	0.1				
Delay (s)	2.4	4.3		7.2	11.4		48.5	32.7				
Level of Service	A	A		A	B		D	C				
Approach Delay (s)		4.3			11.2		45.2			0.0		
Approach LOS		A			B		D			A		
Intersection Summary												
HCM 2000 Control Delay		13.2			HCM 2000 Level of Service		B					
HCM 2000 Volume to Capacity ratio		0.54										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)		15.6					
Intersection Capacity Utilization		55.0%			ICU Level of Service		A					
Analysis Period (min)		15										
c Critical Lane Group												

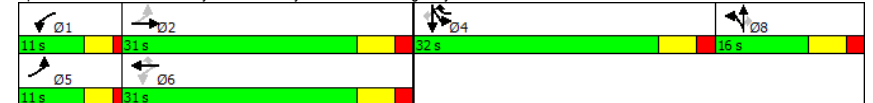
Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

2031 Total AM

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 	 		 	 		 	 
Traffic Volume (vph)	142	222	30	394	797	22	30	34	281	42	97
Future Volume (vph)	142	222	30	394	797	22	30	34	281	42	97
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	31.0	11.0	31.0	32.0	16.0	16.0	16.0	32.0	32.0	32.0
Total Split (%)	12.2%	34.4%	12.2%	34.4%	35.6%	17.8%	17.8%	17.8%	35.6%	35.6%	35.6%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	36.8	30.9	34.9	25.6	45.7	10.3	10.3	10.3	20.1	20.1	20.1
Actuated g/C Ratio	0.45	0.38	0.43	0.31	0.56	0.13	0.13	0.13	0.25	0.25	0.25
v/c Ratio	0.49	0.20	0.07	0.75	0.80	0.12	0.15	0.13	0.44	0.44	0.22
Control Delay	21.3	21.5	15.5	37.4	11.1	37.3	37.6	0.9	30.1	29.9	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.3	21.5	15.5	37.4	11.1	37.3	37.6	0.9	30.1	29.9	2.6
LOS	C	C	B	D	B	D	D	A	C	C	A
Approach Delay		21.4		19.7			23.2			23.7	
Approach LOS		C		B			C			C	
Intersection Summary											
Cycle Length: 90											
Actuated Cycle Length: 81.3											
Natural Cycle: 75											
Control Type: Semi Act-Uncoord											
Maximum v/c Ratio: 0.80											
Intersection Signal Delay: 20.9						Intersection LOS: C					
Intersection Capacity Utilization 79.0%						ICU Level of Service D					
Analysis Period (min) 15											

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E



HCM Signalized Intersection Capacity Analysis
7: Cedar Street & First Street

2031 Total PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	62	1429	59	28	1545	7	67	21	24	86	21	81
Future Volume (vph)	62	1429	59	28	1545	7	67	21	24	86	21	81
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	3521		1755	3576		1764	1743		1782	1643	
Flt Permitted	0.09	1.00		0.12	1.00		0.69	1.00		0.73	1.00	
Satd. Flow (perm)	173	3521		214	3576		1278	1743		1362	1643	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	1504	62	29	1626	7	71	22	25	91	22	85
RTOR Reduction (vph)	0	2	0	0	0	0	0	22	0	0	75	0
Lane Group Flow (vph)	65	1564	0	29	1633	0	71	25	0	91	32	0
Confl. Peds. (#/hr)	12		8	8		12	2		6	6		2
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	4%	3%	2%	4%	2%	0%	3%	0%	0%	1%	0%	2%
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		
Actuated Green, G (s)	73.9	68.6		70.7	67.0		12.0	12.0		12.0	12.0	
Effective Green, g (s)	73.9	68.6		70.7	67.0		12.0	12.0		12.0	12.0	
Actuated g/C Ratio	0.74	0.69		0.71	0.67		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	211	2415		208	2395		153	209		163	197	
v/s Ratio Prot	c0.02	0.44		0.01	c0.46		0.01			0.02		
v/s Ratio Perm	0.21			0.09			0.06			c0.07		
v/c Ratio	0.31	0.65		0.14	0.68		0.46	0.12		0.56	0.16	
Uniform Delay, d1	8.0	8.9		6.4	10.0		41.0	39.3		41.5	39.5	
Progression Factor	1.00	1.00		0.52	0.47		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.4		0.2	1.1		2.2	0.3		4.1	0.4	
Delay (s)	8.8	10.2		3.6	5.8		43.2	39.5		45.6	39.9	
Level of Service	A	B		A	A		D	D		D	D	
Approach Delay (s)		10.2			5.7			41.8			42.5	
Approach LOS		B			A			D			D	

Intersection Summary

HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
8: Pine Street & First Street

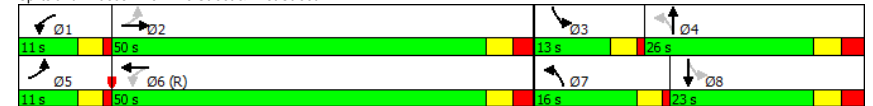
2031 Total PM

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	76	1241	22	1181	252	38	73	66
Future Volume (vph)	76	1241	22	1181	252	38	73	66
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	16.0	26.0	13.0	23.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	16.0%	26.0%	13.0%	23.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	59.7	54.9	57.7	50.3	30.3	18.7	23.1	12.8
Actuated g/C Ratio	0.60	0.55	0.58	0.50	0.30	0.19	0.23	0.13
v/c Ratio	0.37	0.78	0.11	0.74	0.80	0.25	0.23	0.66
Control Delay	15.1	16.0	7.1	18.8	46.8	19.7	26.2	36.6
Queue Delay	0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	15.1	16.5	7.1	19.0	46.8	19.7	26.2	36.6
LOS	B	B	A	B	D	B	C	D
Approach Delay		16.5		18.8		39.9		33.5
Approach LOS		B		B		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 21.0
Intersection Capacity Utilization 86.7%
Analysis Period (min) 15
Intersection LOS: C
ICU Level of Service E

Splits and Phases: 8: Pine Street & First Street



Queues
8: Pine Street & First Street

2031 Total PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	81	1500	23	1329	268	91	78	185
v/c Ratio	0.37	0.78	0.11	0.74	0.80	0.25	0.23	0.66
Control Delay	15.1	16.0	7.1	18.8	46.8	19.7	26.2	36.6
Queue Delay	0.0	0.5	0.0	0.2	0.0	0.0	0.0	0.0
Total Delay	15.1	16.5	7.1	19.0	46.8	19.7	26.2	36.6
Queue Length 50th (m)	1.3	76.5	1.2	121.2	42.4	6.8	11.0	21.1
Queue Length 95th (m)	m6.6	#195.6	m2.7	109.9	#67.7	19.5	20.3	41.1
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	219	1930	207	1788	337	398	347	348
Starvation Cap Reductn	0	0	0	71	0	0	0	0
Spillback Cap Reductn	0	130	0	0	0	1	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.83	0.11	0.77	0.80	0.23	0.22	0.53

Intersection Summary

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.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2031 Total PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	76	1241	169	22	1181	69	252	38	48	73	66	108
Future Volume (vph)	76	1241	169	22	1181	69	252	38	48	73	66	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.92		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3498		1825	3547		1787	1694		1744	1711	
Flt Permitted	0.09	1.00		0.08	1.00		0.36	1.00		0.70	1.00	
Satd. Flow (perm)	168	3498		158	3547		671	1694		1281	1711	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	81	1320	180	23	1256	73	268	40	51	78	70	115
RTOR Reduction (vph)	0	9	0	0	4	0	0	41	0	0	61	0
Lane Group Flow (vph)	81	1491	0	23	1325	0	268	50	0	78	124	0
Confl. Peds. (#/hr)	11		8	8		11	7		7	7		7
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	0%	2%	3%	0%	2%	0%	2%	3%	2%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	57.5	51.7		51.5	48.7		29.6	18.7		20.5	13.6	
Effective Green, g (s)	57.5	51.7		51.5	48.7		29.6	18.7		20.5	13.6	
Actuated g/C Ratio	0.58	0.52		0.52	0.49		0.30	0.19		0.20	0.14	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	192	1808		128	1727		332	316		294	232	
v/s Ratio Prot	c0.02	c0.43		0.01	0.37		c0.10	0.03		0.02	0.07	
v/s Ratio Perm	0.22			0.09			c0.14			0.04		
v/c Ratio	0.42	0.82		0.18	0.77		0.81	0.16		0.27	0.53	
Uniform Delay, d1	15.0	20.3		16.4	21.0		29.8	34.0		33.1	40.2	
Progression Factor	1.25	0.64		0.70	0.76		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.2	3.6		0.6	2.8		13.4	0.2		0.5	2.3	
Delay (s)	19.9	16.6		12.0	18.8		43.2	34.3		33.6	42.6	
Level of Service	B	B		B	B		D	C		C	D	
Approach Delay (s)		16.8			18.7			40.9			39.9	
Approach LOS		B			B			D			D	

Intersection Summary

HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings

2031 Total PM

9: Hurontario Street & First Street/Huron Street

	↖	→	↙	←	↘	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↖	↖↗	↖	↖↗	↖	↖
Traffic Volume (vph)	20	1047	91	906	373	16
Future Volume (vph)	20	1047	91	906	373	16
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	57.0	11.0	57.0	32.0	32.0
Total Split (%)	11.0%	57.0%	11.0%	57.0%	32.0%	32.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead		Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		Yes
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	61.9	55.0	64.4	59.6	24.6	24.6
Actuated g/C Ratio	0.62	0.55	0.64	0.60	0.25	0.25
v/c Ratio	0.06	0.74	0.43	0.45	0.89	0.20
Control Delay	2.1	7.8	13.5	13.2	59.0	10.5
Queue Delay	0.0	0.2	0.0	0.1	0.0	0.0
Total Delay	2.1	8.0	13.5	13.3	59.0	10.5
LOS	A	A	B	B	E	B
Approach Delay		7.9		13.3		49.6
Approach LOS		A		B		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 16.6

Intersection LOS: B

Intersection Capacity Utilization 77.5%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street

↖ 01	↖ 02	↖ 04
11 s	57 s	32 s
↖ 05	↖ 06 (R)	
11 s	57 s	

Queues

2031 Total PM

9: Hurontario Street & First Street/Huron Street

	↖	→	↙	←	↘	↑
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	21	1420	96	965	393	94
v/c Ratio	0.06	0.74	0.43	0.45	0.89	0.20
Control Delay	2.1	7.8	13.5	13.2	59.0	10.5
Queue Delay	0.0	0.2	0.0	0.1	0.0	0.0
Total Delay	2.1	8.0	13.5	13.3	59.0	10.5
Queue Length 50th (m)	0.3	119.1	6.4	46.9	71.7	2.5
Queue Length 95th (m)	m0.5	21.8	13.1	79.8	#118.6	14.3
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	371	1922	229	2128	475	487
Starvation Cap Reductn	0	86	0	0	0	0
Spillback Cap Reductn	0	0	0	253	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.77	0.42	0.51	0.83	0.19

Intersection Summary

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.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2031 Total PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	20	1047	302	91	906	10	373	16	73	0	0	0
Future Volume (vph)	20	1047	302	91	906	10	373	16	73	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.88				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1704	3452		1825	3572		1798	1630				
Flt Permitted	0.25	1.00		0.09	1.00		0.95	1.00				
Satd. Flow (perm)	455	3452		176	3572		1798	1630				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	1102	318	96	954	11	393	17	77	0	0	0
RTOR Reduction (vph)	0	25	0	0	1	0	0	58	0	0	0	0
Lane Group Flow (vph)	21	1395	0	96	964	0	393	36	0	0	0	0
Confl. Peds. (#/hr)	16		11	11		16	12		11	11		12
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	56.9	54.3		62.7	57.2		24.6	24.6				
Effective Green, g (s)	56.9	54.3		62.7	57.2		24.6	24.6				
Actuated g/C Ratio	0.57	0.54		0.63	0.57		0.25	0.25				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	291	1874		201	2043		442	400				
v/s Ratio Prot	0.00	c0.40		c0.03	0.27			0.02				
v/s Ratio Perm	0.04			0.27			c0.22					
v/c Ratio	0.07	0.74		0.48	0.47		0.89	0.09				
Uniform Delay, d1	9.7	17.5		13.2	12.5		36.4	29.1				
Progression Factor	0.29	0.34		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	1.8		1.8	0.8		19.1	0.1				
Delay (s)	2.9	7.7		15.0	13.3		55.5	29.2				
Level of Service	A	A		B	B		E	C				
Approach Delay (s)		7.7			13.5		50.4			0.0		
Approach LOS		A			B		D			A		

Intersection Summary

HCM 2000 Control Delay	16.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

2031 Total PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	102	427	38	294	530	28	57	60	788	56	140
Future Volume (vph)	102	427	38	294	530	28	57	60	788	56	140
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	26.0	11.0	26.0	37.0	16.0	16.0	16.0	37.0	37.0	37.0
Total Split (%)	12.2%	28.9%	12.2%	28.9%	41.1%	17.8%	17.8%	17.8%	41.1%	41.1%	41.1%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effect Green (s)	29.0	23.1	28.3	21.0	58.1	10.5	10.5	10.5	28.8	28.8	28.8
Actuated g/C Ratio	0.35	0.28	0.34	0.26	0.71	0.13	0.13	0.13	0.35	0.35	0.35
v/c Ratio	0.37	0.49	0.13	0.67	0.46	0.14	0.28	0.20	0.79	0.81	0.24
Control Delay	23.2	29.8	19.7	39.6	2.9	38.1	40.5	1.4	37.0	38.3	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.2	29.8	19.7	39.6	2.9	38.1	40.5	1.4	37.0	38.3	4.8
LOS	C	C	B	D	A	D	D	A	D	D	A
Approach Delay		28.6		16.1			23.9			33.0	
Approach LOS		C		B			C			C	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 82.2	
Natural Cycle: 80	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 25.8	Intersection LOS: C
Intersection Capacity Utilization 64.6%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E

Ø1	Ø2	Ø3	Ø4	Ø5	Ø6
11 s	26 s	37 s	16 s	11 s	26 s



BURNSIDE

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Appendix H

2041 Total Traffic Operations (Synchro)

HCM Signalized Intersection Capacity Analysis 7: Cedar Street & First Street

2041 Total AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	102	1279	50	10	1054	8	37	38	22	87	31	153
Future Volume (vph)	102	1279	50	10	1054	8	37	38	22	87	31	153
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.98	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.94		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3525		1825	3502		1753	1759		1773	1608	
Flt Permitted	0.16	1.00		0.13	1.00		0.35	1.00		0.71	1.00	
Satd. Flow (perm)	316	3525		254	3502		643	1759		1328	1608	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	119	1487	58	12	1226	9	43	44	26	101	36	178
RTOR Reduction (vph)	0	2	0	0	0	0	0	23	0	0	121	0
Lane Group Flow (vph)	119	1543	0	12	1235	0	43	47	0	101	93	0
Confl. Peds. (#/hr)	11		1	1		11	1		9	9		1
Confl. Bikes (#/hr)			1									
Heavy Vehicles (%)	0%	3%	0%	0%	4%	17%	4%	3%	0%	1%	0%	4%
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		
Actuated Green, G (s)	75.3	70.1		65.3	64.1		13.0	13.0		13.0	13.0	
Effective Green, g (s)	75.3	70.1		65.3	64.1		13.0	13.0		13.0	13.0	
Actuated g/C Ratio	0.75	0.70		0.65	0.64		0.13	0.13		0.13	0.13	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	346	2471		184	2244		83	228		172	209	
v/s Ratio Prot	c0.02	c0.44		0.00	0.35			0.03			0.06	
v/s Ratio Perm	0.23			0.04			0.07			c0.08		
v/c Ratio	0.34	0.62		0.07	0.55		0.52	0.21		0.59	0.45	
Uniform Delay, d1	5.6	8.0		6.9	10.0		40.6	38.9		41.0	40.2	
Progression Factor	1.00	1.00		0.49	0.62		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	1.2		0.1	0.8		5.4	0.5		5.0	1.5	
Delay (s)	6.2	9.2		3.5	6.9		45.9	39.4		46.0	41.7	
Level of Service	A	A		A	A		D	D		D	D	
Approach Delay (s)		8.9			6.9			41.9			43.1	
Approach LOS		A			A			D			D	

Intersection Summary

HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Timings 8: Pine Street & First Street

2041 Total AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	40	971	20	1080	140	15	53	28
Future Volume (vph)	40	971	20	1080	140	15	53	28
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	13.0	26.0	13.0	26.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	13.0%	26.0%	13.0%	26.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	67.7	63.0	66.7	60.7	17.4	10.5	19.3	10.3
Actuated g/C Ratio	0.68	0.63	0.67	0.61	0.17	0.10	0.19	0.10
v/c Ratio	0.16	0.58	0.09	0.61	0.62	0.18	0.21	0.40
Control Delay	3.6	8.4	4.8	9.9	45.2	28.3	30.8	23.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.6	8.4	4.8	10.0	45.2	28.3	30.8	23.9
LOS	A	A	A	A	D	C	C	C
Approach Delay		8.3		9.9		42.3		26.7
Approach LOS		A		A		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.62
Intersection Signal Delay: 12.2
Intersection Capacity Utilization 57.6%
Analysis Period (min) 15
Intersection LOS: B
ICU Level of Service B

Splits and Phases: 8: Pine Street & First Street

Ø1	Ø2	Ø3	Ø4
11 s	50 s	13 s	26 s
Ø5	Ø6 (R)	Ø7	Ø8
11 s	50 s	13 s	26 s

Queues
8: Pine Street & First Street

2041 Total AM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	47	1280	24	1287	165	34	62	91
v/c Ratio	0.16	0.58	0.09	0.61	0.62	0.18	0.21	0.40
Control Delay	3.6	8.4	4.8	9.9	45.2	28.3	30.8	23.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.6	8.4	4.8	10.0	45.2	28.3	30.8	23.9
Queue Length 50th (m)	1.3	72.8	1.0	55.0	26.5	3.2	9.4	6.0
Queue Length 95th (m)	m1.4	31.3	m1.8	59.5	41.0	11.2	18.2	18.3
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	286	2189	267	2126	266	350	303	388
Starvation Cap Reductn	0	0	0	49	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.16	0.58	0.09	0.62	0.62	0.10	0.20	0.23

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2041 Total AM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	40	971	117	20	1080	14	140	15	14	53	28	49
Future Volume (vph)	40	971	117	20	1080	14	140	15	14	53	28	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.93		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3468		1629	3503		1733	1690		1715	1711	
Flt Permitted	0.14	1.00		0.15	1.00		0.70	1.00		0.68	1.00	
Satd. Flow (perm)	260	3468		257	3503		1273	1690		1226	1711	
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	47	1142	138	24	1271	16	165	18	16	62	33	58
RTOR Reduction (vph)	0	7	0	0	1	0	0	15	0	0	53	0
Lane Group Flow (vph)	47	1273	0	24	1286	0	165	19	0	62	38	0
Confl. Peds. (#/hr)	17		1	1		17	3		4	4		3
Confl. Bikes (#/hr)			1						1			1
Heavy Vehicles (%)	0%	3%	6%	12%	4%	0%	5%	0%	9%	6%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	62.8	58.5		59.8	57.0		18.1	8.5		19.5	9.2	
Effective Green, g (s)	62.8	58.5		59.8	57.0		18.1	8.5		19.5	9.2	
Actuated g/C Ratio	0.63	0.58		0.60	0.57		0.18	0.08		0.20	0.09	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	230	2028		192	1996		274	143		289	157	
v/s Ratio Prot	c0.01	0.37		0.00	c0.37		c0.06	0.01		0.02	0.02	
v/s Ratio Perm	0.12			0.07			c0.05			0.02		
v/c Ratio	0.20	0.63		0.12	0.64		0.60	0.14		0.21	0.24	
Uniform Delay, d1	9.7	13.6		9.8	14.6		37.1	42.3		33.6	42.2	
Progression Factor	0.42	0.59		0.71	0.61		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	1.2		0.3	1.4		3.7	0.4		0.4	0.8	
Delay (s)	4.5	9.2		7.2	10.4		40.8	42.8		34.0	43.0	
Level of Service	A	A		A	B		D	D		C	D	
Approach Delay (s)		9.1			10.3			41.1			39.3	
Approach LOS		A			B			D			D	

Intersection Summary

HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings

2041 Total AM

9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	24	804	46	864	257	21
Future Volume (vph)	24	804	46	864	257	21
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	59.0	11.0	59.0	30.0	30.0
Total Split (%)	11.0%	59.0%	11.0%	59.0%	30.0%	30.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	66.0	58.9	67.2	61.1	21.0	21.0
Actuated g/C Ratio	0.66	0.59	0.67	0.61	0.21	0.21
v/c Ratio	0.09	0.59	0.18	0.49	0.81	0.20
Control Delay	2.1	5.1	7.1	13.2	54.5	13.9
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	5.1	7.1	13.2	54.5	13.9
LOS	A	A	A	B	D	B
Approach Delay		5.1		12.9		46.0
Approach LOS		A		B		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 14.0

Intersection LOS: B

Intersection Capacity Utilization 60.6%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street

Ø1	Ø2	Ø4
11 s	59 s	30 s
Ø5	Ø6 (R)	
11 s	59 s	

Queues

2041 Total AM

9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	29	1213	55	1060	306	81
v/c Ratio	0.09	0.59	0.18	0.49	0.81	0.20
Control Delay	2.1	5.1	7.1	13.2	54.5	13.9
Queue Delay	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	2.1	5.1	7.1	13.2	54.5	13.9
Queue Length 50th (m)	0.4	85.7	3.1	63.2	56.0	3.9
Queue Length 95th (m)	m0.8	8.5	6.8	78.4	76.1	13.5
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	329	2048	312	2159	438	456
Starvation Cap Reductn	0	93	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.62	0.18	0.49	0.70	0.18

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2041 Total AM

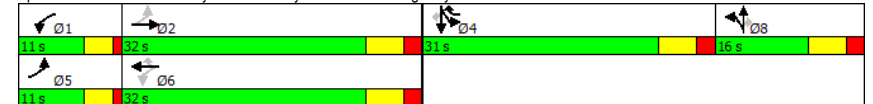
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	24	804	215	46	864	26	257	21	47	0	0	0
Future Volume (vph)	24	804	215	46	864	26	257	21	47	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.90				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1587	3442		1825	3529		1797	1698				
Flt Permitted	0.22	1.00		0.16	1.00		0.95	1.00				
Satd. Flow (perm)	367	3442		307	3529		1797	1698				
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	29	957	256	55	1029	31	306	25	56	0	0	0
RTOR Reduction (vph)	0	21	0	0	2	0	0	44	0	0	0	0
Lane Group Flow (vph)	29	1192	0	55	1058	0	306	37	0	0	0	0
Confl. Peds. (#/hr)	3		6	6		3	4		5	5		4
Confl. Bikes (#/hr)							1					
Heavy Vehicles (%)	15%	3%	0%	0%	3%	0%	1%	0%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	62.0	58.1		64.8	59.5		21.0	21.0				
Effective Green, g (s)	62.0	58.1		64.8	59.5		21.0	21.0				
Actuated g/C Ratio	0.62	0.58		0.65	0.60		0.21	0.21				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	275	1999		279	2099		377	356				
v/s Ratio Prot	0.00	c0.35		c0.01	0.30			0.02				
v/s Ratio Perm	0.06			0.12			c0.17					
v/c Ratio	0.11	0.60		0.20	0.50		0.81	0.10				
Uniform Delay, d1	8.0	13.4		8.3	11.7		37.6	31.9				
Progression Factor	0.28	0.29		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	1.1		0.3	0.9		12.5	0.1				
Delay (s)	2.4	5.0		8.7	12.6		50.1	32.0				
Level of Service	A	A		A	B		D	C				
Approach Delay (s)		4.9			12.4		46.3			0.0		
Approach LOS		A			B		D			A		
Intersection Summary												
HCM 2000 Control Delay		13.8			HCM 2000 Level of Service		B					
HCM 2000 Volume to Capacity ratio		0.62										
Actuated Cycle Length (s)		100.0			Sum of lost time (s)		15.6					
Intersection Capacity Utilization		60.6%			ICU Level of Service		B					
Analysis Period (min)		15										
c Critical Lane Group												

Timings
10: Pretty River Parkway & Hume Street/Highway 26 E

2041 Total AM

											
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 		 	 		 	 		 	 
Traffic Volume (vph)	161	265	31	436	855	22	32	35	348	44	140
Future Volume (vph)	161	265	31	436	855	22	32	35	348	44	140
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	32.0	11.0	32.0	31.0	16.0	16.0	16.0	31.0	31.0	31.0
Total Split (%)	12.2%	35.6%	12.2%	35.6%	34.4%	17.8%	17.8%	17.8%	34.4%	34.4%	34.4%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	37.5	31.6	35.7	26.5	48.3	10.2	10.2	10.2	21.8	21.8	21.8
Actuated g/C Ratio	0.45	0.38	0.43	0.32	0.58	0.12	0.12	0.12	0.26	0.26	0.26
v/c Ratio	0.63	0.24	0.08	0.82	0.86	0.13	0.17	0.14	0.51	0.50	0.31
Control Delay	28.2	21.9	15.3	42.6	16.1	37.8	38.4	1.0	31.9	31.6	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	28.2	21.9	15.3	42.6	16.1	37.8	38.4	1.0	31.9	31.6	6.2
LOS	C	C	B	D	B	D	D	A	C	C	A
Approach Delay		24.2		24.8			23.7			25.0	
Approach LOS		C		C			C			C	
Intersection Summary											
Cycle Length: 90											
Actuated Cycle Length: 83.8											
Natural Cycle: 90											
Control Type: Semi Act-Uncoord											
Maximum v/c Ratio: 0.86											
Intersection Signal Delay: 24.7						Intersection LOS: C					
Intersection Capacity Utilization 83.6%						ICU Level of Service E					
Analysis Period (min) 15											

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E



HCM Signalized Intersection Capacity Analysis 7: Cedar Street & First Street

2041 Total PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	74	1669	68	29	1861	8	79	22	26	90	22	104
Future Volume (vph)	74	1669	68	29	1861	8	79	22	26	90	22	104
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1755	3521		1755	3576		1765	1740		1782	1633	
Flt Permitted	0.06	1.00		0.07	1.00		0.62	1.00		0.72	1.00	
Satd. Flow (perm)	108	3521		129	3576		1154	1740		1359	1633	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	1757	72	31	1959	8	83	23	27	95	23	109
RTOR Reduction (vph)	0	2	0	0	0	0	0	24	0	0	86	0
Lane Group Flow (vph)	78	1827	0	31	1967	0	83	26	0	95	46	0
Confl. Peds. (#/hr)	12		8	8		12	2		6	6		2
Confl. Bikes (#/hr)						1						
Heavy Vehicles (%)	4%	3%	2%	4%	2%	0%	3%	0%	0%	1%	0%	2%
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		
Actuated Green, G (s)	73.9	68.2		70.1	66.3		12.3	12.3		12.3	12.3	
Effective Green, g (s)	73.9	68.2		70.1	66.3		12.3	12.3		12.3	12.3	
Actuated g/C Ratio	0.74	0.68		0.70	0.66		0.12	0.12		0.12	0.12	
Clearance Time (s)	4.0	5.7		4.0	5.7		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	173	2401		152	2370		141	214		167	200	
v/s Ratio Prot	c0.03	0.52		0.01	c0.55			0.02			0.03	
v/s Ratio Perm	0.31			0.14			c0.07			0.07		
v/c Ratio	0.45	0.76		0.20	0.83		0.59	0.12		0.57	0.23	
Uniform Delay, d1	15.7	10.5		9.4	12.6		41.5	39.0		41.3	39.6	
Progression Factor	1.00	1.00		0.65	0.55		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	2.3		0.4	2.0		6.2	0.3		4.4	0.6	
Delay (s)	17.5	12.8		6.5	9.0		47.6	39.3		45.7	40.2	
Level of Service	B	B		A	A		D	D		D	D	
Approach Delay (s)		13.0			9.0			44.5			42.5	
Approach LOS		B			A			D			D	

Intersection Summary

HCM 2000 Control Delay	13.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.7
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings 8: Pine Street & First Street

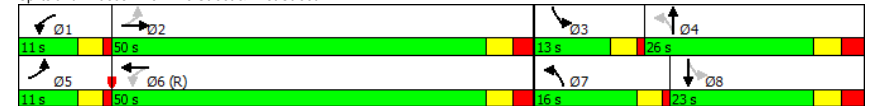
2041 Total PM

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	↱	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	84	1379	23	1364	287	40	76	69
Future Volume (vph)	84	1379	23	1364	287	40	76	69
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	5	2	1	6	7	4	3	8
Permitted Phases	2		6		4		8	
Detector Phase	5	2	1	6	7	4	3	8
Switch Phase								
Minimum Initial (s)	7.0	32.0	7.0	32.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	37.8	11.0	37.8	11.0	16.1	11.0	16.1
Total Split (s)	11.0	50.0	11.0	50.0	16.0	26.0	13.0	23.0
Total Split (%)	11.0%	50.0%	11.0%	50.0%	16.0%	26.0%	13.0%	23.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.0	3.3	3.0	3.3
All-Red Time (s)	1.0	2.5	1.0	2.5	1.0	2.8	1.0	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.8	4.0	5.8	4.0	6.1	4.0	6.1
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes		Yes		Yes		Yes	
Recall Mode	None	Max	None	C-Max	None	None	None	None
Act Effct Green (s)	59.4	54.6	57.2	49.8	30.7	19.0	23.5	13.1
Actuated g/C Ratio	0.59	0.55	0.57	0.50	0.31	0.19	0.24	0.13
v/c Ratio	0.42	0.87	0.12	0.86	0.93	0.26	0.24	0.69
Control Delay	19.5	18.9	7.0	23.1	66.0	19.7	26.0	38.1
Queue Delay	0.0	3.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	19.5	21.9	7.0	23.3	66.0	19.7	26.0	38.1
LOS	B	C	A	C	E	B	C	D
Approach Delay		21.8		23.0		54.9		34.6
Approach LOS		C		C		D		C

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 11 (11%), Referenced to phase 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 26.5
Intersection Capacity Utilization 94.2%
Analysis Period (min) 15
Intersection LOS: C
ICU Level of Service F

Splits and Phases: 8: Pine Street & First Street



Queues
8: Pine Street & First Street

2041 Total PM

	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	89	1673	24	1528	305	96	81	201
v/c Ratio	0.42	0.87	0.12	0.86	0.93	0.26	0.24	0.69
Control Delay	19.5	18.9	7.0	23.1	66.0	19.7	26.0	38.1
Queue Delay	0.0	3.0	0.0	0.1	0.0	0.0	0.0	0.0
Total Delay	19.5	21.9	7.0	23.3	66.0	19.7	26.0	38.1
Queue Length 50th (m)	1.3	71.0	1.3	150.8	49.0	7.3	11.3	23.2
Queue Length 95th (m)	m7.4	#228.8	m2.3	m#197.6	#75.3	20.4	20.9	44.7
Internal Link Dist (m)		579.7		117.0		406.4		46.5
Turn Bay Length (m)	50.0		40.0			25.0		
Base Capacity (vph)	212	1917	207	1771	328	400	352	351
Starvation Cap Reductn	0	0	0	14	0	0	0	0
Spillback Cap Reductn	0	158	0	0	0	2	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.95	0.12	0.87	0.93	0.24	0.23	0.57

Intersection Summary

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.

HCM Signalized Intersection Capacity Analysis
8: Pine Street & First Street

2041 Total PM

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↲	↰	↱	↲	↰	↱	↲	↰	↱	↲
Traffic Volume (vph)	84	1379	194	23	1364	72	287	40	50	76	69	120
Future Volume (vph)	84	1379	194	23	1364	72	287	40	50	76	69	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		1.00	0.98	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		0.99	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.92		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1825	3496		1825	3549		1787	1697		1744	1706	
Flt Permitted	0.08	1.00		0.08	1.00		0.32	1.00		0.69	1.00	
Satd. Flow (perm)	149	3496		159	3549		609	1697		1276	1706	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	89	1467	206	24	1451	77	305	43	53	81	73	128
RTOR Reduction (vph)	0	10	0	0	4	0	0	43	0	0	65	0
Lane Group Flow (vph)	89	1663	0	24	1524	0	305	53	0	81	136	0
Confl. Peds. (#/hr)	11		8	8		11	7		7	7		7
Confl. Bikes (#/hr)						1			1			1
Heavy Vehicles (%)	0%	2%	3%	0%	2%	0%	2%	3%	2%	4%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	5	2		1	6		7	4		3	8	
Permitted Phases	2			6			4			8		
Actuated Green, G (s)	57.3	51.4		51.1	48.3		29.9	19.0		20.8	13.9	
Effective Green, g (s)	57.3	51.4		51.1	48.3		29.9	19.0		20.8	13.9	
Actuated g/C Ratio	0.57	0.51		0.51	0.48		0.30	0.19		0.21	0.14	
Clearance Time (s)	4.0	5.8		4.0	5.8		4.0	6.1		4.0	6.1	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	184	1796		127	1714		323	322		297	237	
v/s Ratio Prot	c0.03	c0.48		0.01	0.43		c0.11	0.03		0.02	0.08	
v/s Ratio Perm	0.25			0.09			c0.17			0.04		
v/c Ratio	0.48	0.93		0.19	0.89		0.94	0.16		0.27	0.57	
Uniform Delay, d1	18.5	22.5		19.4	23.4		31.6	33.9		32.9	40.3	
Progression Factor	1.37	0.58		0.68	0.74		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	7.1		0.6	5.8		35.4	0.2		0.5	3.3	
Delay (s)	26.6	20.2		13.8	23.1		67.0	34.1		33.4	43.6	
Level of Service	C	C		B	C		E	C		C	D	
Approach Delay (s)		20.5			22.9			59.1			40.7	
Approach LOS		C			C			E			D	

Intersection Summary

HCM 2000 Control Delay	26.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	19.9
Intersection Capacity Utilization	94.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Timings

2041 Total PM

9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Configurations	↰	↱	↰	↱	↰	↱
Traffic Volume (vph)	21	1155	96	1026	440	17
Future Volume (vph)	21	1155	96	1026	440	17
Turn Type	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6		4
Permitted Phases	2		6		4	
Detector Phase	5	2	1	6	4	4
Switch Phase						
Minimum Initial (s)	4.0	4.0	5.0	4.0	4.0	4.0
Minimum Split (s)	8.0	10.0	9.0	10.0	9.6	9.6
Total Split (s)	11.0	55.0	11.0	55.0	34.0	34.0
Total Split (%)	11.0%	55.0%	11.0%	55.0%	34.0%	34.0%
Yellow Time (s)	3.0	3.3	3.0	3.3	3.3	3.3
All-Red Time (s)	1.0	2.7	1.0	2.7	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	5.6	5.6
Lead/Lag	Lead	Lag	Lead	Lag		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes		
Recall Mode	None	Max	None	C-Max	None	None
Act Effct Green (s)	59.0	52.1	61.4	56.6	27.6	27.6
Actuated g/C Ratio	0.59	0.52	0.61	0.57	0.28	0.28
v/c Ratio	0.08	0.86	0.50	0.54	0.93	0.20
Control Delay	3.5	12.5	20.5	15.9	63.1	9.6
Queue Delay	0.0	0.9	0.0	0.4	0.0	0.0
Total Delay	3.5	13.4	20.5	16.3	63.1	9.6
LOS	A	B	C	B	E	A
Approach Delay		13.3		16.7		53.5
Approach LOS		B		B		D

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 100

Offset: 12 (12%), Referenced to phase 6:WBT, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 21.2

Intersection LOS: C

Intersection Capacity Utilization 85.8%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 9: Hurontario Street & First Street/Huron Street

⤴ 01	⤵ 02	⤴ 04
11 s	55 s	34 s
⤴ 05	⤵ 06 (R)	
11 s	55 s	

Queues

2041 Total PM

9: Hurontario Street & First Street/Huron Street

	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT
Lane Group Flow (vph)	22	1575	101	1091	463	101
v/c Ratio	0.08	0.86	0.50	0.54	0.93	0.20
Control Delay	3.5	12.5	20.5	15.9	63.1	9.6
Queue Delay	0.0	0.9	0.0	0.4	0.0	0.0
Total Delay	3.5	13.4	20.5	16.3	63.1	9.6
Queue Length 50th (m)	0.4	143.6	7.2	59.3	86.4	2.5
Queue Length 95th (m)	m0.7	#37.6	19.7	98.6	#142.8	14.3
Internal Link Dist (m)		117.0		100.6		812.8
Turn Bay Length (m)	40.0		50.0			
Base Capacity (vph)	306	1822	204	2022	511	522
Starvation Cap Reductn	0	77	0	0	0	0
Spillback Cap Reductn	0	0	0	442	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.90	0.50	0.69	0.91	0.19

Intersection Summary

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.

HCM Signalized Intersection Capacity Analysis
9: Hurontario Street & First Street/Huron Street

2041 Total PM

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	21	1155	341	96	1026	10	440	17	79	0	0	0
Future Volume (vph)	21	1155	341	96	1026	10	440	17	79	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98				
Flpb, ped/bikes	1.00	1.00		1.00	1.00		0.99	1.00				
Frt	1.00	0.97		1.00	1.00		1.00	0.88				
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00				
Satd. Flow (prot)	1705	3449		1825	3573		1801	1631				
Flt Permitted	0.20	1.00		0.07	1.00		0.95	1.00				
Satd. Flow (perm)	355	3449		142	3573		1801	1631				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	22	1216	359	101	1080	11	463	18	83	0	0	0
RTOR Reduction (vph)	0	26	0	0	0	0	0	60	0	0	0	0
Lane Group Flow (vph)	22	1549	0	101	1091	0	463	41	0	0	0	0
Confl. Peds. (#/hr)	16		11	11		16	12		11	11		12
Heavy Vehicles (%)	7%	2%	1%	0%	2%	0%	0%	7%	0%	0%	0%	0%
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA				
Protected Phases	5	2		1	6			4				
Permitted Phases	2			6			4					
Actuated Green, G (s)	53.8	51.2		59.8	54.2		27.6	27.6				
Effective Green, g (s)	53.8	51.2		59.8	54.2		27.6	27.6				
Actuated g/C Ratio	0.54	0.51		0.60	0.54		0.28	0.28				
Clearance Time (s)	4.0	6.0		4.0	6.0		5.6	5.6				
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0				
Lane Grp Cap (vph)	226	1765		179	1936		497	450				
v/s Ratio Prot	0.00	c0.45		c0.03	0.31			0.03				
v/s Ratio Perm	0.05			0.31			c0.26					
v/c Ratio	0.10	0.88		0.56	0.56		0.93	0.09				
Uniform Delay, d1	11.6	21.6		17.9	15.1		35.3	26.9				
Progression Factor	0.43	0.39		1.00	1.00		1.00	1.00				
Incremental Delay, d2	0.1	3.7		4.0	1.2		24.4	0.1				
Delay (s)	5.1	12.1		22.0	16.3		59.7	27.0				
Level of Service	A	B		C	B		E	C				
Approach Delay (s)		12.0			16.8		53.8			0.0		
Approach LOS		B			B		D			A		

Intersection Summary

HCM 2000 Control Delay	20.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.6
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Timings

10: Pretty River Parkway & Hume Street/Highway 26 E

2041 Total PM

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱	↰	↱	↱	↰	↱	↱	↰	↱	↱
Traffic Volume (vph)	140	470	38	345	616	29	59	62	850	58	167
Future Volume (vph)	140	470	38	345	616	29	59	62	850	58	167
Turn Type	pm+pt	NA	pm+pt	NA	pm+ov	Split	NA	Perm	Split	NA	Perm
Protected Phases	5	2	1	6	4	8	8		4	4	
Permitted Phases	2		6		6			8			4
Detector Phase	5	2	1	6	4	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	7.0	10.0	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	22.0	11.0	22.0	22.0	16.0	16.0	16.0	22.0	22.0	22.0
Total Split (s)	11.0	27.0	11.0	27.0	36.0	16.0	16.0	16.0	36.0	36.0	36.0
Total Split (%)	12.2%	30.0%	12.2%	30.0%	40.0%	17.8%	17.8%	17.8%	40.0%	40.0%	40.0%
Yellow Time (s)	3.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag							
Lead-Lag Optimize?	Yes	Yes	Yes	Yes							
Recall Mode	None	Max	None	Max	None	None	None	None	None	None	None
Act Effct Green (s)	32.0	25.9	30.3	21.2	56.8	10.1	10.1	10.1	29.6	29.6	29.6
Actuated g/C Ratio	0.37	0.30	0.35	0.25	0.66	0.12	0.12	0.12	0.34	0.34	0.34
v/c Ratio	0.61	0.50	0.13	0.82	0.58	0.17	0.31	0.22	0.87	0.88	0.28
Control Delay	31.4	29.4	19.1	48.5	5.7	38.6	41.5	1.6	45.2	47.0	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.4	29.4	19.1	48.5	5.7	38.6	41.5	1.6	45.2	47.0	4.7
LOS	C	C	B	D	A	D	D	A	D	D	A
Approach Delay		29.8		21.0			24.4			39.7	
Approach LOS		C		C			C			D	

Intersection Summary

Cycle Length: 90	
Actuated Cycle Length: 86.2	
Natural Cycle: 90	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 30.1	Intersection LOS: C
Intersection Capacity Utilization 71.0%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 10: Pretty River Parkway & Hume Street/Highway 26 E

↰ Ø1	↱ Ø2	↰ Ø4	↱ Ø8
11 s	27 s	36 s	16 s
↰ Ø5	↱ Ø6		
11 s	27 s		

Attachment C

ITE Trip Generation Excerpts

Land Use: 221

Multifamily Housing (Mid-Rise)

Description

Mid-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have between three and 10 levels (floors). Multifamily housing (low-rise) (Land Use 220), multifamily housing (high-rise) (Land Use 222), off-campus student apartment (Land Use 225), and mid-rise residential with 1st-floor commercial (Land Use 231) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the mid-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the six sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.46 residents per occupied dwelling unit.

For the five sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 95.7 percent of the total dwelling units were occupied.

Time-of-day distribution data for this land use are presented in Appendix A. For the eight general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 4:45 and 5:45 p.m., respectively.

For the four dense multi-use urban sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:15 and 5:15 p.m., respectively. For the three center city core sites with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 6:45 and 7:45 a.m. and 5:00 and 6:00 p.m., respectively.

For the six sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.46 residents per occupied dwelling unit.

For the five sites for which data were provided for both occupied dwelling units and total dwelling units, an average of 95.7 percent of the units were occupied.

The average numbers of person trips per vehicle trip at the five center city core sites at which both person trip and vehicle trip data were collected were as follows:

- 1.84 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.94 during Weekday, AM Peak Hour of Generator
- 2.07 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.59 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 32 dense multi-use urban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.90 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.90 during Weekday, AM Peak Hour of Generator
- 2.00 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.08 during Weekday, PM Peak Hour of Generator

The average numbers of person trips per vehicle trip at the 13 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.56 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.88 during Weekday, AM Peak Hour of Generator
- 1.70 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 2.07 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Delaware, District of Columbia, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Hampshire, New Jersey, Ontario, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Virginia, and Wisconsin.

Source Numbers

168, 188, 204, 305, 306, 321, 357, 390, 436, 525, 530, 579, 638, 818, 857, 866, 901, 904, 910, 912, 918, 934, 936, 939, 944, 947, 948, 949, 959, 963, 964, 966, 967, 969, 970

Multifamily Housing (Mid-Rise) (221)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.

Setting/Location: General Urban/Suburban

Number of Studies: 53

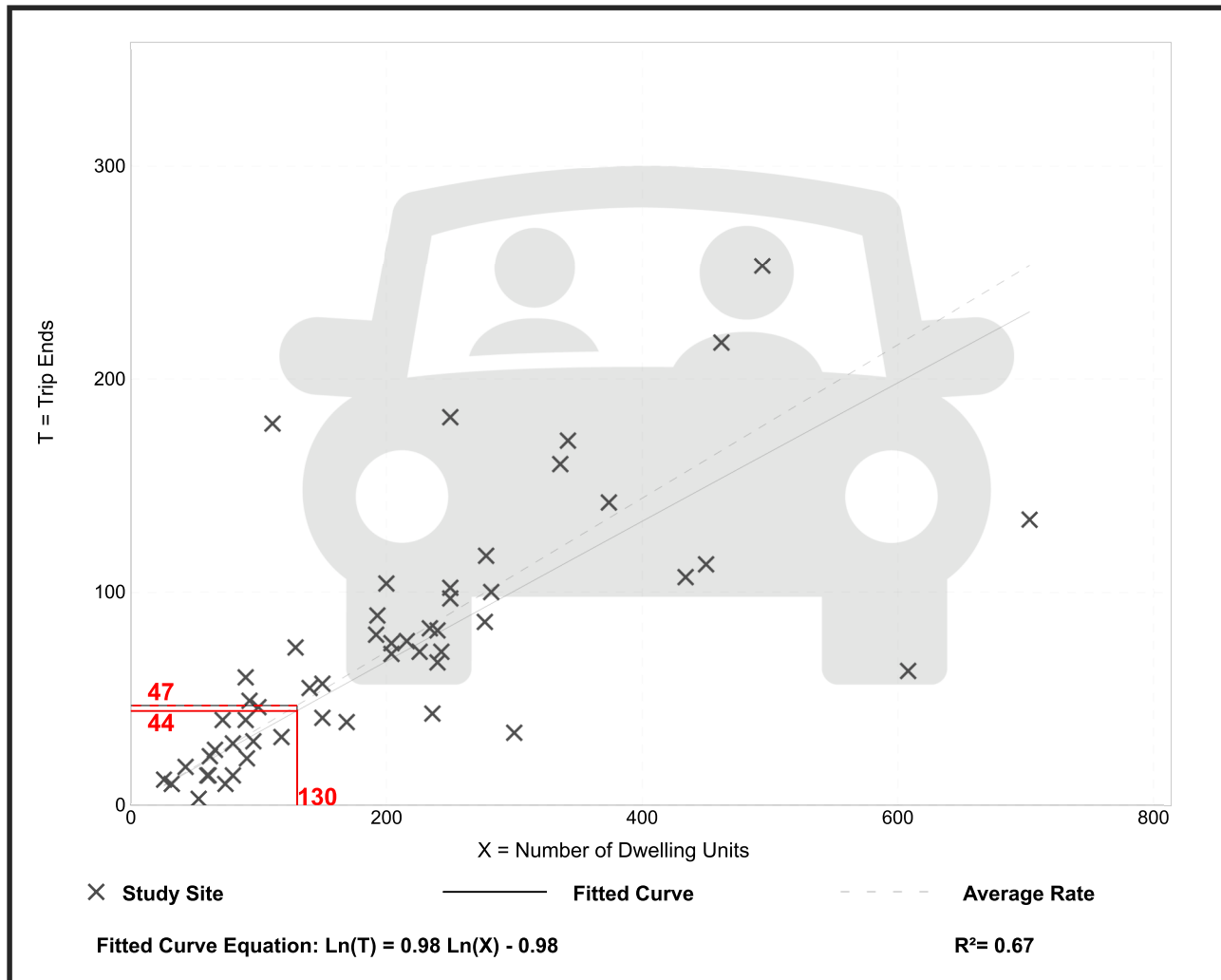
Avg. Num. of Dwelling Units: 207

Directional Distribution: 26% entering, 74% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.36	0.06 - 1.61	0.19

Data Plot and Equation



Multifamily Housing (Mid-Rise) (221)

Vehicle Trip Ends vs: Dwelling Units

On a: Weekday,

Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.

Setting/Location: General Urban/Suburban

Number of Studies: 60

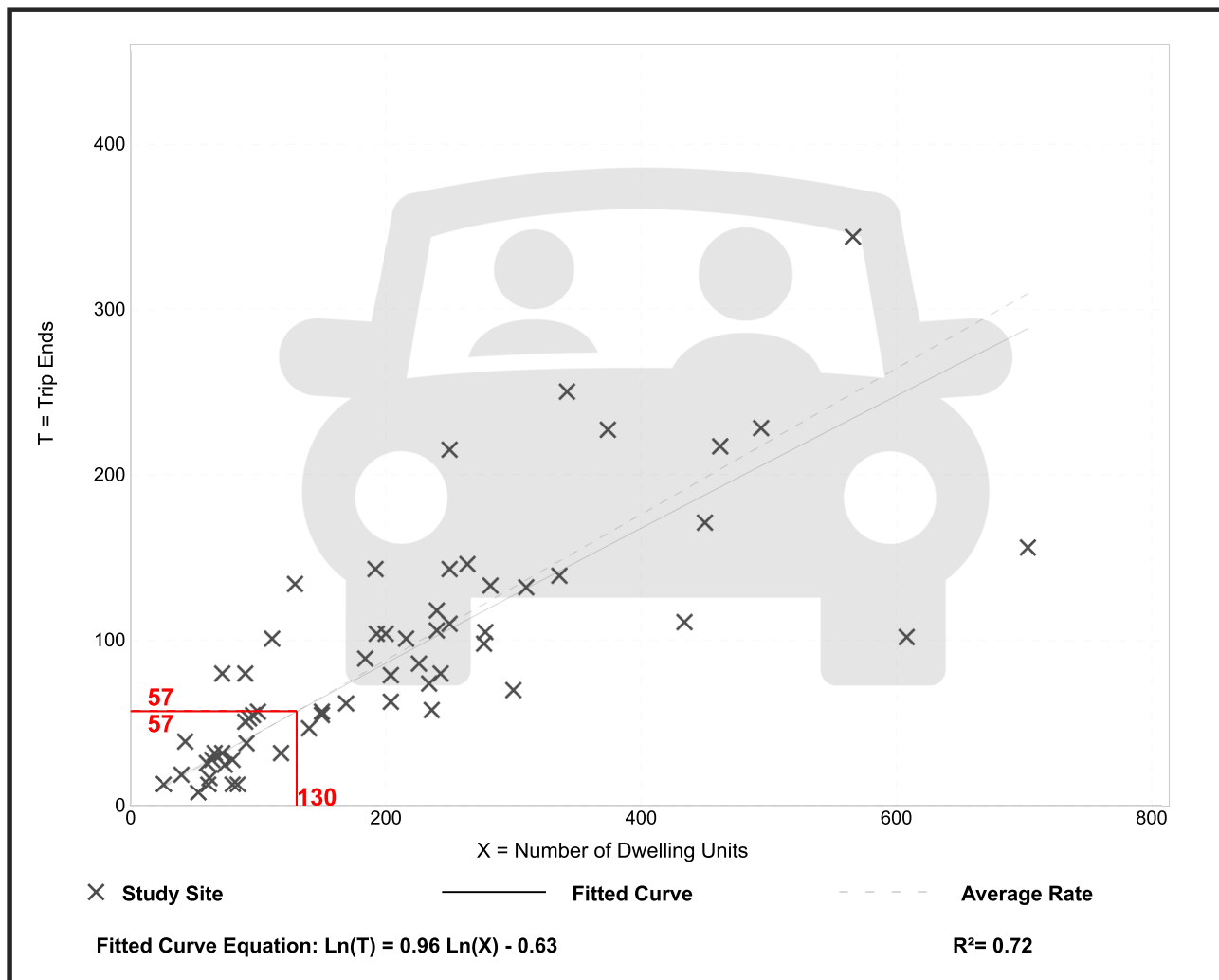
Avg. Num. of Dwelling Units: 208

Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.44	0.15 - 1.11	0.19

Data Plot and Equation



Land Use: 820

Shopping Center

Description

A shopping center is an integrated group of commercial establishments that is planned, developed, owned, and managed as a unit. A shopping center's composition is related to its market area in terms of size, location, and type of store. A shopping center also provides on-site parking facilities sufficient to serve its own parking demands. Factory outlet center (Land Use 823) is a related use.

Additional Data

Shopping centers, including neighborhood centers, community centers, regional centers, and super regional centers, were surveyed for this land use. Some of these centers contained non-merchandising facilities, such as office buildings, movie theaters, restaurants, post offices, banks, health clubs, and recreational facilities (for example, ice skating rinks or indoor miniature golf courses).

Many shopping centers, in addition to the integrated unit of shops in one building or enclosed around a mall, include outparcels (peripheral buildings or pads located on the perimeter of the center adjacent to the streets and major access points). These buildings are typically drive-in banks, retail stores, restaurants, or small offices. Although the data herein do not indicate which of the centers studied included peripheral buildings, it can be assumed that some of the data show their effect.

The vehicle trips generated at a shopping center are based upon the total GLA of the center. In cases of smaller centers without an enclosed mall or peripheral buildings, the GLA could be the same as the gross floor area of the building.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 11:45 a.m. and 12:45 p.m. and 12:15 and 1:15 p.m., respectively.

The average numbers of person trips per vehicle trip at the 27 general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.31 during Weekday, AM Peak Hour of Generator
- 1.43 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.
- 1.46 during Weekday, PM Peak Hour of Generator

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in Alberta (CAN), British Columbia (CAN), California, Colorado, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Vermont, Virginia, Washington, West Virginia, and Wisconsin.

Source Numbers

105, 110, 154, 156, 159, 186, 190, 198, 199, 202, 204, 211, 213, 239, 251, 259, 260, 269, 294, 295, 299, 300, 301, 304, 305, 307, 308, 309, 310, 311, 314, 315, 316, 317, 319, 358, 365, 376, 385, 390, 400, 404, 414, 420, 423, 428, 437, 440, 442, 444, 446, 507, 562, 580, 598, 629, 658, 702, 715, 728, 868, 870, 871, 880, 899, 908, 912, 915, 926, 936, 944, 946, 960, 961, 962, 973, 974, 978

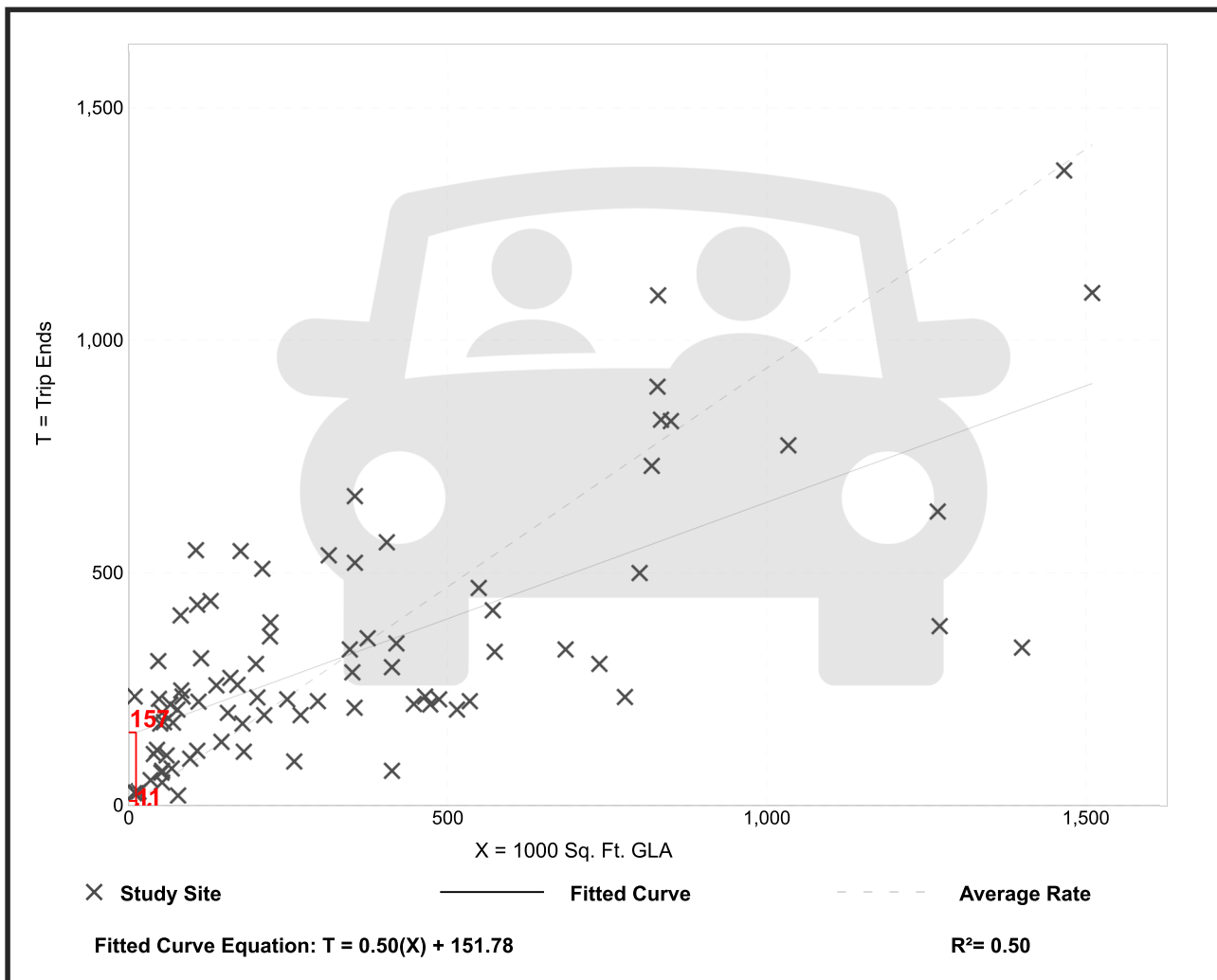
Shopping Center (820)

Vehicle Trip Ends vs: 1000 Sq. Ft. GLA
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.
 Setting/Location: General Urban/Suburban
 Number of Studies: 84
 Avg. 1000 Sq. Ft. GLA: 351
 Directional Distribution: 62% entering, 38% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
0.94	0.18 - 23.74	0.87

Data Plot and Equation



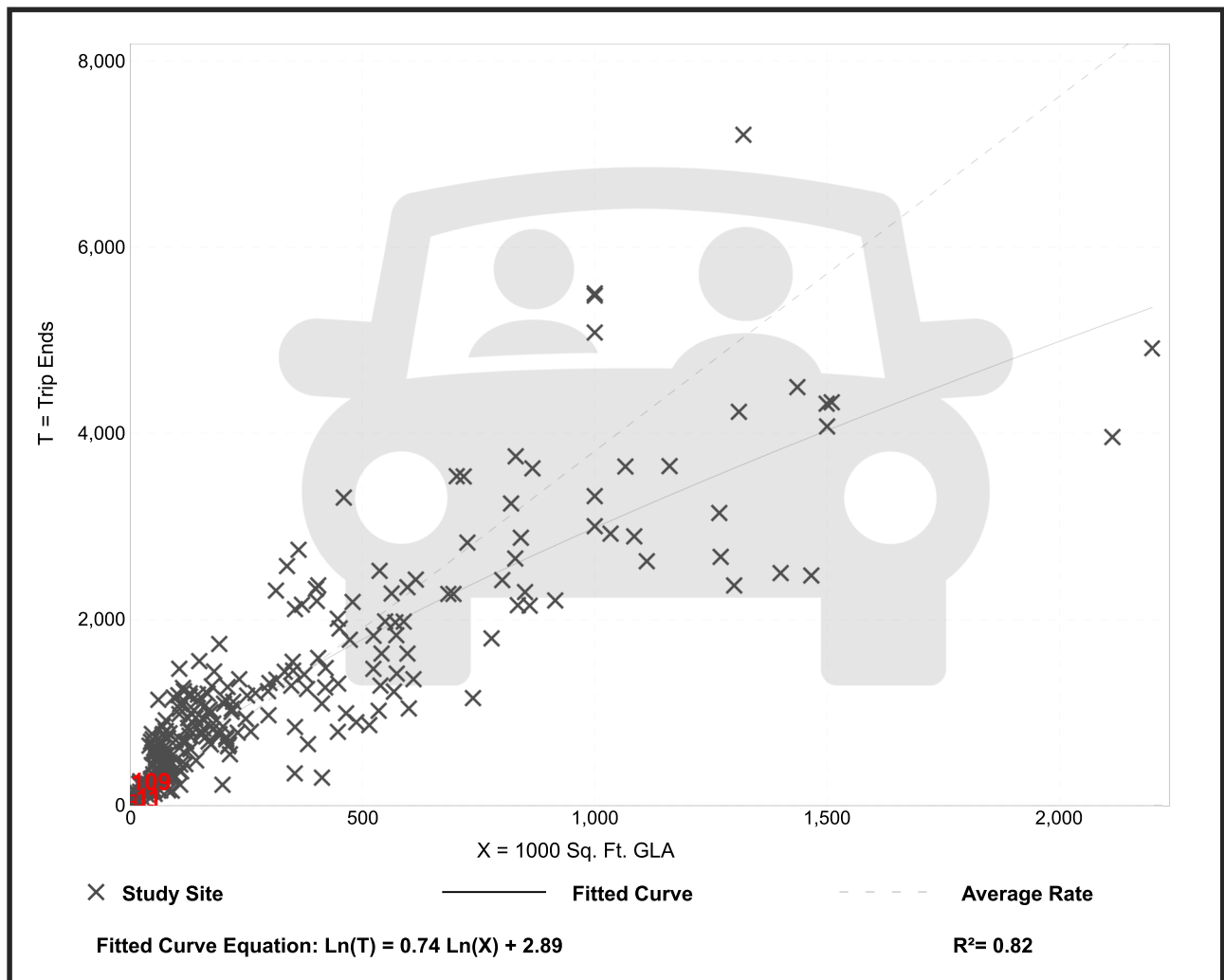
Shopping Center (820)

Vehicle Trip Ends vs: 1000 Sq. Ft. GLA
On a: Weekday,
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: General Urban/Suburban
Number of Studies: 261
Avg. 1000 Sq. Ft. GLA: 327
Directional Distribution: 48% entering, 52% exiting

Vehicle Trip Generation per 1000 Sq. Ft. GLA

Average Rate	Range of Rates	Standard Deviation
3.81	0.74 - 18.69	2.04

Data Plot and Equation



**Table E.9 (Cont'd) Pass-By and Non-Pass-By Trips Weekday, PM
Peak Period Land Use Code 820—Shopping Center**

SIZE (1,000 SQ. FT. GLA)	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIP (%)			ADJ. STREET PEAK HOUR VOLUME	AVERAGE 24-HOUR TRAFFIC	SOURCE
						PRIMARY	DIVERTED	TOTAL			
921	Albany, NY	July & Aug. 1985	196	4:00–6:00 p.m.	23	42	35	77	—	60,950	Raymond Keyes Assoc.
108	Overland Park, KS	July 1988	111	4:30–5:30 p.m.	26	61	13	74	—	34,000	—
118	Overland Park, KS	Aug. 1988	123	4:30–5:30 p.m.	25	55	20	75	—	—	—
256	Greece, NY	June 1988	120	4:00–6:00 p.m.	38	62	—	62	—	23,410	Sear Brown
160	Greece, NY	June 1988	78	4:00–6:00 p.m.	29	71	—	71	—	57,306	Sear Brown
550	Greece, NY	June 1988	117	4:00–6:00 p.m.	48	52	—	52	—	40,763	Sear Brown
51	Boca Raton, FL	Dec. 1987	110	4:00–6:00 p.m.	33	34	33	67	—	42,225	Kimley-Horn and Assoc. Inc.
1,090	Ross Twp, PA	July 1988	411	2:00–8:00 p.m.	34	56	10	66	—	51,500	Wilbur Smith and Assoc.
97	Upper Dublin Twp, PA	Winter 1988/89	—	4:00–6:00 p.m.	41	—	—	59	—	34,000	McMahon Associates
118	Tredyffrin Twp, PA	Winter 1988/89	—	4:00–6:00 p.m.	24	—	—	76	—	10,000	Booz Allen & Hamilton
122	Lawnside, NJ	Winter 1988/89	—	4:00–6:00 p.m.	37	—	—	63	—	20,000	Pennoni Associates
126	Boca Raton, FL	Winter 1988/89	—	4:00–6:00 p.m.	43	—	—	57	—	40,000	McMahon Associates
150	Willow Grove, PA	Winter 1988/89	—	4:00–6:00 p.m.	39	—	—	61	—	26,000	Booz Allen & Hamilton
153	Broward Cnty., FL	Winter 1988/89	—	4:00–6:00 p.m.	50	—	—	50	—	85,000	McMahon Associates
153	Arden, DE	Winter 1988/89	—	4:00–6:00 p.m.	30	—	—	70	—	26,000	Orth-Rodgers & Assoc. Inc.
154	Doylestown, PA	Winter 1988/89	—	4:00–6:00 p.m.	32	—	—	68	—	29,000	Orth-Rodgers & Assoc. Inc.
164	Middletown Twp, PA	Winter 1988/89	—	4:00–6:00 p.m.	33	—	—	67	—	25,000	Booz Allen & Hamilton
166	Haddon Twp, NJ	Winter 1988/89	—	4:00–6:00 p.m.	20	—	—	80	—	6,000	Pennoni Associates
205	Broward Cnty., FL	Winter 1988/89	—	4:00–6:00 p.m.	55	—	—	45	—	62,000	McMahon Associates

**Table E.9 (Cont'd) Pass-By and Non-Pass-By Trips Weekday, PM Peak Period
Land Use Code 820—Shopping Center**

SIZE (1,000 SQ. FT. GLA)	LOCATION	WEEKDAY SURVEY DATE	NO. OF INTERVIEWS	TIME PERIOD	PASS-BY TRIP (%)	NON-PASS-BY TRIP (%)			ADJ. STREET PEAK HOUR VOLUME	AVERAGE 24-HOUR TRAFFIC	SOURCE
						PRIMARY	DIVERTED	TOTAL			
237	W. Windsor Twp, NJ	Winter 1988/89	—	4:00–6:00 p.m.	48	—	—	52	—	46,000	Booz Allen & Hamilton
242	Willow Grove, PA	Winter 1988/89	—	4:00–6:00 p.m.	37	—	—	63	—	26,000	McMahon Associates
297	Whitehall, PA	Winter 1988/89	—	4:00–6:00 p.m.	33	—	—	67	—	26,000	Orth-Rodgers & Assoc. Inc.
360	Broward Cnty., FL	Winter 1988/89	—	4:00–6:00 p.m.	44	—	—	56	—	73,000	McMahon Associates
370	Pittsburgh, PA	Winter 1988/89	—	4:00–6:00 p.m.	19	—	—	81	—	33,000	Wilbur Smith
150	Portland, OR	—	519	4:00–6:00 p.m.	68	6	26	32	—	25,000	Kittelson and Associates
150	Portland, OR	—	655	4:00–6:00 p.m.	65	7	28	35	—	30,000	Kittelson and Associates
760	Calgary, Alberta	Oct.-Dec. 1987	15,436	4:00–6:00 p.m.	20	39	41	80	—	—	City of Calgary DOT
178	Bordentown, NJ	Apr. 1989	154	2:00–6:00 p.m.	35	—	—	65	—	37,980	Raymond Keyes Assoc.
144	Manalapan, NJ	July 1990	176	3:30–6:15 p.m.	32	44	24	68	—	69,347	Raymond Keyes Assoc.
549	Natick, MA	Feb. 1989	—	4:45–5:45 p.m.	33	26	41	67	—	48,782	Raymond Keyes Assoc.

Average Pass-By Trip Percentage: 34

“—” means no data were provided

Attachment D

M/D/1 Queuing Analysis

Date 7/23/2020

 Project No. 1838-6493

 Prepared By MF

Reviewed By _____

 Project 31 Huron St (streetcar)

 Subject M/D/1 Queuing Analysis

Traffic Intensity = $\rho = \lambda / \mu$ where λ = average arrival rate
 μ = average service rate

Average Queue Length = $\bar{Q} = \rho^2 / 2(1-\rho)$

Scenario 1: $\lambda = 35 \text{ veh/hr} = 0.58 \text{ veh/min}$

$\mu = 1 \text{ veh/25s} = 2.4 \text{ veh/min}$

$\rho = 0.58 / 2.4 = 0.242$

$\bar{Q} = \frac{0.242^2}{2(1-0.242)} = 0.04 \text{ veh} = 1 \text{ veh}$

Scenario 2: $\lambda = 70 \text{ veh/hr} = 1.2 \text{ veh/min}$

$\mu = 2.4 \text{ veh/min}$

$\rho = 1.2 / 2.4 = 0.5$

$\bar{Q} = \frac{0.5^2}{2(1-0.5)} = 0.25 \text{ veh} = 1 \text{ veh}$

Scenario 3: $\lambda = 35 \text{ veh/hr} = 0.58 \text{ veh/min}$

$\mu = 1 \text{ veh/50sec} = 1.2 \text{ veh/min}$

$\rho = 0.58 / 1.2 = 0.48$

$\bar{Q} = 0.22 \text{ veh} = 1 \text{ veh}$

Scenario 4: $\lambda = 60 \text{ veh/hr} = 1 \text{ veh/min}$

$\mu = 1 \text{ veh/50s} = 1.2 \text{ veh/min}$

$\rho = 1 / 1.2 = 0.83$

$\bar{Q} = 0.83^2 / (2(1-0.83)) = 2.03 \text{ veh}$

Attachment E

TAC GDGCR Excerpts

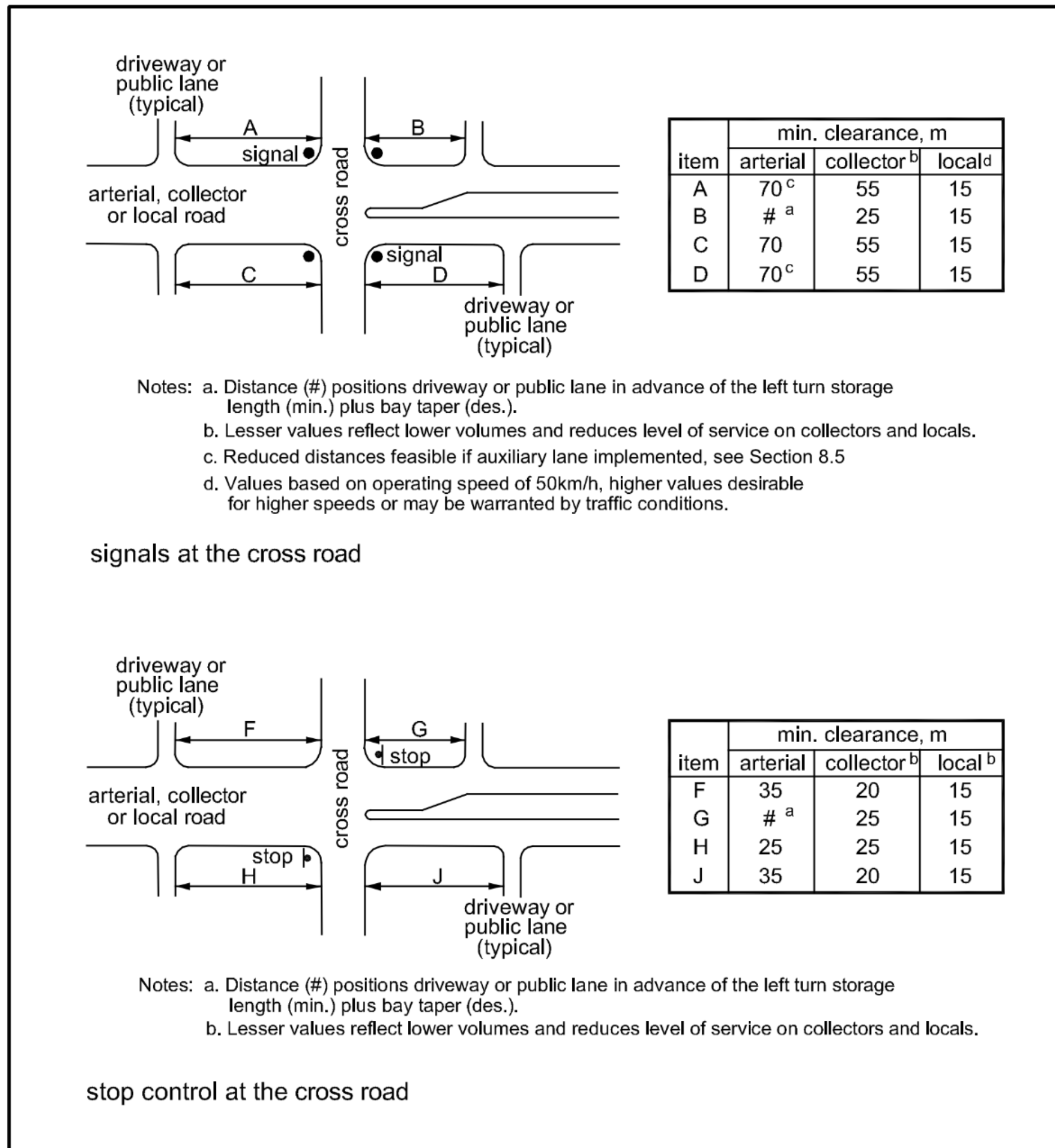


Figure 8.8.2: Suggested Minimum Corner Clearances to Accesses or Public Lanes at Major Intersections

Inadequate corner clearance between accesses and signalized intersections along a major road, such as a major arterial, can create serious operational problems including:

Table 9.9.4: Design Intersection Sight Distance – Case B1, Left Turn From Stop

Design Speed (km/h)	Stopping Sight Distance (m)	Intersection Sight Distance for Passenger Cars	
		Calculated (m)	Design (m)
20	20	41.7	45
30	35	62.6	65
40	50	83.4	85
50	65	104.3	105
60	85	125.1	130
70	105	146.0	150
80	130	166.8	170
90	160	187.7	190
100	185	208.5	210
110	220	229.4	230
120	250	250.2	255
130	285	271.1	275

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3% or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right turns (case B2) will provide sufficient sight distance for a passenger car to cross the near roadway to reach the median. Possible exceptions are addressed in the discussion of case B3.

Attachment F

Town of Collingwood Design Standards Excerpts



Corporation of the Town of Collingwood

Development Standards

ROAD DESIGN STANDARDS							
	Road Classification						
	Local Residential		Collector			Arterial	
Design Element	urban	rural	urban	rural	industrial		
ROW	20	20	26	26	30	26	
Design Speed	50	60	60	70	70	80	
Posted Speed	40	50	50	60	60	60	
	Design Speed (km/h)						
Design Element	40	50	60	70	80	90	100
stopping sight distance (SSD)	45	65	85	110	135	160	185
horizontal curve radius (m)	55	90	130	190	250	340	420
maximum grade (%)							
rural	-	12	6-12	6-12	6-8	6-8	6-7
urban	8-12	8-12	6-12	6-12	6-8	-	-
minimum grade	0.5	0.5	0.5	0.5	0.5	0.5	0.5
vertical curve - minimum 'k'							
crest curve	4	8	15	25	35	50	70
sag curve	8	12	18	25	30	40	45
sag curve (illuminated road)	4	5	8	12	15	20	25
INTERSECTION DESIGN STANDARDS							
	Intersecting Roads						
Design Element	local - local	local - collector	collector - collector	collector - arterial	arterial - arterial		
angle of intersection (degrees)	70-110	70-110	70-110	80-100	80-100		
minimum curb radius (m)	5	7.5	10	15	18		
minimum corner rounding (m)	5	5	-	-	-		
minimum daylight triangle (m)	3 x 3	5 x 5	10 x 10	15 x 15	15 x 15		
minimum grade through intersection (%)							
major road	0.15	0.15	0.15	0.15	0.15		
minor road	0.5	0.5	0.5	0.5	0.5		
maximum grade through intersection (%)							
major road	3	3	3	3	3		
minor road	2	2	2	2	2		
minimum tangent on approach - from centre of intersection (m)							
major road	40	45	45	75	75		
minor road	40	40	45	45	75		
NOTES							
1. Horizontal curves not required for deflections less than 0 degrees 30 minutes							
2. Vertical curves not required for changes in alignment of 0.5% or less							
3. Increase curb radius to 18.0 metres in industrial areas or if high right turning truck volumes							

NO.	REVISION	APR'D	DATE
1	REVISED RURAL COLLECTOR ROAD WIDTH	EDH	APR 07

TOWN OF COLLINGWOOD		APR'D: EDH	DATE: JUN/03
		DRAWN:	SCALE: N/A
GEOMETRIC DESIGN STANDARDS FOR ROADS		STD. No.	100