

Langara YMCA Redevelopment, Vancouver, BC

Transportation Impact Assessment

Draft Report

Prepared for
YMCA of Greater Vancouver

Date
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Project No.
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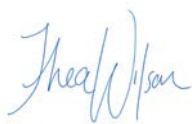
Dear Roy:

**Re: Langara YMCA Redevelopment, Vancouver, BC
Transportation Access and Management Study (TAMS)**

Bunt & Associates Engineering Ltd. (Bunt) has completed our Transportation Access and Management Study (TAMS) of the proposed mixed-use redevelopment of the Langara Family YMCA facility, located at 282 West 49th Avenue in Vancouver. The attached report documents the site context and accessibility, parking and loading supply, the estimated number of vehicle trips from the proposed development, and the anticipated impact of the development traffic on the adjacent street network.

We are pleased to have the opportunity to work with the YMCA on another unique project, and trust that our input here will be of assistance.

Yours truly,
Bunt & Associates



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cc: Alan Endall, Endall Elliot Associates

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1. INTRODUCTION

1.1 Study Purpose

The YMCA of Greater Vancouver Properties Foundation has retained Bunt & Associates Engineering Ltd. (Bunt) to provide transportation consulting services for a proposed mixed-use redevelopment of the Langara Family YMCA facility located at 282 West 49th Avenue in Vancouver.

To assist with their review of the Development Permit application, City of Vancouver Staff requires a Transportation Access and Management Study (TAMS) for the proposed development. The following report summarizes the study process and key findings/recommendations.

1.2 Study Scope and Area

A Terms of Reference for the TAMS was prepared by Bunt and submitted to the City of Vancouver for their review and approval prior to commencement of our work. The approved Terms of Reference is included in **Appendix A. Exhibit 1.1** presents the site location and the study area.

1.3 Proposed Development

The YMCA of Greater Vancouver Properties Foundation (YMCA) is proposing a redevelopment of its existing Langara Family YMCA to result in a new and expanded YMCA facility with over 72,000 square feet of area, a 9,000 square foot childcare facility, a 20 storey residential strata building with 158 dwelling units, and a 13 storey affordable residential building with 70 dwelling units.

The redeveloped YMCA will be constructed with the ability to expand further from the proposed 72,890 sqft GFA to 84,890 sq ft GFA to meet future membership needs.

The architectural model view of the development looking south from West 49th Avenue is provided in **Figure 1** below.



Exhibit 1.1 Site Location

Langara YMCA
November 2018

04-18-0080

Figure 1.1: Proposed Langara YMCA Redevelopment



1.4 Report Layout

The report sections of the study have been organized as follows:

- Section 2 – Existing Conditions
- Section 3 – Future Traffic Conditions
- Section 4 - Development Plan Review
- Section 5 – Summary

2. EXISTING CONDITIONS

2.1 Land Use

The Langara Family YMCA at 282 West 49th Avenue has been in operation for 40 years dating back to 1978. The existing facility is approximately 45,000 square feet in size, and includes a 9,000 square feet space dedicated to fitness equipment and programs, a full size gymnasium and 25 meter swimming pool.

There are approximately 120 parking spaces available for YMCA patrons and employee use, including 75 spaces located in a YMCA use only parking lot immediately to the south of the building and an additional 45 spaces marked for YMCA use in the surface lot further to south. This same parking lot also has parking available for the Langara municipal golf course to the south. Based on field observations, YMCA members also utilize the on-street parking on Alberta Street, adjacent to the site. Both parking lots are accessed from Alberta Street which connects to West 49th Avenue with full traffic signal control.

To the east of the YMCA is Langara Park and east of the park is Langara College which has a current FTE of 10,500 students and is currently completing a Master Planning process to accommodate anticipated future campus growth.

2.2 Data Collection

2.2.1 Traffic & Parking Data Collection Program

To document existing transportation conditions in the study area relating to: vehicle traffic, pedestrians, cyclists, parking, and area traffic patterns generally, a comprehensive data collection program was conducted by Bunt on Wednesday, September 26th 2018. The information observed will be further described in the following sections and is summarised as follows:

- For the study intersections of Cambie Street & West 49th Avenue and Alberta Street & West 49th Avenue, the morning count period was from 7:00-9:00am, and the afternoon count period was from 3-6pm. Within these periods, the peak hours were 8-9am and 4:30-5:30pm respectively.
- One hour spot counts were conducted for all driveways on Alberta Street (between West 49th Avenue and the Langara Golf Course) during the morning and afternoon count periods described above.
- An all day parking survey was conducted for the off-street parking for the Langara YMCA and golf course, as well as the on-street parking on Alberta Street, from 6:00am to 10:00pm.
- To assess local traffic movement in the area, a license plate survey was conducted at the private driveway (connecting to Greensborough Place) at the south end of Alberta Street and the northern driveway on Cambie Street (at Pinehurst Drive) which serves the multifamily development of Langara Estates. This survey was conducted from 7-9am and 3-6pm. A second southern driveway is also present on Cambie Street however this access was gated closed (to the general public) the day of the survey.

The study intersections and locations of the driveway and parking observations are illustrated in **Exhibit 2.1**.

2.3 Existing Transportation Network

2.3.1 Road Network

The two key arterial streets in the area include West 49th Avenue extending east-west and bordering the north side of the YMCA site, and Cambie Street extending north-south and located approximately 250 meters west of the development site.

Alberta Street south of West 49th Avenue is a cul-de-sac street approximately 170 metres in length with street parking along both sides of the street, and provides access to the YMCA, Langara Golf Course, and existing multi-family residential development positioned between Alberta Street and Cambie Street to the west.

The transportation network immediate to the site is presented in **Exhibit 2.2** while the characteristics of the local street network are presented in **Table 2.1**.

Table 2.1: Street Characteristics (sections adjacent to YMCA)

STREET	CLASSIFI- CATION	TRAVEL LANES	STREET PARKING	VEHICLES TWO-WAY PEAK HOURS	BIKE ROUTE	BICYCLE TWO-WAY PEAK HOUR
Cambie Street	Arterial	4	Both Sides	2,300(am) / 3,000(pm)	Yes (painted)	20
West 49 th Avenue	Arterial	3	Both Sides	1,700(am) / 1,800(pm)	No	10
Alberta Street	Local	2	Both Sides	200(am) / 300(pm)	No	<5

Nearby the site, Cambie Street operates as a five lane road. Both Cambie Street and 41st Avenue are presently heavily travelled arterial traffic routes and peak period traffic operation at key junctions is nearing capacity.

Vehicle volumes on West 49th Avenue indicate that it operates at or close to capacity during peak periods, while Alberta Street functions with lower vehicle volumes. Two-way vehicle volumes observed by the City of Vancouver on West 49th Avenue dating back to 1993 have been plotted (**Figure 2.1**) to illustrate that weekday AM and PM peak hour volumes have not changed significantly over the past 25 years.

The turning movement volumes for the existing AM and PM peak hour traffic volumes observed by Bunt in September 2018 are shown in **Exhibit 2.3**.



Exhibit 2.1 Data Collection Map

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Langara YMCA
November 2018



Exhibit 2.2 Road Classification, Traffic Control and Laning

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Langara YMCA
November 2018

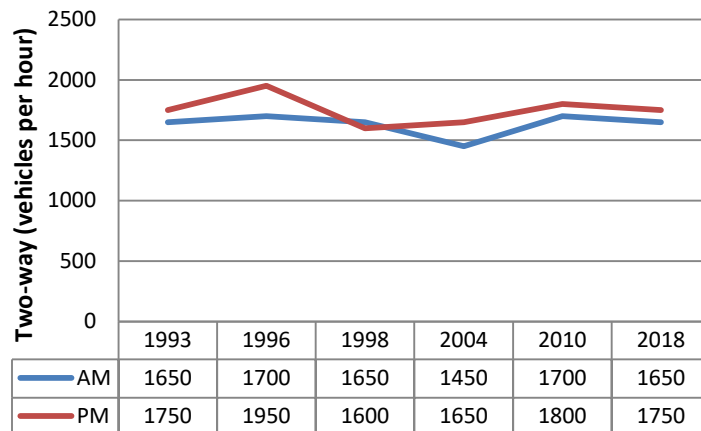


Exhibit 2.3 Existing Peak Hour Traffic Volumes

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Langara YMCA
November 2018

Figure 2.1: West 49th Avenue (between Columbia & Manitoba)



2.3.2 Pedestrian and Transit Facilities

The location of the site in relation to amenities and transit facilities within 800m (i.e. a 10-minute walk) is presented in **Exhibit 2.4**.

While street patterns to the north of the site follow a traditional fine-grained network, providing permeable connections, the permeability of the site is presently limited by Langara park and Langara College to the east, Langara Golf Course to the south and multifamily development and private strata roads to the west. All streets in the vicinity of the proposed redevelopment have concrete sidewalks along both sides of the road. Marked pedestrian crosswalks are provided at the key intersections within the study area.

Langara trail (approximately 2.5 km) extending around the perimeter of Langara golf course is accessible from the south end of Alberta Street.

At the north east corner of West 49th Avenue and Cambie Street is the Langara-49th Avenue Station on the Canada Line rapid transit line, and is a 350m walk to the site. Observations of movements to and from the station along 49th Avenue indicate that around 500 pedestrians per hour access the station at peak times. Damage to the street boulevard is evident with the current heavy use by pedestrians, where the sidewalk width is typically only 1.5 metres. Traffic signals are located on West 49th Avenue at Cambie Street, Alberta Street and Columbia Street (main access to Langara College).

The weekday AM and PM peak hour pedestrian and cycling volumes observed by Bunt in September 2018 are illustrated in **Exhibit 2.5**.



Exhibit 2.4 Site Accessibility

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Langara YMCA
November 2018

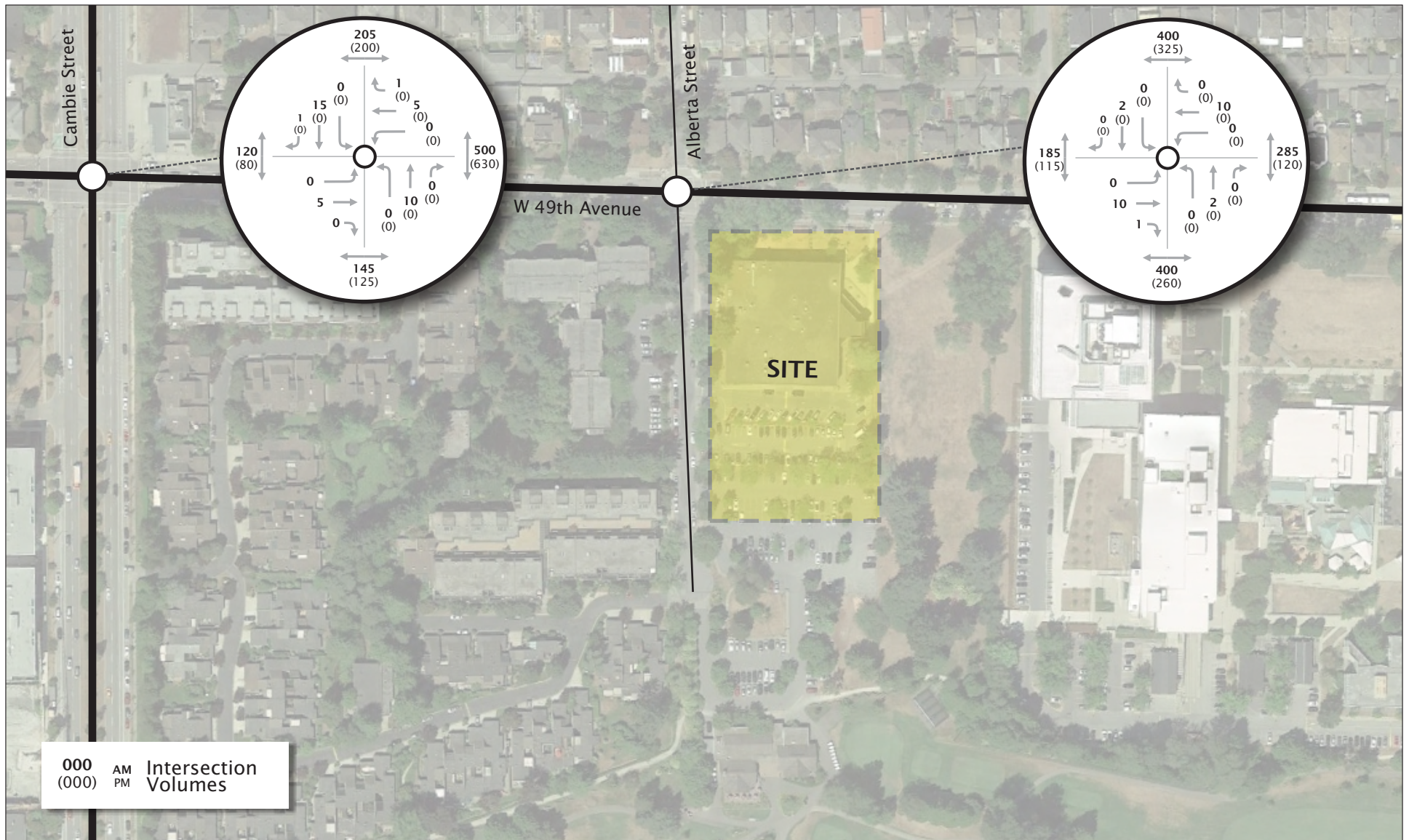


Exhibit 2.5 Pedestrian and Cycling Volumes

04-18-0080

Langara YMCA
November 2018

Cambie Street is approximately 250m to the west of the site and is served by bus route #15 connecting to Olympic village station and then to downtown via Granville Island as bus route #50. Fronting the site and across 49th Avenue at Alberta Street are bus stops for Route #49: (UBC to Metrotown). Route #3 on Main Street provides connection from Main at Marine Drive, Science World and Downtown/ Waterfront Station

Summarized in **Table 2.2** are the bus transit services (described above) within walking distance of the site.

Table 2.2: Transit Service Frequency

ROUTE #	WEEKDAY SERVICE SPAN		FREQUENCY MINUTES			
	Start	End	AM	Mid-Day	PM	Evening
#3	4:50am	2:00am	7	7	7	15
#15	4:45am	1:42am	15	15	15	20
#49	5:48am	12:35am	6	9	5	15

2.3.3 Cycling

The Langara YMCA site is well-located with respect to the City's bicycle network and routes are highlighted in Exhibit 2.2 referred to previously.

The Ontario Street bikeway, located east of the site, extends from the Seawall / South East False Creek (in the north) to Kent Avenue / Fraser River (in the south). It crosses a number of strategic east-west routes, including at 10th Avenue, 37th Avenue and 59th Avenue. Cambie Street to the west has marked bike lanes providing north-south connections.

More generally, the residential street system to the north and east provides a permeable network of low volume streets to access the site, while controlled street crossings on West 49th Avenue are located at Alberta Street, Columbia Street and further east at Ontario Street (pedestrian signal).

Typically a cyclist travels up to 8-km (30 minute) to access work destinations. This threshold indicates that large parts of the City of Vancouver are within reasonable cycling distance along with parts of Richmond (with the bike connection on the Canada Line bridge connection over the Fraser River).

As presented previously in Exhibit 2.5, cycling volumes in the immediate vicinity of the site are relatively low, with less than 5 cyclists an hour observed on Alberta Street.

2.3.4 Existing Site Vehicle Trip Generation

Vehicle trip generation for the existing Langara YMCA facility was determined through driveway counts and verified with the parking survey described in Section 2.3.5 to follow.

For the purposes of this analysis, of the three driveways on the east side of Alberta Street, the following observed vehicle volumes were attributed towards each land use. These assumptions correlate to the parking restrictions regulating parking by land use and direct observation of the parking users and their destination once parked.

- North Driveway: 100% Langara YMCA
- Middle driveway: 50% Langara YMCA, 50% Langara Golf Course
- Southern Driveway: 100% Langara Golf Course

The observed trip rate, per 1000 sq ft of the existing YMCA is summarised in **Table 2.3**. For comparison purposes, the 10th Edition Institute of Transportation Engineers (ITE) reported trip rate for a recreational community facility (ITE 495) is also noted.

Table 2.3: Existing Site Trip Generation

LAND USE	AM PEAK HOUR			PM PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Existing YMCA Vehicle Volumes	40 vph	69 vph	109 vph	90 vph	93 vph	183 vph
Existing YMCA Vehicle Trip Rate	0.88	1.53	2.41	2.00	2.06	4.06
ITE 495 trip Rate	1.09	0.64	1.73	1.06	1.24	2.30

2.3.5 Existing Parking Demand & Supply

For vehicle parking, the existing Langara YMCA provides approximately 120 surface parking spaces including 75 stalls in the parking lot located directly south of the building and an additional 45 spaces in YMCA designated spaces in the larger parking lot separating the YMCA site and the Langara municipal golf course. Both parking areas provide direct access to Alberta Street which in turn connects to 49th Avenue.

The existing site and neighbourhood parking supply as well as posted parking restrictions are illustrated in **Exhibit 2.6**.

The breakdown of parking supply and peak occupancy is summarised in **Table 2.4**, while the daily parking profile is illustrated in **Figure 2.2**.

Table 2.4 Site Area Parking Supply & Peak Occupancy

TYPE	PARKING SUPPLY	PICK-UP/DROP-OFF	PEAK AM OCCUPANCY	PEAK PM OCCUPANCY
Langara YMCA Only	121	2	98% (10:30am)	93% (6:00pm, 7:30pm)
Unmarked (Langara Golf Course & YMCA)	132	-	99% (10:30am)	89% (4:00pm)
Alberta Street On-Street (2hr 8am-6pm)	29	-	90% (10:00-11:30am)	100% (3:30pm)

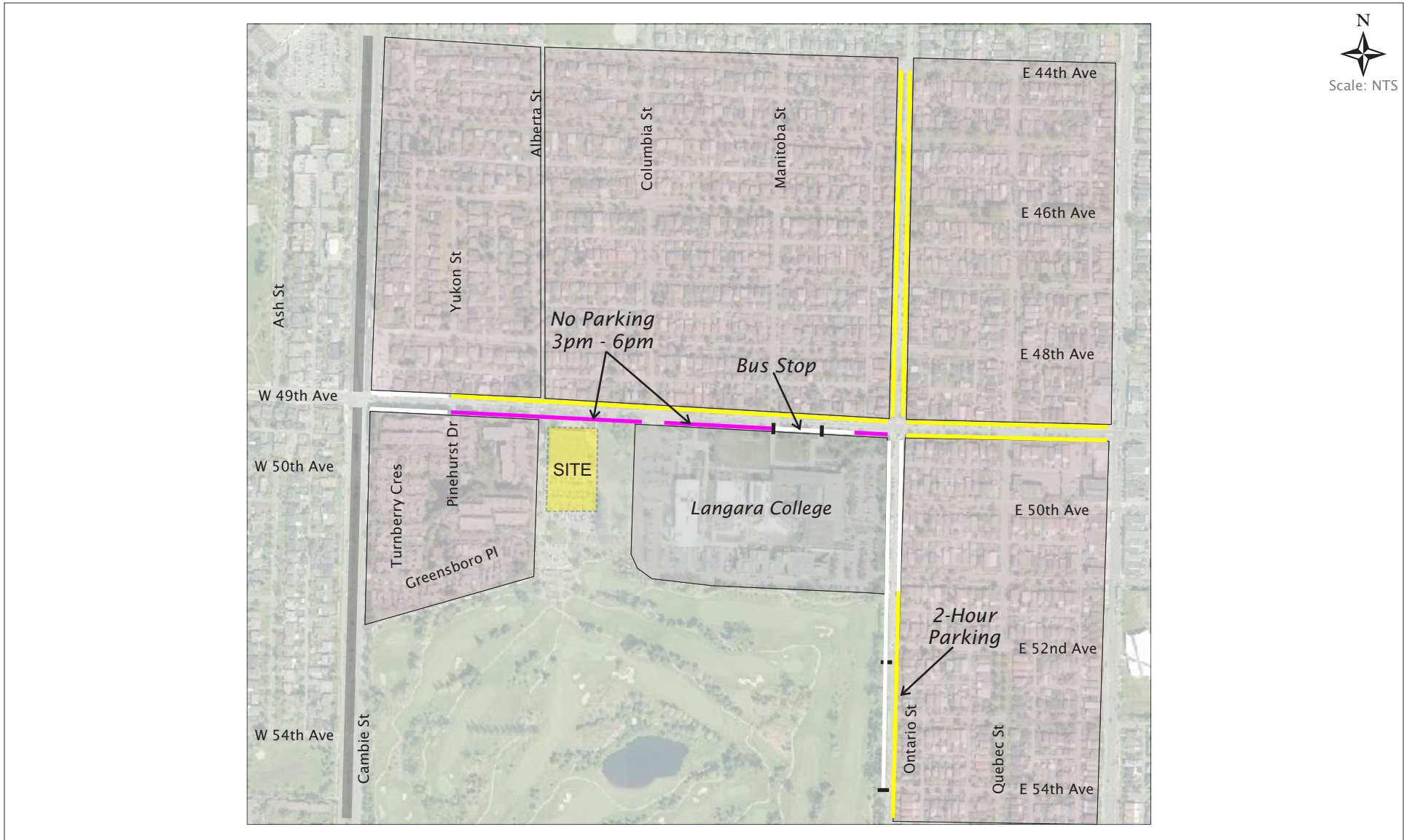
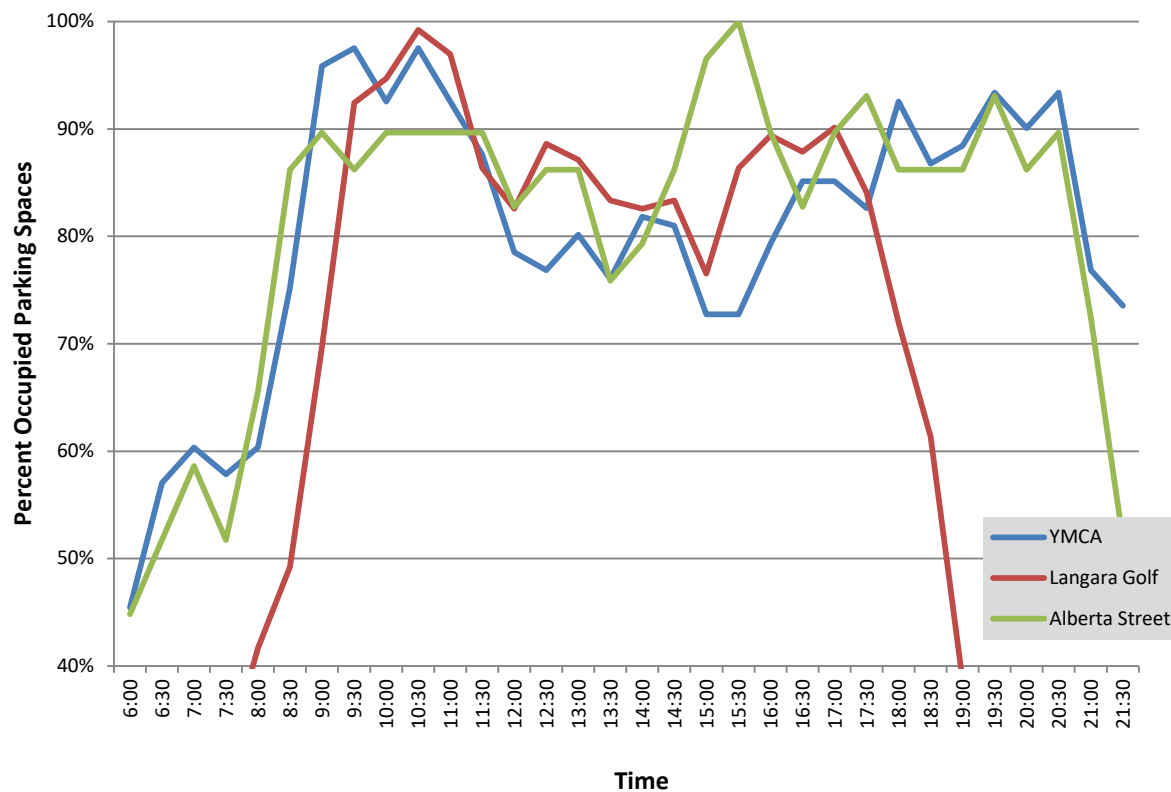


Exhibit 2.6 On-Street Parking Restrictions

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Langara YMCA
November 2018

Figure 2.2: Parking Profile



2.3.6 Shortcutting Traffic

As previously described, an assessment of vehicle traffic shortcutting through the neighbouring Langara Estates residential development was conducted to determine how many vehicles are using the private strata roads to connect between Alberta Street and Cambie Street. A license plate survey (partial, for privacy reasons) was conducted on the private driveway (connecting to Greensboro Place) at the south end of Alberta Street and the northern driveway on Cambie Street (at Pinehurst Drive). Existing signage at each of the access driveway connections Cambie Street and Alberta Street identify the private roads are for resident traffic use only.

The criterion used to identify a possible shortcutting vehicle was that the same vehicle would need to be observed at both ends of the strata driveway system (i.e., at both the Cambie and Alberta Street driveway connections) and the interval between the pair of observations less than five minutes.

The observed volumes for the weekday AM and PM peak traffic periods (7-9am and 3-6pm) are summarised in **Table 2.5**.

Table 2.5 Recorded Vehicles Shortcutting Through Langara Estates

TIME PERIOD	TOTAL VEHICLES OBSERVED AT EACH DRIVEWAY	NUMBER OF SHORTCUTTING VEHICLES	DIRECTION
7:00-9:00am	Alberta: 9 Cambie: 15	1	Eastbound
3:00-6:00pm	Alberta: 33 Cambie: 43	8	1 Westbound 7 Eastbound

The traffic survey did identify that there is some shortcutting traffic using the existing strata roads to connect between Alberta Street and Cambie Street; however, the volume is relatively low with only a single eastbound (Cambie to Alberta Street) during the two hour (7-9am) weekday morning peak period, and 8 vehicles (between 2-3 vehicles per hour) during the three hour (3-6pm) weekday afternoon peak period. All but one of these observed 8 vehicles was travelling eastbound from Cambie Street for access to Alberta Street through the strata development.

2.4 Existing Operations

2.4.1 Performance Thresholds

The existing operations of study area intersections and access points were assessed using the methods outlined in the 6th Edition of the Highway Capacity Manual (HCM), using the Synchro 10 analysis software. The traffic operations were assessed using the traffic performance measures of Level of Service (LOS) based on predicted vehicle delay, and volume-to-capacity (V/C) ratio. The LOS rating is based on average vehicle delay and ranges from “A” to “F” based on the quality of operation at the intersection. LOS “A” represents optimal, minimal delay conditions while a LOS “F” represents an over-capacity condition with considerable congestion and/or delay. Delay is calculated in seconds and is based on the average intersection delay per vehicle. **Table 2.6** summarizes the LOS thresholds for the six Levels of Service, for both the signalized and unsignalized intersections.

Table 2.6: Intersection Level of Service Thresholds

LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	
	SIGNALIZED	UNSIGNALIZED
A	≤10	≤10
B	>10 and ≤20	>10 and ≤15
C	>20 and ≤35	>15 and ≤25
D	>35 and ≤55	>25 and ≤35
E	>55 and ≤80	>35 and ≤50
F	>80	>50

Source: Highway Capacity Manual

The volume to capacity (V/C) ratio of an intersection represents the ratio between the demand volume and the available capacity. A V/C ratio less than 0.85 indicates that there is sufficient capacity to accommodate demands and generally represents acceptable traffic conditions in suburban settings. A V/C value between 0.85 and 0.95 indicates an intersection is approaching practical capacity; a V/C ratio over 0.95 indicates that traffic demands are close to exceeding the available capacity, resulting in saturated conditions. A V/C ratio over 1.0 indicates a very congested intersection where drivers may experience considerable delay. In downtown and Town Centre contexts, during peak demand periods, V/C ratios over 0.90 and even 1.0 are common.

As directed by the City of Vancouver, the performance thresholds for acceptable traffic performance employed in this study are listed below:

Signalized Intersections:

- Overall intersection Level of Service = LOS D or better;
- Overall intersection V/C ratio = 0.85 or less;
- Individual movement Level of Service = LOS E or better; and,
- Individual movement V/C ratio = 0.90 or less.

In interpreting the analysis results, it is noted that the HCM methodology reports performance differently for various types of intersection traffic control. In this report, the performance reporting convention is as follows:

- For signalized intersections: HCM 6 output for overall LOS and V/C as well as individual movement LOS and V/C is reported. 95th Percentile Queues are reported as estimated by Synchro.

The performance reporting conventions noted above have been consistently applied throughout this document and the detailed outputs are provided in **Appendix A**.

2.4.2 Existing Operational Analysis Results

Existing operations were found to be very satisfactory with all study intersections operating overall at LOS A or better during both the AM and PM peak hours. The results are summarized in **Table 2.7**, and full Synchro output is available in **Appendix B**.

Table 2.7: Existing Traffic Operations

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	AM			PM		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
Cambie & W49 th Ave	OVERALL	D	-	-	D	-	-
	EBL	D	0.78	#73	D	0.45	29
	EBT	D	0.56	90	D	0.72	103
	EBR	D	0.57		D	0.73	
	WBL	C	0.60	54	D	0.80	#77
	WBT	E	0.95	#215	D	0.79	#167
	WBR	D	0.32	15	D	0.56	20
	NBL	C	0.54	36	C	0.62	34
	NBT	D	0.78	#188	D	0.83	185
	NBR	C	0.37	38	C	0.38	35
	SBL	C	0.66	42	F	0.99	#147
	SBT	C	0.57	114	D	0.88	#259
	SBR	C	0.51	17	C	0.38	30
	OVERALL	B	-	-	B	-	-
Alberta St & W 49 th Ave	EBL	B	0.54	-	B	0.57	-
	EBT	A	0	57	A	0	67
	EBR	B	0.54	-	B	0.56	-
	WBL	C	0.83	-	C	0.84	-
	WBT	A	0	#162	A	0	#176
	WBR	A	0.03	2	A	0.04	4
	NBL	B	0.14	-	B	0.27	-
	NBT	A	0	16	A	0	30
	NBR	A	0	-	A	0	-
	SBL	B	0.27	-	B	0.17	-
	SBT	A	0	25.4	A	0	19
	SBR	A	0	-	A	0	-
	OVERALL	B	-	-	B	-	-
	EBL	B	0.54	-	B	0.57	-

1. V/C for shared lanes reported for left turning vehicles only

The Synchro analysis shows that the two study intersections overall are operating within the performance thresholds outlined in Section 2.4.1.

Alberta Street south of West 49th Avenue presently operates with weekday morning and afternoon peak period traffic volumes ranging from 200 to 300 vehicles per hour at the north end closest to West 49th Avenue decreasing to approximately 50 vehicles per hour at the south end. The northbound approach of Alberta Street to the West 49th Avenue intersection operates well within capacity with very satisfactory Level of Service A or B delay conditions.

For the intersection of Cambie and West 49th Avenue, the 49th Avenue westbound through movement has a volume/capacity (v/c) ratio over 0.90 in the AM peak hour and the southbound Cambie Street left movement in the PM peak hour has an LOS F and v/c ratio of 0.99. Traffic operational analysis results such as these are not uncommon during peak hours at critical intersections.

In the AM, the eastbound West 49th Avenue left movement has a 95th percentile queue length that exceeds the available left-turn bay, while in the PM the southbound Cambie Street left and the westbound 49th Avenue left have 95th percentile queues that extend beyond the available left-turn bay lengths. Lengthening of the left-turn bays on the westbound and eastbound 49th Avenue approaches are not possible on account of the relatively short street block lengths on West 49th Avenue on either side of the Cambie intersection.

Vehicle queues on West 49th Avenue (westbound in the AM and PM) and Cambie Street (northbound, AM and southbound in the PM) were determined to extend beyond one block of the approach.

While the existing southbound Cambie Street left-turn lane cannot physically be extended, an additional southbound left turn bay could physically be added to the intersection. While it is recognized that this change would likely not be supported by the Cambie Boulevard Heritage Society on account of the physical removal of some of the boulevard area, this was modeled in Synchro for the PM peak hour as a test of the additional traffic capacity that would result from this modification.

It was assumed in the modeling that one southbound left lane would have the same storage length as existing (75m) and the second would have 35m. The existing cycle length was kept constant and the intersection splits were optimized. The southbound left movement was also changed to operate as a protected left-turn phase only rather than the existing protective/permissive phasing. With the implementation of a second southbound left-turn lane on Cambie Street, the performance of the southbound left-turn movement would improve to be within the City's acceptable thresholds (v/c ratio 0.85, LOS E) and the 95th percentile queue of 65m would be accommodated within the storage. While the addition of a second southbound left-turn lane on Cambie Street approaching the 49th Avenue intersection does provide some improvement to traffic operations at the intersection, we are not recommending this mitigation measure on account of the physical impact to the Cambie Boulevard space.

3. FUTURE TRAFFIC CONDITIONS

3.1 Traffic Forecasts

3.1.1 Background Traffic Forecasts

Vehicle volumes on West 49th Avenue and Cambie Street indicate that these arterials near to capacity during peak periods; however, traffic volume data dating back to 2010 indicates that peak period traffic on 49th Avenue has actually been decreasing since that time to the present. There is also increasing evidence that, in Vancouver at least, new development around key intersections is not leading to higher volumes of traffic. New local trips are replacing the longer distance trips as a result of changing travel behaviours, including different routing.

This same pattern is anticipated to hold into the future even with the considerable future development anticipated for the Cambie Corridor generally and for the emerging Municipal Town Centre (MTC) area extending out from the intersection of Cambie Street and West 41st Avenue. With development, significant additional transit capacity will be provided with more train cars (shorter intervals between trains) on the Canada Line and the introduction in 2019/2020 of the B-Line rapid bus service on the West 41st Avenue corridor.

In light of these considerations, a general background growth rate has not been applied to our analysis of future traffic for the Langara YMCA traffic study, and for the purposes of this analysis the existing vehicle traffic volumes on area streets are carried forward into the future traffic analysis.

3.1.2 Site Traffic

Trip Generation

This section presents the projected the number of new vehicles expected to be generated by the proposed redevelopment of the Langara YMCA.

Future development vehicle movements were estimated for the weekday morning and afternoon peak-hour periods. Trip rates for the residential are based on Bunt's database for multifamily residential and rental buildings within a similar transit and land use context. These rates are also higher than that applied for the Oakridge redevelopment plans, at Cambie & West 41st Avenue, which has a wider mix of land uses and a lower parking provision.

The new YMCA facility, while expanding significantly and now able to accommodate more activity by YMCA members and the public, is not anticipated to generate any significant increase in vehicle trips in the future over the existing condition. Our rationale for this is largely premised on the changing community context for this area.

The existing Langara YMCA is positioned within a largely low density, single family residential community. Not surprisingly the existing travel mode split for the facility (as surveyed and documented by Bunt & Associates in September 2016) has a relatively high percentage of trips made by private automobile (nearly 80% of all trips), with fewer than 10% of trips by transit and another 10% involving walking and cycling trips.

Redevelopment of the Cambie Corridor including the Oakridge Centre redevelopment (planned for completion by 2026) and more generally the MTC precinct will add more than 50,000 persons to the area with convenient access to new YMCA facility by transit using the Canada Line, or simply be relatively short distance walking and cycling trips. As such, a significant increase in the transit, walking and cycling mode split is anticipated for the new facility. Therefore, the parking strategy for the expanded new facility is to maintain the parking supply at 130 stalls (although 142 stalls will be available during the evening and weekend periods when the childcare stalls are available for general use) or roughly the peak parking demand of the smaller, existing facility.

By not increasing the parking supply for the new facility, there should, accordingly, not be any significant change from the observed existing vehicle trip generation rates. As such, for the purposes of the future conditions traffic analysis, the vehicle trips assumed for the expanded new facility are expected to be very similar to the current pattern observed for the existing facility.

The following **Table 3.1** presents the estimated vehicle trip rates for the redeveloped site, covering both residential and non-residential uses. Note, the YMCA trip rate is as observed from the existing conditions, and as a comparable the ITE (Institute of Transportation Engineers) Trip Generation Handbook 10th Edition rate has also been included for comparison, which is significantly lower.

Table 3.1: Peak Hour Vehicle Trip Rates

LAND USE	1000 SQFT GFA/ CHILDREN / UNITS	AM PEAK HOUR			PM PEAK HOUR		
		In	Out	Total	In	Out	Total
Existing YMCA Facility	45,000	0.88	1.53	2.41	2.00	2.06	4.06
ITE 495		1.9	0.64	1.73	1.05	1.24	2.3
YMCA Childcare	74	0.34	0.32	0.66	0.40	0.41	0.81
Strata Residential	158	0.05	0.20	0.25	0.1408	0.0792	0.22
Rental Residential	70	0.0608	0.1292	0.19	0.1207	0.0493	0.17

Table 3.2 summarizes the anticipated future site generated vehicle trips for the proposed development based on the above rates.

Table 3.2: Estimated Peak Hour Site Vehicle Trips

LAND USE	AM PEAK HOUR			PM PEAK HOUR		
	IN	OUT	TOTAL	IN	OUT	TOTAL
YMCA Childcare	25	24	49	29	30	60
Strata Residential	8	32	40	22	13	35
Rental Residential	4	9	13	8	3	12
Net New Trips	37	64	102	60	46	106
Existing Site	40	69	109	90	93	183
SITE TOTAL	77	133	211	150	139	289

The existing YMCA generates approximately 100 vehicle trips (inbound and outbound combined) during the weekday morning peak hour traffic period and just under 200 vehicle trips during the weekday afternoon peak hour period, or on average about three vehicles per minute either arriving to or departing from the site.

The proposed redevelopment with the new residential uses and the expanded YMCA facility and childcare centre is anticipated to generate an additional two vehicles per minute during peak traffic periods. Roughly half of this traffic increase will be from the residential component and half from the expanded YMCA and childcare centre.

Trip Distribution & Assignment

The assignment of the estimated future site traffic onto the street network is based on the observed existing turning movements at the study intersections. The trip distribution is summarised in **Table 3.3**, and the predicted weekday morning and afternoon peak hour development generated traffic volumes are shown in **Exhibit 3.1**.

Table 3.3: Estimated Trip Distribution

ORIGIN/DESTINATION	AM PEAK HOUR		PM PEAK HOUR	
	IN (%)	OUT (%)	IN (%)	OUT (%)
Cambie Street North	28%	33%	38%	29%
W 49 th Avenue West	17%	21%	15%	15%
Cambie Street South	34%	25%	29%	35%
W 49 th Avenue East	18%	20%	16%	21%
Alberta Street North	3%	1%	2%	1%
TOTAL	100%	100%	100%	100%

The site's contribution to the existing vehicle volumes at the study intersections is shown in **Table 3.4**, which is relatively minor.

Table 3.4: Net Change in Future Intersection Vehicle Volumes with New Site Trips

INTERSECTION	AM PEAK HOUR VOLUMES			PM PEAK HOUR VOLUMES		
	BACK-GROUND	SITE	% CHANGE	BACK-GROUND	SITE	% CHANGE
Cambie Street & W 49 th Ave	3,871	80	2%	4,545	146	3%
Alberta Street & W 49 th Ave	1,703	102	6%	1,902	183	9%

3.1.1 Total Traffic

The site traffic forecasts for the full build out/ future traffic conditions are shown in **Exhibit 3.2**.

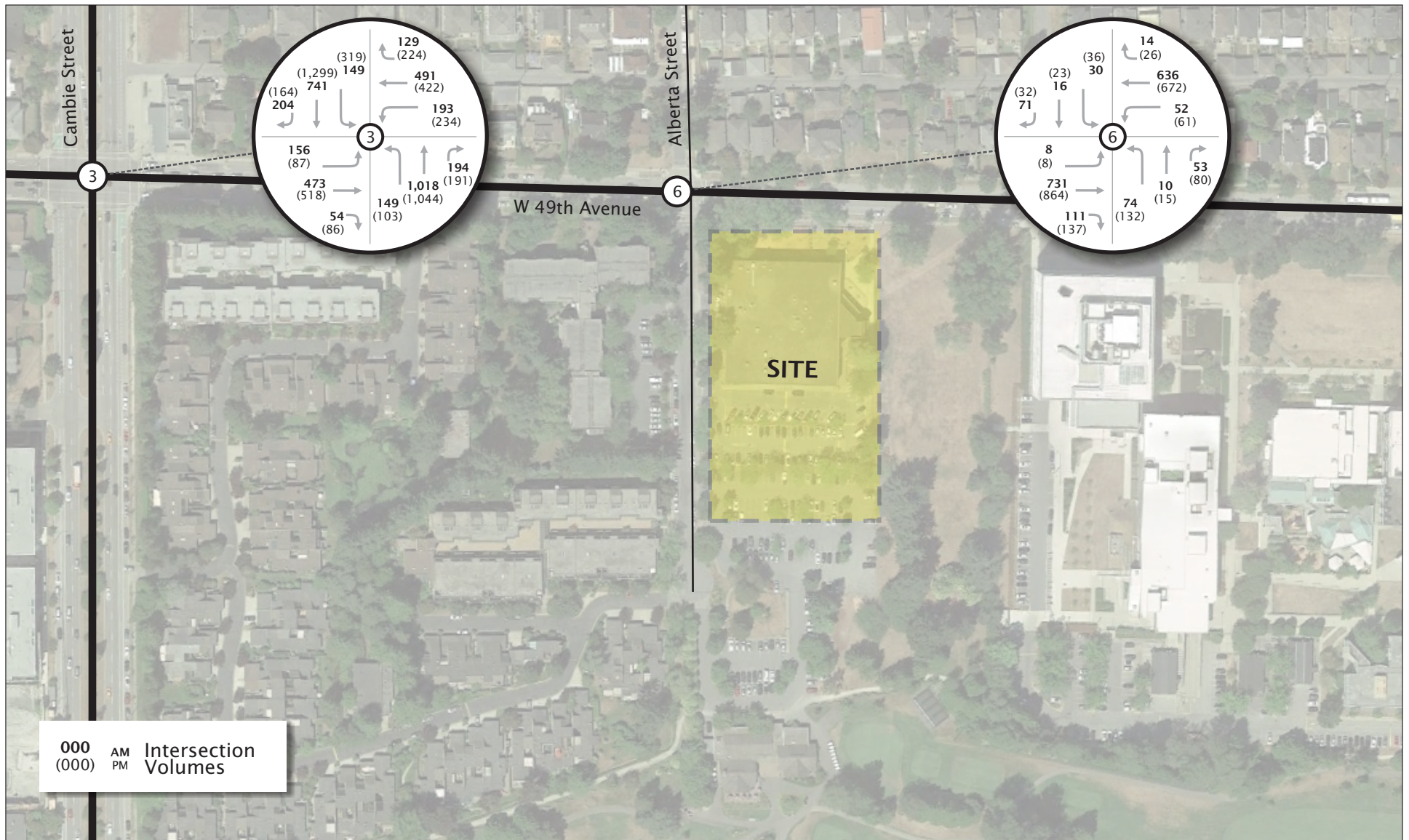


Exhibit 3.2 Opening Day Total Traffic Forecasts

04-18-0080

Langara YMCA
November 2018

3.2 Future Traffic Operations

The traffic operations analysis results are shown in **Table 3.5** for the opening day total traffic scenario. Similar to the existing conditions, both study intersections are operating at an LOS D or better overall. Comparing to the existing conditions, the peak vehicle queues on Cambie Street and West 49th Avenue have increased approximately 25m or an equivalent of 4 passenger cars. Full Synchro output is available in **Appendix C**.

Table 3.5: Opening Day Total Vehicle Operations

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	AM			PM		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
Cambie & W49 th Ave	OVERALL	D	-	-	D	-	-
	EBL	D	0.81	#72	D	0.47	29
	EBT	D	0.56	90	D	0.73	105
	EBR	D	0.57		D	0.74	
	WBL	C	0.65	#62	E	0.93	#102
	WBT	E	0.96	#225	D	0.82	#177
	WBR	D	0.37	16	D	0.63	23
	NBL	C	0.54	36	C	0.62	34
	NBT	D	0.79	#188	D	0.83	185
	NBR	C	0.40	41	C	0.44	42
	SBL	C	0.70	47	F	1.11	#172
	SBT	C	0.58	114	D	0.88	#259
	SBR	C	0.52	17	C	0.38	30
	OVERALL	B	-	-	C	-	-
Alberta St & W 49 th Ave	EBL	B	0.57	-	B	0.74	-
	EBT	A	0	60	A	0	77
	EBR	B	0.54	-	B	0.59	-
	WBL	C	0.85	-	C	0.93	-
	WBT	A	0	#169	A	0	#197
	WBR	A	0.03	2	A	0.04	4
	NBL	B	0.29	-	C	0.50	-
	NBT	A	0	32	A	0	#57
	NBR	A	0	-	A	0	-
	SBL	B	0.28	-	C	0.19	-
	SBT	A	0	25	A	0	19
	SBR	A	0	-	A	0	-
	OVERALL	A	0	-	A	0	-
	OVERALL	A	0	-	A	0	-

At both study intersections the westbound left movement v/c ratio has increased to exceed the performance thresholds listed in Section 2. At the intersection of Alberta Street and West 49th Avenue, the westbound left movement in the PM peak hour has a v/c ratio of 0.93 (increased from 0.84 in the existing volume scenario) and at Cambie Street and West 49th Avenue the same movement in the PM peak hour has a v/c ratio of 0.93 (increased from 0.80 existing volume scenario).

Acceptable traffic operations can however be generally be maintained throughout the study area with optimization of existing traffic signal phasing splits, as summarised in Table 3.6.

Table 3.6: Opening Day Total Vehicle Operations – Signal Optimization

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	AM			PM		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
Cambie & W49 th Ave	OVERALL	D	-	-	D	-	-
	EBL	D	0.77	#76	D	0.48	29
	EBT	D	0.57	90	D	0.76	112
	EBR	D	0.58		E	0.77	
	WBL	C	0.61	56	E	0.86	#110
	WBT	E	0.92	#205	D	0.77	160
	WBR	C	0.35	15	D	0.58	21
	NBL	C	0.55	39	D	0.63	44
	NBT	D	0.82	180	E	0.90	#199
	NBR	C	0.42	40	D	0.49	38
	SBL	D	0.72	63	F	1.02	#157
	SBT	C	0.60	121	D	0.89	224
	SBR	D	0.55	18	C	0.38	25
Alberta St & W 49 th Ave	OVERALL	B	-	-	C	-	-
	EBL	A	0.50	-	B	0.59	-
	EBT	A	0	46	A	0	77
	EBR	A	0.53	-	B	0.57	-
	WBL	B	0.79	-	C	0.86	-
	WBT	A	0	118	A	0	#183
	WBR	A	0.03	1	A	0.04	4
	NBL	B	0.32	-	C	0.54	-
	NBT	A	0	34	A	0	#67
	NBR	A	0	-	A	0	-
	SBL	B	0.33	-	C	0.20	-
	SBT	A	0	27	A	0	20
	SBR	A	0	-	A	0	-

There are trade-offs for the improvements to the intersection of Cambie Street & W 49th Avenue, while the westbound movement can be improved with signal phase optimization, the northbound through in the PM worsens to have a 95th percentile queue that would extend beyond one block of the approach. The intersection of Alberta Street and W 49th Avenue capacity and 95th percentile queue issues were shown to improve to performance thresholds for acceptable traffic performance with signal split optimization.

4. PARKING & LOADING BY-LAW REVIEW

4.1 Parking Supply

4.1.1 Vehicle Parking

On July 25, 2018, amendments to the Parking By-law were approved by Council with formal adoption anticipated for January 1, 2019. Based on the timeline of this project, the Langara YMCA redevelopment will be required to adhere to the new parking by-law and as such, the following analysis is based on the by-law updates.

According to the City's updated Bylaw, a development can obtain a scaled parking supply reduction based on the site's proximity to high quality transit. There are three different categories of transit accessibility, and the site's location with 400m of a SkyTrain station qualifies it for Level A Transit Accessibility. The following parking reductions are available from the base By-Law rates for each land use:

- 20% for the rental residential uses; and,
- 10% for the strata residential and other uses

Table 4.1 and **4.2** summarizes the bylaw parking requirement along with the parking reduction applied for Level A transit accessibility for or the rental residential and strata residential use respectively.

Table 4.1: Vehicle Parking Supply Requirement – Rental Residential

LAND USE	UNITS	DENSITY	BY-LAW RATE	SUPPLY REQUIREMENTS	SUPPLY REQUIREMENTS WITH TRANSIT REDUCTION
Market Rental Residential	49	5867m ²	A minimum of 1 space for each 125 m ² of gross floor area.	28	22
HIL Rental residential	21		0.3 spaces per Studio & 1 Bed and 0.5 spaces per 2 Bed and over.	9	7
Rental Residential Visitors	70	-	A minimum of 0.05 spaces for every dwelling unit	3	2
TOTAL				40	31

Based on the site plan, the proposed vehicle parking supply will meet the minimum by-law requirements by providing 31 stalls for the rental housing component of the project.

Of the residential stalls, the bylaw requires that 1 stall per building with at least 7 units and an additional 0.034 stalls for each additional unit be accessible. Based on the proposed density, the residential land use requires 3 stalls be accessible of the total bylaw parking requirement. It is noted that accessible stalls can be counted as 2 stalls for the purpose of satisfying the minimum parking requirement.

Table 4.2: Vehicle Parking Supply Requirement – Strata Residential

LAND USE	UNITS	DENSITY	BY-LAW RATE	SUPPLY REQUIREMENTS	SUPPLY REQUIREMENTS WITH TRANSIT REDUCTION
Market Strata Residential	158	16,868m ²	A minimum of 0.6 spaces per unit and 1 space for each 200 m ² of gross floor area.	179	161
Rental Residential Visitors	-	-	A minimum of 0.05 spaces for every dwelling unit	8	7
TOTAL				187	168

Based on the site plan, the proposed vehicle parking supply will meet the minimum by-law requirements by providing 168 strata residential stalls.

Of the residential stalls, the bylaw requires that 1 stall per building with at least 7 units and an additional 0.034 stalls for each additional unit be accessible. Based on the proposed density, the residential land use requires 6 stalls be accessible of the total bylaw parking requirement. It is noted that accessible stalls can be counted as 2 stalls for the purpose of satisfying the minimum parking requirement.

Table 4.3 summarises the YMCA facility and daycare use parking supply, which is based on Bunt's previous project experience with YMCA facilities and daycare centres across Metro Vancouver.

Table 4.3: Vehicle Parking Supply Requirement – YMCA

LAND USE	UNITS	DENSITY	BUNT RATE	PROPOSED SUPPLY
YMCA Facility		86,781 sq.ft. post expansion GFA	1.5 space for each 1000 ft ² of gross floor area.	128
YMCA Daycare	74 Children & 16 Employees	-	1 space per 12 children for pick-up/drop-off & 1 space per 2 employees,	12
TOTAL				140

4.1.2 Bicycle Parking

Well managed, secure, accessible and covered bicycle parking will be provided as part of the development plan. **Table 4.4** summarizes the bicycle parking requirements based on the City of Vancouver's updated bylaw. For reference, a copy of the development statistics from the project architect is included in **Appendix D**, which outlines the residential unit breakdown size.

Table 4.4 Class A Bicycle Parking Requirements

USE	UNIT SIZE	UNIT SUPPLY	RATE	REQUIREMENT	PROVIDED
Rental Residential	<65m ²	35	1.5 per unit	53	
	65m ² -105m ²	35	2.5 per unit	88	
	>105m ²	0	3 per unit		
Sub Total		70	-	140	140
Strata Residential	<65m ²	28	1.5 per unit	42	
	65m ² -105m ²	100	2.5 per unit	250	
	>105m ²	30	3 per unit	90	
Sub Total				382	382
YMCA (retail/ service use)	7,876 m ² GFA	-	1 per 340 m ² GFA	23	
Sub Total		-		23	23
TOTAL				545	545

The development will provide at least 548 Class A spaces. In addition the development will follow the Class B bicycle parking requirements of the By-Law which is summarised in **Table 4.5**. The Class A -Long Term parking spaces must be located in a convenient location on the P1 level. The Class B - Short Term parking should be provided in a publically accessible area near the entrance in a well lit and highly visible area.

Table 4.5 Class B Bicycle Parking Requirement

USE	UNITS	RATE	REQUIREMENT	PROVIDED
Rental Residential	70	2 per first 20 units and 1 per each remaining 20 units.	5	5
Strata Residential	158		9	9
YMCA (retail/ service use)	7,876 m ² GFA	A minimum of 6 spaces for any development containing a minimum of 1,000m ² GFA.	12	40
TOTAL			26	54

The definition of Class A and Class B bicycle parking is located in Section 6 "Off-Street Bicycle Space Regulations" of the Parking-By-law (May 2018). Additionally, the City of Vancouver's "Parking Bylaw Updates to Achieve Transportation 2040 Actions" includes a number of policy changes that are recommended and summarized below.

Class A Bicycle Parking Access

- Requirements for a minimum of 5% of bicycle parking spaces provided to accommodate non-standard bicycle such as recumbent, tandem, cargo bikes and trailers. This requires a larger space of 2.4m x 0.9m compared to a typical 1.8m x 0.6m bicycle parking space, as well as a wider access aisle of 1.5m;
- Requirements for automatic openers on doors leading to and from bicycle parking;
- Allowances for stacked bicycle parking at up to 60% of the provided spaces;
- Adjustment of maximums for vertical spaces to accommodate the provision of stacked bicycle parking. A combined total of 60% of spaces may be vertical and stacked, with up to 30% of spaces being vertical; and,
- Adjustment to minimums for lockers to 10% of total number of spaces.

Class B Bicycle Parking Access

- Provided for the benefit of visitors to buildings and are typically located outside, on private property, in the form of bike racks; and,
- In order to improve usability of Class B bicycle parking, increased spacing requirements and dimensions are recommended; currently sized at 0.6 m x 1.8 m.

End of Trip Facilities

- While the non residential use of the project requires over 20 Class A bicycle parking spaces, no end of trip facilities are proposed for this project as the YMCA facility programmed area already includes washrooms, showers, lockers and other components

4.2 Loading Requirements

4.2.1 Passenger Loading Spaces

The updated Parking By-law also requires the provision of passenger loading spaces for all land uses. For this particular development, **Table 4.6** summarizes the minimum recommended passenger loading spaces for all land uses according to the City's requirements.

Table 4.6: Passenger Loading Vehicle Requirements

USE	UNITS/ AREA	BYLAW RATE	BYLAW SUPPLY REQUIREMENT	PROVIDED
Rental Residential	70	1 space for less than 274 units	1	1
Strata Residential	158		1	1
YMCA (retail/ service)	7,876 m ² GFA	1 space for retail for 1 st 2,000 m ² of GFA, plus 1 additional space for each 4,000 m ² of GFA >4,000 m ²	1	1
TOTAL			3	3

4.2.2 Service Vehicles

The City of Vancouver's Parking Bylaw (No. 6059) outlines loading requirements for different uses in new projects. **Table 4.7** summarizes the requirements that are relevant to the proposed development along with the required loading spaces.

Table 4.7: Loading Bylaw Rates

LAND USE	DENSITY	BY-LAW RATE			BY-LAW SUPPLY REQUIREMENT		
		CLASS A	CLASS B	CLASS C	CLASS A	CLASS B	CLASS C
Rental Residential	70	None	1 for 100-299 units	None	0	0	0
Strata Residential	158				0	1	0
Community Centre	7,876 m ²	None	1 for each 2800m ² GFA	None	0	3	0
TOTAL					0	4	0

Based on the by-law, the development would require 1 Class B loading space for the residential use and 3 Class B spaces for the YMCA component. According to the City's By-law, the required minimum dimensions of the Class B loading spaces are: 8.5 m long, 3.0 m wide and 3.9 m high.

The CoV loading By-law is general as it relates to a variety of land uses. As the YMCA has many locations in Metro Vancouver, they are very familiar with the range of their loading requirement for S-U9 vehicles. Based on years of experience operating multiple locations they have determined 1 Class B loading space will be sufficient to meet their needs.

4.3 Parking Layout & On-Site Vehicle Circulation

Bunt has conducted high level review of the parking and loading areas to ensure general compliance of CoV design standards and manoeuvrability. At this stage of the approval process however a full site plan review has not been completed. A full review will be completed at the Development Permit stage and submitted with other project deliverables

5. TDM & ACTIVE MODES

5.1 Definition

Transportation Demand Management (TDM) is defined as the “application of strategies and policies to reduce travel demand (specifically that of single-occupancy private vehicles), or to redistribute this demand in space or in time”¹. A successful TDM program can influence travel behaviour away from Single Occupant Vehicle (SOV) travel during peak periods towards more sustainable modes such as High Occupancy Vehicle (HOV) travel, transit, cycling or walking. The responsibility for implementation of TDM measures can range across many groups, including regional and municipal governments, transit agencies, private developers, residents/resident associations or employers.

5.2 City of Vancouver’s New TDM Policy

The City of Vancouver has developed a TDM program (CoV TDM Program) using a framework modeled on a “points menu”. It includes the requirement for a comprehensive TDM program for all new developments in the Downtown with potential opportunities as well for City-wide new developments. The purpose of this program is to provide clarity and guidance for developers on the creation of a TDM plan, and a basis for staff to easily evaluate the plans.

5.3 Projects which Require a TDM Plan

To determine if this development requires a TDM plan, the City has prescribed a list of thresholds regarding the development size and location. A TDM Plan is mandatory for sites in the Downtown, and those defined as a ‘large site’ (total site size of 8,000 m² or 45,000 m² of new floor area).

The site size and new floor area are summarised below, and shows the site area is just over the threshold for it to be considered a large site.

- Site Size: 87,103 sqft / 8,092 sqm
- New Floor Area: 295,552 sqft / 27,458 sqm

Given the site is being redeveloped to be primarily a non-profit community centre land use, and that the site area is just marginally over the threshold for a large site, it has not been confirmed whether a TDM Plan will be required, and it is expected further detailed will be available at the Development Permit stage.

¹ <http://ops.fhwa.dot.gov/tdm/index.htm> FHWA Travel Demand Management home page

6. CONCLUSIONS & RECOMMENDATIONS

6.1 Conclusions

The site is located at 282 West 49th Avenue in Vancouver with vehicle access to the site provided from one location on Alberta Street.

The site will consist of a redevelopment of its existing Langara Family YMCA to an expanded facility with over 72,000 square feet of area, a 9,000 square feet childcare facility, a 20 storey residential strata building with 158 dwelling units, and a 13 storey affordable residential building with 70 dwelling units.

The redeveloped YMCA will be constructed with the ability to expand further from the proposed 72,890 sqft GFA to 84,890 sq ft GFA.

Existing traffic conditions in the area during the weekday morning (AM) and afternoon (PM) peak traffic periods are operating at near capacity conditions at the 49th Avenue intersections of Cambie Street and Alberta Street, with significant vehicle queues for certain of the traffic movements particularly at the Cambie/49th intersection. Review of City of Vancouver traffic data dating back to 2003, weekday morning and afternoon traffic volumes have not changed significantly since this time and the queuing issues observed in 2018 are not unlike they were back 15 or more years ago.

Alberta Street south of 49th Avenue, with between 100 to 150 vehicles per hour of traffic, or on average about 2-3 vehicles per minute both southbound and northbound, is a moderate volume local road. Turning traffic to/from the YMCA and the Langara Golf Course parking lots, coupled with the “edge friction” effect of curbside parking create conditions that tend to slow/calm traffic on this cul-de-sac segment of Alberta Street south of 49th Avenue. The northbound approach of Alberta Street to the West 49th Avenue intersection operates well within capacity with very satisfactory Level of Service A or B delay conditions.

The net additional vehicle traffic with the proposed redevelopment is anticipated to be approximately 100 vehicle trips, or on average about one-two vehicles per minute during peak activity periods. This is the incremental traffic associated with the proposed residential development on the site, both rental and strata. The redevelopment of the YMCA facility is not expected to result in any significant change to the existing traffic generated by the facility as the parking supply for the new facility will be held to near the same number of parking spaces as the existing facility.

No traffic capacity or operational improvements are required at the intersections of 49th Avenue/Alberta Street and 49th Avenue/Cambie Street to accommodate this incremental traffic.

Observation of vehicle traffic movement on the private strata roads of the adjacent Langara Estates residential development confirms that some vehicles are “shortcutting” through Langara Estates using the private strata driveway system, the volume is relatively low with only a single vehicle (eastbound from Cambie Street to Alberta Street) observed during the two hour weekday morning peak period (7-9am), and eight vehicles (7 eastbound and 1 westbound) during the three hour weekday afternoon peak period (3-6pm). To curtail this activity completely, a gated closure to the Greensboro Place connection to Alberta Street could be considered; however, some form of intercom type security would be needed to control gate openings for visitors and service/loading vehicles.

The proposed on-site vehicle parking supply will meet the bylaw requirements and provide 31 spaces for rental residential, 186 for strata residential, 12 for the YMCA Daycare and 130 for the YMCA recreational facility.

The proposed on-site bicycle parking supply will meet the bylaw requirements with 545 Class A bicycle stalls and 40 Class B bicycle stalls overall.

Based on the bylaw requirement, the development requires 3 Class A passenger loading spaces which will be provided in the underground parkade.

The Parking By-law calls for a total of 4 Class B service vehicle loading spaces. The By-law requirements, however, do not take into consideration of the fact that many of the loading activities can be undertaken by smaller vehicles such as vans, pick-up trucks, or passenger cars. Additionally, given the special recreational use of the YMCA facility, which is consistent across the other Metro Vancouver locations, 1 Class B space is proposed for residential and 1 for the YMCA.

APPENDIX A

Terms of Reference

From: [Draskovic, Rosemarie](#)
To: [Thea Wilson](#)
Subject: RE: Langara YMCA Expansion - Proposed TOR
Date: October 29, 2018 10:51:36 AM
Attachments: [image002.png](#)
[image003.png](#)

Hi Thea,

Thank you for providing the draft TOR. A few comments:

- Please confirm study intersections. Yukon does not intersect W 49th.
- Assessment of shortcutting should also include recommended mitigation measures.
- Parking supply analysis should include loading, as well
- As the site is greater than 8,000 m², a large site TDM plan is required.
- Given the land uses (community, day care), the circulation review should include an assessment and recommendations to facilitate pick-up and drop-off.

Regards,

Rosemarie Draskovic, P.Eng., PTOE, PTP

Transportation Development Engineer
City of Vancouver | t. 604.829.9218

From: Thea Wilson [mailto:twilson@bunteng.com]
Sent: Monday, October 22, 2018 1:50 PM
To: Draskovic, Rosemarie
Subject: Langara YMCA Expansion - Proposed TOR

Hi Rosemarie,

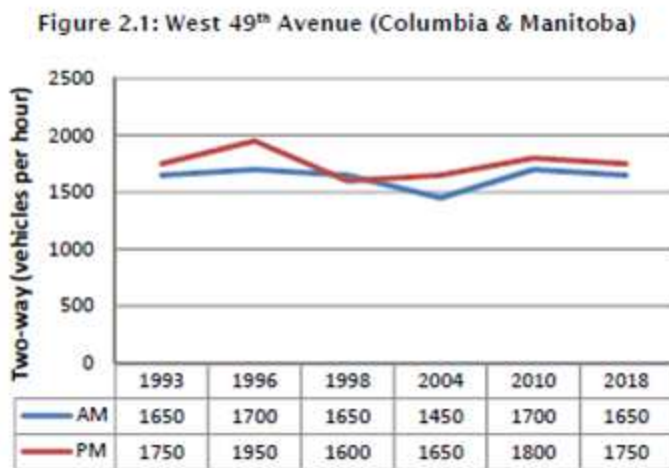
I am emailing you to get your feedback/ approval on a TOR for the new and expanded YMCA Langara. Peter Joyce has been working on this project to date, so apologies if I am doubling up on any communication on this project; he is away on vacation for a bit and I have been tasked with moving forward on the project.

The following outlines our proposed TOR of the TIA . Following that, in blue, is a summary about the proposed site redevelopment.

- Conduct weekday AM & PM (7-9am & 3-6pm) vehicle, pedestrian and cyclist volume counts at the following locations to establish existing baseline traffic operation conditions: 49th & Yukon, and 49th & Cambie;
- Using the Synchro/SimTraffic traffic model, evaluate existing traffic capacity conditions for the weekday AM & PM peak hour at the study intersections identified above;
- Vehicle volumes on West 49th Avenue indicate that it operates at or close to capacity during

peak periods, with two way volumes decreasing between 2010-2018 (graph below). We therefore propose no growth rate be applied to the operational assessment;

- We will also provide some information on potential vehicle short cutting between Cambie Street and Yukon Street through the adjacent residential project to the west of Yukon;
- Predict the future traffic and parking requirements of the proposed development;
- Conduct a neighbourhood scale traffic impact assessment to identify the potential change to area street traffic operation with the added traffic associated with the proposed development; and
- Review the proposed site plan in terms of driveway access, internal traffic circulation, loading/garbage/recycling access (all in terms of vehicle turning path requirements), parking configuration and pedestrian/cyclist access.



Proposed is approximately 74,000 square feet of gross floor area (with the ability to expand in the future by a further 12,000 square feet) including:

- 9,000 square feet childcare facility intended to accommodate up to 74 children,
- a 20 storey residential strata building with 158 dwelling units,
- a 13 storey affordable rental residential building with 70 dwelling units.

The existing YMCA generates approximately 150 to 200 vehicle trips (inbound and outbound combined) during peak activity periods, or on average about three vehicles per minute either arriving to or departing from the site. The proposed redevelopment with the new residential uses and the expanded YMCA facility and childcare centre is anticipated to generate an additional two to three vehicles per minute during peak traffic periods. Roughly half of this traffic increase will be from the residential component and half from the expanded YMCA and childcare centre

The proposed redevelopment will provide approximately 340 parking spaces as underground parking beneath the new buildings. This includes approximately:

- 170 spaces for the residents and visitors of the 158 unit strata residential building,
- 33 spaces for the residents and visitors of the 70 unit affordable rental building,
- 130 spaces for the YMCA (120 surface parking existing)
- 12 spaces for the childcare (YMCA will have evening and weekend access to the childcare parking).

This parking supply includes consideration of the recently revised City of Vancouver Parking Bylaw including adjustment to account for the Class A transit accessibility. This underground parking will all be accessed from a single parking access driveway connecting to Alberta Street.

Thea Wilson, MSc., MRTPI | Transportation Planner



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APPENDIX B

Existing Volumes - Synchro Reports

Queues
3: Cambie & W 49th Ave

Existing AM
11/19/2018



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	170	567	192	518	117	162	1107	197	151	805	222
v/c Ratio	0.85	0.57	0.66	0.97	0.27	0.53	0.83	0.43	0.64	0.59	0.38
Control Delay	64.9	42.0	38.7	78.5	7.7	23.8	43.2	14.9	33.2	33.0	5.1
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	64.9	42.0	38.7	78.5	7.7	23.8	43.2	14.9	33.2	33.0	5.1
Queue Length 50th (m)	31.1	69.7	35.0	143.0	0.0	23.0	145.8	13.7	21.3	92.0	0.0
Queue Length 95th (m)	#73.1	89.5	53.9	#215.1	14.9	36.3	#187.7	37.8	41.7	113.7	16.9
Internal Link Dist (m)		101.9		232.0			122.2			77.1	
Turn Bay Length (m)	40.0		40.0		110.0	80.0		60.0	75.0		75.0
Base Capacity (vph)	201	1012	294	547	438	310	1333	462	285	1363	589
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.56	0.65	0.95	0.27	0.52	0.83	0.43	0.53	0.59	0.38

Intersection Summary

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

HCM 6th Signalized Intersection Summary

3: Cambie & W 49th Ave

Existing AM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	467	54	177	477	108	149	1018	181	139	741	204
Future Volume (veh/h)	156	467	54	177	477	108	149	1018	181	139	741	204
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	0.94		0.78	0.99		0.80	1.00		0.65
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1841	1856	1841	1870	1870	1781	1885	1885	1767	1885
Adj Flow Rate, veh/h	170	508	59	192	518	117	162	1107	197	151	805	222
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	4	4	3	4	2	2	8	1	1	9	1
Cap, veh/h	217	898	103	321	546	368	302	1425	537	230	1404	435
Arrive On Green	0.08	0.29	0.29	0.08	0.30	0.30	0.07	0.42	0.42	0.06	0.42	0.42
Sat Flow, veh/h	1795	3058	352	1767	1841	1239	1781	3385	1276	1795	3357	1040
Grp Volume(v), veh/h	170	288	279	192	518	117	162	1107	197	151	805	222
Grp Sat Flow(s),veh/h/ln	1795	1749	1661	1767	1841	1239	1781	1692	1276	1795	1678	1040
Q Serve(g_s), s	8.6	18.3	18.7	10.0	36.2	9.6	6.8	37.0	13.9	6.2	24.1	20.8
Cycle Q Clear(g_c), s	8.6	18.3	18.7	10.0	36.2	9.6	6.8	37.0	13.9	6.2	24.1	20.8
Prop In Lane	1.00		0.21	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	217	514	488	321	546	368	302	1425	537	230	1404	435
V/C Ratio(X)	0.78	0.56	0.57	0.60	0.95	0.32	0.54	0.78	0.37	0.66	0.57	0.51
Avail Cap(c_a), veh/h	222	532	505	321	560	377	331	1425	537	333	1404	435
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.0	39.3	39.4	30.4	45.3	35.9	22.3	32.8	26.1	27.1	29.3	28.3
Incr Delay (d2), s/veh	16.4	1.3	1.4	3.0	25.5	0.5	1.5	4.2	1.9	3.1	1.7	4.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	5.4	5.3	2.9	14.8	2.0	1.6	9.6	2.8	1.6	6.0	3.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	50.3	40.5	40.8	33.4	70.7	36.4	23.8	37.0	28.0	30.2	31.0	32.5
LnGrp LOS	D	D	D	C	E	D	C	D	C	C	C	C
Approach Vol, veh/h		737			827			1466			1178	
Approach Delay, s/veh		42.9			57.2			34.3			31.2	
Approach LOS		D			E			C			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.5	60.3	15.0	43.6	12.9	60.0	14.6	44.0				
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	16.0	50.0	11.0	40.0	11.0	55.0	11.0	40.0				
Max Q Clear Time (g_c+I1), s	8.2	39.0	12.0	20.7	8.8	26.1	10.6	38.2				
Green Ext Time (p_c), s	0.3	7.0	0.0	4.1	0.1	9.7	0.0	0.8				
Intersection Summary												
HCM 6th Ctrl Delay				39.4								
HCM 6th LOS				D								



Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	892	740	15	78	126
v/c Ratio	0.58	0.92	0.05	0.18	0.33
Control Delay	13.5	34.7	2.2	15.7	18.1
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.5	34.7	2.2	15.7	18.1
Queue Length 50th (m)	41.3	88.1	0.0	6.2	11.1
Queue Length 95th (m)	57.4	#162.3	1.6	16.0	25.4
Internal Link Dist (m)	232.0	97.7		109.8	90.7
Turn Bay Length (m)			30.0		
Base Capacity (vph)	1769	925	317	422	383
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.50	0.80	0.05	0.18	0.33

Intersection Summary

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

HCM 6th Signalized Intersection Summary
6: Alberta St & W 49th Ave

Existing AM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	731	81	45	636	14	23	9	40	30	15	71
Future Volume (veh/h)	8	731	81	45	636	14	23	9	40	30	15	71
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.76	1.00		0.74	0.81		0.81	0.85		0.67
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1826	1693	1900	1900	1900	1796	1796	1796
Adj Flow Rate, veh/h	9	795	88	49	691	15	25	10	43	33	16	77
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	5	5	14	0	0	0	7	7	7
Cap, veh/h	57	1437	163	89	804	523	192	91	263	146	77	248
Arrive On Green	0.49	0.49	0.49	0.49	0.49	0.49	0.36	0.36	0.36	0.36	0.36	0.36
Sat Flow, veh/h	7	2906	330	67	1625	1058	342	251	730	224	213	687
Grp Volume(v), veh/h	491	0	401	740	0	15	78	0	0	126	0	0
Grp Sat Flow(s),veh/h/ln	1739	0	1504	1692	0	1058	1323	0	0	1124	0	0
Q Serve(g_s), s	0.7	0.0	12.7	13.9	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	27.3	0.0	12.7	26.6	0.0	0.5	2.4	0.0	0.0	5.1	0.0	0.0
Prop In Lane	0.02		0.22	0.07		1.00	0.32		0.55	0.26		0.61
Lane Grp Cap(c), veh/h	913	0	744	892	0	523	546	0	0	472	0	0
V/C Ratio(X)	0.54	0.00	0.54	0.83	0.00	0.03	0.14	0.00	0.00	0.27	0.00	0.00
Avail Cap(c_a), veh/h	1063	0	869	1026	0	611	546	0	0	472	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.1	0.0	12.1	15.2	0.0	9.0	14.9	0.0	0.0	15.8	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	0.6	5.2	0.0	0.0	0.5	0.0	0.0	1.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.1	1.3	0.0	0.0	0.2	0.0	0.0	0.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.6	0.0	12.7	20.4	0.0	9.0	15.5	0.0	0.0	17.2	0.0	0.0
LnGrp LOS	B	A	B	C	A	A	B	A	A	B	A	A
Approach Vol, veh/h		892			755			78			126	
Approach Delay, s/veh		12.6			20.1			15.5			17.2	
Approach LOS		B			C			B			B	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		30.0		39.3		30.0		39.3				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		25.0		40.0		25.0		40.0				
Max Q Clear Time (g_c+I1), s		4.4		29.3		7.1		28.6				
Green Ext Time (p_c), s		0.5		4.9		0.9		4.9				
Intersection Summary												
HCM 6th Ctrl Delay				16.1								
HCM 6th LOS				B								

Queues
3: Cambie & W 49th Ave

Future PM
11/19/2018



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	95	656	254	459	243	112	1135	208	347	1412	178
v/c Ratio	0.49	0.74	1.03	0.91	0.48	0.60	0.83	0.48	1.25	0.91	0.29
Control Delay	34.2	48.0	97.5	67.9	8.2	35.3	42.9	16.8	170.9	45.2	11.4
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	34.2	48.0	97.5	67.9	8.2	35.3	42.9	16.8	170.9	45.2	11.4
Queue Length 50th (m)	16.3	83.2	~49.9	120.0	1.2	15.1	152.7	16.5	~107.1	198.4	11.1
Queue Length 95th (m)	28.5	105.4	#102.2	#176.9	23.2	33.9	185.2	42.4	#172.4	#258.7	29.3
Internal Link Dist (m)		101.9		232.0			122.2			77.1	
Turn Bay Length (m)	40.0		40.0		110.0	80.0		60.0	75.0		75.0
Base Capacity (vph)	213	1038	247	572	544	214	1372	434	278	1544	616
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.63	1.03	0.80	0.45	0.52	0.83	0.48	1.25	0.91	0.29

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary

3: Cambie & W 49th Ave

Future PM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	87	518	86	234	422	224	103	1044	191	319	1299	164
Future Volume (veh/h)	87	518	86	234	422	224	103	1044	191	319	1299	164
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.95		0.77	0.95		0.79	1.00		0.76	1.00		0.65
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1826	1826	1885	1856	1900	1900	1870	1900	1870	1856	1885
Adj Flow Rate, veh/h	95	563	93	254	459	243	112	1135	208	347	1412	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	5	5	1	3	0	0	2	0	2	3	1
Cap, veh/h	201	767	126	272	560	385	180	1367	469	314	1605	474
Arrive On Green	0.05	0.27	0.27	0.08	0.30	0.30	0.05	0.38	0.38	0.12	0.46	0.46
Sat Flow, veh/h	1810	2847	466	1795	1856	1275	1810	3554	1218	1781	3526	1041
Grp Volume(v), veh/h	95	341	315	254	459	243	112	1135	208	347	1412	178
Grp Sat Flow(s),veh/h/ln	1810	1735	1579	1795	1856	1275	1810	1777	1218	1781	1763	1041
Q Serve(g_s), s	4.9	23.3	23.7	11.0	29.8	21.4	4.8	37.5	16.5	16.0	47.3	14.6
Cycle Q Clear(g_c), s	4.9	23.3	23.7	11.0	29.8	21.4	4.8	37.5	16.5	16.0	47.3	14.6
Prop In Lane	1.00		0.30	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	201	467	425	272	560	385	180	1367	469	314	1605	474
V/C Ratio(X)	0.47	0.73	0.74	0.93	0.82	0.63	0.62	0.83	0.44	1.11	0.88	0.38
Avail Cap(c_a), veh/h	260	534	486	272	571	392	238	1367	469	314	1605	474
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.5	43.2	43.4	38.1	42.1	39.1	30.0	36.2	29.7	35.2	32.2	23.3
Incr Delay (d2), s/veh	1.7	4.4	5.2	36.9	9.1	3.2	3.5	6.0	3.0	82.5	7.2	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	7.3	6.8	6.4	10.4	4.7	1.3	10.9	3.3	9.7	12.4	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.2	47.6	48.6	75.0	51.2	42.3	33.5	42.1	32.7	117.7	39.4	25.5
LnGrp LOS	D	D	D	E	D	D	C	D	C	F	D	C
Approach Vol, veh/h		751			956			1455			1937	
Approach Delay, s/veh		46.6			55.3			40.1			52.2	
Approach LOS		D			E			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	20.0	55.0	15.0	40.0	10.8	64.2	10.8	44.2				
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	16.0	50.0	11.0	40.0	11.0	55.0	11.0	40.0				
Max Q Clear Time (g_c+I1), s	18.0	39.5	13.0	25.7	6.8	49.3	6.9	31.8				
Green Ext Time (p_c), s	0.0	7.0	0.0	4.2	0.1	4.7	0.1	3.1				
Intersection Summary												
HCM 6th Ctrl Delay			48.5									
HCM 6th LOS			D									



Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	1097	796	28	246	99
v/c Ratio	0.65	0.98	0.08	0.65	0.23
Control Delay	14.0	46.0	4.0	29.9	15.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.0	46.0	4.0	29.9	15.7
Queue Length 50th (m)	56.2	111.9	0.1	29.3	7.3
Queue Length 95th (m)	76.6	#196.8	3.5	#57.4	19.0
Internal Link Dist (m)	232.0	97.7		109.8	90.7
Turn Bay Length (m)			30.0		
Base Capacity (vph)	1745	844	358	379	432
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.63	0.94	0.08	0.65	0.23

Intersection Summary

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

HCM 6th Signalized Intersection Summary 6: Alberta St & W 49th Ave

Future PM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	864	137	61	672	26	132	15	80	36	23	32
Future Volume (veh/h)	8	864	137	61	672	26	132	15	80	36	23	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.81	1.00		0.81	0.86		0.87	0.97		0.81
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	9	939	149	66	730	28	143	16	87	39	25	35
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	0	0	0	0	0	0	0
Cap, veh/h	46	1358	254	93	765	736	297	45	148	221	142	164
Arrive On Green	0.56	0.56	0.56	0.56	0.56	0.56	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	1	2415	451	78	1361	1309	723	144	474	507	455	526
Grp Volume(v), veh/h	606	0	491	796	0	28	246	0	0	99	0	0
Grp Sat Flow(s),veh/h/ln	1381	0	1486	1439	0	1309	1341	0	0	1488	0	0
Q Serve(g_s), s	1.5	0.0	17.3	26.3	0.0	0.8	8.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	45.0	0.0	17.3	43.5	0.0	0.8	11.6	0.0	0.0	3.6	0.0	0.0
Prop In Lane	0.01		0.30	0.08		1.00	0.58		0.35	0.39		0.35
Lane Grp Cap(c), veh/h	822	0	836	858	0	736	490	0	0	528	0	0
V/C Ratio(X)	0.74	0.00	0.59	0.93	0.00	0.04	0.50	0.00	0.00	0.19	0.00	0.00
Avail Cap(c_a), veh/h	822	0	836	858	0	736	490	0	0	528	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	14.0	0.0	11.4	17.1	0.0	7.8	22.6	0.0	0.0	20.1	0.0	0.0
Incr Delay (d2), s/veh	3.5	0.0	1.1	16.0	0.0	0.0	3.6	0.0	0.0	0.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.3	3.8	0.0	0.0	1.8	0.0	0.0	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.5	0.0	12.5	33.1	0.0	7.8	26.3	0.0	0.0	20.9	0.0	0.0
LnGrp LOS	B	A	B	C	A	A	C	A	A	C	A	A
Approach Vol, veh/h	1097				824		246				99	
Approach Delay, s/veh	15.3				32.2		26.3				20.9	
Approach LOS	B				C		C				C	
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	30.0		50.0		30.0		50.0					
Change Period (Y+Rc), s	5.0		5.0		5.0		5.0					
Max Green Setting (Gmax), s	25.0		45.0		25.0		45.0					
Max Q Clear Time (g_c+I1), s	13.6		47.0		5.6		45.5					
Green Ext Time (p_c), s	1.4		0.0		0.6		0.0					
Intersection Summary												
HCM 6th Ctrl Delay			22.9									
HCM 6th LOS			C									

APPENDIX C

Future Volumes -Synchro Reports

Queues
3: Cambie & W 49th Ave

Future AM
11/20/2018



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	170	573	210	534	140	162	1107	211	162	805	222
v/c Ratio	0.84	0.57	0.72	0.98	0.31	0.54	0.84	0.46	0.68	0.59	0.38
Control Delay	62.7	42.0	42.6	81.6	7.4	24.2	44.8	15.5	37.7	33.4	5.1
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	62.7	42.0	42.6	81.6	7.4	24.2	44.8	15.5	37.7	33.4	5.1
Queue Length 50th (m)	30.5	70.6	38.7	149.2	0.0	23.0	147.4	15.3	23.2	92.0	0.0
Queue Length 95th (m)	#71.7	90.4	#61.5	#225.0	16.4	36.3	#187.7	40.9	47.2	113.7	16.9
Internal Link Dist (m)		101.9		232.0			122.2			77.1	
Turn Bay Length (m)	40.0		40.0		110.0	80.0		60.0	75.0		75.0
Base Capacity (vph)	203	1007	292	543	452	307	1311	462	279	1354	587
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.57	0.72	0.98	0.31	0.53	0.84	0.46	0.58	0.59	0.38

Intersection Summary

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

HCM 6th Signalized Intersection Summary 3: Cambie & W 49th Ave

Future AM
11/20/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	473	54	193	491	129	149	1018	194	149	741	204
Future Volume (veh/h)	156	473	54	193	491	129	149	1018	194	149	741	204
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.78	0.94		0.79	0.99		0.80	1.00		0.65
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1841	1856	1841	1870	1870	1781	1885	1885	1767	1885
Adj Flow Rate, veh/h	170	514	59	210	534	140	162	1107	211	162	805	222
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	4	4	3	4	2	2	8	1	1	9	1
Cap, veh/h	210	915	104	323	555	375	300	1401	527	232	1393	431
Arrive On Green	0.08	0.30	0.30	0.08	0.30	0.30	0.07	0.41	0.41	0.07	0.42	0.42
Sat Flow, veh/h	1795	3065	349	1767	1841	1244	1781	3385	1272	1795	3357	1038
Grp Volume(v), veh/h	170	291	282	210	534	140	162	1107	211	162	805	222
Grp Sat Flow(s),veh/h/ln	1795	1749	1665	1767	1841	1244	1781	1692	1272	1795	1678	1038
Q Serve(g_s), s	8.6	18.6	18.9	11.0	37.8	11.7	6.9	37.7	15.4	6.8	24.5	21.1
Cycle Q Clear(g_c), s	8.6	18.6	18.9	11.0	37.8	11.7	6.9	37.7	15.4	6.8	24.5	21.1
Prop In Lane	1.00		0.21	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	210	522	497	323	555	375	300	1401	527	232	1393	431
V/C Ratio(X)	0.81	0.56	0.57	0.65	0.96	0.37	0.54	0.79	0.40	0.70	0.58	0.52
Avail Cap(c_a), veh/h	216	528	503	323	556	376	328	1401	527	325	1393	431
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.1	39.1	39.3	30.7	45.6	36.4	22.8	33.8	27.3	28.0	29.8	28.8
Incr Delay (d2), s/veh	19.7	1.3	1.5	4.6	28.9	0.6	1.5	4.6	2.3	3.8	1.8	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	5.5	5.4	3.3	15.9	2.5	1.6	9.9	3.1	1.7	6.2	3.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.7	40.4	40.7	35.3	74.5	37.1	24.3	38.4	29.5	31.7	31.6	33.2
LnGrp LOS	D	D	D	D	E	D	C	D	C	C	C	C
Approach Vol, veh/h		743			884			1480			1189	
Approach Delay, s/veh		43.6			59.3			35.6			31.9	
Approach LOS		D			E			D			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	13.1	59.9	15.0	44.5	13.0	60.0	14.6	44.9				
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	16.0	50.0	11.0	40.0	11.0	55.0	11.0	40.0				
Max Q Clear Time (g_c+I1), s	8.8	39.7	13.0	20.9	8.9	26.5	10.6	39.8				
Green Ext Time (p_c), s	0.3	6.7	0.0	4.1	0.1	9.7	0.0	0.1				
Intersection Summary												
HCM 6th Ctrl Delay				40.8								
HCM 6th LOS				D								



Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	925	748	15	149	127
v/c Ratio	0.60	0.94	0.05	0.41	0.34
Control Delay	13.7	37.4	2.1	21.0	18.3
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	37.4	2.1	21.0	18.3
Queue Length 50th (m)	43.4	91.9	0.0	14.8	11.2
Queue Length 95th (m)	60.8	#168.7	1.6	31.5	25.5
Internal Link Dist (m)	232.0	97.7		109.8	90.7
Turn Bay Length (m)			30.0		
Base Capacity (vph)	1692	884	311	361	377
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.55	0.85	0.05	0.41	0.34

Intersection Summary

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

HCM 6th Signalized Intersection Summary

6: Alberta St & W 49th Ave

Future AM
11/20/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	731	111	52	636	14	74	10	53	30	16	71
Future Volume (veh/h)	8	731	111	52	636	14	74	10	53	30	16	71
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.77	1.00		0.76	0.81		0.81	0.88		0.66
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1826	1693	1900	1900	1900	1796	1796	1796
Adj Flow Rate, veh/h	9	795	121	57	691	15	80	11	58	33	17	77
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	5	5	14	0	0	0	7	7	7
Cap, veh/h	53	1386	223	93	786	560	295	53	173	139	76	236
Arrive On Green	0.52	0.52	0.52	0.52	0.52	0.52	0.35	0.35	0.35	0.35	0.35	0.35
Sat Flow, veh/h	6	2680	432	76	1520	1083	633	155	502	222	221	684
Grp Volume(v), veh/h	516	0	409	748	0	15	149	0	0	127	0	0
Grp Sat Flow(s),veh/h/ln	1658	0	1460	1596	0	1083	1290	0	0	1128	0	0
Q Serve(g_s), s	1.5	0.0	13.6	17.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	32.3	0.0	13.6	30.7	0.0	0.5	4.8	0.0	0.0	5.5	0.0	0.0
Prop In Lane	0.02		0.30	0.08		1.00	0.54		0.39	0.26		0.61
Lane Grp Cap(c), veh/h	908	0	755	879	0	560	521	0	0	452	0	0
V/C Ratio(X)	0.57	0.00	0.54	0.85	0.00	0.03	0.29	0.00	0.00	0.28	0.00	0.00
Avail Cap(c_a), veh/h	971	0	806	934	0	598	521	0	0	452	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	11.8	0.0	11.7	15.5	0.0	8.6	17.1	0.0	0.0	17.4	0.0	0.0
Incr Delay (d2), s/veh	0.7	0.0	0.6	7.3	0.0	0.0	1.4	0.0	0.0	1.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.1	1.8	0.0	0.0	0.6	0.0	0.0	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	12.5	0.0	12.4	22.7	0.0	8.6	18.5	0.0	0.0	18.9	0.0	0.0
LnGrp LOS	B	A	B	C	A	A	B	A	A	B	A	A
Approach Vol, veh/h		925			763			149			127	
Approach Delay, s/veh		12.5			22.5			18.5			18.9	
Approach LOS		B			C			B			B	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		30.0		42.5		30.0		42.5				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		25.0		40.0		25.0		40.0				
Max Q Clear Time (g_c+I1), s		6.8		34.3		7.5		32.7				
Green Ext Time (p_c), s		1.0		3.2		0.9		3.6				
Intersection Summary												
HCM 6th Ctrl Delay				17.2								
HCM 6th LOS				B								

Queues
3: Cambie & W 49th Ave

Future PM
11/19/2018



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	95	656	254	459	243	112	1135	208	347	1412	178
v/c Ratio	0.49	0.74	1.03	0.91	0.48	0.60	0.83	0.48	1.25	0.91	0.29
Control Delay	34.2	48.0	97.5	67.9	8.2	35.3	42.9	16.8	170.9	45.2	11.4
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	34.2	48.0	97.5	67.9	8.2	35.3	42.9	16.8	170.9	45.2	11.4
Queue Length 50th (m)	16.3	83.2	~49.9	120.0	1.2	15.1	152.7	16.5	~107.1	198.4	11.1
Queue Length 95th (m)	28.5	105.4	#102.2	#176.9	23.2	33.9	185.2	42.4	#172.4	#258.7	29.3
Internal Link Dist (m)		101.9		232.0			122.2			77.1	
Turn Bay Length (m)	40.0		40.0		110.0	80.0		60.0	75.0		75.0
Base Capacity (vph)	213	1038	247	572	544	214	1372	434	278	1544	616
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.63	1.03	0.80	0.45	0.52	0.83	0.48	1.25	0.91	0.29

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

HCM 6th Signalized Intersection Summary

3: Cambie & W 49th Ave

Future PM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	87	518	86	234	422	224	103	1044	191	319	1299	164
Future Volume (veh/h)	87	518	86	234	422	224	103	1044	191	319	1299	164
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.95		0.77	0.95		0.79	1.00		0.76	1.00		0.65
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1900	1826	1826	1885	1856	1900	1900	1870	1900	1870	1856	1885
Adj Flow Rate, veh/h	95	563	93	254	459	243	112	1135	208	347	1412	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	0	5	5	1	3	0	0	2	0	2	3	1
Cap, veh/h	201	767	126	272	560	385	180	1367	469	314	1605	474
Arrive On Green	0.05	0.27	0.27	0.08	0.30	0.30	0.05	0.38	0.38	0.12	0.46	0.46
Sat Flow, veh/h	1810	2847	466	1795	1856	1275	1810	3554	1218	1781	3526	1041
Grp Volume(v), veh/h	95	341	315	254	459	243	112	1135	208	347	1412	178
Grp Sat Flow(s),veh/h/ln	1810	1735	1579	1795	1856	1275	1810	1777	1218	1781	1763	1041
Q Serve(g_s), s	4.9	23.3	23.7	11.0	29.8	21.4	4.8	37.5	16.5	16.0	47.3	14.6
Cycle Q Clear(g_c), s	4.9	23.3	23.7	11.0	29.8	21.4	4.8	37.5	16.5	16.0	47.3	14.6
Prop In Lane	1.00		0.30	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	201	467	425	272	560	385	180	1367	469	314	1605	474
V/C Ratio(X)	0.47	0.73	0.74	0.93	0.82	0.63	0.62	0.83	0.44	1.11	0.88	0.38
Avail Cap(c_a), veh/h	260	534	486	272	571	392	238	1367	469	314	1605	474
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.5	43.2	43.4	38.1	42.1	39.1	30.0	36.2	29.7	35.2	32.2	23.3
Incr Delay (d2), s/veh	1.7	4.4	5.2	36.9	9.1	3.2	3.5	6.0	3.0	82.5	7.2	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	7.3	6.8	6.4	10.4	4.7	1.3	10.9	3.3	9.7	12.4	2.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.2	47.6	48.6	75.0	51.2	42.3	33.5	42.1	32.7	117.7	39.4	25.5
LnGrp LOS	D	D	D	E	D	D	C	D	C	F	D	C
Approach Vol, veh/h		751			956			1455			1937	
Approach Delay, s/veh		46.6			55.3			40.1			52.2	
Approach LOS		D			E			D			D	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	20.0	55.0	15.0	40.0	10.8	64.2	10.8	44.2				
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	16.0	50.0	11.0	40.0	11.0	55.0	11.0	40.0				
Max Q Clear Time (g_c+I1), s	18.0	39.5	13.0	25.7	6.8	49.3	6.9	31.8				
Green Ext Time (p_c), s	0.0	7.0	0.0	4.2	0.1	4.7	0.1	3.1				
Intersection Summary												
HCM 6th Ctrl Delay			48.5									
HCM 6th LOS			D									



Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	1097	796	28	246	99
v/c Ratio	0.65	0.98	0.08	0.65	0.23
Control Delay	14.0	46.0	4.0	29.9	15.7
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	14.0	46.0	4.0	29.9	15.7
Queue Length 50th (m)	56.2	111.9	0.1	29.3	7.3
Queue Length 95th (m)	76.6	#196.8	3.5	#57.4	19.0
Internal Link Dist (m)	232.0	97.7		109.8	90.7
Turn Bay Length (m)			30.0		
Base Capacity (vph)	1745	844	358	379	432
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.63	0.94	0.08	0.65	0.23

Intersection Summary

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

HCM 6th Signalized Intersection Summary

6: Alberta St & W 49th Ave

Future PM
11/19/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	864	137	61	672	26	132	15	80	36	23	32
Future Volume (veh/h)	8	864	137	61	672	26	132	15	80	36	23	32
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.81	1.00		0.81	0.86		0.87	0.97		0.81
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1856	1856	1900	1900	1900	1900	1900	1900	1900
Adj Flow Rate, veh/h	9	939	149	66	730	28	143	16	87	39	25	35
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	3	3	0	0	0	0	0	0	0
Cap, veh/h	46	1358	254	93	765	736	297	45	148	221	142	164
Arrive On Green	0.56	0.56	0.56	0.56	0.56	0.56	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	1	2415	451	78	1361	1309	723	144	474	507	455	526
Grp Volume(v), veh/h	606	0	491	796	0	28	246	0	0	99	0	0
Grp Sat Flow(s),veh/h/ln	1381	0	1486	1439	0	1309	1341	0	0	1488	0	0
Q Serve(g_s), s	1.5	0.0	17.3	26.3	0.0	0.8	8.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	45.0	0.0	17.3	43.5	0.0	0.8	11.6	0.0	0.0	3.6	0.0	0.0
Prop In Lane	0.01		0.30	0.08		1.00	0.58		0.35	0.39		0.35
Lane Grp Cap(c), veh/h	822	0	836	858	0	736	490	0	0	528	0	0
V/C Ratio(X)	0.74	0.00	0.59	0.93	0.00	0.04	0.50	0.00	0.00	0.19	0.00	0.00
Avail Cap(c_a), veh/h	822	0	836	858	0	736	490	0	0	528	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	14.0	0.0	11.4	17.1	0.0	7.8	22.6	0.0	0.0	20.1	0.0	0.0
Incr Delay (d2), s/veh	3.5	0.0	1.1	16.0	0.0	0.0	3.6	0.0	0.0	0.8	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.3	3.8	0.0	0.0	1.8	0.0	0.0	0.6	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	17.5	0.0	12.5	33.1	0.0	7.8	26.3	0.0	0.0	20.9	0.0	0.0
LnGrp LOS	B	A	B	C	A	A	C	A	A	C	A	A
Approach Vol, veh/h	1097		824				246				99	
Approach Delay, s/veh	15.3		32.2				26.3				20.9	
Approach LOS	B		C				C				C	
Timer - Assigned Phs	2		4		6		8					
Phs Duration (G+Y+Rc), s	30.0		50.0		30.0		50.0					
Change Period (Y+Rc), s	5.0		5.0		5.0		5.0					
Max Green Setting (Gmax), s	25.0		45.0		25.0		45.0					
Max Q Clear Time (g_c+I1), s	13.6		47.0		5.6		45.5					
Green Ext Time (p_c), s	1.4		0.0		0.6		0.0					
Intersection Summary												
HCM 6th Ctrl Delay	22.9											
HCM 6th LOS	C											

Queues
3: Cambie & W 49th Ave

Future AM
11/20/2018



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	170	573	210	534	140	162	1107	211	162	805	222
v/c Ratio	0.89	0.59	0.65	0.93	0.30	0.55	0.83	0.45	0.78	0.62	0.39
Control Delay	73.5	42.6	34.4	67.7	6.7	25.5	43.1	14.7	50.3	35.8	5.7
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	73.5	42.6	34.4	67.7	6.7	25.5	43.1	14.7	50.3	35.8	5.7
Queue Length 50th (m)	30.6	70.6	36.6	140.8	0.0	24.6	149.1	14.8	24.5	98.2	0.0
Queue Length 95th (m)	#75.6	90.4	55.6	#205.3	15.4	38.9	180.2	39.0	#62.7	121.4	18.4
Internal Link Dist (m)		101.9		232.0			122.2			77.1	
Turn Bay Length (m)	40.0		40.0		110.0	80.0		60.0	75.0		75.0
Base Capacity (vph)	191	1033	336	627	501	312	1327	467	208	1291	569
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.55	0.63	0.85	0.28	0.52	0.83	0.45	0.78	0.62	0.39

Intersection Summary

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

HCM 6th Signalized Intersection Summary

3: Cambie & W 49th Ave

Future AM
11/20/2018

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	156	473	54	193	491	129	149	1018	194	149	741	204
Future Volume (veh/h)	156	473	54	193	491	129	149	1018	194	149	741	204
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.78	0.94		0.79	0.99		0.79	1.00		0.63
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1885	1841	1841	1856	1841	1870	1870	1781	1885	1885	1767	1885
Adj Flow Rate, veh/h	170	514	59	210	534	140	162	1107	211	162	805	222
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	4	4	3	4	2	2	8	1	1	9	1
Cap, veh/h	221	902	103	347	580	397	293	1356	504	224	1341	404
Arrive On Green	0.08	0.29	0.29	0.10	0.32	0.32	0.07	0.40	0.40	0.07	0.40	0.40
Sat Flow, veh/h	1795	3064	348	1767	1841	1259	1781	3385	1258	1795	3357	1011
Grp Volume(v), veh/h	170	291	282	210	534	140	162	1107	211	162	805	222
Grp Sat Flow(s),veh/h/ln	1795	1749	1663	1767	1841	1259	1781	1692	1258	1795	1678	1011
Q Serve(g_s), s	8.5	18.3	18.7	10.5	36.3	11.1	6.9	37.8	15.7	6.9	24.6	21.9
Cycle Q Clear(g_c), s	8.5	18.3	18.7	10.5	36.3	11.1	6.9	37.8	15.7	6.9	24.6	21.9
Prop In Lane	1.00		0.21	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	221	515	490	347	580	397	293	1356	504	224	1341	404
V/C Ratio(X)	0.77	0.57	0.58	0.61	0.92	0.35	0.55	0.82	0.42	0.72	0.60	0.55
Avail Cap(c_a), veh/h	221	539	512	377	638	436	334	1356	504	240	1341	404
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	33.6	38.8	38.9	28.7	42.9	34.2	23.5	34.7	28.0	28.6	30.8	30.0
Incr Delay (d2), s/veh	15.2	1.3	1.5	2.4	17.8	0.5	1.6	5.5	2.6	9.6	2.0	5.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	5.4	5.2	2.9	13.5	2.3	1.7	10.1	3.2	2.1	6.2	3.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	48.8	40.1	40.4	31.1	60.6	34.8	25.1	40.2	30.6	38.1	32.8	35.3
LnGrp LOS	D	D	D	C	E	C	C	D	C	D	C	D
Approach Vol, veh/h		743			884			1480			1189	
Approach Delay, s/veh		42.2			49.5			37.2			34.0	
Approach LOS		D			D			D			C	
Timer - Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	12.9	57.0	16.7	43.2	13.0	56.9	14.0	45.9				
Change Period (Y+Rc), s	4.0	5.0	4.0	5.0	4.0	5.0	4.0	5.0				
Max Green Setting (Gmax), s	10.0	52.0	15.0	40.0	12.0	50.0	10.0	45.0				
Max Q Clear Time (g_c+I1), s	8.9	39.8	12.5	20.7	8.9	26.6	10.5	38.3				
Green Ext Time (p_c), s	0.1	7.6	0.2	4.1	0.2	9.0	0.0	2.6				
Intersection Summary												
HCM 6th Ctrl Delay				39.7								
HCM 6th LOS				D								



Lane Group	EBT	WBT	WBR	NBT	SBT
Lane Group Flow (vph)	925	748	15	149	127
v/c Ratio	0.57	0.89	0.05	0.46	0.38
Control Delay	10.0	25.7	1.6	22.8	18.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	10.0	25.7	1.6	22.8	18.9
Queue Length 50th (m)	32.4	69.6	0.0	10.9	7.6
Queue Length 95th (m)	45.5	118.2	1.2	33.7	26.5
Internal Link Dist (m)	232.0	97.7		109.8	90.7
Turn Bay Length (m)			30.0		
Base Capacity (vph)	2336	1228	421	321	337
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.40	0.61	0.04	0.46	0.38
Intersection Summary					

HCM 6th Signalized Intersection Summary

6: Alberta St & W 49th Ave

Future AM
11/20/2018



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔	↔		↔			↔	
Traffic Volume (veh/h)	8	731	111	52	636	14	74	10	53	30	16	71
Future Volume (veh/h)	8	731	111	52	636	14	74	10	53	30	16	71
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.75	1.00		0.73	0.72		0.74	0.81		0.56
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1856	1856	1856	1826	1826	1693	1900	1900	1900	1796	1796	1796
Adj Flow Rate, veh/h	9	795	121	57	691	15	80	11	58	33	17	77
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	3	3	5	5	14	0	0	0	7	7	7
Cap, veh/h	66	1503	227	105	840	551	268	51	144	130	66	184
Arrive On Green	0.53	0.53	0.53	0.53	0.53	0.53	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	8	2846	430	76	1591	1044	575	169	474	177	216	605
Grp Volume(v), veh/h	519	0	406	748	0	15	149	0	0	127	0	0
Grp Sat Flow(s),veh/h/ln	1843	0	1441	1668	0	1044	1219	0	0	998	0	0
Q Serve(g_s), s	0.0	0.0	11.0	10.4	0.0	0.4	0.0	0.0	0.0	0.2	0.0	0.0
Cycle Q Clear(g_c), s	10.9	0.0	11.0	21.8	0.0	0.4	4.5	0.0	0.0	5.6	0.0	0.0
Prop In Lane	0.02		0.30	0.08		1.00	0.54		0.39	0.26		0.61
Lane Grp Cap(c), veh/h	1035	0	761	946	0	551	463	0	0	379	0	0
V/C Ratio(X)	0.50	0.00	0.53	0.79	0.00	0.03	0.32	0.00	0.00	0.33	0.00	0.00
Avail Cap(c_a), veh/h	1513	0	1142	1362	0	827	463	0	0	379	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	9.2	0.0	9.2	11.4	0.0	6.7	15.9	0.0	0.0	16.3	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.6	2.1	0.0	0.0	1.8	0.0	0.0	2.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	0.0	0.1	0.5	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	9.6	0.0	9.8	13.5	0.0	6.7	17.8	0.0	0.0	18.7	0.0	0.0
LnGrp LOS	A	A	A	B	A	A	B	A	A	B	A	A
Approach Vol, veh/h		925			763			149			127	
Approach Delay, s/veh		9.7			13.4			17.8			18.7	
Approach LOS		A			B			B			B	
Timer - Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		23.0		36.3		23.0		36.3				
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0				
Max Green Setting (Gmax), s		18.0		47.0		18.0		47.0				
Max Q Clear Time (g_c+I1), s		6.5		13.0		7.6		23.8				
Green Ext Time (p_c), s		0.9		9.1		0.7		7.5				
Intersection Summary												
HCM 6th Ctrl Delay				12.3								
HCM 6th LOS				B								

