

Ladner Willows Non-Market Housing Transportation Impact Assessment

Prepared for
VanMar Constructors

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CORPORATE AUTHORIZATION

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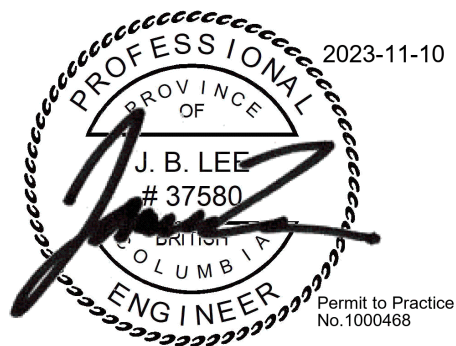
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EXECUTIVE SUMMARY

Background & Existing Site Context

Red Door Housing Society (RDHS) is proposing to develop 146 Non-Market Housing units at 5625 Ladner Trunk Road in Delta, BC. The project is currently going through the Rezoning/Development Permit application process.

VanMar Constructors, on behalf of RDHS, retained Bunt & Associates Engineering Ltd. (Bunt) to conduct a Transportation Impact Assessment (TIA) for the development, which was required by the City of Delta as part of the project approval process. The purpose of the TIA was to analyze the traffic and parking impact of the development and rationalize the parking supply variance being proposed.

The site is currently occupied by 40 townhouse units which would be demolished prior to construction. The site is well served by four different bus transit routes (with headways of 10 to 12 minutes during the peak periods) and is located within 800m of a number of key pedestrian destinations including Leslie Park, Trenant Park Square, Ladner Centre, Paterson Park, Maple Crescent Park, and Hawthorne Elementary School. At present, there are limited cycling facilities in the area, which include shared bike lanes on Harvest Drive and Ladner Trunk Road (east of Harvest Drive), and an informal shared lane exists on 57A Street.

Traffic Operations

Under existing conditions, all intersections included in the study area were shown to operate within acceptable performance thresholds in terms of Level of Service (LOS), V/C ratio, and 95th percentile queues.

In the future, the proposed development is expected to result in a net increase in traffic of approximately 33 and 54 vehicle trips during the weekday AM and PM peak hours, respectively. This translates to fewer than one new vehicle trip per minute, on average, during both studied peak hours.

In the future 2024 Opening Day study horizon, traffic operations at the studied intersections are expected to continue operating within acceptable performance thresholds with or without the development traffic added to the road network. As such, no intersection improvements are required to accommodate the future traffic demands within this timeline.

Signal Warrant Analysis

The City of Delta requested that a signal warrant analysis be conducted to determine whether the current pedestrian signal at 55B Street & Ladner Trunk Road would require an upgrade to a full traffic signal under existing, future Background, and/or future Total traffic conditions. Bunt's analysis indicated that a full traffic signal would not be warranted under any of these three scenarios. In addition, it is worth noting

that this intersection currently operates as somewhat of a hybrid pedestrian signal as it has a vehicle detector loop on the minor street (55B Street), which is not typical of a pedestrian signal. As such, when a vehicle waits for an extended period of time to turn from 55B Street onto Ladner Trunk Road (i.e., more than 10 seconds), the detector loop will activate the signal and traffic will be stopped on Ladner Trunk Road to allow the vehicle to perform this movement.

Corner Cut Sight Distance Analysis

Bunt conducted a sight distance review to see whether a reduced 3m by 3m corner cut at the southwest corner of the subject property could be supported from a sight distance perspective, rather than providing the typical 6m by 6m corner cut required by the City. This reduced corner cut size would be consistent with what was provided by the recently constructed residential development on the opposite side of 55B Street at 5571 Ladner Trunk Road. The sight distance tested included the sight distance between vehicles approaching from the east and vehicles attempting to turn from 55B Street (North) onto Ladner Trunk Road. The results of the analysis indicated that the minimum required stopping sight distance (SSD) and intersection sight distance (ISD) could still be achieved with the proposed reduced corner cut size. In fact, given the relative positions of the edge of the roadway and the property line (which is set far back from Ladner Trunk Road), the southwest corner of the site's property line would not impact vehicle sight triangles at all for this particular location.

Parking Analysis

Vehicle Parking

The required parking supply for the development is 161 spaces (146 resident, 15 visitor) compared to a proposed supply of 155 spaces (140 resident, 15 visitor). This translates to an overall supply rate of 1.06 spaces per unit (0.96 resident, 0.10 visitor), representing a total shortfall of 6 spaces (4% reduction).

Parking Supply Rationale

The City's "Apartment Building – Purpose-Built Rental" resident parking rate used to calculate the required parking supply does not take into account key factors which significantly affect vehicle ownership levels including income and the proximity of the site to facilities and amenities for alternative modes.

Based on industry studies and parking demand data from previous Bunt studies, it is evident that these factors would have a considerable effect on the expected resident parking demand. For this reason, it is Bunt's opinion that the City's Zoning Bylaw parking rate overstates the anticipated parking demand for the proposed development.

Bicycle Parking

The proposed bicycle parking supply includes 157 resident bicycle spaces and 5 visitor bicycle spaces, which exceeds the minimum bylaw requirement for residents and meets the requirement for visitors.

Site Servicing

In terms of residential loading, the City's Zoning Bylaw requires that 1 loading space be provided, which the developer proposes to provide along the east side of the building immediately north of the east building entry. Bunt's vehicle turning path analysis indicated that an SU9 design vehicle would be able to successfully enter and exit the loading space without any issues or conflicts.

In addition to this off-street loading space, the City intends to locate an on-street "Loading Zone" approximately 14m in length (i.e., two parallel parking stalls) on 55B Street along the site frontage south of rear lane access. This Loading Zone will be used for passenger pick-up/drop-off, as well as to accommodate ride hailing services (e.g., Uber and Lyft), food delivery services (e.g., Uber Eats, Door Dash, etc.), and online retailer deliveries (E.g., Amazon, etc.).

In terms of waste collection, garbage and recycling bins will be provided in a garbage room on the underground parking level. To collect the bins, a small hauler truck would enter the underground parking to pick-up the garbage/recycling bins from the garbage room and drop the bins off in the staging area located at ground level. A full-sized garbage/recycling truck would then visit the site to transfer the contents of the bins into the truck's container and then exit the site. The hauler truck would then return to the site and take the empty garbage/recycling bins back to the garbage room. Bunt's vehicle turning path analysis indicated that both the hauler truck and a full-sized garbage truck could perform the required waste collection operations without any issues or conflicts.

Recommendations

1. With underground parking spaces generally costing in the order of \$60,000 to \$80,000 to construct, providing parking in excess of the anticipated demand would have a profound impact on the affordability of the proposed non-market housing units. For this reason, Bunt recommends that the City approve the proposed parking variances and associated rates for the development, which are expected to better reflect the anticipated parking demand, if not still remain conservative.
2. As Bunt's analysis indicated that the proposed reduced 3m by 3m corner cut does not affect the ability to achieve the minimum required sight distances (SSD and ISD), Bunt recommends that the City of Delta approve the requested reduced size property line corner cut. This size of corner cut is consistent with what was provided by the recently constructed residential development at 5571 Ladner Trunk Road situated at the northwest corner of 55B Street (North) & Ladner Trunk Road.

1. INTRODUCTION

1.1 Background

Red Door Housing Society (RDHS) is proposing to develop 146 Non-Market Housing units at 5625 Ladner Trunk Road in Delta, BC. As a result of the proposed development, the existing 40 townhouse units currently occupying the site would be demolished.

As part of the approvals process, the City of Delta requires that a Transportation Impact Assessment (TIA) study be conducted to analyze the traffic and parking impact of the development and rationalize the parking supply variance being proposed for the project. In addition, the City has also requested a signal warrant analysis at 55b Street & Ladner Trunk Road, as well as a sight distance analysis related to a city-required property line corner cut at the southeast corner of the development site be conducted.

In response to this request, VanMar Constructors, on behalf of RDHS, retained Bunt & Associates Engineering Ltd. (Bunt) to conduct the required TIA. The scope of the study was developed in consultation with City of Delta staff and the agreed upon Terms of Reference (ToR) is included in **Appendix A**. Bunt's findings and recommendations are documented in the following report.

Project Update

This project's Rezoning/Development Permit application was previously denied by Council at the June 2022 Public Hearing. After a temporary project pause, the Developer is now planning to re-apply for a Rezoning/Development Permit, incorporating project feedback from City staff and the surrounding neighbourhood.

As such, this report represents an update to previous versions prepared prior to the original Rezoning/DP application (the latest dated May 5, 2022) to incorporate changes to the development plan relevant to transportation. Specifically, the plan now includes fewer dwelling units, updates to the parking supply and parking requirements based on new City policy, and minor changes to the site plan and parkade layout. Given these relatively minor changes, the study remains largely the same as previous versions, but has been updated to reflect the most up-to-date plans and City policies.

1.2 Organization of Report

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

- **Section 1** presents the study background, site location, and details of the proposed development.
- **Section 2** presents the existing conditions, including land use, road network, transit, cycling, and pedestrian facilities. In addition, the existing traffic conditions in the study area are analyzed.

- **Section 3** assesses the future traffic conditions, including estimating the site trip generation, and analyzes the traffic operations with and without these trips on study road network.
- **Section 4** provides the traffic signal warrant analysis for the 55b Street (North) & Ladner Trunk Road intersection adjacent to the site.
- **Section 5** includes a sight distance analysis related to the requested property line corner cut requested by the City of Delta at the southwest corner of the site.
- **Section 6** provides a parking analysis, comparing the required parking supply to the proposed supply, and an overview of the site servicing.
- **Section 7** presents a parking supply variance rationale to support the proposed parking rates.
- **Section 8** provides the conclusions and recommendations of the study.

1.3 Proposed Development

1.3.1 Site Location

The site is located at 5625 Ladner Trunk Road in the Ladner community in Delta, BC. The site is situated within the Ladner Village Core (as defined by the Ladner Official Community Plan), north of Ladner Trunk Road, and east of 55B Street. The site location is shown in **Exhibit 1.1**.

1.3.2 Proposed Development

The proposed development is planned for Non-Market Families Housing comprising 146 rental dwelling units. The developer and future operator of the project is Red Door Housing Society, with funding provided by BC Housing. To accommodate the new development, the 40 townhouse units currently occupying the site would be demolished prior to construction.

The development's dwelling units would include a mix of income levels, including:

- Deep Subsidy units (20%): households requiring a deeper level of subsidy, such as seniors on fixed incomes and those receiving income assistance. These include incomes up to \$28,669, depending on unit size;
- Rent-Geared-to-Income units (50%): rent set at ~30% of gross household income for households earning up to \$86,000; and
- Low-End-of-Market units (30%): units geared to moderate income earners for household incomes up to \$82,310 for homes with fewer than two bedrooms, or up to \$128,810 for homes with two or more bedrooms.

A summary of the development plan is included in **Table 1.1**.

Table 1.1: Development Plan

UNIT TYPE (% OF DWELLING UNITS)	QUANTITY (DWELLING UNITS)
Deep Subsidy (20%)	29
Rent-Geared-to-Income (50%)	73
Low-End-of-Market (30%)	44
OVERALL	146

The proposed site plan for the development is shown in **Exhibit 1.2**.

Vehicular Access and 55B Street Frontage

Similar to existing conditions, vehicular access to the proposed development will be via 55B Street and Ladner Trunk Road. However, as part of the redevelopment, the rear lane connecting to 55B Street at the north side of the site will be realigned and moved further to the north. This rear lane will provide access to a parking ramp leading to the development's underground parking.

In addition, to enhance driver and pedestrian sightlines at the 55B Street rear lane access, the City is planning to restrict on-street parking on either side of the lane for a distance of approximately 14m (i.e., two parallel parking stall lengths). Keeping these areas clear of parked vehicles will provide better visibility between exiting vehicles and vehicles travelling along 55B Street, as well as between vehicles and pedestrians in general.

While discussed in greater detail in Section 6.2, the City also intends to locate an on-street "Loading Zone" approximately 14m in length (i.e., two parallel parking stalls) on 55B Street immediately south of the no parking zone.

Furthermore, as Bunt understands finding on-street parking in the vicinity of the site can be challenging, to help facilitate more frequent parking turnover (and therefore better availability), the City could consider implementing time restrictions on 55B Street south of the loading zone. Currently, no parking restrictions exist.

The general locations of the future lane access, no parking zones, loading zone, and potential time-restricted parking area on 55B Street are shown in **Figure 1.1**.

Figure 1.1: 55B Street Site Frontage Detail

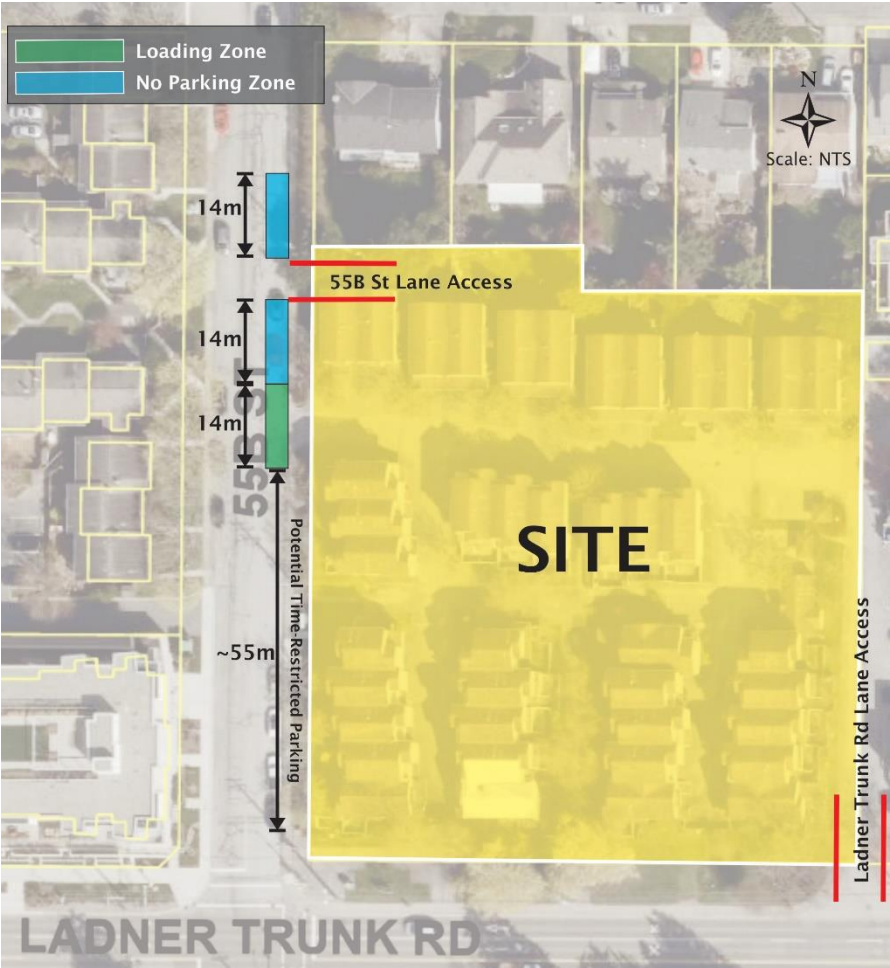




Exhibit 1.1 Site Location & Surrounding Area

Ladner Willows Non-Market Housing
04-20-0032 July 2021

Source: dys architecture
Dated: 2023-11-07

bunt
& associates

Ladner Willows Non-Market Housing
04-20-0032 November 2023

2. EXISTING CONDITIONS

2.1 Existing Land Use

The existing site is occupied by 40 townhouse units, which would be demolished prior to construction of the new development. The property is bordered by Ladner Trunk Road to the south, 55B Street to the west, and neighbouring residential developments to the north and east.

2.2 Existing Transportation Network

2.2.1 Road Network

Table 2.1 summarizes the characteristics of the adjacent road network.

Table 2.1: Existing Street Characteristics

STREET	CLASSIFICATION	NUMBER OF TRAVEL LANES ¹	POSTED SPEED	TWO-WAY PEAK HOUR VEHICLE VOLUMES	ON-STREET PARKING
Ladner Trunk Road	Arterial	4	50 km/h	AM: 1,400 PM: 1,650	None
55B Street	Local Road	2	50 km/h	AM: 85 PM: 100	Both sides

1. Number of through travel lanes on the roadway in vicinity of the site.

2.2.2 Transit Network

The existing development is well served by transit along Ladner Trunk Road, given its close proximity to Highway 17A (approximately 800m away). **Exhibit 2.1** shows the transit routes in the study network within 800m of the site and beyond, while **Table 2.2** provides a summary of nearby bus stop locations and amenities.

Table 2.2: Nearby Transit Routes and Stops

STOP LOCATION	DIRECTION	STOP #	AMENITY	ROUTES SERVICED	WALKING DISTANCE
EB Ladner Trunk Road FS 55B Street	EB	57394	Shelter and Bench	310, 601, 616, 618	30m
WB Ladner Trunk Road FS 55B Street	WB	57399	Shelter and Bench	310, 601, 618	60m

Note: FS = far-side.

The #616 and #618 bus routes provide east-west and north-south connections locally within Ladner, respectively. The #601 bus route connects South Delta, by way of Ladner, to Richmond's Bridgeport Station for connection to the Canada Line. The #310 is an east-west circular route that connects Scottsdale Exchange in Surrey to Ladner Village in Delta. The closest bus stops are located fewer than 100m walking distance from the site frontage, directly adjacent to the site.

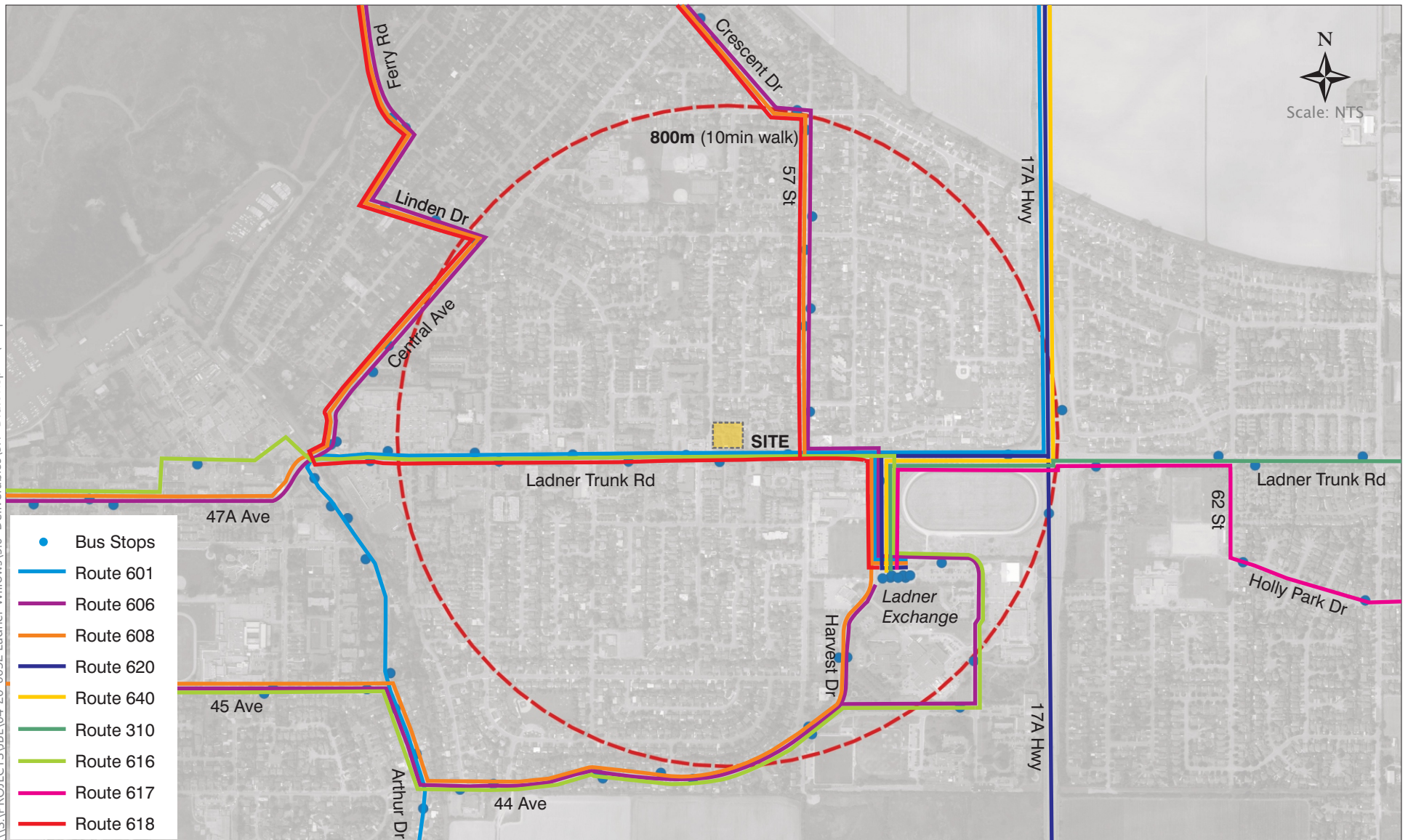


Exhibit 2.1 Nearby Transit Routes & Stops

Ladner Willows Non-Market Housing
04-20-0032 July 2021

Table 2.3 provides a summary of the transit service frequency of the routes directly serving the site.

Table 2.3: Existing Transit Service Frequency

ROUTE		WEEKDAY SERVICE SPAN		HEADWAY (MIN.)				
#	DIRECTION	START	END	AM	MID-DAY	PM	EVENING	WEEKEND
310	EB/WB	5:34 am	9:44 pm	20	30	20	30	30
601	EB/WB	4:16 am	2:42 am	10	15	12	20	20
616	EB/WB	7:52 am	6:55 pm	20	30	20	-	30
618	EB/WB	8:10 am	7:27 pm	30	30	30	30	30

As shown above, the bus routes servicing the site run frequently with headways of less than 30 minutes, seven days a week, with the #601 route arriving every 10 to 12 minutes during the AM and PM peak periods. While the site is not located on Metro Vancouver's Frequent Transit Network (FTN), this level of frequency is consistent with that of an FTN route during these peak times (i.e., transit service every 15 minutes or better).

2.2.3 Pedestrian & Cycling Networks

Pedestrian Network

Walking is an everyday activity whether as a single-purpose journey or linked with transit and driving. Typically, people are willing to walk up to 15-minutes for certain activities (i.e., work, school, recreational activities.) and 400 to 800m is the average distance for such trips.

The majority of streets in the vicinity of the site have sidewalks on at least one side of the roadway although some older local roadways with limited connections or limited residential units have no sidewalks. Along the site frontage, sidewalk exists on both sides of Ladner Trunk Road and 55B Street. In addition, 55B Street & Ladner Trunk Road is controlled by a pedestrian signal, enabling a protected crossing for pedestrians across Ladner Trunk Road.

In terms of key pedestrian locations, in addition to Leslie Park, which is located within 400m from the site, there are several more popular destinations located within 800m from the site, such as Trenant Park Square, Ladner Centre, Paterson Park, Maple Crescent Park, and Hawthorne Elementary School. **Exhibit 2.2** displays the nearby pedestrian amenities.

According to Walk Score (<https://www.walkscore.com/>), the site has a Walk Score of 58 out of 100, which puts the site in the "somewhat walkable" class. Walk Score is an online rating website that estimates the walking, transit, and cycling score of a location based on its proximity to local services such as schools, shopping, recreation, and other nearby amenities.

Cycling Network

Cyclists can generally travel 3 to 4 times the distance of pedestrian over a similar period of time, and therefore cycling 4 to 5 km from the site would be a reasonable distance for a resident or site user to

travel. The average cycling speed for commuters is about 15 km/h, and the average distance per journey is approximately 5 km. This equates to about a 20-minute journey on average. Cycling is increasingly becoming a more popular travel mode for work and leisure.

In general, there are currently limited cycling facilities in the vicinity of the site. The notable bike routes (formal or informal) nearby include:

- Harvest Drive (Collector Road): Shared lanes with signs and pavement markings.
- Ladner Trunk Road, east of Harvest Drive (Arterial Road): Shared lanes with signs and pavement markings.
- 57A Street (Local Road): Informal shared lanes.

Similar to the Walk Score, the site also has a Bike Score of 58 out of 100, which puts the site in the “somewhat bikeable” class, indicating that biking is convenient for some trips.

Exhibit 2.3 highlights the nearby cycling amenities.



Exhibit 2.2 Pedestrian Amenities

Ladner Willows Non-Market Housing
04-20-0032 July 2021

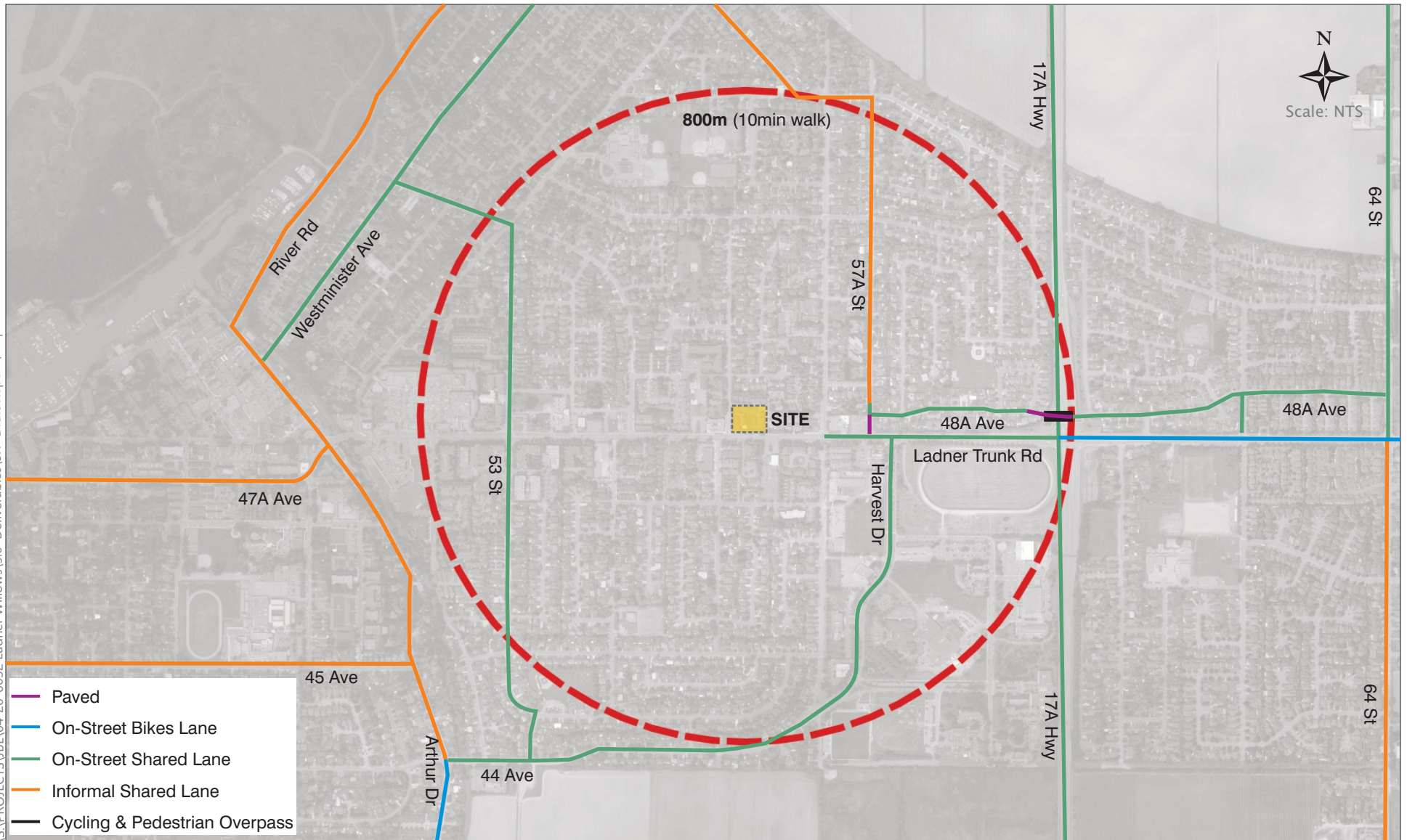


Exhibit 2.3 Cycling Routes

Ladner Willows Non-Market Housing
04-20-0032 July 2021

2.3 Data Collection

2.3.1 Traffic Data Collection Program

Bunt conducted traffic counts on Tuesday, February 25, 2020, covering the weekday morning (7:00 am to 9:00 am), Mid-Day (11:00 am – 1:00 pm), and afternoon (3:00 pm to 6:00 pm) peak traffic periods of the study area network. A site visit was also conducted at this time. Note that these traffic counts were conducted before the COVID-19 pandemic had affected traffic patterns throughout Metro Vancouver.

Table 2.4 provides a summary of the traffic count data of study intersections.

Table 2.4: Summary of Available and Counted Traffic Data

INTERSECTION	DATE OF COUNT	PEAK HOURS	
		AM	PM
55B Street (north) & Ladner Trunk Road	Tuesday, February 25, 2020	8:00-9:00	3:00-4:00
55B Street (south) & Ladner Trunk Road	Tuesday, February 25, 2020	8:00-9:00	3:00-4:00
55B Street & North Driveway	Tuesday, February 25, 2020	8:00-9:00	3:00-4:00
Ladner Trunk Road & East Driveway	Tuesday, February 25, 2020	8:00-9:00	3:00-4:00
OVERALL STUDY AREA PEAK HOUR		8:00-9:00	3:00-4:00

Existing peak hour traffic volumes at the study area intersections are illustrated in **Exhibit 2.4**. It is noted that traffic volumes were balanced between the counted intersections accordingly.

Existing pedestrian and cyclist volumes were counted at all study area intersections. This is important to consider especially in the context of the pedestrian signal intersection at 55B Street & Ladner Trunk Road. Traffic operations analysis is discussed in Section 2.4.

2.3.1 Existing Site Vehicle Trip Generation

Existing site-generated vehicle trips were observed and counted during the weekday AM and PM peak hours. The two driveways that serve the site also serve two neighbouring townhouse developments, therefore, the trips counted are likely conservatively. The existing site was observed to generate 20 trips (8 in, 12 out) and 10 trips (6 in, 4 out) during the AM and PM peak hours, respectively.

Although these represent relatively low peak hour trip generation, the existing site-generated trips were removed from the network when establishing future traffic volumes with the proposed development in place, as the existing townhouse complex would be demolished prior to construction.

2.4 Existing Traffic Operations

2.4.1 Performance Thresholds

The existing operations of study area intersections and access points were assessed using the methods outlined in the 2000 Highway Capacity Manual (HCM), using the Synchro 9.2 analysis software (Build 915). The traffic operations were assessed using the performance measures of Level of Service (LOS), volume-to-capacity (V/C) ratio, and 95th percentile queue lengths.

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 2.5 below summarizes the LOS thresholds for the six Levels of Service, for both signalized and unsignalized intersections.

Table 2.5: 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 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 reasonable 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 have to wait through several signal cycles. In downtown and Town Centre contexts, during peak demand periods, V/C ratios over 0.90 and even 1.0 are common.

Typically, performance measure thresholds are established by municipalities. The City of Delta requires that each movement at study intersections be projected to operate at LOS D or better with a v/c ratio of 0.85 or less under all horizons considered. These thresholds are applied to all intersections regardless of the intersection location (urban or suburban), traffic control (signalized or stop-controlled), or intersecting

road classifications (arterial, collector, or local); all of these elements somewhat influence drivers' expectations for intersection operations.

The 95th percentile queue is defined as the length that has only a 5-percent probability of being exceeded during the analysis time period. It is a useful parameter for determining the appropriate length of turning storage bays, but it is not typical of what an average driver would experience.

In interpreting of the analysis results, note 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 pedestrian signal intersections: HCM 2000 LOS, V/C and 95th percentile queue output is reported using a semi-actuated uncoordinated signal, with modelling that very closely resembles the behaviour of the pedestrian signal.
- For unsignalized two-way stop-controlled intersections: HCM 2000 LOS, V/C and 95th percentile queue output is reported just for individual lanes as the HCM methodology does not report overall performance.
- 95th percentile queue lengths reported have been rounded to the nearest 5m.

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

2.4.2 Existing Conditions Analysis Assumptions

Synchro Parameters

The analysis was completed utilizing Synchro defaults for the majority of parameters with a default saturation flow of 1,900 vehicles per hour. Peak hour factors, pedestrian and cyclist volumes, and percentage of heavy vehicles were taken from existing traffic count observations.

Pedestrian Signal at 55B Street (North) & Ladner Trunk Road

The pedestrian signal at 55B Street (North) & Ladner Trunk Road was modeled in Synchro as indicated on the City of Delta's signal timing plan. According to the timing plan, the signal rests in flashing green for Ladner Trunk Road until either: (1) a pedestrian activates the flashing crossing across Ladner Trunk Road by pressing the push-button, or (2) a vehicle has been present on the 55B Street detector loop for at least 10 seconds.

If pedestrians activate the crossing, the signal will first turn solid green, yellow, then red, at which time pedestrians have 7 seconds of walk time plus 16 seconds of "flashing don't walk" time to clear the crosswalk. If the detector loops senses vehicle(s) on 55B Street, the signal will first turn solid green, yellow, then red, at which time the vehicles have 8 seconds of "minimum green time" to perform their

movement and clear the intersection. The signal then repeats the cycle and rests in flashing green for Ladner Trunk Road.

Typically, a pedestrian signal would not have a detector loop on the minor street to allow a vehicle to activate the signal. Instead, a vehicle would either need to wait for a gap in traffic to turn onto the main street or wait for a pedestrian to press the push-button in order to stop traffic. In this case, 55B Street does have a vehicle detector loop; however, the vehicle must be present for at least 10 seconds to activate the signal, which is longer than what is required at a typical traffic signal.

As such, in this particular scenario, the 55B Street (North) & Ladner Trunk Road pedestrian signal operates as somewhat of a hybrid signal, providing primarily pedestrian activation, but also providing vehicle activation if a vehicle is forced to wait for an extended period of time when attempting to turn from 55B Street onto Ladner Trunk Road.

2.4.3 Existing Operational Analysis Results

A summary of the existing operations is presented below in **Table 2.6**.

Table 2.6: Existing Traffic Operations

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	AM			PM		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
55B Street & North Driveway (Unsignalized)	WB	A	0.01	0	A	<0.01	0
	NB	A	0.02	0	A	0.03	0
	SB	A	<0.01	0	A	<0.01	0
55B Street & Ladner Trunk Road – South (Unsignalized)	EBT	A	0.28	0	A	0.38	0
	EBTR	A	0.15	0	A	0.21	0
	WBTL	A	0.06	0	A	0.10	5
	WBT	A	0.28	0	A	0.32	0
	NB	B	0.12	5	C	0.12	5
	<i>Overall</i>	A	0.31	-	A	0.37	-
55B Street & Ladner Trunk Road – North (Pedestrian Signal)	EB	A	0.33	45	A	0.41	55
	WB	A	0.29	40	A	0.31	45
	SB	C	0.13	10	C	0.11	10
	EBTL	A	<0.01	0	A	<0.01	0
Ladner Trunk Road & East Driveway (Unsignalized)	EBT	A	0.31	0	A	0.36	0
	WBT	A	0.28	0	A	0.32	0
	WBTR	A	0.14	0	A	0.16	0
	SB	C	0.02	0	C	0.01	0

The existing traffic analysis indicated that all study area intersections are currently operating within acceptable intersection performance parameters at peak times, therefore no intersection improvements are required to accommodate existing traffic demands.

3. FUTURE TRAFFIC CONDITIONS

3.1 Traffic Forecasts

3.1.1 Background Traffic Forecasts

Background traffic is traffic that would be present on the road network if the site did not redevelop. Consistent with previous Bunt studies in the City of Delta, a non-compounded linear growth rate of 1% per year was applied to the Opening Day horizon to establish Background traffic volume estimates.

Note, as this study was initiated in 2020, the projected Opening Day at the time was the year 2024. However, given how the project approval process has progressed, the expected Opening Day would now be later in the future. Despite this fact, because traffic capacity was not found to be a concern in previous versions of this study and for consistency with the original analysis, the stated Opening Year has not been changed in this version of the report. However, changing the Opening Year is not expected to have resulted in a fundamental change to the overall conclusions of the study.

The Opening Day Background 2024 traffic volumes are shown in **Exhibit 3.1**.

3.1.2 Site-Generated Traffic

Trip Generation

To estimate the trip generation associated with the development, Bunt used rates published in the Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Ed). Specifically, the manual's Multi-family Housing (Mid-rise) code 221 trip rate was used to calculate the trip generation for the site.

Using this rate, the resulting estimated trip generation for the development is summarized in **Table 3.1**. To determine the net new trip generation, the observed existing vehicle trips associated with the current townhouse complex were subtracted from the total. As the townhouse complex will be demolished prior to construction of the new development, its trips would not be present on the road network once the new development is in place.



Exhibit 3.1
Opening Day (2024) Background Traffic Forecasts

Table 3.1: Estimated Net New Peak Hour Trip Generation

LAND USE	SIZE	DESCRIPTION	AM PEAK HOUR			PM PEAK HOUR		
			IN	OUT	TOTAL	IN	OUT	TOTAL
ESTIMATED FUTURE TRIP GENERATION								
Proposed Development	146 units	Trip Rate¹	26%	74%	0.36	61%	39%	0.44
		Vehicle Trips	14	39	53	39	25	64
ESTIMATED EXISTING TRIP GENERATION (REMOVED FROM ROAD NETWORK)								
Existing Townhouse Development (to be Removed)	40 units	Observed Vehicle Trips	8	12	20	6	4	10
NET NEW TRIP GENERATION	-	VEHICLE TRIPS	6	27	33	33	21	54

1. ITE (221), 10th Edition: Multi-Family Housing Mid-Rise rate

The net new trip generation for the proposed development is expected to be approximately 33 trips (6 in, 27 out) and 54 trips (33 in, 21 out) during the AM and PM peak hours, respectively. This translates to fewer than one new trip per minute on average during both peak hours.

The resulting site generated traffic volumes are illustrated in **Exhibit 3.2**. All vehicular trips were distributed to the road network based on existing traffic patterns and assigned to the development accesses based on logical routing patterns given the site layout.

3.1.3 Total Traffic

The future Total traffic was calculated by adding the site traffic to the Background traffic and is illustrated in **Exhibit 3.3**.

3.2 Future Traffic Operations

3.2.1 Future Conditions Analysis Assumptions

Similar to existing conditions, the future analysis was carried out using Synchro 9 and the HCM 2000 methodology. The same performance thresholds were also used to trigger consideration of roadway or traffic control improvements, as detailed in Section 2.4.

The Ladner Official Community Plan (OCP) indicates that Ladner Trunk Road, between 53 Street and 57 Street, may be widened to 5 lanes in the long-term future (5-10 years from Council adoption). However, given that this would be beyond the Opening Day horizon year (2024), Ladner Trunk Road was assumed to remain as a 4-lane arterial road for the purposes of this study.

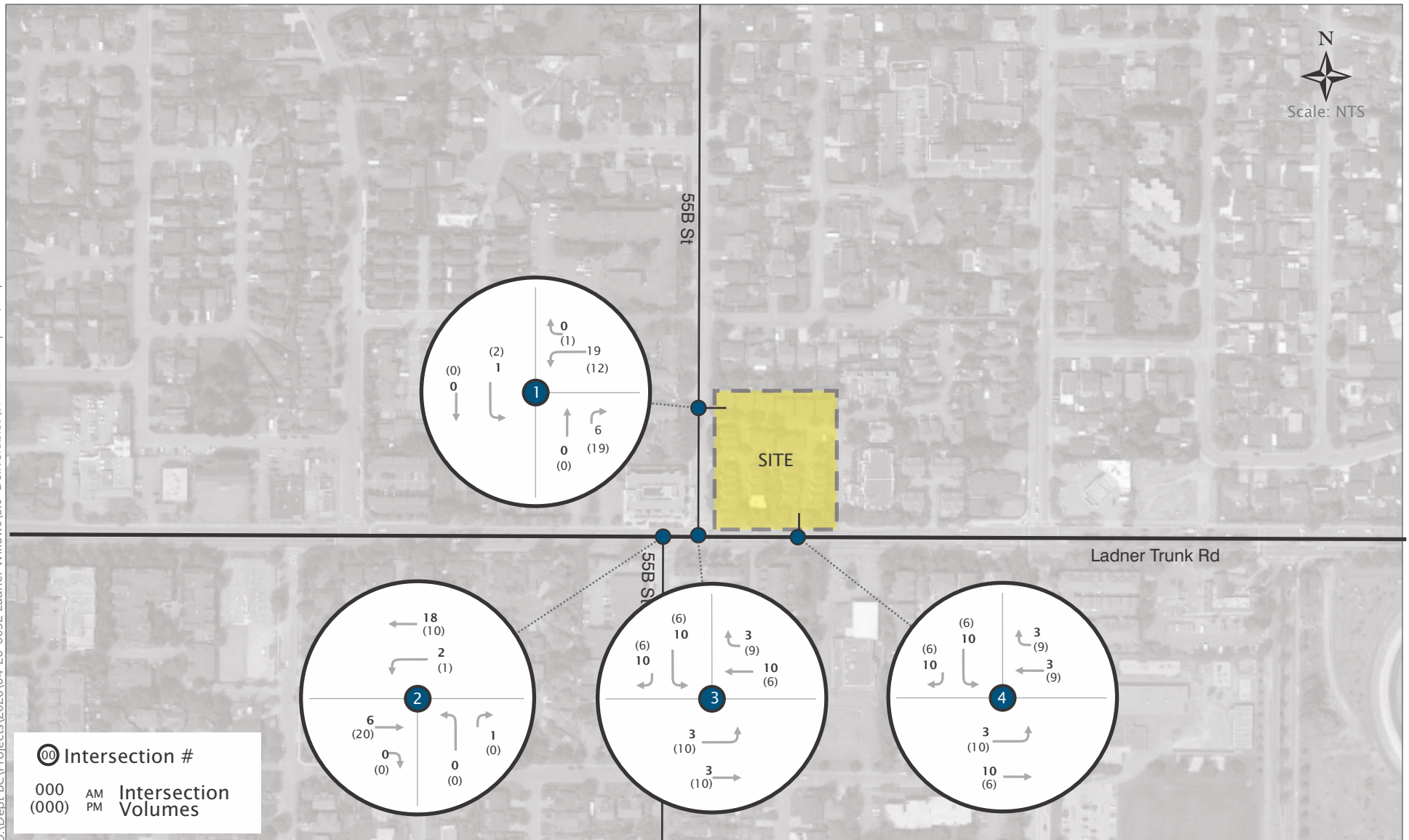


Exhibit 3.2 Peak Hour Site Traffic Forecasts

Ladner Willows Non-Market Housing
04-20-0032 November 2023



Exhibit 3.3 Opening Day (2024) Total Traffic Forecasts

Ladner Willows Non-Market Housing
04-20-0032 November 2023

3.2.1 Future Traffic Operations

Table 3.2 and **3.3** summarize the capacity analysis results for the weekday AM and PM peak hours for the future Opening Day (2024) Background and Total traffic scenarios. The detailed Synchro outputs are included in Appendix B.

Note, although the unit count has reduced by four units since the previous iteration of this study, the traffic operations analysis has not been updated. As the unit count change resulted in a reduction of two site trips in either peak hour, this is not expected to have made a material change to the operations results.

Table 3.2: Opening Day (2024) Traffic Operations – Weekday AM Peak Hour

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	BACKGROUND			TOTAL		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
55B Street & North Driveway (Unsignalized)	WB	A	0.01	0	A	0.03	0
	NB	A	0.02	0	A	0.02	0
	SB	A	<0.01	0	A	<0.01	0
55B Street & Ladner Trunk Road – South (Unsignalized)	EBT	A	0.29	0	A	0.30	0
	EBTR	A	0.16	0	A	0.16	0
	WBTL	A	0.07	0	A	0.07	0
	WBT	A	0.29	0	A	0.30	0
	NB	B	0.13	5	B	0.13	5
55B Street & Ladner Trunk Road – North (Pedestrian Signal)	<i>Overall</i>	A	0.32	-	A	0.34	-
	EB	A	0.35	45	A	0.37	45
	WB	A	0.30	40	A	0.32	40
	SB	C	0.14	10	C	0.17	10
Ladner Trunk Road & East Driveway (Unsignalized)	EBTL	A	<0.01	0	A	<0.01	0
	EBT	A	0.32	0	A	0.32	0
	WBT	A	0.29	0	A	0.29	0
	WBTR	A	0.15	0	A	0.15	0
	SB	C	0.02	0	C	0.07	0

The Opening Day (2024) AM Peak Hour traffic analysis indicates that all study area intersections are anticipated to operate within acceptable capacity parameters, therefore no intersection improvements are required to accommodate the traffic demands for either the future Background or Total traffic conditions.

Table 3.3: Opening Day (2024) Traffic Operations – Weekday PM Peak Hour

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	BACKGROUND			TOTAL		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
55B Street & North Driveway (Unsignalized)	WB	A	0.00	0	A	0.02	0
	NB	A	0.04	0	A	0.05	0
	SB	A	<0.01	0	A	<0.01	0
55B Street & Ladner Trunk Road – South (Unsignalized)	EBT	A	0.39	0	A	0.40	0
	EBTR	A	0.21	0	A	0.22	0
	WBTL	A	0.11	5	A	0.12	5
	WBT	A	0.34	0	A	0.34	0
	NB	C	0.13	5	C	0.14	5
55B Street & Ladner Trunk Road – North (Pedestrian Signal)	<i>Overall</i>	A	0.39	-	A	0.41	-
	EB	A	0.43	60	A	0.45	65
	WB	A	0.33	45	A	0.33	45
	SB	C	0.11	10	C	0.15	10
Ladner Trunk Road & East Driveway (Unsignalized)	EBTL	A	<0.01	0	A	0.01	0
	EBT	A	0.38	0	A	0.38	0
	WBT	A	0.33	0	A	0.33	0
	WBTR	A	0.17	0	A	0.17	0
	SB	C	0.01	0	C	0.06	0

Similar to the AM peak hour, the Opening Day (2024) PM Peak Hour traffic analysis indicates that all study area intersections are anticipated to operate within acceptable capacity parameters. As such, no intersection improvements are required to accommodate the traffic demands for either the Background or Total traffic conditions.

4. SIGNAL WARRANT ANALYSIS

4.1 Background

Bunt was asked by the City of Delta to determine whether the existing pedestrian signal at the 55B Street (North) & Ladner Trunk Road intersection would warrant being upgraded to a full traffic signal in either the existing or future (with and without development) study periods. This section presents the findings of the warrant analysis.

4.2 Signal Warrant Analysis

A signal warrant analysis was conducted at the 55B Street (North) & Ladner Trunk Road intersection using the Transportation Association of Canada (TAC) signal warrant methodology to determine if this intersection would require a full traffic signal given the existing, background and/or total (background + site traffic) traffic conditions.

The Canadian Traffic Signal Warrant Procedure is a “cumulative factors methodology” (CFM) that includes a cross-product relationship of the vehicle-vehicle conflict and the vehicle-pedestrian conflict. It also considers various local factors such as pedestrian demographics, pedestrian exposure, and roadway characteristics. The TAC methodology uses the peak six hours of vehicle and pedestrian traffic data which typically occurs during weekday AM, mid-day, and PM peak periods. **Appendix C** presents the results of the signal warrant analysis for all three scenarios.

Existing Conditions

The existing conditions signal warrant requires six hours of traffic and pedestrian volumes which were collected on Tuesday, February 25, 2020. The analysis indicated that under current traffic volumes, a traffic signal is not warranted. The analysis indicated a ‘W’ warrant value of 31, whereas a threshold of 100 is required.

Opening Day (2024) Background Conditions

A signal warrant was conducted for the future Opening Day (2024) Background traffic condition. The 1% per year growth rate used in this study was applied to all six peak hours to estimate the future Background traffic volumes. The analysis indicated that under future Background traffic volumes, a traffic signal would not be warranted, with a ‘W’ warrant value of 33.

Opening Day (2024) Total Conditions

Lastly, a signal warrant was again conducted for the future Opening Day (2024) Total traffic condition. The Total traffic volumes were developed by again applying a 1% per year growth rate to all six peak hours and then adding the estimated site trips. To estimate the site trips for the four hours not included in the previous analysis (i.e., the hours outside the AM and PM peak hours estimated in Section 3.1.2), the peak hour site trip volumes were proportioned based on the relative intersection volumes in existing conditions. The analysis indicated that under Total 2024 traffic volumes, a traffic signal would still not be warranted, with a ‘W’ warrant value of 71.

Warrant Analysis Summary

The key finding of the analysis is that this intersection does not appear to warrant a full traffic signal with or without the proposed development due to the relatively low volumes on the minor approach (<75 veh/hr).

In addition, as noted previously in Section 2.4.2, this intersection already operates as somewhat of a hybrid pedestrian signal as it has a vehicle detector loop on the minor street (55B Street), which is not typical of a pedestrian signal. As such, when a vehicle waits for an extended period of time to turn from 55B Street onto Ladner Trunk Road (i.e., more than 10 seconds), the detector loop will activate the signal and traffic will be stopped on Ladner Trunk Road.

5. CORNER CUT SIGHT DISTANCE ANALYSIS

5.1 Background

As a standard requirement, the City of Delta requested that the Developer dedicate a 6m by 6m property line corner cut to the City at the southwest corner of the property. From Bunt's understanding, a key reason for this requirement is to ensure that the City maintains the ability to control this portion of land to keep it clear of visual obstructions that would impact the sight distance between vehicles approaching from the east and vehicles attempting to turn from 55B Street (North) onto Ladner Trunk Road.

In response to this requirement, the Developer proposes to instead provide a smaller 3m by 3m corner cut in order to reduce the impact to the development, but still provide adequate sight distance for vehicles. This reduced 3m by 3m corner cut would be consistent with the size of the corner cut provided by a recently constructed residential development on the opposite side of 55B Street at 5571 Ladner Trunk Road, situated at the northwest corner of the 55B Street (North) & Ladner Trunk Road intersection.

Prior to approving this reduced size corner cut, the City has requested that a sight distance assessment be undertaken at 55B Street (North) & Ladner Trunk Road to ensure that the proposed 3m by 3m corner cut would be able to achieve adequate sight distance for vehicles. The findings of this assessment are discussed below.

5.2 Sight Distance Analysis

5.2.1 Stopping Sight Distance and Intersection Sight Distance

Sight distance is the length of roadway visible to a driver. Clear sight triangles are provided at intersections to allow drivers of stopped vehicles a sufficient view of the intersecting roadway to decide when to enter the intersection roadway or to cross it.

If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance (SSD) for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, a major-road vehicle may need to stop or slow to accommodate the maneuver by a minor road vehicle. For vehicles approaching an intersection, SSD based on design speed is the minimum criterion.

To enhance traffic operations, intersection sight distance (ISD) that exceeds SSD is desirable along the major road. ISD is defined as the sight distance available from a point where vehicles are required to stop on the intersecting road, while drivers are looking left and right along the major roadway, before entering the intersection. The recommended dimensions of the clear sight triangle for desirable traffic operations are based on assumptions derived from field observations of driver gap-acceptance behavior. Note that while meeting ISD is recommended for operational purposes and is desirable, it is not required for safety purposes as is the case for SSD.

As stated in the Transportation Association of Canada's (TAC) *Geometric Design Guide*, it is calculated that for a 50 km/h road, the SSD is 65m, and an ISD of 105m should be used for design.

5.2.2 Clear Sight Triangles

The recommended decision point for measuring the clear sight triangle is 4.4 metres from the edge of the major roadway, which represents the typical position of the minor roadway driver's eye when a vehicle is stopped relatively close to the major road. The clear sight triangles at the proposed site access point are shown in **Exhibits 5.1** and **5.2**, which illustrate both SSD and ISD. To enable the required sight distances, the areas defined by these clear sight triangles would need to be kept clear of any visual obstructions.

Note that in this scenario, the relevant sight distance is between vehicles attempting to turn from 55B Street (North) and vehicles approaching from the east only. As the Developer does not control the property on the northwest corner of the intersection, it cannot account for the sight distance between vehicles on 55B Street (North) and vehicles approaching from the west.

As the exhibits indicate, the required SSD and ISD sight triangles are not negatively impacted by the proposed 3m by 3m corner cut. In fact, given the relative positions of the edge of the roadway and the property line (which is set far back from Ladner Trunk Road), the southwest corner of the site's property line would not impact vehicle sight triangles in this particular instance. For this reason, from the perspective of sight distance requirements, Bunt recommends that the City of Delta approve the requested reduced size property line corner cut.

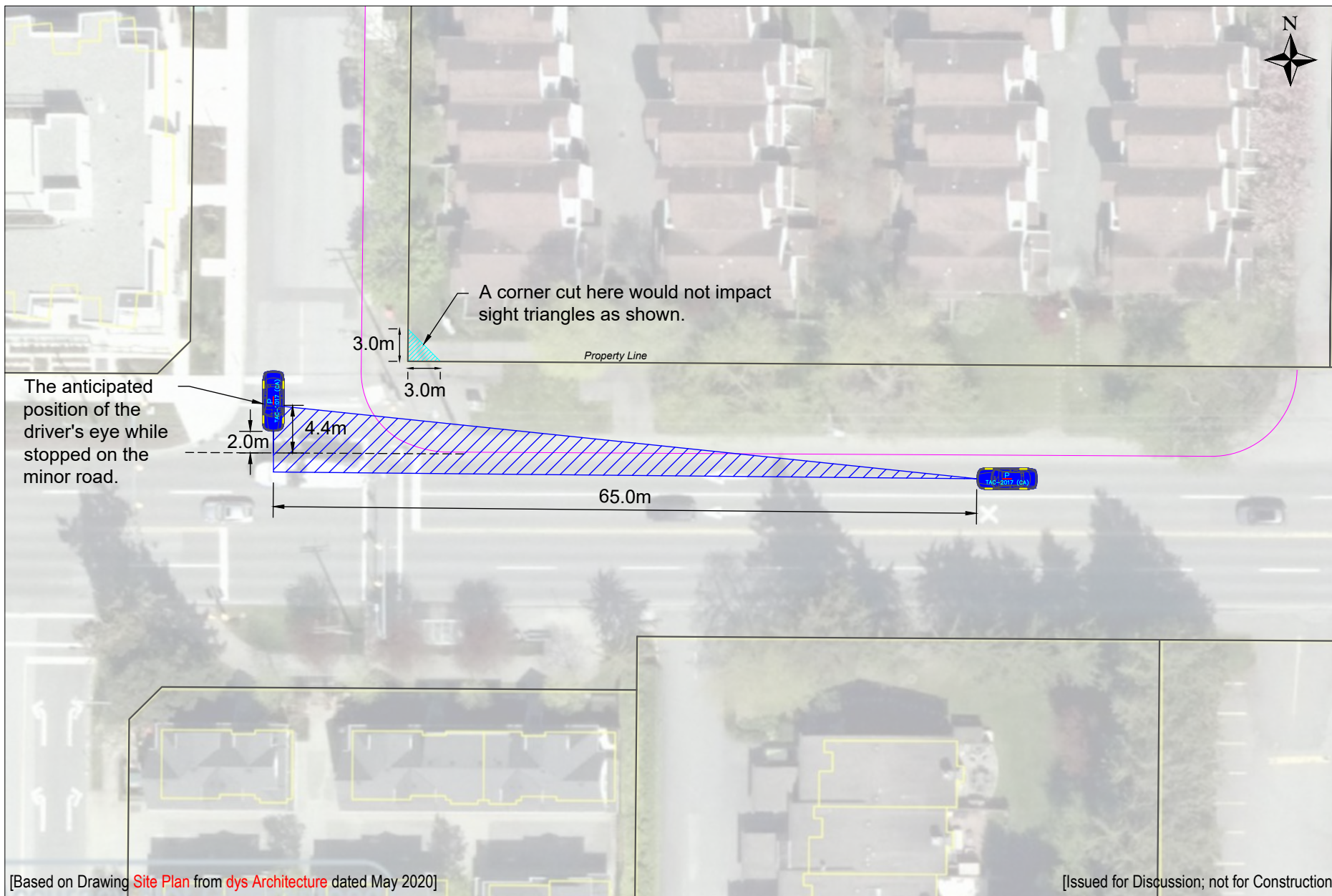


Exhibit 5.1 Stopping Sight Distance (SSD) Assessment

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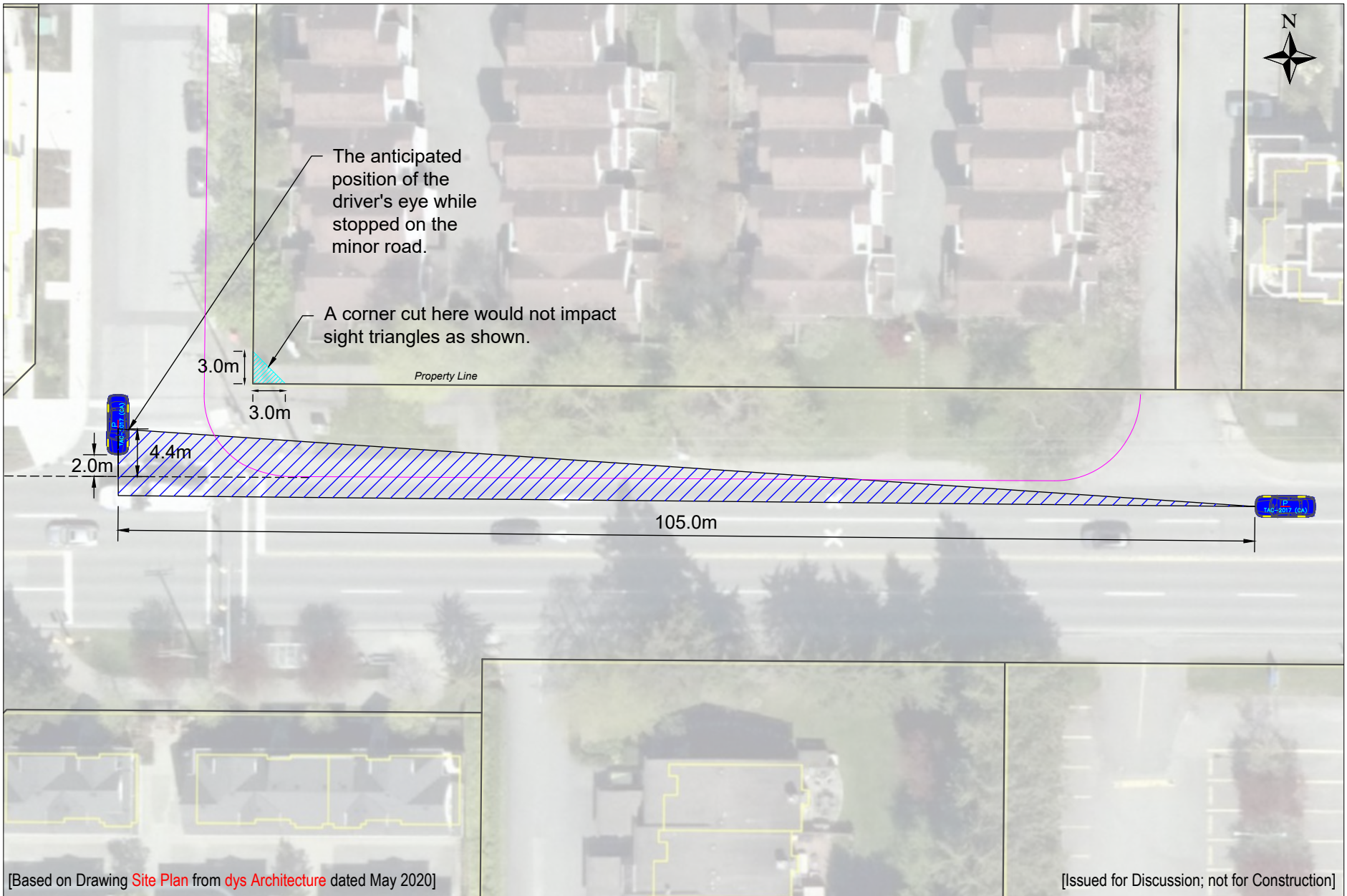


Exhibit 5.2 Intersection Sight Distance (ISD) Assessment



6. PARKING & SITE SERVICING

6.1 Parking Supply

6.1.1 Vehicle Parking

Table 6.1 summarizes the proposed off-street parking supply for the development in comparison to the City of Delta's Zoning Bylaw minimum requirement.

Note, this table incorporates updated Bylaw rates (i.e., a new "Purpose-Built Rental" rate and an updated residential visitor rate), which came into effect since the last version of this report.

Table 6.1: Minimum Vehicle Parking Supply Requirement & Provision

DESCRIPTION	QTY (DWELLING UNITS (DU))	BYLAW RATE (SPACES / DU) ¹	PROPOSED RATE (SPACES / DU)	REQUIRED (SPACES)	PROPOSED (SPACES)	DIFFERENCE (SPACES)
Studio	23	1.0	0.96	146	140	-6 (-4%)
1 Bedroom	47					
2 Bedroom	54					
3 Bedroom	19					
4 Bedroom	3					
Visitor Parking	146	0.10	0.10	15	15	-
RESIDENT	146	1.0	0.96	146	140	-6 (-4%)
VISITOR	146	0.10	0.10	15	15	-
TOTAL	146	1.10	1.06	161	155	-6 (-4%)

1. Delta Zoning Bylaw 8.4.2., Apartment Building Use – Purpose-Built Rental

The required parking supply for the development would be 161 spaces (146 resident, 15 visitor) compared to a proposed supply of 155 spaces (140 resident, 15 visitor), representing a total shortfall of 6 spaces (4% reduction).

Disability Spaces

Based on the City's Zoning Bylaw (8.5.5a), 15 disability spaces would be needed, based on the requirement for one disability space being provided for 50% of the required adaptable units. As 20% of all single storey units are required to be adaptable, this translates to 29 required adaptable units and therefore 15 required disability spaces.

The developer proposes to provide the required 15 spaces, which will consist of 14 resident disability spaces and 1 visitor disability space. In addition, as the Zoning Bylaw also requires that 50% of disability spaces be van accessible, the developer plans to make 8 of the 15 disability spaces van accessible, including the single visitor disability space.

Small Car Spaces

The City's Zoning Bylaw (8.5.4) permits up to 25% of the parking supply to be provided as small car spaces, including up to 25% of the visitor parking. For the proposed 155 spaces, this translates to 39 small car spaces.

The developer proposes 37 small car spaces (34 resident, 3 visitor), which would fall within the maximum allowed overall and by user type.

Vehicle Parking Summary

As summarized in Tables 6.1, the proposed parking supply would fall just short of the supply required by the City of Delta's Zoning Bylaw.

However, it is Bunt's opinion that the City's Bylaw parking rate would overstate the actual parking demand experienced at the proposed development. Despite the City having introduced a "Purpose-Built Rental" parking rate since the previous version of this report, this new rate does still not account for two key factors which industry studies have shown significantly impact vehicle ownership levels: (1) the income level of the tenants and (2) proximity to alternative mode facilities and amenities that reduce the reliance on auto ownership.

Given that the development is planned to be aimed at lower income individuals and families, the City's Zoning Bylaw parking rate would likely result in an oversupply of parking. In addition, while the development site is not located directly on Metro Vancouver's Frequent Transit Network (FTN), it is well-served by transit, which would also affect vehicle ownership, but is not reflected in the City's Bylaw rate.

To support this notion, a detailed parking supply variance rationale is provided in Section 7.

6.1.2 Bicycle Parking

Table 6.2 summarizes the bicycle parking space supply requirement for the proposed development.

Table 6.2: Bicycle Parking Supply Requirement & Provision

LAND USE	QTY (DWELLING UNITS (DU))	BYLAW RATE (SPACES / DU) ¹	REQUIRED (SPACES)	PROPOSED (SPACES)
Apartment Building - Resident	146	1 space per dwelling unit for residents	146	157
Apartment Building - Visitor	146 (1 building)	5 spaces per apartment building for visitors	5	5
TOTAL	-		151	162

As the table indicates, the proposed bicycle parking supply for the development would meet the minimum bylaw requirement for visitor bicycle spaces and exceed the requirement for residents.

6.1.3 Scooter Parking

While not required based on the City's Zoning Bylaw, developer proposes to provide 5 scooter parking spaces in the underground parking level as an additional amenity for the site.

6.2 Site Servicing

6.2.1 Off-Street Loading

The City's Zoning Bylaw (9.2.1) requires that 1 loading space per building with more than 80 dwelling units be provided. This translates to a requirement of 1 loading space for the development.

The developer proposes to provide the required loading space along the east side of the building immediately north of the east building entry.

Exhibit 6.1 shows the entering and exiting vehicle turning paths of a standard SU9 design vehicle, which is expected to be the largest loading truck to access the site. In most cases, the loading vehicle is likely to be smaller than an SU9. As the exhibit indicates, an SU9 is shown to be able to successfully enter and exit the loading bay without any maneuvering issues.

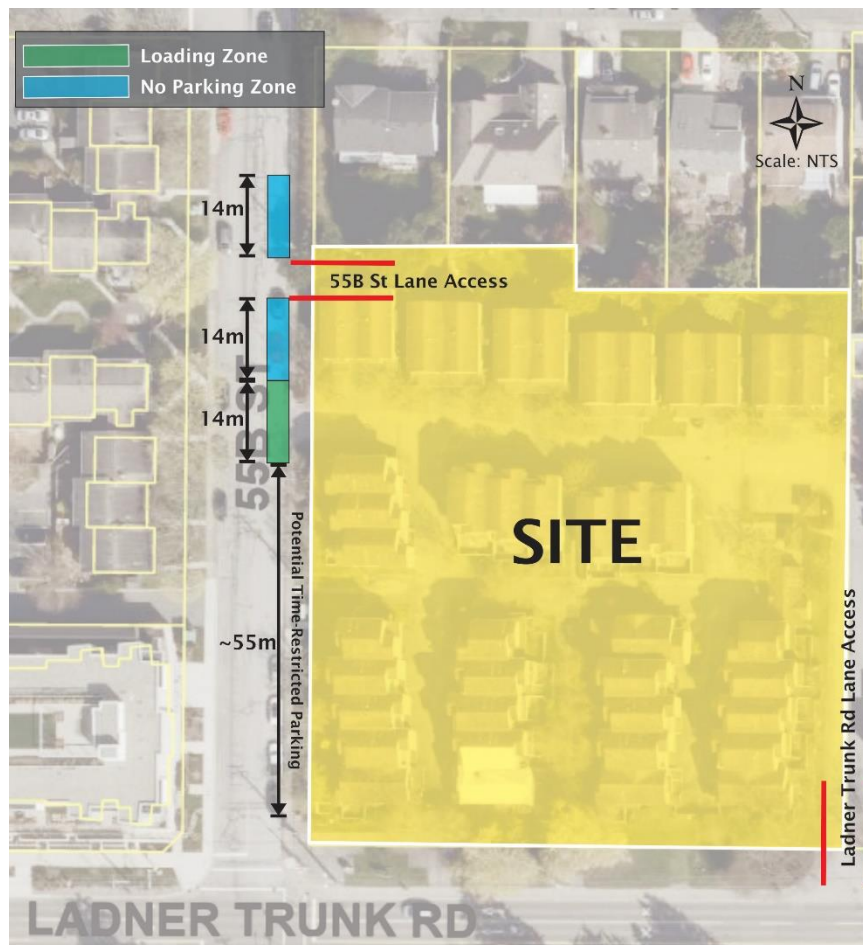
6.2.2 On-Street Loading

In addition to the development's off-street loading, the City intends to also locate an on-street "Loading Zone" approximately 14m in length (i.e., two parallel parking stalls) on 55B Street along the site frontage. This Loading Zone will be used for passenger pick-up/drop-off, as well as to accommodate ride hailing services (e.g., Uber and Lyft), food delivery services (e.g., Uber Eats, Door Dash, etc.), and online retailer deliveries (E.g., Amazon, etc.). On-street Loading Zones typically allow a driver to stop for up to 3 minutes for loading/unloading of passengers and up to 10 minutes for the loading/unloading of materials. The

proposed location for this Loading Zone is south of the site's 55B Street rear lane access immediately south of the No Parking zone discussed previously in Section 1.3.2. **Figure 6.1** illustrates the approximate location in the context of the site.

As this Loading Zone area will sit unoccupied more frequently than a regular parking space, an added benefit of this area is that when it is unoccupied it will provide an extended section of unobstructed views, thereby enhancing sightlines between exiting vehicles and vehicles travelling along 55B Street, as well as between vehicles and pedestrians in general.

Figure 6.1: Future On-Street Loading Zone



6.2.3 Waste Collection

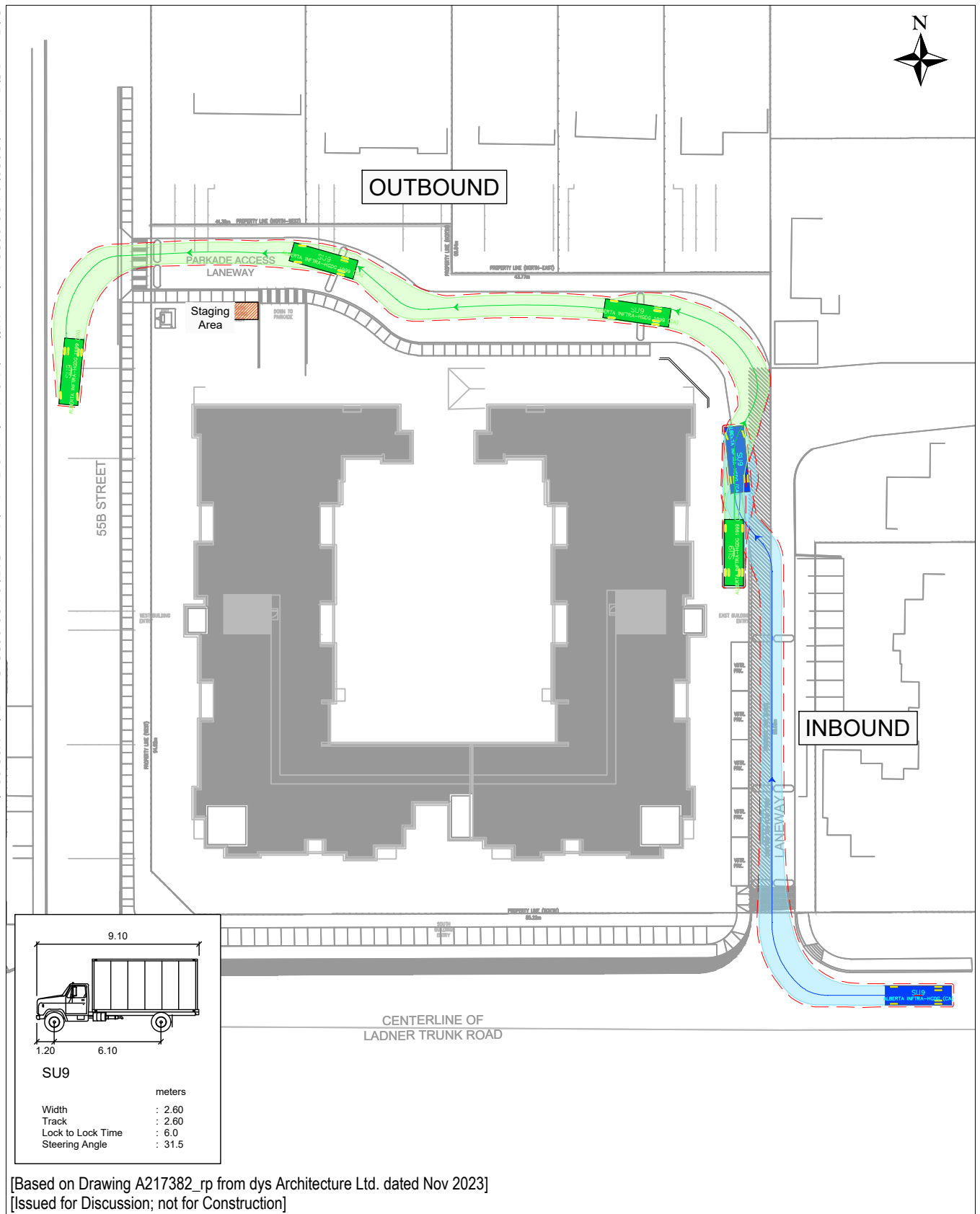
The garbage and recycling bins for the development are to be located in a garbage room located on the underground parking level immediately west of the parking ramp.

To perform the garbage/recycling collection, a hauler truck (i.e., typically the size of an Ford F350) would enter the underground parking level, attach the garbage or recycling bins to the rear of the truck, and then transport the bin(s) to the garbage/recycling bin staging area located at ground level, just west of the parking entrance. A full-sized garbage/recycling truck would then visit the site to transfer the contents of the garbage/recycling bins into the truck's container and then exit the site. Finally, the hauler truck would return to the site and take the empty garbage/recycling bins back to the garbage room.

Exhibits 6.2 and 6.3 demonstrate that a hauler truck would be able to enter and exit the underground garbage room to pick up the garbage/recycling bins to take them to the staging area and then return them without any maneuvering issues.

Exhibit 6.4 shows the entering and exiting vehicle turning paths of a full-sized waste collection vehicle accessing the site to collect the contents of the waste bins from the staging area without any maneuvering issues.

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[Based on Drawing A217382_rp from dys Architecture Ltd. dated Nov 2023]
[Issued for Discussion; not for Construction]

Exhibit 6.1 SU9 Entering & Exiting Loading Space

04-20-0032

Nov 2023

Ladner Willows Non-Market Housing
Scale 1:750 on Letter Prepared by ST / EFT





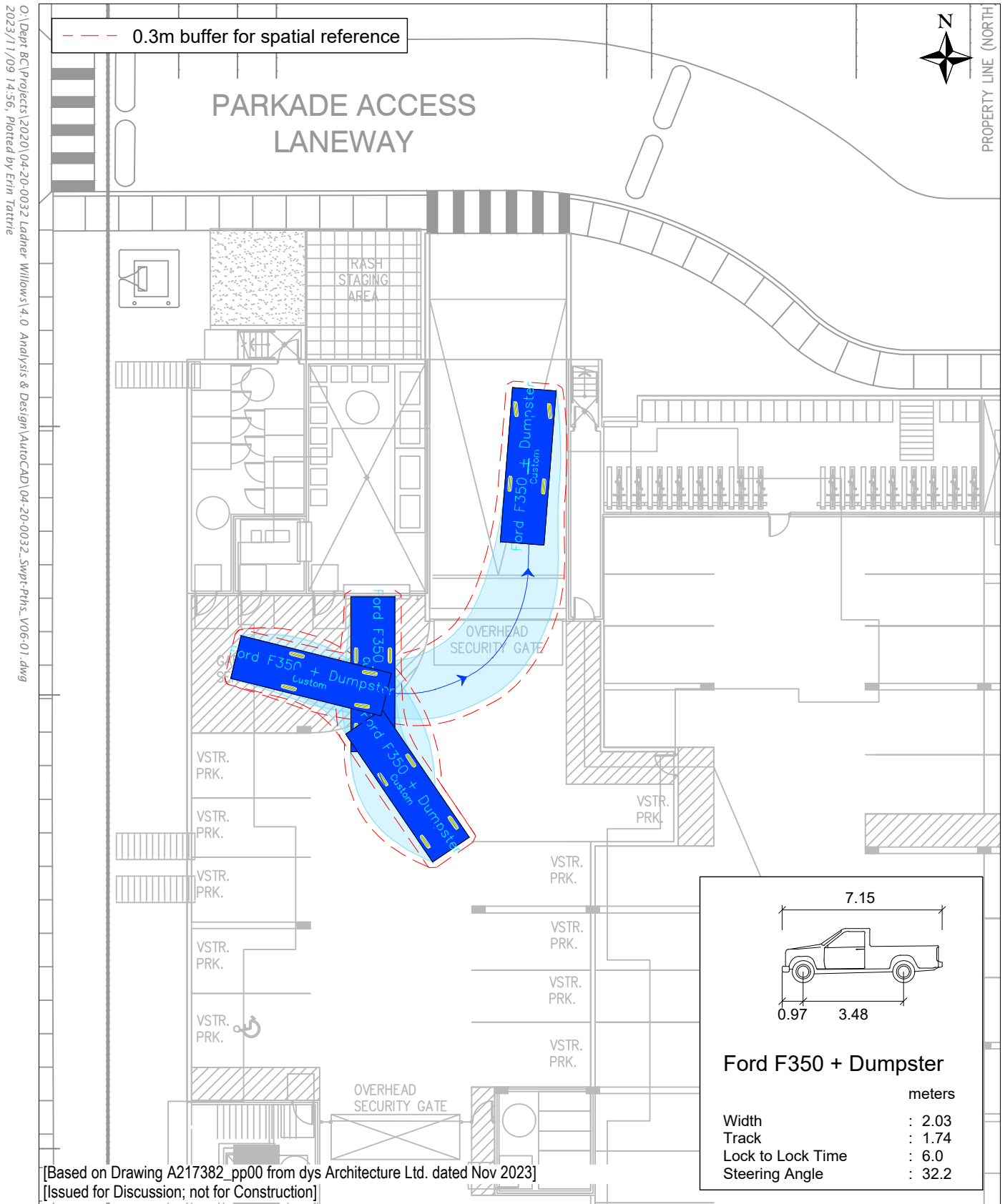


Exhibit 6.3
Hauler Truck Exiting Garbage Room Area



7. PARKING SUPPLY VARIANCE RATIONALE

7.1 Overview

It is Bunt's opinion that the City's Bylaw parking rate would overstate the actual parking demand experienced at the proposed development. Despite the City having introduced a "Purpose-Built Rental" parking rate since the previous version of this report, this new rate does still not account for two key factors which industry studies have shown significantly impact vehicle ownership levels: (1) the income level of the tenants and (2) proximity to alternative mode facilities and amenities that reduce the reliance on auto ownership.

To support this notion and rationalize the proposed parking supply, the following sections provide a summary of industry research on these factors and parking demand data at comparable sites.

7.2 Industry Research

7.2.1 Effect of Lower Incomes

The City's bylaw rate does not differentiate between "market" and "non-market" housing, despite that fact that industry studies have indicated that affordable "non-market" housing experiences considerably lower vehicle ownership rates than "market" housing. This intuitively makes sense, as many of the residents in a non-market development simply do not have the financial resources necessary to pay for a private vehicle, insurance, gas, and maintenance.

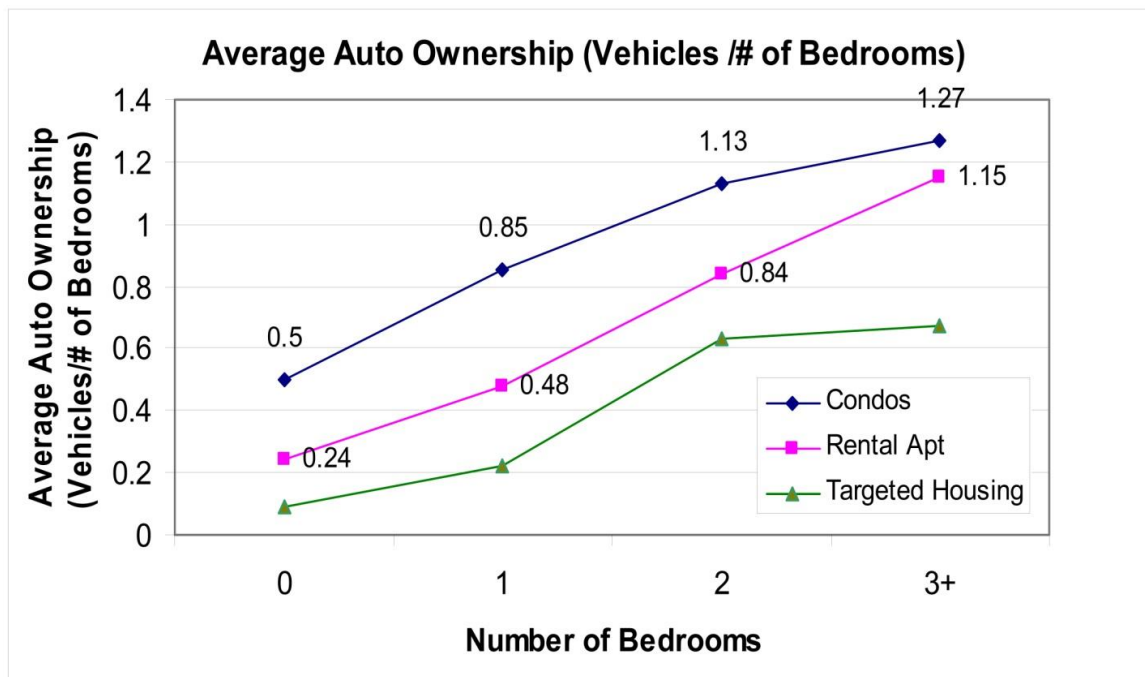
The 2018 Regional Parking Study (RPS) conducted by Metro Vancouver strongly supports this notion, as the Household Survey component of this study indicated that non-market rental apartments were found to have 50% lower auto ownership levels than market rental apartments. Similarly, the Parking Facilities Survey component of the RPS observed non-market rental apartment parking demand to be 80% lower than market rental apartments.

In addition to this data, the Canada Mortgage and Housing Corporation (CMHC) (Research Highlight, Socio-Economic Series Issue 50- Revision 2) concluded that household income is the second-best predictor of auto ownership. As income increases, auto ownership and use increase. A study reported in the Australia Transportation Forum (2007) confirmed a strong correlation between vehicle ownership and household income. A study published by Pushkar et al (TRB 2000) based on a survey of 115,000 households in Toronto indicated that higher income households owned more vehicles. A study conducted by Bunt in the Vancouver area in the early 1990s and in the Calgary area in 2003 also supported a positive, almost linear relationship between income and auto ownership.

Other communities that have studied auto ownership associated with subsidized/affordable housing have also found that affordable rental apartment units have lower auto ownership than market rental unit residents. **Figure 7.1** below illustrates the auto ownership levels of residents of approximately 4,700 apartment buildings in a large study conducted on behalf of the City of Toronto, which clearly

demonstrates this relationship. Affordable or “targeted” housing units as indicated in the graph were found to have auto ownership levels approximately 30% to 60% lower than market units; the smaller units in particular were found to have 60% fewer vehicles.

Figure 7.1: 2006 Average Auto Ownership by Housing Type and No. of Bedrooms



Source: City of Toronto Parking Standards Review – Phase Two Apartment Building/Multi-Unit Block Developments Component, New Zoning Bylaw Project, Cansult Limited, February 2007

The City of Mississauga conducted a study of over 4,600 non-profit rental housing units by various stratifications. **Figure 7.2** summarizes in tabular form the proposed minimum parking guidelines resulting from the survey findings from this study for market rental units, for units with a “shallow” (lower) subsidy level, and for units with a “deep” (higher) subsidy level.

Figure 7.2: Proposed Minimum Parking Guidelines for Non-Seniors Apartments

Subsidy Category	Unit Size	Vehicle Ownership Rate
Market	One Bedroom	0.75
	Two Bedroom	0.90
	Three Bedroom	1.14
	Four Bedroom	1.21
Shallow	One Bedroom	0.40
	Two Bedroom	0.60
	Three Bedroom	0.74
	Four Bedroom	1.10
Deep	One Bedroom	0.31
	Two Bedroom	0.50
	Three Bedroom	0.70
	Four Bedroom	0.97

Source: City of Mississauga Policy & Planning Division, Parking Guidelines for Public and Private Non-Profit Housing, March 2005

A clear relationship in these rates can be seen that supports Bunt's contention that the lower the income level, the lower the auto ownership will be, and therefore, the lower the parking requirement should be. It is worth re-emphasizing that the proposed development plans for a spectrum of income levels for its units, which includes 30% (44 units) low-end-of-market, 50% (73 units) rent-geared-to-income, and 20% (29 units) deep subsidy. Based on the data, these three unit types are expected to have decreasing levels of vehicle ownership.

7.2.2 Effect of Proximity to Alternative Mode Facilities and Amenities

As was highlighted in Section 2.2, the site is located in close proximity to alternative mode facilities and amenities that would help reduce the reliance on auto ownership.

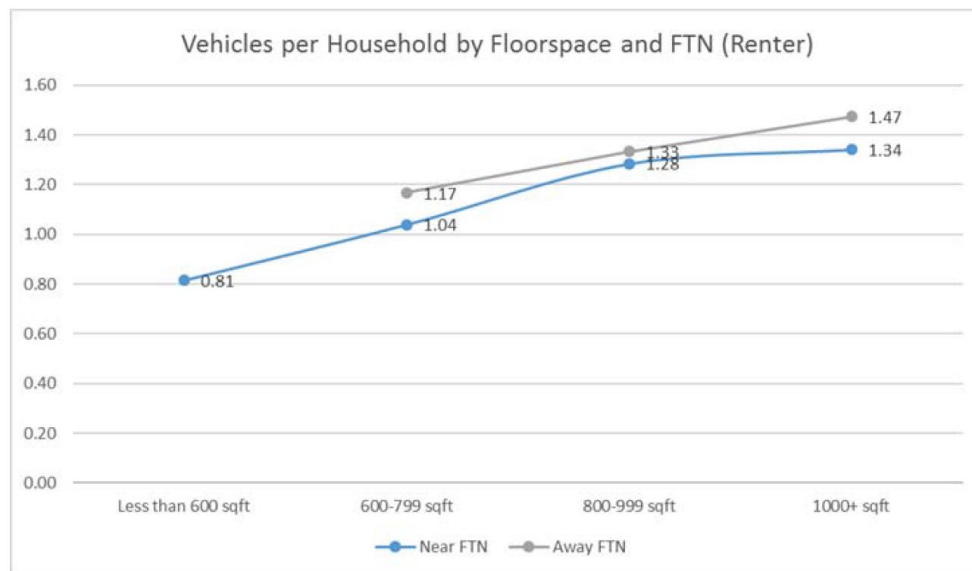
For pedestrians, within 800m of the site are several popular destinations such as Leslie Park, Trenant Park Square, Ladner Centre, Paterson Park, Maple Crescent Park, and Hawthorne Elementary School. For cyclists, shared bike lanes exist on Harvest Drive and Ladner Trunk Road (east of Harvest Drive), and an informal shared lane exists on 57A Street.

In terms of transit, bus routes servicing the site run frequently with headways of less than 30 minutes seven days a week, with the #601 route arriving every 10 to 12 minutes during the AM and PM peak periods.

Research has shown that accessibility to alternative modes of travel reduce auto ownership, particularly proximity to high quality/high frequency transit. The findings of the RPS found that apartments within 800m of Metro Vancouver's Frequent Transit Network (FTN) have auto ownership levels up to 11% lower than those outside convenient walking distance to bus and rail transit services, depending on the unit size. The FTN network is a network of corridors where transit service runs at least every 15 minutes in both directions throughout the day and into the evening, every day of the week.

The relationship between vehicle ownership and proximity to the region's FTN is shown in **Figure 7.3**.

Figure 7.3: Vehicle Ownership by Unit Size & Transit Proximity (Rental Sites)



Source: Progress Update on the 2018 Regional Parking Study – Household Survey Memo,

While the rates shown in the figure are not directly applicable to the subject site as they are an average of all locations and do not account for income levels, the conclusion from the data is that there is a direct relationship between vehicle ownership and proximity to high quality/high frequency transit.

As acknowledged previously, while the site is not located on Metro Vancouver's FTN, the level of transit frequency and connectivity available to the site during the peak periods would be consistent with that of an FTN route. With this level of transit service, many residents living at the development would not have to rely on using a private vehicle to get to/from their destinations, which would likely result in lower vehicle ownership.

7.3 Supportive Parking Data

To further support the notion that the City's Bylaw rate would overstate the actual parking demand at the proposed development, **Table 7.1** provides a summary of peak on-site parking demand rates from a sample of previous Bunt projects across Metro Vancouver. While not all sites are directly comparable to the subject site, all sites shared a few key factors with the proposed development, which include:

- All sites were non-market, non-Seniors, multi-family rental residential developments (either apartments or townhomes); and,
- All sites were not located in close proximity to SkyTrain or on an FTN route.

Table 7.1: Bunt Parking Demand Data for Comparable Non-Market Multi-Family Developments

LAND USE NAME	MUNICIPALITY	ADDRESS	DESCRIPTION	PEAK PARKING DEMAND RATE (SPACES/DU)	NOTES
Moffatt Park	Richmond	7660 Moffatt Road	Non-Market, Non-Seniors Housing	1.00	Resident demand only. Visitor Demand not available.
Maple Vine Court	Richmond	7500 Francis Road	Non-Market, Non-Seniors Housing	0.94	Resident demand only. Visitor Demand not available.
Decaire Heights	Coquitlam	310 Decaire Street	Non-Market, Non-Seniors Housing	0.90	Includes both resident & visitor demand.
Place Des Amis	Coquitlam	99 Laval Street	Non-Market, Non-Seniors Housing	0.67	Resident demand only. Visitor Demand not available.
Rose Hill Townhomes	Coquitlam	2850 Rambler Way	Non-Market, Non-Seniors Housing	1.09	Resident demand only. Visitor Demand not available.
Glen Meadows	Coquitlam	2829/2841 Glen Drive	Non-Market, Non-Seniors Housing	1.03	Resident demand only. Visitor Demand not available.
Falcon Crest Estates Housing Coop	Coquitlam	1170 Falcon Drive	Non-Market, Non-Seniors Housing	1.37	Resident demand only. Visitor Demand not available.
N/A	Surrey	6455 121 Street	Non-Market, Non-Seniors Housing	0.89	Resident demand only. Visitor Demand not available.
Claridge Court	Surrey	17478 103 Avenue	Non-Market, Non-Seniors Housing	0.59	Resident demand only. Visitor Demand not available.
N/A	Surrey	9537 Prince Charles Boulevard	Non-Market, Non-Seniors Housing	0.58	Resident demand only. Visitor Demand not available.
N/A	Surrey	9537 Prince Charles Boulevard	Non-Market, Non-Seniors Housing	0.84	Resident demand only. Visitor Demand not available.
N/A	Surrey	7561 140 Street	Non-Market, Non-Seniors Housing	0.79	Resident demand only. Visitor Demand not available.
Heather Place	Vancouver	774 West 13th Avenue	Non-Market, Non-Seniors Housing	0.60	Resident demand only. Visitor Demand not available.

River Mist	Richmond	8520 Granville Avenue	Non-Market, Non-Seniors Housing	1.29	Resident demand only. Visitor Demand not available.
RainCity Housing	Coquitlam	3030 Gordon Avenue	Non-Market, Non-Seniors Housing	0.09	Resident demand only. Visitor Demand not available.
			AVERAGE:	0.84	
			MEDIAN:	0.89	
			85TH PERCENTILE:	1.08	

The peak parking demand rate at the 15 comparable sites ranged from 0.09 to 1.37 spaces per unit. The average peak parking demand rate was found to be 0.84 spaces per unit, the median was 0.89 spaces per unit, and the 85th percentile was 1.08 spaces per unit. Note that all but one of these sites included resident parking only, as visitor parking was not available.

In comparison, the resident parking supply rate of 0.96 spaces per unit proposed for the development exceeds the average and median rates above and is just under the 85th percentile rate.

7.4 Vehicle Parking Summary

Based on industry studies and parking demand data from previous Bunt studies presented above, it is Bunt's opinion that the proposed parking supply for residents of the proposed development would be adequate, if not conservative, to accommodate the expected demand despite falling just short of the Bylaw requirement (i.e., 6 spaces or 4% shortfall).

As the City's Apartment Building – Purpose-Built Rental parking rate does not take into account key factors which significantly affect vehicle ownership such as income level and proximity to alternative mode facilities, applying this rate would overstate the actual parking demand resulting in an oversupply of parking. With underground parking spaces generally costing in the order of \$60,000 to \$80,000 to construct, such an over-supply would have a profound effect on the affordability of the proposed housing units. For this reason, Bunt recommends that the City approve the proposed parking variance for the development.

8. CONCLUSIONS & RECOMMENDATIONS

Based on Bunt's review of the proposed development, a summary of the conclusions and recommendations of the study is provided below.

8.1 Conclusions

Proposed Development

- The proposed development includes 146 Non-Market Housing rental dwelling units for lower income families. The developer and future operator of the project is Red Door Housing Society, with funding provided by BC Housing.
- To accommodate the new development, the 40 townhouse units currently occupying the site would be demolished prior to construction.
- The development's dwelling units would include a mix of income levels, including Deep Subsidy units (20%), Rent-Geared-to-Income units (50%), and Low-End-of-Market units (30%).
- Vehicular access to the development will be via both 55B Street and Ladner Trunk Road. As part of the redevelopment, the existing rear lane connecting to 55B Street at the north side of the site will be realigned and moved further to the north. This rear lane will provide access to a parking ramp leading to the development's underground parking.
- To enhance driver and pedestrian sightlines at the 55B Street rear lane access, the City is planning to restrict on-street parking on either side of the lane for a distance of approximately 14m (i.e., two parallel parking stall lengths).
- To provide a place for passenger pick-up/drop-off, as well as to accommodate ride hailing, food delivery, and online retailer delivery services, the City intends to locate an on-street "Loading Zone" approximately 14m in length on 55B Street immediately south of the no parking zone. Furthermore, to help facilitate more frequent parking turnover (and therefore better availability), the City could consider implementing time restrictions on 55B Street south of the loading zone. Currently, no parking restrictions exist.
- The site is well-connected to transit being served by three different bus routes connecting it to the greater regional transit network. Specifically, bus routes #310, #601, #616, and #618 run within 60m of the site, with the closest bus stops located less than 30m walking distance from the site frontage on Ladner Trunk Road. These bus routes run relatively frequently with headways of less than 30 minutes seven days a week, with the #601 route arriving every 10 to 12 minutes during the AM and PM peak periods.

- The site is located in close proximity to a number of key pedestrian destinations with Leslie Park, Trenant Park Square, Ladner Centre, Paterson Park, Maple Crescent Park, and Hawthorne Elementary School all located within 800m of the site.
- At present, there are limited cycling facilities in the vicinity of the site. Bike routes in the area include shared bike lanes on Harvest Drive and Ladner Trunk Road (east of Harvest Drive), and an informal shared lane exists on 57A Street.

Traffic Impact Assessment

- The existing traffic analysis indicates that all study area intersections are currently operating within acceptable capacity parameters during the AM and PM peak hours.
- The proposed development is expected to generate approximately 33 (6 in, 27 out) and 54 (33 in, 21 out) net new vehicle trips during the AM and PM peak hours, respectively. This translates to fewer than one new trip per minute on average during both peak hours.
- The Opening Day (2024) Background and Total traffic analysis indicated that all study area intersections are anticipated to continue operating within acceptable capacity parameters, with or without the proposed development. As such, no intersection improvements are required to accommodate the future traffic demands within this timeline.

Signal Warrant Analysis

- A TAC signal warrant analysis was conducted to see whether the current pedestrian signal at 55B Street & Ladner Trunk Road would require a full traffic signal under existing, future Background, and/or future Total traffic conditions. The results of the analysis indicated that a full traffic signal would not be warranted under any of the three traffic scenarios analyzed.
- While a full signal was not shown to be warranted, it should be acknowledged that this intersection already operates as somewhat of a hybrid pedestrian signal as it has a vehicle detector loop on the minor street (55B Street), which is not typical of a pedestrian signal. As such, when a vehicle is forced to wait for an extended period of time to turn from 55B Street onto Ladner Trunk Road (i.e., more than 10 seconds), the detector loop will activate the signal and traffic will be stopped on Ladner Trunk Road.

Corner Cut Sight Distance Analysis

- Analysis was conducted to see whether a reduced 3m by 3m corner cut at the southwest corner of the subject property could be supported from a sight distance perspective, rather than providing the typical 6m by 6m corner cut required by the City. The sight distance tested included the sight distance between vehicles approaching from the east and vehicles attempting to turn from 55B Street (North) onto Ladner Trunk Road.

- The results of the analysis indicated that the minimum required stopping sight distance (SSD) and intersection sight distance (ISD) could still be achieved with the proposed reduced corner cut size. In fact, given the relative positions of the edge of the roadway and the property line (which is set far back from Ladner Trunk Road), the southwest corner of the site's property line would not impact vehicle sight triangles at all for this particular location.

Parking Analysis

Vehicle Parking

- The required parking supply for the development is 161 spaces (146 resident, 15 visitor) compared to a proposed supply of 155 spaces (140 resident, 15 visitor). This translates to an overall supply rate of 1.06 spaces per unit (0.96 resident, 0.10 visitor), representing a total shortfall of 6 spaces (4% reduction).
- The developer proposes 15 disability spaces and 37 small car spaces, both of which comply with the minimum requirement and maximum allowable requirement, respectively.

Bicycle Parking

- The proposed bicycle parking supply includes 157 resident bicycle spaces and 5 visitor bicycle spaces, which exceeds the minimum bylaw requirement for residents and meets the requirement for visitors.

Scooter Parking

- While not required based on the City's Zoning Bylaw, the developer proposes 5 scooter parking spaces in the underground parking level as an additional amenity for the site.

Site Servicing

- The developer proposes to provide a single loading space along the east side of the building immediately north of the east building entry to meet the City's Zoning Bylaw requirement.
- Bunt's vehicle turning path analysis indicated that an SU9 design vehicle would be able to successfully enter and exit the loading space without any maneuvering issues or conflicts.
- In addition to the development's off-street loading, as discussed above, the City intends to locate an on-street "Loading Zone" approximately 14m in length (i.e., two parallel parking stalls) on 55B Street along the site frontage (immediately south of the future No Parking zone on the south side of the 55B Street rear lane access). This Loading Zone will be used for passenger pick-up/drop-off, as well as to accommodate ride hailing services (e.g., Uber and Lyft), food delivery services (e.g., Uber Eats, Door Dash, etc.), and online retailer deliveries (E.g., Amazon, etc.).
- For waste collection, a small hauler truck would enter the underground parking to pick-up the garbage/recycling bins from the garbage room and drop the bins off in the staging area located at ground level. A full-sized garbage/recycling truck would then visit the site to transfer the contents

of the bins into the truck's container and then exit the site. Finally, the hauler truck would return to the site and take the empty garbage/recycling bins back to the garbage room.

- Bunt's vehicle turning path analysis indicated that both the hauler truck and a full-sized garbage truck could perform the required waste collection operations without any maneuvering issues or conflicts.

Parking Variance Rationale

- The City's Apartment Building parking rate does not take into account key factors which significantly impact vehicle ownership levels including income and the proximity of the site to alternative mode facilities and amenities.
- Based on industry studies and parking demand data from previous Bunt studies, it is evident that the above factors would have a considerable effect on the expected parking demand for both residents and visitors. For this reason, it is Bunt's opinion that the City's parking rate would overstate the actual parking demand and that the proposed parking supply rates for the development (i.e., 1.06 spaces per unit, including 0.96 for resident, 0.10 for visitor) would be adequate, if not conservative, for the site.

8.2 Recommendations

- With underground parking spaces generally costing in the order of \$60,000 to \$80,000 to construct, providing parking in excess of the anticipated demand would have a profound impact on the affordability of the proposed non-market housing units. For this reason, Bunt recommends that the City approve the proposed parking variances and associated rates for the development, which are expected to better reflect the anticipated parking demand, if not still remain conservative.
- As Bunt's analysis indicated that the proposed reduced 3m by 3m corner cut does not affect the ability to achieve the minimum required sight distances (SSD and ISD), Bunt recommends that the City of Delta approve the requested reduced size property line corner cut. This size of corner cut is consistent with what was provided by the recently constructed residential development at 5571 Ladner Trunk Road situated at the northwest corner of 55B Street (North) & Ladner Trunk Road.

APPENDIX A

Terms of Reference





MEMO

DATE: February 6, 2020
PROJECT NO: 04-20-0032P
PROJECT: **Ladner Willows Non-Market Housing TIA**
SUBJECT: **Proposed TIA Terms of Reference**

TO: Doreann Mayhew, City of Delta

PREPARED BY: James Lee, Bunt & Associates

The following document outlines Bunt's proposed Terms of Reference (ToR) for the Ladner Willows Non-Market Housing project at 5625 Ladner Trunk Road in Delta, BC.

The proposed study requirements reflect our phone conversation on Wednesday, January 22nd, 2019 and have used both the City of Delta's "Terms of Reference for Traffic Impact Studies" guidelines and the recently established Evergreen Lanes Non-Market Housing TIA ToR as reference guides.

Should you have any questions or comments, please do not hesitate to contact me.

Yours truly,

Bunt & Associates

A handwritten signature in black ink, appearing to read "James Lee", written over a light blue horizontal line.

James Lee, P.Eng., MBA, PMP

Associate, Senior Transportation Engineer

1. PROPOSED TERMS OF REFERENCE

1.1 Report

- Sealed and signed by a Professional Engineer registered in the Province of British Columbia.

Note: The report will not be signed and sealed until the report has been finalized. This finalization of the report would occur once the City has provided all review comments on the draft report and the comments have been addressed by Bunt.

1.2 Study Contents

1.2.1 Proposed Development and Study Area

- Describe the land use(s) in the proposed development;
- Provide a map of the site plan and street network.

1.2.2 Existing Traffic Conditions

- Describe the nearby roadway/intersection classifications and traffic control types at study intersections;
- Summarize the existing multi-modal transportation network, including pedestrian, bicycle, and transit facilities in the nearby area;
- Collect traffic volume data for the weekday AM (7am-9am) and PM periods (3pm-6pm) at the following nearby study intersections:
 1. Ladner Trunk Road & 55b Street (north);
 2. Ladner Trunk Road & 55b Street (south); and,
 3. Site Access(es).

Note: For the purposes of conducting the Signal Warrant Analysis (See Section 1.2.4) at Ladner Trunk Road & 55b Street (north), weekday mid-day (11am-1pm) traffic volume data will also be collected at this location.

- Assess existing traffic operations at the study intersections listed above for the weekday AM and PM peak hour periods. The measures of effectiveness (MOEs) will include Level of Service (LOS) delay, V/C ratio, and 95th percentile queue lengths.

1.2.3 Future Traffic Conditions

Proposed Site Traffic

- Estimate the site-generated traffic volumes during the AM and PM peak hours using ITE Trip Generation Manual (10th ed.) trip rates;
- Provide figure(s) showing proposed AM and PM peak hour site-generated traffic, including the distribution of the site trips to the adjacent study road network.

Future Traffic Operations Analysis

- Assess future Background (i.e., without development) traffic operations at the study intersections for the Opening Day scenario for the AM and PM peak hour periods;
- Assess future Total (i.e., with development) traffic operations at the study intersections for the Opening Day scenario for the AM and PM peak hour periods;
- Identify what mitigation measures (if any) would be required at the study intersections in order to accommodate the addition of site traffic; and,
- Provide figure(s) showing the AM and PM peak hour Background (i.e., without development) and Total (i.e., with development) traffic volumes for the projected Opening Day of the development.

1.2.4 Signal Warrant Analysis

- Conduct a signal warrant analysis (as per Transportation Association of Canada (TAC) guidelines) at Ladner Trunk Road & 55b Street (north) to determine whether the existing pedestrian-activated traffic signal warrants being upgraded to a full traffic signal. The warrant will be conducted under existing and future traffic conditions (both with and without future site-generated traffic).

1.2.5 Corner Cut Sight Distance Analysis

- Conduct a desktop sight distance assessment (as per TAC sight distance guidelines) at the Ladner Trunk Road & 55b Street (north) intersection to identify the required clear sight triangles. The purpose of this analysis is to determine whether the proposed 3m x 3m property line corner cut at the southwest corner of the subject site would be adequate to achieve the required sight triangles, or whether the City's required 6m x 6m corner cut is necessary.

1.2.6 Parking Analysis

- Review the proposed parking supply and compare to the City's Zoning Bylaw requirement; and,
- If a variance is required, prepare a parking supply variance rationale that supports the proposed parking supply. The rationale will be based on Bunt's pre-existing parking demand data for similar type developments, information included in industry studies, an emphasis on the alternative transportation mode facilities available in the nearby area, and, if applicable, planned Transportation Demand Management (TDM) measures for the site.

APPENDIX B

Synchro Output Results



HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Existing AM
03/03/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	3	29	3	0	51
Future Volume (Veh/h)	2	3	29	3	0	51
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	3	33	3	0	58
Pedestrians	20					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	2					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	112	54			56	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	112	54			56	
tC, single (s)	6.4	6.5			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.6			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	873	915			1533	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	5	36	58			
Volume Left	2	0	0			
Volume Right	3	3	0			
cSH	897	1700	1533			
Volume to Capacity	0.01	0.02	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.5				
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Existing AM
03/03/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	650	16	48	640	12	68
Future Volume (Veh/h)	650	16	48	640	12	68
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	722	18	53	711	13	76
Pedestrians					2	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						5
Median type	None			None		
Median storage veh						
Upstream signal (m)				28		
pX, platoon unblocked					0.93	
vC, conflicting volume			742		1194	372
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			742		1062	372
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		93	88
cM capacity (veh/h)			859		191	624
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	481	259	290	474	89	
Volume Left	0	0	53	0	13	
Volume Right	0	18	0	0	76	
cSH	1700	1700	859	1700	731	
Volume to Capacity	0.28	0.15	0.06	0.28	0.12	
Queue Length 95th (m)	0.0	0.0	1.5	0.0	3.1	
Control Delay (s)	0.0	0.0	2.3	0.0	13.6	
Lane LOS			A		B	
Approach Delay (s)	0.0		0.9		13.6	
Approach LOS					B	
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			50.9%	ICU Level of Service		A
Analysis Period (min)			15			

Queues

Existing AM

3: Ladner Trunk Road & 55b Street

03/03/2020

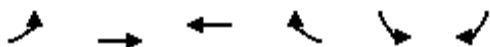


Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	780	726	57
v/c Ratio	0.31	0.27	0.20
Control Delay	4.8	4.5	13.0
Queue Delay	0.0	0.0	0.0
Total Delay	4.8	4.5	13.0
Queue Length 50th (m)	14.7	13.1	1.9
Queue Length 95th (m)	44.0	39.0	9.8
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2510	2678	582
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.31	0.27	0.10
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Existing AM
03/03/2020

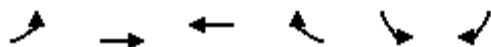


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	16	702	652	16	17	36
Future Volume (vph)	16	702	652	16	17	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.91	
Flt Protected		1.00	1.00		0.98	
Satd. Flow (prot)		3365	3364		1623	
Flt Permitted		0.94	1.00		0.98	
Satd. Flow (perm)		3152	3364		1623	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	763	709	17	18	39
RTOR Reduction (vph)	0	0	1	0	35	0
Lane Group Flow (vph)	0	780	725	0	22	0
Confl. Peds. (#/hr)	18			18	16	
Heavy Vehicles (%)	0%	6%	6%	6%	0%	6%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		51.5	51.5		7.3	
Effective Green, g (s)		51.5	51.5		7.3	
Actuated g/C Ratio		0.74	0.74		0.10	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2332	2489		170	
v/s Ratio Prot			0.22			
v/s Ratio Perm		c0.25			c0.01	
v/c Ratio		0.33	0.29		0.13	
Uniform Delay, d1		3.1	3.0		28.3	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.3	
Delay (s)		3.2	3.1		28.6	
Level of Service		A	A		C	
Approach Delay (s)		3.2	3.1		28.6	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			4.1		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.31			
Actuated Cycle Length (s)			69.6		Sum of lost time (s)	10.8
Intersection Capacity Utilization			53.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Existing AM
03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (veh/h)	2	717	664	3	3	4
Future Volume (Veh/h)	2	717	664	3	3	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	779	722	3	3	4
Pedestrians					18	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.93	
vC, conflicting volume	743				1135	380
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	743				1000	380
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	859				223	613
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	262	519	481	244	7	
Volume Left	2	0	0	0	3	
Volume Right	0	0	0	3	4	
cSH	859	1700	1700	1700	350	
Volume to Capacity	0.00	0.31	0.28	0.14	0.02	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.5	
Control Delay (s)	0.1	0.0	0.0	0.0	15.5	
Lane LOS	A				C	
Approach Delay (s)	0.0		0.0		15.5	
Approach LOS					C	
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			31.2%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Existing PM
03/03/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	0	45	3	1	48
Future Volume (Veh/h)	2	0	45	3	1	48
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	2	0	55	4	1	59
Pedestrians	16					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	134	73			75	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	134	73			75	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	851	980			1515	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	2	59	60			
Volume Left	2	0	1			
Volume Right	0	4	0			
cSH	851	1700	1515			
Volume to Capacity	0.00	0.03	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.2	0.0	0.1			
Lane LOS	A		A			
Approach Delay (s)	9.2	0.0	0.1			
Approach LOS	A					
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			17.5%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Existing PM
03/03/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↘			↙↑↑	↖	↗
Traffic Volume (veh/h)	828	25	60	709	10	46
Future Volume (Veh/h)	828	25	60	709	10	46
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	963	29	70	824	12	53
Pedestrians					23	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						5
Median type	None			None		
Median storage veh						
Upstream signal (m)				28		
pX, platoon unblocked					0.92	
vC, conflicting volume			1015		1552	519
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1015		1431	519
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		88	89
cM capacity (veh/h)			677		103	491
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	642	350	345	549	65	
Volume Left	0	0	70	0	12	
Volume Right	0	29	0	0	53	
cSH	1700	1700	677	1700	560	
Volume to Capacity	0.38	0.21	0.10	0.32	0.12	
Queue Length 95th (m)	0.0	0.0	2.6	0.0	3.0	
Control Delay (s)	0.0	0.0	3.3	0.0	19.0	
Lane LOS			A		C	
Approach Delay (s)	0.0		1.3		19.0	
Approach LOS					C	
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			58.4%	ICU Level of Service		B
Analysis Period (min)			15			

Queues

Existing PM

3: Ladner Trunk Road & 55b Street

03/03/2020

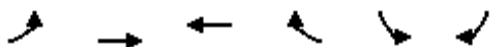


Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	950	814	54
v/c Ratio	0.38	0.29	0.18
Control Delay	5.2	4.5	12.2
Queue Delay	0.0	0.0	0.0
Total Delay	5.2	4.5	12.2
Queue Length 50th (m)	19.3	15.0	1.5
Queue Length 95th (m)	57.2	44.1	9.1
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2500	2784	589
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.38	0.29	0.09
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Existing PM
03/03/2020

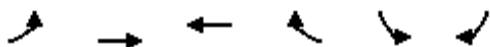


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	31	843	732	17	13	37
Future Volume (vph)	31	843	732	17	13	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.90	
Flt Protected		1.00	1.00		0.99	
Satd. Flow (prot)		3460	3494		1644	
Flt Permitted		0.91	1.00		0.99	
Satd. Flow (perm)		3141	3494		1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	916	796	18	14	40
RTOR Reduction (vph)	0	0	1	0	36	0
Lane Group Flow (vph)	0	950	813	0	18	0
Confl. Peds. (#/hr)	17			17	18	
Heavy Vehicles (%)	0%	3%	2%	6%	0%	3%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		51.5	51.5		7.3	
Effective Green, g (s)		51.5	51.5		7.3	
Actuated g/C Ratio		0.74	0.74		0.10	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2324	2585		172	
v/s Ratio Prot			0.23			
v/s Ratio Perm		c0.30			c0.01	
v/c Ratio		0.41	0.31		0.11	
Uniform Delay, d1		3.4	3.1		28.2	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.3	
Delay (s)		3.5	3.1		28.5	
Level of Service		A	A		C	
Approach Delay (s)		3.5	3.1		28.5	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			4.1		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.37			
Actuated Cycle Length (s)			69.6		Sum of lost time (s)	10.8
Intersection Capacity Utilization			61.6%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Existing PM
03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕↕	↕↕		↕↕	
Traffic Volume (veh/h)	2	854	748	0	1	1
Future Volume (Veh/h)	2	854	748	0	1	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	928	813	0	1	1
Pedestrians					14	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.91	
vC, conflicting volume	827				1295	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	827				1121	420
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	802				182	580
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	311	619	542	271	2	
Volume Left	2	0	0	0	1	
Volume Right	0	0	0	0	1	
cSH	802	1700	1700	1700	277	
Volume to Capacity	0.00	0.36	0.32	0.16	0.01	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.2	
Control Delay (s)	0.1	0.0	0.0	0.0	18.1	
Lane LOS	A				C	
Approach Delay (s)	0.0		0.0		18.1	
Approach LOS					C	
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			35.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Background 2024 AM

03/04/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	3	30	3	0	51
Future Volume (Veh/h)	2	3	30	3	0	51
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	2	3	34	3	0	58
Pedestrians	20					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	2					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	114	56			57	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	114	56			57	
tC, single (s)	6.4	6.5			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.6			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	872	913			1532	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	5	37	58			
Volume Left	2	0	0			
Volume Right	3	3	0			
cSH	896	1700	1532			
Volume to Capacity	0.01	0.02	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.0	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	9.0	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay		0.5				
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Background 2024 AM

03/04/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	676	17	50	666	12	71
Future Volume (Veh/h)	676	17	50	666	12	71
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	751	19	56	740	13	79
Pedestrians						2
Lane Width (m)						3.6
Walking Speed (m/s)						1.1
Percent Blockage						0
Right turn flare (veh)						5
Median type	None		None			
Median storage veh						
Upstream signal (m)	28					
pX, platoon unblocked					0.93	
vC, conflicting volume			772		1244	387
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			772		1108	387
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		93	87
cM capacity (veh/h)			837		176	610
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	501	269	303	493	92	
Volume Left	0	0	56	0	13	
Volume Right	0	19	0	0	79	
cSH	1700	1700	837	1700	711	
Volume to Capacity	0.29	0.16	0.07	0.29	0.13	
Queue Length 95th (m)	0.0	0.0	1.6	0.0	3.4	
Control Delay (s)	0.0	0.0	2.4	0.0	13.9	
Lane LOS			A			B
Approach Delay (s)	0.0		0.9		13.9	
Approach LOS						B
Intersection Summary						
Average Delay	1.2					
Intersection Capacity Utilization			52.4%	ICU Level of Service		A
Analysis Period (min)	15					



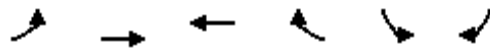
Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	811	755	60
v/c Ratio	0.32	0.28	0.21
Control Delay	4.9	4.5	13.3
Queue Delay	0.0	0.0	0.0
Total Delay	4.9	4.5	13.3
Queue Length 50th (m)	15.6	13.7	2.1
Queue Length 95th (m)	46.3	41.0	10.2
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2505	2678	585
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.32	0.28	0.10
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Background 2024 AM

03/04/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	17	730	678	17	18	37
Future Volume (vph)	17	730	678	17	18	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.91	
Flt Protected		1.00	1.00		0.98	
Satd. Flow (prot)		3365	3364		1627	
Flt Permitted		0.93	1.00		0.98	
Satd. Flow (perm)		3146	3364		1627	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	18	793	737	18	20	40
RTOR Reduction (vph)	0	0	1	0	36	0
Lane Group Flow (vph)	0	811	754	0	24	0
Confl. Peds. (#/hr)	18			18	16	
Heavy Vehicles (%)	0%	6%	6%	6%	0%	6%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		51.5	51.5		7.3	
Effective Green, g (s)		51.5	51.5		7.3	
Actuated g/C Ratio		0.74	0.74		0.10	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2327	2489		170	
v/s Ratio Prot			0.22			
v/s Ratio Perm		c0.26			c0.01	
v/c Ratio		0.35	0.30		0.14	
Uniform Delay, d1		3.2	3.0		28.3	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.4	
Delay (s)		3.3	3.1		28.7	
Level of Service		A	A		C	
Approach Delay (s)		3.3	3.1		28.7	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			4.1		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.32			
Actuated Cycle Length (s)			69.6		Sum of lost time (s)	10.8
Intersection Capacity Utilization			53.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Background 2024 AM

03/04/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (veh/h)	2	746	691	3	3	4
Future Volume (Veh/h)	2	746	691	3	3	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	811	751	3	3	4
Pedestrians					18	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.93	
vC, conflicting volume	772				1180	395
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	772				1038	395
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	99
cM capacity (veh/h)	838				209	600
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	272	541	501	253	7	
Volume Left	2	0	0	0	3	
Volume Right	0	0	0	3	4	
cSH	838	1700	1700	1700	333	
Volume to Capacity	0.00	0.32	0.29	0.15	0.02	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.5	
Control Delay (s)	0.1	0.0	0.0	0.0	16.0	
Lane LOS	A				C	
Approach Delay (s)	0.0		0.0		16.0	
Approach LOS					C	
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			32.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Background 2024 PM

03/03/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	2	0	47	3	1	50
Future Volume (Veh/h)	2	0	47	3	1	50
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	2	0	57	4	1	61
Pedestrians	16					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	138	75			77	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	138	75			77	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	847	978			1512	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	2	61	62			
Volume Left	2	0	1			
Volume Right	0	4	0			
cSH	847	1700	1512			
Volume to Capacity	0.00	0.04	0.00			
Queue Length 95th (m)	0.1	0.0	0.0			
Control Delay (s)	9.3	0.0	0.1			
Lane LOS	A		A			
Approach Delay (s)	9.3	0.0	0.1			
Approach LOS	A					
Intersection Summary						
Average Delay		0.2				
Intersection Capacity Utilization		17.5%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Background 2024 PM

03/03/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↖	↗
Traffic Volume (veh/h)	861	26	62	737	10	48
Future Volume (Veh/h)	861	26	62	737	10	48
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	1001	30	72	857	12	56
Pedestrians					23	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						5
Median type	None			None		
Median storage veh						
Upstream signal (m)				28		
pX, platoon unblocked					0.92	
vC, conflicting volume			1054		1612	538
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1054		1487	538
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		87	88
cM capacity (veh/h)			654		94	477
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	667	364	358	571	68	
Volume Left	0	0	72	0	12	
Volume Right	0	30	0	0	56	
cSH	1700	1700	654	1700	531	
Volume to Capacity	0.39	0.21	0.11	0.34	0.13	
Queue Length 95th (m)	0.0	0.0	2.8	0.0	3.3	
Control Delay (s)	0.0	0.0	3.4	0.0	19.8	
Lane LOS			A		C	
Approach Delay (s)	0.0		1.3		19.8	
Approach LOS					C	
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			60.2%	ICU Level of Service		B
Analysis Period (min)			15			



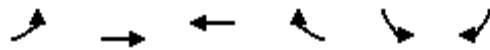
Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	988	847	56
v/c Ratio	0.40	0.30	0.19
Control Delay	5.4	4.6	12.3
Queue Delay	0.0	0.0	0.0
Total Delay	5.4	4.6	12.3
Queue Length 50th (m)	20.5	15.7	1.6
Queue Length 95th (m)	60.3	46.3	9.3
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2495	2781	591
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.40	0.30	0.09
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Background 2024 PM

03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	32	877	761	18	14	38
Future Volume (vph)	32	877	761	18	14	38
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		1.00	
Frt		1.00	1.00		0.90	
Flt Protected		1.00	1.00		0.99	
Satd. Flow (prot)		3460	3493		1646	
Flt Permitted		0.90	1.00		0.99	
Satd. Flow (perm)		3133	3493		1646	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	953	827	20	15	41
RTOR Reduction (vph)	0	0	1	0	37	0
Lane Group Flow (vph)	0	988	846	0	19	0
Confl. Peds. (#/hr)	17			17	18	
Heavy Vehicles (%)	0%	3%	2%	6%	0%	3%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		51.5	51.5		7.3	
Effective Green, g (s)		51.5	51.5		7.3	
Actuated g/C Ratio		0.74	0.74		0.10	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2318	2584		172	
v/s Ratio Prot			0.24			
v/s Ratio Perm		c0.32			c0.01	
v/c Ratio		0.43	0.33		0.11	
Uniform Delay, d1		3.4	3.1		28.2	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.3	
Delay (s)		3.6	3.2		28.5	
Level of Service		A	A		C	
Approach Delay (s)		3.6	3.2		28.5	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			4.1		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.39			
Actuated Cycle Length (s)			69.6		Sum of lost time (s)	10.8
Intersection Capacity Utilization			63.2%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Background 2024 PM

03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (veh/h)	2	888	778	0	1	1
Future Volume (Veh/h)	2	888	778	0	1	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	965	846	0	1	1
Pedestrians					14	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.90	
vC, conflicting volume	860				1346	437
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	860				1165	437
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	780				169	566
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	324	643	564	282	2	
Volume Left	2	0	0	0	1	
Volume Right	0	0	0	0	1	
cSH	780	1700	1700	1700	260	
Volume to Capacity	0.00	0.38	0.33	0.17	0.01	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	0.2	
Control Delay (s)	0.1	0.0	0.0	0.0	18.9	
Lane LOS	A				C	
Approach Delay (s)	0.0		0.0		18.9	
Approach LOS					C	
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			35.9%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Total 2024 AM
03/04/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	20	0	30	7	1	53
Future Volume (Veh/h)	20	0	30	7	1	53
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	23	0	34	8	1	60
Pedestrians	20					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	2					
Right turn flare (veh)						
Median type			None			None
Median storage (veh)						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	120	58			62	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	120	58			62	
tC, single (s)	6.4	6.5			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.6			2.2	
p0 queue free %	97	100			100	
cM capacity (veh/h)	864	910			1526	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	23	42	61			
Volume Left	23	0	1			
Volume Right	0	8	0			
cSH	864	1700	1526			
Volume to Capacity	0.03	0.02	0.00			
Queue Length 95th (m)	0.6	0.0	0.0			
Control Delay (s)	9.3	0.0	0.1			
Lane LOS	A		A			
Approach Delay (s)	9.3	0.0	0.1			
Approach LOS	A					
Intersection Summary						
Average Delay		1.8				
Intersection Capacity Utilization		18.2%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Total 2024 AM
03/04/2020

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	680	17	52	679	12	71
Future Volume (Veh/h)	680	17	52	679	12	71
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	756	19	58	754	13	79
Pedestrians					2	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						5
Median type	None			None		
Median storage veh						
Upstream signal (m)				28		
pX, platoon unblocked					0.92	
vC, conflicting volume			777		1260	390
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			777		1107	390
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		93	87
cM capacity (veh/h)			834		174	608
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	504	271	309	503	92	
Volume Left	0	0	58	0	13	
Volume Right	0	19	0	0	79	
cSH	1700	1700	834	1700	708	
Volume to Capacity	0.30	0.16	0.07	0.30	0.13	
Queue Length 95th (m)	0.0	0.0	1.7	0.0	3.4	
Control Delay (s)	0.0	0.0	2.4	0.0	14.0	
Lane LOS			A		B	
Approach Delay (s)	0.0		0.9		14.0	
Approach LOS					B	
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			53.0%		ICU Level of Service	A
Analysis Period (min)			15			

Queues

Total 2024 AM

3: Ladner Trunk Road & 55b Street

03/04/2020

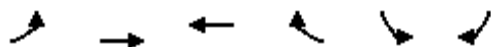


Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	818	761	79
v/c Ratio	0.35	0.31	0.27
Control Delay	5.6	5.2	13.8
Queue Delay	0.0	0.0	0.0
Total Delay	5.6	5.2	13.8
Queue Length 50th (m)	15.7	13.8	3.1
Queue Length 95th (m)	46.9	41.3	12.4
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2309	2487	592
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.35	0.31	0.13
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Total 2024 AM
03/04/2020

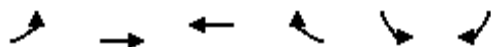


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	20	732	684	17	27	46
Future Volume (vph)	20	732	684	17	27	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		0.99	
Frt		1.00	1.00		0.91	
Flt Protected		1.00	1.00		0.98	
Satd. Flow (prot)		3365	3364		1635	
Flt Permitted		0.93	1.00		0.98	
Satd. Flow (perm)		3123	3364		1635	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	796	743	18	29	50
RTOR Reduction (vph)	0	0	1	0	43	0
Lane Group Flow (vph)	0	818	760	0	36	0
Confl. Peds. (#/hr)	18			18	16	
Heavy Vehicles (%)	0%	6%	6%	6%	0%	6%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		48.9	48.9		9.0	
Effective Green, g (s)		48.9	48.9		9.0	
Actuated g/C Ratio		0.71	0.71		0.13	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2222	2394		214	
v/s Ratio Prot			0.23			
v/s Ratio Perm		c0.26			c0.02	
v/c Ratio		0.37	0.32		0.17	
Uniform Delay, d1		3.9	3.7		26.5	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.4	
Delay (s)		4.0	3.8		26.9	
Level of Service		A	A		C	
Approach Delay (s)		4.0	3.8		26.9	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			5.0		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.34			
Actuated Cycle Length (s)			68.7		Sum of lost time (s)	10.8
Intersection Capacity Utilization			53.2%		ICU Level of Service	A
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Total 2024 AM
03/04/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (veh/h)	4	755	691	3	10	10
Future Volume (Veh/h)	4	755	691	3	10	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	821	751	3	11	11
Pedestrians					18	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.92	
vC, conflicting volume	772				1189	395
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	772				1026	395
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				95	98
cM capacity (veh/h)	838				210	600
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	278	547	501	253	22	
Volume Left	4	0	0	0	11	
Volume Right	0	0	0	3	11	
cSH	838	1700	1700	1700	311	
Volume to Capacity	0.00	0.32	0.29	0.15	0.07	
Queue Length 95th (m)	0.1	0.0	0.0	0.0	1.7	
Control Delay (s)	0.2	0.0	0.0	0.0	17.4	
Lane LOS	A				C	
Approach Delay (s)	0.1		0.0		17.4	
Approach LOS					C	
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			33.7%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

1: 55b Street & North Driveway

Total 2024 PM
03/03/2020

						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	12	1	47	19	2	50
Future Volume (Veh/h)	12	1	47	19	2	50
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	15	1	57	23	2	61
Pedestrians	16					
Lane Width (m)	3.6					
Walking Speed (m/s)	1.1					
Percent Blockage	1					
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (m)			79			
pX, platoon unblocked						
vC, conflicting volume	150	84			96	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	150	84			96	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	100			100	
cM capacity (veh/h)	834	966			1488	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	16	80	63			
Volume Left	15	0	2			
Volume Right	1	23	0			
cSH	841	1700	1488			
Volume to Capacity	0.02	0.05	0.00			
Queue Length 95th (m)	0.4	0.0	0.0			
Control Delay (s)	9.4	0.0	0.2			
Lane LOS	A		A			
Approach Delay (s)	9.4	0.0	0.2			
Approach LOS	A					
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			17.9%	ICU Level of Service		A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

2: 55b Street & Ladner Trunk Road

Total 2024 PM
03/03/2020

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑			↑↑	↖	↗
Traffic Volume (veh/h)	879	26	64	746	10	48
Future Volume (Veh/h)	879	26	64	746	10	48
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	1022	30	74	867	12	56
Pedestrians					23	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					2	
Right turn flare (veh)						5
Median type	None			None		
Median storage veh						
Upstream signal (m)				28		
pX, platoon unblocked					0.92	
vC, conflicting volume			1075		1642	549
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1075		1518	549
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			88		86	88
cM capacity (veh/h)			642		89	470
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	
Volume Total	681	371	363	578	68	
Volume Left	0	0	74	0	12	
Volume Right	0	30	0	0	56	
cSH	1700	1700	642	1700	504	
Volume to Capacity	0.40	0.22	0.12	0.34	0.14	
Queue Length 95th (m)	0.0	0.0	3.0	0.0	3.5	
Control Delay (s)	0.0	0.0	3.6	0.0	20.4	
Lane LOS			A		C	
Approach Delay (s)	0.0		1.4		20.4	
Approach LOS					C	
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			61.0%	ICU Level of Service		B
Analysis Period (min)			15			

Queues

Total 2024 PM

3: Ladner Trunk Road & 55b Street

03/03/2020



Lane Group	EBT	WBT	SBL
Lane Group Flow (vph)	1008	859	68
v/c Ratio	0.41	0.31	0.23
Control Delay	5.5	4.6	12.8
Queue Delay	0.0	0.0	0.0
Total Delay	5.5	4.6	12.8
Queue Length 50th (m)	21.4	16.0	2.3
Queue Length 95th (m)	63.2	47.2	10.8
Internal Link Dist (m)	3.8	71.7	55.3
Turn Bay Length (m)			
Base Capacity (vph)	2432	2777	597
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.41	0.31	0.11
Intersection Summary			

HCM Signalized Intersection Capacity Analysis

3: Ladner Trunk Road & 55b Street

Total 2024 PM
03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (vph)	42	885	766	24	19	43
Future Volume (vph)	42	885	766	24	19	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.4	5.4		5.4	
Lane Util. Factor		0.95	0.95		1.00	
Frpb, ped/bikes		1.00	1.00		1.00	
Flpb, ped/bikes		1.00	1.00		0.99	
Frt		1.00	1.00		0.91	
Flt Protected		1.00	1.00		0.98	
Satd. Flow (prot)		3459	3488		1654	
Flt Permitted		0.88	1.00		0.98	
Satd. Flow (perm)		3055	3488		1654	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	962	833	26	21	47
RTOR Reduction (vph)	0	0	2	0	42	0
Lane Group Flow (vph)	0	1008	857	0	26	0
Confl. Peds. (#/hr)	17			17	18	
Heavy Vehicles (%)	0%	3%	2%	6%	0%	3%
Bus Blockages (#/hr)	0	6	4	0	0	0
Turn Type	Perm	NA	NA		Perm	
Protected Phases		2	6			
Permitted Phases	2				4	
Actuated Green, G (s)		51.5	51.5		7.3	
Effective Green, g (s)		51.5	51.5		7.3	
Actuated g/C Ratio		0.74	0.74		0.10	
Clearance Time (s)		5.4	5.4		5.4	
Vehicle Extension (s)		3.0	3.0		3.0	
Lane Grp Cap (vph)		2260	2580		173	
v/s Ratio Prot			0.25			
v/s Ratio Perm		c0.33			c0.02	
v/c Ratio		0.45	0.33		0.15	
Uniform Delay, d1		3.5	3.1		28.3	
Progression Factor		1.00	1.00		1.00	
Incremental Delay, d2		0.1	0.1		0.4	
Delay (s)		3.7	3.2		28.7	
Level of Service		A	A		C	
Approach Delay (s)		3.7	3.2		28.7	
Approach LOS		A	A		C	
Intersection Summary						
HCM 2000 Control Delay			4.3		HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio			0.41			
Actuated Cycle Length (s)			69.6		Sum of lost time (s)	10.8
Intersection Capacity Utilization			71.1%		ICU Level of Service	C
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis

4: Ladner Trunk Road & East Driveway

Total 2024 PM
03/03/2020



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑↑	
Traffic Volume (veh/h)	10	894	784	9	6	6
Future Volume (Veh/h)	10	894	784	9	6	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	972	852	10	7	7
Pedestrians					14	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)		96				
pX, platoon unblocked					0.90	
vC, conflicting volume	876				1379	445
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	876				1196	445
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				96	99
cM capacity (veh/h)	769				159	559
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	335	648	568	294	14	
Volume Left	11	0	0	0	7	
Volume Right	0	0	0	10	7	
cSH	769	1700	1700	1700	247	
Volume to Capacity	0.01	0.38	0.33	0.17	0.06	
Queue Length 95th (m)	0.3	0.0	0.0	0.0	1.4	
Control Delay (s)	0.5	0.0	0.0	0.0	20.4	
Lane LOS	A				C	
Approach Delay (s)	0.2		0.0		20.4	
Approach LOS					C	
Intersection Summary						
Average Delay			0.2			
Intersection Capacity Utilization			41.8%		ICU Level of Service	A
Analysis Period (min)			15			

APPENDIX C

Signal Warrant Analysis Results





City of Delta - Traffic Signal Warrant Analysis

Main Street (name) **Ladner Trunk Road**
 Side Street (name) **55b Street**
 Quadrant / Int #
 for Warrant Calculation Results, please hit 'Page Down'

Direction (EW or NS) **EW**
 Direction (EW or NS) **NS**
 Comments **Existing Conditions 2020**

Road Authority: **City of Delta**
 City: **City of Delta**
 Analysis Date: **2020 Feb 26, Wed**
 Count Date: **2020 Feb 25, Tue**
 Date Entry Format: **2/26/2020**

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Ladner Trunk Road	WB			1		1		220	2
Ladner Trunk Road	EB		1	1				220	2
55b Street	NB								
55b Street	SB				1				

Are the 55b Street SB right turns significantly impeded by through movements? (y/n) **n**

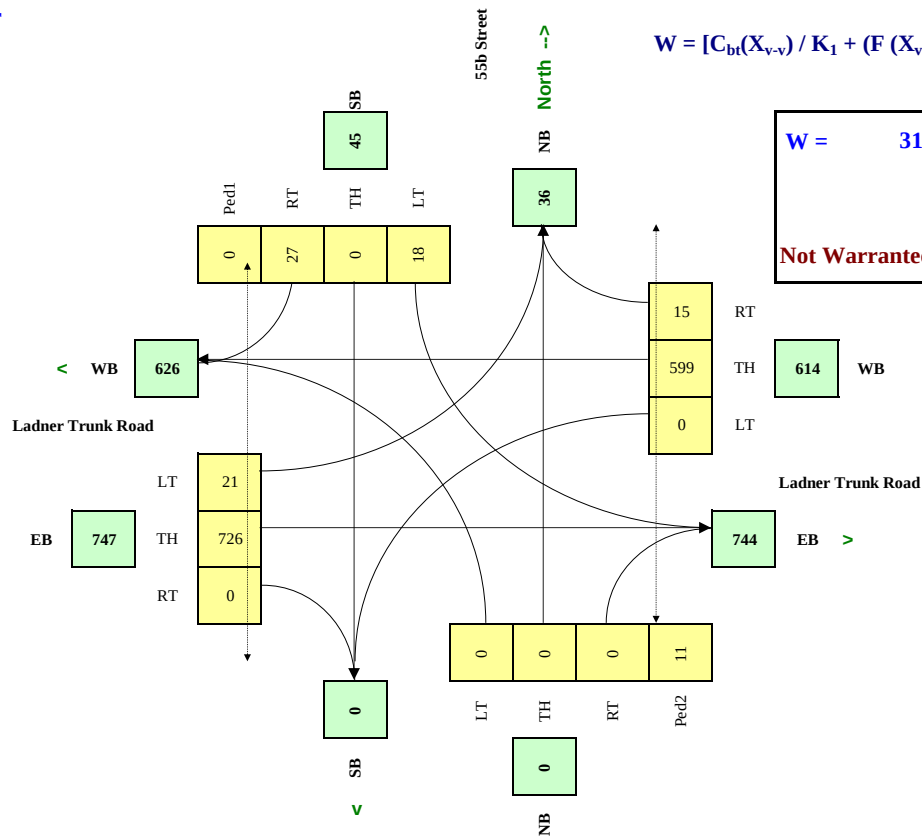
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Ladner Trunk Road	EW	50	6.0%	y	0.0
55b Street	NS	50	6.0%	n	

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,463,000
Central Business District	(y/n)	n

Set Peak Hours													Ped1	Ped2	Ped3	Ped4
Traffic Input	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00				30		23		319	12	8	688			11	24	
8:00 - 9:00				17		36		652	16	16	702			16	18	
11:00 - 12:00				12		19		500	11	18	694			6	11	
12:00 - 13:00				20		24		592	11	22	750			5	7	
15:00 - 16:00				13		37		732	17	31	843			18	17	
16:00 - 17:00				15		25		798	22	31	679			7	15	
Total (6-hour peak)	0	0	0	107	0	164	0	3,593	89	126	4,356	0	0	63	92	0
Average (6-hour peak)	0	0	0	18	0	27	0	599	15	21	726	0	0	11	15	0

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$



W = 31 18 13
Veh Ped
Not Warranted - Vs<75

RESET SHEET



City of Delta - Traffic Signal Warrant Analysis

Main Street (name) **Ladner Trunk Road**
Side Street (name) **55b Street**
Quadrant / Int #
CHECK SHEET

Direction (EW or NS) **EW**
Direction (EW or NS) **NS**
Comments **Background Conditions 2024**

Road Authority: **City of Delta**
City: **City of Delta**
Analysis Date: **2020 Feb 26, Wed**
Count Date: **2020 Feb 25, Tue**
Date Entry Format: **2/26/2020**

for Warrant Calculation
Results, please hit 'Page
Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Ladner Trunk Road	WB			1		1		220	2
Ladner Trunk Road	EB		1	1				220	2
55b Street	NB								
55b Street	SB				1				

Are the 55b Street SB right turns significantly impeded by through movements? (y/n) **n**

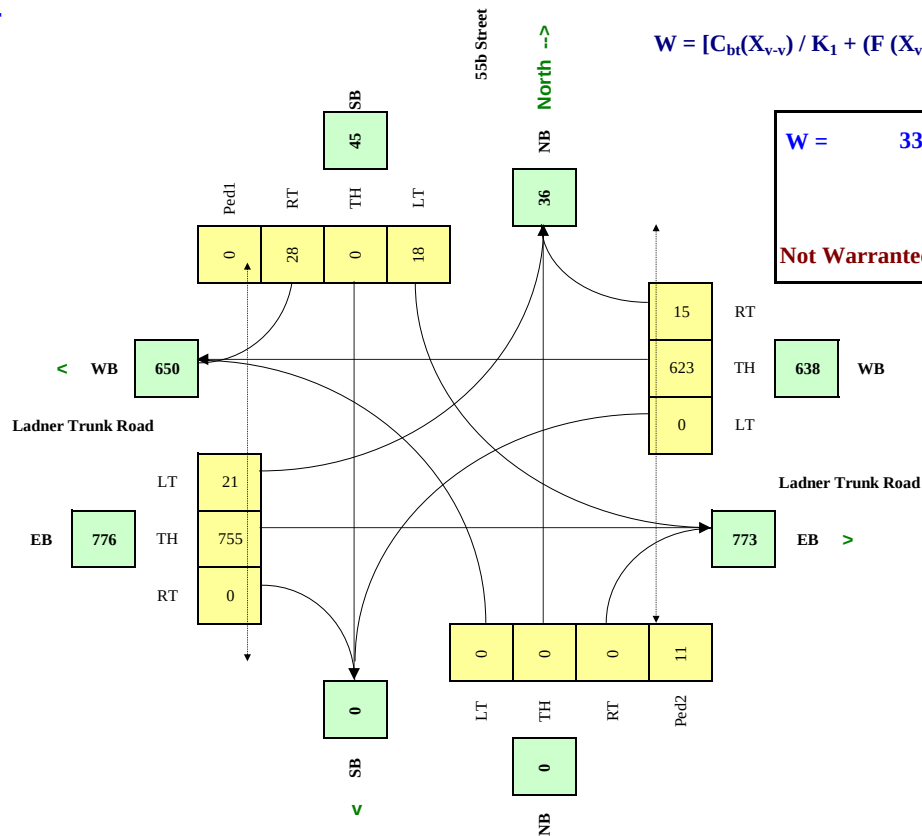
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Ladner Trunk Road	EW	50	6.0%	y	0.0
55b Street	NS	50	6.0%	n	

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,463,000
Central Business District	(y/n)	n

Set Peak Hours													Ped1	Ped2	Ped3	Ped4
Traffic Input	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00				30		23		332	12	8	716			11	24	
8:00 - 9:00				17		36		679	16	16	730			16	18	
11:00 - 12:00				12		19		519	11	18	722			6	11	
12:00 - 13:00				20		24		616	11	22	780			5	7	
15:00 - 16:00				13		38		761	17	31	877			18	17	
16:00 - 17:00				15		25		830	22	31	706			7	15	
Total (6-hour peak)	0	0	0	107	0	165	0	3,737	89	126	4,531	0	0	63	92	0
Average (6-hour peak)	0	0	0	18	0	28	0	623	15	21	755	0	0	11	15	0

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$



W = 33 19 14
Veh Ped
Not Warranted - Vs<75

RESET SHEET



City of Delta - Traffic Signal Warrant Analysis

Main Street (name) **Ladner Trunk Road**
Side Street (name) **55b Street**
Quadrant / Int #
CHECK SHEET

Direction (EW or NS) **EW**
Direction (EW or NS) **NS**
Comments **Total Conditions 2024**

Road Authority: **City of Delta**
City: **City of Delta**
Analysis Date: **2020 Feb 26, Wed**
Count Date: **2020 Feb 25, Tue**
Date Entry Format: **2/26/2020**

for Warrant Calculation
Results, please hit 'Page
Down'

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Ladner Trunk Road	WB			1		1		220	2
Ladner Trunk Road	EB		1	1				220	2
55b Street	NB								
55b Street	SB				1				

Are the 55b Street SB right turns significantly impeded by through movements? (y/n) **n**

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Ladner Trunk Road	EW	50	6.0%	y	0.0
55b Street	NS	50	6.0%	n	

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	2,463,000
Central Business District	(y/n)	n

Set Peak Hours													Ped1	Ped2	Ped3	Ped4
Traffic Input	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
7:00 - 8:00				39		32		341	15	12	720			35	77	
8:00 - 9:00				27		46		689	19	20	734			51	58	
11:00 - 12:00				19		26		526	13	21	725			19	35	
12:00 - 13:00				27		31		623	13	25	783			16	22	
15:00 - 16:00				19		44		767	26	41	887			58	54	
16:00 - 17:00				20		30		835	30	40	715			22	48	
Total (6-hour peak)	0	0	0	151	0	209	0	3,781	116	159	4,564	0	0	201	294	0
Average (6-hour peak)	0	0	0	25	0	35	0	630	19	27	761	0	0	34	49	0

Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$

