TRANSPORTATION PLANNERS AND ENGINEERS

bunt & associates

Qualicum Bus Garage Site
Transportation Mobility Study

Version 4

Prepared for

Town of Qualicum Beach

Date

June 6, 2024

Project No.

08-23-0012

Bunt & Associates acknowledges and respects the Traditional Territories upon which our work spans, and from which we benefit. We are grateful for the unique cultures and histories of Indigenous Peoples that enrich our understanding and connection to the lands we call home. We honour learning, listening, and truth in our journey to reconciliation.

June 6, 2024
08-23-0012

Luke Sales
Director of Planning and Community Development
Town of Qualicum Beach
Email: lSales@qualicumbeach.com

Dear Luke:

Re: Qualicum Beach Bus Garage Mobility Study
Version 4

Please find attached our Mobility Report for the proposed redevelopment of the Qualicum Beach Bus Garage site. This study reviews existing and future (with and without proposed development) traffic operations in the adjacent area and provides potential mitigation options to assist Qualicum Beach increase the viability of various forms of transportation in Qualicum's downtown area.

We trust this study will be helpful in the development rezoning application. Please do not hesitate to contact us if you have any questions.

Yours truly,
Bunt & Associates

Jason Potter, M.Sc., PTP
Associate | Senior Transportation Planner

Kieran Quan, EIT
Transportation Analyst

CORPORATE AUTHORIZATION

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Date: June 6, 2024
Project No. 08-23-0012
Version 4

Approved By: Yulia Liem, P.Eng, PTOE
Principal

Permit No. 1000468

Written with respect and gratitude for the Traditional Territories upon which we work and live.

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EXECUTIVE SUMMARY

Study Purpose & Objectives

Bunt & Associates Engineering Ltd. (Bunt) has prepared a Transportation Mobility Study to meet the following objectives:

- Summarize existing transportation conditions in the study area.
- Summarize relevant Town policies and plans.
- Estimate the proposed development's impact on study area traffic operations and review recommended mitigation.
- Review vehicle parking impacts of the proposed development and parking supply options.
- Provide a swept path analysis to confirm functionality of vehicle access, circulation, parking and loading.
- Recommend improvements to the study area multi-modal transportation network with the objective of improving the active transport mode share.

Development

The proposed development would replace the existing 130 parking space surface lot with a pedestrian plaza adjacent to a 1,748 m^2 health food store ('Naked Natural Foods'), and a 506 m^2 restaurant, with 9 residential units above.

The preferred plaza and parking option results in a total of 164 parking spaces (64 for Naked Natural building and 100 for public parking).

Traffic

- The Synchro model traffic analysis indicates existing traffic conditions at study area intersections operate within typical threshold criteria in regard to peak period delays and volume to capacity ratios.

- The most pressurized study area traffic movement is the westbound First Avenue to northbound Memorial Avenue left turn movement. Laning and traffic control mitigation options are limited due to the close proximity of the rail line, north of the intersection, which does not allow vehicles to stop north of the intersection. As this traffic movement is shown to operate within typically acceptable thresholds, no traffic related mitigation is recommended, rather mitigation recommendations for this intersection pertain to pedestrian realm improvement considerations.

- The proposed development is anticipated to generate approximately 220 vehicle trips (total in and out) during its peak hour period when using ITE trip generation rates. These volumes were used in the traffic analysis however it is noted that actual site trips in Qualicum Beach are anticipated to

be significantly lower due to its more dispersed peak hour and the applied grocery store rates likely being higher than anticipated to be generated by the more speciality Naked Natural store.

- The traffic model indicates that the additional traffic generated by the development is not anticipated to have a significant impact on local area traffic operations. All traffic movement remain within capacity thresholds with little difference between the existing and post-development scenarios.

Parking

- The proposed development will meet or exceed the vehicle, bicycle, and loading space supply requirements outlined in the bylaw.
- If, conservatively, the peak parking demand at the existing site is assumed to be 100%, an approximate 23 vehicle parking demand (depending on the site plan option) will be displaced off-site.
- Visitors arriving to the town from Highway 19 on Memorial Avenue may be more likely to bypass the site and seek parking in other areas as the proposed building will obscure some of the proposed surface parking. This may redistribute parking demand to less well-used parking in the study area.
- Bunt concludes that the surrounding area with its approximate 430 surface lot and on-street parking supply will be able to absorb the displaced demand for all three options with varying degrees of supportive measures. Supportive measures that may reduce the amount of displaced parking demand or redistribute the parking demand to less well-used locations in the study area, include:
    - The Town identify areas of underutilized in-block parking north and south of 2nd Avenue and considering adding wayfinding signage to direct motorists towards these potential parking options.
    - Mark on-street parking spaces with paint markings.
    - Monitor the parking demand of the site and the underground parking spaces once the proposed development is fully occupied. If there is excess parking demand, some of the underground parking spaces may be reassigned to unrestricted public parking.

Swept Path Analysis

The following site design updates are recommended based on the swept path analysis of the proposed Option 3 site plan:

- Provide a convex mirror on the corner of the underground parking access ramp to provide a sight line around the 90-degree corner and warn drivers to yield to oncoming vehicles.
- Remove the landscaping strip at the southeast corner of the site to accommodate inbound vehicle paths for WB-20 trucks.

Transportation Demand Management

Recommended study area transportation improvements for consideration include:

- Pedestrian related improvements near the Memorial Avenue & First Avenue/Fir Street and Memorial Avenue & Railway Street/Veterans Way intersections.
- A pedestrian scramble phase at the signalized Fern Road & Memorial Avenue intersections,
- A second pedestrian crossing of Fern Road adjacent to TOSH building.
- A sidewalk along Fourth Avenue's south edge, across from the development site, between Memorial Avenue and lane.
- Introduction of pedestrian amenities throughout downtown area such as benches and water fountains.
- Bicycle parking integrated into plaza design.
- Provision of long-term bicycle spaces (including larger sized cargo spaces) for building residents and at minimum a 6-space short-term bicycle rack for grocery store and residential visitors.

1. INTRODUCTION

1.1 Study Purpose & Objectives

PWL Partnership Landscape Architects, on behalf of the Town of Qualicum Beach, is seeking a transportation study for the proposed mixed-use grocery store/restaurant/residential development on the 'Qualicum Bus Garage' site in Qualicum Beach, BC. The 'Qualicum Bus Garage' site (the 'site') is currently an L-shaped parking lot on the southwest corner of Memorial Avenue & Fern Road; no other land uses exist on the site except for a heritage schoolhouse building (The Old School House / TOSH) which will be maintained.

The proposed development consists of a 1,748 m^2 health food store ('Naked Natural Foods'), a 506 m^2 restaurant, 4 one-bedroom units, and 5 two-bedroom units. Vehicle access is proposed via the existing access with Fern Road on the west side of the schoolhouse and the existing access with Fourth Avenue at the south edge of the site. The existing access with Fern Road on the east side of the schoolhouse is proposed to be removed.

There are currently three potential options for the proposed site plan. These options vary in their parking configuration and supply. All other aspects of the proposed development, including vehicles access and land use, are unchanged between the three options.

The developer and the Town of Qualicum Beach (the 'Town') are seeking a transportation mobility study with the following objectives:

- Summarize the existing and future land use, zoning, and transportation network connectivity of the proposed site;
- Summarize relevant Town policies and plans in the local area and their potential effect on transportation-related elements in the study area;
- Estimate the development's impact on traffic performance and provide recommended mitigations (if required);
- Review vehicle parking impacts of the proposed development;
- Provide a swept path analysis using AutoTURN software to confirm functionality of vehicle access, circulation, parking and loading for all three site plan options; and,
- Recommend improvements to the study area multi-modal network with the objective of improving the active mode split and the local pedestrian and cycling connections.

It should be noted that this study does not address the proposed parking supply, parking variance below the Town bylaw requirements, or reduction in public parking from the Downtown area. However, Bunt will undertake a separate study, to be completed at a later date, to address these items.

1.2 Study Area

The study area includes the following intersections:

- Memorial Avenue & Railway Street/Veterans Way
- Memorial Avenue & First Avenue/Fir Street
- Memorial Avenue & Second Avenue
- Memorial Avenue & Fern Road
- Memorial Avenue & Fourth Avenue
- Fern Road & West School Access
- Fern Road & Quality Foods Access
- Fern Road & East School Access
- Fourth Avenue & South Site Access

This study will review existing and total (existing + proposed development) traffic operations at the study intersections as well as provide a high-level review of pedestrian and/or cyclist improvement opportunities at the study intersections.

Exhibit 1.1 illustrates the site location and study area.

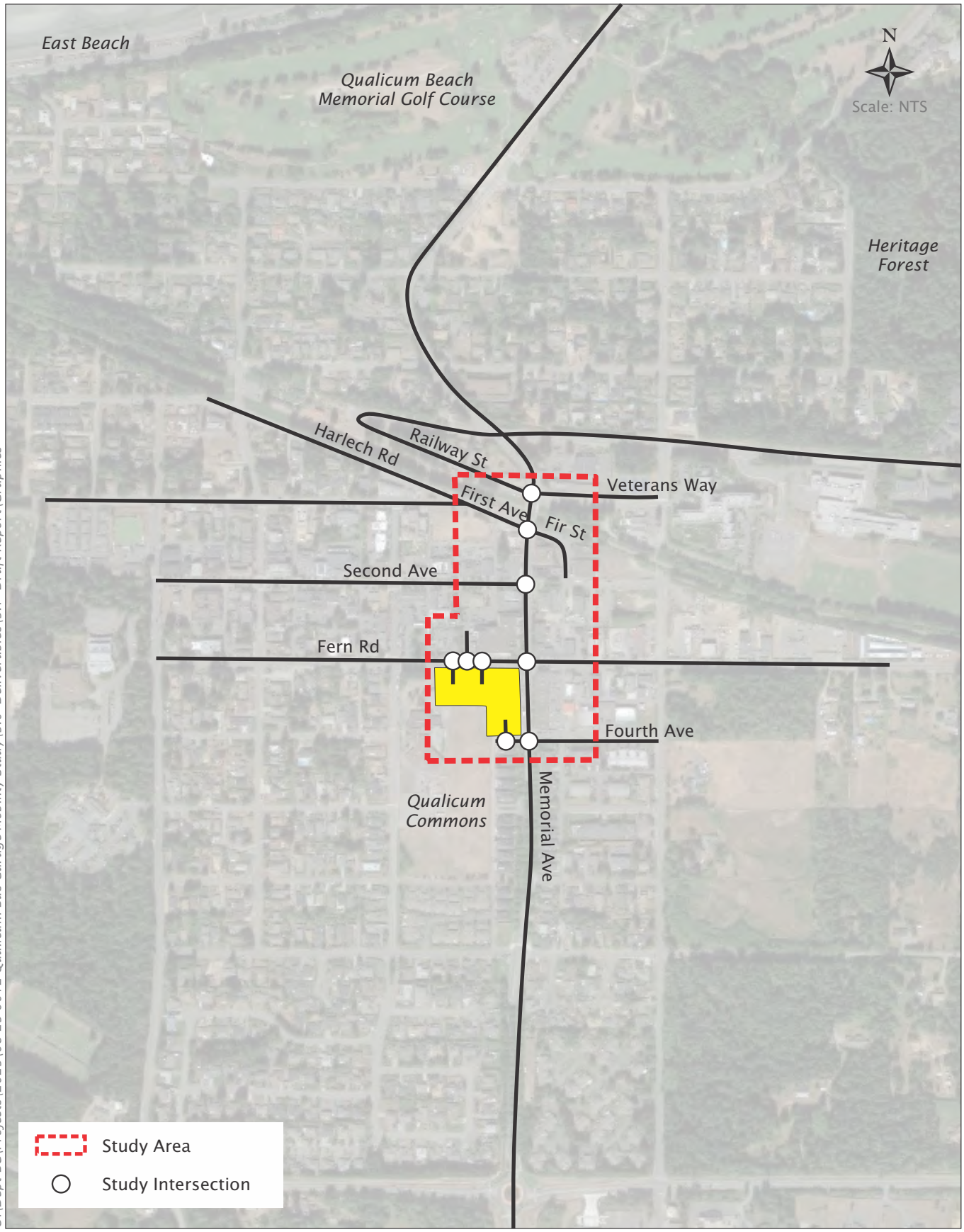

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Exhibit 1.1

Site Location & Study Area

08-23-0012

Qualicum Mobility
April 2024

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1.3 Organization of Report

Section 1 introduces the proposed development, study objectives, and study area.

Section 2 provides background information on the existing conditions of the site and study area in terms of its land use & zoning, transportation connectivity, relevant policies and plans, and traffic operations.

Section 3 summarizes the traffic operations analysis for the estimated total (with development) traffic scenario and provides recommended mitigations, if required.

Section 4 summarizes the Town parking requirements for the development and provides an estimate of the appropriateness of both the proposed parking supply for the development and the proposed reduction to the public parking supply in the area.

Section 5 summarizes the swept path analysis completed in AutoTURN software which confirms functionality of vehicle access, circulation, parking, and loading on the proposed site.

Section 6 provides high-level active mode focused concepts of potential pedestrian and/or cyclist improvements in the study area.

Section 7 summarizes the conclusions and recommendations of the study.

1.4 Proposed Development

Table 1.1 summarizes the proposed development land uses.

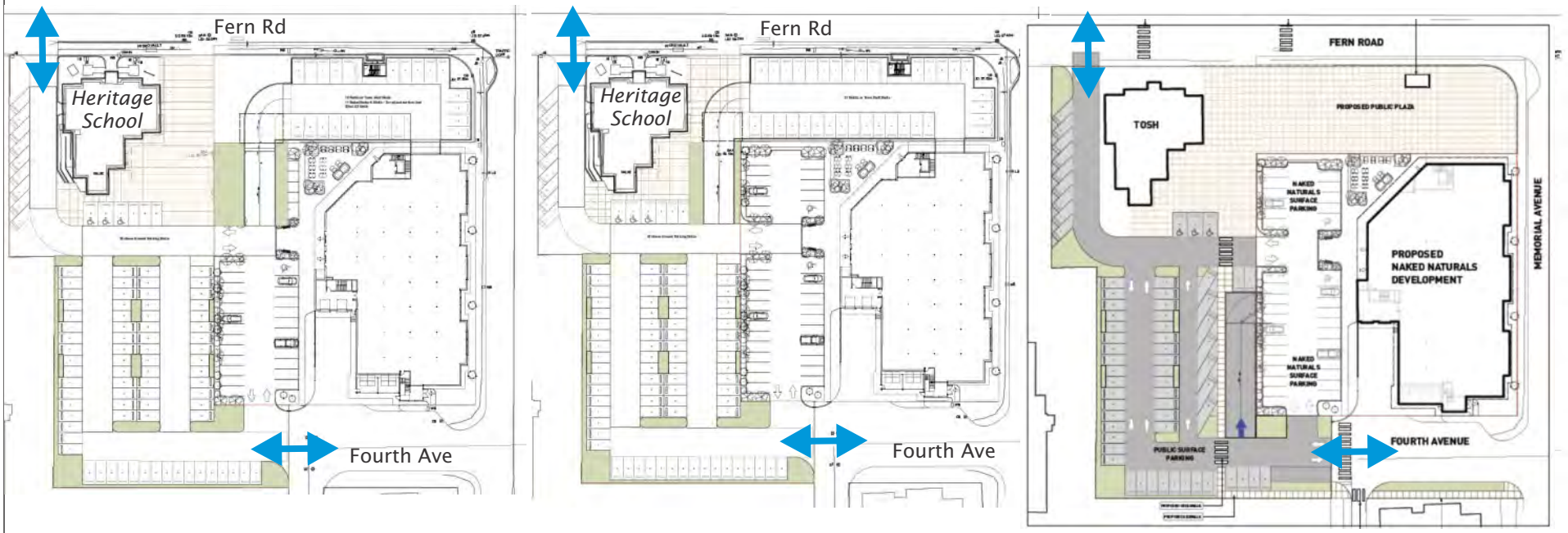
Table 1.1: Proposed Land Uses

LAND USE	DENSITY	UNITS
Health Food Store	1,748	Square Metres
Restaurant	506	Square Metres
1-bedroom unit	4	Dwelling Units
2-bedroom unit	5	Dwelling Units

Exhibit 1.2 illustrates the proposed site plan.

N

Scale: NTS



Option 1 **Option 2** **Option 3**

Proposed Vehicle Access

Exhibit 1.2
Site Plan

08-23-0012

Qualicum Mobility
March 2024

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2. EXISTING CONDITIONS

2.1 Site Location & Land Use

The site is centrally located in the 'Village Neighbourhood' which is Qualicum Beach's main commercial area. The site is currently occupied by a public parking lot with approximately 130 spaces.

2.2 Existing Transportation Network

2.2.1 Road Network

The site is located on the southwest corner of the signalized Memorial Avenue & Fern Road intersection.

Memorial Avenue is an arterial road that serves as the gateway to/from Highway 19 and serves as the main route into the Town. Memorial Avenue features one lane in each travel direction and on-street parking on both sides.

Fern Road is an arterial road that serves as a main access route for large commercial buildings such as the Quality Foods grocery store. Fern Road features one lane in each travel direction and on-street parking on both sides.

The remaining study intersections are unsignalized, with two-way stop control. The remaining study area roads mainly serve as collector roads for the commercial area. Most of which feature on-street parking on both sides.

2.2.2 Transit Network

Three bus routes operate within the study area. These are the 91, 97, and 99. The 91 provides connections to the communities to the south such as Parksville, Nanoose, and Lantzville and operates with 30–60-minute service at peak times. The 97 is a loop that runs through the residential neighbourhoods of the town and operates with approximately 60-minute service at peak times. Finally, the 99 provides connections to the communities to the north of the town such as Dashwood, Qualicum Bay, Bowser, and Deep Bay and operates once in the morning and once in the afternoon in each travel direction.

2.2.3 Cycling & Pedestrian Networks

There is minimal dedicated cycling infrastructure in the study area. However, many of the local roads near the study area, such as the section of Fourth Avenue to the west of the site, are signed as cycling connections and are suitable for cyclists of moderate skill level.

The site is well-connected to the local pedestrian network. Most study area roads feature concrete sidewalks on both sides. The signalized Memorial Avenue & Fern Road intersection features a pedestrian crosswalk on all four legs. All the unsignalized intersections on Memorial Avenue in the study area feature at least one leg with a painted zebra pedestrian crossing. There is a painted zebra pedestrian crossing on Fern Road between the site and the Quality Foods grocery store; this crossing also features a pole-

mounted overhead pedestrian crossing sign for additional visibility. Finally, the Dollymount Multi-Use trail runs from east to west along the inactive Island Rail Corridor between Qualicum Road and the Memorial Avenue & First Avenue/Fir Street intersection.

Exhibit 2.1 illustrates the transportation context as described in Sections 2.2.1 to 2.2.3 above.

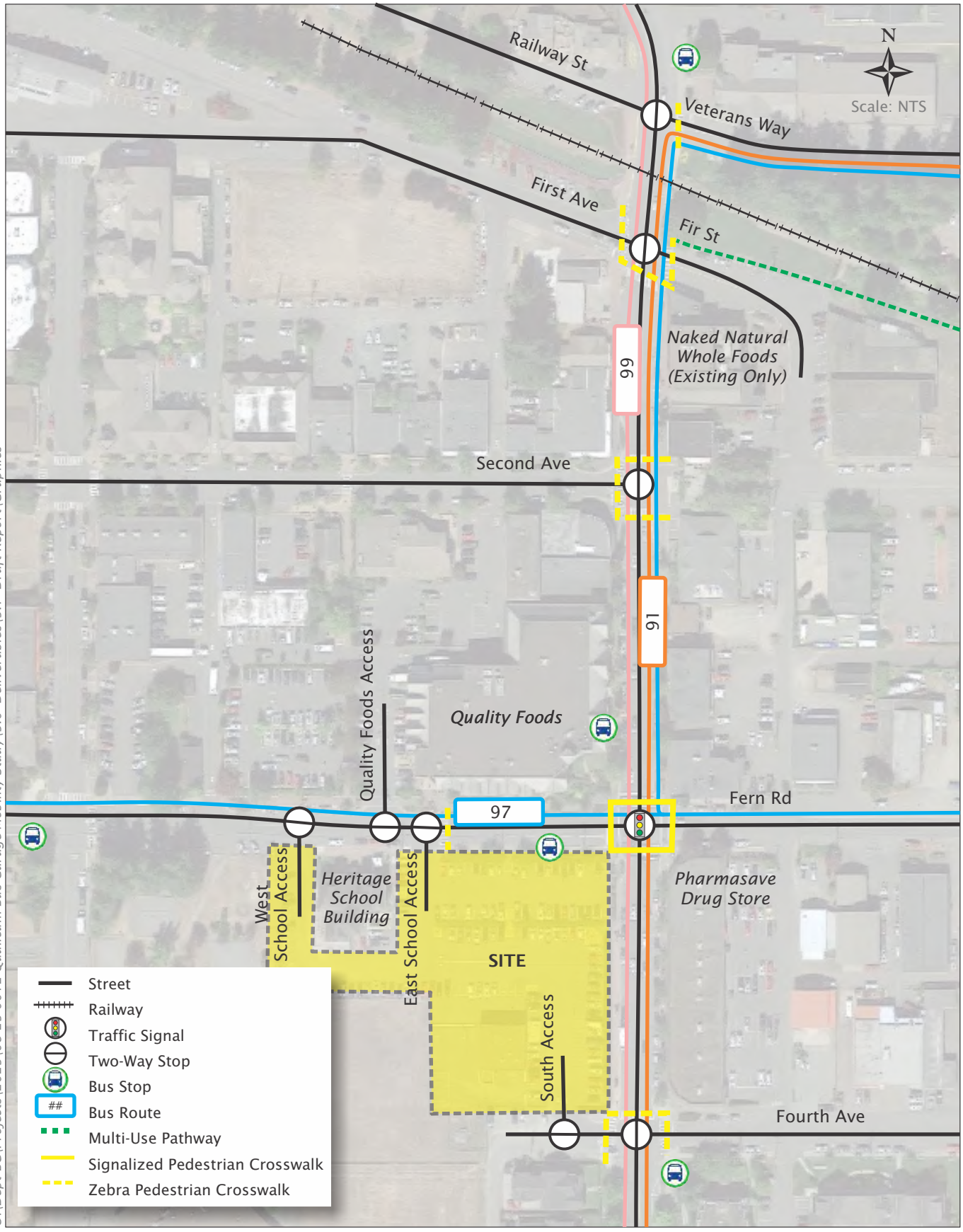

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Exhibit 2.1

Transportation Context

08-23-0012

Qualicum Mobility
April 2024

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2.3 Current Relevant Policies & Plans

2.3.1 Community Transportation Plan

The Town of Qualicum Beach *Community Transportation Plan* (formerly known as the *Age-Friendly Transportation Plan*) serves as a roadmap for upcoming pedestrian and cycling improvement projects. It should be noted that at the time of this study, the most recent version of the Community Transportation Plan was dated December 2019; however, there has recently been an update to the plan in 2024 This recent update is not anticipated to impact the findings and recommendations of this study. The two stated goals of the plan are to:

- Improve mobility by active transportation modes, and
- Improve safety for vulnerable road users.

The plan outlines a series of future projects that seek to achieve these goals. **Figure 2.1** illustrates one of the plan's projects relevant to the study area: an extension of the Dollymount multi-use path to run across the Memorial Avenue & First Avenue/Fir Street intersection and continue onto First Avenue and Harlech Road.

Figure 2.1: Community Transportation Plan: Proposed Dollymount Trail Extension[1]

[1] Town of Qualicum Beach, "Age-Friendly Transportation Plan 2019 Update," Town of Qualicum Beach, Qualicum Beach, BC, Canada, 27 December 2019. Accessed:
January 8, 2024. [Online]. Available: https://qualicumbeach.civicweb.net/document/9569/

2.4 Existing Traffic Volumes

2.4.1 Traffic Data Collection Program

The Town of Qualicum Beach indicated that the weekday peak hour of vehicle traffic in the town occurs between 13:00 and 15:00. Therefore, one hour of traffic data was collected at each study intersection during this period on weekdays (Tuesday, Wednesday, or Thursday) between November 16, 2023, and November 22, 2023.

Seasonal Adjustment

The traffic data collected in November 2023 was compared to previous traffic data collected in the summer to confirm if a seasonal adjustment factor would be required.

The Town supplied summer traffic volumes (from September 1st, 2012) at Memorial Avenue & First Avenue/Fir Street. A 1.5% per year linear growth rate was applied to this September 2012 data to estimate the traffic volumes at the same intersection in September 2023 (this equates to 16.5% growth applied to the intersection volumes). A 1.5% per year linear growth rate is consistent with the standard growth rate applied by other reviewing agencies in the area, such as the Ministry of Transportation and Infrastructure (MoTI). After applying this growth rate, the estimated September 2023 volumes were found to be 1.9% higher, on average, than the collected November 2023 volumes.

Based on these high-level findings, the study area traffic volumes are estimated to be approximately 2% higher on average in the summer than in November. This difference in volume is minimal and is not anticipated to have a significant impact on traffic operations in the study area. Therefore, no seasonal adjustment factor was applied, and the traffic volumes and operations presented in this study are based on the collected November 2023 data. Furthermore, it is noted that analysis of the non-summer peak period is considered a reasonable original approach as it represents typical conditions and includes schools being in-class.

2.4.2 Peak Hour Traffic Volumes

As a conservative measure, Bunt adjusted the traffic data in the study area by balancing the vehicle traffic data towards the higher volume of adjacent intersections. Bunt maintained existing turning movement distributions when balancing. **Exhibit 2.2** illustrates the existing peak hour traffic volumes in the study area, after volume balancing.

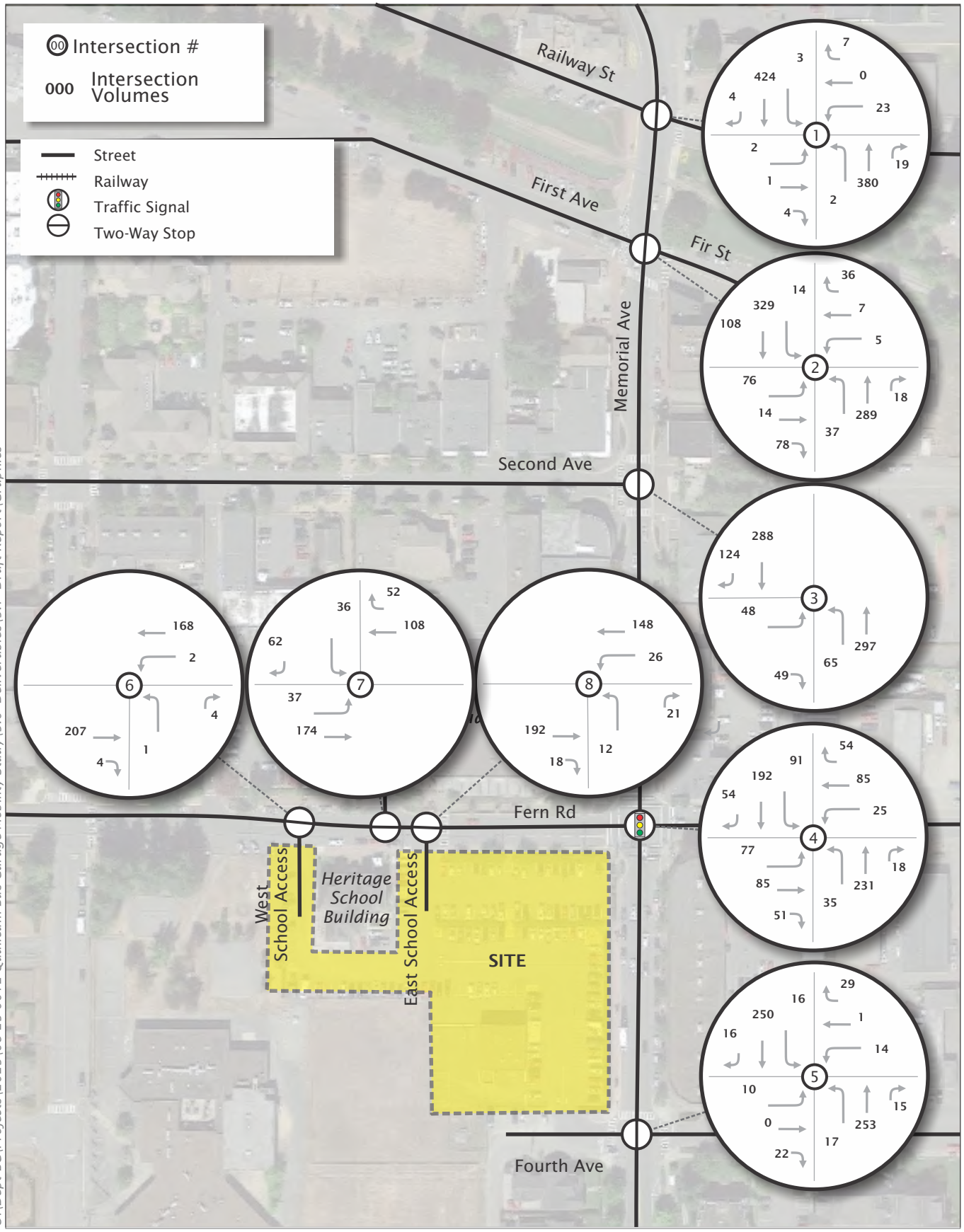

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Exhibit 2.2

Existing Peak Hour Traffic Volumes

2.5 Existing Operations

2.5.1 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 11 analysis software. The traffic operations were assessed using the performance measures of Level of Service (LOS) and volume-to-capacity (V/C) ratio.

The LOS rating is based on average vehicle delay and ranges from "A" to "F" based on the quality of operation at the intersection. LOS "A" represents optimal, minimal delay conditions while a LOS "F" represents an over-capacity condition with considerable congestion and/or delay. Delay is calculated in seconds and is based on the average intersection delay per vehicle.

Table 2.1 below summarizes the LOS thresholds for the six Levels of Service, for both signalized and unsignalized intersections.

Table 2.1: 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.

The performance thresholds that were used to trigger consideration of roadway or traffic control improvements to support roadway or traffic control improvements employed in this study are listed below:

Signalized Intersections:

- Overall intersection Level of Service = LOS D or better;
- Overall intersection V/C ratio = 0.85 or less;

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

Unsignalized Intersections and Roundabouts:

- Individual movement Level of Service = LOS E or better, unless the volume is very low in which case LOS F is acceptable.

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

2.5.2 Existing Conditions Analysis Assumptions

Signal Timing

Signal timing for the signalized Memorial Avenue & Fern Road intersection was provided by the Town of Qualicum Beach and input into Synchro software.

Synchro Parameters

Default Synchro parameters were used, except:

- Observed heavy vehicle percentages were used for each traffic movement, except where it was less than 2%, in which case the heavy vehicle percentage was set to a minimum of 2%; and,
- Overall intersection Peak Hour Factor (PHF) was applied to each traffic movement.

2.5.3 Existing Operational Analysis Results

Table 2.2 summarizes the existing peak hour traffic operations at the study intersections.

Table 2.2: Existing Traffic Operations

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	EXISTING (PM)		
		LOS	V/C	95TH Q (M)
Memorial Ave & Railway St/Veterans Way (unsignalized)	EBR	B	0.02	5
	WBLTR	C	0.12	5
	NBLTR	A	0.00	5
	SBLTR	A	0.00	5
Memorial Ave & First Ave/Fir St (unsignalized)	EBL	D	0.36	10
	EBTR	B	0.21	5
	WBLTR	B	0.12	5
	NBLTR	A	0.04	5
	SBLTR	A	0.01	5
Memorial Ave & Second Ave (unsignalized)	EBLR	C	0.32	10
	NBTL	A	0.07	5
	SBTR	A	0.26	5
Memorial Ave & Fern Rd (signalized)	*OVERALL*	*A*	*0.43*	*5*
	EBLTR	B	0.26	10
	WBLTR	B	0.32	20
	NBLTR	A	0.37	35
	SBLTR	A	0.49	45
Memorial Ave & Fourth Ave (unsignalized)	EBLTR	B	0.07	5
	WBLTR	B	0.10	5
	NBLTR	A	0.02	5
	SBLTR	A	0.01	5
West School Access & Fern Road (unsignalized)	EBTR	A	0.13	5
	WBTL	A	0.00	5
	NBLR	A	0.01	5
Fern Road & Quality Foods Access (unsignalized)	EBTL	A	0.04	5
	WBTR	A	0.11	5
	SBLR	B	0.19	5
East School Access & Fern Road (unsignalized)	EBTR	A	0.13	5
	WBTL	A	0.02	5
	NBLR	B	0.05	5
South Site Access & Fourth Ave (unsignalized)	EBTL	A	0.00	5
	WBTR	A	0.02	5
	SBLR	A	0.04	5

As shown above, the Synchro analysis indicates there are no traffic movements in the study area that exceed performance thresholds in the existing condition.

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. Bunt did not forecast a background traffic scenario due to the anticipated low growth in local traffic volumes in the near term. Instead, the total (with development) traffic will be compared to the existing traffic condition in this section.

3.1.2 Site Traffic

Site traffic is the estimated future peak hour vehicle volumes in the study area with an origin/destination of the proposed development. The following subsections summarize the methods used to estimate site traffic.

Trip Generation

Future vehicle trips from the proposed development are layered onto the existing conditions and its existing site trips. This analysis therefore assumes that the existing volume of parking lot (including TOSH) generated trips will remain consistent into the future condition despite an anticipated reduction in parking spaces. This assumption is considered a conservative approach which can account for potential additional trips generated by the proposed public plaza area of the site.

Bunt estimated the vehicle trip generation of the proposed development using the rates provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th Edition. **Tables 3.1** and **3.2** summarize the peak hour vehicle trip rates and estimated vehicle trips, respectively, for each land use. It should be noted that ITE does not provide trip rates for the specific peak hour of the study area (one hour between 13:00 and 15:00); therefore, Bunt applied the ITE trip rates for the PM peak hour between 16:00 and 18:00.

Table 3.1: Peak Hour Vehicle Trip Rates

LAND USE	UNITS	PM PEAK HOUR (4 – 6 PM)		
		IN (%)	OUT (%)	TOTAL
ITE 850 – Supermarket	1000 SF	50%	50%	8.95
ITE 932 – High-Turnover Sit-Down Restaurant	1000 SF	61%	39%	9.05
ITE 220 – Multifamily Housing (Low-Rise)	Dwelling Units	63%	37%	0.51

Table 3.2: Estimated Peak Hour Site Vehicle Trips

LAND USE	PM PEAK HOUR (4 – 6 PM)		
	IN	OUT	TOTAL
Health Food Store	84	84	168
Restaurant	30	19	49
Residential	3	2	5
TOTAL	117	105	222

Based on ITE rates, the proposed development is anticipated to generate approximately 220 (115 in, 105 out) vehicle trips in the PM peak hour. Substantially lower trip generation is anticipated from the site due to the following reasons:

- The rate for 'ITE 850 – Supermarket' was considered the most appropriate rate available to represent the proposed health food store. However, based on the ITE description of this land use category, the data used to inform this rate was collected at large grocery stores (e.g., Walmart, Superstore, Save-on-Foods, etc.). The proposed health food store will offer specialty food items as opposed to weekly groceries and is therefore anticipated to see less frequent activity and a reduced trip rate than ITE 850.
- The restaurant is anticipated to be more of ancillary land use to the grocery store rather than the rate applied which insinuates an approximate full 50-seat restaurant (average 25 vehicles entering per peak hour applied to a 2-person vehicle occupancy).
- The peak hour of the study area (one hour between 13:00 – 15:00) is anticipated to be outside of the peak hour of the proposed restaurant.

Due to these reasons the actual increase in peak hour trip generation of the proposed building site is anticipated to be in the magnitude of 100 total two-way trips in a peak hour period. This is the volume of traffic that would be added onto the existing volumes that are generated by the current public parking on the site, that will continue to do so on proposed public parking on the site.

Trip Distribution & Assignment

Bunt distributed the estimated site traffic throughout the study area using a combination of existing traffic patterns and engineering judgement. **Exhibit 3.1** illustrates site traffic forecasts.

3.1.3 Total Traffic

Bunt estimated the total (with development) traffic volumes by adding the estimated site traffic to the existing traffic volumes. **Exhibit 3.2** illustrates the total peak hour traffic volumes in the study area.

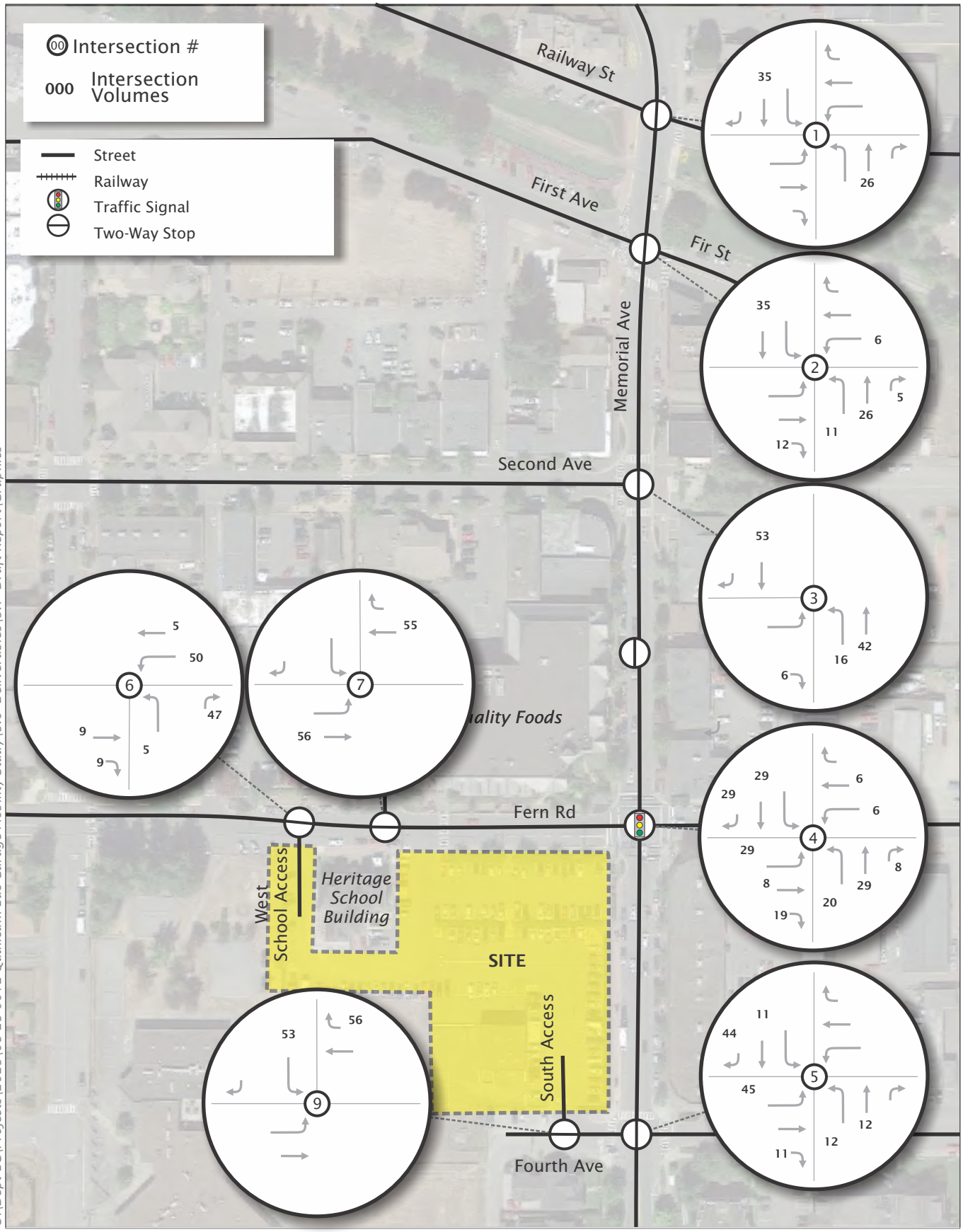

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Exhibit 3.1

Site Traffic Forecasts

08-23-0012

Qualicum Mobility
April 2024

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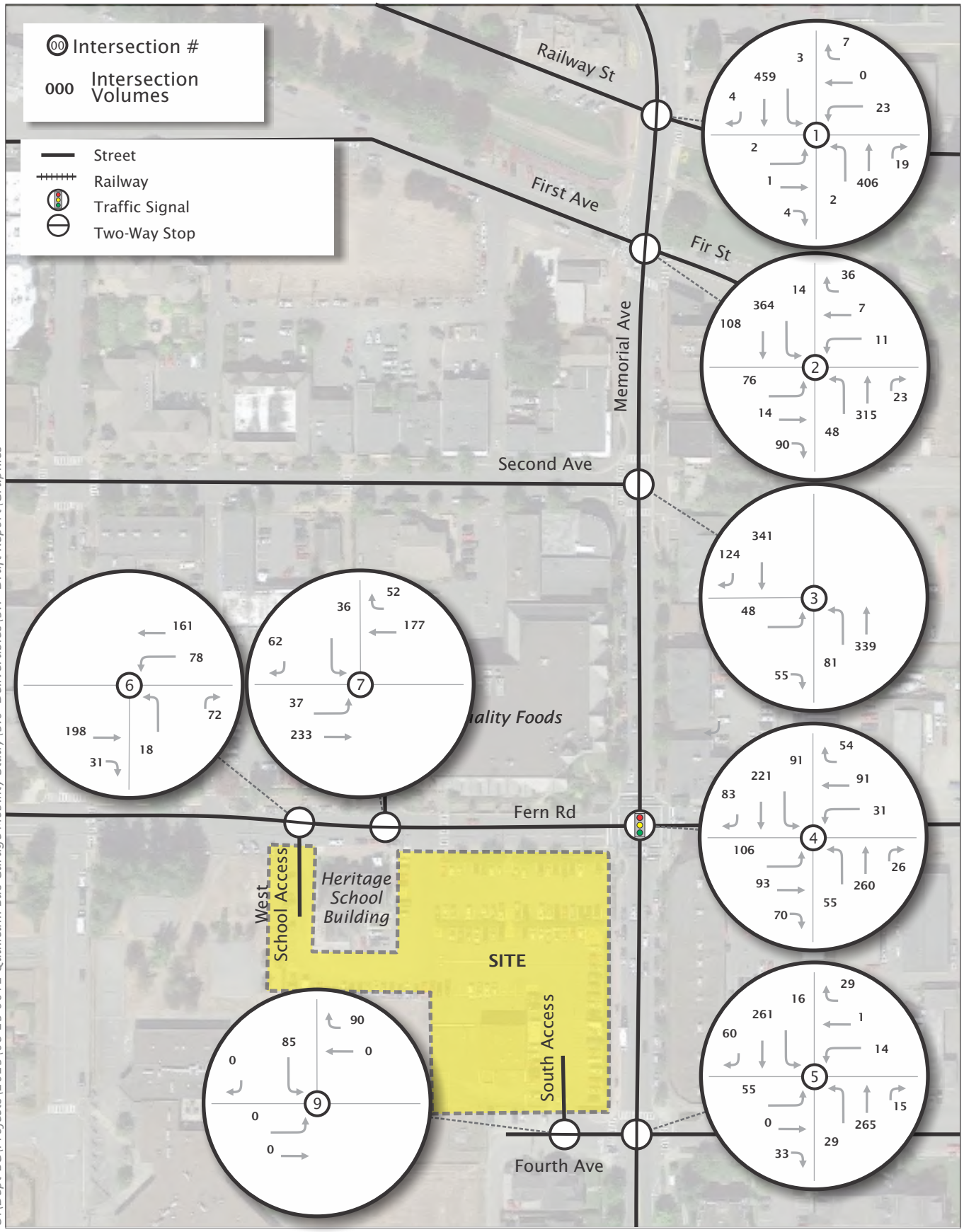

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Exhibit 3.2

Total Peak Hour Traffic Forecasts

3.2 Total Traffic Operations

3.2.1 Total Condition Analysis Assumptions

The signal timing and Synchro parameters applied to total condition are unchanged from the existing condition.

3.2.2 Total Traffic Operations

Table 3.3 compares the existing and total (with development) traffic operations in the study area.

Table 3.3: Existing vs. Total (with Development) Vehicle Operations

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	EXISTING			TOTAL (WITH SITE)		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
Memorial Ave & Railway St/Veterans Way (unsignalized)	EBR	B	0.02	5	C	0.02	5
	WBLTR	C	0.12	5	C	0.14	5
	NBLTR	A	0.00	5	A	0.00	5
	SBLTR	A	0.00	5	A	0.00	5
Memorial Ave & First Ave/Fir St (unsignalized)	EBL	D	0.36	10	E	0.42	15
	EBTR	B	0.21	5	C	0.25	10
	WBLTR	B	0.12	5	C	0.19	5
	NBLTR	A	0.04	5	*A*	*0.05*	5
	SBLTR	A	0.01	5	A	0.01	5
Memorial Ave & Second Ave (unsignalized)	EBLR	C	0.32	10	D	0.39	15
	NBTL	A	0.07	5	A	0.09	5
	SBTR	A	0.26	5	A	0.30	5
Memorial Ave & Fern Rd (signalized)	*OVERALL*	*A*	*0.43*	-	*A*	*0.50*	-
	EBLTR	B	0.26	10	B	0.33	15
	WBLTR	B	0.32	20	B	0.38	20
	NBLTR	A	0.37	35	A	0.47	45
	SBLTR	A	0.49	45	A	0.57	55
Memorial Ave & Fourth Ave (unsignalized)	EBLTR	B	0.07	5	C	0.28	10
	WBLTR	B	0.10	5	B	0.11	5
	NBLTR	A	0.02	5	A	0.03	5
	SBLTR	A	0.01	5	A	0.01	5
West School Access & Fern Road (unsignalized)	EBTR	A	0.13	5	A	0.15	5
	WBTL	A	0.00	5	A	0.07	5
	NBLR	A	0.01	5	B	0.14	5
Fern Road & Quality Foods Access (unsignalized)	EBTL	A	0.04	5	A	0.04	5
	WBTR	A	0.11	5	A	0.16	5
	SBLR	B	0.19	5	B	0.22	5
East School Access & Fern Road (unsignalized)	EBTR	A	0.13	5	A	0.17	5
	WBTL	A	0.02	5	A	0.00	5
	NBLR	B	0.05	5	A	0.05	5
South Site Access & Fourth Ave (unsignalized)	EBTL	A	0.00	5	A	0.00	5
	WBTR	A	0.02	5	A	0.06	5
	SBLR	A	0.04	5	A	0.10	5

As shown, the estimated site traffic is not anticipated to cause any movement to operate above performance thresholds. All traffic movements operate well within capacity and queuing thresholds.

All traffic movements operate at LOS C or better except for the eastbound left turn at the Memorial Avenue & First Avenue/Fir Street intersection, which operates at LOS D in the existing condition and at LOS E in the total condition. This is due to the high volume of north/south through traffic which may create difficulties for vehicles seeking a safe gap to turn left. However, the 95th percentile queues for this movement are minimal (approx. 2 vehicles in the existing condition and 3 vehicles in the total condition).

3.2.3 Consideration of Converting 2nd Avenue to One-Way Configuration

Bunt was asked to consider the opportunities and constraints related to the potential conversion of 2nd Avenue to a one-way configuration.

2nd Avenue currently operates with two-way travel with one travel lane in each direction with parallel curb-side parking along both road edges as well as two areas of angled parking. In the 3 blocks from Memorial Avenue to Jones Street, 2nd Avenue has approximately 98 curbside parking spaces (15 angled and 83 parallel).

Conversion to a one-way condition would allow for significantly reduced road width from the current 7-metre roadway to approximately 4-metres. This would allow for increased portions of angled parking.

Angled parking spaces have a typical depth (road to sidewalk) of 5.6m and a width of 4.5m. Parallel spaces have a typical width (road to sidewalk) of 2.5m and a length of 6.5m. With these measurements approximately parking supply can be increased by approximately 40% by converting areas of parallel to angled parking. In the context of 2nd Avenue this would equate to an approximate increase in parking spaces along the three-block section of 2nd Avenue from its current 98 spaces up to 135 spaces or an increase of approximately 35 spaces. Despite potentially reduced drive aisle width, pedestrian / sidewalk area would still need to be reduced in various locations along 2nd Avenue to allow width required for angled parking along both road edges.

Increase in parking supply is viewed as the main positive outcome of converting 2nd Avenue to one-way travel. Other positive impacts are shorter pedestrian crossing distances and reduced conflict points as pedestrians will only need to look one direction when crossing the roadway.

The described positive impacts are countered by the following factors:

- A one-way condition would reduce turning opportunities and put pressure on the surrounding minor street capacities resulting in potentially increased vehicle queues and delays the intersections.
- One-way streets tend to have higher vehicle operating speeds, this can also cause issues with angled parking vehicles backing out into the roadway.
- The angled parking can cause increased conflicts with cyclists due to reduced sightlines as well as the possibility of cyclists travelling counter to the one-way direction.

- One-way roads can be confusing for drivers, especially for non-residents and may increase travel distances for motorists which equates to higher levels of green house gas emissions.
- Converting to a one-way condition can lead to less direct access and reduced retail visibility for commercial development which is the prominent land use along 2nd Avenue.
- Converting to one-way travel is often controversial with the adjacent businesses due to potentially reduced access to their business.
- Costs of conversion to one-way are considerable.
- Parallel parking spaces have more favourable loading ability than angled parking as passengers can load/unload to a sidewalk rather than into an adjacent parking space.
- Further inputs from the Town indicate that the curb-to-curb width of 2nd Avenue (13m) is insufficient to accommodate the required width for one-way angled parking (15.2m) and as such the adjacent sidewalks would need to be reduced which would negatively impacting the pedestrian realm along 2nd Avenue.

Considering these factors, the positive outcomes of one-way conversion (increased parking spaces) are not considered to outweigh the negative impacts. If parking supply increases are desired it is recommended that the Town first look to better utilize parking supplies that currently exist behind many 2nd Avenue businesses through increase signage. If further parking is still desired, then it is recommended that the Town pursue opportunities for consolidated parking pools which allow motorists to find a parking space more easily with less travel distances.

3.2.4 Summary of Traffic Impacts & Recommended Mitigations

All traffic movements are within performance thresholds in both the existing and total scenario.

The Memorial Avenue & First Avenue/Fir Street eastbound left turn is approaching the threshold for vehicle delay (LOS D in the existing condition and LOS E in the total condition). Bunt tested the potential mitigation of converting the intersection to a 4-way stop. This is indicated to successfully reduce the delays for the movement to LOS C in the total condition. However, this mitigation is not recommended for the following reasons:

- There is a rail crossing approximately 15 metres north of where a stop bar for the north approach would be located. A 4-way stop may introduce queues on the north leg of the intersection, which creates a risk that vehicles would queue on the rail line. It should be noted that the rail line is not currently active; in the future, should it be confirmed that the rail line will be permanently closed, the Town intends to consider improvements at the intersection. Timing potential improvements with this process is advisable to avoid costly rework.
- Although vehicle delays are approaching the threshold, the Synchro analysis indicates that there are no significant capacity or queuing issues for the movement (V/C = 0.42, 95th percentile queue length = 15m or approx. 3 vehicles).
- As noted in Section 3.1.2, the estimated site vehicle trips are anticipated to be conservative. As a result, the Synchro analysis may be overstating the delays for the movement.

Due to the proximity of the rail crossing and the anticipated minimal impact to traffic performance, Bunt does not recommend any traffic-specific mitigations in the study area. However, the performance of the intersection should be monitored if further development is introduced in the local area.

An alternative mitigation option is to augment pedestrian crossings at the intersection which will provide more gaps in Memorial Avenue traffic, this can allow for reduced delays from First Avenue as northbound traffic on Memorial Avenue is stopped to allow for the pedestrians to cross. This mitigation option is discussed further in Section 5.

4. PARKING

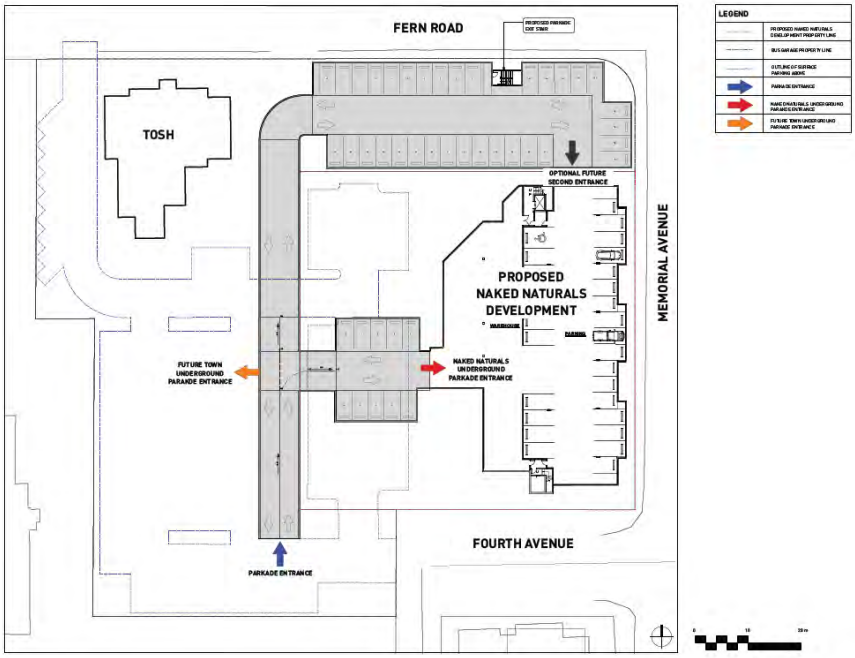
Three parking configurations were originally considered. All options had the same vehicle access points from the external road network. Each option includes 64 parking spaces (including 3 accessible) provided for the site land uses. In addition, depending on the site plan option, 73-118 parking spaces were provided for public parking. **Figure 4.1** illustrates the currently preferred option which has 107 public spaces, illustrating both surface and underground parking.

The preferred option has 64 spaces for the private development and 107 for public for a site total parking supply of 171 vehicle spaces.

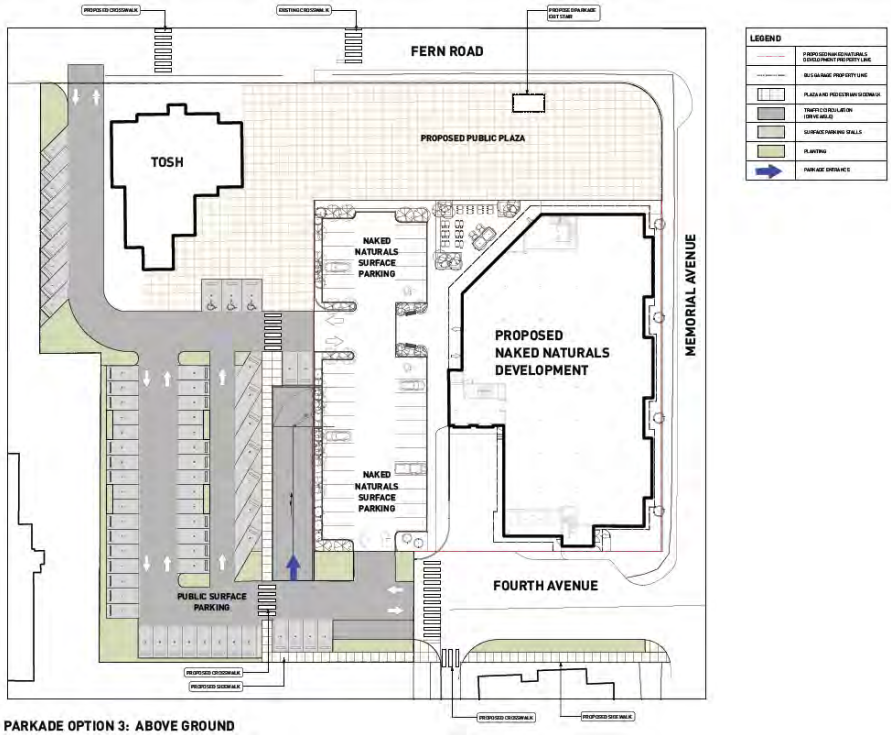
Due to all options resulting in public parking reductions, Bunt reviewed the viability of proposed parking supplies. The parking analysis:

- Summarizes the Town of Qualicum Beach parking and loading supply requirements for the proposed development and compare them to the proposed supply;
- Estimates the existing public parking demand of the site;
- Estimates the existing public parking supply in the local area;
- Estimates feasibility of the local area to absorb the displaced public parking demand;
- Identifies the preferred site plan option from a parking supply perspective;
- Recommends potential parking demand management strategies for the local area; and,
- Summarizes conclusions & recommendations.

Figure 4.1: Preferred Parking Option



PARKADE OPTION 3: BELOW GROUND



PARKADE OPTION 3: ABOVE GROUND

4.1 Bylaw Review

Vehicle parking supply requirements are outlined in the Town *Land Use and Subdivision Bylaw No. 580, 1999*[2] ('the bylaw'). Based on the Town *Official Community Plan Bylaw 800, 2018* ('OCP'), the site is in the "Village Neighbourhood" zone. Land uses in the "Village Neighbourhood" zone are subject to Schedule 6B, Section 2 of the bylaw. **Table 4.1** summarizes the vehicle parking supply requirement and provision for the proposed development (Naked Naturals building). The public plaza has no parking bylaw requirements.

Table 4.1: Vehicle Parking Supply Requirement & Provision (Village Neighbourhood)

LAND USE	DENSITY	BYLAW RATE	BYLAW SUPPLY REQUIREMENT	PROVIDED	DIFFERENCE
Ground Floor Commercial (Naked Naturals)	1,748 m²	1 / 40 m²	44	61	-
Above-Ground Floor Commercial (Restaurant)	506 m²	1 / 60 m²	8		
Multi-Dwelling Unit	9 units	1 / unit	9		
Accessible	66 spaces	1 for first 20, then 1 / 50	2	3	+1
		TOTAL	63	64	+1 ACCESSIBLE

The proposed development will exceed the parking supply requirement for its proposed land uses by 1 accessible parking space.

4.1.1 Small Car Parking Supply

Per the bylaw, up to 20% of the proposed parking spaces can be designed and designated as "small car" parking. The proposed small car parking supply is within the allowable maximum.

4.1.2 Bicycle Parking Supply

No bicycle parking spaces are required per the bylaw.

However, Bunt recommends that the Naked Naturals building consider bicycle parking for both residents (long-term) and visitors (short-term). Bunt recommends:

[2] Town of Qualicum Beach, "Land Use and Subdivision Bylaw No. 580, 1999", Town of Qualicum Beach, Qualicum Beach, BC, Canada, Consolidated January 2021. Accessed: January 23, 2024. [Online]. Available: https://qualicumbeach.civicweb.net/filepro/documents/5637/

- Two (2) horizontal bicycle parking spaces, including one (1) oversized cargo bicycle parking space, per residential unit, for a total of eighteen (18) spaces (including 9 cargo). The long-term bicycle parking for residents should be in a secure room within the development.
- A covered, 6-space bicycle rack at the main entrance to the building.

4.1.3 Loading Space Supply

For commercial land uses, one (1) loading space for each 2,000 m^2 of floor area or part thereof is required. The proposed development will provide two (2) loading spaces, which meets the requirement.

4.1.4 Bylaw Review Summary

The proposed Naked Naturals building will meet or exceed the vehicle, bicycle, and loading space supply requirements outlined in the bylaw. The public plaza has no parking requirements.

4.2 Public Parking Supply Review

The site is currently occupied by a public parking lot with approximately 130 spaces. The proposed development will provide 107 public parking spaces. This equates to a loss of 23 public parking spaces from the local area.

The following subsections review the existing parking demand at the site, and the parking supply in the surrounding area to determine the suitability of the proposed public parking supply reduction.

4.2.1 Existing Site Parking Demand

Parking Demand

Bunt counted the number of parked vehicles at the existing site parking lot on Thursday, January 11th, 2024, at 3:00 PM. The observed parking demand was 83 vehicles out of 130 spaces (64% parked).

It is noted that the peak parking demand is anticipated to be higher as data was collected at only one time and in January, which is assumed to be outside of the peak month. This said, the observed parking demand at the site compares well with the proposed public parking supply of 107 spaces.

At the same time, Bunt counted the number of parked vehicles at the Quality Foods and the Pharmasave. The observed parking demand was 71 vehicles out of 88 spaces (81% parked), and 14 vehicles out of 31 spaces (45% parked), respectively.

Parking Survey Data

Bunt circulated an intercept survey to drivers parked at the existing site in November 2023. The survey sought information on destination, origin, and duration. The following information was compiled from 55 responses:

- Destination: Quality Foods Grocery Store (62%), Employment (6%), Other (33%).
- Origin: Within Qualicum Beach (56%), Out of Town (44%).

- Duration: Less than 1 hour (80%), 2-4 hours (12%), over 4 hours (8%).

The surveys indicated that most of the parking demand of the existing site is generated by the Quality Foods Grocery Store. There is a near even number of local and out-of-town trips to the site. And the parking behaviour of the site is largely high turnover, with most visits lasting less than 1 hour.

It should be noted that most respondents who selected 'Other' as their destination specified that they were visiting the Pharmasave.

4.2.2 Local Area Parking Supply

Bunt completed a desktop review of the local area parking supply by estimating the number of spaces in the study area at key locations and on-street using aerial imagery and Google Street View. **Exhibit 4.1** summarizes the estimated parking supplies in the local area.

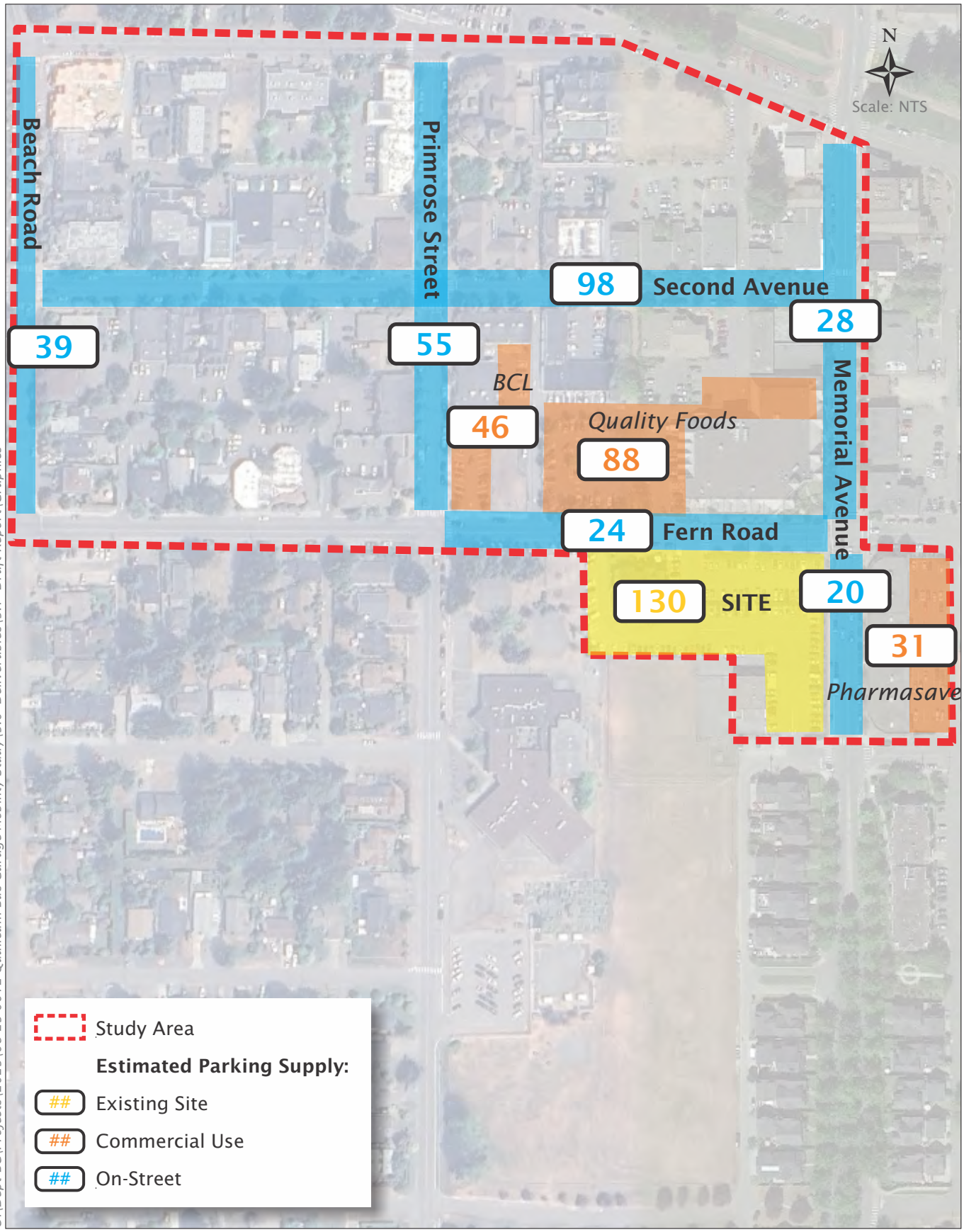


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Exhibit 4.1

Estimated Local Area Parking Supply

Qualicum Bus Garage Site
08-23-0012 February 2024

bunt & associates

Based on the desktop review, Bunt estimated the local public parking supply as follows:

- 165 spaces available at commercial surface lots, and,
- 264 spaces available on-street.

This results in a total of 429 off-site public parking spaces.

4.2.3 Anticipated Future Parking Behaviour

Based on the observed parking demand of 83 vehicles at the existing site, the proposed public parking supply of 107 vehicles may be able to accommodate most of the existing demand. However, as noted, the peak parking demand of the site is anticipated to be higher than observed due to the limited amount of data collected and the off-season collection period. Therefore, as a conservative measure, it is assumed that the peak parking demand of the site is 100%, or 130 vehicles.

As a result, the proposed supply of 107 public parking spaces is anticipated to displace 23 vehicles from the site to elsewhere in the study area.

Bunt assigned these 23 displaced trips using the destination data compiled from the circulated surveys:

- Quality Foods (62%): 14 displaced vehicles.
- Employees (6%): 1 displaced vehicle.
- Other/Pharmasave (33%): 8 displaced vehicles.

Bunt observed that the parking demand of the Pharmasave was low at 14 vehicles out of 31 spaces (41% parked). As a result, the Pharmasave may have sufficient capacity to accommodate its additional parking demand due to displaced vehicles.

The Quality Foods appears to have a parking demand that is greater than its supply (observed 81% parked). Therefore, it is assumed the remaining approximate 15 displaced vehicles assigned to the Quality Foods and Employment destinations would need to be accommodated by the public surface parking lots or on-street in the study area. The distribution of the 15 displaced demand equates to approximately 3% of the estimated study area supply of 429 spaces. Section 4.3 provides potential management strategies, including strategies to redistribute displaced parking demand throughout the study area by guiding drivers to less well-used parking areas.

4.3 Parking Management

As noted prior, approximately 23 vehicles are anticipated to be displaced from the existing site to elsewhere in the study area based on our described estimates and propagation of demand factors. The following subsections describe potential measures to manage this displaced demand.

4.3.1 Site Plan Options

From a purely parking demand perspective, the site plan option with the highest public parking supply will present the least risk. The number of proposed surface and underground public parking spaces in each of the most recent site plan options were as follows:

- Option 1: 73 Public Spaces (73 surface, 0 underground)
- Option 2: 118 Public Spaces (84 surface, 34 underground)
- Option 3: 107 Public Spaces (64 surface, 43 underground)

Therefore, the option that presents the least risk of introducing unaccommodated parking demand to the study area is Option 2, followed by Option 3, then Option 1.

It is however importantly noted that Option 3 is also considered viable with supporting measures. Option 1 is also considered viable but with a higher degree of supporting measures.

4.3.2 Wayfinding Signage

As noted prior, based on the survey results, most of the existing site parking demand is bound for the Quality Foods. Bunt observed the Quality Foods underground parking to be underused compared to the surface parking lot. Bunt also observed the entrance to the underground parking to be difficult to find as it is located at the back of the building without any clear signage. If surface spaces are not available, then more vehicles may use the Quality Foods parkade. However, the underground parkade has a limited parking supply; therefore, adding wayfinding signage to guide drivers to the underground parking area is not recommended as it may quickly reach capacity in the future.

It was noted through various site visits that parking areas behind businesses on 2nd Avenue (to both the north and south of 2nd Avenue) have substantially lower occupancy than the on-street parking spaces. It is recommended that the Town identify areas of underutilized in-block parking and add wayfinding signage to direct motorists towards these potential parking options. Currently these areas are largely accessed through one-way lanes that extend from 2nd Avenue, therefore signage may be placed on 2nd Avenue at selected locations based on further assessment of underutilized parking areas.

4.3.3 On-Street Parking Paint Markings

Most streets in the study area feature unrestricted parking on both sides. Bunt observed available parking spaces on most streets during the January 2024 site visit. Paint markings to outline on-street parking spaces may help drivers identify available on-street parking.

4.3.4 Public Parking Visibility

The site, in its existing condition, is clearly visible as the first available public parking area when entering the Town via Memorial Avenue.

The public parking will become less visible to visitors after the proposed development is completed, as most of the surface parking will be obscured by the proposed building. This may result in visitors driving further into town to find parking, which would better distribute the parking demand across the study area.

4.3.5 Shared-Use Underground Parking

The proposed development will exceed the bylaw requirement for the proposed Naked Natural Foods store. As a result, it is anticipated that the proposed parking supply for the Naked Natural Foods may exceed its parking demand. Bunt recommends that the actual demand of the underground parking is monitored after site occupation. If the Naked Natural Foods parking demand is less than the supply, the development may consider converting some of the Naked Natural Foods parking to unrestricted public parking. This additional public parking could accommodate some potential displaced demand.

4.4 Parking Conclusions & Recommendations

4.4.1 Parking Conclusions

Development Parking Supply

- The proposed Naked Natural building will meet or exceed the vehicle, bicycle, and loading space supply requirements outlined in the bylaw.

Public Parking Supply

- If, conservatively, the peak parking demand at the existing site is assumed to be 100%, a 30-vehicle parking demand (with preferred option 3) will be displaced off-site.
- Bunt completed a high-level estimate of future parking behaviour:
    - Based on observed demand, the Pharmasave may be able to accommodate some of the displaced demand.
    - The remaining approximately 20 vehicles are anticipated to be able to be absorbed into the adjacent area surface lot or on-street parking supplies, of which the total supply is approximately 429 spaces.
- Visitors arriving to the town via Memorial Avenue may be more likely to bypass the site and seek parking in other areas as the proposed building will obscure some of the proposed surface parking. This may redistribute parking demand to less well-used parking in the study area.

4.4.2 Parking Recommendations

- All three development plan options are considered viable from a parking perspective with anticipation that the lower parking supply options may require supportive measures to manage the parking demand, these may include:
    - It is recommended that the Town identify areas of underutilized in-block parking north and south of 2nd Avenue and considering adding wayfinding signage to direct motorists towards these potential parking options.
    - Highlight on-street parking with paint markings.
    - Monitor the parking demand of the site including the underground parking spaces once the proposed development is fully occupied. If there is excess parking demand, some of the underground parking spaces may be reassigned to unrestricted public parking.
- While no bicycle parking is required per the bylaw, Bunt recommends Naked Naturals consider long-term bicycle spaces (including larger sized cargo spaces) for residents and a 6-space short-term bicycle rack for visitors.

5. ACTIVE MODES IMPROVEMENTS

5.1 Intersection Upgrades

Bunt conducted a site visit and review of existing active mode infrastructure in the study area to identify opportunities for improvements. Bunt identified two study intersections as candidates for active mode improvements based on the site visit, discussions with the Town, and through consulting the *Age-Friendly Transportation Plan* (discussed in Section 2.3.1):

- Memorial Avenue & Railway Street/Veterans Way; and,
- Memorial Avenue & First Avenue/Fir Street.

Bunt identified these study intersections as both seeing significant pedestrian traffic and having an important role in connecting existing and proposed active mode infrastructure. The following subsections provide a high-level description of potential active modes improvements at these study intersections.

5.1.1 Memorial Avenue & Railway Street/Veterans Way

Northwest Corner: Bollards and Painted Pedestrian Refuge Area

The Town has noted that vehicles park on top of paint markings at the northwest corner of the intersection. In addition, vehicles have been observed taking the southbound right turn too sharply and driving through the white paint markings that outline the corner. This behavior presents a safety hazard as parked vehicles may encroach into the road width, increasing the likelihood of conflicts and potentially impacting the sight line between the southbound vehicle and any pedestrians on the west leg. Vehicles overlapping with the paint markings while turning have an increased likelihood of collision with pedestrians or cyclists on the corner.

If this area is not required for large vehicle turning movements, Bunt recommends the existing white paint markings that define the corner be refreshed. In addition, Bunt recommends flexible bollards be installed over the paint markings to further outline the corner and prevent vehicles from parking or overlapping. This creates an opportunity to add street art to the newly defined pedestrian refuge area within the corner. This potential measure has the added benefit of reducing the crossing distance on the west leg of the intersection; this reduces exposure time.

North Leg: Provide a Painted Zebra Crossing with a Rectangular Rapid Flashing Beacon (RRFB)

The Town has noted that there is a significant pedestrian volume on the north leg of the intersection, especially on Saturdays when the Qualicum Beach Farmers' Market is open. There is no marked pedestrian crossing here. This presents a safety issue as drivers may not be aware of the unmarked crossing, which limits their ability to see and react to pedestrians. This is especially prominent for southbound vehicles exiting a horizontal curve which, combined with the lack of markings/signage for the crossing, provides a short reaction window.

Bunt recommends providing a painted zebra crossing with pole-mounted pedestrian crossing signs on both sides and facing both travel directions. As an additional measure, the visibility of the crossing could be further improved with push-activated Rectangular Rapid Flashing Beacons (RRFB).

Southbound Approach: Provide a Pole-Mounted Sign for Crosswalk

As noted above, the horizontal curve of the road for southbound vehicles limits the sight line to the currently unmarked pedestrian crossing on the north leg.

Bunt recommends a pole-mounted advanced warning sign for the crosswalk (yellow diamond sign with pedestrian symbol) be installed on the southbound approach ahead of the intersection north leg. This measure would be paired with the recommended painted zebra crossing and RRFB described above. This aims to warn southbound drivers of the upcoming crossing and prepare them to stop for pedestrians.

5.1.2 Memorial Avenue & First Avenue/Fir Street

Northwest Corner: Extend Curb Bulge

The pedestrian crossing on the west leg of the intersection is long (approx. 20m). This presents a safety issue as longer crossing distances have longer pedestrian exposure times.

Bunt recommends the hardscaping on the northwest corner be extended into the intersection to reduce the west leg crossing distance. This measure also aims to force southbound vehicles to take a wider right turn, which will require vehicles to enter the turn at slower speeds. Note that the extend of the bulge will need to be confirmed through the turning movement of the intended vehicles expected to use the intersection.

Southwest Corner: Provide a Double-Sided, Pole-Mounted Pedestrian Crossing Sign

The existing zebra pedestrian crossing on the south leg of the intersection is missing a double-sided pedestrian crossing sign (white rectangles with pedestrian symbol).

Bunt recommends installing a double-sided pedestrian crossing sign to improve visibility of the crossing.

South Leg: Upgrade Existing Crossing with a Rectangular Rapid Flashing Beacon (RRFB)

The existing south leg zebra crossing is an important connection between the existing Dollymount Multi-Use trail to the east and the future extension of the Dollymount Mult-Use trail to the west. As a result, it is anticipated that the crossing will see significant pedestrian and cyclist traffic in the future.

Bunt recommends that the crossing be upgraded with a push-activated Rectangular Rapid Flashing Beacon (RRFB) to improve the visibility of this important crossing.

Wayfinding Signage

The ideal location for a crosswalk would be the north leg of the intersection, as it would directly connect the existing and future sections of the Dollymount Trail. However, this is not possible due to its proximity to the E&N rail line. Therefore, pedestrians and cyclists must instead cross three legs of the intersection to

stay on the Dollymount Trail. This is potentially confusing and may reduce the number of users on the trail.

Bunt recommends wayfinding signage be installed on the trail just before the intersection, or on the corners of the intersection, in both travel directions. The signs could feature arrows and symbols directing pedestrians and cyclists to use the marked crossings and continue onto the trail.

Exhibit 5.1 summarizes the potential active mode upgrades described above.

5.2 Additional Active Mode Measures

The developer and the Town may consider other, more general measures that aim to increase the mode split for pedestrians and cyclists. These potential measures are outlined below.

5.2.1 Mid-Block Pedestrian Crossings

There is currently one mid-block pedestrian crossing of Fern Road along the site's north frontage. This is aligned with the east leg of the existing site's East Fern Road Access. In addition to this crossing, it is also recommended that the Town consider introducing a second mid-block crossing approximately 33 meters to the west which would align with the existing pedestrian path that extends north through the Qualicum Foods - Quality Foods parking lot to 2nd Avenue.

5.2.2 Pedestrian Scramble Phase at Fern Road & Memorial Avenue Intersection

The Fern Road & Memorial Avenue intersection is immediately adjacent to the public plaza. The future proposed development includes public parking therefore pedestrian connectivity and safety is a critical consideration. The intersection is the only signalized intersection in Qualicum Beach and represents a focal point for the community which will be augmented with the adjacent proposed development. The intersection is shown to operate well from a vehicle operations perspective, however opportunities to improve the intersection from a pedestrian perspective were evaluated to acknowledge its importance to the pedestrian realm.

It is recommended to consider implementing a pedestrian scramble signal phase where pedestrians are permitted to cross all legs of the intersection including diagonal crossings during a single, all pedestrian crossing signal phase. Adding a pedestrian scramble phase should include new pavement paint markings and infrastructure improvements to include audible instructions in coordination with push-button activation (i.e. "Walk sign is on for all crossings").

Importantly, this would allow fully protected pedestrian crossings in all directions (all vehicle movements would be under red light stop control during the one pedestrian phase), thus removing pedestrian and motorist conflict points and improving safety for all modes.

An image of paint markings at an intersection with a pedestrian scramble phase is shown in **Figure 5.1**.

Consider extending existing paint markings further into intersection and installing bollards to deter vehicles from overlapping or parking on this corner.

The paved area within the bollards can be painted with street art. The potential zebra crossing can connect to this corner.

Example:

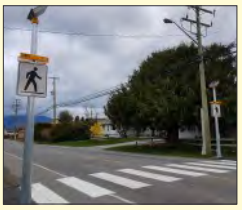
Provide a pole-mounted advanced warning sign for crosswalk:

N

Scale: NTS

Railway St

Consider a painted zebra crossing with Rectangular Rapid Flashing Beacons (RRFBs) and pedestrian crossing signs at the north leg:



Veterans Way

Dollymount Trail (Future)

E&N Rail Line

Consider wayfinding signage to connect existing and future planned Dollymount Multi-Use Trail

First Ave

Extend curb bulge to shorten crossing distance on west leg.

Dollymount Trail (Existing)

Fir St

Provide a pole-mounted double-sided pedestrian crossing sign:

Memorial Ave

Consider upgrading the crossing with Rectangular Rapid Flashing Beacons (RRFBs):

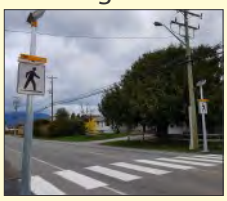


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Exhibit 5.1

Potential Active Mode Upgrades

Figure 5.1: Paint Markings at an Intersection with Pedestrian Scramble Signal Phase

Source: Google Maps image of Buffalo Street & Banff Avenue Intersection

Total Traffic Operations – Pedestrian Scramble

Synchro 11 software was used to estimate the future traffic operations at the Fern Road & Memorial Avenue intersection if it were to have a pedestrian scramble phase. The intersection was given a separate pedestrian-only phase which would give a red signal to all vehicle movements. All existing pedestrian phases that operate concurrently with vehicle movements were removed from the model. The following assumptions were input for the pedestrian phase:

- A "Walk" time of 2 seconds (i.e., the time where the pedestrian signal heads show the symbol for a walking person).
- A "Flash, Don't Walk" (FDW) time of 22 seconds (i.e., the time where the pedestrian signal heads show a flashing orange hand and a countdown timer) based on an estimated diagonal crossing distance of 22 metres and a walking speed of 1.0 m/s.
- The Synchro "Optimize Cycle Length" tool was applied, which attempts to recalculate the cycle length and individual split times for optimal traffic operations. This resulted in a 90 second cycle length. This is within the typical range for a traffic signal cycle length in an urban environment.

Table 5.1 summarizes the total (with development) traffic operations at the Fern Road & Memorial Avenue intersection with a 24 second pedestrian scramble phase modeled in Synchro 11 software. Detailed outputs are provided in Appendix B.

Table 5.1: Total (with Development) Vehicle Operations – No Scramble vs. Pedestrian Scramble

INTERSECTION/ TRAFFIC CONTROL	MOVEMENT	TOTAL (WITH SITE) – EXISTING TIMING			TOTAL (WITH SITE) – PEDESTRIAN SCRAMBLE		
		LOS	V/C	95TH Q (M)	LOS	V/C	95TH Q (M)
Memorial Ave & Fern Rd (signalized)	*OVERALL*	*A*	*0.50*	-	*C*	*0.49*	-
	EBLTR	B	0.33	15	C	0.63	35
	WBLTR	B	0.38	20	C	0.64	50
	NBLTR	A	0.47	45	C	0.67	85
	SBLTR	A	0.57	55	D	0.86	115

As expected, the intersection is anticipated to be more delayed if a pedestrian scramble is implemented as vehicles must wait longer on average for their phase. However, results indicate that all movements will continue to operate within performance thresholds for level of service, V/C ratio, and queuing. Therefore, a pedestrian scramble is anticipated to be viable from a traffic operations perspective.

5.2.3 Wayfinding Signs

Wayfinding signs can be installed in high-pedestrian-traffic areas. These signs can provide directions and information on points of interest such as key destinations (restaurants, tourist attractions, etc.), parks and beaches, trails, cycling routes, water stations, bike racks, etc. This measure may provide active mode users with destinations they would have otherwise missed and provide information which will enhance their experience such as water stations and bike racks. **Figure 5.2** provides an example of a wayfinding sign.

Figure 5.2: Wayfinding Sign Example

Source: City of Vancouver

5.2.4 Water Stations

Water stations can be installed in high-traffic areas. These stations can be equipped with water fountains at different heights, and a ground-height fountain for dogs. In addition, stations can be equipped with water fill stations and misting stations. With the increasing frequency of record-breaking summer temperatures, these stations can improve active mode safety. **Figure 5.3** provides an example of a water station with all the described features.

Figure 5.3: Water Station Example

5.2.5 Bike Racks

Access to bike racks near key destinations is an important measure to encourage cycling for daily errands and day trips. Bike racks should be able to accommodate most types of bicycles (road bikes, children's bikes, cargo bikes, etc.) and be in visible areas to decrease the likelihood of theft. **Figure 5.4** provides two examples of bike racks that can accommodate most bikes.

Figure 5.4: Bike Rack Examples: "Post-and-Ring" (Left) and "Sheffield" (Right)

5.2.6 Benches

Benches encourage activities outdoors and provide a rest point for active mode users.

6. SWEPT PATH ANALYSIS

Bunt completed a swept path analysis of proposed site plan option 3 (currently preferred by the design team) to confirm functionality of passenger vehicle access, circulation, and parking as well as loading vehicle maneuvers. The swept path analysis is attached in **Appendix C**. The following summarizes the exhibit package:

- **Exhibit 1** illustrates passenger vehicle circulation on the ground level and on the access ramp to the underground parking. Two-way concurrent circulation is achievable at all corners between at least a 4.6m small car ("Honda Civic 2017") and a 5.6m standard vehicle ("P-TAC" – Passenger – Transportation Association of Canada), which is the minimum standard per Bunt internal guidelines. It is recommended that a convex mirror be installed on the corner of the ramp to the underground parking, as indicated in the Exhibit, to provide a sight line around the 90-degree corner and warn drivers to yield to oncoming traffic.
- **Exhibit 2** illustrates successful parking maneuvers in the one-way angled parking section of the surface parking lot.
- **Exhibits 3 and 4** illustrates inbound and outbound loading maneuvers into both on-site loading spaces with a 20-metre WB-20 semi-tractor trailer truck. As indicated, the inbound vehicle paths into both loading spaces overlap the landscaping strip on the southeast corner of the site; this landscaping strip will need to be removed to accommodate WB-20 trucks. Note that loading vehicles will not be permitted to use the north-south laneway that intersects with Fourth Avenue.
- **Exhibits 5 and 6** illustrates successful loading maneuvers in and out of the on-site loading spaces with a 15-metre WB-15 truck. Note that loading vehicles will not be permitted to use the north-south laneway that intersects with Fourth Avenue.

7. CONCLUSIONS & RECOMMENDATIONS

7.1 Conclusions

The proposed development would replace the existing 130 parking space surface lot with a pedestrian plaza adjacent to a 1,748 m^2 health food store ('Naked Natural Foods'), and a 506 m^2 restaurant, with 9 residential units above.

The preferred plaza and parking option results in a total of 171 parking spaces (64 for Naked Natural building and 107 for public parking).

Traffic

1. The Synchro model traffic analysis indicates existing traffic conditions at study area intersections operate within typical threshold criteria in regard to peak period delays and volume to capacity ratios.

2. The most pressurized study area traffic movement is the westbound First Avenue to northbound Memorial Avenue left turn movement. Laning and traffic control mitigation options are limited due to the close proximity of the rail line, north of the intersection, which does not allow vehicles to stop north of the intersection. As this traffic movement is shown to operate within common thresholds, no traffic related mitigation is recommended, rather mitigation recommendations for this intersection pertain to pedestrian realm improvement considerations.

3. The proposed development is anticipated to generate approximately 220 vehicle trips (total in and out) during its peak hour period when using ITE trip generation rates. These volumes were used in the traffic analysis however it is noted that actual site trips in Qualicum Beach are anticipated to be significantly lower due to its more dispersed peak hour and the applied grocery store rates likely being higher than anticipated to be generated by the more speciality Nake Natural store and the restaurant being more of an ancillary land use.

4. The traffic model indicates that the additional traffic generated by the development is not anticipated to have a significant impact on local area traffic operations. All traffic movement remain within capacity thresholds with little difference between the existing and post-development scenarios.

Parking

5. The proposed Naked Natural building will meet or exceed the vehicle, bicycle, and loading space supply requirements outlined in the bylaw.

6. If, conservatively, the peak parking demand at the existing site is assumed to be 100%, a 30-vehicle parking demand (with preferred option 3) will be displaced off-site.

7. Bunt completed a high-level estimate of future parking behaviour:

- Based on observed demand, the Pharmasave may be able to accommodate some of the displaced demand.
- The remaining approximately 20 vehicles are anticipated to be able to be absorbed into the adjacent area surface lot or on-street parking supplies, of which the total supply is approximately 429 spaces.
- Visitors arriving to the town via Memorial Avenue may be more likely to bypass the site and seek parking in other areas as the proposed building will obscure some of the proposed surface parking. This may redistribute parking demand to less well-used parking in the study area.

7.2 Recommendations

Swept Path Analysis

8. The following site design updates are recommended based on the swept path analysis of the proposed Option 3 site plan:
   - Provide a convex mirror on the corner of the underground parking access ramp to provide a sight line around the 90-degree corner and warn drivers to yield to oncoming vehicles.
   - Remove the landscaping strip at the southeast corner of the site to accommodate inbound vehicle paths for WB-20 trucks.

Traffic and Transportation Demand Management

9. Recommended study area transportation improvements for consideration include:
   - Pedestrian related improvements near the Memorial Avenue & First Avenue/Fir Street and Memorial Avenue & Railway Street/Veterans Way intersections.
   - A pedestrian scramble phase at the signalized Fern Road & Memorial Avenue intersections.
   - A second pedestrian crossing of Fern Road adjacent to TOSH building.
   - A sidewalk along Fourth Avenue's south edge, across from the development site, between Memorial Avenue and lane.
   - Introduction of pedestrian amenities throughout downtown area such as benches and water fountains.
   - Bicycle parking integrated into plaza design.
   - Provision of long-term bicycle spaces (including larger sized cargo spaces) for building residents and at minimum a 6-space short-term bicycle rack for grocery store and residential visitors.

Parking Recommendations

10. All three development plan options are considered viable from a parking perspective with anticipation that the lower parking supply options may require supportive measures to manage the parking demand, these may include:

    - It is recommended that the Town identify areas of underutilized in-block parking north and south of 2nd Avenue and considering adding wayfinding signage to direct motorists towards these potential parking options.
    - Highlight on-street parking with paint markings.
    - Monitor the parking demand of the site including the underground parking spaces once the proposed development is fully occupied. If there is excess parking demand, some of the underground parking spaces may be reassigned to unrestricted public parking.

11. While no bicycle parking is required per the bylaw, Bunt recommends Naked Naturals consider long-term bicycle spaces (including larger sized cargo spaces) for residents and a 6-space short-term bicycle rack for visitors.

APPENDIX A

Traffic Data

Memorial Ave @ Veterans Way – Qualicum Beach, BC

Project#: 08-23-0012 **Weather:** Sun **Analysis Period:** 15:00 - 16:00
Date: 11-22-2023 **Road Cond:** Dry **Intersection Peak:** 15:00 - 16:00
Notes:

TIME	AUTOMOBILE COUNT												PEDESTRIANS			
INTERVAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
15:00 - 15:15	1	110	7	2	97	2	1	1	1	4	0	2	0	3	5	1
15:15 - 15:30	0	95	1	0	127	1	0	0	1	8	0	4	3	2	12	1
15:30 - 15:45	1	95	8	1	96	0	0	0	2	9	0	1	0	2	6	2
15:45 - 16:00	0	80	3	0	104	1	1	0	0	2	0	0	0	0	6	1
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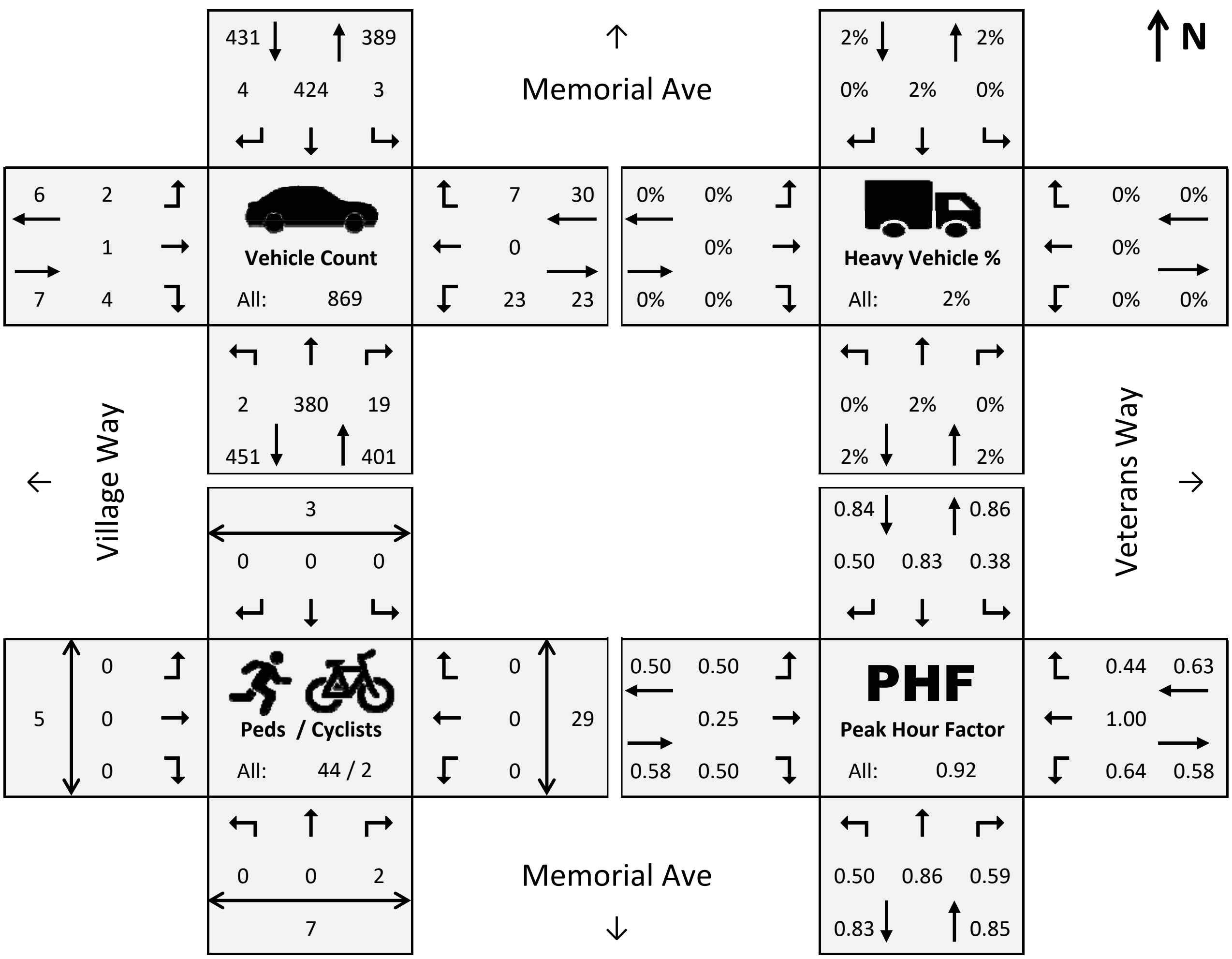

Memorial Ave @ First Ave – Qualicum Beach, BC

Project#: 08-23-0012 **Weather:** Sun **Analysis Period:** 13:45 - 14:45
Date: 11-16-2023 **Road Cond:** Dry **Intersection Peak:** 13:45 - 14:45
Notes: Pattern of pedestrian movement was observed in which people were crossing multiple intersections and coming back in the same direction like they were strolling

TIME INTERVAL	AUTOMOBILE COUNT												PEDESTRIANS			
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:45 - 14:00	7	84	5	3	57	23	17	5	15	0	4	10	0	18	9	1
14:00 - 14:15	7	63	5	5	57	28	16	1	15	0	0	10	0	14	9	6
14:15 - 14:30	15	58	3	2	66	29	22	4	14	2	2	5	0	11	8	7
14:30 - 14:45	8	69	5	4	62	21	16	4	16	2	1	10	0	10	7	8
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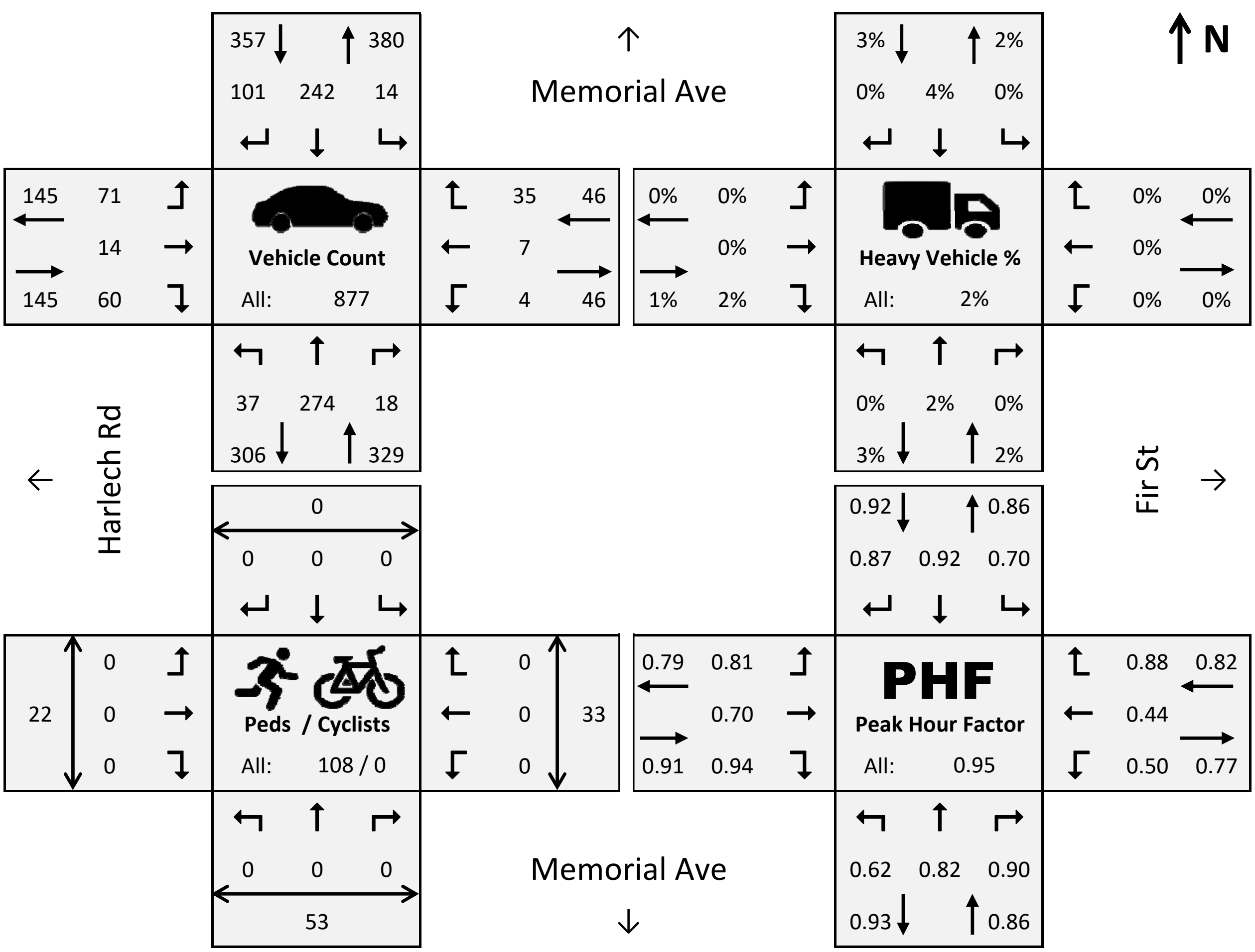

Memorial Ave @ W 2nd Ave – Qualicum Beach, BC

Project#: 08-23-0012 **Weather:** Sun **Analysis Period:** 15:00 - 16:00
Date: 11-16-2023 **Road Cond:** Dry **Intersection Peak:** 15:00 - 16:00
Notes:

TIME	AUTOMOBILE COUNT												PEDESTRIANS			
INTERVAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
15:00 - 15:15	20	93	0	0	77	30	11	0	18	0	0	0	10	24	0	1
15:15 - 15:30	21	60	0	0	67	28	12	0	4	0	0	0	21	62	0	13
15:30 - 15:45	10	69	0	0	67	28	14	0	14	0	0	0	11	33	0	5
15:45 - 16:00	14	56	0	0	64	34	11	0	13	0	0	0	9	19	0	11
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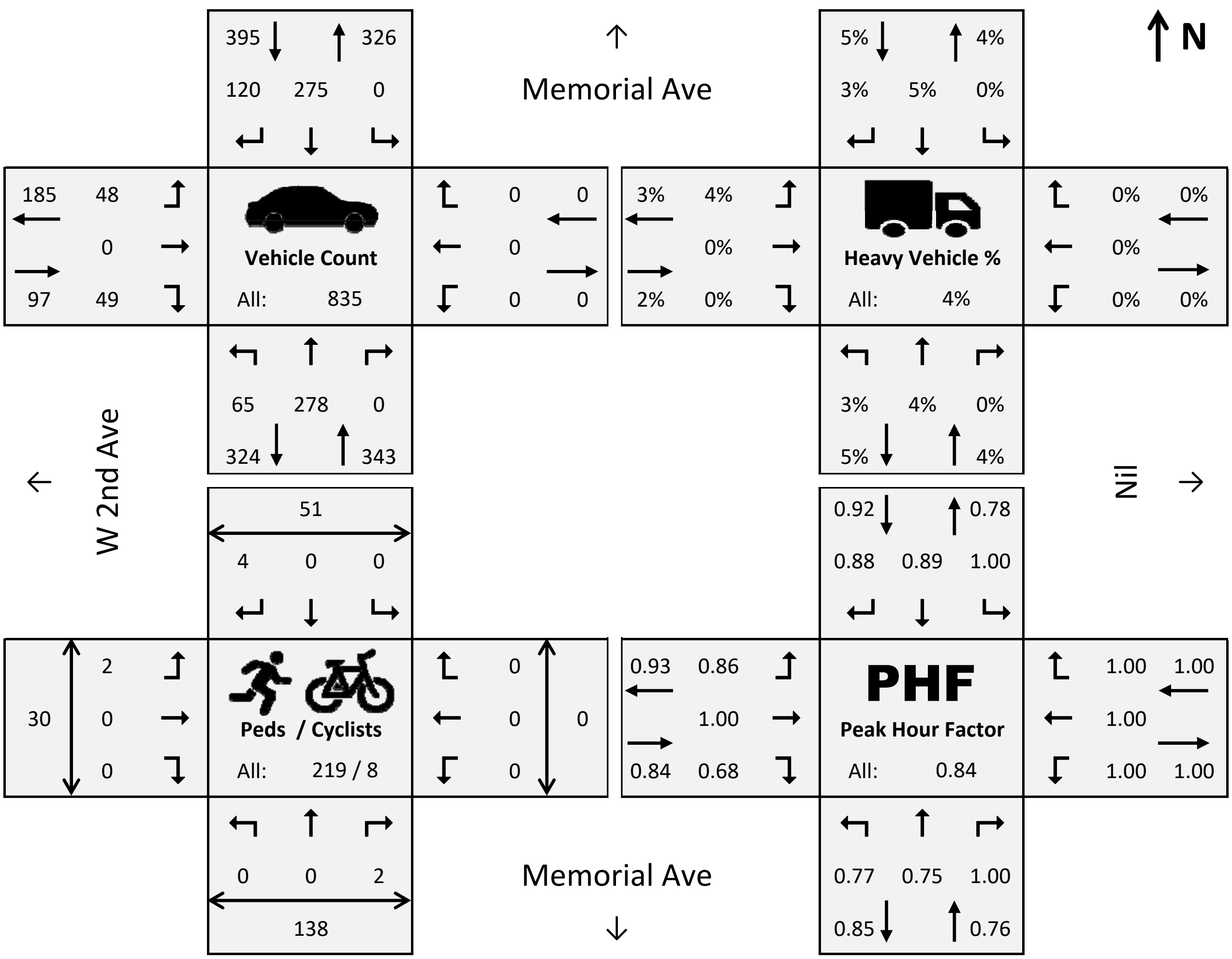

Fern Road @ Memorial Ave – Qualicum Beach, BC

Project#:	08-23-0012	**Weather:**	Sun	**Analysis Period:**	13:45 - 14:45
Date:	Nov 16, 2023 (Thu)	**Road Cond:**	Dry	**Intersection Peak:**	13:45 - 14:45
Notes:					

TIME INTERVAL	AUTOMOBILE COUNT												PEDESTRIANS			
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:45 - 14:00	0	75	1	12	41	9	17	19	7	6	19	17	12	21	7	3
14:00 - 14:15	12	51	6	22	44	13	21	19	11	7	17	7	11	16	22	4
14:15 - 14:30	15	50	6	19	29	11	23	22	13	8	23	15	9	9	17	6
14:30 - 14:45	8	55	5	21	41	10	16	25	20	4	26	15	8	16	8	11
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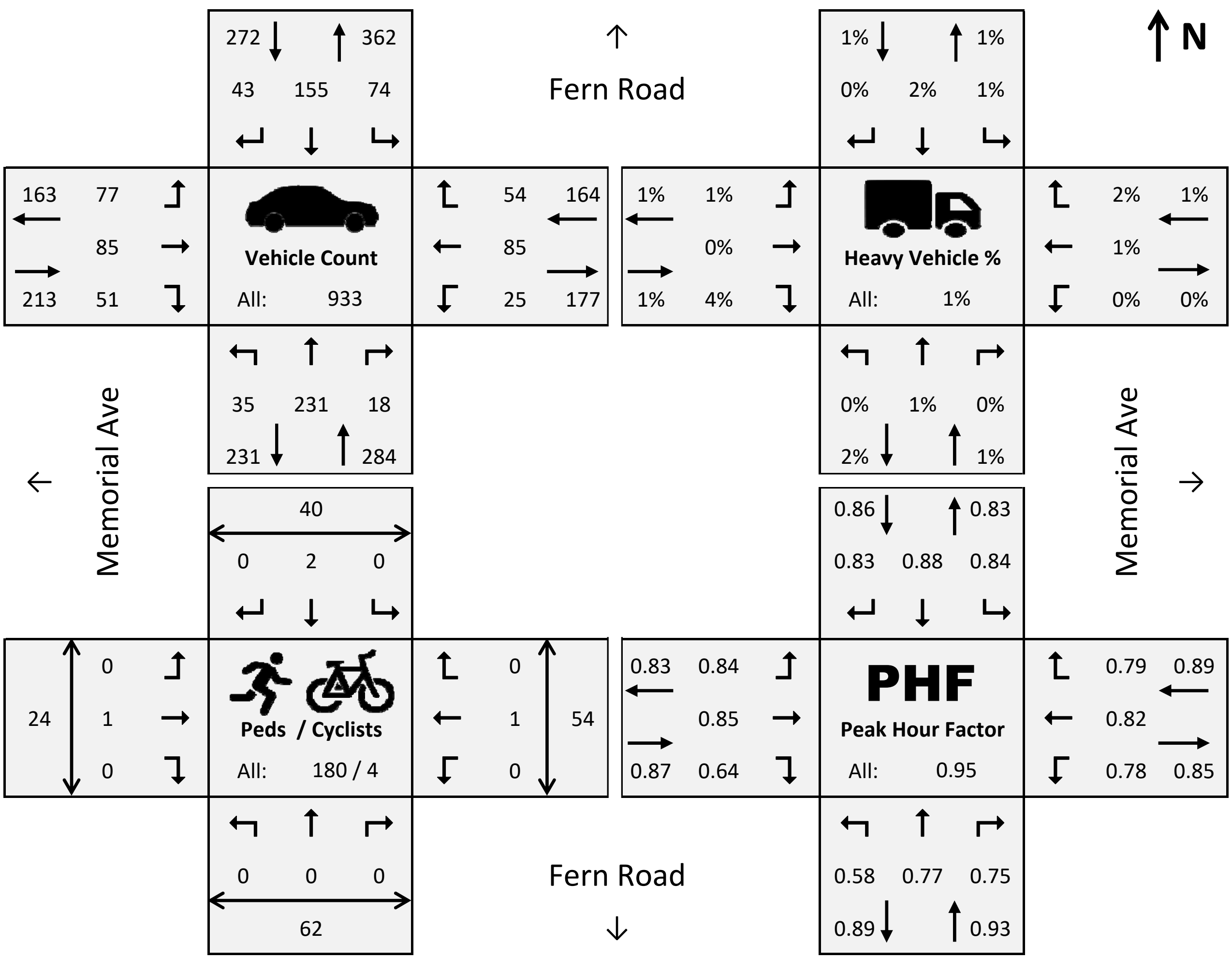

Memorial Ave @ Fourth Street – Qualicum Beach, BC

bunt & associates

Project#:	08-23-0012	**Weather:**	Sun	**Analysis Period:**	15:00 - 16:00
Date:	Nov 16, 2023 (Thu)	**Road Cond:**	Dry	**Intersection Peak:**	15:00 - 16:00
Notes:					

TIME INTERVAL	AUTOMOBILE COUNT												PEDESTRIANS			
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
15:00 - 15:15	5	73	5	11	67	1	4	0	5	5	0	5	5	2	0	2
15:15 - 15:30	4	63	5	2	64	7	2	0	10	2	0	9	3	2	3	2
15:30 - 15:45	5	55	2	1	53	2	3	0	6	3	0	7	4	0	1	4
15:45 - 16:00	3	62	3	2	66	6	1	0	1	4	1	8	1	0	3	0
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N

Memorial Ave (north) / Memorial Ave (south) / Fourth Street (west) / Fourth Street (east)

Vehicle Count — All: 643

North approach: 282 (in) / 292 (out); 16, 250, 16

West approach: 34 / 32; 10, 0, 22

East approach: 29, 1, 14; 44 / 31

South approach: 17, 253, 15; 286 / 285

Heavy Vehicle % — All: 3%

North approach: 4% / 2%; 0%, 5%, 0%

West approach: 0% / 3%; 10%, 0%, 0%

East approach: 0%, 0%, 0%; 0% / 0%

South approach: 0%, 2%, 0%; 4% / 2%

Peds / Cyclists — All: 32 / 6

North crosswalk: 13; 0, 2, 0

West crosswalk: 8; 0, 0, 0

East crosswalk: 0, 2, 0; 7

South crosswalk: 0, 2, 0; 4

PHF Peak Hour Factor — All: 0.89

North approach: 0.89 / 0.89; 0.57, 0.93, 0.36

West approach: 0.77 / 0.67; 0.63, 1.00, 0.55

East approach: 0.81, 0.25, 0.70; 0.85 / 0.75

South approach: 0.85, 0.87, 0.75; 0.93 / 0.86

Fern Road @ West Site Access – Qualicum Beach, BC

Project#: 08-23-0012 **Weather:** Sun **Analysis Period:** 13:30 - 14:30
Date: 11-22-2023 **Road Cond:** Dry **Intersection Peak:** 13:30 - 14:30
Notes: This intersection is on the west of old school arts centre when facing towards north

TIME INTERVAL	AUTOMOBILE COUNT												PEDESTRIANS			
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:30 - 13:45	0	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0
13:45 - 14:00	1	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
14:00 - 14:15	0	0	1	0	0	0	0	0	0	1	0	0	0	4	0	0
14:15 - 14:30	0	0	2	0	0	0	0	0	2	0	0	0	0	1	0	0
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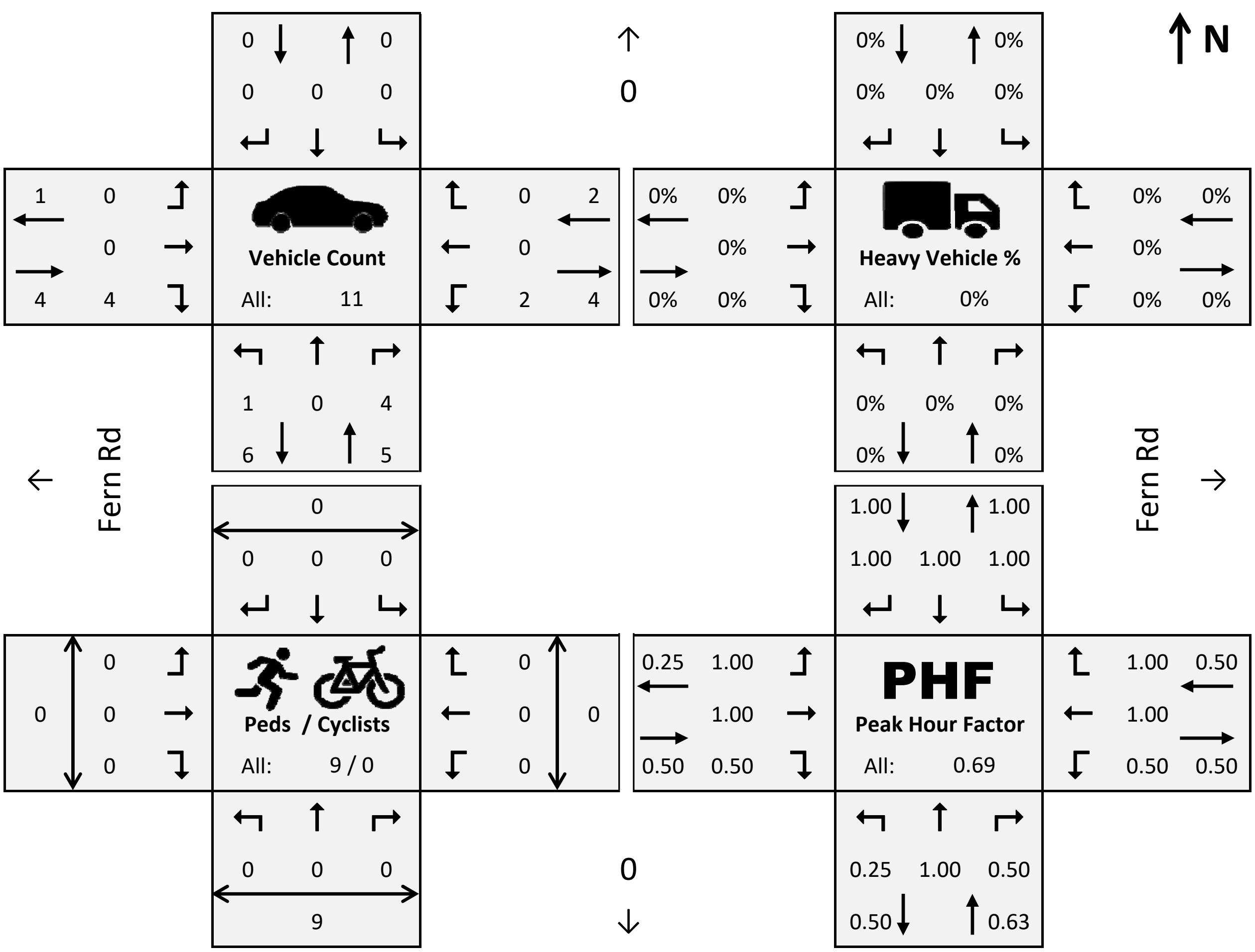

Fern Rd @ East Site Access – Qualicum Beach, BC

Project#: 08-23-0012 **Weather:** Sun **Analysis Period:** 13:30 - 14:30
Date: 11-22-2023 **Road Cond:** Dry **Intersection Peak:** 13:30 - 14:30
Notes: This intersection is on the East of The old school arts centre when facing towards north

TIME	AUTOMOBILE COUNT												PEDESTRIANS			
INTERVAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:30 - 13:45	6	0	4	0	0	0	0	0	3	5	0	0	0	8	0	0
13:45 - 14:00	1	0	5	0	0	0	0	0	1	8	0	0	0	7	0	0
14:00 - 14:15	3	0	8	0	0	0	0	0	5	4	0	0	0	6	0	0
14:15 - 14:30	2	0	4	0	0	0	0	0	9	9	0	0	0	1	0	0
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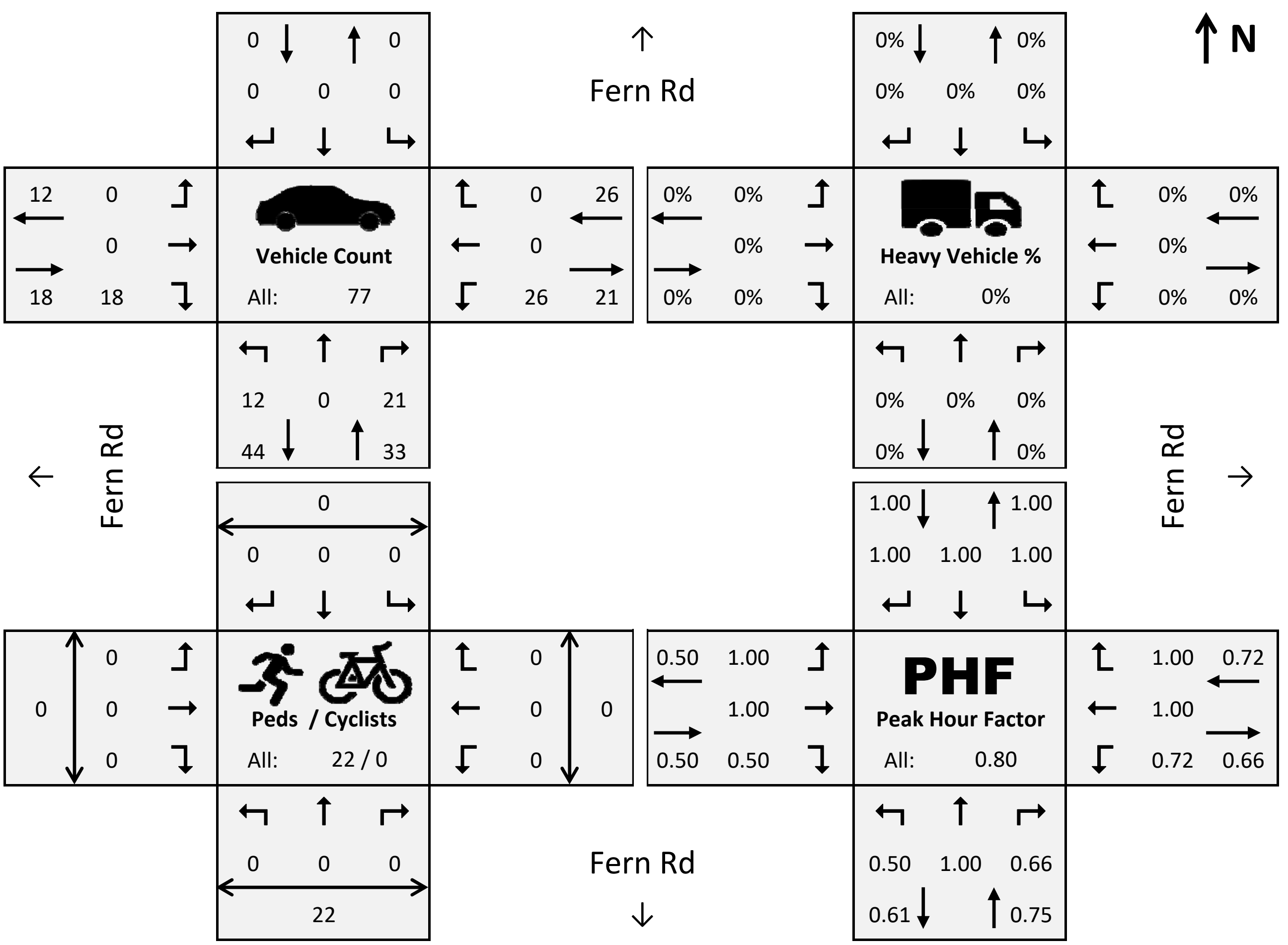

Fern Road @ Qualicum Foods East Access – Qualicum Beach, BC

Project#:	08-23-0012	**Weather:**	Sun	**Analysis Period:**	13:45 - 14:45
Date:	Nov 22, 2023 (Wed)	**Road Cond:**	Dry	**Intersection Peak:**	13:45 - 14:45
Notes:					

TIME	AUTOMOBILE COUNT												PEDESTRIANS			
INTERVAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:45 - 14:00	0	0	0	3	0	16	9	0	0	0	0	12	19	0	24	0
14:00 - 14:15	0	0	0	11	0	17	9	0	0	0	0	13	19	0	31	0
14:15 - 14:30	0	0	0	10	0	17	5	0	0	0	0	12	23	0	35	0
14:30 - 14:45	0	0	0	12	0	12	14	0	0	0	0	15	21	0	34	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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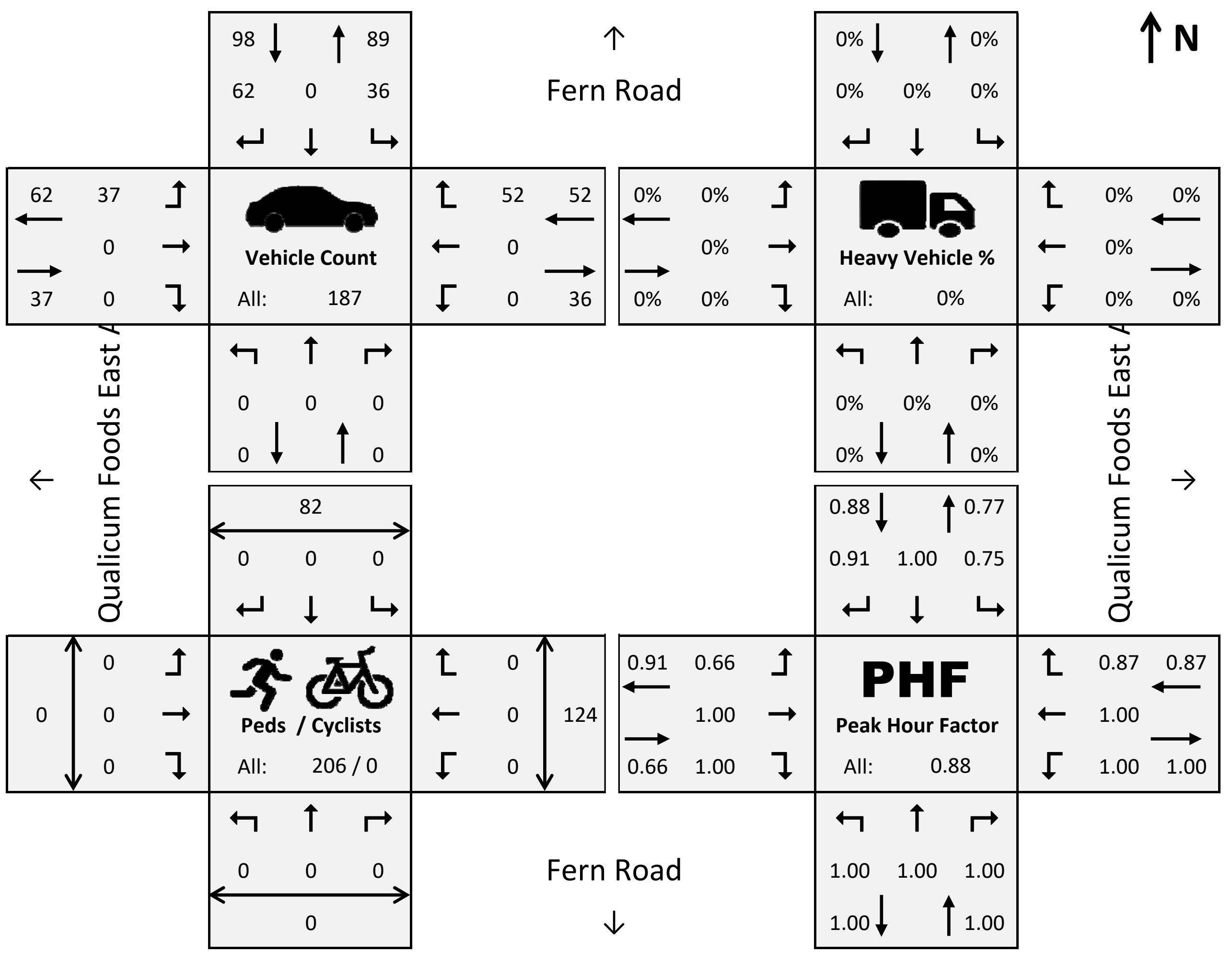

Fern Road @ Qualicum Foods West Access – Qualicum Beach, BC

Project#:	08-23-0012	**Weather:**	Sun	**Analysis Period:**	13:45 - 14:45
Date:	Nov 22, 2023 (Wed)	**Road Cond:**	Dry	**Intersection Peak:**	13:45 - 14:45
Notes:					

TIME	AUTOMOBILE COUNT												PEDESTRIANS			
INTERVAL	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	N	S	E	W
13:45 - 14:00	0	0	0	6	0	5	0	0	0	0	0	0	10	0	6	0
14:00 - 14:15	0	0	0	12	0	11	0	0	0	0	0	0	10	0	10	0
14:15 - 14:30	0	0	0	12	0	9	0	0	0	0	0	0	10	0	3	0
14:30 - 14:45	0	0	0	10	0	10	0	0	0	0	0	0	13	0	7	0
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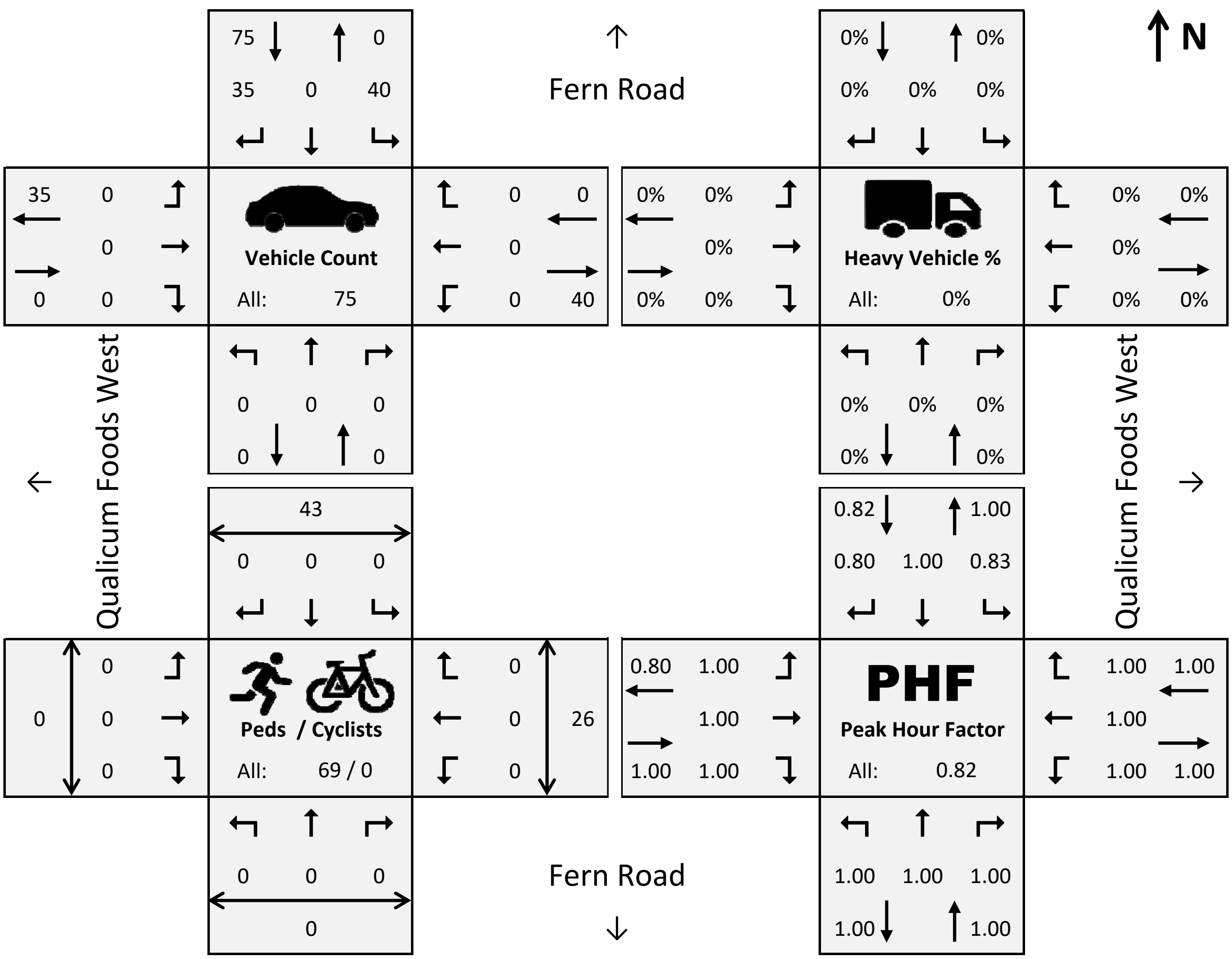


The attached information is provided to support the agency's review process and shall not be distributed to other parties without written consent from Bunt & Associates Engineering Ltd.

APPENDIX B

Synchro Reports

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	4	23	0	7	2	380	19	3	424	4
Future Volume (Veh/h)	2	1	4	23	0	7	2	380	19	3	424	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1	4	25	0	8	2	413	21	3	461	4
Pedestrians		5			29			7			3	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			2			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								246				
pX, platoon unblocked												
vC, conflicting volume	912	941	475	937	932	456	470			463		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	912	941	475	937	932	456	470			463		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	89	100	99	100			100		
cM capacity (veh/h)	243	255	584	229	258	589	1087			1072		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	33	436	468
Volume Left	2	25	2	3
Volume Right	4	8	21	4
cSH	368	269	1087	1072
Volume to Capacity	0.02	0.12	0.00	0.00
Queue Length 95th (m)	0.5	3.3	0.0	0.1
Control Delay (s)	15.0	20.2	0.1	0.1
Lane LOS	B	C	A	A
Approach Delay (s)	15.0	20.2	0.1	0.1
Approach LOS	B	C		

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	Err%	ICU Level of Service	H	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	14	78	5	7	36	37	289	18	14	329	108
Future Volume (Veh/h)	76	14	78	5	7	36	37	289	18	14	329	108
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	80	15	82	5	7	38	39	304	19	15	346	114
Pedestrians		22			33			53				
Lane Width (m)		3.6			3.6			3.6				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		2			3			4				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								194				
pX, platoon unblocked												
vC, conflicting volume	888	889	478	1000	936	346	482			356		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	888	889	478	1000	936	346	482			356		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	64	94	85	97	97	94	96			99		
cM capacity (veh/h)	223	256	551	156	240	677	1061			1170		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	80	97	50	362	475
Volume Left	80	0	5	39	15
Volume Right	0	82	38	19	114
cSH	223	468	426	1061	1170
Volume to Capacity	0.36	0.21	0.12	0.04	0.01
Queue Length 95th (m)	12.4	6.2	3.2	0.9	0.3
Control Delay (s)	30.0	14.7	14.6	1.3	0.4
Lane LOS	D	B	B	A	A
Approach Delay (s)	21.6		14.6	1.3	0.4
Approach LOS	C		B		

Intersection Summary				
Average Delay	4.9			
Intersection Capacity Utilization	53.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	48	49	65	297	288	124
Future Volume (Veh/h)	48	49	65	297	288	124
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	52	53	71	323	313	135
Pedestrians	30			138	51	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	3			12	4	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				114		
pX, platoon unblocked	0.97					
vC, conflicting volume	926	548	478			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	908	548	478			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	89	93			
cM capacity (veh/h)	256	462	1052			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	105	394	448
Volume Left	52	71	0
Volume Right	53	0	135
cSH	330	1052	1700
Volume to Capacity	0.32	0.07	0.26
Queue Length 95th (m)	10.7	1.7	0.0
Control Delay (s)	20.9	2.2	0.0
Lane LOS	C	A	
Approach Delay (s)	20.9	2.2	0.0
Approach LOS	C		

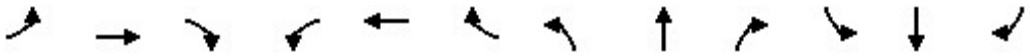
Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	224	172	299	355
v/c Ratio	0.25	0.33	0.34	0.46
Control Delay	8.0	8.8	10.3	11.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.0	8.8	10.3	11.6
Queue Length 50th (m)	3.3	4.3	9.2	11.2
Queue Length 95th (m)	11.2	17.6	35.8	44.9
Internal Link Dist (m)	53.3	103.0	82.4	90.0
Turn Bay Length (m)				
Base Capacity (vph)	1596	931	1135	1002
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.14	0.18	0.26	0.35

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	77	85	51	25	85	54	35	231	18	91	192	54
Future Volume (vph)	77	85	51	25	85	54	35	231	18	91	192	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.2			5.2	
Lane Util. Factor		0.95			1.00			1.00			1.00	
Frpb, ped/bikes		0.98			0.98			1.00			0.99	
Flpb, ped/bikes		0.99			0.99			1.00			0.99	
Frt		0.96			0.96			0.99			0.98	
Flt Protected		0.98			0.99			0.99			0.99	
Satd. Flow (prot)		3237			1721			1827			1775	
Flt Permitted		0.84			0.91			0.93			0.83	
Satd. Flow (perm)		2754			1586			1704			1498	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	81	89	54	26	89	57	37	243	19	96	202	57
RTOR Reduction (vph)	0	40	0	0	42	0	0	4	0	0	12	0
Lane Group Flow (vph)	0	184	0	0	130	0	0	295	0	0	343	0
Confl. Peds. (#/hr)	40		62	62		40	24		54	54		24
Confl. Bikes (#/hr)			1			1						2
Heavy Vehicles (%)	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.8			9.8			17.8			17.8	
Effective Green, g (s)		9.8			9.8			17.8			17.8	
Actuated g/C Ratio		0.26			0.26			0.47			0.47	
Clearance Time (s)		5.0			5.0			5.2			5.2	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		714			411			802			705	
v/s Ratio Prot												
v/s Ratio Perm		0.07			c0.08			0.17			c0.23	
v/c Ratio		0.26			0.32			0.37			0.49	
Uniform Delay, d1		11.1			11.3			6.4			6.9	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			0.4			0.3			0.5	
Delay (s)		11.3			11.7			6.7			7.4	
Level of Service		B			B			A			A	
Approach Delay (s)		11.3			11.7			6.7			7.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	8.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	37.8	Sum of lost time (s)	10.2
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	0	22	14	1	29	17	253	15	16	250	16
Future Volume (Veh/h)	10	0	22	14	1	29	17	253	15	16	250	16
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	11	0	25	16	1	33	19	284	17	18	281	18
Pedestrians		8			7			4			13	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											106	
pX, platoon unblocked												
vC, conflicting volume	711	680	302	692	680	312	307			308		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	711	680	302	692	680	312	307			308		
tC, single (s)	7.2	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	100	97	95	100	95	98			99		
cM capacity (veh/h)	306	358	730	332	357	716	1245			1245		

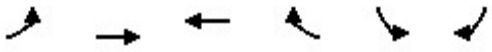
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	36	50	320	317
Volume Left	11	16	19	18
Volume Right	25	33	17	18
cSH	513	515	1245	1245
Volume to Capacity	0.07	0.10	0.02	0.01
Queue Length 95th (m)	1.8	2.6	0.4	0.4
Control Delay (s)	12.5	12.7	0.6	0.6
Lane LOS	B	B	A	A
Approach Delay (s)	12.5	12.7	0.6	0.6
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	33.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	207	4	2	168	1	4
Future Volume (Veh/h)	207	4	2	168	1	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)	225	4	2	183	1	4
Pedestrians					9	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				118		
pX, platoon unblocked						
vC, conflicting volume			238		423	236
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			238		423	236
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	99
cM capacity (veh/h)			1319		582	797

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	229	185	5
Volume Left	0	2	1
Volume Right	4	0	4
cSH	1700	1319	742
Volume to Capacity	0.13	0.00	0.01
Queue Length 95th (m)	0.0	0.0	0.2
Control Delay (s)	0.0	0.1	9.9
Lane LOS		A	A
Approach Delay (s)	0.0	0.1	9.9
Approach LOS			A

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	21.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	37	174	108	52	36	62
Future Volume (Veh/h)	37	174	108	52	36	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	45	212	132	63	44	76
Pedestrians			26		43	
Lane Width (m)			3.6		3.6	
Walking Speed (m/s)			1.2		1.2	
Percent Blockage			2		4	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			101			
pX, platoon unblocked						
vC, conflicting volume	238				534	206
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	238				534	206
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				90	91
cM capacity (veh/h)	1281				461	804

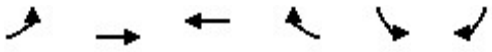
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	257	195	120
Volume Left	45	0	44
Volume Right	0	63	76
cSH	1281	1700	632
Volume to Capacity	0.04	0.11	0.19
Queue Length 95th (m)	0.9	0.0	5.6
Control Delay (s)	1.6	0.0	12.0
Lane LOS	A		B
Approach Delay (s)	1.6	0.0	12.0
Approach LOS			B

Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	39.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	192	18	26	148	12	21
Future Volume (Veh/h)	192	18	26	148	12	21
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)	209	20	28	161	13	23
Pedestrians					22	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					2	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				77		
pX, platoon unblocked						
vC, conflicting volume			251		458	241
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			251		458	241
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		98	97
cM capacity (veh/h)			1290		539	783

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	229	189	36
Volume Left	0	28	13
Volume Right	20	0	23
cSH	1700	1290	673
Volume to Capacity	0.13	0.02	0.05
Queue Length 95th (m)	0.0	0.5	1.4
Control Delay (s)	0.0	1.3	10.7
Lane LOS		A	B
Approach Delay (s)	0.0	1.3	10.7
Approach LOS			B

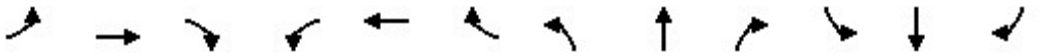
Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	35.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	34	32	0
Future Volume (Veh/h)	0	0	0	34	32	0
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)	0	0	0	37	35	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	37				18	18
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	37				18	18
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				96	100
cM capacity (veh/h)	1574				999	1060

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	37	35
Volume Left	0	0	35
Volume Right	0	37	0
cSH	1700	1700	999
Volume to Capacity	0.00	0.02	0.04
Queue Length 95th (m)	0.0	0.0	0.9
Control Delay (s)	0.0	0.0	8.7
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	1	4	23	0	7	2	406	19	3	459	4
Future Volume (Veh/h)	2	1	4	23	0	7	2	406	19	3	459	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1	4	25	0	8	2	441	21	3	499	4
Pedestrians		5			29			7			3	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		0			2			1			0	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								246				
pX, platoon unblocked												
vC, conflicting volume	978	1007	513	1003	998	484	508			491		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	978	1007	513	1003	998	484	508			491		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	88	100	99	100			100		
cM capacity (veh/h)	219	233	556	207	236	568	1053			1046		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	7	33	464	506
Volume Left	2	25	2	3
Volume Right	4	8	21	4
cSH	339	244	1053	1046
Volume to Capacity	0.02	0.14	0.00	0.00
Queue Length 95th (m)	0.5	3.7	0.0	0.1
Control Delay (s)	15.8	22.0	0.1	0.1
Lane LOS	C	C	A	A
Approach Delay (s)	15.8	22.0	0.1	0.1
Approach LOS	C	C		

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	Err%	ICU Level of Service	H	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	76	14	90	11	7	36	48	315	23	14	364	108
Future Volume (Veh/h)	76	14	90	11	7	36	48	315	23	14	364	108
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	80	15	95	12	7	38	51	332	24	15	383	114
Pedestrians		22			33			53				
Lane Width (m)		3.6			3.6			3.6				
Walking Speed (m/s)		1.2			1.2			1.2				
Percent Blockage		2			3			4				
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								194				
pX, platoon unblocked												
vC, conflicting volume	980	983	515	1104	1028	377	519			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	980	983	515	1104	1028	377	519			389		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	58	93	82	90	97	94	95			99		
cM capacity (veh/h)	190	223	525	125	210	651	1028			1137		

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	80	110	57	407	512
Volume Left	80	0	12	51	15
Volume Right	0	95	38	24	114
cSH	190	443	304	1028	1137
Volume to Capacity	0.42	0.25	0.19	0.05	0.01
Queue Length 95th (m)	15.3	7.7	5.4	1.3	0.3
Control Delay (s)	37.1	15.8	19.6	1.6	0.4
Lane LOS	E	C	C	A	A
Approach Delay (s)	24.8		19.6	1.6	0.4
Approach LOS	C		C		

Intersection Summary				
Average Delay	5.7			
Intersection Capacity Utilization	60.8%	ICU Level of Service	B	
Analysis Period (min)	15			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	48	55	81	339	341	124
Future Volume (Veh/h)	48	55	81	339	341	124
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	52	60	88	368	371	135
Pedestrians	30			138	51	
Lane Width (m)	3.6			3.6	3.6	
Walking Speed (m/s)	1.2			1.2	1.2	
Percent Blockage	3			12	4	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)				114		
pX, platoon unblocked	0.95					
vC, conflicting volume	1064	606	536			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1042	606	536			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	86	91			
cM capacity (veh/h)	205	429	1001			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	112	456	506
Volume Left	52	88	0
Volume Right	60	0	135
cSH	284	1001	1700
Volume to Capacity	0.39	0.09	0.30
Queue Length 95th (m)	14.4	2.3	0.0
Control Delay (s)	25.7	2.5	0.0
Lane LOS	D	A	
Approach Delay (s)	25.7	2.5	0.0
Approach LOS	D		

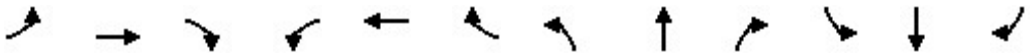
Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	284	186	359	416
v/c Ratio	0.31	0.35	0.42	0.53
Control Delay	8.3	9.9	11.1	12.4
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	8.3	9.9	11.1	12.4
Queue Length 50th (m)	4.5	5.6	12.4	14.5
Queue Length 95th (m)	13.4	19.8	44.8	54.6
Internal Link Dist (m)	53.3	103.0	82.4	90.0
Turn Bay Length (m)				
Base Capacity (vph)	1677	952	1042	968
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.20	0.34	0.43

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	93	70	31	91	54	55	260	26	91	221	83
Future Volume (vph)	106	93	70	31	91	54	55	260	26	91	221	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.2			5.2	
Lane Util. Factor		0.95			1.00			1.00			1.00	
Frpb, ped/bikes		0.98			0.98			1.00			0.99	
Flpb, ped/bikes		0.99			0.99			1.00			1.00	
Frt		0.96			0.96			0.99			0.97	
Flt Protected		0.98			0.99			0.99			0.99	
Satd. Flow (prot)		3215			1727			1820			1765	
Flt Permitted		0.83			0.88			0.88			0.84	
Satd. Flow (perm)		2725			1535			1621			1494	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	98	74	33	96	57	58	274	27	96	233	87
RTOR Reduction (vph)	0	55	0	0	38	0	0	5	0	0	17	0
Lane Group Flow (vph)	0	229	0	0	148	0	0	354	0	0	399	0
Confl. Peds. (#/hr)	40		62	62		40	24		54	54		24
Confl. Bikes (#/hr)			1			1						2
Heavy Vehicles (%)	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		9.5			9.5			17.4			17.4	
Effective Green, g (s)		9.5			9.5			17.4			17.4	
Actuated g/C Ratio		0.26			0.26			0.47			0.47	
Clearance Time (s)		5.0			5.0			5.2			5.2	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		697			393			760			700	
v/s Ratio Prot												
v/s Ratio Perm		0.08			c0.10			0.22			c0.27	
v/c Ratio		0.33			0.38			0.47			0.57	
Uniform Delay, d1		11.2			11.4			6.7			7.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.3			0.6			0.5			1.1	
Delay (s)		11.5			12.0			7.1			8.3	
Level of Service		B			B			A			A	
Approach Delay (s)		11.5			12.0			7.1			8.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	37.1	Sum of lost time (s)	10.2
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	55	0	33	14	1	29	29	265	15	16	261	60
Future Volume (Veh/h)	55	0	33	14	1	29	29	265	15	16	261	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Hourly flow rate (vph)	62	0	37	16	1	33	33	298	17	18	293	67
Pedestrians		8			7			4			13	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											106	
pX, platoon unblocked												
vC, conflicting volume	790	758	338	783	784	326	368			322		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	790	758	338	783	784	326	368			322		
tC, single (s)	7.2	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	77	100	95	94	100	95	97			99		
cM capacity (veh/h)	268	318	697	280	308	703	1183			1231		

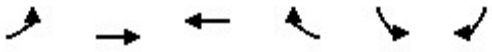
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	99	50	348	378
Volume Left	62	16	33	18
Volume Right	37	33	17	67
cSH	348	466	1183	1231
Volume to Capacity	0.28	0.11	0.03	0.01
Queue Length 95th (m)	9.2	2.9	0.7	0.4
Control Delay (s)	19.4	13.7	1.0	0.5
Lane LOS	C	B	A	A
Approach Delay (s)	19.4	13.7	1.0	0.5
Approach LOS	C	B		

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	42.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	198	31	78	161	18	72
Future Volume (Veh/h)	198	31	78	161	18	72
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)	215	34	85	175	20	78
Pedestrians					9	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				118		
pX, platoon unblocked						
vC, conflicting volume			258		586	241
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			258		586	241
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		95	90
cM capacity (veh/h)			1297		438	792

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	249	260	98
Volume Left	0	85	20
Volume Right	34	0	78
cSH	1700	1297	680
Volume to Capacity	0.15	0.07	0.14
Queue Length 95th (m)	0.0	1.7	4.0
Control Delay (s)	0.0	3.0	11.2
Lane LOS		A	B
Approach Delay (s)	0.0	3.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	37	233	177	52	36	62
Future Volume (Veh/h)	37	233	177	52	36	62
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	45	284	216	63	44	76
Pedestrians			26		43	
Lane Width (m)			3.6		3.6	
Walking Speed (m/s)			1.2		1.2	
Percent Blockage			2		4	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			101			
pX, platoon unblocked						
vC, conflicting volume	322				690	290
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	322				690	290
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				88	89
cM capacity (veh/h)	1193				373	722

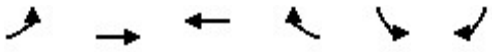
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	329	279	120
Volume Left	45	0	44
Volume Right	0	63	76
cSH	1193	1700	537
Volume to Capacity	0.04	0.16	0.22
Queue Length 95th (m)	0.9	0.0	6.8
Control Delay (s)	1.4	0.0	13.6
Lane LOS	A		B
Approach Delay (s)	1.4	0.0	13.6
Approach LOS			B

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	269	0	0	229	0	0
Future Volume (Veh/h)	269	0	0	229	0	0
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)	292	0	0	249	0	0
Pedestrians					22	
Lane Width (m)					3.6	
Walking Speed (m/s)					1.2	
Percent Blockage					2	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				77		
pX, platoon unblocked						
vC, conflicting volume			314		563	314
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			314		563	314
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1223		479	713

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	292	249	0
Volume Left	0	0	0
Volume Right	0	0	0
cSH	1700	1223	1700
Volume to Capacity	0.17	0.00	0.05
Queue Length 95th (m)	0.0	0.0	0.0
Control Delay (s)	0.0	0.0	0.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	0.0
Approach LOS			A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	17.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	0	0	90	85	0
Future Volume (Veh/h)	0	0	0	90	85	0
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)	0	0	0	98	92	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	98				49	49
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	98				49	49
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				90	100
cM capacity (veh/h)	1495				960	1020

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	0	98	92
Volume Left	0	0	92
Volume Right	0	98	0
cSH	1700	1700	960
Volume to Capacity	0.00	0.06	0.10
Queue Length 95th (m)	0.0	0.0	2.5
Control Delay (s)	0.0	0.0	9.1
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.1
Approach LOS			A

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	16.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	WBT	NBT	SBT
Lane Group Flow (vph)	284	186	359	416
v/c Ratio	0.66	0.65	0.67	0.87
Control Delay	32.9	38.7	29.1	43.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	32.9	38.7	29.1	43.7
Queue Length 50th (m)	18.4	24.6	46.3	57.3
Queue Length 95th (m)	32.8	47.9	82.5	#116.1
Internal Link Dist (m)	42.4	103.0	82.4	90.0
Turn Bay Length (m)				
Base Capacity (vph)	612	407	673	598
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.46	0.46	0.53	0.70

Intersection Summary

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

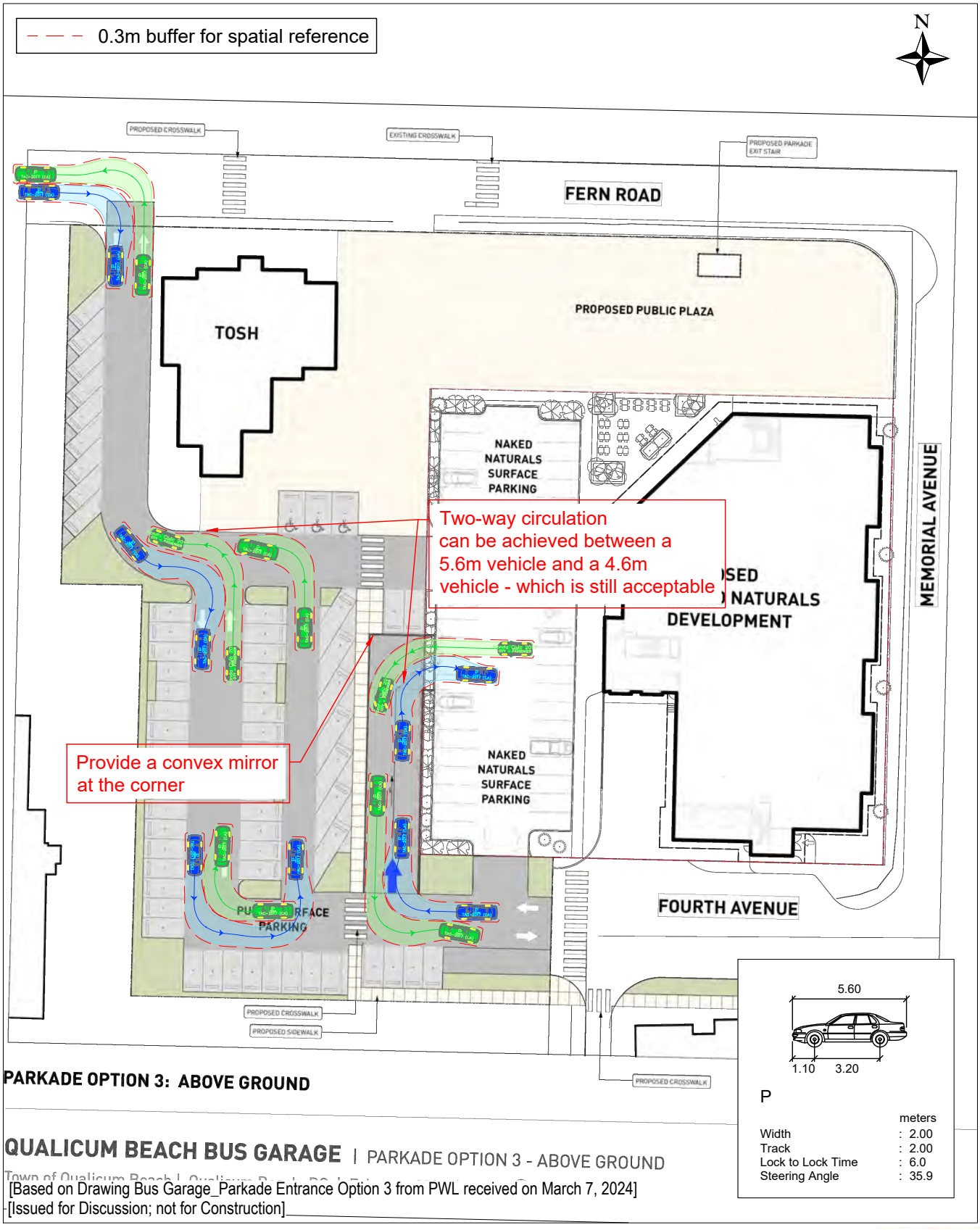
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	106	93	70	31	91	54	55	260	26	91	221	83
Future Volume (vph)	106	93	70	31	91	54	55	260	26	91	221	83
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			5.2			5.2	
Lane Util. Factor		0.95			1.00			1.00			1.00	
Frpb, ped/bikes		0.95			0.96			1.00			0.99	
Flpb, ped/bikes		0.97			0.98			1.00			0.99	
Frt		0.96			0.96			0.99			0.97	
Flt Protected		0.98			0.99			0.99			0.99	
Satd. Flow (prot)		3068			1664			1816			1759	
Flt Permitted		0.70			0.88			0.86			0.78	
Satd. Flow (perm)		2177			1483			1572			1379	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	112	98	74	33	96	57	58	274	27	96	233	87
RTOR Reduction (vph)	0	42	0	0	19	0	0	3	0	0	11	0
Lane Group Flow (vph)	0	242	0	0	167	0	0	356	0	0	405	0
Confl. Peds. (#/hr)	40		62	62		40	24		54	54		24
Confl. Bikes (#/hr)			1			1						2
Heavy Vehicles (%)	2%	2%	4%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.8			13.8			26.5			26.5	
Effective Green, g (s)		13.8			13.8			26.5			26.5	
Actuated g/C Ratio		0.18			0.18			0.34			0.34	
Clearance Time (s)		5.0			5.0			5.2			5.2	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		385			262			534			468	
v/s Ratio Prot												
v/s Ratio Perm		0.11			c0.11			0.23			c0.29	
v/c Ratio		0.63			0.64			0.67			0.86	
Uniform Delay, d1		29.7			29.8			22.0			24.1	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		3.2			5.0			3.1			15.3	
Delay (s)		32.9			34.8			25.1			39.3	
Level of Service		C			C			C			D	
Approach Delay (s)		32.9			34.8			25.1			39.3	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM 2000 Control Delay	33.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	78.0	Sum of lost time (s)	13.2
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

The attached information is provided to support the agency's review process and shall not be distributed to other parties without written consent from Bunt & Associates Engineering Ltd.

APPENDIX C

Swept Path Analysis



PARKADE OPTION 3: ABOVE GROUND

QUALICUM BEACH BUS GARAGE | PARKADE OPTION 3 - ABOVE GROUND

Town of Qualicum Beach | Qualicum Beach BC | Title

[Based on Drawing Bus Garage_Parkade Entrance Option 3 from PWL received on March 7, 2024]
[Issued for Discussion; not for Construction]

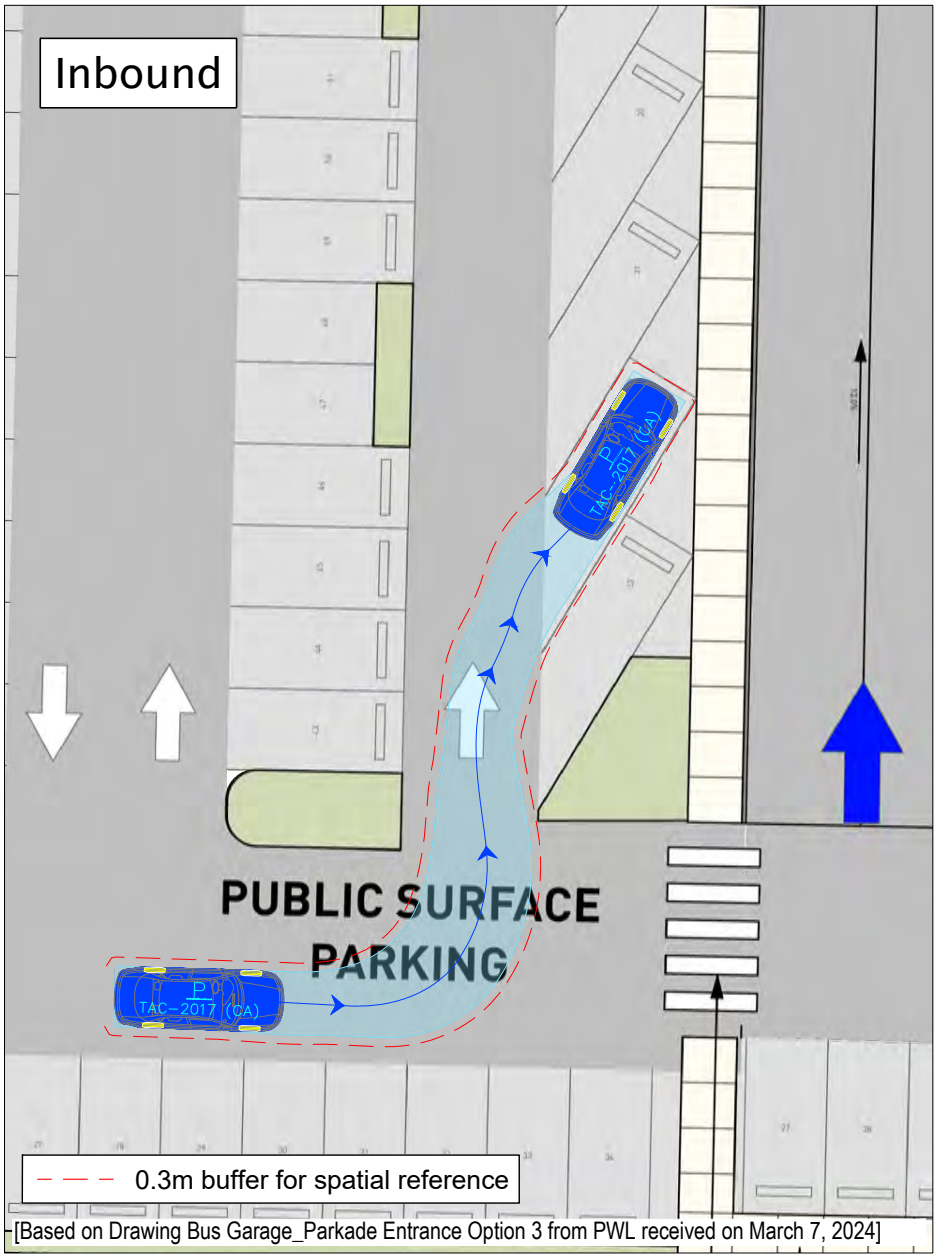
Exhibit 1

Passenger Vehicle Circulation - Option 3

Naked Natural Foods Site Plan

08-23-0012 March 2024 Scale 1:750 on Letter Prepared by KQ

bunt & associates



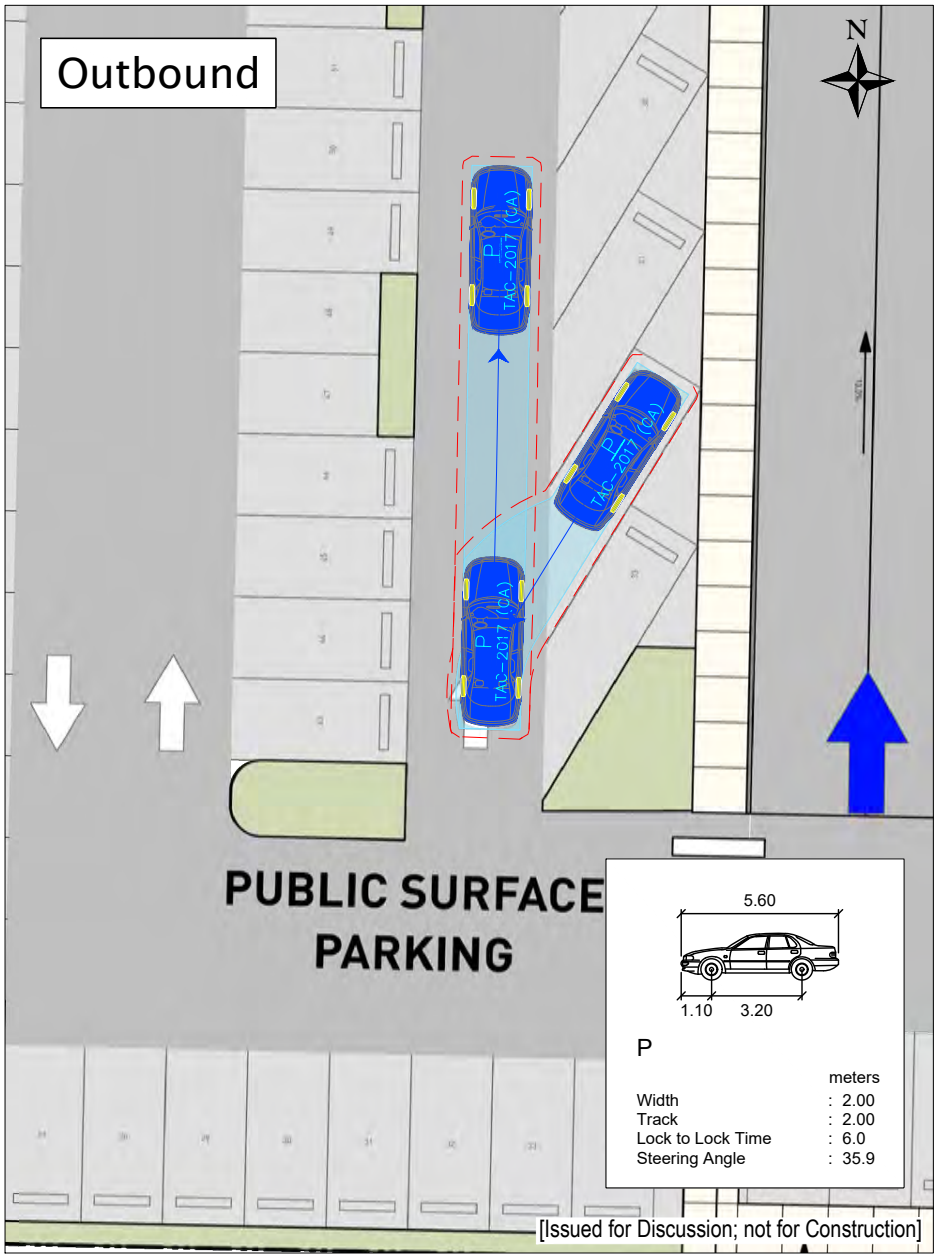


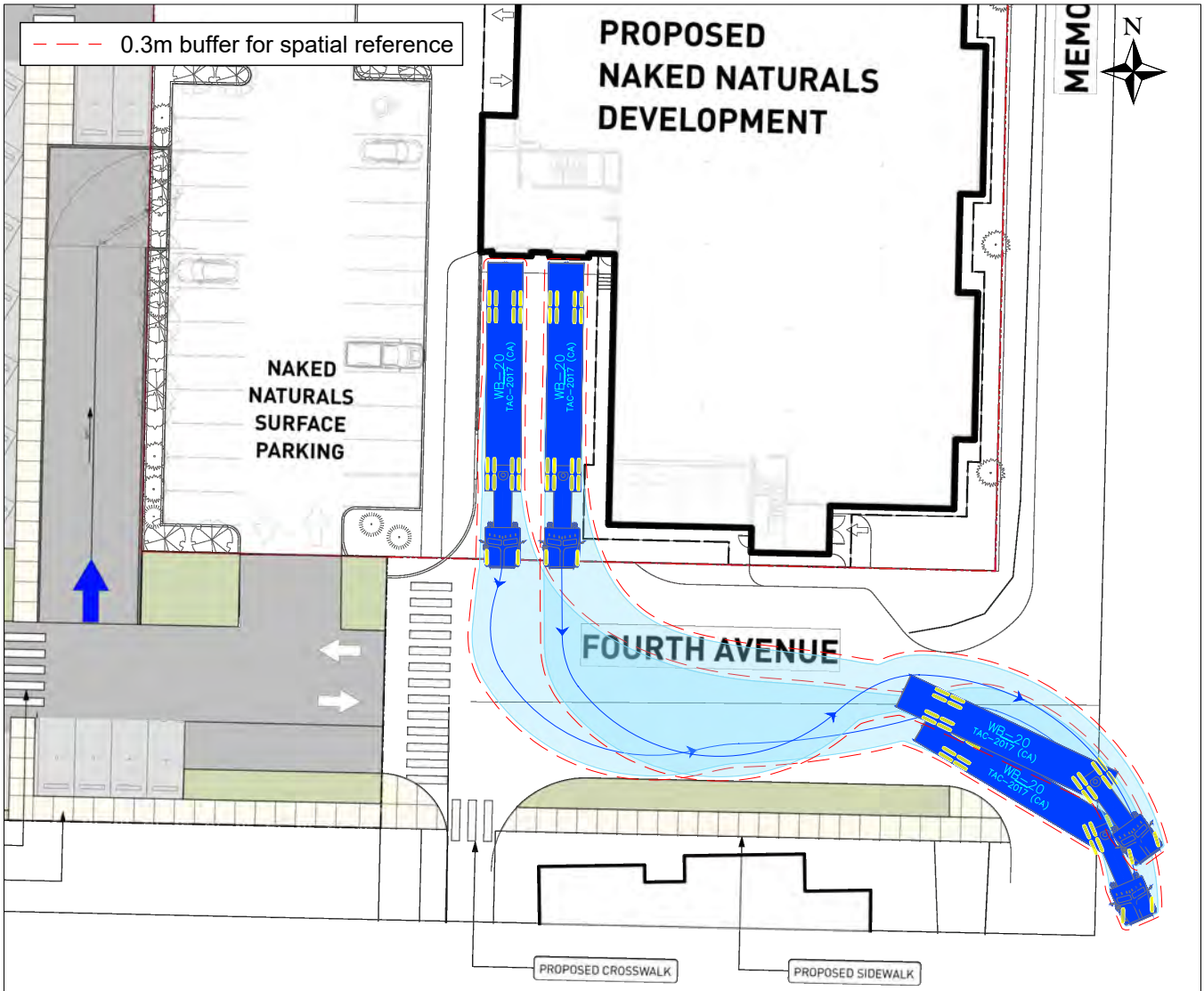
Exhibit 2

Passenger Vehicle Parking - One-Way Angled Parking

Naked Natural Foods Site Plan

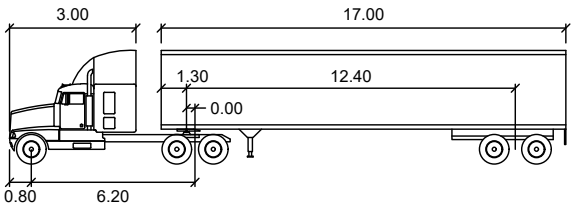
08-23-0012 March 2024 Scale 1:250 on Letter Prepared by KQ

bunt & associates



PARKADE OPTION 3 - ABOVE GROUND

February 2024 | 1:250



WB-20

meters

Tractor Width	: 2.60	Lock to Lock Time	: 6.0
Trailer Width	: 2.60	Steering Angle	: 28.2
Tractor Track	: 2.60	Articulating Angle	: 70.0
Trailer Track	: 2.60		

[Based on Drawing Bus Garage_Parkade Entrance Option 3 from PWL received on March 7, 2024]
[Issued for Discussion; not for Construction]

Exhibit 4

WB-20 Maneuvers - Outbound - Option 3

Naked Natural Foods Site Plan

08-23-0012 March 2024 Scale 1:500_1 on Letter Prepared by KQ

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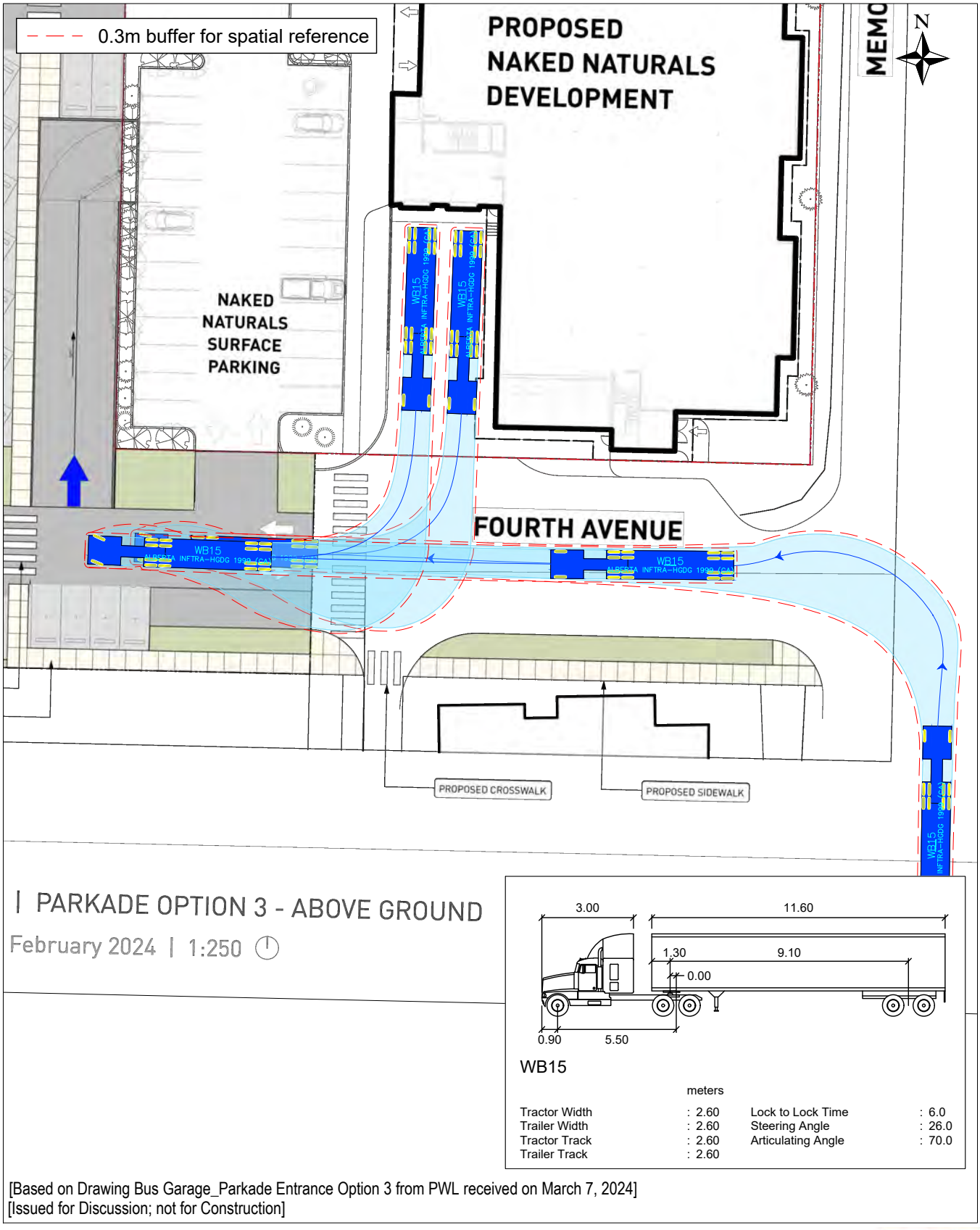

[Based on Drawing Bus Garage_Parkade Entrance Option 3 from PWL received on March 7, 2024]
[Issued for Discussion; not for Construction]

Exhibit 5

WB-15 Maneuvers - Inbound - Option 3

Naked Natural Foods Site Plan
08-23-0012 March 2024 Scale 1:500_1 on Letter Prepared by KQ

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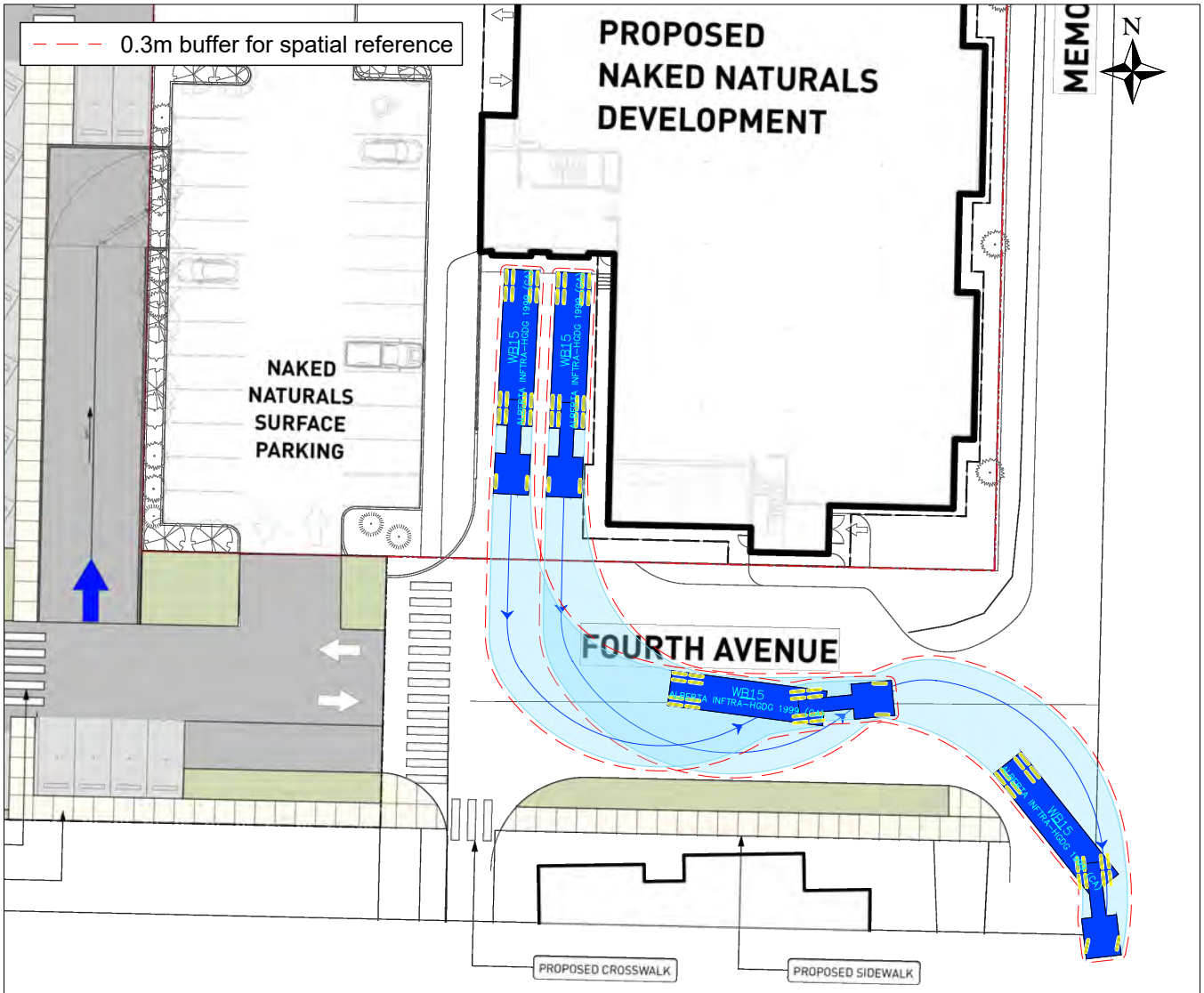
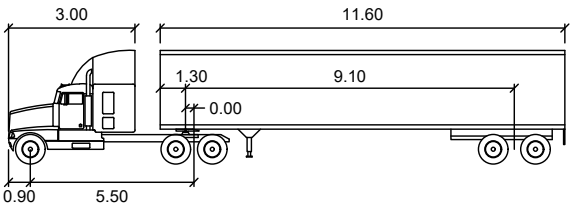


PARKADE OPTION 3 - ABOVE GROUND

February 2024 | 1:250



WB15

meters

Tractor Width	: 2.60	Lock to Lock Time	: 6.0
Trailer Width	: 2.60	Steering Angle	: 26.0
Tractor Track	: 2.60	Articulating Angle	: 70.0
Trailer Track	: 2.60		

[Based on Drawing Bus Garage_Parkade Entrance Option 3 from PWL received on March 7, 2024]
[Issued for Discussion; not for Construction]

Exhibit 6

WB-15 Maneuvers - Outbound - Option 3

Naked Natural Foods Site Plan
08-23-0012 March 2024 Scale 1:500_1 on Letter Prepared by KQ

bunt & associates