

Phase 2 Summary Report

Wesbrook Place Neighbourhood Plan

Project: Wesbrook Place Neighbourhood Plan

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1 Executive Summary

This technical report is an update to the report prepared for Phase 1 engagement of the Wesbrook Place Neighbourhood Plan Amendment. It presents the results of a traffic analysis, which was undertaken to understand the impact of planned growth in the Wesbrook Place neighbourhood as well as the effectiveness of assessed road infrastructure improvements to minimize the impacts and address existing issues in the neighbourhood.

The transportation model analyzed the morning, afternoon, and weekend peak hours. These peak hours were analysed for each of the scenarios summarized in Table 1.1.

Table 1.1: Modelled scenarios.

No.	Scenario	Demand Year	Description
1	Present year base model	2024	Present year traffic and pedestrian demand. Present-year infrastructure and transit operations.
2a	Future year – Do nothing	2035	Future year traffic (existing traffic + traffic growth to year 2035 + development generated traffic). Future year pedestrian demand (existing pedestrian + pedestrian growth to year 2035). Present-year infrastructure and transit operations.
2b	Future year – With Improvements	2035	Future year traffic (existing traffic + traffic growth to year 2035 + development generated traffic). Future year pedestrian demand (existing pedestrian + pedestrian growth to year 2035). Future year cyclist demand (existing cyclist + cyclist growth to year 2035). Considered infrastructural and operational interventions in 2035, and future-year transit operations.

In this round of modelling for Phase 2 engagement of the Plan, eight road infrastructure improvements were assessed in the future year. Most of the improvements are consistent with the modelling from the Phase 1 engagement. However, the ones that did not provide any benefits have been removed and a few new improvements have been added in response to feedback during Phase 1 engagement. Most of these proposed improvements are consistent with the Wesbrook Place Neighbourhood Plan update's draft plan, but some proposals are expected to be considered as part of future planning, or as part of the Campus Plan update. The eight infrastructure improvements are shown in Table 1.2 and contextually represented in Figure 6.1 later in the report. Implementation of these improvements will require collaboration with the BC Ministry of Transportation and Transit, TransLink, and University Neighbourhoods Association.

Table 1.2: Considered Road Infrastructural Improvements

No.	Location	Description
A	Binning and West 16th Avenue*	Implementation of pedestrian-controlled signalized intersection.
B	Wesbrook Mall and West 16th Avenue	Widened northbound Wesbrook Mall at West 16th Avenue to provide a dedicated lane for right turns onto West 16 th Avenue.
E	Wesbrook Mall and Southwest Marine Drive	Provided additional lane to allow buses to jump the queue travelling southbound on Wesbrook Mall to turn left onto Marine Drive.
F	Wesbrook Mall between Thunderbird Boulevard and West 16th Avenue	Upgraded street to include additional bus only lane north of West 16 th Avenue in the northbound travel direction.
G	West 16th Avenue between Wesbrook Mall and East Mall**	Upgrading the existing zebra crossing to a pedestrian signal.
H	Gray Avenue and Ross Drive**	Local street bikeway on Gray Avenue and Ross Drive
I	Gray Avenue and Wesbrook Mall**	Upgrading the existing all-way stop to accommodate a pedestrian/cyclist signal for crossing movements on Wesbrook Mall.
J	West 16th Avenue*	A new multi-use path on the south side of West 16th Avenue

* Detailed design to be determined and in accordance with BC Ministry of Transportation and Transit design guidelines.

** To be considered as part of future planning.

Traffic performance was compared for the three periods and scenarios by analyzing delays, queue lengths at intersections, and travel times experienced by vehicles and transit along key corridors.

Future year traffic increases were most notable along West 16th Avenue and Wesbrook Mall, leading to significant capacity constraints at the West 16th Avenue and Wesbrook Mall roundabout. Network upgrades in the *With Improvements* scenario mitigate most of the forecasted increased delays at that roundabout in the future year.

There is an overall increase in traffic using the local roads as a result of the growth planned for the neighbourhood, which does increase delays and queuing in the *Do Nothing* scenario, but the forecasted increases in delays and queuing are mitigated by the considered infrastructure improvements in the *With Improvements* scenario.

Table 1.3 documents the Level of Service at intersections, based on simulated traffic delay performance compared to established industry standards. Intersection performance is shown here for the PM peak hour since that is the overall peak period for the day, with the highest traffic volumes and associated impacts to level of service.

Table 1.3: Intersection Level of Service (LOS) results in the PM peak

No	Intersection Name	Present Year	Do Nothing	With Improvements
1	SW Marine Dr & W 16 Ave	A	A	A
2	East Mall and W 16 Ave	A	A	A
3	Wesbrook Mall and W 16 Ave	C	D	B
4	W 16 Ave & Hampton Pl/Binning Rd	A	A	B
5	Wesbrook Mall and Hampton Pl	B	F	A
6	Wesbrook Mall and Berton Ave	B	B	A
7	Berton Ave and Binning Rd	A	A	A
8	Birney Ave and Ross Dr	A	A	A
9	Birney Ave and Webber Lane	A	A	A
10	Birney Ave and Shrum Lane	B	A	A
11	Wesbrook Mall and Birney Ave	C	D	B
12	Binning Rd and Birney Ave	A	A	A
13	Gray Ave and Ross Dr	A	A	A
14	Wesbrook Mall and Gray Ave	A	A	A
15	Gray Ave and Binning Rd	A	A	A
16	Wesbrook Mall and Ross Drive	B	C	B
17	Wesbrook Mall & Binning Rd	A	A	A
18	Wesbrook Mall & TRIUMF access	A	A	A
19	Southwest Marine Dr and Wesbrook Mall	A	A	B

Note: LOS grading levels A to F are explained in Section 7.1.

In a typical municipality in Metro Vancouver, many intersections perform at a level C or D during peak rush hour, which means a vehicle may be waiting for more than one light cycle at a signalized intersection or be in a longer queue waiting up to 35 seconds to go through a non-signalized intersection. At UBC, LOS A or B means that vehicles will be delayed less than 20 seconds at signals (which represents free flow conditions or waiting for only one signal cycle) or 15 seconds at non signalized intersections.

Some of the assessed infrastructure improvements result in trade-offs between traffic operations and safety for car driver, transit, and active modes road users. The key takeaways of the considered improvements are as follows:

- Changes to the road geometry at West 16th Avenue and Binning Road to enable a westbound left (WBL) turn notably improved overall network performance by providing drivers with an additional route into the Wesbrook neighbourhood. While signalization slightly increases delay and queues experienced by drivers along West 16th Avenue, it can create safety benefits for other road users.
- A northbound right-turn only lane on Wesbrook Mall at West 16th Avenue reduced delays for right-turning traffic.
- Bus priority measures at the Southwest Marine Drive and Wesbrook Mall intersection prioritize transit operations in Wesbrook Place by maintaining existing bus journey times despite future traffic growth.

- The implementation of a mid-block pedestrian signal across West 16th Avenue between East Mall and Wesbrook Mall, pedestrian / bicycle signal at Wesbrook Mall and Gray Avenue, a multi-use path along the south side of West 16 Avenue, and a local street bikeway along Ross Drive and Gray Avenue had minimal impacts on driving experience. However, these treatments are expected to have significant beneficial impacts on pedestrian and bicycling comfort in line with the future vision of the Wesbrook Neighbourhood. They are expected to result in benefits to predicted safety outcomes and could encourage additional active travel in the study area.

The results of this analysis will inform the proposed updates to the Wesbrook Place Neighbourhood Plan, and may also inform subsequent planning and implementation by UBC, the BC Ministry of Transportation and Transit, TransLink and/or the University Neighbourhoods Association.

2 Introduction

Updating the neighbourhood plan for Wesbrook Place enables opportunities to better prioritize walking, rolling, cycling, and transit in the neighbourhood through improvements to streets and intersections.

This technical report provides an updated summary of the transportation planning activities conducted by Mott MacDonald within the transportation scope of the amendments to the Wesbrook Place Neighbourhood Plan. The Phase 0 activities included modelling the impacts of a series of potential improvements to neighbourhood transportation infrastructure, and growth in travel volumes as determined by planned building uses and population distribution of the Campus Vision 2050. The phase 2 activities included modelling the impacts of a refined series of potential improvement using updated building and population distribution from the Wesbrook Place Neighbourhood Plan update's draft plan layout. In addition to benefits for pedestrians and cyclists, this traffic modeling confirms that the improvements considered would provide an acceptable level of service for vehicles in the future with Wesbrook Place South completed.

This modelling has limited applications, and focuses on vehicle and transit movements, which is only one input into how transportation networks are planned.

2.1 Purpose and Scope

Expansion and development of the Wesbrook Place neighbourhood is a key priority identified in the UBC Campus Vision 2050 and the update to the 10-Year Campus Plan. The transportation scope of the Wesbrook Place neighbourhood plan included an evaluation of the traffic impacts of considered network improvements through microsimulation modelling.

Transportation modelling was undertaken to include key intersections (study area as indicated in Figure 2.1) expected to be impacted by these potential future network improvements. The study area includes:

- Intersections adjacent to development areas, including the intersection at Binning Road and Wesbrook Mall.
- Intersections designated as 'primary' and 'secondary' entry locations at West 16th Avenue and Wesbrook Mall, West 16th Avenue and East Mall, Southwest Marine Drive and Wesbrook Mall, and Binning Avenue and Wesbrook Mall.
- Remaining intersections along roads designated as neighbourhood collectors or local streets.

Figure 2.1: Model extent and intersections included within the study area



2.2 Model Scenarios

Mott MacDonald has modelled a total of three scenarios as outlined in Table 2.1. For each scenario, three analysis peaks were modelled.

Table 2.1: Modelled scenarios.

No.	Scenario	Demand Year	Description
1	Present year base model	2024	Present year demands, present-year infrastructure, present -year transit operations.
2a	Future year – Do nothing	2035	Future year demands, present-year infrastructure, present-year transit operations.
2b	Future year – With Improvements	2035	Future year demands, considered infrastructural and operational interventions in 2035, and future-year transit operations.

2.2.1 Analysis Peaks

Based on observed traffic volume counts, AM, PM, and weekend peaks were defined as follows:

- AM Peak: 08:30 to 09:30
- PM Peak: 16:45 to 17:45
- Weekend peak: 12:00 to 13:00

2.3 Report Structure

The remainder of this report has been structured as follows:

- Sections 3 to 4 provide a summary of base present year model development, including inputs and assumptions, model development, and model calibration.
- Section 5 provides a summary of future year model development.
- Sections 6 to 11 present the evaluation metrics, results, and recommendations from the modelling analysis.

3 Model Inputs and Assumptions

3.1 Infrastructure

Present-year infrastructure was coded in VISSIM based on various geographically-coded sources as noted in Table 3.1. The desktop coding was supplemented with observations from a site visit to confirm infrastructural elements and refine the model geometry.

Table 3.1: Present-year infrastructure

Feature(s)	Source
Network and roadway geometry <ul style="list-style-type: none"> – Number of vehicle lanes – Vehicle Lane width – Curb radii – Permitted vehicle movements by lane, based on lane markings 	Maxar, Microsoft Corporation, and Distribution Airbus DS
Traffic control measures	Google Street View
Posted speed limits	Google Earth

3.2 Vehicle Travel Demand

Vehicle demands for the present year (2024) were derived from demand matrices extracted from the 2022 and 2035 10-Year Priorities networks in the TransLink Regional Travel Model (RTM) version 3.6. These 2024 matrices were subsequently adjusted based on observed turn movement count data provided by UBC.

The following steps were implemented to derive base year demand matrices:

1. The RTM model was cordoned off for the study area.
2. Matrices for 2022 and 2035 were extracted for both light and heavy vehicle classes.
3. The 2024 matrices were interpolated based on the 2022 and 2035 matrices.
4. Due to the difference in spatial aggregation between the RTM and the zonal definitions used in VISSIM, the RTM matrices were disaggregated proportionally into smaller VISSIM zones.
5. The 2024 RTM matrices served as prior demand matrices for the base year VISSIM model calibration.
6. The prior demand matrices were adjusted by comparing the modeled turn counts with the observed turn counts during model calibration.

Since the TransLink RTM version 3.6 lacks weekend demand matrices, weekend demands were assumed to be the average of the calibrated weekday AM and PM peak hour demand.

3.3 Driving Behaviour

Driving behaviour was coded to reflect the motor vehicle act, local traffic laws, rules, and behavioural tendencies. Unless otherwise noted, drivers were assumed to behave according to local regulations. A summary of key driving behaviours is given in Table 3.2.

Table 3.2: Coded driving behaviours

Behaviour	Coding	Source
Desired speeds	Coded to reflect posted speed limits along each link. Where no posted speed limits were observed (e.g., on local streets), a desired speed of 30 km/hr has been modelled in line with UBC rules.	UBC Traffic Parking Rules (dated September 2019), clause 12(a)(i)
Yielding to Buses	When a bus departs a bus stop, vehicles on the lane adjacent to the bus stop will yield to the departing bus.	Motor Vehicle Act, clause 169.1 (1)(b)

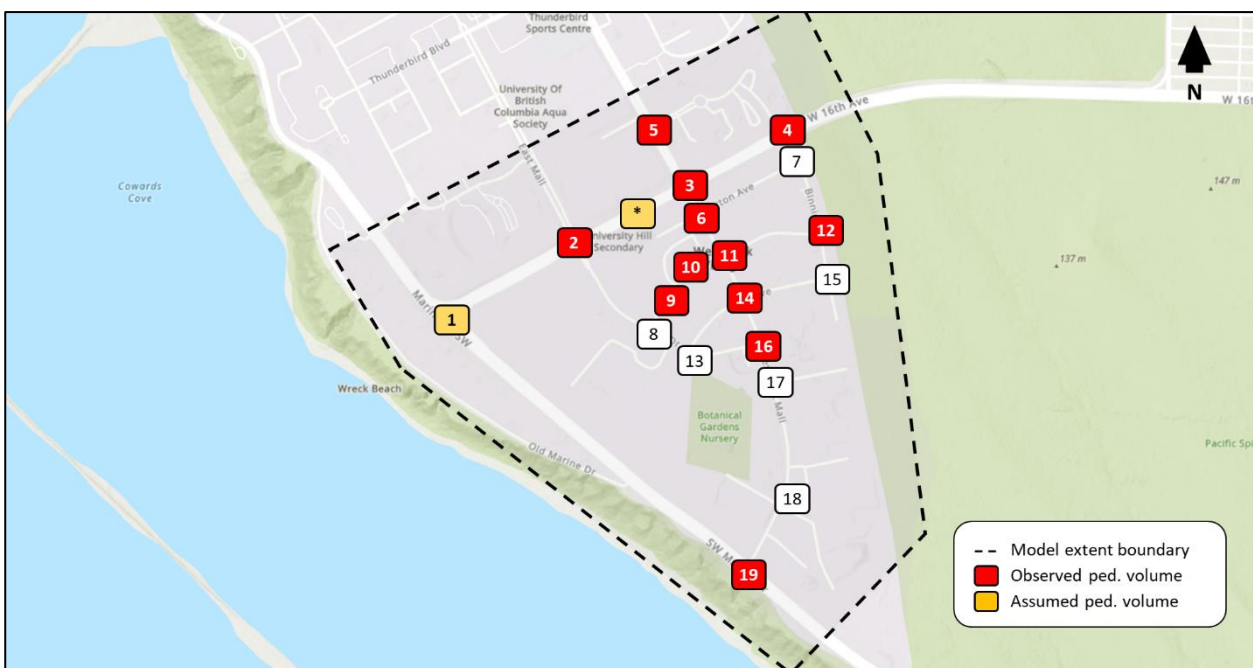
3.4 Pedestrian Demand

Pedestrian movement was modelled to capture delays experienced by drivers as they yield to pedestrians in a crosswalk. Figure 3.1 highlights the crosswalks for which pedestrian demand was modelled.

As highlighted in the figure, pedestrian demands were available for 12 out of 19 intersections. For two locations, pedestrian demands were assumed:

1. Pedestrian movement was modelled for the crosswalk on the eastern arm of Southwest Marine Drive and West 16th Avenue given the presence of pedestrian actuation at that intersection. Here, pedestrian demands were assumed to be equal to that of the western arm crosswalk at East Mall and West 16th Avenue.
2. Pedestrian movement at the mid-block crosswalk on West 16th Avenue between Wesbrook Mall and East Mall was modelled following observations of frequent pedestrian activation of the flashing beacon here during a site visit. Here, pedestrian demand was assumed to be equal to that of the eastern arm crosswalk at Wesbrook Mall and West 16th Avenue.

Figure 3.1: Modelled pedestrian movements



3.5 Transit Operations

Transit vehicles were included in the model to capture the effect of bus dwelling and merging behaviour on traffic operations. Information on present-year transit operations were derived from TransLink’s Transit Service Performance Review (TSPR) 2023 and TransLink’s online Bus Schedules webpage.

As shown in Table 3.3 ,Figure 3.2, and Figure 3.3, five bus services operate within the study area in the present year (2024).

Table 3.3: Summary of bus services operating within the study area in the present year

Line	Line Name	Predominant Rolling Stock	Direction	Frequency during peak hour (buses per peak hour)		
				AM	PM	Weekend
025	Brentwood Station / UBC	Std. Bus	UBC	11	7	4
			Brentwood Station	8	8	4
033	29 Ave Station / UBC	Std. Bus	UBC	5	4	2
			29th Ave Station	5	4	3
049	Metrotown Station / Dunbar Loop / UBC	Artic. Bus	UBC	12	14	5
			Metrotown	12	12	5
068	UBC Exchange / Wesbrook Village	Mini-Bus	-	3	3	3
R4	41st Ave	Artic. Bus	UBC	17	17	7
			41st Ave	11	17	7

Figure 3.2: Bus services which operate within the study area



Figure 3.3: Bus stops within the study area



3.5.1 Dwell Times

As shown in Figure 3.4, bus dwell times were derived using the methodology outlined in the Transit Capacity and Quality of Service Manual (TCQSM). Peak hour boarding and alighting volumes were derived using data from the RTM and TransLink Transit Service Performance Review (TSPR). All bus services were assumed to only allow front-door boarding except for the R4 bus line. The R4 bus line serviced by articulated rolling stock was assumed to allow all-door boarding. Resulting dwell times coded into the model are shown in Table 3.4, with Figure IDs referencing locations on the map in Figure 3.3.

Figure 3.4: Methodology for estimating dwell times

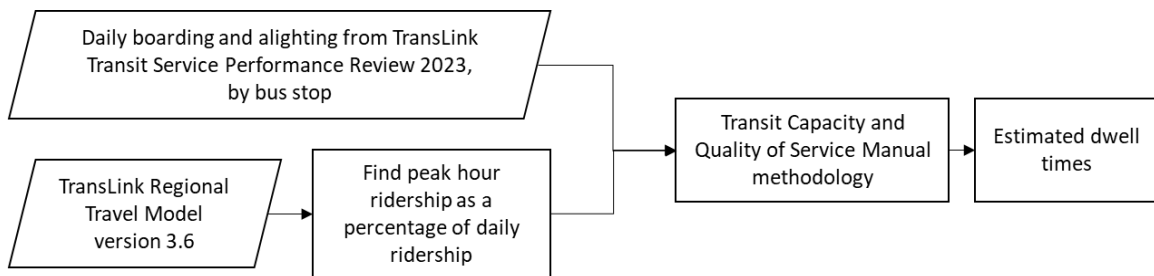


Table 3.4: Modelled bus dwell time

Figure ID	Stop ID	Stop Name	Bus Line	Dwell Time Range during Peak (s)		
				AM	PM	Weekend
A	51600	NB Wesbrook Mall @ 2900 Block	25	10-15	10-15	10-15
A	51600	NB Wesbrook Mall @ 2900 Block	33	10-15	10-15	10-15
A	51600	NB Wesbrook Mall @ 2900 Block	49	10-15	10-15	10-15
B	51483	SB Wesbrook Mall @ Hampton Pl	25	10-15	10-15	10-15
B	51483	SB Wesbrook Mall @ Hampton Pl	33	10-15	10-15	10-15
B	51483	SB Wesbrook Mall @ Hampton Pl	49	10-15	10-15	10-15
C	61043	WB W 16 Ave @ NS Wesbrook Mall	25	10-15	10-15	10-15
C	61043	WB W 16 Ave @ NS Wesbrook Mall	33	10-15	10-15	10-15
D	51484	EB W 16 Ave @ FS Wesbrook Mall	25	20-25	25-30	40-45
D	51484	EB W 16 Ave @ FS Wesbrook Mall	33	15-20	20-25	20-25
E	61044	NB Wesbrook Mall @ NS W 16 Ave	68	30-35	45-50	40-45
F	61042	EB W 16 AVE @ NS Wesbrook Mall	R4	20-25	10-15	20-25
G	51882	WB W 16 Ave @ FS Wesbrook Mall	R4	10-15	15-20	20-25
H	61580	NB Wesbrook Mall @ FS Birney Ave	49	60-65	35-40	75-80
I	61579	SB Wesbrook Mall @ Birney Ave	49	20-25	30-35	35-40
I	61579	SB Wesbrook Mall @ Birney Ave	68	20-25	30-35	35-40
J	61893	WB Ross Dr @ Birney Ave	68	10-15	10-15	10-15
K	61894	EB Ross Dr @ Birney Ave	68	15-20	20-25	15-20
L	61581	SB Wesbrook Mall @ Triumf Centre	49	10-15	10-15	10-15
M	51881	NB Wesbrook Mall @ Triumf Centre	49	10-15	10-15	10-15

4 Base Model Development

4.1 Software Package

Microsimulation modelling was conducted using PTV VISSIM 2023, service pack 14.

4.2 VISSIM Zone Configuration

The base model VISSIM zone structure for the Wesbrook Place neighbourhood and surrounding areas was coded as shown in Figure 4.1. This zone structure was later modified to account for the future growth planned in Wesbrook south, which is discussed in Section 6.

Figure 4.1: Base model VISSIM zone configuration



4.3 Dynamic Traffic Assignment

Vehicle routing was determined dynamically within VISSIM to better reflect real-world behaviour and allow drivers to react to changes in traffic conditions. Importantly, this allows the model to measure changes in driver routing in response to changes in demand and road infrastructure.

Dynamic assignment is an iterative process where vehicles aim to optimize their travel time in each run based on the travel time and cost values from the previous run. This process continues until the convergence criteria are met, which require that 85% of travel times on the paths are within 15% of the previous run for three consecutive simulation runs. The concept of dynamic assignment is based on user equilibrium, where drivers choose routes considering general costs, which depends on travel time, travel distance, financial cost such as tolls, and surcharge reflecting inconvenience. This leads to a more balanced and efficient use of the network.

For this process, costs were added to turns and local routes in VISSIM. Costs are parameters used in the VISSIM platform to represent the real-world perceptions associated with driving on local roads, such high-occupancy on-street parking, vegetation obstructing sight lines, and increased pedestrian activity, among other factors.

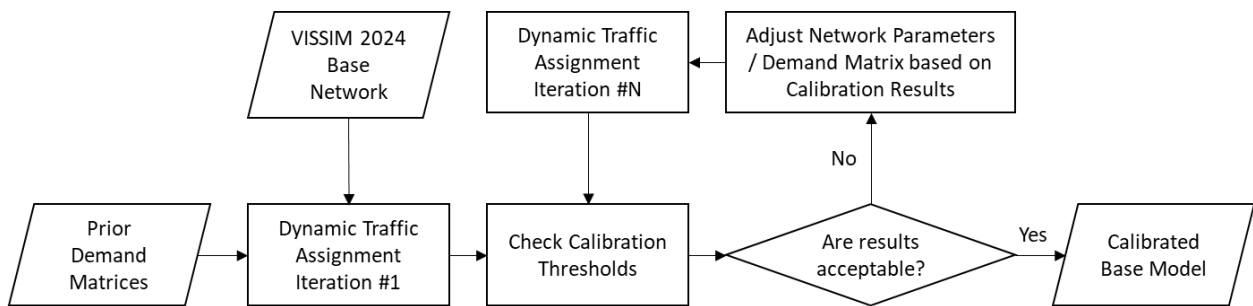
5 Base Model Calibration

5.1 Calibration Methodology

The model was calibrated using the methodology shown in Figure 5.1. The GEH statistic (formula below) is used in traffic engineering to compare modelled traffic volumes with observed traffic volumes.

$$GEH = \sqrt{\frac{2(M-C)^2}{M+C}}, \text{ where: } M \text{ is modelled flows (vph)} \\ C \text{ is observed flows (vph)}$$

Figure 5.1: Model calibration methodology



The thresholds used to determine whether the base model is sufficiently calibrated were based on industry standard for microsimulation models and are presented in Table 5.1.

Table 5.1: Calibration thresholds

Measures/Check	Target
Turn Volume:	
Percentage of Turns with GEH <=5	85%
Percentage of Turns with GEH <=10	100%
Travel Time:	
Percentage of key routes within 15% Model/Observed or within 60 seconds	100%

5.2 Survey Data

5.2.1 Travel Time

For calibration purposes, travel times were observed for four different routes during the weekday AM and PM peaks through a site visit. Weekend peak travel times were estimated using Google Maps. It should be noted that a notable amount of construction activity impeded travel along Wesbrook Mall during the weekday AM peak, but not during the PM peak observation period. Observed travel times are documented in Table 5.2 and the routes used for travel time measurement in the model are shown in Figure 5.2.

Table 5.2: Observed travel times along key routes

Travel Route	AM Peak (sec)	PM Peak (sec)	Weekend Peak (sec)
Wesbrook Mall NB	227.00	233.00	240.00
Wesbrook Mall SB	255.00	242.00	240.00
West 16th Avenue EB	148.00	134.00	180.00
West 16th Avenue WB	166.00	162.00	180.00

Figure 5.2: Routes used for travel time measurement and calibration



5.2.2 Turn Movement Counts

For calibration purposes, Mott MacDonald used the most recent turn movement counts provided by the University of British Columbia (UBC) and data collected by Premiere Traffic Data Services. As shown in Figure 5.3, observed turn movement counts were available for 12 out of 19 intersections in the study area.

Figure 5.3: Summary of observed turn movement counts for intersections in the study area



As shown in Table 5.3, eight out of the 12 datasets were collected in 2024. To obtain turn counts for each intersection that are representative of the 2024 demand year, turn movement counts were balanced through spreadsheet analysis. Turn movement counts were adjusted at intersections for which no observed turn counts existed or for which turn counts were observed before 2024.

In the absence of observed data for weekends, modeled weekend turn counts were compared against 0.9 times the observed weekday PM peak turn volumes. This multiplication factor of 0.9 was based on historical weekly counts provided by UBC.

Table 5.3: Summary of available turning movement count data

No	Intersection Name	Date
1	SW Marine Dr & W 16 Ave	<i>No Data</i>
2	East Mall and W 16 Ave	Wednesday, October 30, 2019
3	Wesbrook Mall and W 16 Ave	Thursday, October 26, 2023
4	W 16 Ave & Hampton Pl/Binning Rd	Thursday, April 27, 2023
5	Wesbrook Mall and Hampton Pl	Wednesday, March 13, 2024
6	Wesbrook Mall and Berton Ave	Wednesday, March 13, 2024
7	Berton Ave and Binning Rd	<i>No Data</i>
8	Birney Ave and Ross Dr	<i>No Data</i>
9	Birney Ave and Webber Lane	Wednesday, March 13, 2024
10	Birney Ave and Shrum Lane	Wednesday, March 13, 2024
11	Wesbrook Mall and Birney Ave	Wednesday, March 13, 2024
12	Binning Rd and Birney Ave	Wednesday, March 13, 2024
13	Gray Ave and Ross Dr	<i>No Data</i>
14	Wesbrook Mall and Gray Ave	Wednesday, March 13, 2024
15	Gray Ave and Binning Rd	<i>No Data</i>
16	Wesbrook Mall and Ross Drive	Tuesday, October 24, 2023
17	Wesbrook Mall & Binning Rd	<i>No Data</i>
18	Wesbrook Mall	<i>No Data</i>
19	Southwest Marine Dr and Wesbrook Mall	Wednesday, March 13, 2024

Note: Emboldened rows highlight intersections for which data was collected in 2024

5.3 Calibration Results

A summary of calibration results with respect to turn movement counts and travel time are shown in Table 5.4 and Table 5.5. Full calibration results with respect to turn movement counts are provided in Appendix A. All three present year models satisfied the calibration thresholds that were presented in Table 5.1.

Table 5.4: Calibration measures of final, calibrated present-year model

Measures/Check	Target	AM	PM	Weekend
Turn Volume:				
Percentage of Turns with GEH <=5	85%	95%	93%	84%
Percentage of Turns with GEH <=10	100%	100%	100%	97%
Travel Time:				
Percentage of key routes within 15% Model/Observed or within 60 seconds	100%	100%	100%	100%

Table 5.5: Comparison of observed and modelled travel time

Peak	Travel Route	Observed	Modelled	Difference	% Difference
AM	Wesbrook - NB	227	216	-11	-5%
	Wesbrook - SB	255	230	-25	-10%
	W 16 Ave - EB	148	135	-13	-9%
	W 16 Ave - WB	166	165	-1	0%
PM	Wesbrook - NB	233	236	3	1%
	Wesbrook - SB	242	269	27	11%
	W 16 Ave - EB	134	136	2	2%
	W 16 Ave - WB	162	154	-8	-5%
Weekend	Wesbrook - NB	240*	278	38	16%
	Wesbrook - SB	240*	274	34	14%
	W 16 Ave - EB	180*	135	-45	-25%
	W 16 Ave - WB	180*	159	-21	-12%

*: Observed data sourced from Google Maps and accurate to the nearest minute

6 Future Year Model Development

Two future year cases were modelled as shown in Table 6.1. The *Do Nothing* scenario evaluated the resiliency of present-year infrastructure to growth in vehicle demand. The *With Improvements* scenario evaluated the impact of considered improvements in infrastructure and transit operations on future year traffic operations.

While this modelling exercise primarily focuses on vehicle and transit movements, these improvements will not only benefit drivers and public transit users but also lead to a better experience for cyclists and pedestrians. Better traffic flow reduces congestion and delays making the transportation network more user-friendly for everyone.

Table 6.1: Changes in future year models with respect to present year model

No.	Scenario	Demand Year	Infrastructure	Vehicle Demand	Transit Operations
1	Present year base model	2024	—	—	—
2a	Future year – Do Nothing	2035	—	✓	—
2b	Future year – With Improvements	2035	✓	✓	✓

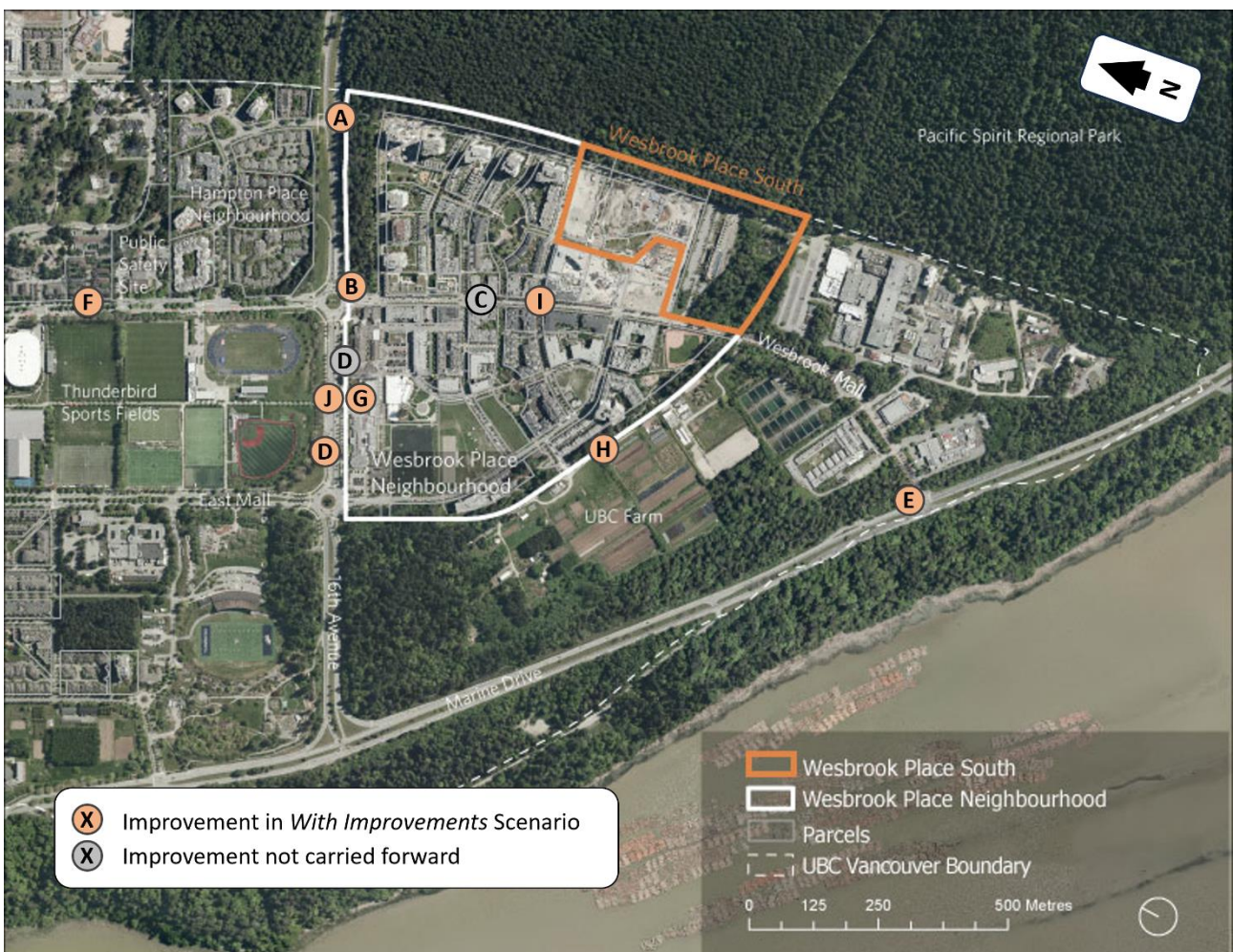
6.1 Infrastructure Improvements

Eight road infrastructure improvements were assessed in the future year *With Improvements* scenario, and they are documented in the following sections. Most of the improvements are consistent with the modelling from the Phase 1 engagement. However, the ones that did not provide any benefits have been removed and a few new improvements have been added in response to feedback during Phase 1 engagement. Most of these proposed improvements are consistent with the Wesbrook Place Neighbourhood Plan update's draft plan and implemented in phases over several years. Some proposals are expected to be considered as part of future planning, or as part of the Campus Plan update. The eight infrastructure improvements are shown in Table 1.2 and contextually represented in Figure 6.1 later in the report. Implementation of these improvements will require collaboration with the BC Ministry of Transportation and Transit, TransLink, and University Neighbourhoods Association.

Two other improvements — labelled as C and D — were investigated using the traffic microsimulation model for the first phase of engagement for the Plan. The assessed benefits of those improvements were not favourable relative to their impacts and as a result, they were removed from the suite of infrastructure improvements in the current analysis. Details on those two original treatments are included in section 6.1.9.

The locations of each of the infrastructure improvements are shown in Figure 6.1 and the improvements are described in summary in Table 6.2.

Figure 6.1: Infrastructure improvement locations



Source: UBC Campus + Community Planning, modified by Mott MacDonald

Table 6.2: Considered Road Infrastructural Improvements

No.	Location	Type	Description
A	Binning and West 16 Avenue*	Traffic control	Implementation of pedestrian-controlled signalized intersection.
B	Wesbrook Mall and West 16th Avenue	Lane addition	Widened northbound Wesbrook Mall at West 16th Avenue to provide a dedicated lane for right turns onto 16th.
E	Wesbrook Mall and Southwest Marine Drive	Lane addition	Provided additional lane to allow buses to jump the queue travelling southbound on Wesbrook Mall to turn left onto Marine Drive.
F	Wesbrook Mall between Thunderbird Boulevard and West 16 Avenue	Lane reconfiguration	Upgraded street to include additional bus only lane north of West 16th Avenue in the northbound travel direction.
G	West 16th Avenue between Wesbrook Mall and East Mall**	Traffic control	Upgrading the existing pedestrian-actuated flashing beacon crossing to a pedestrian signal.
H	Gray Avenue and Ross Drive**	Active transportation	Local street bikeway on Gray Avenue and Ross Drive
I	Gray Avenue and Wesbrook Mall**	Traffic control	Upgrading the existing all-way stop to accommodate a pedestrian/cyclist signal for crossing movements on Wesbrook Mall.
J	West 16th Avenue*	Active transportation	A multi-use path on the south side of West 16th Avenue

* Detailed design to be determined and in accordance with BC Ministry of Transportation and Transit design guidelines.

** To be considered as part of future planning.

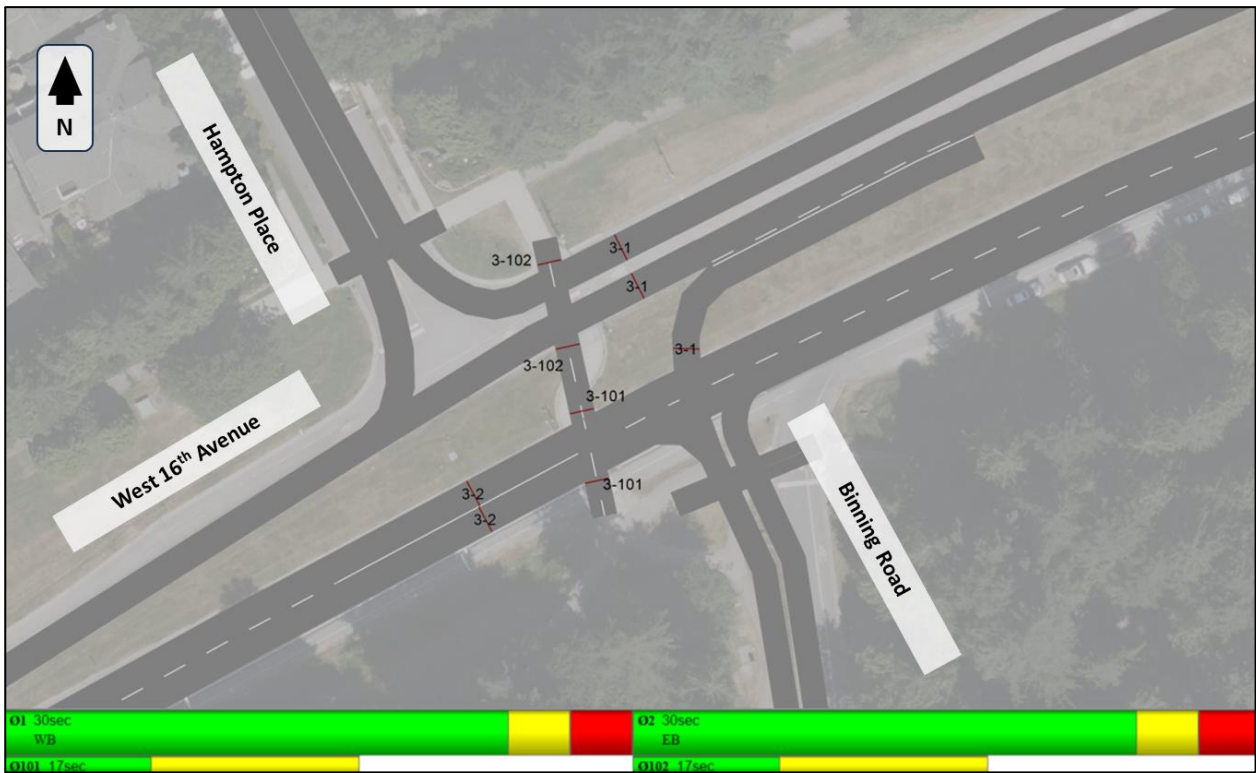
6.1.1 Improvement A: Implementation of Pedestrian-Controlled Signalized Intersection at Binning Road and West 16th Avenue

As shown in Figure 6.2, a pedestrian-controlled signal was implemented at Binning Road and West 16th Avenue, with an additional lane added along Binning Road to allow westbound left (WBL) and eastbound right (EBR) turns at the intersection. Pedestrian crossing facilitated through split phasing.

The signal was coded to operate on a fixed two-phase timing with a 60-second cycle. The pedestrian phase split is 17 seconds - 7 seconds for walking and 10 seconds for the flashing 'do not walk' signal. When westbound traffic is running, the southern crosswalk is green. Similarly, when eastbound traffic is running, the northern crosswalk is green.

The ultimate design and control at this intersection will be dictated to the BC Ministry of Transportation and Transit to ensure the intersection meets provincial design requirements. Figure 6.2 depicts the key outcome of this improvement for the study area, which is a new access into Wesbrook Place from 16th Avenue.

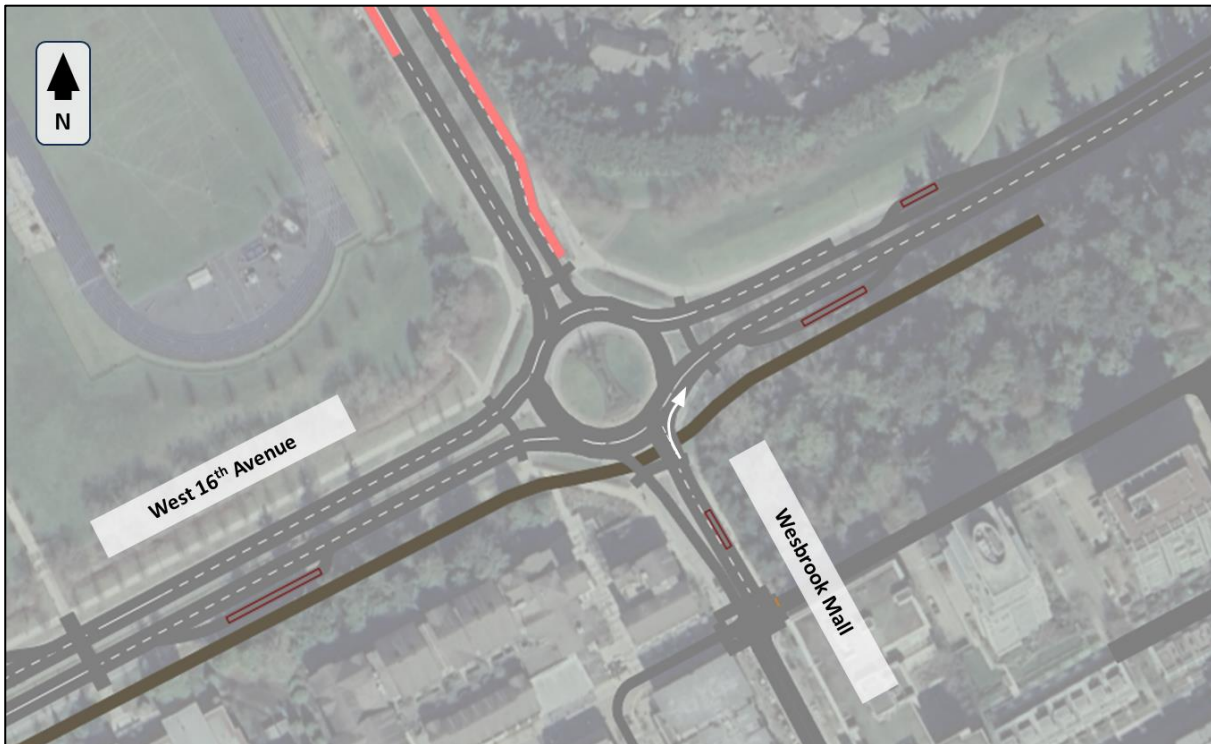
Figure 6.2: Coding of pedestrian-controlled signaled intersection at Binning Road and West 16th Avenue



6.1.2 Improvement B: Widening of northbound Wesbrook Mall at West 16th Avenue to Provide Dedicated Right-Turn Lane

As shown in Figure 6.3, the northbound approach of the intersection Wesbrook Mall at West 16th Avenue was widened to provide a dedicated lane for right turns from Wesbrook Mall onto West 16th Avenue. Lanes marked in pink in Figure 6.3 represent future potential bus-only lanes, which are discussed further in section 6.1.4.

Figure 6.3: Model coding of widened northbound Wesbrook Mall at West 16th Avenue



6.1.3 Improvement E: Bus Queue Jump at Wesbrook Mall and Southwest Marine Drive

As shown in Figure 6.4, an additional lane was added at the intersection of Wesbrook Mall and Southwest Marine Drive, allowing right-turning vehicles as well as left-turning buses to exit the intersection without waiting behind left-turning vehicles. This improvement was expected to reduce delays for buses traveling southbound on Wesbrook Mall and turning left onto Marine Drive.

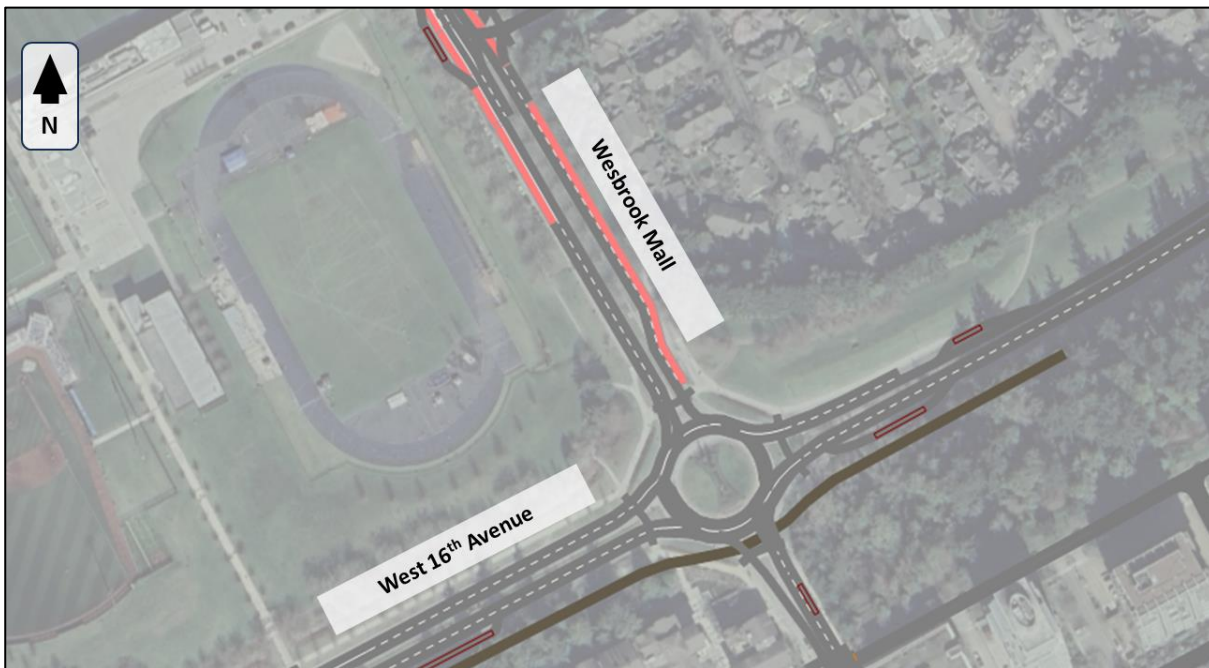
Figure 6.4: Coding of additional lane along southbound Wesbrook Mall at Marine Drive



6.1.4 Improvement F: Bus Priority at Wesbrook Mall between Thunderbird Boulevard and West 16th Avenue

As shown in Figure 6.5, Wesbrook Mall was upgraded to include an additional bus-only lane north of West 16th Avenue in the northbound direction, which is planned for Phase 4 of the Wesbrook Mall Redesign project¹. This improvement does not result in any changes to operation of the roundabout.

Figure 6.5: Coding of bus-only lanes (coloured in pink) on Wesbrook Mall between Thunderbird Boulevard and West 16th Avenue



6.1.5 Improvement G: Implementation of a Mid-block Pedestrian Signal on West 16th Avenue between East Mall and Wesbrook Mall

To test the feasibility of a new pedestrian signal on West 16th Avenue, the existing mid-block crosswalk on West 16th Avenue between East Mall and Wesbrook Mall was upgraded in the *With Improvements* scenario from a zebra crossing to a pedestrian signal, as shown in Figure 6.6. The current crossing features overhead signage with a pedestrian-actuated flashing beacon to increase visibility for pedestrians. However, some drivers still fail to yield despite the existing safety treatments for the crossing. Installing a pedestrian signal at this location could enhance safety for all road users and encourage active transportation by clearly delineating active transportation and vehicle movements. Additionally, it would improve accessibility with audible cues and countdown timers.

The signal was coded to operate on a two-phase timing according to the guidelines for a pedestrian / bicycle signal from the City of Vancouver². Details of the signal timing phases are given in Table 6.3. By default, vehicles along West 16 Avenue receive a green signal. When a pedestrian arrives at the pedestrian signal head, the pedestrian phase is serviced with a minimum green time of seven seconds and a clearance time of 24 seconds. To avoid excess delay for vehicles along West 16 Avenue, the major through movement has a minimum green time of 24 seconds, in line with the signal at Binning Road and West 16th Avenue.

¹ The Wesbrook Mall Redesign project has been ongoing since 2019 and is focused on improving the experience for people taking transit, walking, biking or rolling along the corridor. Phase 4 is the last phase of the project between 16th Avenue and Thunderbird Boulevard and is planned to be constructed summer of 2027.

² <https://vancouver.ca/files/cov/eng-tdm-signal-timing-guidelines-phase-1-final.pdf>

Table 6.3: Signal timings for mid-block pedestrian signal on West 16 Avenue

No	Phase	Min. Green (s)	Min. Red (s)	Amber (s)	Clearance (s)
1	Major Street Through	24	2.5	3.5	5
2	Pedestrian	7	—	—	24

Figure 6.6: New mid-block pedestrian signal on West 16th Avenue



6.1.6 Improvement H: Local Street Bikeway on Ross Drive and Gray Avenue

A local street bikeway on Ross Drive and Gray Avenue, as shown in Figure 6.7, is proposed to prioritize active travel through Wesbrook Place with safety and wayfinding improvements for cyclists. The posted speed limit will be set at 30 km/h, consistent with the B.C. Active Transportation Design Guidelines for a AAA neighbourhood bikeway. Traffic calming measures may be implemented to reduce driver speeds and limit traffic flow. Additionally, signage and pavement markings will communicate with all road users that the road is a shared space for all modes of transportation.

Within the traffic microsimulation model, the local street bikeway on Ross Drive and Gray Avenue is depicted with links that limit vehicle speeds to 30 km/h, which is common for local roads in the study area.

Figure 6.7: Local Street Bikeway on Ross Drive and Gray Avenue



6.1.7 Improvement I: Implementation of a Pedestrian / Bicycle Signal at the Intersection of Gray Avenue and Wesbrook Mall

The existing all-way stop-controlled intersection at Gray Avenue and Wesbrook Mall was upgraded in the *With Improvements* scenario to a pedestrian / bicycle signal to accommodate active transportation movements across Wesbrook Mall, as shown in Figure 6.8. The proposed signal is expected to have benefits both for vehicle movements on Wesbrook Mall and for active transportation. First, the signal complements the local street bikeway Improvement H by delineating pedestrian and bicycle movements on Gray avenue across Wesbrook Mall from conflicting vehicle movements, increasing safety and amenity; potentially encouraging additional active transportation along the new bikeway. Second, the signal will be need actuated, and eliminates the need for vehicles on Wesbrook Mall to come to a stop and incurring delays even when no pedestrians or cyclists are present, potentially increasing traffic flow and reducing congestion and transit travel times along the main northbound/southbound thoroughfare through Wesbrook Place.

The signal was coded to operate on a two-phase timing according to the guidelines for a pedestrian / bicycle signal from the City of Vancouver³, with timing details given in Table 6.4. Signal heads for vehicles were placed along Wesbrook Mall only. Vehicles traveling along Gray Avenue remain stop controlled. By default, vehicles along Wesbrook Mall receive a green signal. When a pedestrian or bicycle traveling along Gray Avenue arrives at the intersection, the pedestrian / bicycle phase is serviced with a minimum green time of seven seconds and a clearance time of 10 seconds.

Table 6.4: Signal timings for pedestrian / bicycle signal at Gray Avenue and Wesbrook Mall

No	Phase	Min. Green (s)	Min. Red (s)	Amber (s)	Clearance (s)
1	Major Street Through	16	2.5	3.5	5
2	Pedestrian / Bicycle	7	—	—	10

³ <https://vancouver.ca/files/cov/eng-tdm-signal-timing-guidelines-phase-1-final.pdf>

Figure 6.8: New pedestrian / bicycle signal at Gray Avenue and Wesbrook Mall



6.1.8 Improvement J: Multi-Use Path on West 16th Avenue

A multi-use path on the south side of West 16th Avenue, as shown in Figure 6.9, can increase journey quality and safety for active transportation users relative to the existing painted bike lanes on the corridor. Cyclists and micromobility users in the existing painted bike lane have no physical separation from vehicles—some of which travel at high speeds—on West 16th Avenue, while a multi-use path would have a curb and landscaped boulevard separating vulnerable road users from motorized traffic.

Implications of the multi-use path for the traffic analysis were limited to modelling the interactions between active transportation users and drivers at Ross Drive and Wesbrook Mall where the path would cross the south legs of those intersections with West 16th Avenue. The design of the multi-use path crossing at the roundabout intersections is expected to increase safety relative to the existing configuration, while potentially resulting in some additional delays for drivers, and the model was used to estimate those delays.

This multi-use path is envisioned as an interim measure that will complement future curb-separated bicycle lanes on both sides of West 16th Avenue to be designed and implemented by the Ministry of Transportation and Transit.

Figure 6.9: Multi-use path on the south side of West 16th Avenue



6.1.9 Other Tested Infrastructure Improvements

Two infrastructure improvements were tested in the microsimulation model as part of this analysis, but ultimately not carried forward for inclusion in the *With Improvements* scenario. Those improvements are described in this subsection of the report.

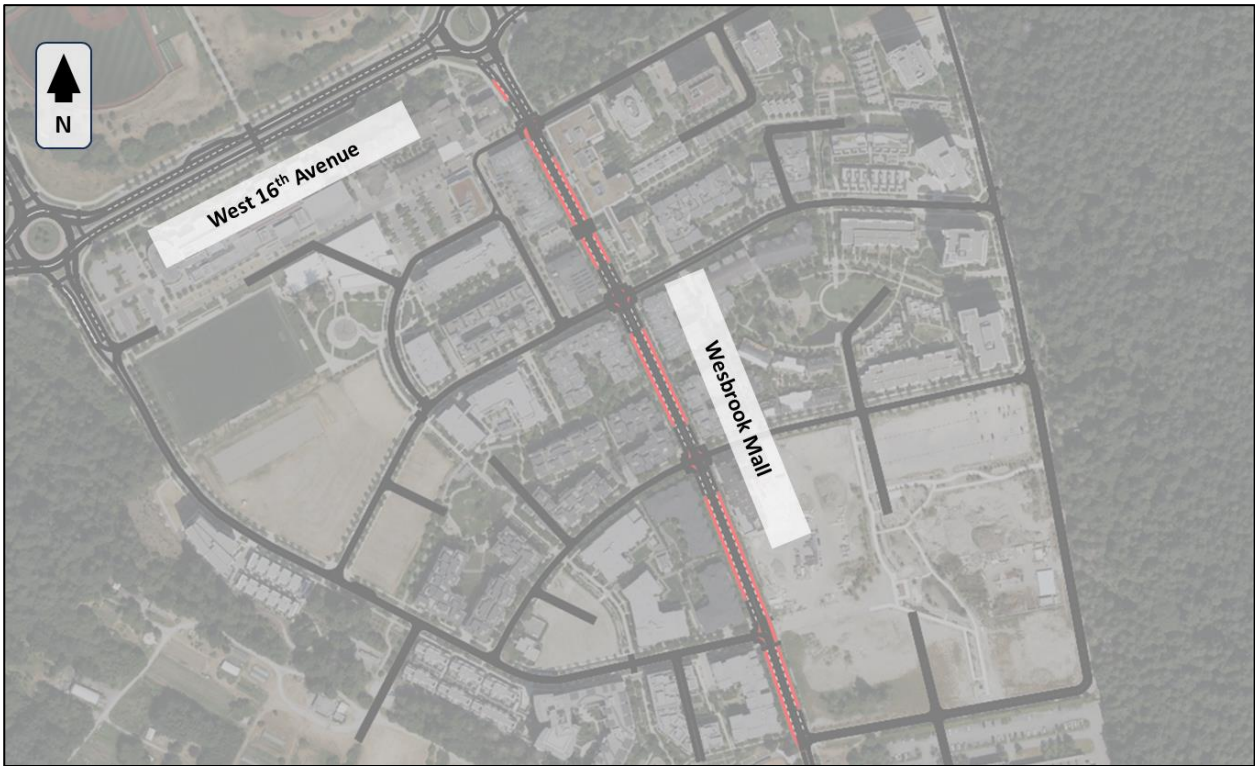
Improvement C: Wesbrook Mall Bus Prioritization

Curbside bus-only lanes in both directions of Wesbrook Mall between Binning Road and West 16th Avenue were tested in the model, as shown in Figure 6.10, in pink. The motivation for testing the bus-only lanes was to enable efficient transit operations through the neighbourhood. It was assumed that these bus-only lanes could be used by right-turning vehicles at the approach and departure arms of an intersection.

Despite the original intention behind testing the bus-only lanes, this infrastructure improvement did not significantly enhance the movement of transit vehicles. However, it had the secondary effect of improving the operations of passenger vehicles by increasing the flexibility and capacity for right turn movements to and from Wesbrook Mall. The effectiveness of bus-only lanes along Wesbrook Mall is limited by the fact that buses must queue with general traffic at Wesbrook Mall and West 16th Avenue. Additionally, bus-only lanes on Wesbrook Mall would be implemented by reallocating road space that is used for on-street parking in the existing conditions, meaning that this infrastructure treatment would have some impact upon parking supply and access to businesses in the area.

As a result of the limited benefits for sustainable transportation, namely bus speed and reliability, the bus-only lanes on Wesbrook Mall were not included in the *With Improvements* scenario.

Figure 6.10: Coding of curbside bus-only lanes (coloured in pink) along both directions of Wesbrook Mall between Binning Road and West 16th Avenue



Improvement D: Bus Stop Reconfiguration at West 16th Avenue

The microsimulation model was used to test the conversion of two bus stops along West 16th Avenue (stop ID 51882 and 61042) between East Mall and Wesbrook Mall, as shown in Figure 6.11, from lay-by stops to in-lane stops consistent with TransLink preferences for RapidBus stops. Generally, in-lane bus stops are considered advantageous for bus speed and reliability by eliminating the need for buses to merge in and out of traffic associated with layby stops. As a trade off for the benefits for transit passengers, in-lane bus stops also generally result in additional delays for drivers that may be behind buses during passenger loading and unloading.

Results of modelling in-lane bus stops showed that the benefits for bus speed and reliability were not significant, and the conversion of the existing layby stops were not included in the *With Improvements* scenario as a result.

Figure 6.11: Coding of in-lane bus stops along West 16th Avenue between East Mall and Wesbrook Mall



6.2 Future Vehicle Travel Demand

6.2.1 Background Travel Demand Growth Forecasts

To forecast 2035 vehicle travel demand, an annual growth rate was calculated based on the 2022 and 2035 travel demand matrices⁴ extracted from RTM v.3.6. This annual growth was then applied to the 2024 calibrated matrices, as described in section 3.2. This approach is considered more accurate than directly using the 2035 RTM matrices as that model is calibrated at the regional level and not at the neighbourhood level of this study.

The RTM v.3.6 includes TransLink's 10-Year Priority investments, which includes the delivery of the Millennium Line UBC Extension with one SkyTrain station at the Trolley Loop. The 10-Year Priorities model also includes other regional investments anticipated by TransLink's Transport 2050: 10-Year Priorities Plan ("Access for Everyone"), which are also likely to impact traffic growth at UBC, given its identity as a regional destination. These regional transit investments are projected to significantly absorb the increased travel demand as a result of growth in student enrollment at UBC.

6.2.2 Forecasting New Travel due to Future Developments

While growth in enrollment at UBC is not anticipated to increase traffic volumes in Wesbrook Place, the future developments in Wesbrook Place are. More traffic will be using neighbourhood streets and existing travel patterns will change. As a result, future developments in Wesbrook Place are incorporated into the future year model scenarios.

The first round of modelling was based on Campus Vision 2050 planned future developments in Wesbrook Place Neighbourhood, including building uses and population, and provided by UBC through a file transfer on August 2, 2024. This initial Campus Vision 2050 data proposed that a total of 16 residential buildings would be constructed by the 2035 future year. This updated analysis documented in this report was based on Wesbrook Place Neighbourhood Plan update's draft plan layout, provided by UBC through a file transfer in January 2025. It proposes the same amount of building area and population as the initial modelling distributed across residential buildings as shown in Figure 6.12

Note that clusters of buildings have been aggregated into zones for use in VISSIM, resulting in the new future year zone configuration shown in Figure 6.13.

The total number of expected trips generated and attracted by these future Campus Vision 2050 developments were estimated using the ITE Trip Generation Manual, 11th Edition, through the ITE Trip Generation Web-Based App. Based on the assumed land-use category, the Trip Generation Manual does not provide rates for weekend peak hour times. Therefore, weekend peak hour trip generations and attractions have been estimated as the average of weekday AM and PM peak hour values. The total number of trip generations and attractions, by zone, is summarized in Table 6.5.

It was assumed that trip generation from future year VISSIM zones would be distributed throughout the network according to the trip patterns of nearby existing residential zones.

⁴ A travel demand matrix contains data on the number of trips made between various origin and destination zones.

Figure 6.12: Summary of Campus Vision 2050 future developments, assumed to be constructed by 2035, categorized by zone

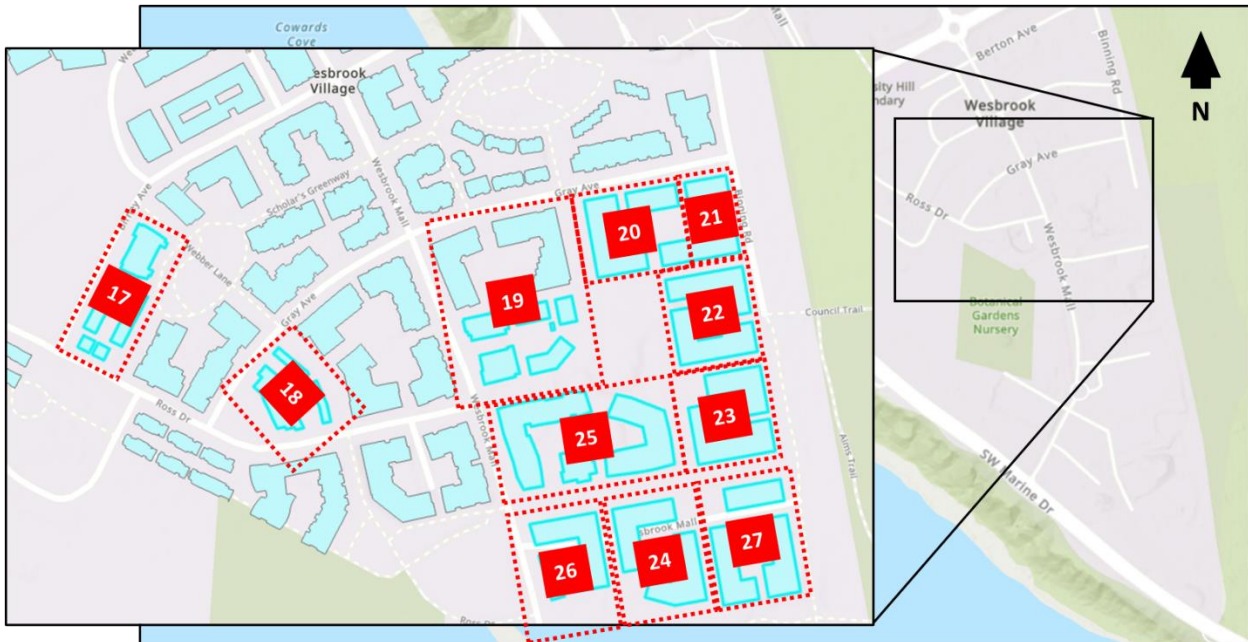


Figure 6.13: Future year VISSIM zone configuration

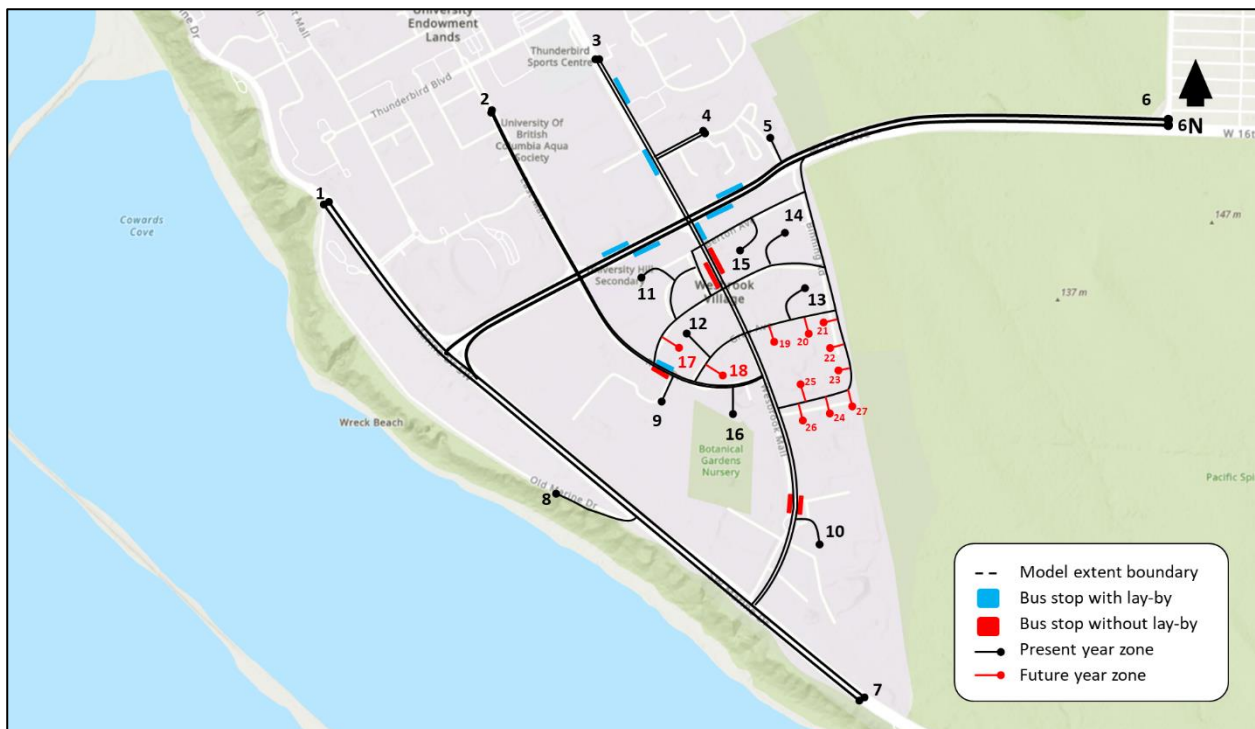


Table 6.5: Estimated trip generations and attractions, by zone

Zone	AM Peak			PM Peak			Weekend Peak		
	Trip Ends	Entries	Exits	Trip Ends	Entries	Exits	Trip Ends	Entries	Exits
17	66	15	52	50	38	12	60	27	33
18	64	14	50	47	36	12	57	25	32
19	85	17	69	57	42	15	73	30	43
20	53	14	40	38	28	10	46	21	25
21	0	0	0	0	0	0	0	0	0
22	82	21	62	62	45	17	73	33	40
23	96	24	72	71	52	19	84	38	46
24	42	11	32	35	26	9	40	19	21
25	140	26	114	115	84	31	130	56	74
26	77	19	58	58	42	16	68	31	37
27	126	32	95	90	66	24	109	49	60

6.3 Pedestrian Demand

When forecasting the pedestrian demand for the future year scenario, we referenced two documents to arrive at a reasonable and conservative growth rate. First, the UBC Campus Vision 2050 document dated December 2023 states that the daytime population is projected to grow from 80,000 people in 2023 to 100,000 in 2050. Assuming a linear growth, there will be a 10% increase in pedestrian demand from 2024 to 2035.

We also referenced the UBC Campus Vision Phase 1-3 Summary Report dated September 2023 where we used the growth in total daily person trips as a proxy for pedestrian growth. This is to capture any potential pedestrian demand generated by trips to the campus (e.g. people taking transit to the campus and walking to the destination). In 2017, the total person trips were 131,900 which is estimated to grow to 212,000 in 2050. This represents an 18% growth from 2024 to 2035.

As a conservative measure, we used a 20% growth rate which was applied to the 2024 pedestrian demand to arrive at the 2035 pedestrian demand in VISSIM.

6.4 Cyclist Demand

Cyclist and micromobility volumes in the Future Year *With Improvements* scenario were forecasted based on existing active transportation volumes collected for this project. Specifically, future year forecasts of cyclist demand for the West 16th Avenue multi-use path used existing counts at the intersections of Ross Drive and Wesbrook Mall with West 16th Avenue. The forecasts for the Gray Avenue / Ross Drive Bikeway used existing counts at the intersection of Gray Avenue and Ross Drive. A 20% growth rate was applied to these existing counts as described in section 6.3 and paired with modal split forecasts in the RTM to relate pedestrian demand to cyclist demand. It was assumed that cycling mode share would double in the *With Improvements* scenario relative to existing conditions. The assumption of doubling cycling mode share was included to conservatively model the highest anticipated impacts of active transportation movements on conflicting vehicle movements.

The resulting bike volumes in the *With Improvements* scenario are shown in Table 6.6.

Table 6.6: Bike volumes in the *With Improvements* scenario

Peak Hour	Bike Flow per Direction (pph)	
	West 16th Ave MUP	Gray Ave / Ross Dr Bikeway
AM	24	8
PM	17	11
Weekend	20	9

6.5 Transit Operations

As shown in Table 6.7 and Figure 6.14, five improvements in transit operations have been included in the future year *With Improvements* scenario following the Transit Network Concept 2035 (Underground UBCX Scenario) map prepared by Campus + Community Planning in January 2024.

Table 6.7: Improvements in transit operations in future year scenario

No.	Improvement	Description
1	Revised route for bus line 68	Route for bus line 68 has been revised such that it does not travel south of West 16th Avenue. <ul style="list-style-type: none"> • Buses are assumed to stop at all stops along its route. • Assumed to dwell for 15 to 20 seconds at each bus stop.
2	Addition of new North-South (NS) shuttle service	New shuttle service with 15-minute headways. <ul style="list-style-type: none"> • Shuttles are assumed to stop at all stops along its route. • Assumed to dwell for 15 to 20 seconds at each bus stop.
3	New bus stops along Wesbrook Mall	Two new bus stops along Wesbrook Mall between Ross Drive and Binning Road. <ul style="list-style-type: none"> • Assumed to service the North-South (NS) shuttle and the 49 bus route • Assumed to be a bus stop without a lay-by.
4	New bus stops along East Mall	Two new bus stops along East Mall north of West 16th Avenue. <ul style="list-style-type: none"> • Assumed to service the North-South (NS) shuttle service and the 68 bus line. • Bus stop along southbound East Mall is assumed to be without a lay-by while the stop along northbound East Mall is assumed to have a lay-by.

Figure 6.14: Future year bus services operating within the study area



Source: Adapted from the Transit Network Concept 2035 map prepared by Campus + Community Planning in January 2024.

7 Evaluation Metrics

The traffic impacts for *Existing*, *Do Nothing*, and *With Improvements* scenarios were evaluated using three metrics as described in this section of the report.

7.1 Delay and Level of Service (LOS)

Level of Service (LOS) is the primary indicator used for traffic operations analysis, quantifying the user experience of traffic based primarily in urban environments on delays experienced by drivers. LOS ranges from levels A to F, where levels A, B, C and D for the intersection overall are generally considered acceptable for planning future infrastructure, while LOS E can be acceptable for specific turning movement. LOS C and D represent typical rush hour conditions in Metro Vancouver. LOS has been extracted directly from VISSIM and was calculated at both the intersection level and turning movement level. As shown in Table 7.1, the software estimates LOS as a function of intersection delay, stratified by the type of traffic control. These values are comparable to the LOS definitions in the American Highway Capacity Manual of 2010.

Table 7.1: Level of Service definitions from VISSIM

LOS	Signalized intersection	Non-signalized intersection	Description
A	< 10s	< 10s	Free flow
B	> 10 s to 20 s	> 10 s to 15 s	Reasonably free flow. High driver comfort and only slight restrictions on maneuverability.
C	> 20 s to 35 s	> 15 s to 25 s	Stable flow. Lane changes require care and some queuing is expected.
D	> 35 s to 55 s	> 25 s to 35 s	Approaching unstable flow. Reduced driver comfort and queues are expected.
E	> 55 s to 80 s	> 35 s to 50 s	Unstable flow or at capacity. Poor driver comfort and substantial queueing.
F	> 80 s	> 50 s	Breakdown. Bottleneck or traffic jam.

7.2 Average and Maximum Queue Length

Average and maximum queue lengths complement LOS by providing a physical indicator of intersection performance. In VISSIM, queue lengths are measured as the distance between the stop line and the last vehicle in a queue. Queue lengths are calculated during each timestep of a simulation run. Averages and maxima are computed across the whole simulation runtime, including timestamps during which there are no vehicles in the queue (i.e., queue length equals zero). A vehicle is considered part of the queue if its speed drops below 5 km/h and remains in the queue until its speed exceeds 10 km/h.

7.3 Travel Time

Travel time provides a corridor-level indicator of network performance, including delays experienced at intersections or on a road segment. Therefore, travel time can capture the cumulative effect of intersection performances on driving experience.

In VISSIM, travel time is calculated as the average time taken by vehicles to travel from the start to the end point of a travel time section. If no vehicles travel between the start and end points, the travel time will be zero.

The calibration and modelling results discussed in this report are the averages of ten simulation runs for all peaks of each scenario. Each simulation was run with a different random seed to replicate real-world randomness. By using different random seeds for each run, we ensure that the randomness in our simulations mimics the unpredictable nature of real-world traffic conditions, specifically caused by the variation in trip start time within an hour by all road users.

8 Modelling Results – AM Peak

Sections 8.1 and 8.2 present and discuss the modelling results for the AM peak for each scenario.

8.1 Intersection Performance

Table 8.1 presents intersection LOS while Table 8.2 presents movement LOS, queue lengths, and vehicle delays.

With respect to intersection performance, the key modelling results are:

- In the present year, all intersections operate at an acceptable LOS A or B.
- In the *Do Nothing* scenario, all except four intersections operate at the same LOS compared to the present year.
 - The intersection of Wesbrook Mall and Birney Avenue degrades from LOS B to C. Movement LOS indicates that this degradation primarily reflects increased delay experienced by drivers along the minor road (Birney Avenue) caused by increased vehicle demand along the major road (Wesbrook Mall). However, these conditions improve to LOS B in the *With Improvements* scenario.
 - The intersection of Wesbrook Mall and West 16th Avenue degrades from LOS A to C. Movement LOS indicates that this degradation primarily reflects overall growth in demand, notably in the westbound and southbound directions, which cause longer queues and delays. It should be noted that LOS improves to LOS B in the *With Improvements* scenario as drivers are afforded an additional route option at Binning Road.
 - The intersection of Wesbrook Mall and Ross Drive also degrades from LOS A to B. Movement LOS suggest that this degradation is attributable to growth in demand along Wesbrook Mall.
 - The intersection of Wesbrook Mall and Birney Avenue degrades from LOS B to C. Movement LOS suggest that this degradation primarily reflects increased demand along southbound Wesbrook Mall, causing longer queues and delays along both the major and minor arms of the intersection.
- In the *With Improvements* scenario, all except four intersections operate at a similar or improved LOS compared to present year. **All intersections operate at LOS A or B, indicating high levels of driver comfort at intersections throughout the road network and limited overall delays.**
 - The intersections of West 16th Avenue and Binning Road, Wesbrook Mall and West 16th Avenue, Wesbrook Mall and Berton Avenue, Wesbrook Mall and Birney Avenue, and Wesbrook Mall and Ross Drive degrade from LOS A to B
 - The intersection of West 16th Avenue and Binning Road degrades from LOS A to B due to the implementation of full signals causing some additional delay at that location, while significantly reducing overall delays in the study area. Subsequent planning and design work will refine the design for the intersection, including whether signalization is warranted, and delays on West 16th Avenue may be further reduced.
 - The intersection of Wesbrook Mall and West 16th Avenue degrades from LOS A to B. Movement LOS indicates that this degradation partially reflects the increased demand along northbound Wesbrook Mall, and partially reflects increased pedestrian volumes along the eastern arm of the intersection. Compared to the *Do Nothing* scenario, southbound movements experience less delay as conflicting westbound volumes have decreased.
 - The degradation of LOS at the intersections of Wesbrook Mall with Berton Avenue and Birney Avenue primarily reflect increased travel along Binning Road, resulting in increased turning volumes from the minor streets.

- The degradation at Westbrook Mall and Ross Drive primarily reflects growth in demand along Westbrook Mall.
- All but one turning movement in the *With Improvements* scenario operate at LOS C or better, with most of them operating at LOS A or B, indicating high levels of driver comfort with turning movements throughout the road network and limited overall delays.
- The impact of considered infrastructural improvements are summarised below.
 - Improvement A: The provision of a westbound left (WBL) turn through full signalization notably improves network-level performance as it provides an additional route option for drivers travelling to the Westbrook Place neighbourhood.
 - Improvement B: The addition of a dedicated right turn lane along northbound Westbrook Mall and West 16th Avenue has decreased delay.
 - Improvement E: The addition of an extra lane allowing buses to jump the queue on Westbrook Mall before turning left to Southwest Marine Drive mitigated the impact of an 100% growth in southbound volumes at that intersection. Bus delays increased by only 16% despite the significant modelled increase in traffic.
 - Improvement F: Minimal observable impacts on intersections within the study area. However, this treatment may improve bus performance along Westbrook Mall north of the study area.
 - Improvement G: The implementation of a pedestrian signal does not have a significant effect on travel times for vehicles along West 16 Avenue. Previously, drivers already had to yield to a pedestrian in the crosswalk. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian comfort.
 - Improvement H: The modeled local street bikeway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.
 - Improvement I: The implementation of a pedestrian signal does not have a significant effect on driving experience at Westbrook Mall and Gray Avenue. The intersection was previously a four-way stop-controlled intersection. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian and bicycling comfort.
 - Improvement J: The modeled multi-use pathway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.

Table 8.1: Intersection Level of Service (LOS) results in the AM peak

No	Intersection Name	Present Year	Do Nothing	With Improvements
1	SW Marine Dr & W 16 Ave	A	A	A
2	East Mall and W 16 Ave	A	A	A
3	Wesbrook Mall and W 16 Ave	A	C	B
4	W 16 Ave & Hampton Pl/Binning Rd	A	A	B
5	Wesbrook Mall and Hampton Pl	A	A	A
6	Wesbrook Mall and Berton Ave	A	B	B
7	Berton Ave and Binning Rd	A	A	A
8	Birney Ave and Ross Dr	A	A	A
9	Birney Ave and Webber Lane	A	A	A
10	Birney Ave and Shrum Lane	A	A	A
11	Wesbrook Mall and Birney Ave	B	C	B
12	Binning Rd and Birney Ave	A	A	A
13	Gray Ave and Ross Dr	A	A	A
14	Wesbrook Mall and Gray Ave	A	A	A
15	Gray Ave and Binning Rd	A	A	A
16	Wesbrook Mall and Ross Drive	A	B	B
17	Wesbrook Mall & Binning Rd	A	A	A
18	Wesbrook Mall & TRIUMF access	A	A	A
19	Southwest Marine Dr and Wesbrook Mall	B	B	B

Table 8.2: Detailed intersection results in the AM peak

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
1	SW Marine Dr & W 16 Ave	Signalized	NBT	836	5	76	10	B	836	6	87	12	B	837	6	86	12	B
			NBR	592	0	17	3	A	629	0	18	4	A	641	0	19	4	A
			WBL	267	5	42	13	B	333	6	42	13	B	331	6	51	14	B
			WBR	8	0	0	0	A	8	0	1	0	A	8	0	2	0	A
			SBL	23	1	21	20	C	29	1	22	20	C	29	1	23	21	B
			SBT	142	1	23	5	A	139	1	23	6	A	140	1	25	6	A
			EBL	329	2	73	6	A	349	1	69	5	A	349	1	65	5	A
			EBT	256	2	73	5	A	288	1	69	5	A	246	1	65	4	A
			EBR	33	2	73	3	A	22	1	69	4	A	78	1	65	4	A
			NBL	29	0	29	9	A	55	1	33	10	B	52	2	42	15	C
2	East Mall and W 16 Ave	Unsignalized Roundabout	NBT	66	0	29	9	A	111	1	33	10	A	119	2	42	14	B
			NBR	56	0	29	2	A	193	1	33	3	A	111	2	42	3	A
			WBL	36	1	46	6	A	26	2	79	6	A	5	5	97	9	B
			WBT	161	1	46	6	A	206	2	79	9	A	205	5	97	14	B
			WBR	203	1	46	6	A	208	2	79	9	A	204	5	97	14	B
			SBL	121	0	23	4	A	128	0	24	5	A	102	1	49	5	A
			SBT	17	0	23	3	A	13	0	24	4	A	43	1	49	5	A
			SBR	85	0	23	1	A	81	0	24	2	A	81	1	49	3	A
3	Wesbrook Mall and W 16 Ave	Unsignalized Roundabout	EBL	192	2	56	8	A	278	13	109	23	C	271	6	80	14	B
			EBT	138	2	56	5	A	217	13	109	10	A	152	6	80	8	A
			EBR	103	2	56	6	A	109	13	109	11	B	31	6	80	8	A
			NBL	33	3	47	11	B	42	9	70	19	C	36	12	70	23	C
			NBT	172	3	47	10	B	243	9	70	18	C	253	12	70	22	C
			NBR	37	3	47	7	A	17	9	70	15	B	2	12	70	4	A
			WBL	176	4	60	10	A	264	18	165	25	D	81	9	67	15	C
			WBT	220	4	60	6	A	226	18	165	15	C	211	9	67	11	B
			WBR	293	4	60	9	A	308	18	165	17	C	310	9	67	16	C
			SBL	165	5	80	13	B	162	13	112	24	D	171	4	61	12	B
			SBT	112	5	80	14	B	111	13	112	27	D	108	4	61	12	B
4	W 16 Ave & Hampton PI/Binning Rd	2024: Stop Controlled (Hampton PI/Binning Rd) 2035: Pedestrian Signal Control	SBR	148	5	80	3	A	172	13	112	4	A	168	4	61	3	A
			EBT	339	2	43	3	A	395	3	46	4	A	314	0	4	13	B
			EBR	-	-	-	-		-	-	-	-		10	0	4	12	B
			NBR	143	1	28	6	A	379	12	83	14	B	461	10	92	9	A
			WBL	-	-	-	-		-	-	-	-		201	31	231	22	C
			WBT	640	14	175	10	B	727	62	323	20	C	528	32	236	20	C
5	Wesbrook Mall and Hampton PI	Stop Controlled (Hampton PI)	WBR	50	0	0	3	A	49	0	0	4	A	49	0	0	12	B
			SBR	48	0	3	10	B	73	0	10	13	B	73	0	8	7	A
			NBT	615	0	3	0	A	786	0	15	1	A	791	0	12	0	A
			NBR	42	0	12	1	A	43	0	25	1	A	44	0	23	3	A
			WBL	53	1	21	14	B	54	1	29	20	C	54	1	22	16	C
			WBR	36	1	22	7	A	36	2	30	11	B	36	1	23	2	A
			SBL	6	0	0	5	A	6	0	5	10	B	6	0	4	11	B

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
6	Wesbrook Mall and Berton Ave	Stop Controlled (Berton Ave)	SBT	347	0	0	1	A	369	0	5	1	A	381	0	4	1	A
			NBL	0	3	68	0	A	0	10	103	0	A	0	5	75	0	A
			NBT	198	3	66	13	B	220	9	102	22	C	167	5	73	21	C
			NBR	18	3	68	11	B	22	10	103	20	C	21	5	75	15	C
			WBL	1	1	27	16	B	2	4	44	28	D	1	7	61	14	B
			WBT	0	1	27	0	A	0	4	44	0	A	11	7	61	22	C
			WBR	47	1	27	11	B	85	4	44	25	C	124	7	61	26	D
			SBL	56	1	68	3	A	83	4	124	3	A	39	0	30	2	A
			SBT	219	1	68	2	A	273	4	124	3	A	106	0	30	2	A
			SBR	119	1	68	2	A	131	4	124	3	A	75	0	30	2	A
7	Berton Ave and Binning Rd	All Way Stop Controlled	EBL	29	1	34	7	A	29	1	33	9	A	29	1	26	11	B
			EBR	32	0	23	5	A	49	0	23	5	A	16	0	19	5	A
			NBL	2	0	0	0	A	25	0	0	0	A	67	0	3	0	A
			NBT	113	0	0	0	A	351	0	0	0	A	433	0	3	0	A
			SBT	-	-	-	-		-	-	-	-		191	0	1	0	A
			SBR	-	-	-	-		-	-	-	-		21	0	1	0	A
8	Birney Ave and Ross Dr	Stop Controlled (Birney Ave)	NBT	102	0	20	0	A	171	0	20	1	A	145	0	20	1	A
			NBR	12	0	20	1	A	15	0	20	1	A	17	0	29	1	A
			WBL	7	0	25	6	A	17	3	40	8	A	20	2	34	8	A
			WBR	50	1	31	5	A	187	4	46	7	A	136	2	34	6	A
			SBL	24	0	6	1	A	12	0	7	1	A	87	0	19	1	A
9	Birney Ave and Webber Lane	Stop Controlled (Webber Lane)	SBT	62	0	1	0	A	50	0	0	0	A	38	0	11	0	A
			EBL	26	0	9	1	A	8	0	6	1	A	57	0	17	1	A
			EBT	10	0	9	0	A	4	0	6	0	A	44	0	17	0	A
			WBT	15	0	26	0	A	20	1	37	0	A	30	1	35	0	A
			WBR	0	0	0	0	A	1	0	3	1	A	1	0	5	3	A
			SBL	40	0	17	2	A	5	0	25	3	A	26	0	26	3	A
10	Birney Ave and Shrum Lane	Stop Controlled (Shrum Lane)	SBR	42	0	15	2	A	131	0	27	3	A	85	0	25	2	A
			EBL	0	0	0	0	A	0	0	0	0	A	0	0	0	0	A
			EBT	50	0	0	0	A	9	0	0	0	A	70	0	0	0	A
			WBT	15	0	0	1	A	21	0	0	1	A	30	0	2	1	A
			WBR	27	0	5	1	A	38	0	7	1	A	38	0	10	1	A
11	Wesbrook Mall and Birney Ave	Stop Controlled	SBL	58	0	18	9	A	6	0	19	10	A	34	0	16	9	A
			SBR	0	0	18	0	A	0	0	19	0	A	0	0	16	0	A
			EBL	66	3	42	17	C	14	1	23	21	C	24	3	34	15	B
			EBT	29	4	43	16	C	1	1	24	16	C	79	3	34	15	C
			EBR	12	3	43	15	B	1	1	24	19	C	1	3	34	16	B
			NBL	27	2	38	9	A	39	9	74	16	B	38	3	46	10	A
			NBT	118	2	37	9	A	193	9	73	15	B	132	3	46	10	A
			NBR	22	2	38	8	A	43	9	74	13	B	13	3	46	9	A
11	Wesbrook Mall and Birney Ave	Stop Controlled	WBL	28	2	31	15	B	38	5	55	30	D	46	3	47	16	C
			WBT	15	2	31	17	C	20	5	55	28	D	30	3	47	17	C
11	Wesbrook Mall and Birney Ave	Stop Controlled	WBR	33	2	31	15	B	35	5	55	31	D	29	3	47	17	C

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
12	Binning Rd and Birney Ave	Stop Controlled (Birney Ave)	SBL	72	7	83	16	C	71	13	104	20	C	25	2	54	11	B
			SBT	148	7	83	15	B	203	14	104	19	C	82	2	54	10	B
			SBR	0	7	83	0	A	1	13	104	19	C	0	2	54	0	A
			EBL	56	0	15	7	A	32	0	9	8	A	80	0	12	10	B
			EBR	21	0	15	6	A	8	0	9	6	A	0	0	12	5	A
			NBL	13	0	3	0	A	0	0	10	0	A	25	0	42	1	A
			NBT	60	0	3	0	A	343	0	10	1	A	421	0	42	1	A
			SBT	30	0	0	0	A	49	0	0	0	A	180	0	12	0	A
			SBR	1	0	0	0	A	0	0	0	0	A	26	0	12	1	A
13	Gray Ave and Ross Dr	Stop Controlled (Gray Ave)	NBT	68	0	0	0	A	93	0	0	0	A	79	0	0	0	A
			NBR	8	0	0	0	A	5	0	0	0	A	5	0	0	0	A
			WBL	1	1	32	5	A	4	1	32	6	A	3	1	31	7	A
			WBR	30	1	29	6	A	82	1	29	6	A	83	1	28	6	A
			SBL	38	0	9	1	A	30	0	8	1	A	25	0	7	0	A
			SBT	9	0	2	0	A	11	0	0	0	A	18	0	0	0	A
14	Wesbrook Mall and Gray Ave	All Way Stop Controlled	EBL	31	1	23	10	A	29	1	28	13	B	13	1	28	10	B
			EBT	23	1	23	11	B	28	1	28	12	B	56	1	28	10	B
			EBR	24	1	23	9	A	39	1	28	12	B	38	1	28	9	A
			NBL	21	0	22	2	A	24	1	29	3	A	23	2	38	9	A
			NBT	109	0	22	1	A	183	1	27	1	A	124	2	38	7	A
			NBR	22	0	22	6	A	48	1	27	6	A	40	2	38	8	A
			WBL	19	0	22	3	A	47	1	27	7	A	57	1	31	4	A
			WBT	9	0	22	3	A	33	1	27	6	A	76	1	31	2	A
			WBR	27	0	22	9	A	64	1	27	11	B	46	1	31	8	A
			SBL	21	2	38	7	A	48	3	44	8	A	19	2	37	8	A
15	Gray Ave and Binning Rd	Stop Controlled (Gray Ave)	SBT	140	2	38	7	A	145	3	45	8	A	86	2	37	7	A
			SBR	28	2	38	2	A	49	3	44	3	A	23	2	37	7	A
			EBL	59	0	22	6	A	110	1	25	8	A	137	1	28	9	A
			EBR	8	0	22	8	A	4	1	25	8	A	1	1	28	6	A
			NBL	8	0	0	0	A	36	0	3	0	A	31	0	10	1	A
			NBT	15	0	25	0	A	233	1	39	0	A	309	2	43	1	A
16	Wesbrook Mall and Ross Drive	All Way Stop Controlled	SBT	25	0	0	0	A	53	0	1	0	A	104	0	1	0	A
			SBR	26	0	0	0	A	3	0	1	0	A	77	0	1	0	A
			EBL	10	0	10	9	B	10	0	16	12	B	9	0	19	8	A
			EBR	2	0	10	7	A	11	0	16	11	B	27	0	19	8	A
			NBL	64	4	52	10	A	88	9	73	13	B	83	7	74	18	C
17	Wesbrook Mall & Binning Rd	Uncontrolled	NBT	143	4	52	11	B	245	9	73	14	B	179	7	74	19	C
			SBT	159	2	33	7	A	197	3	42	8	A	147	0	25	1	A
			SBR	25	2	33	6	A	34	3	42	6	A	35	0	25	5	A
			NBT	204	0	0	0	A	224	0	3	1	A	180	0	36	2	A
17	Wesbrook Mall & Binning Rd	Uncontrolled	NBR	23	0	0	0	A	81	0	3	1	A	116	0	36	1	A
			WBL	30	0	12	2	A	123	1	32	3	A	150	1	26	3	A
			WBR	3	0	5	2	A	111	1	31	2	A	82	0	24	1	A
			NBT	204	0	0	0	A	224	0	3	1	A	180	0	36	2	A

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
18	Wesbrook Mall & TRIUMF access	Unsignalized Mini Roundabout	SBL	0	0	0	0	A	34	0	15	2	A	20	0	19	3	A
			SBT	161	0	0	0	A	174	0	10	0	A	153	0	12	0	A
			NBT	170	0	31	2	A	236	1	43	3	A	224	1	39	3	A
			NBR	55	0	31	2	A	54	1	43	2	A	54	1	39	2	A
			WBL	14	0	10	3	A	20	0	13	4	A	21	0	14	4	A
			WBR	58	0	10	3	A	67	0	13	4	A	66	0	14	4	A
			SBL	63	0	36	2	A	80	0	41	3	A	81	1	65	7	A
			SBT	129	0	36	2	A	217	0	41	3	A	219	1	65	7	A
19	South West Marine Dr and Wesbrook Mall	Signalized	EBL	17	1	39	22	C	16	2	44	24	C	10	2	48	24	C
			EBT	422	2	39	4	A	483	2	44	6	A	482	2	48	5	A
			WBT	1302	15	111	13	B	1326	19	128	16	B	1327	20	126	16	B
			WBR	209	0	18	1	A	273	0	20	1	A	267	0	18	1	A
			SBL	121	6	62	22	C	178	11	80	25	C	181	9	79	23	C
			SBR	23	2	51	9	A	59	6	73	12	B	59	7	70	16	B

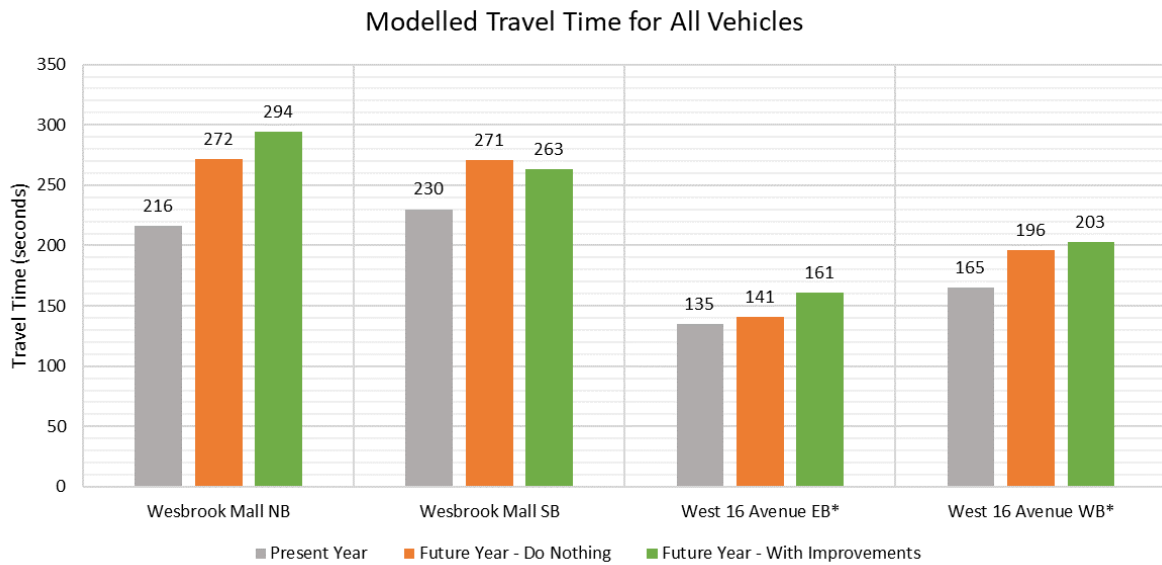
8.2 Route Travel Time

Figure 8.1 presents changes in modelled travel time for all vehicles while Figure 8.2 presents changes in modelled bus travel time in the AM peak across the three scenarios.

With respect to vehicular travel time, the headline modelling results are:

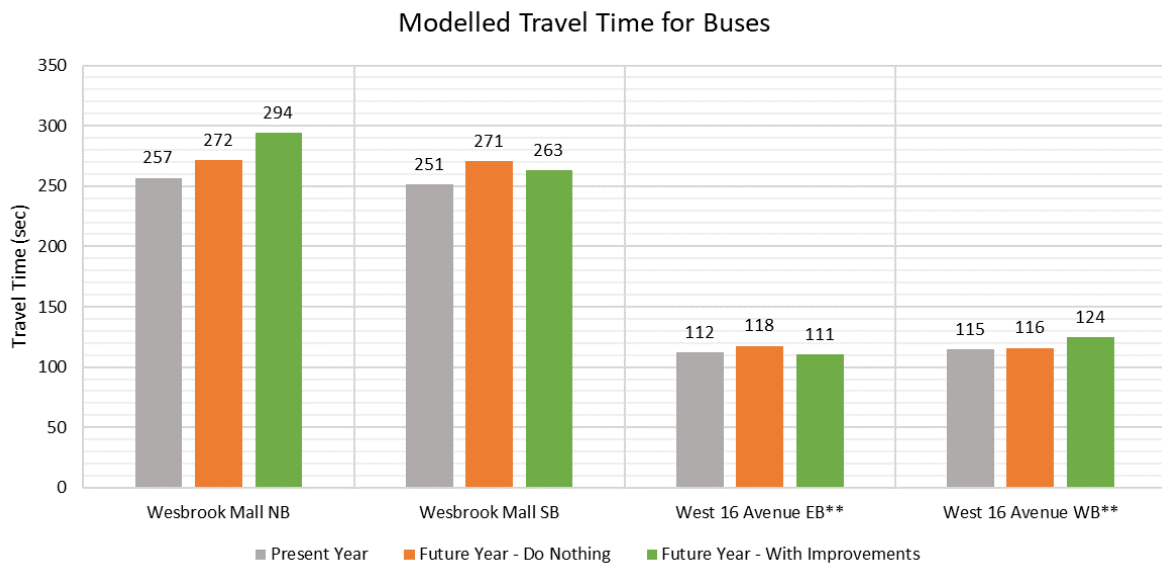
- Travel time generally increases in future year cases compared to present year for both all vehicles and buses only.
- For all vehicles:
 - In the *Do Nothing* scenario, the percentage increase in travel time for all vehicles is as follows: 26% for northbound (NB) travel along Wesbrook Mall, 18% for southbound (SB) travel along Wesbrook Mall, 4% for eastbound (EB) travel along West 16th Avenue and 19% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage increase in travel time for all vehicles is as follows: 36% for northbound (NB) travel along Wesbrook Mall, 14% for southbound (SB) travel along Wesbrook Mall, 19% for eastbound (EB) travel along West 16th Avenue and 23% for westbound (WB) travel along West 16th Avenue.
 - In general, the change in travel time along Wesbrook Mall is greater than that along West 16th Avenue in the *Do Nothing* scenario. This can be attributed to the increased demand along the local streets.
 - Owing to the additional route choice afforded by adding a westbound left turn (WBL) movement at West 16th Avenue and Binning Road, the increase in travel time along southbound Wesbrook Mall in the *With Improvements* scenario is smaller than that along northbound Wesbrook Mall. On the other hand, travel time along West 16th Avenue increases in the *With Improvements* scenario due to the implementation of a pedestrian signal.
- For buses:
 - In the *Do Nothing* scenario, the percentage increase in travel time for buses is as follows: 6% for northbound (NB) travel along Wesbrook Mall, 8% for southbound (SB) travel along Wesbrook Mall, 5% for eastbound (EB) travel along West 16th Avenue and 1% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage increase in travel time for buses are as follows: 15% for northbound (NB) travel along Wesbrook Mall, 5% for southbound (SB) travel along Wesbrook Mall, -2% for eastbound (EB) travel along West 16th Avenue and 9% for westbound (WB) travel along West 16th Avenue.
 - Changes in travel time follow a similar trend to that observed with all vehicles. However, the travel times along Wesbrook Mall increases to a lesser extent in the *With Improvements* scenario for buses compared to all vehicles because a large proportion of bus travel times reflect dwell time at stops. Bus dwell times do not change between the present year and future year models.

Figure 8.1: Changes in modelled travel time for all vehicles in the AM peak



Note: * Measured on West 16th Avenue between U-turn route (at Salish Trail) and Southwest Marine Drive

Figure 8.2: Changes in modelled travel time for buses in the AM peak



Note: ** Measured on West 16th Avenue between Wesbrook Mall and Southwest Marine Drive

9 Modelling Results – PM Peak

Sections 9.1 and 9.2 present and discuss the modelling results for the PM peak for each scenario.

9.1 Intersection Performance

Table 9.1 presents intersection LOS while Table 9.2 presents movement LOS, queue lengths, and vehicle delays.

With respect to intersection performance, the key modelling results are:

- In the present year, all intersections operate at an acceptable LOS A, B, or C.
- In the *Do Nothing* scenario, all except three intersections operate at the same or better LOS compared to the present year.
 - The intersections of West 16th Avenue and Wesbrook Mall, and Wesbrook Mall and Birney Avenue degrades from LOS C to D.
 - The degradation at West 16th Avenue and Wesbrook Mall may be due to overall growth in demand, with particularly notable growth in the westbound and southbound directions causing longer queues and delays. It should be noted that LOS improves to LOS B in the *With Improvements* scenario as drivers are afforded an additional route option at Binning Road.
 - Modelling suggests that there is a capacity constraint at the West 16th Avenue and Wesbrook Mall roundabout, reflected in observations of a bottleneck along southbound Wesbrook Mall and excessive queue lengths in the *Do Nothing* scenario. A capacity constraint was not observed in the *With Improvements* scenario as drivers taking the westbound left at this roundabout are afforded an additional route option at Binning Road, which provides more gaps for southbound traffic on Wesbrook Mall to enter the roundabout.
 - The degradation at Wesbrook Mall and Birney Avenue is attributable to growth in demand along Wesbrook Mall. It should be noted that LOS improves to LOS B in the *With Improvements* scenario as drivers are afforded an additional route option at Binning Road.
 - The intersection of Wesbrook Mall and Hampton Place degrades from LOS B to F due to the capacity constraint along southbound Wesbrook Mall described above. However, LOS improves to LOS A in the *With Improvements* scenario.
 - The intersection of Wesbrook Mall and Ross Drive degrades from LOS B to C due to the overall growth in demand, resulting longer delays and queues. However, LOS improves to LOS B in the *With Improvements* scenario.
 - The intersection of Birney Avenue and Shrum Lane improves from LOS B to A as drivers originating from zone 11 re-route to travel on Ross Drive instead of Wesbrook Mall.
- In the *With Improvements* scenario, all except two intersections operate at the same or improved LOS compared to the present year. **All intersections operate at LOS A or B, indicating high levels of driver comfort at intersections throughout the road network and limited overall delays.**
 - The intersection of West 16th Avenue and Binning Road degrades from LOS A to B due to the implementation of full signals causing some additional delay at that location, while significantly reducing overall delays in the study area. Subsequent planning and design work will refine the design for the intersection, including whether signalization is warranted, and delays on West 16th Avenue may be further reduced.
 - The intersection of Wesbrook Mall and Southwest Marine Drive degrades from LOS A to B due to growth in demand along Wesbrook Mall.

- All but two turning movements in the *With Improvements* scenario operate at LOS C or better, with most of them operating at LOS A or B, indicating high levels of driver comfort with turning movements throughout the road network and limited overall delays.
- The impact of planned infrastructural improvements are summarised below.
 - Improvement A: The provision of a westbound left (WBL) turn through full signalization notably improves network-level performance as it provides an additional route option for drivers travelling to the Westbrook Place neighbourhood.
 - Improvement B: The addition of a dedicated right turn lane along northbound Westbrook Mall and West 16th Avenue results in decreased delay.
 - Improvement E: The addition of an extra lane allowing buses to jump the queue on Westbrook Mall before turning left to Southwest Marine Drive mitigated the impact of an 30% growth in southbound volumes at that intersection. Bus delays increased by only 14% despite the significant modelled increase in traffic.
 - Improvement F: Minimal observable impacts on intersections within the study area. However, this treatment may improve bus performance along Westbrook Mall north of the study area.
 - Improvement G: The implementation of a pedestrian signal does not have a significant effect on travel times for vehicles along West 16 Avenue. Previously, drivers already had to yield to a pedestrian in the crosswalk. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian comfort and safety.
 - Improvement H: The modeled local street bikeway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.
 - Improvement I: The implementation of a pedestrian signal does not have a significant effect on driving experience at Westbrook Mall and Gray Avenue. The intersection was previously a four-way stop-controlled intersection. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian and bicycling comfort and safety.
 - Improvement J: The modeled multi-use pathway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.

Table 9.1: Intersection Level of Service (LOS) results in the PM peak

No	Intersection Name	Present Year	Do Nothing	With Improvements
1	SW Marine Dr & W 16 Ave	A	A	A
2	East Mall and W 16 Ave	A	A	A
3	Wesbrook Mall and W 16 Ave	C	D	B
4	W 16 Ave & Hampton Pl/Binning Rd	A	A	B
5	Wesbrook Mall and Hampton Pl	B	F	A
6	Wesbrook Mall and Berton Ave	B	B	A
7	Berton Ave and Binning Rd	A	A	A
8	Birney Ave and Ross Dr	A	A	A
9	Birney Ave and Webber Lane	A	A	A
10	Birney Ave and Shrum Lane	B	A	A
11	Wesbrook Mall and Birney Ave	C	D	B
12	Binning Rd and Birney Ave	A	A	A
13	Gray Ave and Ross Dr	A	A	A
14	Wesbrook Mall and Gray Ave	A	A	A
15	Gray Ave and Binning Rd	A	A	A
16	Wesbrook Mall and Ross Drive	B	C	B
17	Wesbrook Mall & Binning Rd	A	A	A
18	Wesbrook Mall & TRIUMF access	A	A	A
19	Southwest Marine Dr and Wesbrook Mall	A	A	B

Table 9.2: Intersection results in the PM peak

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
1	SW Marine Dr & W 16 Ave	Signalized	NBT	150	1	30	12	B	152	1	28	12	B	152	1	29	12	B
			NBR	327	0	19	2	A	325	0	19	2	A	410	0	22	2	A
			WBL	628	8	56	11	B	670	9	62	12	B	690	10	62	12	B
			WBR	8	0	1	0	A	10	0	1	1	A	10	0	1	0	A
			SBL	19	1	34	21	C	24	1	37	23	C	24	1	37	22	C
			SBT	544	4	39	10	B	545	5	42	11	B	545	5	42	11	B
			EBL	99	1	42	6	A	133	1	41	4	A	133	1	52	5	A
			EBT	216	1	42	4	A	202	1	41	4	A	239	1	52	4	A
			EBR	33	1	42	3	A	13	1	41	2	A	60	1	52	4	A
			NBL	41	0	19	5	A	62	0	15	5	A	49	0	23	9	A
2	East Mall and W 16 Ave	Unsignalized Roundabout	NBT	58	0	19	5	A	32	0	15	5	A	39	0	23	8	A
			NBR	50	0	19	1	A	146	0	15	2	A	78	0	23	2	A
			WBL	31	1	48	4	A	32	1	58	3	A	10	3	86	4	A
			WBT	244	1	48	4	A	276	1	58	6	A	305	3	86	11	B
			WBR	154	1	48	3	A	148	1	58	5	A	145	3	86	9	A
			SBL	271	1	51	7	A	273	2	52	8	A	266	5	82	9	A
			SBT	9	1	51	6	A	11	2	52	6	A	22	5	82	9	A
			SBR	351	1	51	3	A	344	2	52	4	A	344	5	82	6	A
3	Wesbrook Mall and W 16 Ave	Unsignalized Roundabout	EBL	184	5	59	16	C	214	22	122	43	E	272	11	88	20	C
			EBT	280	5	59	8	A	364	22	122	16	B	281	11	88	12	B
			EBR	74	5	59	7	A	40	22	122	14	B	24	11	88	9	B
			NBL	35	9	54	19	C	31	8	53	23	C	19	10	65	36	D
			NBT	179	9	54	19	C	188	8	53	20	C	132	10	65	35	E
			NBR	103	9	54	14	B	13	8	53	18	C	2	10	65	5	A
			WBL	245	2	40	9	A	401	13	162	20	C	104	3	40	8	A
			WBT	152	2	40	5	A	154	13	162	8	A	141	3	40	6	A
			WBR	166	2	40	6	A	178	13	162	9	A	178	3	40	9	A
			SBL	383	81	243	45	E	326	474	520	85	F	399	15	149	18	C
			SBT	148	81	243	44	E	117	474	520	83	F	131	15	149	16	C
4	W 16 Ave & Hampton PI/Binning Rd	2024: Stop Controlled (Hampton PI/Binning Rd) 2035: Pedestrian Signal Control	SBR	242	81	243	8	A	270	474	520	14	B	295	15	149	4	A
			EBT	766	2	48	2	A	703	3	55	3	A	667	0	13	14	B
			EBR	-	-	-	-		-	-	-	-		15	0	13	15	B
			NBR	126	1	22	7	A	187	2	32	8	A	282	4	52	7	A
			WBL	-	-	-	-		-	-	-	-		311	17	135	19	B
			WBT	519	3	78	4	A	687	12	145	8	A	376	16	134	17	B
			WBR	70	0	0	2	A	71	0	0	3	A	71	0	0	12	B
5	Wesbrook Mall and Hampton PI	Stop Controlled (Hampton PI)	SBR	46	0	4	10	A	48	0	4	11	B	48	0	2	5	A
			NBT	481	0	7	0	A	527	0	22	1	A	530	0	6	0	A
			NBR	47	0	21	3	A	53	0	35	3	A	53	0	19	5	A
			WBL	30	1	16	17	C	31	3	29	56	F	31	0	15	12	B
			WBR	22	1	17	6	A	22	3	30	20	C	22	0	16	3	A
			SBL	20	27	132	10	B	17	440	512	89	F	20	1	40	8	A

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
6	Wesbrook Mall and Berton Ave	Stop Controlled (Berton Ave)	SBT	722	27	132	18	C	662	440	512	117	F	781	1	40	3	A
			NBL	11	19	133	23	C	0	11	97	0	A	0	3	55	0	A
			NBT	290	19	131	26	D	205	10	96	22	C	124	3	54	15	B
			NBR	18	19	133	26	D	29	11	97	19	C	15	3	55	10	B
			WBL	2	1	18	25	C	0	1	21	0	A	3	1	19	10	B
			WBT	0	1	18	0	A	0	1	21	0	A	2	1	19	22	C
			WBR	29	1	18	27	D	32	1	21	26	D	30	1	19	18	C
			SBL	78	5	112	5	A	138	15	155	8	A	26	1	31	3	A
			SBT	232	5	112	4	A	286	15	155	7	A	118	1	31	3	A
7	Berton Ave and Binning Rd	All Way Stop Controlled	SBR	159	5	112	5	A	138	15	155	8	A	117	1	31	3	A
			EBL	20	1	23	6	A	21	2	29	9	A	21	0	19	8	A
			EBR	24	0	12	5	A	91	1	19	5	A	11	0	12	5	A
			NBL	3	0	0	0	A	2	0	0	0	A	12	0	0	0	A
			NBT	105	0	0	0	A	167	0	0	0	A	261	0	0	0	A
			SBT	-	-	-	-		-	-	-	-		284	0	0	0	A
8	Birney Ave and Ross Dr	Stop Controlled (Birney Ave)	SBR	-	-	-	-		-	-	-	-		41	0	0	0	A
			NBT	82	0	20	1	A	68	0	20	1	A	70	0	20	1	A
			NBR	19	0	20	1	A	34	0	20	1	A	36	0	29	1	A
			WBL	40	1	22	6	A	69	3	38	8	A	83	2	30	7	A
			WBR	66	2	29	5	A	172	5	44	7	A	96	2	29	6	A
9	Birney Ave and Webber Lane	Stop Controlled (Webber Lane)	SBL	17	0	8	1	A	25	0	9	1	A	68	0	9	1	A
			SBT	56	0	2	0	A	30	0	2	0	A	24	0	2	0	A
			EBL	24	0	7	1	A	15	0	7	1	A	65	0	11	1	A
			EBT	11	0	7	0	A	9	0	7	0	A	19	0	11	0	A
			WBT	25	0	30	0	A	38	1	38	0	A	61	1	35	0	A
			WBR	0	0	0	0	A	0	0	0	0	A	0	0	0	0	A
10	Birney Ave and Shrum Lane	Stop Controlled (Shrum Lane)	SBL	54	0	20	2	A	41	0	28	3	A	81	0	24	3	A
			SBR	81	0	20	2	A	191	1	28	3	A	123	0	24	3	A
			EBL	0	0	2	0	A	0	0	3	0	A	0	0	0	0	A
			EBT	66	0	2	3	A	50	0	2	3	A	99	0	0	0	A
			WBT	25	0	0	1	A	38	0	2	1	A	61	0	1	1	A
11	Wesbrook Mall and Birney Ave	Stop Controlled	WBR	28	0	6	1	A	66	0	9	1	A	38	0	8	1	A
			SBL	93	3	43	23	C	0	0	1	9	A	28	0	10	10	A
			SBR	0	3	43	0	A	0	0	1	0	A	0	0	10	0	A
			EBL	117	12	53	36	E	38	4	40	46	E	20	4	38	19	C
			EBT	6	13	54	46	E	11	5	42	27	D	100	4	38	18	C
			EBR	33	13	54	34	D	0	4	42	33	D	8	4	39	17	C
			NBL	28	4	50	13	B	66	10	74	17	C	38	2	35	11	B
			NBT	170	4	49	11	B	168	10	74	16	C	89	2	35	9	A
NBR	20	4	50	10	B	47	10	74	15	B	22	2	35	10	A			
WBL	24	3	36	25	D	23	6	46	40	E	39	3	33	18	C			
WBT	25	3	36	28	D	38	6	46	41	E	44	3	33	21	C			
WBR	33	3	36	19	C	29	6	46	40	E	31	3	33	14	B			

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
12	Binning Rd and Birney Ave	Stop Controlled (Birney Ave)	SBL	92	12	107	23	C	83	22	122	30	D	35	2	46	13	B
			SBT	144	12	107	21	C	207	22	122	28	D	68	2	47	12	B
			SBR	0	12	107	0	A	1	21	122	26	C	18	2	46	13	B
			EBL	36	0	9	7	A	40	0	10	7	A	129	0	18	10	A
			EBR	19	0	9	6	A	11	0	10	6	A	4	0	18	10	A
			NBL	21	0	4	0	A	1	0	5	0	A	40	0	12	1	A
			NBT	72	0	4	0	A	130	0	5	0	A	146	0	12	1	A
			SBT	24	0	1	0	A	91	0	1	0	A	245	0	8	0	A
			SBR	0	0	1	0	A	0	0	1	0	A	51	0	8	1	A
13	Gray Ave and Ross Dr	Stop Controlled (Gray Ave)	NBT	62	0	0	0	A	61	0	0	0	A	63	0	3	0	A
			NBR	10	0	0	0	A	21	0	0	0	A	27	0	3	0	A
			WBL	0	0	23	0	A	0	0	23	6	A	3	0	21	7	A
			WBR	25	0	20	5	A	12	0	20	5	A	12	0	19	6	A
			SBL	51	0	8	1	A	18	0	7	1	A	8	0	3	0	A
			SBT	35	0	0	0	A	57	0	0	0	A	70	0	1	0	A
14	Wesbrook Mall and Gray Ave	All Way Stop Controlled	EBL	30	1	23	11	B	18	2	26	15	C	13	1	25	10	A
			EBT	37	1	23	12	B	44	2	26	16	C	47	1	25	11	B
			EBR	34	1	23	11	B	41	2	26	13	B	38	1	25	10	A
			NBL	48	0	18	2	A	62	2	34	4	A	61	4	49	10	B
			NBT	167	0	21	1	A	225	2	34	2	A	106	4	49	9	A
			NBR	30	0	19	6	A	110	2	34	7	A	101	4	49	10	B
			WBL	22	0	14	4	A	46	1	22	9	A	46	0	19	3	A
			WBT	7	0	14	2	A	4	1	22	6	A	40	0	19	2	A
			WBR	21	0	14	9	A	38	1	22	13	B	31	0	19	7	A
			SBL	38	2	32	8	A	72	3	34	9	A	13	1	35	9	A
15	Gray Ave and Binning Rd	Stop Controlled (Gray Ave)	SBT	122	2	33	7	A	94	3	34	8	A	66	1	35	7	A
			SBR	43	2	32	3	A	64	2	34	3	A	35	1	35	8	A
			EBL	45	0	16	6	A	71	0	16	6	A	76	1	16	7	A
			EBR	13	0	16	8	A	3	0	16	6	A	1	0	16	6	A
			NBL	29	0	3	0	A	22	0	5	1	A	25	0	7	1	A
			NBT	48	0	20	0	A	61	0	31	0	A	110	1	31	0	A
16	Wesbrook Mall and Ross Drive	All Way Stop Controlled	SBT	22	0	0	0	A	95	0	0	0	A	147	0	5	0	A
			SBR	21	0	0	0	A	7	0	0	0	A	103	0	5	1	A
			EBL	16	0	14	10	A	22	1	21	12	B	18	1	22	11	B
			EBR	20	0	14	7	A	37	1	21	11	B	55	1	22	8	A
			NBL	52	6	55	11	B	67	25	93	24	C	67	14	89	22	C
17	Wesbrook Mall & Binning Rd	Uncontrolled	NBT	229	6	55	13	B	377	25	93	25	D	249	14	89	23	C
			SBT	153	2	28	6	A	171	2	32	6	A	133	0	19	0	A
			SBR	24	2	28	5	A	10	2	32	7	A	17	0	19	5	A
			NBT	283	0	2	0	A	417	3	86	3	A	293	2	89	4	A
17	Wesbrook Mall & Binning Rd	Uncontrolled	NBR	78	0	2	1	A	229	3	86	3	A	269	2	89	3	A
			WBL	35	0	10	2	A	64	0	17	5	A	58	0	19	6	A
			WBR	0	0	5	0	A	29	0	20	5	A	24	0	16	1	A

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
18	Wesbrook Mall & TRIUMF access	Unsignalized Mini Roundabout	SBL	0	0	0	0	A	73	1	41	9	A	24	0	27	6	A
			SBT	173	0	0	0	A	135	1	36	2	A	164	0	20	1	A
			NBT	208	0	25	2	A	463	1	46	4	A	415	2	65	5	A
			NBR	9	0	25	2	A	11	1	46	3	A	11	2	65	3	A
			WBL	51	0	20	3	A	61	3	51	11	B	98	3	46	10	B
			WBR	153	0	20	4	A	184	3	51	12	B	147	3	46	11	B
			SBL	33	0	42	2	A	33	1	53	4	A	34	2	70	7	A
			SBT	174	0	42	3	A	166	1	53	5	A	185	2	70	8	A
19	South West Marine Dr and Wesbrook Mall	Signalized	EBL	11	6	74	15	B	84	7	79	17	B	82	9	95	18	B
			EBT	1117	6	74	8	A	1154	7	79	7	A	1169	9	95	9	A
			WBT	447	7	54	16	B	445	7	51	17	B	492	8	53	17	B
			WBR	207	0	17	1	A	390	1	39	2	A	344	1	37	2	A
			SBL	203	8	64	18	B	188	7	63	18	B	209	8	81	19	B
			SBR	21	3	59	8	A	38	3	61	8	A	73	7	76	12	B

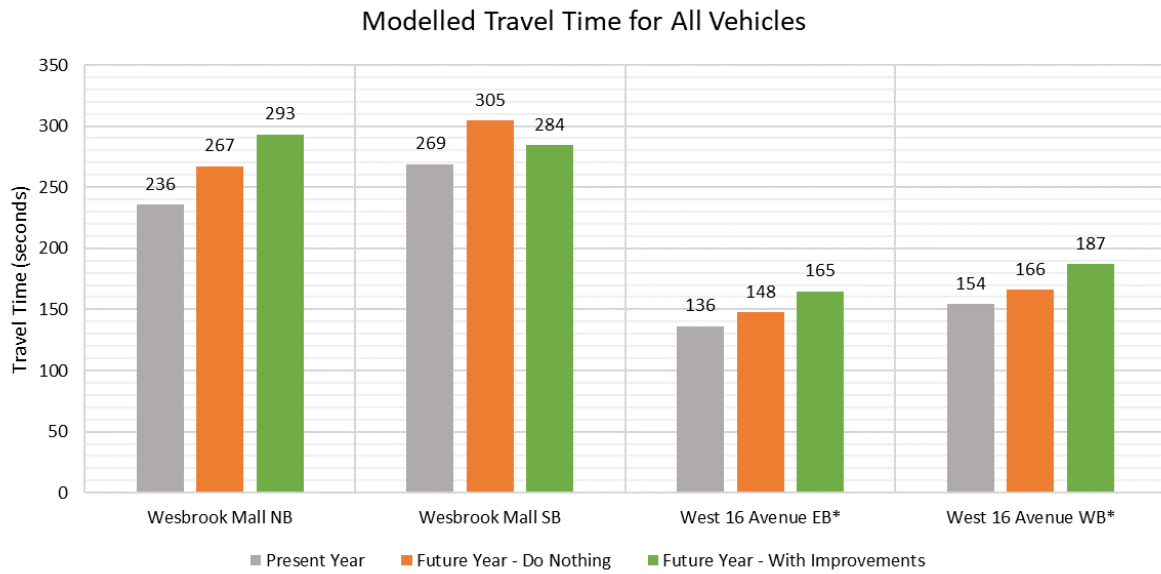
9.2 Route Travel Time

Figure 9.1 presents changes in modelled travel time for all vehicles while Figure 9.2 presents changes in modelled bus travel time in the PM peak across the three scenarios.

With respect to vehicular travel time, the headline modelling results are:

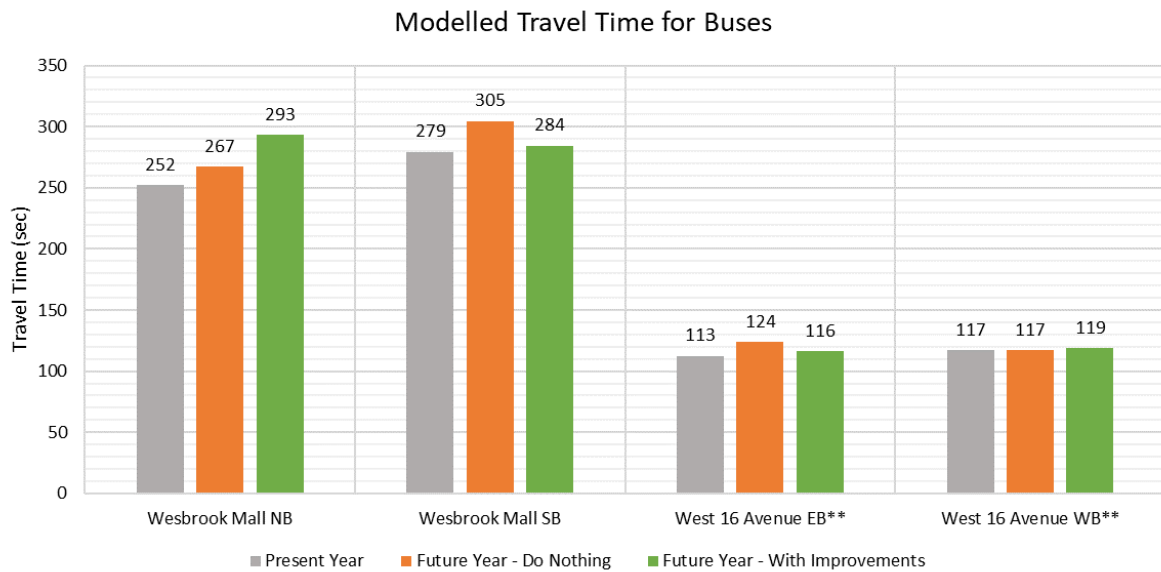
- Travel time generally increases in future year cases compared to the present year for both all vehicles and buses only. Changes in travel time during the PM peak follow the same trend as the AM peak.
- For all vehicles:
 - In the *Do Nothing* scenario, the percentage increase in travel time for all vehicles is as follows: 13% for northbound (NB) travel along Wesbrook Mall, 13% for southbound (SB) travel along Wesbrook Mall, 8% for eastbound (EB) travel along West 16th Avenue and 7% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage change in travel time for all vehicles is as follows: 24% for northbound (NB) travel along Wesbrook Mall, 6% for southbound (SB) travel along Wesbrook Mall, 21% for eastbound (EB) travel along West 16th Avenue and 21% for westbound (WB) travel along West 16th Avenue.
 - In general, the change in travel time along Wesbrook Mall is greater than that along West 16th Avenue in the *Do Nothing* scenario. This can be attributed to the increased demand along the local streets.
 - Owing to the additional route choice afforded by adding a westbound left turn (WBL) movement at West 16th Avenue and Binning Road, travel time along southbound Wesbrook Mall decreases in the *With Improvements* scenario. On the other hand, travel time along West 16 Avenue increases in the *With Improvements* scenario due to the implementation of a pedestrian signal.
- For buses:
 - In the *Do Nothing* scenario, the percentage change in travel time for all vehicles is as follows: 6% for northbound (NB) travel along Wesbrook Mall, 9% for southbound (SB) travel along Wesbrook Mall, 10% for eastbound (EB) travel along West 16th Avenue and 0% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage increase in travel time for all vehicles is as follows: 16% for northbound (NB) travel along Wesbrook Mall, 2% for southbound (SB) travel along Wesbrook Mall, 3% for eastbound (EB) travel along West 16th Avenue and 1% for westbound (WB) travel along West 16th Avenue.
 - Changes in travel time follow a similar trend to that observed with all vehicles. However, the travel times along Wesbrook Mall increases to a lesser extent in the *With Improvements* scenario for buses compared to all vehicles because a large proportion of bus travel times reflect dwell time at stops. Bus dwell times do not change between the present year and future year models.

Figure 9.1: Changes in modelled travel time for all vehicles in the PM peak



Note: * Measured on West 16th Avenue between U-turn route (at Salish Trail) and Southwest Marine Drive

Figure 9.2: Changes in modelled travel time for buses in the PM peak



Note: ** Measured on West 16th Avenue between Wesbrook Mall and Southwest Marine Drive

10 Modelling Results – Weekend Peak

Sections 10.1 and 10.2 summarize the modelling results for the weekend peak for each scenario.

10.1 Intersection Performance

Table 10.1 presents intersection LOS while Table 10.2 presents movement LOS, queue lengths, and vehicle delays.

With respect to intersection performance, the key modelling results are:

- In the present year, all intersections operate at an acceptable LOS A, B or C.
- In the *Do Nothing* scenario, all except three intersections operate the same LOS compared to present year.
 - The intersection of West 16th Avenue and Westbrook Mall degrades from LOS A to C. This degradation may be due to overall growth in demand, with particularly notable growth in the westbound and southbound directions causing longer queues and delays. It should be noted that LOS improves to LOS B in the *With Improvements* scenario as drivers are afforded an additional route option at Binning Road.
 - The intersections of Westbrook Mall and Ross Drive, and Southwest Marine Drive and Westbrook Mall degrades from LOS A to B. This is attributable to growth in demand along Westbrook Mall.
- In the *With Improvements* scenario, all except five intersections operate at a similar or improved LOS compared to present year. **All intersections operate at LOS A or B, indicating high levels of driver comfort at intersections throughout the road network and limited overall delays.**
 - The intersections of West 16th Avenue and Binning Road, Westbrook Mall and West 16 Avenue, Westbrook Mall and Berton Avenue, Westbrook Mall and Ross Drive, and Southwest Marine Drive and Westbrook Mall degrade from LOS A to B.
 - The intersection of West 16th Avenue and Binning Road degrades from LOS A to B due to the implementation of full signals causing some additional delay at that location, while significantly reducing overall delays in the study area. Subsequent planning and design work will refine the design for the intersection, including whether signalization is warranted, and delays on West 16th Avenue may be further reduced.
 - The degradation at Westbrook Mall and West 16 Avenue, Westbrook Mall and Ross Drive, and Southwest Marine Drive and Westbrook Mall is attributable to overall demand growth along Westbrook Mall.
 - The degradation at Westbrook Mall and Berton Avenue is attributable to increased travel along Binning Road, resulting in increased demand for westbound movements at this intersection and associated delays.
- The impact of planned infrastructural improvements are summarised below.
 - Improvement A: The provision of a westbound left (WBL) turn through full signalization notably improves network-level performance as it provides an additional route option for drivers travelling through Westbrook Place neighbourhood.
 - Improvement B: The addition of a dedicated right turn lane along northbound Westbrook Mall and West 16th Avenue has notably decreased delay.
 - Improvement E: The addition of an extra lane allowing buses to jump the queue on Westbrook Mall before turning left to Southwest Marine Drive mitigate the impact of an 80% growth in southbound volumes at that intersection. Bus delays increased by only 9% despite the significant modelled increase in traffic.

- Improvement F: Minimal observable impacts on intersections within the study area. However, this treatment may improve bus performance along Wesbrook Mall north of the study area.
- Improvement G: The implementation of a pedestrian signal does not have a significant effect on travel times for vehicles along West 16 Avenue. Previously, drivers already had to yield to a pedestrian in the crosswalk. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian comfort.
- Improvement H: The modeled local street bikeway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.
- Improvement I: The implementation of a pedestrian signal does not have a significant effect on driving experience at Wesbrook Mall and Gray Avenue. The intersection was previously a four-way stop-controlled intersection. Despite the minimal impacts on drivers, this treatment has a significant beneficial impact on pedestrian and bicycling comfort.
- Improvement J: The modeled multi-use pathway had minimal impacts on driving experience. However, the implementation of this treatment has a significant beneficial impact on bicycling comfort.

Table 10.1: Intersection Level of Service (LOS) results in the weekend peak

No	Intersection Name	Present Year	Do Nothing	With Improvements
1	SW Marine Dr & W 16 Ave	A	A	A
2	East Mall and W 16 Ave	A	A	A
3	Wesbrook Mall and W 16 Ave	A	C	B
4	W 16 Ave & Hampton Pl/Binning Rd	A	A	B
5	Wesbrook Mall and Hampton Pl	A	A	A
6	Wesbrook Mall and Berton Ave	A	A	B
7	Berton Ave and Binning Rd	A	A	A
8	Birney Ave and Ross Dr	A	A	A
9	Birney Ave and Webber Lane	A	A	A
10	Birney Ave and Shrum Lane	A	A	A
11	Wesbrook Mall and Birney Ave	C	C	B
12	Binning Rd and Birney Ave	A	A	A
13	Gray Ave and Ross Dr	A	A	A
14	Wesbrook Mall and Gray Ave	A	A	A
15	Gray Ave and Binning Rd	A	A	A
16	Wesbrook Mall and Ross Drive	A	B	B
17	Wesbrook Mall & Binning Rd	A	A	A
18	Wesbrook Mall & TRIUMF access	A	A	A
19	Southwest Marine Dr and Wesbrook Mall	A	B	B

Table 10.2: Intersection results in the weekend peak

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
1	SW Marine Dr & W 16 Ave	Signalized	NBT	492	3	53	11	B	492	4	63	13	B	494	4	57	12	B
			NBR	496	0	18	3	A	479	0	14	3	A	506	0	18	3	A
			WBL	487	7	50	12	B	522	8	55	13	B	507	7	53	12	B
			WBR	8	0	1	0	A	11	0	0	0	A	10	0	1	0	A
			SBL	24	1	24	21	C	27	1	23	22	C	27	1	25	21	C
			SBT	342	2	29	8	A	345	2	32	8	A	345	2	33	8	A
2	East Mall and W 16 Ave	Unsignalized Roundabout	EBL	248	1	53	5	A	244	1	54	5	A	242	1	62	6	A
			EBT	268	1	53	4	A	249	1	54	4	A	236	1	62	4	A
			EBR	3	1	53	2	A	16	1	54	3	A	56	1	62	3	A
			NBL	29	0	14	6	A	59	0	27	8	A	51	1	29	10	B
			NBT	22	0	14	7	A	71	0	27	8	A	83	1	29	11	B
			NBR	44	0	14	2	A	171	0	27	2	A	93	1	29	3	A
			WBL	12	1	49	5	A	35	2	76	4	A	19	4	92	8	A
			WBT	248	1	49	5	A	262	2	76	7	A	256	4	92	10	B
			WBR	191	1	49	4	A	184	2	76	7	A	178	4	92	11	B
			SBL	206	0	28	5	A	204	1	38	6	A	192	2	67	6	A
3	Wesbrook Mall and W 16 Ave	Unsignalized Roundabout	SBR	6	0	28	4	A	12	1	38	6	A	28	2	67	7	A
			SBR	218	0	28	2	A	212	1	38	3	A	212	2	67	4	A
			EBL	200	3	63	10	B	251	16	115	30	D	249	7	80	16	C
			EBT	205	3	63	6	A	281	16	115	13	B	224	7	80	9	A
			EBR	114	3	63	6	A	92	16	115	12	B	45	7	80	8	A
			NBL	54	5	45	13	B	50	10	62	21	C	33	11	67	26	D
			NBT	154	5	45	12	B	208	10	62	21	C	210	11	67	25	C
			NBR	97	5	45	9	A	14	10	62	21	C	24	11	67	4	A
			WBL	227	3	54	9	A	342	13	150	21	C	95	5	47	11	B
			WBT	179	3	54	5	A	194	13	150	10	B	186	5	47	8	A
			WBR	224	3	54	7	A	241	13	150	11	B	242	5	47	12	B
4	W 16 Ave & Hampton PI/Binning Rd	2024: Stop Controlled (Hampton PI/Binning Rd) 2035: Pedestrian Signal Control	SBL	272	12	124	19	C	269	48	189	48	E	279	6	85	12	B
			SBT	98	12	124	19	C	117	48	189	47	E	109	6	85	12	B
			SBR	218	12	124	3	A	237	48	189	6	A	232	6	85	3	A
			EBT	572	2	45	2	A	564	3	48	3	A	514	0	6	13	B
			EBR	-	-	-	-		-	-	-	-		12	0	6	16	B
			NBR	118	1	27	6	A	303	6	60	10	B	353	6	62	8	A
			WBL	-	-	-	-		-	-	-	-		258	22	181	20	B
5	Wesbrook Mall and Hampton PI	Stop Controlled (Hampton PI)	WBT	582	6	100	6	A	712	28	260	13	B	459	22	180	18	B
			WBR	60	0	0	3	A	60	0	0	3	A	60	0	0	11	B
			SBR	49	0	6	10	B	64	0	8	13	B	63	0	7	6	A
5	Wesbrook Mall and Hampton PI	Stop Controlled (Hampton PI)	NBT	532	0	1	0	A	645	0	6	0	A	646	0	3	0	A
			NBR	47	0	11	2	A	55	0	19	2	A	55	0	14	3	A
			WBL	43	1	18	12	B	44	1	23	16	C	44	0	20	13	B

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
6	Wesbrook Mall and Berton Ave	Stop Controlled (Berton Ave)	WBR	29	1	19	6	A	29	1	24	8	A	29	0	21	3	A
			SBL	14	0	13	5	A	14	7	114	7	A	14	0	16	7	A
			SBT	534	0	13	1	A	567	7	114	6	A	571	0	16	2	A
			NBL	0	7	105	0	A	0	6	79	0	A	0	7	90	0	A
			NBT	257	7	103	15	B	208	6	78	16	C	204	7	88	17	C
			NBR	19	8	105	12	B	20	6	79	14	B	18	7	90	14	B
			WBL	0	1	26	0	A	1	3	32	69	C	7	2	31	23	C
			WBT	0	1	26	0	A	0	3	32	0	A	8	2	31	15	B
			WBR	50	1	26	15	B	68	3	32	28	D	62	2	31	20	C
			SBL	59	2	84	4	A	130	9	141	5	A	32	1	28	2	A
			SBT	221	2	84	3	A	285	9	141	5	A	115	1	28	2	A
			SBR	163	2	84	3	A	140	9	141	5	A	103	1	28	3	A
7	Berton Ave and Binning Rd	All Way Stop Controlled	EBL	25	0	29	6	A	26	2	35	9	A	26	1	28	9	A
			EBR	3	0	18	5	A	76	0	26	5	A	13	0	22	5	A
			NBL	0	0	0	0	A	19	0	0	0	A	27	0	0	0	A
			NBT	93	0	0	0	A	278	0	0	0	A	327	0	0	0	A
			SBT	-	-	-	-		-	-	-	-		235	0	0	0	A
			SBR	-	-	-	-		-	-	-	-		34	0	0	0	A
8	Birney Ave and Ross Dr	Stop Controlled (Birney Ave)	NBT	56	0	20	1	A	116	0	20	1	A	123	0	20	1	A
			NBR	14	0	20	1	A	26	0	20	1	A	44	0	29	1	A
			WBL	23	1	18	5	A	44	3	43	8	A	55	2	35	8	A
			WBR	38	1	24	5	A	186	5	50	7	A	104	2	34	7	A
			SBL	0	0	0	0	A	13	0	6	1	A	65	0	11	1	A
			SBT	21	0	0	0	A	50	0	0	0	A	38	0	4	0	A
9	Birney Ave and Webber Lane	Stop Controlled (Webber Lane)	EBL	8	0	5	1	A	9	0	7	1	A	72	0	14	1	A
			EBT	6	0	5	0	A	6	0	7	0	A	22	0	14	0	A
			WBT	6	0	32	0	A	34	1	34	0	A	38	1	31	0	A
			WBR	5	0	9	2	A	0	0	0	0	A	0	0	1	2	A
			SBL	96	0	21	2	A	24	0	26	3	A	78	0	22	3	A
			SBR	55	0	21	2	A	167	1	26	3	A	102	0	21	2	A
10	Birney Ave and Shrum Lane	Stop Controlled (Shrum Lane)	EBL	0	0	1	0	A	0	0	3	0	A	0	0	0	0	A
			EBT	102	0	0	1	A	29	0	2	0	A	101	0	0	0	A
			WBT	12	0	0	1	A	34	0	2	1	A	38	0	0	1	A
			WBR	24	0	5	1	A	51	0	10	1	A	23	0	5	1	A
			SBL	37	0	17	10	B	0	0	0	0	A	17	0	18	10	A
			SBR	0	0	17	0	A	0	0	0	0	A	0	0	18	0	A
11	Wesbrook Mall and Birney Ave	Stop Controlled	EBL	110	7	47	25	C	23	2	30	31	D	56	4	39	18	C
			EBT	3	7	49	29	D	3	2	31	26	C	59	4	39	15	C
			EBR	25	7	48	24	C	3	2	31	26	C	3	4	40	13	B
			NBL	29	3	40	10	A	51	7	63	15	C	23	2	36	10	A
			NBT	122	3	40	11	B	164	7	62	14	B	127	3	37	9	A
			NBR	32	3	40	9	A	39	7	63	13	B	11	2	36	10	B
			WBL	28	2	34	20	C	45	8	63	35	D	43	4	45	19	C

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
12	Binning Rd and Birney Ave	Stop Controlled (Birney Ave)	WBT	6	2	34	19	C	30	8	63	48	E	38	4	45	22	C
			WBR	44	2	34	18	C	40	8	63	35	E	38	4	45	16	C
			SBL	83	8	80	17	C	83	16	112	25	D	43	2	48	11	B
			SBT	138	8	80	16	C	198	17	113	22	C	78	2	49	11	B
			SBR	0	8	80	0	A	4	16	112	25	D	0	2	48	0	A
			EBL	35	0	14	7	A	36	0	11	8	A	85	0	18	10	A
			EBR	23	0	14	6	A	2	0	11	7	A	1	0	18	14	B
			NBL	10	0	4	0	A	17	0	8	1	A	47	0	22	1	A
			NBT	59	0	4	0	A	261	0	8	1	A	268	0	22	1	A
			SBT	3	0	0	0	A	74	0	1	0	A	210	0	6	0	A
SBR	0	0	0	0	A	3	0	1	0	A	38	0	6	1	A			
13	Gray Ave and Ross Dr	Stop Controlled (Gray Ave)	NBT	26	0	0	0	A	85	0	0	0	A	106	0	2	0	A
			NBR	1	0	0	0	A	18	0	0	0	A	19	0	2	0	A
			WBL	0	0	27	0	A	2	1	24	7	A	2	1	29	6	A
			WBR	30	0	24	5	A	40	1	22	6	A	46	1	26	6	A
			SBL	7	0	3	1	A	26	0	7	1	A	15	0	4	0	A
			SBT	22	0	1	0	A	43	0	1	0	A	53	0	1	0	A
			EBL	31	1	26	11	B	21	2	39	15	C	11	1	33	11	B
			EBT	17	1	26	13	B	52	2	39	15	C	53	1	33	11	B
			EBR	32	1	26	10	B	44	2	39	14	B	43	1	33	9	A
			NBL	48	0	22	2	A	43	1	27	3	A	42	3	38	9	A
14	Wesbrook Mall and Gray Ave	All Way Stop Controlled	NBT	126	0	22	1	A	178	1	26	2	A	98	3	38	8	A
			NBR	35	0	22	6	A	78	1	26	7	A	66	3	38	8	A
			WBL	29	0	22	5	A	50	2	32	9	A	57	1	31	4	A
			WBT	4	0	22	2	A	20	2	32	7	A	53	1	31	2	A
			WBR	24	0	22	10	A	54	2	32	13	B	52	1	31	8	A
			SBL	44	2	33	7	A	64	3	41	9	A	18	2	37	9	A
			SBT	81	2	32	7	A	123	3	42	8	A	76	2	37	7	A
			SBR	66	2	32	2	A	57	3	41	3	A	30	2	37	7	A
			EBL	46	0	20	6	A	109	1	24	8	A	107	1	22	9	A
			EBR	0	0	20	0	A	5	1	24	7	A	3	1	22	6	A
15	Gray Ave and Binning Rd	Stop Controlled (Gray Ave)	NBL	19	0	3	0	A	33	0	8	0	A	44	0	10	1	A
			NBT	23	0	21	0	A	169	1	38	0	A	207	1	42	0	A
			SBT	26	0	0	0	A	70	0	0	0	A	122	0	1	0	A
			SBR	0	0	0	0	A	6	0	0	0	A	88	0	1	1	A
			SBL	0	0	0	0	A	6	0	0	0	A	88	0	1	1	A
16	Wesbrook Mall and Ross Drive	All Way Stop Controlled	EBL	30	0	14	9	A	13	1	21	12	B	12	1	21	10	B
			EBR	12	0	14	7	A	29	1	21	12	B	43	1	21	9	A
			NBL	31	3	44	8	A	86	12	86	15	B	102	9	83	17	C
			NBT	179	3	44	11	B	286	12	86	17	C	193	9	83	19	C
			SBT	118	1	32	6	A	195	3	37	7	A	146	0	22	1	A
SBR	24	1	31	5	A	22	2	37	6	A	30	0	22	6	A			
17	Wesbrook Mall & Binning Rd	Uncontrolled	NBT	203	0	0	0	A	299	0	16	1	A	233	0	54	2	A
			NBR	42	0	0	0	A	172	0	16	1	A	216	0	54	1	A

No	Intersection Name	Intersection Type	Turn	Present					Do Nothing					With Improvements				
				Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS	Turn Volume	Average Queue Length	Max. Queue Length	Vehicle Delay	LOS
18	Wesbrook Mall & TRIUMF access	Unsignalized Mini Roundabout	WBL	20	0	8	1	A	84	1	26	4	A	105	1	31	4	A
			WBR	7	0	6	1	A	73	1	29	4	A	64	0	29	1	A
			SBL	0	0	0	0	A	57	1	32	4	A	22	0	24	5	A
			SBT	130	0	0	0	A	168	0	27	1	A	166	0	17	1	A
			NBT	143	0	22	2	A	343	1	47	3	A	328	1	52	4	A
			NBR	32	0	22	1	A	34	1	47	2	A	37	1	52	3	A
			WBL	38	0	11	2	A	41	1	27	6	A	51	1	28	7	A
			WBR	102	0	11	2	A	130	1	27	6	A	119	1	28	6	A
			SBL	49	0	21	2	A	64	1	48	2	A	61	1	77	6	A
			SBT	101	0	21	2	A	189	1	48	3	A	206	1	77	6	A
19	South West Marine Dr and Wesbrook Mall	Signalized	EBL	26	3	49	15	B	55	4	61	18	B	57	5	63	20	B
			EBT	806	3	49	5	A	838	4	61	6	A	816	5	63	7	A
			WBT	920	11	76	14	B	886	13	80	17	B	898	14	90	17	B
			WBR	150	0	17	1	A	321	0	31	2	A	306	0	37	2	A
			SBL	110	4	46	19	B	179	9	70	21	C	200	9	80	22	C
			SBR	27	1	42	7	A	50	4	62	10	B	58	8	77	14	B

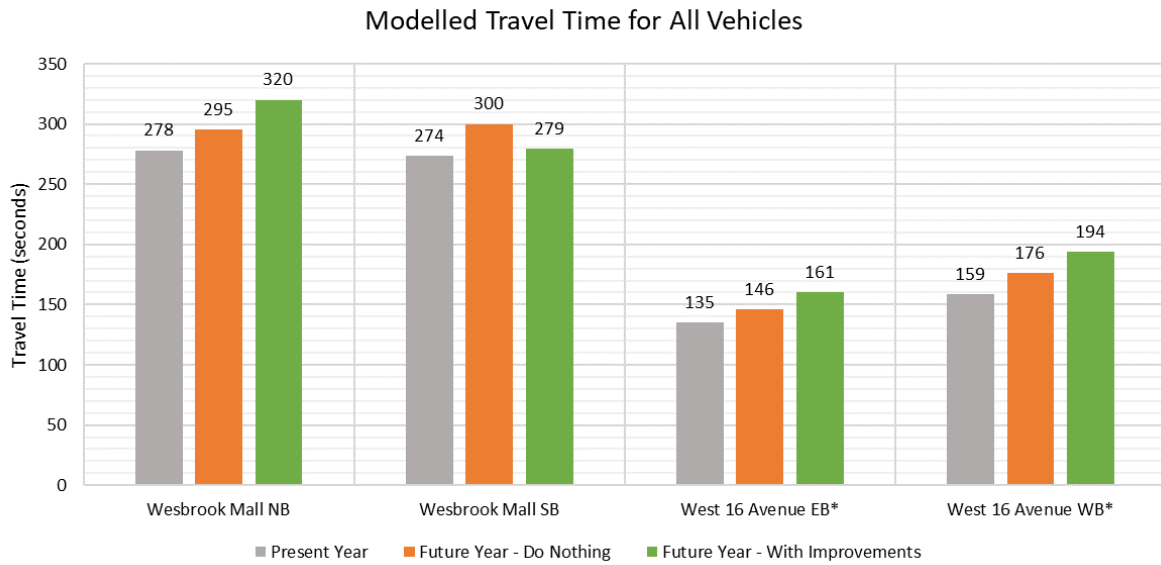
10.2 Route Travel Time

Figure 10.1 presents changes in modelled travel time for all vehicles while Figure 10.2 presents changes in modelled bus travel time in the weekend peak across the three scenarios.

With respect to vehicular travel time, the key modelling results are:

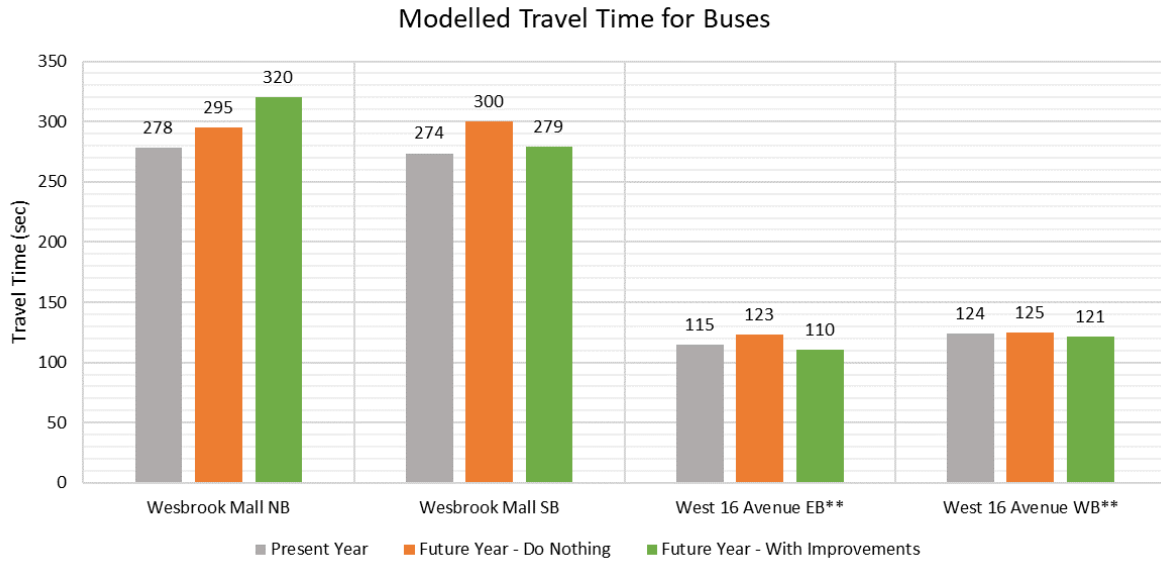
- Travel time generally increases in future year cases compared to present year for both all vehicles and buses only. Changes in travel time during the weekend peak follow the same trend as the AM and PM peaks.
- For all vehicles:
 - In the *Do Nothing* scenario, the percentage increase in travel time for all vehicles is as follows: 6% for northbound (NB) travel along Wesbrook Mall, 10% for southbound (SB) travel along Wesbrook Mall, 8% for eastbound (EB) travel along West 16th Avenue and 11% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage increase in travel time for all vehicles is as follows: 15% for northbound (NB) travel along Wesbrook Mall, 2% for southbound (SB) travel along Wesbrook Mall, 19% for eastbound (EB) travel along West 16th Avenue and 22% for westbound (WB) travel along West 16th Avenue.
 - In general, the change in travel time along Wesbrook Mall is greater than that along West 16th Avenue in the *Do Nothing* scenario. This can be attributed to the increased demand along the local streets.
 - Owing to the additional route choice afforded by adding a westbound left turn (WBL) movement at West 16th Avenue and Binning Road, travel time along southbound Wesbrook Mall decreases in the *With Improvements* scenario. On the other hand, travel time along West 16 Avenue increases in the *With Improvements* scenario due to the implementation of a pedestrian signal.
- For buses:
 - In the *Do Nothing* scenario, the percentage change in travel time for all vehicles is as follows: 6% for northbound (NB) travel along Wesbrook Mall, 10% for southbound (SB) travel along Wesbrook Mall, 7% for eastbound (EB) travel along West 16th Avenue and 1% for westbound (WB) travel along West 16th Avenue.
 - In the *With Improvements* scenario, the percentage increase in travel time for all vehicles is as follows: 15% for northbound (NB) travel along Wesbrook Mall, 2% for southbound (SB) travel along Wesbrook Mall, -4% for eastbound (EB) travel along West 16th Avenue and -2% for westbound (WB) travel along West 16th Avenue.

Figure 10.1: Changes in modelled travel time for all vehicles in the Weekend peak



Note: * Measured on West 16th Avenue between U-turn route (at Salish Trail) and Southwest Marine Drive

Figure 10.2: Changes in modelled travel time for buses in the Weekend peak



Note: * Measured on West 16th Avenue between Wesbrook Mall and Southwest Marine Drive

11 Summary, Conclusions, and Limitations

Consistent with modelling conducted as part of Campus Vision 2050, the more detailed modelling documented in this report for the Wesbrook Place Neighbourhood Plan indicates that UBC's road network, with some improvements, has enough capacity to support projected volumes anticipated with population growth.

11.1 Drivers of Vehicle Demand and Resulting Constraints

- The most notable increases in vehicle demand (from 2024 to 2035) were observed along West 16th Avenue and Wesbrook Mall, which presents as:
 - A significant capacity constraint at the roundabout at West 16th Avenue and Wesbrook Mall, causing a bottleneck and significant queueing along southbound Wesbrook Mall in the *Do Nothing* scenario.
 - Degraded LOS on the minor approaches of intersections along Wesbrook Mall, particularly in the *Do Nothing* scenario.
- Demand is higher during the PM peak than during the AM peak, resulting in higher expected delays and queue lengths in the afternoon relative to the rest of the day.

11.2 Assessment of Infrastructure Improvements

11.2.1 Key Beneficial Improvements

- The implementation of changes to the configuration of the West 16th Avenue and Binning Road intersection to enable a westbound left turn improves network performance by providing drivers with an additional route option to access the Wesbrook Place neighbourhood.
 - While the signalization increases delay and queues experienced by drivers along West 16th Avenue, the potential safety improvements for vehicles and pedestrians should be noted in addition to the benefits to overall network performance. Subsequent planning and design work will refine the design for the intersection, including whether signalization is warranted.
- The implementation of right-turn only lanes along northbound Wesbrook Mall at West 16th Avenue shows notable improvements in travel experience for right-turning traffic.
- Bus priority measures at the Southwest Marine Drive and Wesbrook Mall intersection prioritize transit operations in Wesbrook Place by maintaining existing bus journey times despite future traffic growth.
- The implementation of a mid-block pedestrian signal across West 16th Avenue between East Mall and Wesbrook Mall, pedestrian / bicycle signal at Wesbrook Mall and Gray Avenue, a multi-use path along the south side of West 16 Avenue, and a local street bikeway along Ross Drive and Gray Avenue had minimal impacts on driving experience. However, these treatments are expected to have significant beneficial impacts on pedestrian and bicycling comfort in line with the future vision of the Wesbrook Neighbourhood.

11.3 Limitations

While traffic modelling attempts to reflect real world conditions, it has the following limitations:

- The model cannot fully capture or quantify the beneficial impacts of infrastructure intended to improve travel experience for those walking or rolling.
- The model may not fully capture the delays experienced by drivers sharing space with active mode users related to specific movements like on-street parking or mid-block uncontrolled pedestrian crossings.

- The model captures future traffic growth based on RTM version 3.6. However, the VISSIM modeling cannot predict how external changes will impact future volumes beyond the specific growth assumptions in the RTM.
- There is no weekend peak model in the RTM, so weekend analysis is an estimate using an average of the AM and PM peak hours.

Appendices

A. Turn Movement Calibration Results	71
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A. Turn Movement Calibration Results

Table A.1: Turn Movement Calibration Results for AM peak

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
2	East Mall and W 16 Ave	EBL	EB	382	324	1	4	383	328	3.1	1.9	2.9
		EBT	EB	236	210	18	30	254	240	1.7	2.4	0.9
		EBR	EB	21	32	0	2	21	34	2.1	2.0	2.5
		NBL	NB	19	26	2	2	21	28	1.5	0.0	1.4
		NBT	NB	44	62	0	1	44	63	2.5	1.4	2.6
		NBR	NB	40	54	1	3	41	57	2.0	1.4	2.3
		WBL	WB	13	34	0	3	13	37	4.3	2.4	4.8
		WBT	WB	195	131	15	19	210	150	5.0	1.0	4.5
		WBR	WB	167	202	6	1	173	203	2.6	2.7	2.2
		SBL	SB	104	120	1	1	105	121	1.5	0.0	1.5
		SBT	SB	31	14	1	0	32	14	3.6	1.4	3.8
SBR	SB	73	81	3	4	76	85	0.9	0.5	1.0		
3	Wesbrook Mall and W 16 Ave	EBL	EB	201	148	18	27	219	175	4.0	1.9	3.1
		EBT	EB	132	136	2	2	134	138	0.3	0.0	0.3
		EBR	EB	47	99	0	4	47	103	6.1	2.8	6.5
		NBL	NB	27	33	0	0	27	33	1.1	0.0	1.1
		NBT	NB	156	146	24	13	180	159	0.8	2.6	1.6
		NBR	NB	69	36	0	1	69	37	4.6	1.4	4.4
		WBL	WB	228	171	0	5	228	176	4.0	3.2	3.7
		WBT	WB	230	218	0	2	230	220	0.8	2.0	0.7
		WBR	WB	201	267	15	10	216	277	4.3	1.4	3.9
		SBL	SB	91	140	14	13	105	153	4.6	0.3	4.2
		SBT	SB	122	83	18	18	140	101	3.9	0.0	3.6
SBR	SB	118	117	21	20	139	137	0.1	0.2	0.2		
4	W 16 Ave & Hampton Pl/Binning Rd	EBT	EB	292	311	16	16	308	327	1.1	0.0	1.1
		NBR	NB	119	139	3	4	122	143	1.8	0.5	1.8
		WBT	WB	612	608	15	17	627	625	0.2	0.5	0.1
		WBR	WB	49	50	0	0	49	50	0.1	0.0	0.1
		SBR	SB	47	48	0	0	47	48	0.1	0.0	0.1
5	Wesbrook Mall and Hampton Pl	NBT	NB	521	520	57	50	578	570	0.0	1.0	0.3
		NBR	NB	36	42	0	0	36	42	1.0	0.0	1.0
		WBL	WB	49	53	0	0	49	53	0.6	0.0	0.6
		WBR	WB	38	36	0	0	38	36	0.3	0.0	0.3
		SBL	SB	9	6	0	0	9	6	1.1	0.0	1.1
SBT	SB	282	285	53	51	335	336	0.2	0.3	0.1		
6	Wesbrook Mall and Berton Ave	NBL	NB	10	0	0	0	10	0	4.5	0.0	4.5
		NBT	NB	205	171	23	12	228	183	2.5	2.6	3.1
		NBR	NB	9	18	0	0	9	18	2.4	0.0	2.4
		WBL	WB	8	1	0	0	8	1	3.3	0.0	3.3

No	Intersection Name	Turn	Direction	Travel demand								
				Light Vehicle		Heavy Vehicles		Cumulative		GEH		
				Observed	Modelled	Observed	Modelled	Observed	Modelled	Light Vehicle	Heavy Vehicles	Cumulative
		WBT	WB	2	0	0	0	2	0	2.0	0.0	2.0
		WBR	WB	47	44	1	3	48	47	0.4	1.4	0.1
		SBL	SB	46	47	0	9	46	56	0.1	4.2	1.4
		SBT	SB	205	191	16	13	221	204	1.0	0.8	1.2
		SBR	SB	146	114	2	6	148	120	2.8	2.0	2.4
9	Birney Ave and Webber Lane	EBL	EB	22	26	2	0	24	26	0.8	2.0	0.4
		EBT	EB	17	10	0	0	17	10	1.9	0.0	1.9
		WBT	WB	23	15	0	0	23	15	1.8	0.0	1.8
		WBR	WB	14	0	0	0	14	0	5.3	0.0	5.3
		SBL	SB	32	38	0	2	32	40	1.0	2.0	1.3
10	Birney Ave and Shrum Lane	SBR	SB	22	40	3	2	25	42	3.2	0.6	2.9
		EBL	EB	1	0	0	0	1	0	1.4	0.0	1.4
		EBT	EB	48	48	0	3	48	51	0.0	2.4	0.4
		WBT	WB	28	15	0	0	28	15	2.8	0.0	2.8
		WBR	WB	27	27	1	0	28	27	0.0	1.4	0.2
11	Wesbrook Mall and Birney Ave	SBL	SB	87	56	4	2	91	58	3.7	1.2	3.8
		SBR	SB	9	0	0	0	9	0	4.2	0.0	4.2
		EBL	EB	90	62	3	4	93	66	3.2	0.5	3.0
		EBT	EB	26	29	0	1	26	30	0.6	1.4	0.8
		EBR	EB	19	12	1	0	20	12	1.8	1.4	2.0
		NBL	NB	24	27	1	0	25	27	0.6	1.4	0.4
		NBT	NB	95	97	19	6	114	103	0.2	3.7	1.1
		NBR	NB	13	20	1	1	14	21	1.7	0.0	1.7
		WBL	WB	17	26	0	2	17	28	1.9	2.0	2.3
		WBT	WB	8	15	0	0	8	15	2.1	0.0	2.1
12	Binning Rd and Birney Ave	WBR	WB	39	30	1	3	40	33	1.5	1.4	1.2
		SBL	SB	67	68	0	4	67	72	0.1	2.8	0.6
		SBT	SB	123	124	16	9	139	133	0.1	2.0	0.5
		SBR	SB	23	0	0	0	23	0	6.8	0.0	6.8
		EBL	EB	46	54	0	1	46	55	1.1	1.4	1.3
14	Wesbrook Mall and Gray Ave	EBR	EB	41	21	1	0	42	21	3.6	1.4	3.7
		NBL	NB	22	13	1	0	23	13	2.2	1.4	2.4
		NBT	NB	73	59	3	2	76	61	1.7	0.6	1.8
		SBT	SB	20	26	0	5	20	31	1.3	3.2	2.2
		SBR	SB	13	1	0	0	13	1	4.5	0.0	4.5
		EBL	EB	19	27	3	1	22	28	1.7	1.4	1.2
		EBT	EB	12	22	0	1	12	23	2.4	1.4	2.6
		EBR	EB	24	23	1	1	25	24	0.2	0.0	0.2
		NBL	NB	17	21	1	1	18	22	0.9	0.0	0.9
		NBT	NB	87	95	18	3	105	98	0.8	4.6	0.7
		NBR	NB	17	21	3	1	20	22	0.9	1.4	0.4
		WBL	WB	24	18	0	1	24	19	1.3	1.4	1.1
WBT	WB	7	9	1	0	8	9	0.7	1.4	0.3		

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
		WBR	WB	26	24	0	3	26	27	0.4	2.4	0.2
		SBL	SB	24	19	0	2	24	21	1.1	2.0	0.6
		SBT	SB	109	121	14	7	123	128	1.1	2.2	0.4
		SBR	SB	26	24	3	1	29	25	0.4	1.4	0.8
		EBL	EB	33	10	0	0	33	10	5.0	0.0	5.0
		EBR	EB	18	2	0	0	18	2	5.1	0.0	5.1
16	Wesbrook Mall and Ross Drive	NBL	NB	24	63	2	1	26	64	5.9	0.8	5.7
		NBT	NB	88	126	23	4	111	130	3.7	5.2	1.7
		SBT	SB	131	137	16	10	147	147	0.5	1.7	0.0
		SBR	SB	26	25	0	0	26	25	0.2	0.0	0.2
		EBL	EB	7	17	3	0	10	17	2.9	2.4	1.9
		EBT	EB	385	372	44	41	429	413	0.7	0.5	0.8
19	South West Marine Dr and Wesbrook Mall	WBT	WB	1260	1231	39	55	1299	1286	0.8	2.3	0.4
		WBR	WB	154	192	23	6	177	198	2.9	4.5	1.5
		SBL	SB	81	96	11	13	92	109	1.6	0.6	1.7
		SBR	SB	22	23	5	0	27	23	0.2	3.2	0.8

Table A.2: Turn Movement Calibration Results for PM peak

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
2	East Mall and W 16 Ave	EBL	EB	103	99	0	0	103	99	0.4	0.0	0.4
		EBT	EB	207	181	19	19	226	200	1.9	0.0	1.8
		EBR	EB	23	33	0	0	23	33	1.9	0.0	1.9
		NBL	NB	20	41	0	0	20	41	3.8	0.0	3.8
		NBT	NB	51	55	0	0	51	55	0.5	0.0	0.5
		NBR	NB	47	50	0	0	47	50	0.4	0.0	0.4
		WBL	WB	13	31	0	0	13	31	3.8	0.0	3.8
		WBT	WB	210	198	23	30	233	228	0.8	1.4	0.3
		WBR	WB	157	154	0	0	157	154	0.2	0.0	0.2
		SBL	SB	220	271	0	0	220	271	3.3	0.0	3.3
		SBT	SB	41	6	0	0	41	6	7.2	0.0	7.2
3	Wesbrook Mall and W 16 Ave	SBR	SB	368	351	0	0	368	351	0.9	0.0	0.9
		EBL	EB	138	149	19	18	157	167	0.9	0.2	0.8
		EBT	EB	282	280	0	0	282	280	0.1	0.0	0.1
		EBR	EB	54	74	0	0	54	74	2.5	0.0	2.5
		NBL	NB	30	35	0	0	30	35	0.9	0.0	0.9
		NBT	NB	180	166	13	0	193	166	1.1	5.1	2.0
		NBR	NB	145	103	1	0	146	103	3.8	1.4	3.9
		WBL	WB	268	245	0	0	268	245	1.4	0.0	1.4
		WBT	WB	125	152	0	0	125	152	2.3	0.0	2.3
		WBR	WB	141	146	11	10	152	156	0.4	0.3	0.3
SBL	SB	323	360	9	11	332	371	2.0	0.6	2.1		
SBT	SB	146	131	15	6	161	137	1.3	2.8	2.0		

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
4	W 16 Ave & Hampton PI/Binning Rd	SBR	SB	225	195	23	29	248	224	2.1	1.2	1.6
		EBT	EB	750	743	10	11	760	754	0.3	0.3	0.2
		NBR	NB	114	126	1	0	115	126	1.1	1.4	1.0
		WBT	WB	494	498	10	10	504	508	0.2	0.0	0.2
		WBR	WB	73	70	0	0	73	70	0.4	0.0	0.4
		SBR	SB	40	46	1	0	41	46	0.9	1.4	0.8
5	Wesbrook Mall and Hampton PI	NBT	NB	414	413	43	28	457	441	0.0	2.5	0.8
		NBR	NB	44	47	0	0	44	47	0.4	0.0	0.4
		WBL	WB	31	30	0	0	31	30	0.2	0.0	0.2
		WBR	WB	29	22	0	0	29	22	1.4	0.0	1.4
		SBL	SB	20	19	1	1	21	20	0.2	0.0	0.2
		SBT	SB	663	658	47	47	710	705	0.2	0.0	0.2
6	Wesbrook Mall and Berton Ave	NBL	NB	19	11	0	0	19	11	2.1	0.0	2.1
		NBT	NB	319	274	14	0	333	274	2.6	5.3	3.4
		NBR	NB	18	18	0	0	18	18	0.0	0.0	0.0
		WBL	WB	6	2	0	0	6	2	2.0	0.0	2.0
		WBT	WB	1	0	0	0	1	0	1.4	0.0	1.4
		WBR	WB	36	29	0	0	36	29	1.2	0.0	1.2
		SBL	SB	70	78	1	0	71	78	0.9	1.4	0.8
		SBT	SB	221	212	14	6	235	218	0.6	2.5	1.1
9	Birney Ave and Webber Lane	SBR	SB	177	159	0	0	177	159	1.4	0.0	1.4
		EBL	EB	27	24	0	0	27	24	0.6	0.0	0.6
		EBT	EB	27	11	0	0	27	11	3.7	0.0	3.7
		WBT	WB	43	25	0	0	43	25	3.1	0.0	3.1
		WBR	WB	24	0	0	0	24	0	6.9	0.0	6.9
		SBL	SB	58	54	0	0	58	54	0.5	0.0	0.5
10	Birney Ave and Shrum Lane	SBR	SB	65	81	0	0	65	81	1.9	0.0	1.9
		EBL	EB	8	0	0	0	8	0	4.0	0.0	4.0
		EBT	EB	77	66	0	0	77	66	1.3	0.0	1.3
		WBT	WB	55	25	0	0	55	25	4.7	0.0	4.7
		WBR	WB	29	28	0	0	29	28	0.2	0.0	0.2
		SBL	SB	169	93	1	0	170	93	6.6	1.4	6.7
11	Wesbrook Mall and Birney Ave	SBR	SB	12	0	0	0	12	0	4.9	0.0	4.9
		EBL	EB	162	117	0	0	162	117	3.8	0.0	3.8
		EBT	EB	40	6	0	0	40	6	7.1	0.0	7.1
		EBR	EB	44	33	1	0	45	33	1.8	1.4	1.9
		NBL	NB	35	28	0	0	35	28	1.2	0.0	1.2
		NBT	NB	154	154	14	0	168	154	0.0	5.3	1.1
		NBR	NB	20	20	1	0	21	20	0.0	1.4	0.2
		WBL	WB	14	24	0	0	14	24	2.3	0.0	2.3
		WBT	WB	8	25	0	0	8	25	4.2	0.0	4.2
WBR	WB	40	33	0	0	40	33	1.2	0.0	1.2		
SBL	SB	74	92	0	0	74	92	2.0	0.0	2.0		

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
12	Binning Rd and Birney Ave	SBT	SB	112	124	14	6	126	130	1.1	2.5	0.4
		SBR	SB	41	0	0	0	41	0	9.1	0.0	9.1
		EBL	EB	52	36	0	0	52	36	2.4	0.0	2.4
		EBR	EB	41	19	1	0	42	19	4.0	1.4	4.2
		NBL	NB	18	21	0	0	18	21	0.7	0.0	0.7
		NBT	NB	62	72	0	0	62	72	1.2	0.0	1.2
		SBT	SB	11	24	0	0	11	24	3.1	0.0	3.1
		SBR	SB	16	0	0	0	16	0	5.7	0.0	5.7
14	Wesbrook Mall and Gray Ave	EBL	EB	27	27	3	0	30	27	0.0	2.4	0.6
		EBT	EB	13	37	0	0	13	37	4.8	0.0	4.8
		EBR	EB	34	34	1	0	35	34	0.0	1.4	0.2
		NBL	NB	56	48	0	0	56	48	1.1	0.0	1.1
		NBT	NB	162	154	12	0	174	154	0.6	4.9	1.6
		NBR	NB	39	30	0	0	39	30	1.5	0.0	1.5
		WBL	WB	31	22	0	0	31	22	1.7	0.0	1.7
		WBT	WB	4	7	0	0	4	7	1.3	0.0	1.3
		WBR	WB	20	21	0	0	20	21	0.2	0.0	0.2
		SBL	SB	30	38	0	0	30	38	1.4	0.0	1.4
16	Wesbrook Mall and Ross Drive	SBT	SB	107	104	12	6	119	110	0.3	2.0	0.8
		SBR	SB	33	40	3	0	36	40	1.2	2.4	0.6
		EBL	EB	36	16	0	0	36	16	3.9	0.0	3.9
		EBR	EB	22	20	0	0	22	20	0.4	0.0	0.4
		NBL	NB	41	52	0	0	41	52	1.6	0.0	1.6
		NBT	NB	221	215	12	0	233	215	0.4	4.9	1.2
19	South West Marine Dr and Wesbrook Mall	SBT	SB	132	135	12	6	144	141	0.3	2.0	0.3
		SBR	SB	40	24	1	0	41	24	2.8	1.4	3.0
		EBL	EB	36	11	0	0	36	11	5.2	0.0	5.2
		EBT	EB	1023	1062	26	38	1049	1100	1.2	2.1	1.6
		WBT	WB	431	403	16	28	447	431	1.4	2.6	0.8
WBR	WB	163	193	12	0	175	193	2.2	4.9	1.3		
SBL	SB	164	185	13	6	177	191	1.6	2.3	1.0		
SBR	SB	15	21	1	0	16	21	1.4	1.4	1.2		

Table A.3: Turn Movement Calibration Results for Weekend peak

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
2	East Mall and W 16 Ave	EBL	EB	93	244	0	3	93	247	11.6	2.4	11.8
		EBT	EB	187	236	18	25	205	261	3.4	1.5	3.7
		EBR	EB	21	3	0	0	21	3	5.2	0.0	5.2
		NBL	NB	18	29	0	0	18	29	2.3	0.0	2.3
		NBT	NB	46	19	0	0	46	19	4.7	0.0	4.7
		NBR	NB	43	43	0	1	43	44	0.0	1.4	0.2
		WBL	WB	12	12	0	0	12	12	0.0	0.0	0.0

No	Intersection Name	Turn	Direction	Travel demand								
				Light Vehicle		Heavy Vehicles		Cumulative		GEH		
				Observed	Modelled	Observed	Modelled	Observed	Modelled	Light Vehicle	Heavy Vehicles	Cumulative
3	Wesbrook Mall and W 16 Ave	WBT	WB	189	209	21	32	210	241	1.4	2.1	2.1
		WBR	WB	142	190	0	1	142	191	3.7	1.4	3.8
		SBL	SB	198	205	0	1	198	206	0.5	1.4	0.6
		SBT	SB	37	3	0	0	37	3	7.6	0.0	7.6
		SBR	SB	332	216	0	2	332	218	7.0	2.0	6.9
		EBL	EB	125	171	18	23	143	194	3.8	1.1	3.9
		EBT	EB	254	203	0	2	254	205	3.4	2.0	3.2
		EBR	EB	49	113	0	2	49	115	7.1	2.0	7.3
		NBL	NB	27	53	0	1	27	54	4.1	1.4	4.2
		NBT	NB	162	141	12	9	174	150	1.7	0.9	1.9
		NBR	NB	131	95	1	1	132	96	3.4	0.0	3.4
		WBL	WB	242	222	0	5	242	227	1.3	3.2	1.0
		WBT	WB	113	177	0	2	113	179	5.3	2.0	5.5
		WBR	WB	127	208	10	10	137	218	6.3	0.0	6.1
		4	W 16 Ave & Hampton Pl/Binning Rd	SBL	SB	291	253	9	12	300	265	2.3
SBT	SB			132	83	14	10	146	93	4.7	1.2	4.8
SBR	SB			203	181	21	30	224	211	1.6	1.8	0.9
EBT	EB			675	550	9	16	684	566	5.1	2.0	4.7
NBR	NB			103	115	1	4	104	119	1.1	1.9	1.4
5	Wesbrook Mall and Hampton Pl	WBT	WB	445	559	9	17	454	576	5.1	2.2	5.4
		WBR	WB	66	60	0	0	66	60	0.8	0.0	0.8
		SBR	SB	36	49	1	0	37	49	2.0	1.4	1.8
		NBT	NB	373	473	39	42	412	515	4.9	0.5	4.8
		NBR	NB	40	47	0	0	40	47	1.1	0.0	1.1
		WBL	WB	28	43	0	0	28	43	2.5	0.0	2.5
6	Wesbrook Mall and Berton Ave	WBR	WB	27	29	0	0	27	29	0.4	0.0	0.4
		SBL	SB	18	13	1	1	19	14	1.3	0.0	1.2
		SBT	SB	597	475	43	52	640	527	5.3	1.3	4.7
		NBL	NB	18	0	0	0	18	0	6.0	0.0	6.0
		NBT	NB	288	242	13	9	301	251	2.8	1.2	3.0
		NBR	NB	17	19	0	0	17	19	0.5	0.0	0.5
		WBL	WB	6	0	0	0	6	0	3.5	0.0	3.5
		WBT	WB	1	0	0	0	1	0	1.4	0.0	1.4
9	Birney Ave and Webber Lane	WBR	WB	33	47	0	3	33	50	2.2	2.4	2.6
		SBL	SB	63	55	1	4	64	59	1.0	1.9	0.6
		SBT	SB	199	204	13	9	212	213	0.4	1.2	0.1
		SBR	SB	160	159	0	3	160	162	0.1	2.4	0.2
		EBL	EB	25	8	0	0	25	8	4.2	0.0	4.2
		EBT	EB	25	6	0	0	25	6	4.8	0.0	4.8
9	Birney Ave and Webber Lane	WBT	WB	39	6	0	0	39	6	7.0	0.0	7.0
		WBR	WB	22	5	0	1	22	6	4.6	1.4	4.3
		SBL	SB	53	94	0	2	53	96	4.8	2.0	5.0
		SBR	SB	59	55	0	0	59	55	0.5	0.0	0.5

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
10	Birney Ave and Shrum Lane	EBL	EB	8	0	0	0	8	0	4.0	0.0	4.0
		EBT	EB	70	100	0	2	70	102	3.3	2.0	3.5
		WBT	WB	50	11	0	1	50	12	7.1	1.4	6.8
		WBR	WB	27	24	0	0	27	24	0.6	0.0	0.6
		SBL	SB	153	35	1	2	154	37	12.2	0.8	12.0
		SBR	SB	11	0	0	0	11	0	4.7	0.0	4.7
11	Wesbrook Mall and Birney Ave	EBL	EB	146	107	0	3	146	110	3.5	2.4	3.2
		EBT	EB	36	3	0	0	36	3	7.5	0.0	7.5
		EBR	EB	40	24	1	1	41	25	2.8	0.0	2.8
		NBL	NB	32	28	0	1	32	29	0.7	1.4	0.5
		NBT	NB	139	111	13	4	152	115	2.5	3.1	3.2
		NBR	NB	18	32	1	0	19	32	2.8	1.4	2.6
		WBL	WB	13	27	0	0	13	27	3.1	0.0	3.1
		WBT	WB	8	6	0	0	8	6	0.8	0.0	0.8
		WBR	WB	36	42	0	2	36	44	1.0	2.0	1.3
		SBL	SB	67	80	0	3	67	83	1.5	2.4	1.8
12	Binning Rd and Birney Ave	SBT	SB	101	124	13	6	114	130	2.2	2.3	1.4
		SBR	SB	37	0	0	0	37	0	8.6	0.0	8.6
		EBL	EB	47	34	0	1	47	35	2.0	1.4	1.9
		EBR	EB	37	22	1	1	38	23	2.8	0.0	2.7
		NBL	NB	17	9	0	1	17	10	2.2	1.4	1.9
		NBT	NB	56	57	0	2	56	59	0.1	2.0	0.4
14	Wesbrook Mall and Gray Ave	SBT	SB	10	3	0	0	10	3	2.7	0.0	2.7
		SBR	SB	15	0	0	0	15	0	5.5	0.0	5.5
		EBL	EB	25	27	3	2	28	29	0.4	0.6	0.2
		EBT	EB	12	17	0	1	12	18	1.3	1.4	1.5
		EBR	EB	31	31	1	1	32	32	0.0	0.0	0.0
		NBL	NB	51	47	0	1	51	48	0.6	1.4	0.4
		NBT	NB	146	121	11	1	157	122	2.2	4.1	3.0
		NBR	NB	36	35	0	1	36	36	0.2	1.4	0.0
		WBL	WB	28	28	0	1	28	29	0.0	1.4	0.2
		WBT	WB	4	4	0	0	4	4	0.0	0.0	0.0
16	Wesbrook Mall and Ross Drive	WBR	WB	18	22	0	2	18	24	0.9	2.0	1.3
		SBL	SB	27	41	0	3	27	44	2.4	2.4	2.9
		SBT	SB	97	75	11	1	108	76	2.4	4.1	3.3
		SBR	SB	30	60	3	3	33	63	4.5	0.0	4.3
		EBL	EB	33	30	0	0	33	30	0.5	0.0	0.5
		EBR	EB	20	12	0	0	20	12	2.0	0.0	2.0
19		NBL	NB	37	31	0	0	37	31	1.0	0.0	1.0
		NBT	NB	199	171	11	2	210	173	2.1	3.5	2.7
		SBT	SB	119	110	11	3	130	113	0.8	3.0	1.5
		SBR	SB	36	24	1	0	37	24	2.2	1.4	2.4
		EBL	EB	33	26	0	0	33	26	1.3	0.0	1.3
		EBT	EB	921	754	24	45	945	799	5.8	3.6	4.9

No	Intersection Name	Turn	Direction	Travel demand						GEH		
				Light Vehicle		Heavy Vehicles		Cumulative		Light Vehicle	Heavy Vehicles	Cumulative
				Observed	Modelled	Observed	Modelled	Observed	Modelled			
	South West Marine Dr and Wesbrook Mall	WBT	WB	388	870	15	43	403	913	19.2	5.2	19.9
		WBR	WB	147	142	11	3	158	145	0.4	3.0	1.1
		SBL	SB	148	102	12	3	160	105	4.1	3.3	4.8
		SBR	SB	14	27	1	0	15	27	2.9	1.4	2.6