THE UNIVERSITY OF BRITISH COLUMBIA

TRANSPORTATION MICRO-SIMULATION MODEL OF DOWNTOWN WEST KELOWNA

2024-10-01

Prepared for:

CITY OF WEST KELOWNA

UiTR
UBC integrated Transportation Research Lab

NSERC CRSNG

Canada

mitacs

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Background

This report provides a summary of the micro-simulation model developed for the City of West Kelowna in partnership with HDR Inc. The model was built for the years 2022 and 2040. The study area is downtown West Kelowna, between Hebert Rd and Gellatly Rd. The purpose of this project is to analyze and understand how Main Street would work if re-designed as a low-speed downtown boulevard when Highway 97 is shifted to the Dobbin Rd as a two-way highway.

This report is divided into two sections: base year model and future model. The base year model reflects the status quo in 2022, using data collected by UBC's Integrated Transportation Research (UiTR) lab utilizing their Miovision equipment. The future model contemplates changes to happen in the next 20 years, in accord to the 2040 West Kelowna Transportation Master Plan. Both models were built considering three-time intervals: 0-3600 seconds, 3600-7200 seconds, and 7200-10800 seconds. The first 3600 seconds warm up the network to receive the peak hour traffic from 3600-7200 seconds. The last hour allows the assigned traffic to leave the network.

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Part I: Base Year Model

1. Study Area

Figure 1 shows the actual road network for this project which includes Dobbin and Main Street corridors between Gosset and Hebert roads. **Figure 2** shows the same road network built using simulation software – i.e., PTV VISSIM.

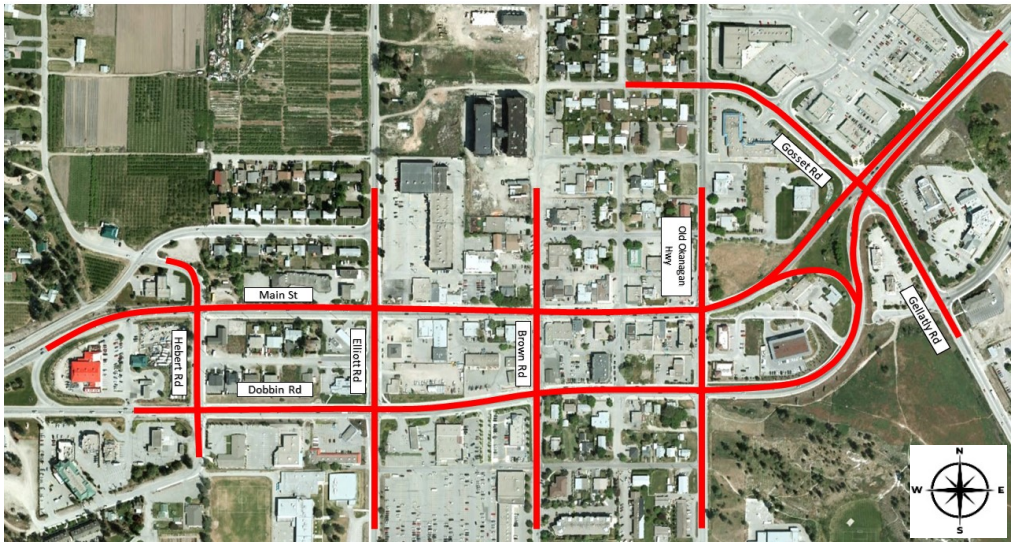

Figure 1 Study Area (Google Earth)

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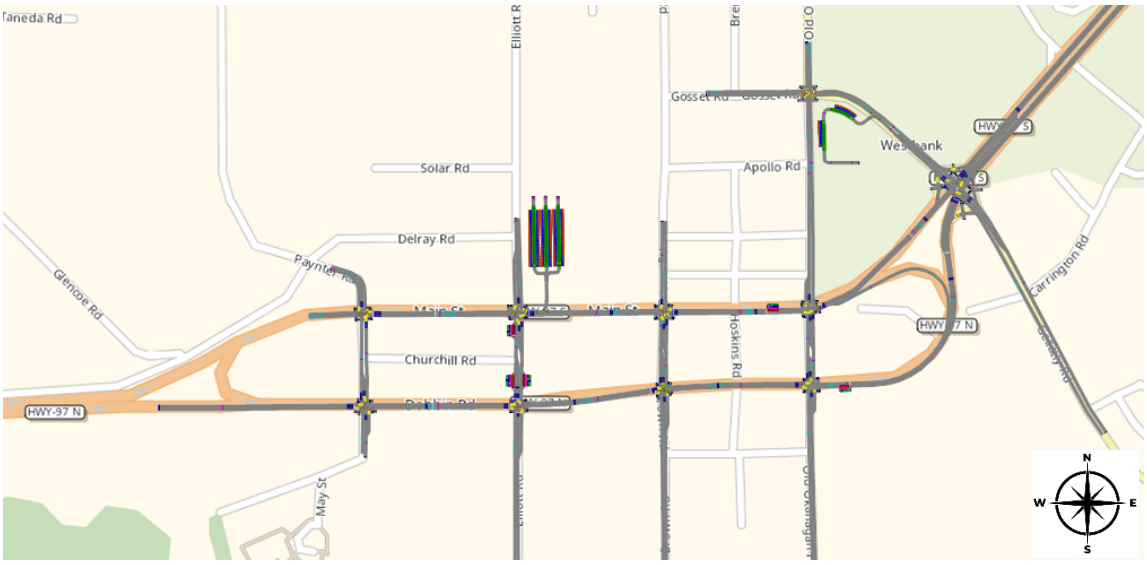

Figure 2 Road Network of the Study Area (PTV Vissim)

2. Model Validation

The microsimulation results presented here are the average for 10 simulation runs. The model was validated using traffic volume and travel time. In the case of traffic volume, the GEH metric was less than 5% for 100% links (**Table 1**). In the case of travel time, the model was validated for four critical routes against the travel time of both car and transit (**Table 2** and **Figure 3**). The actual avg travel time was calculated using Google Maps. In the case of travel time, the actual travel time for transit is closely represented, whereas car travel times have small differences (**Table 3**).

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Table 1 GEH Value per approach

No.	Name	Real Count	Model Count Avg	GEH Avg
1	Main St & Hebert WBT	1857	1729.3	3.02
2	Main St & Hebert WBR	24	21.1	0.61
3	Main St & Hebert WBL	48	45	0.44
4	Main St & Hebert SBT	60	61.6	0.21
5	Main St & Hebert SBR	46	49.1	0.45
6	Main St & Hebert NBT	14	13	0.27
7	Main St & Hebert NBL	39	35.5	0.57
8	Dobbin Rd & Hebert Rd EBT	1669	1643.6	0.62
9	Dobbin Rd & Hebert Rd NBT	21	20.8	0.04
10	Dobbin Rd & Hebert Rd NBR	79	76.6	0.27
11	Dobbin Rd & Hebert Rd SBL	41	49.1	1.21
12	Dobbin Rd & Hebert Rd SBT	47	57.7	1.48
13	Dobbin Rd & Hebert Rd EBL	32	28.1	0.71
14	Dobbin Rd & Hebert Rd EBS	10	9.6	0.13
15	Dobbin Rd & Elliott Rd EBT	1523	1548.9	0.66
16	Dobbin Rd & Elliott Rd EBL	101	106.5	0.54
17	Dobbin Rd & Elliott Rd EBR	101	102.3	0.13
18	Dobbin Rd & Elliott Rd NBT	191	193.2	0.16
19	Dobbin Rd & Elliott Rd NBR	95	92.5	0.26
20	Dobbin Rd & Elliott Rd SBT	206	173.4	2.37
21	Dobbin Rd & Elliott Rd SBR	76	64.2	1.41
22	Main St & Elliott Rd WBT	1587	1532.6	1.38
23	Main St & Elliott Rd WBR	36	33.2	0.48
24	Main St & Elliott Rd WBL	133	135.6	0.22
25	Main St & Elliott Rd NBT	183	161.9	1.61
26	Main St & Elliott Rd NBL	144	138.5	0.46
27	Main St & Elliott Rd SBT	120	113.6	0.59
28	Main St & Elliott Rd SBR	126	125.2	0.07
29	Main St & Brown Rd WBT	1531	1525.5	0.14
30	Main St & Brown Rd WBR	79	77.6	0.16
31	Main St & Brown Rd WBL	278	282	0.24
32	Main St & Brown Rd NBT	113	107.8	0.49
33	Main St & Brown Rd NBL	61	57.8	0.42
34	Main St & Brown Rd SBT	85	84.2	0.09
35	Main St & Brown Rd SBR	81	77.6	0.38
36	Dobbin Rd & Brown Rd EBT	1600	1613.3	0.33

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No.	Name	Real Count	Model Count Avg	GEH Avg
37	Dobbin Rd & Brown Rd EBR	13	12.1	0.25
38	Dobbin Rd & Brown Rd EBL	71	74.4	0.40
39	Dobbin Rd & Brown Rd NBT	95	92.3	0.28
40	Dobbin Rd & Brown Rd NBR	183	184.7	0.13
41	Dobbin Rd & Brown Rd SBT	324	321.6	0.13
42	Dobbin Rd & Brown Rd SBL	39	39.2	0.03
43	Dobbin Rd & Old Okanagan EBT	1705	1696	0.22
44	Dobbin Rd & Old Okanagan EBR	18	18.7	0.16
45	Dobbin Rd & Old Okanagan EBL	97	99.4	0.24
46	Dobbin Rd & Old Okanagan NBT	195	199.9	0.35
47	Dobbin Rd & Old Okanagan NBR	229	217.2	0.79
48	Dobbin Rd & Old Okanagan SBT	111	104	0.68
49	Dobbin Rd & Old Okanagan SBL	37	33.3	0.62
50	Main St & Old Okanagan WBT	1595	1662.1	1.66
51	Main St & Old Okanagan WBR	124	101.6	2.11
52	Main St & Old Okanagan WBL	53	42.3	1.55
53	Main St & Old Okanagan NBT	212	261.7	3.23
54	Main St & Old Okanagan NBL	28	34	1.08
55	Main St & Old Okanagan SBT	97	94.5	0.26
56	Main St & Old Okanagan SBR	185	199.5	1.05
57	Old Okanagan & Gosset Rd NBT	253	294.6	2.51
58	Old Okanagan & Gosset Rd NBR	64	66.8	0.35
59	Old Okanagan & Gosset Rd NBL	2	2.2	0.14
60	Old Okanagan & Gosset Rd EBT	40	39.5	0.08
61	Old Okanagan & Gosset Rd EBR	10	11.3	0.40
62	Old Okanagan & Gosset Rd EBL	29	28.6	0.07
63	Old Okanagan & Gosset Rd WBT	83	100.9	1.87
64	Old Okanagan & Gosset Rd WBR	100	123.7	2.24
65	Old Okanagan & Gosset Rd WBL	27	35.9	1.59
66	Old Okanagan & Gosset Rd SBT	243	249.2	0.40
67	Old Okanagan & Gosset Rd SBR	23	21.5	0.32
68	Old Okanagan & Gosset Rd SBL	73	74.3	0.15
69	Hwy 97 & Gellatly Rd EBT	1406	1282.3	3.37
70	Hwy 97 & Gellatly Rd EBR	202	185.3	1.20
71	Hwy 97 & Gellatly Rd EBL	63	59.7	0.42
72	Hwy 97 & Gellatly Rd WBT	1223	1214.4	0.25
73	Hwy 97 & Gellatly Rd WBR	38	33.5	0.75
74	Hwy 97 & Gellatly Rd WBL	164	158.5	0.43
75	Hwy 97 & Gellatly Rd NBT	183	170.5	0.94

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No.	Name	Real Count	Model Count Avg	GEH Avg
76	Hwy 97 & Gellatly Rd NBR	91	95.1	0.43
77	Hwy 97 & Gellatly Rd NBL	201	192.5	0.61
78	Hwy 97 & Gellatly Rd SBT	153	106.8	4.05
79	Hwy 97 & Gellatly Rd SBR	48	34.1	2.17
80	Hwy 97 & Gellatly Rd SBL	81	59.6	2.55
Overview of GEH statistics across the network				
Total Data Collection Points for Vehicle Count				80
Approaches Less than 5% GEH				80 (100%)
Approaches Greater than 5% GEH				0 (0%)

Table 2 List of Routes for the Travel Time Validation

#	Name	Start Link	End Link
1	Transit To Westbank Exchange	10553: Main-Brown EA	117: Main-Elliot SB
2	Transit From Westbank Exchange	118: Main-Elliot SB	155: Dobbin-Old Ok HWY EB
3	Car Main Rd	17: Main-Old Ok HWY EA	2: Main-Elliot WB
4	Car Dobbin Rd	32: Dobbin-Elliot WA	25: Dobbin-Old Ok HWY EB

Figure 3 Start and End Locations for Each Routes for Travel Time Calculations

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Table 3 Travel Time Validation Results

Time Interval	Route	Model Avg Travel Time (s)	Actual Avg Travel Time (s)
3600-7200	1: Transit To Westbank Exchange - Line 20	100.69	85.33
3600-7200	2: Transit From Westbank Exchange - Line 20	97.63	79
3600-7200	3: Car Main Rd	207.13	180
3600-7200	4: Car Dobbin Rd	226.77	240

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Part II: Future Model

1. Overview of the Future Scenario

The future model was built using the validated base model. The traffic input was updated to reflect the future – given by HDR Inc. The street design was also updated to reflect the changes proposed in the 2040 Transportation Master Plan. Main Street was converted into a two-way street **(Figure 4)**, with bike lanes added on the north side and parking spaces on the south side **(Figure 5)**. To give space for the bike lanes, the bus stop currently located between Hoskins Rd and Old Okanagan Hwy was transferred about 100 meters upstream to the Eleanor Reece Memorial Park (**Figure 6**).

Figure 4 Future Road Network

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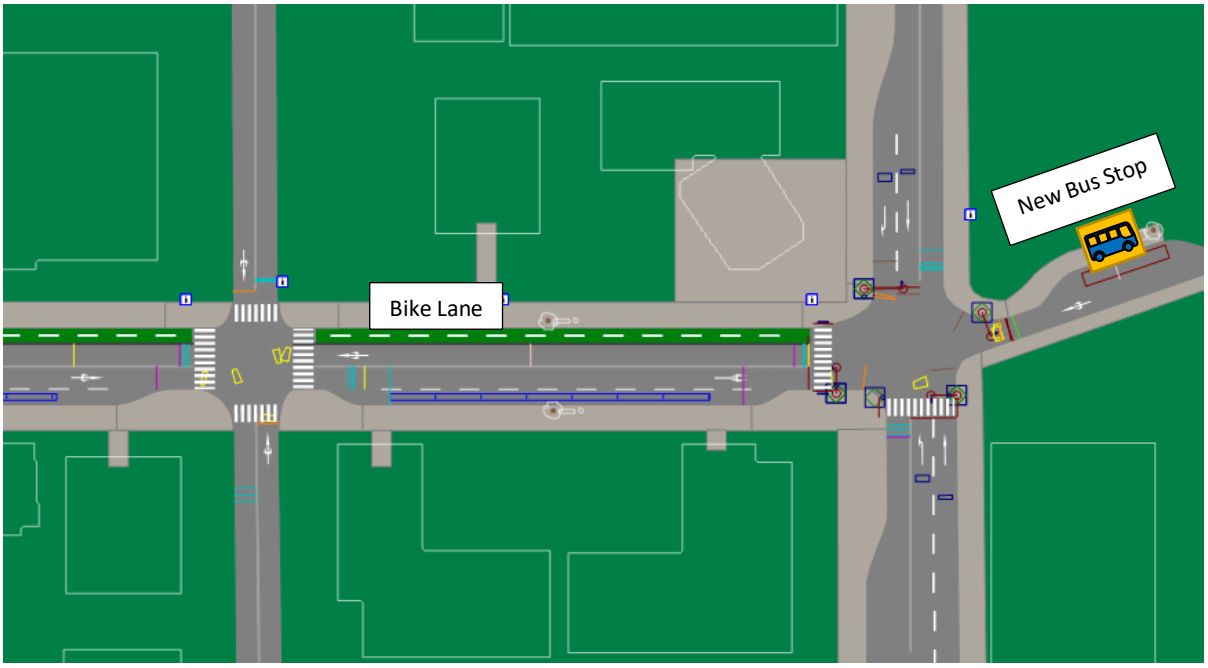

Figure 5 Bike Lane and Parking Configurations on the Main Street

Figure 6 Change of the Bus Stop Location

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2. Microsimulation Results

The future scenario has been evaluated based on travel time and queue length. Travel time metric has been generated for six road segments (**Table 4** and **Figure 7**). **Table 5** presents the number of vehicles, travel times in seconds, and distances traveled in meters for different road segments across three time intervals: 0-3600 seconds, 3600-7200 seconds, and 7200-10800 seconds. The comparison of travel times between the base model and future model for selected routes is shown in **Table 6**. Overall, there was a reduction in travel time because of the future changes. The only route presenting an increase in travel time is route number 2: Transit from Westbank Exchange, possibility due to the expected higher traffic volume passing through West Kelowna. **Table 7** presents the microsimulation results for queue lengths in the Future Model. Notably, the intersection at Highway 97 & Gellatly Road shows the highest average queue length. A few locations, such as Dobbin Road & Elliot Road, report minimal or no traffic congestion at these points. The data highlights significant variations in queue lengths across different intersections, reflecting differing traffic conditions and potential areas for traffic management improvements.

Table 4 List of Road Segments for Generating the Travel time Indicator

#	Name	Start Link	End Link
1	Transit to Westbank Exchange - Line 20	156: Main-Brown EA	117: Main-Elliot SB
2	Transit from Westbank Exchange - Line 20	117: Main-Elliot SB	155: Dobbin Rd & Gellatly Rd EB
3	Car Main Rd	158: Hwy 97 & Gellatly Rd WB	59: Main St & Hebert Rd WB
4	Car Dobbin Rd	32: Dobbin Rd & Elliot EB	95: Hwy 97 & Gellatly Rd EB
5	Car to Westbank Exchange	109: Main St & Old Okanagan Hwy WB	4: Dobbin Rd & Elliot Rd SB
6	Car from Westbank Exchange	4: Dobbin Rd & Elliot Rd SB	25: Dobbin Rd & Gellatly Rd EB

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Figure 7 Start and End Locations for Each Routes for Travel Time Calculation

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Table 5 Number of vehicles, travel time and distance travelled for different road segments

Time Interval	Route	Vehs (All)	Vehs (10)	Vehs (20)	Vehs (30)	Avg Travel Time (All) (s)	Avg Travel Time (10) (s)	Avg Travel Time (20) (s)	Avg Travel Time (30) (s)	Distance Travelled (All) (m)	Distance Travelled (10) (m)	Distance Travelled (20) (m)	Distance Travelled (30) (m)
0-3600	1: Transit To Westbank Exchange - Line 20	4	0	0	4	81.634			81.634	461.892			461.892
0-3600	2: Transit From Westbank Exchange - Line 20	4	0	0	4	108.686			108.686	548.245			548.245
0-3600	3: Car Main Rd	123	121	2	0	96.094	96.021	100.486		947.121	947.606	917.780	
0-3600	4: Car Dobbin Rd	422	416	6	0	107.213	107.238	105.427		1042.565	1042.587	1041.038	
0-3600	5: Car To Westbank Exchange	8	6	0	2	52.540	55.249		44.413	459.907	459.907		459.907
0-3600	6: Car From Westbank Exchange	27	24	1	2	109.596	100.676	106.894	217.989	547.120	546.887	546.887	550.033
3600-7200	1: Transit To Westbank Exchange - Line 20	4	0	0	4	93.075			93.075	461.892			461.892
3600-7200	2: Transit From Westbank Exchange - Line 20	4	0	0	4	153.803			153.803	548.245			548.245
3600-7200	3: Car Main Rd	237	229	8	0	123.662	122.972	143.409		954.994	955.274	946.980	
3600-7200	4: Car Dobbin Rd	926	881	45	0	140.535	140.289	145.342		1041.972	1042.020	1041.038	
3600-7200	5: Car To Westbank Exchange	17	15	0	2	66.160	65.774		69.058	459.907	459.907		459.907
3600-7200	6: Car From Westbank Exchange	64	57	5	2	115.860	112.365	118.903	207.868	546.985	546.887	546.887	550.033
7200-10800	1: Transit To Westbank Exchange - Line 20	0	0	0	0								
7200-10800	2: Transit From Westbank Exchange - Line 20	0	0	0	0								
7200-10800	3: Car Main Rd	130	124	6	0	101.002	100.611	109.078		959.594	953.335	1088.940	
7200-10800	4: Car Dobbin Rd	519	501	18	0	120.469	120.646	115.543		1043.487	1043.575	1041.038	
7200-10800	5: Car To Westbank Exchange	17	14	1	2	59.165	57.724	63.870	66.899	459.907	459.907	459.907	459.907
7200-10800	6: Car From Westbank Exchange	35	33	0	2	132.134	124.707		254.684	565.034	565.943		550.033

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Table 6 Travel times for the Base Model vs Future Model.

Time Interval	Route	Base Model	Future Model
3600-7200	1: Transit To Westbank Exchange - Line 20	100.69	93.075
3600-7200	2: Transit From Westbank Exchange - Line 20	97.63	153.803
3600-7200	3: Car Main Rd	207.13	123.662
3600-7200	4: Car Dobbin Rd	226.77	140.535

Table 7 The following table contains results on queue length in meters.

Time Interval	Queue Counter Location	Avg Queue Length (m)	Queue Length Maximum (m)
0-3600	1: Main St & Old Okanagan Hwy WBLTR	2.13	63.12
0-3600	2: Main St & Brown Rd WBLTR	0.49	35.95
0-3600	3: Main St & Elliot Rd WBLTR	0.16	23.57
0-3600	4: Main St & Herbert Rd WBLTR	0.00	0.00
0-3600	5: Dobbin Rd & Herbert Rd EBLTR	0.80	37.26
0-3600	6: Dobbin Rd & Elliot Rd EBLTR	0.90	25.41
0-3600	7: Dobbin Rd & Brown Rd EBLTR	2.39	46.67
0-3600	8: Dobbin Rd & Old Okanagan Hwy EBLTR	8.44	66.83
0-3600	9: Hwy 97 & Gellatly Rd EBTR	6.88	73.46
0-3600	10: Dobbin Rd & Elliot Rd SBTL	1.82	29.44
0-3600	11: Dobbin Rd & Elliot Rd NBT	0.00	0.00
0-3600	12: Main St & Elliot Rd NBT	0.74	14.56
0-3600	14: Hwy 97 & Gellatly Rd NBT	1.77	30.32
0-3600	15: Hwy 97 & Gellatly Rd NBR	0.07	12.17
0-3600	16: Hwy 97 & Gellatly Rd EBL	1.25	18.29
0-3600	17: Hwy 97 & Gellatly Rd WBL	0.82	33.57
0-3600	18: Hwy 97 & Gellatly Rd WBT	7.30	91.69
0-3600	19: Hwy 97 & Gellatly Rd WBR	0.00	0.00
0-3600	20: Dobbin Rd & Elliot Rd NBR	0.00	0.00
3600-7200	1: Main St & Old Okanagan Hwy WBLTR	7.16	94.13
3600-7200	2: Main St & Brown Rd WBLTR	6.16	92.37
3600-7200	3: Main St & Elliot Rd WBLTR	2.63	90.08
3600-7200	4: Main St & Herbert Rd WBLTR	0.12	21.97
3600-7200	5: Dobbin Rd & Herbert Rd EBLTR	4.44	76.55
3600-7200	6: Dobbin Rd & Elliot Rd EBLTR	7.69	95.17
3600-7200	7: Dobbin Rd & Brown Rd EBLTR	12.56	132.57

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Time Interval	Queue Counter Location	Avg Queue Length (m)	Queue Length Maximum (m)
3600-7200	8: Dobbin Rd & Old Okanagan Hwy EBLTR	36.06	146.89
3600-7200	9: Hwy 97 & Gellatly Rd EBTR	46.37	262.12
3600-7200	10: Dobbin Rd & Elliot Rd SBTL	4.09	39.80
3600-7200	11: Dobbin Rd & Elliot Rd NBT	0.00	0.00
3600-7200	12: Main St & Elliot Rd NBT	1.31	36.66
3600-7200	14: Hwy 97 & Gellatly Rd NBT	47.22	263.70
3600-7200	15: Hwy 97 & Gellatly Rd NBR	0.37	24.68
3600-7200	16: Hwy 97 & Gellatly Rd EBL	4.40	32.66
3600-7200	17: Hwy 97 & Gellatly Rd WBL	9.00	65.54
3600-7200	18: Hwy 97 & Gellatly Rd WBT	105.57	504.75
3600-7200	19: Hwy 97 & Gellatly Rd WBR	0.00	0.00
3600-7200	20: Dobbin Rd & Elliot Rd NBR	0.00	0.00
7200-10800	1: Main St & Old Okanagan Hwy WBLTR	1.07	41.95
7200-10800	2: Main St & Brown Rd WBLTR	0.76	39.50
7200-10800	3: Main St & Elliot Rd WBLTR	0.31	42.12
7200-10800	4: Main St & Herbert Rd WBLTR	0.00	0.00
7200-10800	5: Dobbin Rd & Herbert Rd EBLTR	0.90	48.79
7200-10800	6: Dobbin Rd & Elliot Rd EBLTR	1.24	32.37
7200-10800	7: Dobbin Rd & Brown Rd EBLTR	3.50	47.25
7200-10800	8: Dobbin Rd & Old Okanagan Hwy EBLTR	9.01	106.88
7200-10800	9: Hwy 97 & Gellatly Rd EBTR	10.43	147.07
7200-10800	10: Dobbin Rd & Elliot Rd SBTL	2.90	29.44
7200-10800	11: Dobbin Rd & Elliot Rd NBT	0.00	0.00
7200-10800	12: Main St & Elliot Rd NBT	0.52	23.02
7200-10800	14: Hwy 97 & Gellatly Rd NBT	2.38	36.36
7200-10800	15: Hwy 97 & Gellatly Rd NBR	0.34	31.20
7200-10800	16: Hwy 97 & Gellatly Rd EBL	1.72	25.97
7200-10800	17: Hwy 97 & Gellatly Rd WBL	1.87	32.81
7200-10800	18: Hwy 97 & Gellatly Rd WBT	4.76	59.80
7200-10800	19: Hwy 97 & Gellatly Rd WBR	0.01	10.45
7200-10800	20: Dobbin Rd & Elliot Rd NBR	0.00	0.00

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Part III: Quality Control

Throughout the project timeline, the work has been reviewed by multiple members from the UiTR lab at various stages. An overview of the quality control process is presented in Table 8.

Table 8 Quality Control

No.	Item	Author / Date	Peer Review / Date	Quality / Date
1	Existing Conditions Model – Validation_Draft	Elis 2022-01-10	Bijoy 2022-01-10	Dr. Fatmi 2022-01-10 HDR 2022-01-13
2	Existing Conditions Model – Validation_Final Review	Elis 2022-01-22	Bijoy 2022-01-23	Dr. Fatmi 2022-01-24
3	Final Report	Elis 2023-05-03	Bijoy 2023-05-03	Dr. Fatmi 2024-09-30

Note: Item 1 was reviewed by HDR on Jan 13th, 2022. A feedback e-mail was sent and Item 2 was updated accordingly.

The model has been reviewed every week several times by Dr. Mahmudur Fatmi for quality control.

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