

MOUNT HOPE AVENUE DEVELOPMENT TRAFFIC IMPACT STUDY FINAL REPORT

PREPARED FOR:
CLAYTON DEVELOPMENT LTD

APRIL 2022

Project No. 211-04927-01





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1 INTRODUCTION

Background

Mount Hope Development plans are being prepared by Clayton Development Ltd. for a residential development that is located on the undeveloped parcels of land (PID 40003600, 41362161 & 41280546) within the Southdale neighbourhood in Dartmouth, Nova Scotia, see Figure 1.

The proposed development is expected to include 39 single detached homes, 18 four-plexes (72 units), 310 townhouse units and 8 mid-rise residential buildings (454 units), see Figure 2.

Nova Scotia Public Works (NSPW) has requested that a Traffic Impact Study be completed to review the impacts to the adjacent road network and the Highway 111 interchange.

WSP Canada Inc. has been retained to complete a Traffic Impact Study (TIS) for the proposed Mount Hope Development. This follows the December 10th, 2021 Scoping Document reviewed by NSPW.

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of determining answers for the following questions:

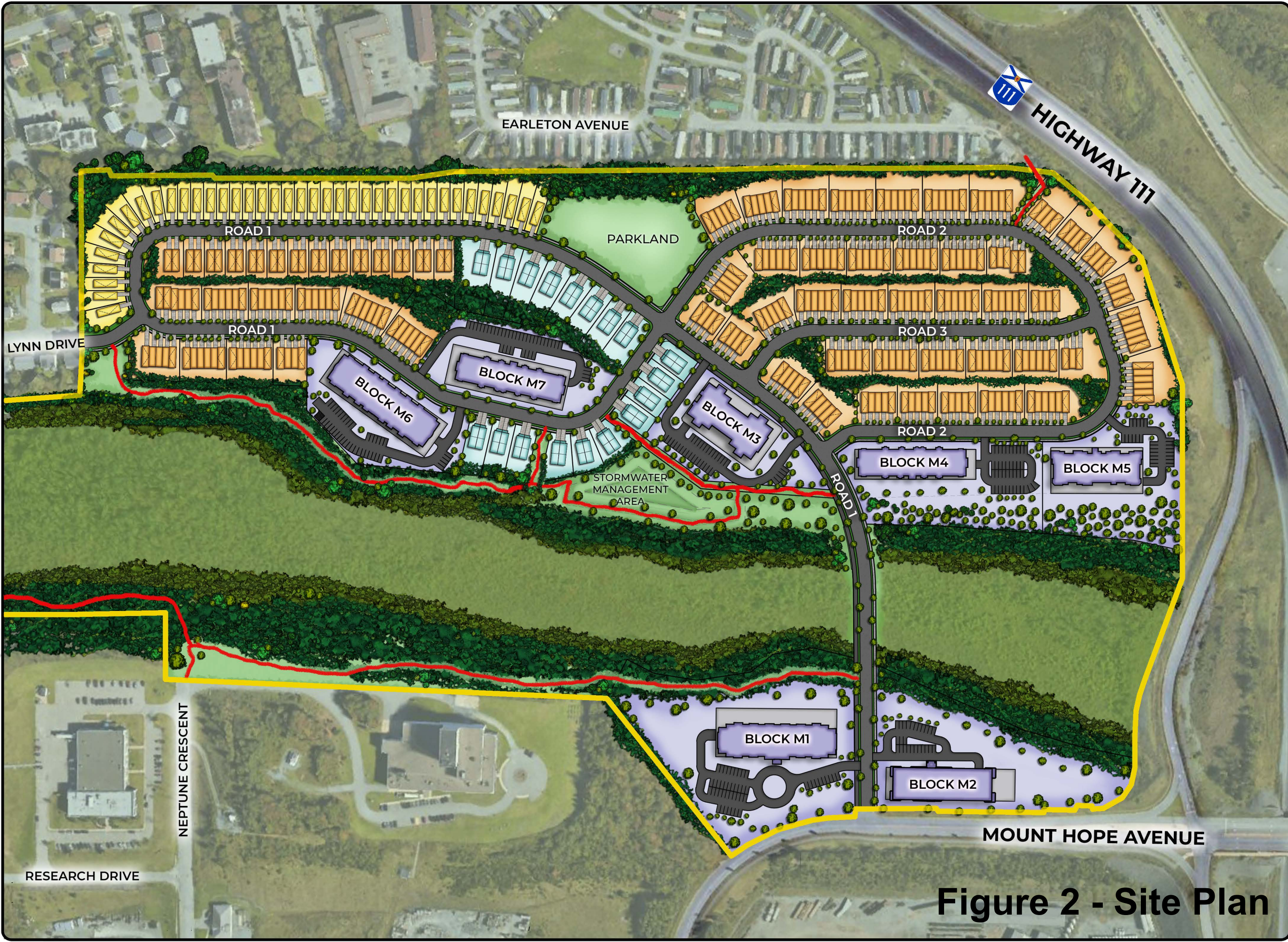
1. **What is the existing transportation situation** adjacent to the study site? How have volumes changed historically?
2. **What transportation changes are expected** at key Study Area locations? How many vehicle and active mode trips are expected to be generated by the proposed development during weekday peak hours? What routes are the trips expected to use to travel within and through the Study Area?
3. **What transportation impacts will occur** on Study Area roads, sidewalks, and intersections?
4. **What transportation improvements are required** to mitigate project impacts on Study Area travel? Are there transportation modifications that should be made to improve the travel experience for all users?

Study Objectives

1. Develop projected 2021 and 2034 background weekday AM and PM peak hourly volumes for Study Intersections.
2. Estimate the number of weekday AM and PM peak hour trips that will be generated by the proposed development.
3. Distribute and assign site generated trips to Study Intersections to project 2034 peak hourly volumes that include site generated trips.
4. Evaluate impacts of site generated traffic on the performance of Study Intersections.
5. Complete warrant analyses, as necessary, for Study Intersections and recommend improvements that may be needed at Study Intersections to mitigate the impacts of site development.



Figure 1 – Study Intersections



CONCEPTUAL PLAN

MOUNT HOPE LANDS

LEGEND

4-Plex	
Single Home	
Townhouse	
Multi-Residential Podium	
Project Boundary	
Future Trail	
Parkland/ Open Space	
Planted/ Existing Vegetation	
Wetland	

NOTES:

- CONCEPTUAL LAYOUT ONLY.
- GRADING IS NOT FINALIZED; WALL HEIGHTS AND ELEVATIONS ARE SUBJECT TO CHANGE.
- FINAL GRADING TO BE IN ACCORDANCE WITH HRM ENGINEERING SPECIFICATIONS & APPLICABLE DESIGN GUIDELINES.
- FINAL PLANS TO BE IN ACCORDANCE WITH THE DEVELOPMENT AGREEMENT AND APPLICABLE LAND USE BY-LAW.

DATE
FEBRUARY 1, 2022

25 0 25 50 75
METRES

Figure 2 - Site Plan



2 STUDY AREA DESCRIPTIONS

Description of Proposed Development

The proposed Mount Hope Development is expected to include 39 single detached homes, 18 four-plexes (72 units), 310 townhouse units and 8 mid-rise residential buildings (454 units). The development proposes to have access to Mount Hope Avenue and Lynn Drive. For the purpose of this study and to be conservative for NSW infrastructure, all traffic is assigned to the Mount Hope Avenue access.

It is anticipated that the development will be completed with full site buildout by 2029. The study will consider the development with a study horizon year of 2034, five years beyond anticipated site buildout.

Existing Study Road Description

Mount Hope Avenue at the site location, is a 2-lane collector, with a multi-use pathway on the south side. The street transitions to a multi-lane arterial just east of the access point on the approach to the Circumferential Highway. It has a posted speed limit of 50km/hr. Within the Regional Plan, there is an envisioned road network project to extend the eastern-most end of Mount Hope Avenue to connect with Portland Estates.

Existing Study Intersection Description

Mount Hope Avenue at Highway 111 is a diamond interchange at Exit 8 with signalized intersections where it intersects with Mount Hope Avenue. At the southbound ramp intersection, there are two lanes and a channelized right on the southbound approach. The westbound approach consists of two left turn lanes and a single through lane. The eastbound approach consists of three lanes and a channelized right turn.

3 BACKGROUND TRAFFIC

Turning Movement Counts

Turning movement volumes were collected on Thursday, October 7th, 2021 at the Highway 111 ramp intersections with Mount Hope Avenue at Intersection 1 during the morning (7:00-9:00AM) and afternoon (3:30-5:30PM) peak periods and at Intersection 2 during the morning (7:00-9:00AM), midday (11:30AM-1:30PM), and afternoon (3:30-5:30PM) peak periods. Intersection counts have been tabulated in 15-minute intervals with peak hours indicated by shaded areas. The PM peak hour for Intersection 1 & 2 was selected as 4-5PM and balanced accordingly. Turning movement volumes are provided in Tables A-1 and A-2, Appendix A.

Seasonal Adjustment & COVID Factors

NSPW completes traffic counts on various roads and highways throughout the year. In order to normalize the collected traffic counts completed for different types of roads and to account for seasonal variation in traffic volumes, NSPW develops average traffic count group factors. There is a factor determined for each week of the year for each road class. Road classes consider the type of traffic use carried on a particular road section. A road section that primarily carries commuter traffic in an urban area does not see as much variation in volumes as a rural road in a tourist area would experience.

Mount Hope Avenue was not listed in the primary or secondary roadway volumes from NSPW. A seasonal adjustment factor of 0.93 for a Class 'A' roadway is illustrated in the table, as shown in the Appendix A, however a seasonal factor of 1.0 was used to be conservative. Nova Scotia was in Phase 5 of the Covid-19 recovery phase and is expected to have minimal impact on the traffic flow during the count period. To account for variation in traffic volumes from day to day and impact of Covid, we have applied a 5% increase to estimate 2021 Design Hourly Volumes.

Traffic Growth Rate

There is limited historical data for the Mount Hope Interchange with Highway 111. Therefore, an annual growth rate of 1.0% will be applied to project 2034 background volumes for this Traffic Impact Study.

Active Transportation & Transit

There is a multi-use pathway on the south side of Mount Hope Avenue along the frontage of the site that has a guardrail between the pathway and roadway. There are currently no marked crosswalks at the proposed site access location, however based on a STOP controlled or signalized intersection at the study access, a marked pedestrian crossing is recommended to be incorporated into the intersection design and the appropriate measures for connection to the existing pathway.

There is currently public transit (Halifax Transit Route #67) with stops in each direction approximately 300m west on Mount Hope Avenue from the proposed site access. Additional transit stops near the proposed site (west side) may provide opportunities for users to travel towards Gaston Road, where additional transit stops exist.

4 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Prepared Trip Generation Estimates

When using the published trip generation rates in the *Trip Generation Manual (Institute of Transportation Engineers)*, the transportation engineer's objective should be to provide a realistic estimate of the number of trips that will be generated by the proposed development.

Anticipated Land Use for the Proposed Development

The proposed development is expected to include 39 single detached homes, 18 four-plexes (72 units), 310 townhouse units and 8 mid-rise residential buildings (454 units).

Estimation of Trips Generated by the Proposed Development

Trip generated by Single Family Detached Housing (Land Use 210), Single Family Attached Housing (Land Use 215) and Multifamily Housing (Mid-Rise) (Land Use 221) are estimated for the AM and PM peak hours of traffic by unit counts. Trip generation estimates for the proposed development were prepared using published rates from *Trip Generation Manual, 11th Edition* (Institute of Transportation Engineers, Washington, 2021).

Reductions to Trip Generation Estimates

Based on the information available from the Census 2016 Journey to Work information, approximately 36% of trips using transit or active transportation and understanding that the ITE trip generation land use codes account for some non-vehicle trips. Two trip generation scenarios were used in this study including a 20% & 0% reduction for the non-vehicle trips. The 20% reduction was applied, which is considered conservative, as the site has good proximity to employment, active transportation facilities and the Woodside Ferry Terminal. As requested by NSPW, a 0% reduction factor was also used for comparison and completion of a sensitivity analysis if more site trips are completed by automobile.

Trips Generated by the Proposed Development

Trip generation estimates for the proposed development with 20% reduction for non-vehicle trips are summarized in Table 1.

During the AM peak hour, it is estimated that the development will generate:

- 303 two-way primary vehicle trips (82 entering and 221 exiting).

During the PM peak hour, it is estimated that the expansion will generate:

- 345 two-way primary vehicle trips (204 entering and 141 exiting).

Table 1 – Trip Generation Estimates for the Proposed Development with 20% non-vehicle reductions

Land Use ¹	Units ²	Trip Generation Rates ³				Trips Generated ⁴			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Proposed Development									
Single-Family Detached Housing (Land Use 210)	39 units	0.18	0.52	0.59	0.35	7	20	23	14
Single-Family Attached Housing ⁵ (Land Use 215)	382 units	0.15	0.33	0.32	0.25	57	127	124	94
Multifamily Housing (Mid-Rise) (Land Use 221)	454 units	0.09	0.28	0.24	0.15	39	129	108	69
Trip Generation Estimate						103	276	255	176
20% Reduction for Non-Vehicle Trips ⁶						21	55	51	35
Total Trips generated by the Proposed Development						82	221	204	141
Notes: 1. Land Use Codes are from <i>Trip Generation Manual</i> , 11th Edition, (Institute of Transportation Engineers, Washington, 2021). 2. The units of measurement are dwelling units. 3. Trip generation rates are 'trips per hour per unit of measurement'. 4. Trips generated are 'trips per hour' for AM and PM peak hours. 5. Four-plexes and townhouses are considered a form of low-rise attached housing (Land Use Code 215) 6. In 2016, approximately 36% of trips were made by transit or using active transportation in the associated census tract Journey to Work information. The Halifax Integrated Mobility Plan has a 60% target for non-auto trips within the Regional Centre by 2031 (Page 16, IMP Implementation Update, 2021). For the sensitivity analysis, a reduction of 0% was used to account for non-auto trips (transit, bicycle and walking trips) generated to the site.									

Trip generation estimates for the proposed development for the sensitivity analysis with 0% reduction for non-vehicle trips are summarized in Table 2.

During the AM peak hour, it is estimated that the development will generate:

- 379 two-way primary vehicle trips (103 entering and 276 exiting).

During the PM peak hour, it is estimated that the expansion will generate:

- 431 two-way primary vehicle trips (255 entering and 176 exiting).

Table 2 – Trip Generation Estimates for the Proposed Development with 0% non-vehicle reductions

Land Use ¹	Units ²	Trip Generation Rates ³				Trips Generated ⁴			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
Proposed Development									
Single-Family Detached Housing (Land Use 210)	39 units	0.18	0.52	0.59	0.35	7	20	23	14
Single-Family Attached Housing ⁵ (Land Use 215)	382 units	0.15	0.33	0.32	0.25	57	127	124	94
Multifamily Housing (Mid-Rise) (Land Use 221)	454 units	0.09	0.28	0.24	0.15	39	129	108	69
Trip Generation Estimate						103	276	255	176
0% Reduction for Non-Vehicle Trips ⁶						0	0	0	0
Total Trips generated by the Proposed Development						103	276	255	176
Notes: 1. Land Use Codes are from <i>Trip Generation Manual, 11th Edition</i> , (Institute of Transportation Engineers, Washington, 2021).									
2. The units of measurement are dwelling units.									
3. Trip generation rates are 'trips per hour per unit of measurement'.									
4. Trips generated are 'trips per hour' for AM and PM peak hours.									
5. Four-plexes and townhouses are considered a form of low-rise attached housing (Land Use Code 215)									
6. In 2016, approximately 36% of trips were made by transit or using active transportation in the associated census tract Journey to Work information. The Halifax Integrated Mobility Plan has a 60% target for non-auto trips within the Regional Centre by 2031 (Page 16, IMP Implementation Update, 2021). For the sensitivity analysis, a reduction of 0% was used to account for non-auto trips (transit, bicycle and walking trips) generated to the site.									

Trip Distribution and Assignment

Background traffic and proposed development generated trips were distributed to the Study Intersections based on counted volumes and local knowledge of the area, considering major trip origins/destinations in the region. The estimated directional distributions are below.

Direction	Distribution	Description
North	45%	(Hwy 111 destinations including Halifax via MacKay Bridge, Airport, Dartmouth Crossing, Bedford and surrounding areas)
South	15%	(Shearwater, Eastern Passage and surrounding areas)
West	25%	(Dartmouth, Halifax, Woodside and surrounding areas)
East	15%	(Woodlawn, Cole Harbour, Porters Lake and surrounding areas)

Projected 2021 & 2034 DHVs without the proposed development

The 2021 DHVs for AM and PM peak hourly volumes without the proposed site are illustrated diagrammatically in Figure A-1, Appendix A. The 2034 DHVs without the proposed site are illustrated diagrammatically in Figure A-2, Appendix A.

Projected 2034 Traffic Volumes with the proposed development

Trips generated by the proposed site with 20% non-vehicle trips (Figure A-3, Appendix A) have been added to the 2034 DHVs (Figure A-2, Appendix A) to provide projected 2034 DHVs AM and PM peak hourly volumes with the proposed site generated trips. The 2034 DHVs with the proposed site with 20% non-vehicle trips are illustrated diagrammatically in Figure A-4, Appendix A.

Trips generated by the proposed site with 0% non-vehicle trips (Figure A-5, Appendix A) have been added to the 2034 DHVs (Figure A-2, Appendix A) to provide projected 2034 AM and PM peak hourly volumes with the proposed site generated trips. The 2034 DHVs with the proposed site with 0% non-vehicle trips are illustrated diagrammatically in Figure A-6, Appendix A.

5 INTERSECTION OPERATIONAL ANALYSIS

Intersection Level of Service (LOS) Analysis was completed to estimate how intersections may be expected to operate into the future without and with site generated trips. This section of the report addresses how left-turn lane warrants and traffic signal warrants were conducted and how each intersection was evaluated. The following subsections identify each study intersection and summarize the results of the operational analysis.

Left-Turn Lane Warrant Analysis

Left-turn movements on a two-lane street may cause both operational and safety problems. Operational problems result as a vehicle stopped waiting for an opportunity to turn across ‘heavy’ opposing traffic causes a queue of stopped vehicles to form. Safety problems result from rear end collisions when a stopped left-turning vehicle is struck by an advancing vehicle, or from head-on or right-angle collisions when a left-turning vehicle is struck by an opposing vehicle.

The *Geometric Design Standards for Ontario Highways Manual* contains nomographs for left-turn lane analysis for two lane streets at unsignalized intersections. The analysis method, which is normally used by WSP Atlantic to evaluate the need for left-turn lanes, uses a series of nomographs that consider speed, advancing volumes, left-turns as a percentage of advancing volumes, and opposing volumes. A point, based on ‘opposing’ and ‘advancing’ volumes, plotted to the right of the ‘warrant line’ of the appropriate ‘% left-turns’ and ‘approach speed’ nomograph, indicates that a left-turn lane is warranted for the conditions used in the analysis. Similarly, a point that is plotted to the left of the warrant line indicates that a left-turn lane is not warranted.

The results of the left-turn lane warrants are detailed within the intersection performance summary for each appropriate intersection. Further details for the left-turn lane warrant analyses are included in Appendix B.

Traffic Signal Warrant Analysis

A signal warrant analysis is completed to determine if the installation of traffic signals at an intersection will provide a positive impact on total intersection operation. That is, the benefits in time saved and improved safety that will accrue to vehicles entering from a side street will exceed the impact that signals will have in time lost and potential additional collisions for vehicles approaching the intersection on the main street.

The *Canadian Traffic Signal Warrant Matrix Analysis (Transportation Association of Canada (TAC), 2005)* considers 100 warrant points as an indication that traffic signals will provide a positive impact. Signal warrant analysis uses vehicular and pedestrian volumes, and intersection, roadway and study area characteristics to calculate a warrant point value.

The results of the traffic signal warrant is detailed within the intersection performance summary for each appropriate intersection. Further details for the traffic signal warrant analyses are included in Appendix B.

Intersection Capacity Analysis Results

Synchro 11.0 software has been used for performance evaluation of the Study Intersections. Summaries of the results are provided in the following sub-sections and detailed results of the analyses are included in Appendix C.

Intersection Level of Service Analysis

The level or quality of performance of an intersection in terms of traffic movement is determined by a level of service (LOS) analysis. LOS for intersections is defined in terms of delay, which is a measure of driver discomfort and frustration, fuel consumption, and increased travel time.

LOS criteria, as shown in Table 3, are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Table 3 – Level of Service Criteria

LOS	Signalized Intersections Control Delay (Seconds per Vehicle)	LOS Description	Roundabouts and Two Way Stop Controlled (TWSC) Intersections Control Delay (Seconds per Vehicle)
A	Less than 10.0	Very low delay; most vehicles do not stop (Excellent)	Less than 10.0
B	Between 10.0 and 20.0	Higher delay; most vehicles stop (Very Good)	Between 10.0 and 15.0
C	Between 20.0 and 35.0	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping (Good)	Between 15.0 and 25.0
D	Between 35.0 and 55.0	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop (Satisfactory)	Between 25.0 and 35.0
E	Between 55.0 and 80.0	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of acceptable delay	Between 35.0 and 50.0
F	Greater than 80.0	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection (Unacceptable)	Greater than 50.0

5.1 ANALYSIS SCENARIOS

Summary Analysis Scenarios Considered

Scenario 1 – 2021 DHVs: Represents projected 2021 design hourly volumes (Figure A-1, Appendix A) on the existing road network, including the existing traffic control and lane configurations of the Study Intersections.

Scenario 2 – 2034 DHVs without site development: Represents future 2034 design hourly volumes (Figure A-2, Appendix A) on the existing road network, including the existing traffic control and lane configurations of the Study Intersections. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods.

Scenario 3A – 2034 DHVs with site development (20% non-vehicle trips): Represents 2034 future design hourly volumes (Figure A-4, Appendix A) with 20% non-vehicle trips and the site access modelled as STOP controlled and as traffic signals. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods.

Scenario 3B – 2034 DHVs with site development (0% non-vehicle trips): Represents 2034 future design hourly volumes (Figure A-6, Appendix A) with 0% non-vehicle trips and the site access modelled as STOP controlled and as traffic signals. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods.

5.2 INT #1: MOUNT HOPE AVENUE AT HWY 111 NB RAMPS

Intersection #1 – Mount Hope Avenue at Highway 111 Northbound Ramps:

Operational performance results for this intersection are provided in Table 4 for both the AM and PM peak hours.

During all scenarios, all movements are expected to operate at a LOS 'D' or better and with a v/c ratio of 0.77 or better with the proposed development traffic for both 20% and 0% non-vehicle trips.

Table 4 - Intersection Capacity Analysis: Mount Hope Avenue at Hwy 111 NB Ramps

LOS Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement						Overall Intersection	
	Mount Hope Avenue				Hwy 107 NB Ramps			
	EB-L	EB-T	WB-T	WB-R	NB-LT	NB-R	Delay	LOS
Scenario 1 - 2021 DHVs AM Peak Hour (Page C-1)								
Delay	23.9	6.4	17.4	4.6	21.6	7.7	11.9	B
LOS	C	A	B	A	C	A		
v/c	0.32	0.16	0.41	0.42	0.02	0.36		
Queue	24.0	21.6	37.8	15.2	3.3	13.7		
Scenario 2 - 2034 DHVs AM Peak Hour (Page C-5)								
Delay	25.1	8.2	20.3	5.5	19.6	6.6	13.4	B
LOS	C	A	C	A	B	A		
v/c	0.35	0.19	0.51	0.49	0.01	0.37		
Queue	26.8	24.1	46.2	17.5	3.0	13.7		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) AM Peak Hour (Page C-9)								
Delay	47.5	9.3	24.0	5.0	23.6	6.1	19.2	B
LOS	D	A	C	A	C	A		
v/c	0.59	0.21	0.46	0.46	0.04	0.31		
Queue	46.9	25.5	52.2	17.4	8.0	15.1		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) AM Peak Hour (Page C-15)								
Delay	50.1	9.7	25.0	5.0	24.3	6.1	20.5	C
LOS	D	A	C	A	C	A		
v/c	0.63	0.22	0.47	0.46	0.05	0.30		
Queue	51.2	25.4	53.4	17.4	9.7	15.5		
Scenario 1 - 2021 DHVs PM Peak Hour (Page C-3)								
Delay	36.0	8.1	26.3	6.6	25.6	10.2	18.0	B
LOS	D	A	C	A	C	B		
v/c	0.65	0.35	0.52	0.57	0.01	0.55		
Queue	78.1	38.5	53.8	22.1	3.7	27.7		
Scenario 2 - 2034 DHVs PM Peak Hour (Page C-7)								
Delay	42.4	7.8	29.3	6.8	28.6	18.5	21.0	C
LOS	D	A	C	A	C	B		
v/c	0.70	0.38	0.56	0.60	0.01	0.65		
Queue	96.3	47.0	67.1	24.8	3.9	52.0		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) PM Peak Hour (Page C-12)								
Delay	43.8	7.4	30.0	6.9	27.2	21.1	22.2	C
LOS	D	A	C	A	C	C		
v/c	0.76	0.39	0.61	0.60	0.10	0.68		
Queue	95.8	42.6	66.7	24.4	13.6	52.0		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) PM Peak Hour (Page C-18)								
Delay	44.3	7.3	30.6	7.0	27.5	21.2	22.6	C
LOS	D	A	C	A	C	C		
v/c	0.77	0.39	0.62	0.61	0.13	0.68		
Queue	97.9	42.5	68.6	24.8	15.9	52.0		

5.3 INT #2: MOUNT HOPE AVENUE AT HWY 111 SB RAMPS

Intersection #2 – Mount Hope Avenue at Highway 111 Southbound Ramps:

Operational performance results for this intersection are provided in Table 5 for both the AM and PM peak hours.

During all scenarios, all movements are expected to operate at a LOS 'D' or better and with a v/c ratio of 0.90 or better with the proposed development traffic for both 20% and 0% non-vehicle trips.

Table 5 - Intersection Capacity Analysis: Mount Hope Avenue at Hwy 111 SB Ramps

LOS Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement						Overall Intersection	
	Mount Hope Avenue				Hwy 107 SB Ramps			
	EB-T	EB-R	WB-L	WB-T	SB-LT	SB-R	Delay	LOS
Scenario 1 - 2021 DHVs AM Peak Hour (Page C-2)								
Delay	15.0	0.0	33.5	22.5	25.3	10.8	17.8	B
LOS	B	A	C	C	C	B		
v/c	0.15	0.01	0.25	0.57	0.34	0.77		
Queue	15.8	0.0	19.7	15.3	28.4	31.5		
Scenario 2 - 2034 DHVs AM Peak Hour (Page C-6)								
Delay	16.7	0.0	33.5	25.0	23.3	10.1	17.6	B
LOS	B	A	C	C	C	B		
v/c	0.18	0.01	0.28	0.50	0.34	0.79		
Queue	19.0	0.0	22.1	15.9	29.7	31.4		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) AM Peak Hour (Page C-10)								
Delay	18.7	0.2	52.7	22.5	25.6	23.9	24.2	C
LOS	B	A	D	C	C	C		
v/c	0.23	0.06	0.38	0.66	0.26	0.89		
Queue	28.3	0.0	25.8	24.1	35.4	121.5		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) AM Peak Hour (Page C-16)								
Delay	20.1	0.3	53.9	23.1	26.0	25.3	25.1	C
LOS	C	A	D	C	C	C		
v/c	0.28	0.09	0.39	0.68	0.25	0.90		
Queue	30.5	0.0	26.2	25.2	36.3	131.0		
Scenario 1 - 2021 DHVs PM Peak Hour (Page C-4)								
Delay	22.0	0.1	37.5	25.0	33.7	7.3	25.2	C
LOS	C	A	D	C	C	A		
v/c	0.56	0.02	0.47	0.43	0.56	0.39		
Queue	61.2	0.0	42.1	13.9	56.8	16.5		
Scenario 2 - 2034 DHVs PM Peak Hour (Page C-8)								
Delay	23.1	0.1	43.3	21.1	38.1	8.0	27.1	C
LOS	C	A	D	C	D	A		
v/c	0.59	0.02	0.54	0.46	0.62	0.42		
Queue	73.4	0.0	51.4	13.4	70.6	19.5		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) PM Peak Hour (Page C-13)								
Delay	23.3	0.2	40.7	31.2	37.0	7.3	26.4	C
LOS	C	A	D	C	D	A		
v/c	0.63	0.06	0.57	0.61	0.62	0.53		
Queue	77.8	0.0	47.0	36.6	62.5	20.0		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) PM Peak Hour (Page C-19)								
Delay	23.4	0.2	40.2	34.2	37.3	7.4	26.6	C
LOS	C	A	D	C	D	A		
v/c	0.64	0.06	0.57	0.65	0.62	0.56		
Queue	79.6	0.0	47.0	44.7	62.5	20.7		

5.4 INT #3: MOUNT HOPE AVENUE AT SITE ACCESS

Intersection #3 – Mount Hope Avenue at Site Access:

A left-turn lane and traffic signal warrant were completed for traffic Scenarios 3A and 3B that include site generated trips. It was determined that:

- A left-turn lane is warranted, as shown in Appendix B.
- For 20% non-vehicle, traffic signals are not warranted (**72 Warrant Points**, Table B-1, Appendix B).
- For 0% non-vehicle, traffic signals are nearing being warranted (**88 Warrant Points**, Table B-2, Appendix B).

The analysis for the intersection of Mount Hope Avenue at the Site Access was modelled in Synchro with an eastbound left-turn lane, westbound right channelized turn lane and two lanes exiting the site, as shown in Figure 3.

Operational performance results for this intersection are provided in Table 6 for both the AM and PM peak hours.

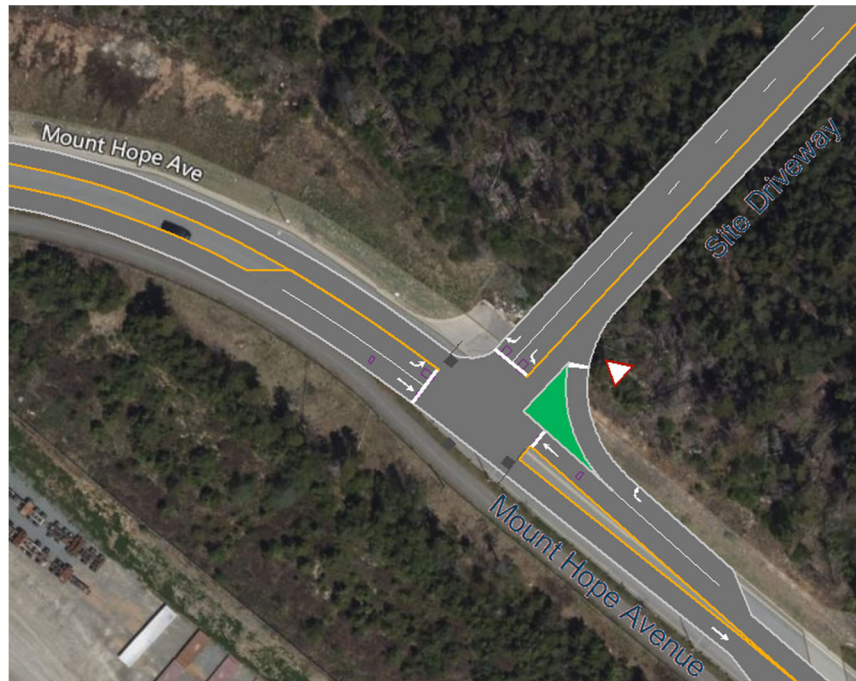


Figure 3 – Proposed Intersection Layout for Site Access with Signals

With a STOP controlled intersection for both 20% and 0% non-vehicle trips, the southbound left-turn experiences high delays and long queues and is shown to be operating over capacity during both the AM and PM peak periods.

Since the STOP controlled intersection is operating at capacity on the site access approach and the traffic signals are near being warranted, additional analysis was completed as a traffic signalized intersection. Overall, the intersection is performing well during the AM and PM peak periods, however there are longer queues on Mount Hope Avenue. During the AM peak period, there are long queues projected in the westbound direction and it is expected to be contained within the available space between Road 1 and the southbound ramp intersection and operates with minimal delays with less than 20 seconds per vehicle. As shown in Figure 3, a westbound right-turn channel is proposed to minimize the queues on Mount Hope Avenue and enhance the operations of the intersection. It is expected that the majority of pedestrians will cross Mount Hope Avenue on the north side to/from the multi-use pathway to the sidewalk.

While in the PM peak period, the queue in the eastbound direction is projected to be in the 185-200m range, there are minimal delays of less than 20 seconds per vehicle.

Table 6 - Intersection Capacity Analysis: Mount Hope Avenue at Site Access

LOS Criteria	Control Delay (sec/veh), Level of Service (LOS), v/c Ratio, and 95 th %ile Queue (m) by Intersection Movement						Overall Intersection	
	Mount Hope Avenue				Road 1			
	EB-L	EB-T	WB-T	WB-R	SB-L	SB-R	Delay	LOS
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) AM Peak Hour (Page C-11) - STOP								
Delay	11.1	0.0	0.0	0.0	252.6	22.6	28.7	D
LOS	B	A	A	A	F	C		
v/c	0.04	0.18	0.59	0.04	1.33	0.23		
Queue	0.9	0.0	0.0	0.0	91.8	6.8		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) AM Peak Hour (Page C-17) - STOP								
Delay	11.1	0.0	0.0	0.0	391.5	22.8	52.3	F
LOS	B	A	A	A	F	C		
v/c	0.04	0.18	0.59	0.05	1.67	0.27		
Queue	1.1	0.0	0.0	0.0	131.7	8.6		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) AM Peak Hour (Page C-21) - Signals								
Delay	7.1	5.9	17.9	2.4	40.1	11.5	17.1	B
LOS	A	A	B	A	D	B		
v/c	0.13	0.25	0.84	0.06	0.57	0.19		
Queue	4.6	31.2	192.5	5.1	60.8	11.7		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) AM Peak Hour (Page C-23) - Signals								
Delay	8.8	6.4	19.7	2.5	43.3	10.5	19.1	B
LOS	A	A	B	A	D	B		
v/c	0.18	0.25	0.86	0.08	0.66	0.20		
Queue	5.7	31.2	192.5	6.0	79.2	12.7		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) PM Peak Hour (Page C-14) - STOP								
Delay	8.4	0.0	0.0	0.0	170.9	11.2	11.3	B
LOS	A	A	A	A	F	B		
v/c	0.05	0.60	0.25	0.10	1.04	0.06		
Queue	1.2	0.0	0.0	0.0	54.9	1.6		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) PM Peak Hour (Page C-20) - STOP								
Delay	8.4	0.0	0.0	0.0	269.7	11.1	20.8	C
LOS	A	A	A	A	F	B		
v/c	0.06	0.60	0.25	0.12	1.32	0.08		
Queue	1.6	0.0	0.0	0.0	78.6	1.9		
Scenario 3A - 2034 DHVs with Site (20% non-auto trips) PM Peak Hour (Page C-22) - Signals								
Delay	5.0	13.3	5.9	1.2	33.1	11.7	11.4	B
LOS	A	B	A	A	C	B		
v/c	0.08	0.75	0.31	0.14	0.36	0.13		
Queue	7.6	197.9	46.9	6.1	36.9	8.7		
Scenario 3B - 2034 DHVs with Site (0% non-auto trips) PM Peak Hour (Page C-24) - Signals								
Delay	5.3	17.4	6.5	1.2	35.1	11.3	14.0	B
LOS	A	B	A	A	D	B		
v/c	0.12	0.84	0.35	0.19	0.47	0.15		
Queue	8.7	184.6	43.9	6.3	44.8	9.7		

6 SUMMARY, CONCLUSION & RECOMMENDATIONS

6.1 SUMMARY

Background	1. Mount Hope Development plans are being prepared by Clayton Development Ltd. for a residential development that is located on the undeveloped parcels of land (PID 40003600, 41362161 & 41280546) within the Southdale neighbourhood in Dartmouth, Nova Scotia.
Description of the Proposed Development	2. The proposed development is expected to include 39 single detached homes, 18 four-plexes (72 units), 310 townhouse units and 8 mid-rise residential buildings (454 units). It is anticipated that the development will be completed with full site buildout by 2029. The study considered the development with a study horizon year of 2034, five years beyond anticipated site buildout.
Proposed Site Access	3. The development proposes to have access to Mount Hope Avenue and Lynn Drive. For the purpose of this study and to be conservative for NSPW infrastructure, all traffic is assigned to the Mount Hope Avenue access.
Study Area Roads	4. Mount Hope Avenue at the site location, is a 2-lane collector, with a multi-use pathway on the south side. The street transitions to a multi-lane arterial just east of the access point on the approach to the Circumferential Highway. It has a posted speed limit of 50km/hr. Within the Regional Plan, there is an envisioned road network project to extend the eastern-most end of Mount Hope Avenue to connect with Caldwell Road and/or Portland Estates.
Turning Movement Counts	5. Turning movement volumes were collected on Thursday, October 7 th , 2021 at Study Intersections 1 and 2.
Background Traffic Volumes	6. Projected 2021 design hourly volumes include: 1.00 Seasonal Adjustment Factor for 2021 turning movement counts; and, 5% increase for Covid-19 Adjustment Factor. 7. Projected 2034 design hourly volumes include: 1.00% annual growth between 2021-2034.
Estimation of Proposed Development Trips	8. Trip generation estimates for the proposed development were prepared using rates published in <i>Trip Generation, 11th Edition</i> (Institute of Transportation Engineers, Washington, 2021). For the 20% non-vehicle trips being generated during the AM peak hour, it is estimated that the development will generate: 303 two-way primary vehicle trips (82 entering and 221 exiting). During the PM peak hour, it is estimated that the expansion will generate: 345 two-way primary vehicle trips (204 entering and 141 exiting). For the 0% non-vehicle trips being generated during the AM peak hour, it is estimated that the development will generate: 379 two-way primary vehicle trips (103 entering and 276 exiting). During the PM peak hour, it is estimated that the expansion will generate: 431 two-way primary vehicle trips (255 entering and 176 exiting).

Trip Distribution and Assignment	9. Proposed development generated trips were distributed to the Study Intersections based on counted volumes and local knowledge of the area considering major trip origins and destinations in the region. Trips were distributed to the north on Highway 111 (45%), south on Highway 111 (15%), west (25%), and east (15%) along Mount Hope Avenue.
Warrant Analysis Summary	10. Warrant reviews were completed for left-turn lanes and traffic signals with the 20% non-vehicle trips and 0% non-vehicle trips at the Mount Hope Avenue at Site Access intersection (Study Intersection 3). 11. It was determined that traffic signals are nearing being warranted at the site access and would benefit pedestrians crossing to the multi-use trail on Mount Hope Avenue. 12. It was determined that an eastbound left-turn lane is warranted at the site access.
Analysis Scenarios Considered	13. Scenario 1 – 2021 DHVs: Represents projected 2021 design hourly volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections. 14. Scenario 2 – 2034 DHVs without site development: Represents future 2034 design hourly volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods. 15. Scenario 3A – 2034 DHVs with site development (20% non-vehicle trips): Represents 2034 future design hourly volumes with 20% non- vehicle trips and the site access modelled as STOP controlled and as traffic signals. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods. Scenario 3B – 2034 DHVs with site development (0% non-vehicle trips): Represents 2034 future design hourly volumes with 0% non- vehicle trips and the site access modelled as STOP controlled and as traffic signals. The traffic signal timing plans for the Highway 111 interchange intersections were modified to accommodate the projected trips for both peak periods.
Summary – Intersection Capacity Analysis	16. Intersection performance analysis was completed using <i>Synchro 11</i> at the Study Intersections. 17. Study Intersections 1 and 2 operate with a LOS ‘D’ or better and with a v/c ratio of 0.90 or better during all scenarios and during both the AM and PM peak periods. 18. Study Intersection 3 operates with long delays and queues on the site access road as a STOP controlled intersection. As a signalized intersection, the intersection operates with LOS ‘D’ or better and with a v/c ratio of 0.90 or better during all scenarios and during both the AM and PM peak periods. 19. While there are queues expected on Mount Hope Avenue during the AM and PM peak period, the overall intersection is performing well with minimal delays.

6.2 CONCLUSIONS

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- Conclusion** 20. Trip generated by the proposed development are expected to have a minimal or negligible impact on the operational performance of Study Intersections 1 and 2.
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6.3 RECOMMENDATIONS

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- Recommendations**
21. Construct the site access at the intersection of Mount Hope Avenue with an eastbound left-turn lane, westbound channelized right-turn lane and two lanes in the southbound approach.
 22. With the traffic scenarios analyzed in this study, consider the installation of traffic signals at the intersection of Mount Hope Avenue at site access. While facilitating site traffic, the traffic signals will also benefit active transportation users accessing the multi-use pathway on the south side of Mount Hope Avenue.
 23. Halifax Transit should consider additional transit stops to the west of the proposed access on Mount Hope Avenue to serve the proposed development.
-

APPENDIX

A

TRAFFIC VOLUME DATA

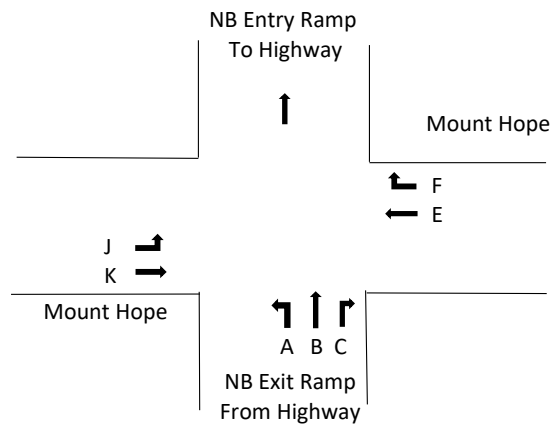


Table A-1 Mount Hope Avenue @ Highway 111, Exit 8, SB Ramps Dartmouth, NS Thursday, October 7, 2021				SB Exit Ramp From Highway I H G ↓ ↓ ↓ Mount Hope E ← ↓ D K → L → Mount Hope ↓ SB Entry Ramp To Highway					
				AM Peak Period Volume Data					
Time		Mount Hope Avenue Westbound Approach		Highway 111, Exit 8, SB Ramps Southbound Approach			Mount Hope Avenue Eastbound Approach		Total Vehicles
		D	E	G	H	I	K	L	
07:00	07:15	16	44	24	0	71	33	1	189
07:15	07:30	23	56	33	0	106	44	1	263
07:30	07:45	38	74	33	0	110	39	1	295
07:45	08:00	23	67	50	0	127	46	1	314
08:00	08:15	27	55	50	0	154	43	1	330
08:15	08:30	18	70	54	0	126	93	0	361
08:30	08:45	20	34	37	0	91	61	1	244
08:45	09:00	23	69	54	0	90	45	2	283
AM Peak Hour		106	266	187	0	517	221	3	1300
07:00	08:00	100	241	140	0	414	162	4	1061
08:00	09:00	88	228	195	0	461	242	4	1218
Heavy Vehicles									
07:00	08:00	0	3	5	0	8	31	3	50
08:00	09:00	2	7	6	0	21	14	2	52
Midday Peak Period Volume Data									
Time		Mount Hope Avenue Westbound Approach		Highway 111, Exit 8, SB Ramps Southbound Approach			Mount Hope Avenue Eastbound Approach		Total Vehicles
		D	E	G	H	I	K	L	
11:30	11:45	38	39	71	1	47	105	1	302
11:45	12:00	46	40	58	0	45	110	0	299
12:00	12:15	52	45	56	0	36	112	6	307
12:15	12:30	46	61	52	0	44	92	2	297
12:30	12:45	54	57	66	0	56	103	3	339
12:45	13:00	44	60	57	1	57	63	1	283
13:00	13:15	40	33	58	0	64	76	2	273
13:15	13:30	55	58	73	0	42	82	1	311
Noon Peak Hour		198	203	232	0	181	417	11	1242
11:30	12:30	182	185	237	1	172	419	9	1205
12:30	13:30	193	208	254	1	219	324	7	1206
PM Peak Period Volume Data									
Time		Mount Hope Avenue Westbound Approach		Highway 111, Exit 8, SB Ramps Southbound Approach			Mount Hope Avenue Eastbound Approach		Total Vehicles
		D	E	G	H	I	K	L	
15:30	15:45	65	40	67	0	63	167	3	405
15:45	16:00	53	30	76	0	69	152	8	388
16:00	16:15	60	47	72	0	46	215	4	444
16:15	16:30	64	37	72	0	46	187	1	407
16:30	16:45	59	44	82	0	28	206	3	422
16:45	17:00	52	27	121	0	39	135	1	375
17:00	17:15	55	39	149	0	30	126	2	401
17:15	17:30	53	23	134	2	34	81	1	328
PM Peak Hour		236	158	302	0	189	760	16	1661
15:30	16:30	242	154	287	0	224	721	16	1644
16:30	17:30	219	133	486	2	131	548	7	1526
Heavy Vehicles									
15:30	16:30	4	9	4	0	35	15	2	69
16:30	17:30	0	6	3	0	12	5	2	28

* PM peak hour adjusted to be 4:00-5:00-pm to match peak period of adjacent intersection for balancing

Table A-2
Mount Hope Avenue
@
Highway 111, Exit 8, NB Ramps

Dartmouth, NS
Thursday, October 7, 2021



AM Peak Period Volume Data

Time	Highway 111, NB Exit Ramp Northbound Approach			Mount Hope Avenue Westbound Approach		Mount Hope Avenue Eastbound Approach		Total Vehicles
	A	B	C	E	F	J	K	
07:00 07:15	1	0	15	59	36	24	34	169
07:15 07:30	3	1	14	77	25	23	53	196
07:30 07:45	2	0	31	107	46	17	54	257
07:45 08:00	2	0	48	92	66	37	67	312
08:00 08:15	0	0	29	86	65	29	65	274
08:15 08:30	1	0	24	92	67	57	95	336
08:30 08:45	0	0	35	57	66	28	60	246
08:45 09:00	1	0	43	94	54	25	80	297
AM Peak Hour	5	0	132	377	244	140	281	1179
07:00 08:00	8	1	108	335	173	101	208	934
08:00 09:00	2	0	131	329	252	139	300	1153
Heavy Vehicles								
07:00 08:00	0	0	3	4	5	28	14	54
08:00 09:00	0	0	4	13	9	9	13	48

PM Peak Period Volume Data

Time	Highway 111, NB Exit Ramp Northbound Approach			Mount Hope Avenue Westbound Approach		Mount Hope Avenue Eastbound Approach		Total Vehicles
	A	B	C	E	F	J	K	
15:30 15:45	3	0	51	97	75	102	126	454
15:45 16:00	1	0	71	99	60	89	142	462
16:00 16:15	3	0	48	111	82	156	162	562
16:15 16:30	0	0	79	102	76	115	158	530
16:30 16:45	3	0	59	99	100	135	167	563
16:45 17:00	1	0	71	89	89	82	172	504
17:00 17:15	0	0	62	93	105	88	219	567
17:15 17:30	2	0	52	83	63	41	184	425
PM Peak Hour	4	0	271	383	370	420	716	2164
15:30 16:30	7	0	249	409	293	462	588	2008
16:30 17:30	6	0	244	364	357	346	742	2059
Heavy Vehicles								
15:30 16:30	5	0	5	9	9	13	9	50
16:30 17:30	0	0	1	6	5	3	9	24

* PM peak hour adjusted to be 4:00-5:00-pm to match peak period of adjacent intersection for balancing

2020 COUNT PROGRAM

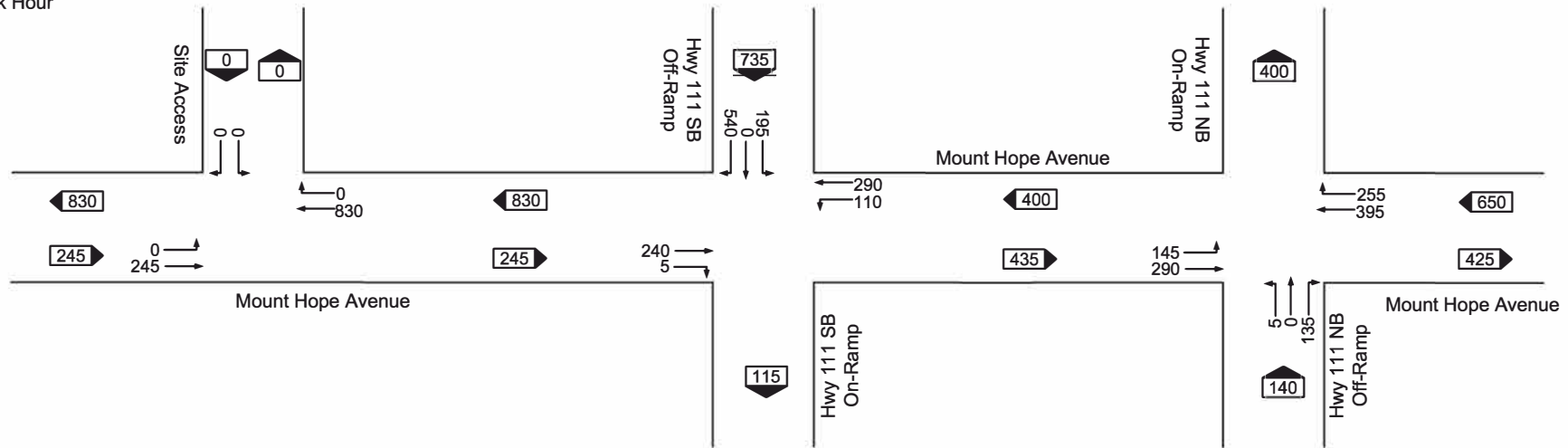
Average Group Factors (2010 to 2019)

G:/im/Asset.sys/censustm/counts/factors/fac10-19.xlw

Week Number	2020 Starting Date	AA Week Factor	A Week Factor	B Week Factor	C Week Factor	D Week Factor	E Week Factor	F Week Factor	G Week Factor	H Week Factor
1	30-Dec	1.27	1.60	1.79	1.62	1.83	2.44	2.57	3.19	3.74
2	06-Jan	1.03	1.16	1.34	1.37	1.47	1.60	1.79	2.22	2.82
3	13-Jan	1.04	1.17	1.36	1.40	1.45	1.59	1.75	2.42	2.91
4	20-Jan	1.02	1.13	1.31	1.34	1.44	1.52	1.77	2.36	2.85
5	27-Jan	1.02	1.20	1.34	1.36	1.52	1.59	1.86	2.39	2.91
6	03-Feb	1.06	1.19	1.31	1.36	1.45	1.60	1.86	2.56	2.97
7	10-Feb	0.99	1.16	1.27	1.33	1.41	1.53	1.74	2.26	2.78
8	17-Feb	1.00	1.19	1.33	1.32	1.52	1.52	1.73	2.32	3.10
9	24-Feb	1.01	1.11	1.22	1.25	1.31	1.43	1.62	2.09	2.65
10	02-Mar	1.00	1.16	1.24	1.26	1.41	1.55	1.67	2.25	2.57
11	09-Mar	1.00	1.11	1.14	1.21	1.17	1.42	1.49	1.99	2.53
12	16-Mar	0.98	1.11	1.20	1.24	1.16	1.55	1.61	2.15	2.63
13	23-Mar	1.02	1.12	1.20	1.24	1.28	1.54	1.65	2.11	2.47
14	30-Mar	1.00	1.08	1.15	1.23	1.24	1.53	1.65	2.23	2.34
15	06-Apr	1.01	1.08	1.10	1.31	1.11	1.42	1.50	2.01	2.11
16	13-Apr	0.99	1.03	1.06	1.12	1.06	1.30	1.42	1.87	1.94
17	20-Apr	1.00	1.01	1.04	1.15	1.04	1.25	1.35	1.78	1.72
18	27-Apr	1.00	0.98	1.02	1.08	1.03	1.18	1.24	1.59	1.24
19	04-May	0.98	0.96	1.00	1.05	1.01	1.12	1.20	1.44	0.97
20	11-May	0.99	0.96	0.97	0.99	0.97	0.97	1.10	1.25	0.92
21	18-May	1.00	0.96	0.98	0.96	0.93	0.97	0.98	1.10	0.87
22	25-May	1.01	0.93	0.94	0.94	0.92	0.95	0.97	1.09	0.87
23	01-Jun	0.99	0.93	0.94	0.94	0.92	0.94	0.98	1.07	0.86
24	08-Jun	0.98	0.93	0.93	0.93	0.93	0.93	0.90	0.90	0.78
25	15-Jun	0.98	0.92	0.90	0.89	0.90	0.84	0.82	0.81	0.72
26	22-Jun	0.99	0.92	0.90	0.87	0.87	0.79	0.77	0.72	0.65
27	29-Jun	1.02	0.89	0.88	0.81	0.81	0.70	0.66	0.61	0.53
28	06-Jul	0.99	0.89	0.84	0.77	0.77	0.66	0.64	0.54	0.50
29	13-Jul	1.00	0.87	0.84	0.75	0.74	0.67	0.60	0.51	0.50
30	20-Jul	1.00	0.89	0.83	0.74	0.71	0.62	0.58	0.48	0.47
31	27-Jul	1.01	0.89	0.81	0.71	0.69	0.58	0.55	0.43	0.46
32	03-Aug	1.04	0.88	0.79	0.69	0.71	0.57	0.52	0.41	0.43
33	10-Aug	1.01	0.87	0.78	0.72	0.73	0.61	0.55	0.44	0.45
34	17-Aug	0.99	0.84	0.77	0.74	0.74	0.63	0.56	0.46	0.47
35	24-Aug	1.00	0.88	0.80	0.74	0.74	0.66	0.62	0.51	0.51
36	31-Aug	1.02	0.90	0.85	0.80	0.80	0.73	0.68	0.60	0.61
37	07-Sep	1.00	0.95	0.89	0.87	0.87	0.80	0.75	0.69	0.64
38	14-Sep	0.98	0.94	0.89	0.89	0.93	0.85	0.79	0.67	0.65
39	21-Sep	0.98	0.93	0.89	0.89	0.93	0.87	0.78	0.72	0.71
40	28-Sep	0.99	0.94	0.91	0.91	0.98	0.89	0.80	0.75	0.83
41	05-Oct	1.00	0.93	0.89	0.85	0.92	0.91	0.73	0.64	0.86
42	12-Oct	1.00	0.97	0.93	0.91	0.94	0.96	0.76	0.72	0.99
43	19-Oct	0.97	0.96	0.95	0.97	1.02	1.04	1.00	1.05	1.19
44	26-Oct	0.97	1.00	1.00	1.03	1.05	1.11	1.17	1.36	1.34
45	02-Nov	0.96	1.04	1.03	1.09	1.09	1.17	1.30	1.57	1.40
46	09-Nov	1.00	1.08	1.04	1.10	1.09	1.27	1.36	1.70	1.41
47	16-Nov	0.97	1.04	1.04	1.09	1.11	1.26	1.35	1.72	1.51
48	23-Nov	0.98	1.05	1.07	1.15	1.15	1.31	1.40	1.77	1.61
49	30-Nov	0.97	1.07	1.08	1.18	1.09	1.30	1.42	1.85	1.65
50	07-Dec	0.99	1.04	1.10	1.17	1.14	1.33	1.47	1.88	1.68
51	14-Dec	1.00	1.06	1.16	1.21	1.19	1.36	1.51	1.91	1.92
52	21-Dec	1.25	1.16	1.24	1.21	1.11	1.60	1.71	2.07	2.54
53	28-Dec	1.35	1.79	1.65	1.88	1.35	1.64	1.90	3.32	3.17

A

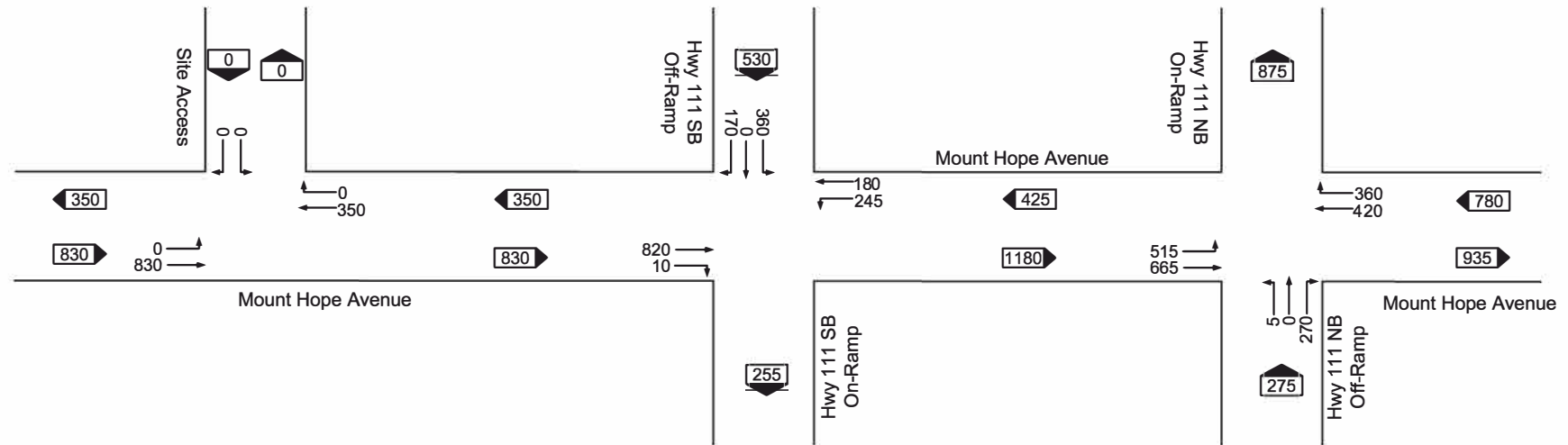
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

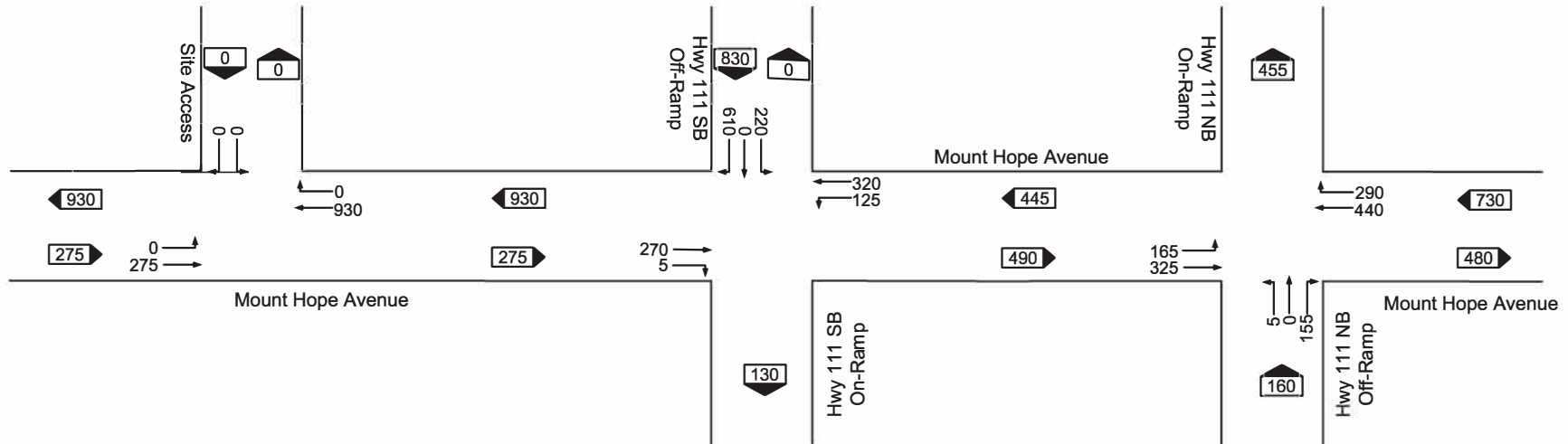
2021 Design Hourly Volumes
Weekday AM and PM Peak Hour

Figure A-1

February 2022

A

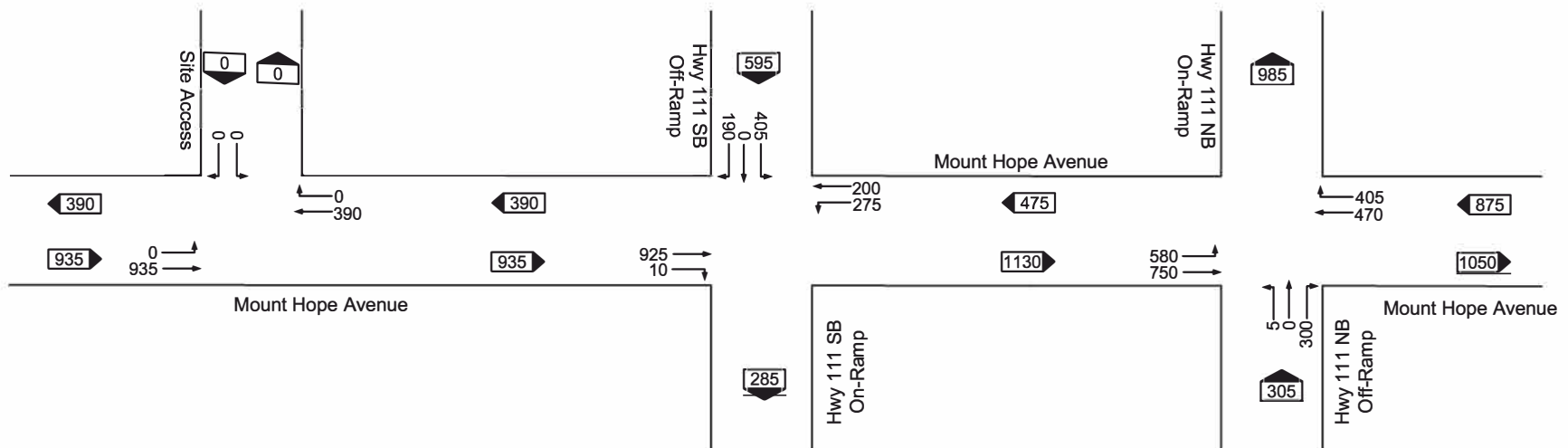
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

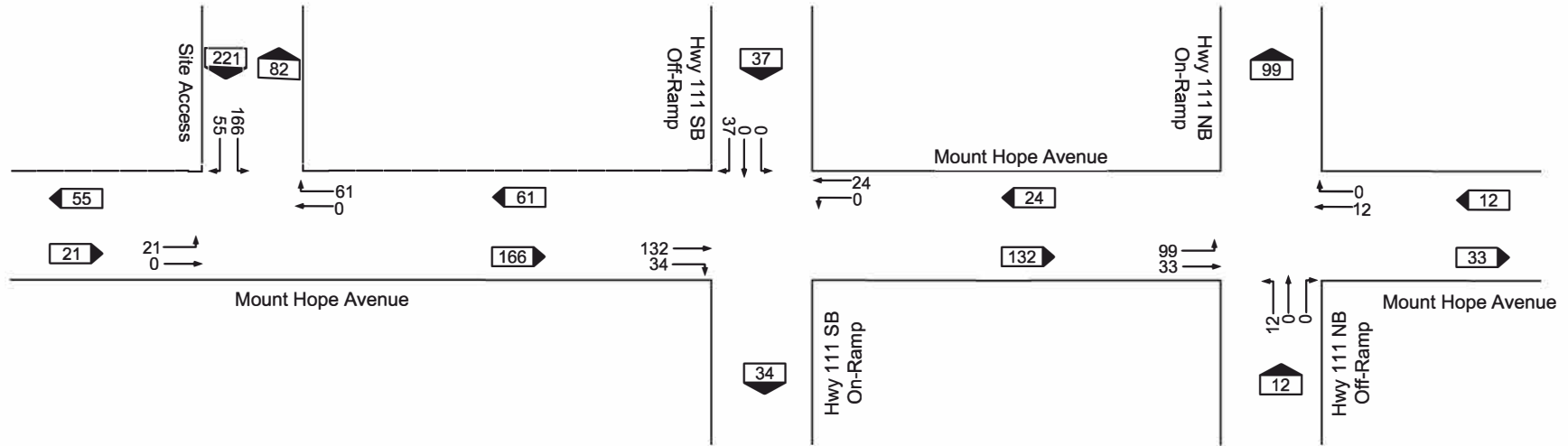
2034 Design Hourly Volumes
Weekday AM and PM Peak Hour

Figure A-2

February 2022

A

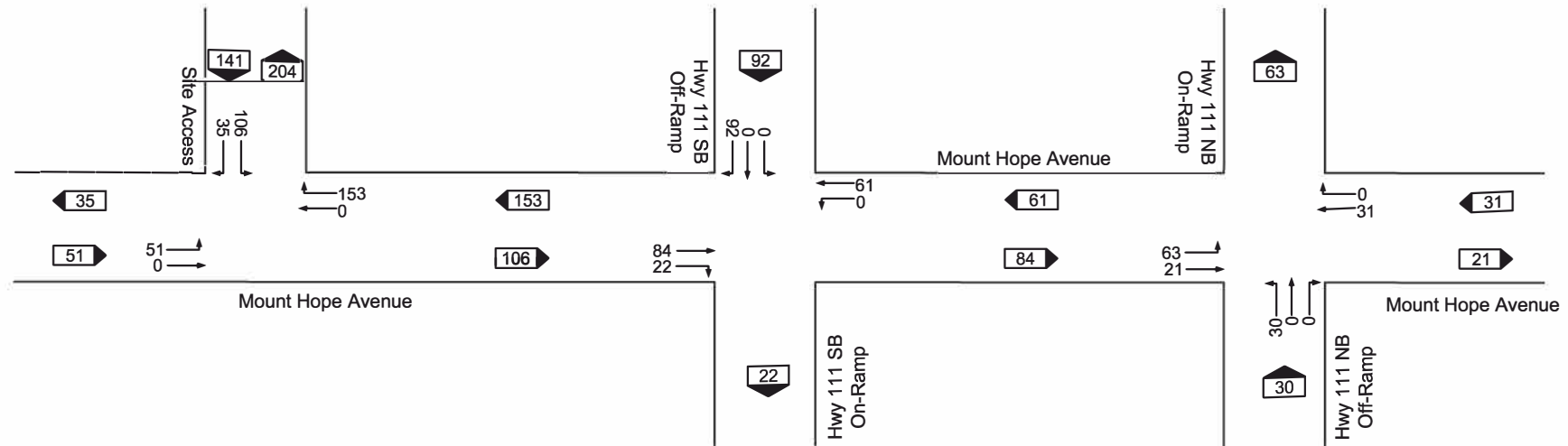
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

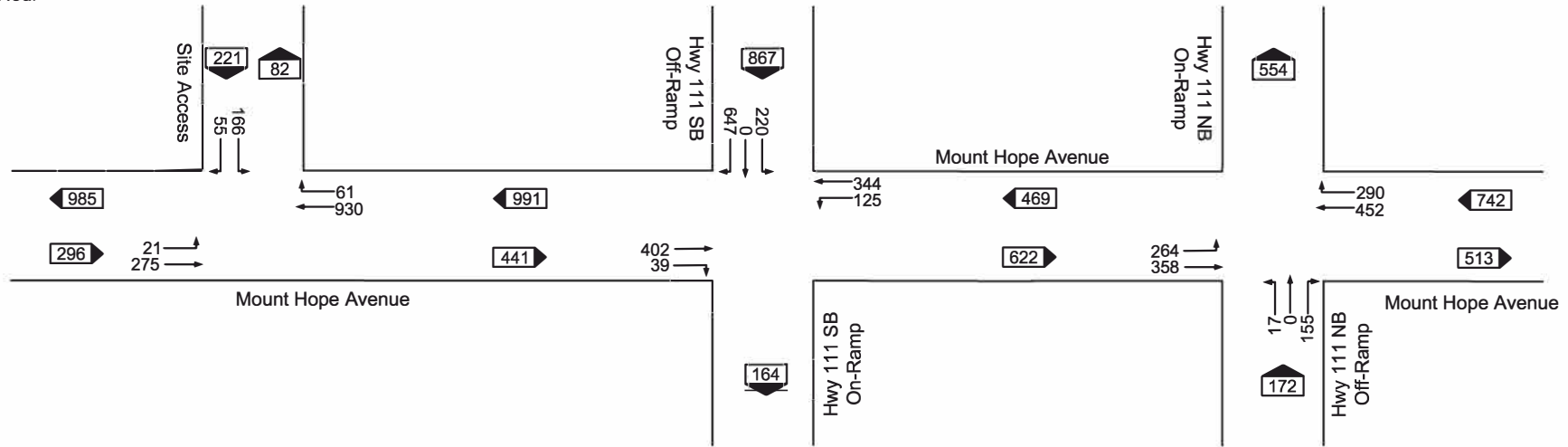
2034 Site Generated Trips (20% Non-Auto Trips)
Weekday AM and PM Peak Hour

Figure A-3

February 2022

A

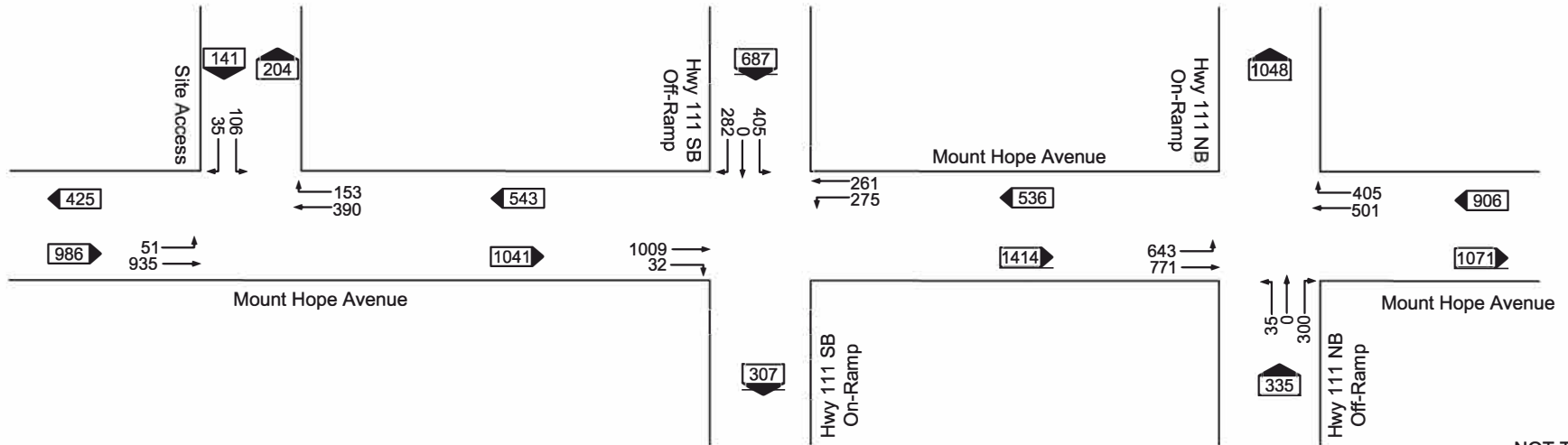
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

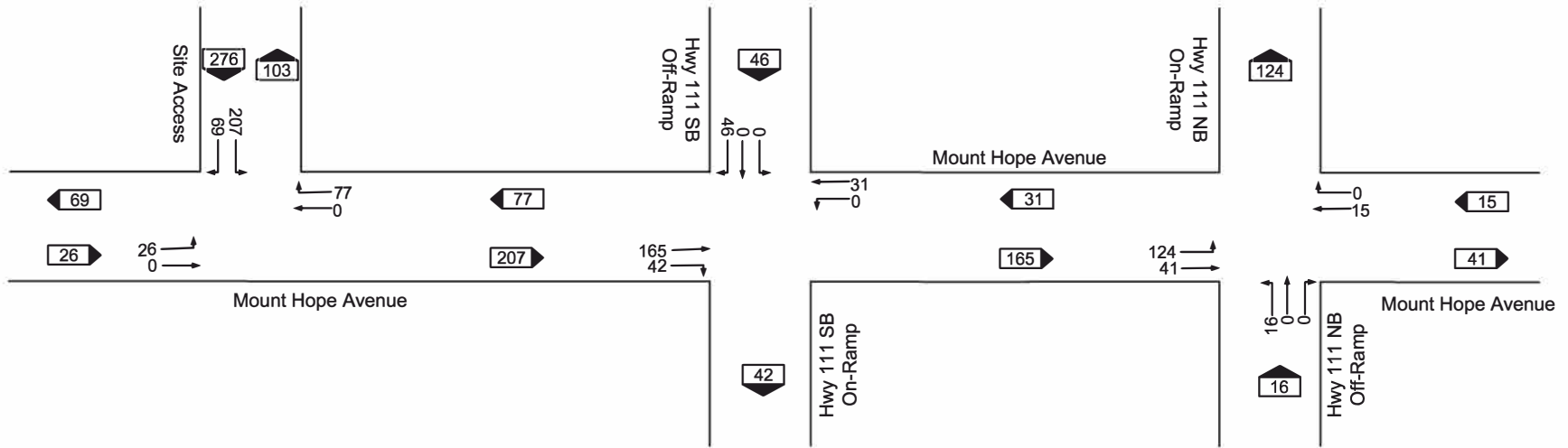
2034 Design Hourly Volumes With Site Development
(20% Non-Auto Trips)
Weekday AM and PM Peak Hour

Figure A-4

February 2022

A

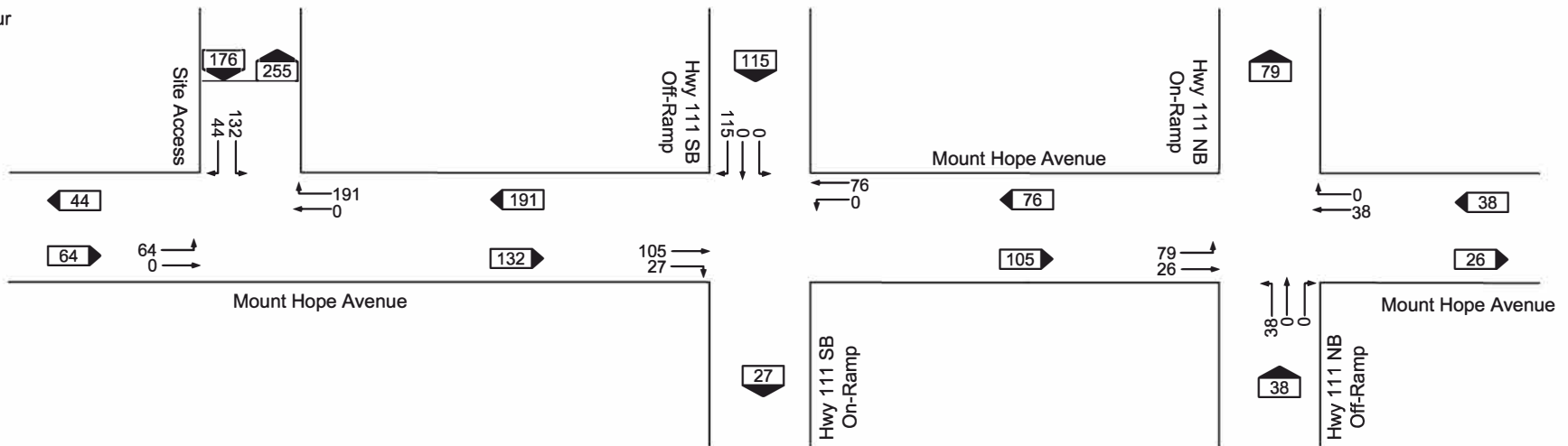
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

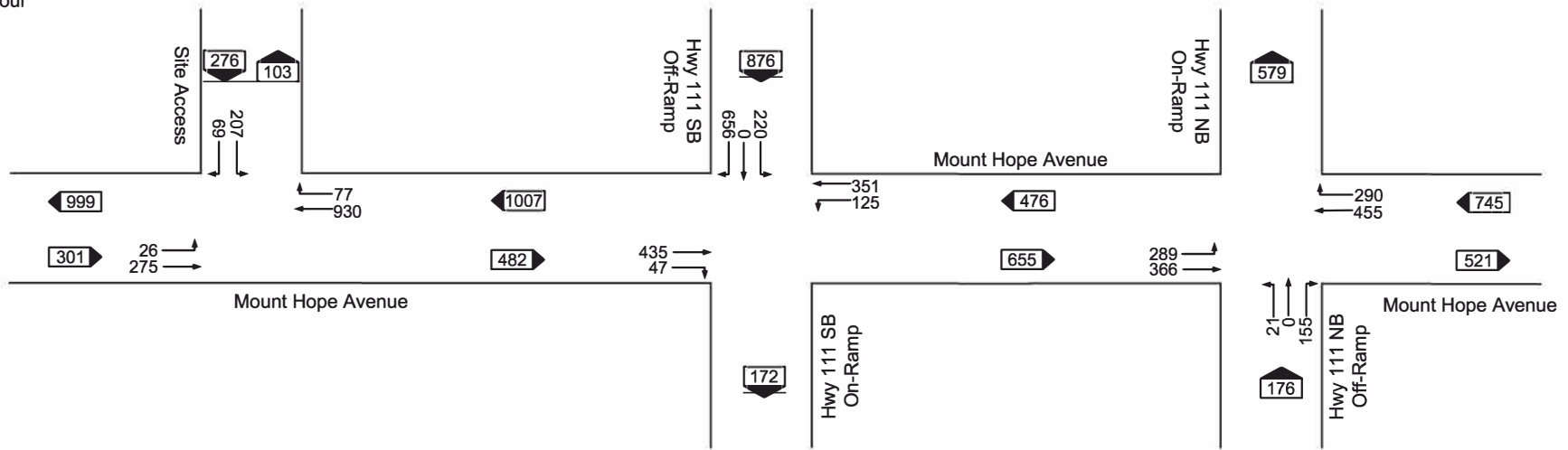
Figure A-5

2034 Site Generated Trips (0% Non-Auto Trips)
Weekday AM and PM Peak Hour

February 2022

A

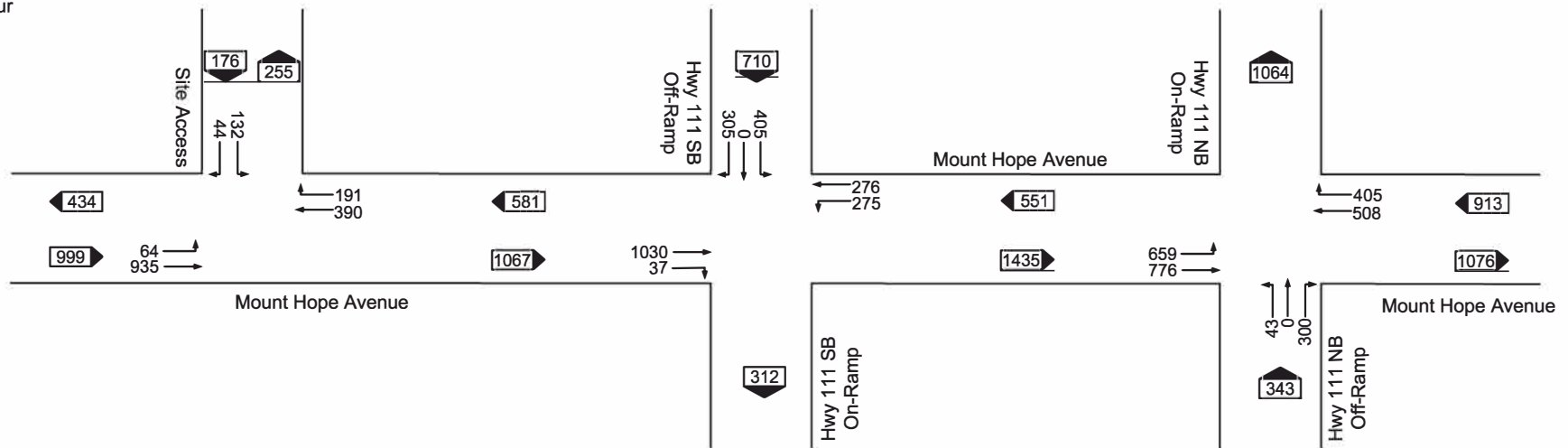
AM Peak Hour



NOT TO SCALE

B

PM Peak Hour



NOT TO SCALE



Traffic Impact Study - Mount Hope Development
Dartmouth, Nova Scotia

2034 Design Hourly Volumes With Site Development
(0% Non-Auto Trips)
Weekday AM and PM Peak Hour

Figure A-6

February 2022

APPENDIX

B

WARRANT ANALYSIS



2005 Canadian Traffic Signal Warrant Matrix Analysis

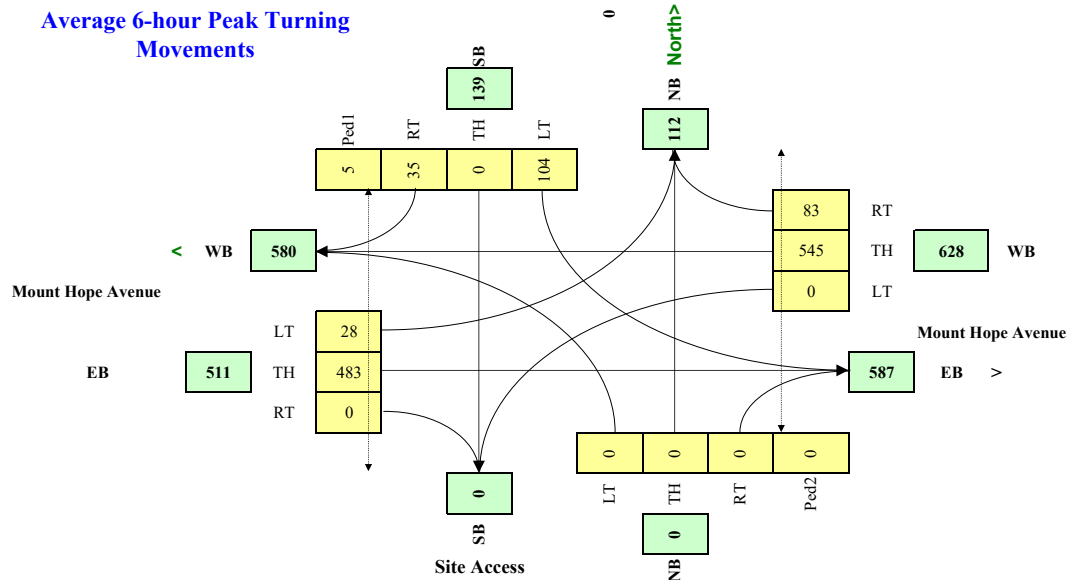
Table B-1 - Mount Hope Avenue at Site Access
DHV 2034 with site (20% non-auto trips)

Main Street (name)	Mount Hope Avenue			Direction (EW or NS)		EW	Date:	February 23, 2022	
Side Street (name)	Site Access			Direction (EW or NS)		NS		City:	Dartmouth, NS
Lane Configuration		Excl LT	Th & LT	Through or Th+RT-LT	Th & RT	Excl RT	UpStream Signal (m)		# of Thru Lanes
Mount Hope Avenue	WB			1			1,000	1	
Mount Hope Avenue	EB	1		1			250	1	
	NB								
Site Access	SB	1				1			
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)				
Mount Hope Avenue	EW	50	2.0%	n	0.0				
Site Access	NS	50	2.0%	n					

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	5	0	0	0
8:00 - 9:00	5	0	0	0
11:30 - 12:30	5	0	0	0
12:30 - 13:30	5	0	0	0
15:30 - 16:30	5	0	0	0
16:30 - 17:30	5	0	0	0
Total (6-hour peak)	30	0	0	0
Average (6-hour peak)	5	0	0	0

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population (#)		400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	0	0	0	165	0	55	0	775	60	20	195	0
8:00 - 9:00	0	0	0	125	0	40	0	815	45	15	290	0
11:30 - 12:30	0	0	0	70	0	25	0	420	55	20	505	0
12:30 - 13:30	0	0	0	70	0	25	0	505	55	20	380	0
15:30 - 16:30	0	0	0	90	0	30	0	445	130	45	870	0
16:30 - 17:30	0	0	0	105	0	35	0	310	155	50	655	0
Total (6-hour peak)	0	0	0	625	0	210	0	3,270	500	170	2,895	0
Average (6-hour peak)	0	0	0	104	0	35	0	545	83	28	483	0



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

W = 72 67 5
 Veh Ped
NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

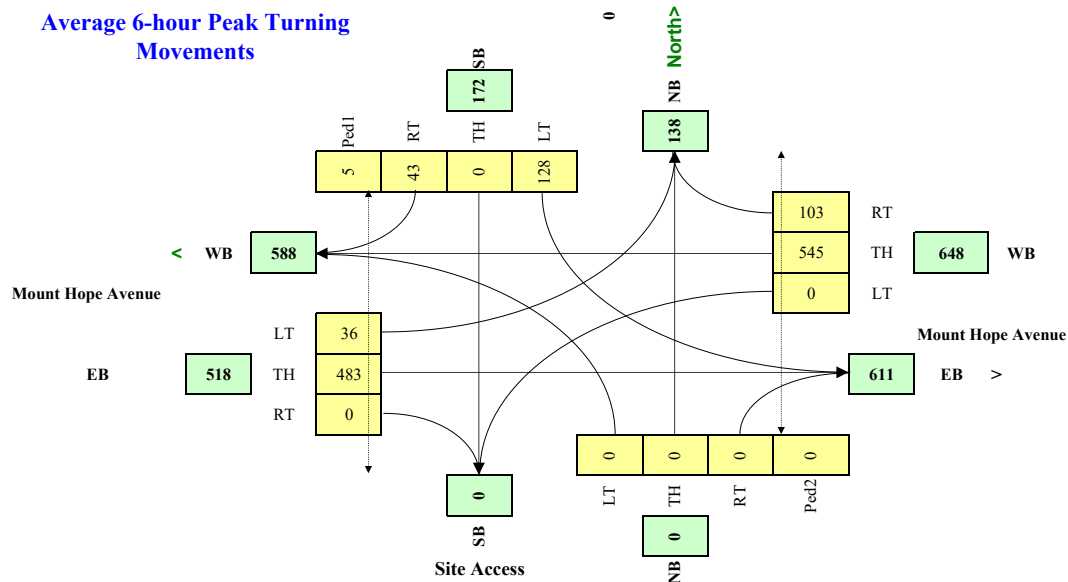
Table B-2 - Mount Hope Avenue at Site Access
DHV 2034 with site (0% non-auto trips)

Main Street (name)	Mount Hope Avenue			Direction (EW or NS)		EW	Date:	February 23, 2022	
Side Street (name)	Site Access			Direction (EW or NS)		NS		City:	Dartmouth, NS
Lane Configuration		Excl LT	Th & LT	Through or Th+RT-LT	Th & RT	Excl RT	UpStream Signal (m)		# of Thru Lanes
Mount Hope Avenue	WB			1			1,000	1	
Mount Hope Avenue	EB	1		1			250	1	
	NB								
Site Access	SB	1				1			
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)				
Mount Hope Avenue	EW	50	2.0%	n	0.0				
Site Access	NS	50	2.0%	n					

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	5	0	0	0
8:00 - 9:00	5	0	0	0
11:30 - 12:30	5	0	0	0
12:30 - 13:30	5	0	0	0
15:30 - 16:30	5	0	0	0
16:30 - 17:30	5	0	0	0
Total (6-hour peak)	30	0	0	0
Average (6-hour peak)	5	0	0	0

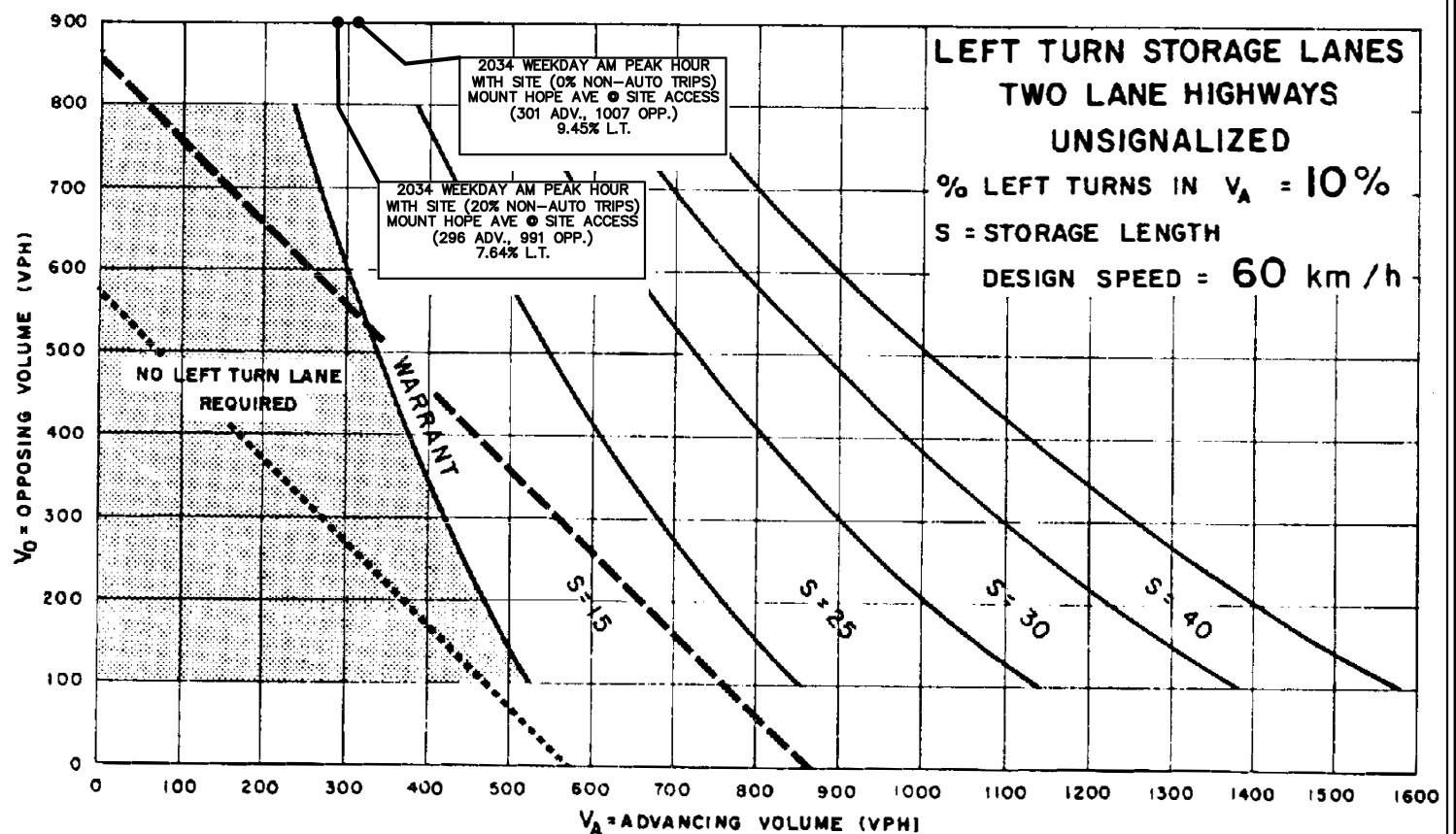
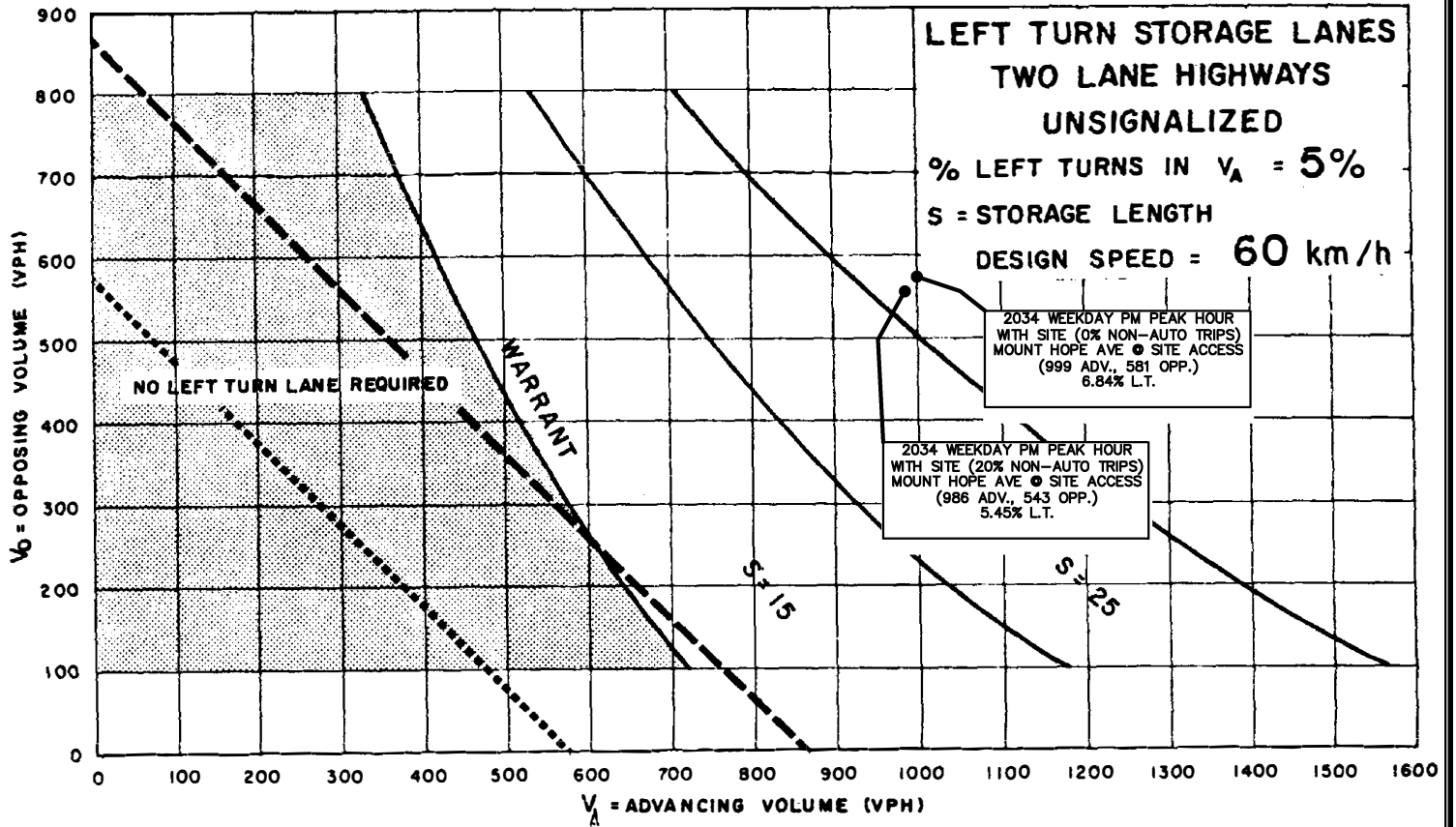
Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population (#)		400,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	0	0	0	205	0	70	0	775	75	25	195	0
8:00 - 9:00	0	0	0	155	0	50	0	815	60	20	290	0
11:30 - 12:30	0	0	0	85	0	30	0	420	65	25	505	0
12:30 - 13:30	0	0	0	85	0	30	0	505	65	25	380	0
15:30 - 16:30	0	0	0	110	0	35	0	445	160	55	870	0
16:30 - 17:30	0	0	0	130	0	45	0	310	190	65	655	0
Total (6-hour peak)	0	0	0	770	0	260	0	3,270	615	215	2,895	0
Average (6-hour peak)	0	0	0	128	0	43	0	545	103	36	483	0



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

W = 88 83 5
 Veh Ped
NOT Warranted



Site Access Review - Mount Hope Lands
Dartmouth, Nova Scotia

Figure B-1

Left Turn Lane Warrants
DHV 2034 with site (20% & 0% non-auto trips)

February 2022

APPENDIX

C

INTERSECTION PERFORMANCE ANALYSIS



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	145	290	0	0	395	255	5	0	135	0	0	0
Future Volume (vph)	145	290	0	0	395	255	5	0	135	0	0	0
Satd. Flow (prot)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Satd. Flow (RTOR)						277			147			
Lane Group Flow (vph)	158	315	0	0	429	277	0	5	147	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	18.0	83.0			65.0	65.0	40.0	40.0	40.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	8.6	32.7			17.6	17.6		10.7	10.7			
Actuated g/C Ratio	0.15	0.57			0.31	0.31		0.19	0.19			
v/c Ratio	0.32	0.16			0.41	0.42		0.02	0.36			
Control Delay	23.9	6.5			17.4	4.6		21.6	7.7			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	23.9	6.5			17.4	4.6		21.6	7.7			
LOS	C	A			B	A		C	A			
Approach Delay		12.3			12.4			8.1				
Approach LOS		B			B			A				
Queue Length 50th (m)	5.8	2.4			18.1	0.0		0.5	0.0			
Queue Length 95th (m)	24.0	21.6			37.8	15.2		3.3	13.7			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	707	3408			3235	1463		1007	962			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.22	0.09			0.13	0.19		0.00	0.15			

Intersection Summary

Cycle Length: 123

Actuated Cycle Length: 57.6

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 11.9

Intersection LOS: B

Intersection Capacity Utilization 59.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↗	↗↗	↑					↗	↗	↗
Traffic Volume (vph)	0	240	5	110	290	0	0	0	0	195	0	540
Future Volume (vph)	0	240	5	110	290	0	0	0	0	195	0	540
Satd. Flow (prot)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Satd. Flow (RTOR)			103									573
Lane Group Flow (vph)	0	261	5	120	315	0	0	0	0	106	106	587
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		66.0	66.0	17.0	65.0					40.0	40.0	40.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		20.3	20.3	8.1	17.6					10.9	10.9	10.9
Actuated g/C Ratio		0.35	0.35	0.14	0.31					0.19	0.19	0.19
v/c Ratio		0.15	0.01	0.25	0.57					0.34	0.34	0.77
Control Delay		15.0	0.0	33.5	22.5					25.3	25.3	10.8
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		15.0	0.0	33.5	22.5					25.3	25.3	10.8
LOS		B	A	C	C					C	C	B
Approach Delay		14.7			25.5						14.7	
Approach LOS		B			C						B	
Queue Length 50th (m)		7.2	0.0	7.4	20.5					10.3	10.3	1.2
Queue Length 95th (m)		15.8	0.0	19.7	15.3					28.4	28.4	31.5
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		4703	1470	616	1719					972	972	1150
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.06	0.00	0.19	0.18					0.11	0.11	0.51

Intersection Summary

Cycle Length: 123

Actuated Cycle Length: 57.6

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 17.8

Intersection LOS: B

Intersection Capacity Utilization 59.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	515	665	0	0	420	360	5	0	270	0	0	0
Future Volume (vph)	515	665	0	0	420	360	5	0	270	0	0	0
Satd. Flow (prot)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Satd. Flow (RTOR)						391			257			
Lane Group Flow (vph)	560	723	0	0	457	391	0	5	293	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	38.0	86.0			48.0	48.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	17.6	41.6			17.4	17.4		14.5	14.5			
Actuated g/C Ratio	0.25	0.59			0.25	0.25		0.21	0.21			
v/c Ratio	0.65	0.35			0.52	0.57		0.01	0.55			
Control Delay	36.0	8.1			26.3	6.6		25.6	10.2			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	36.0	8.1			26.3	6.6		25.6	10.2			
LOS	D	A			C	A		C	B			
Approach Delay		20.3			17.2			10.5				
Approach LOS		C			B			B				
Queue Length 50th (m)	43.6	24.1			27.6	0.0		0.6	3.9			
Queue Length 95th (m)	78.1	38.5			53.8	22.1		3.7	27.7			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	1616	3430			2213	1136		770	834			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.35	0.21			0.21	0.34		0.01	0.35			

Intersection Summary

Cycle Length: 123

Actuated Cycle Length: 70.3

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 18.0

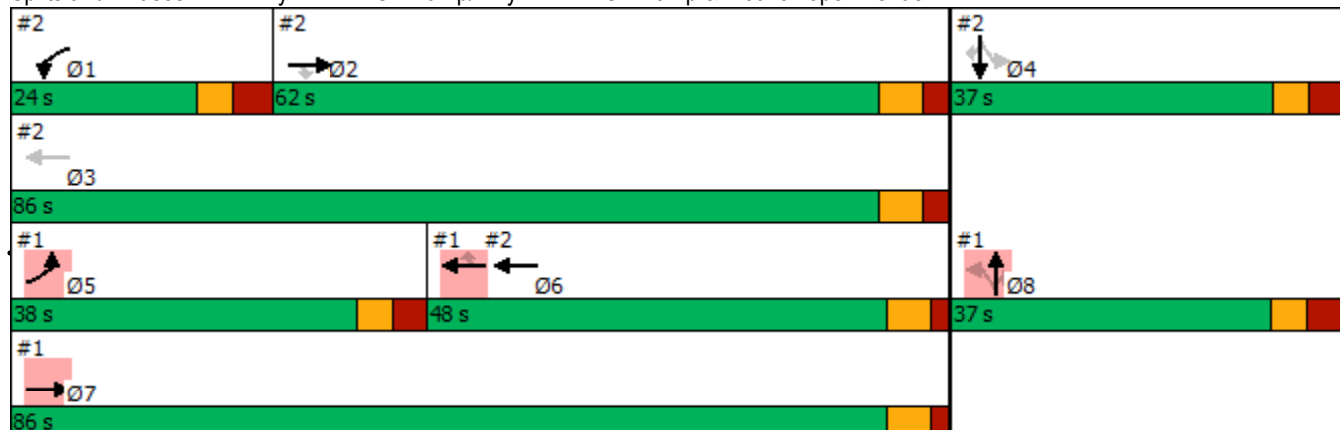
Intersection LOS: B

Intersection Capacity Utilization 59.4%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑↑	↑					↑	↑	↑
Traffic Volume (vph)	0	820	10	245	180	0	0	0	0	360	0	170
Future Volume (vph)	0	820	10	245	180	0	0	0	0	360	0	170
Satd. Flow (prot)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1583
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1583
Satd. Flow (RTOR)			103									185
Lane Group Flow (vph)	0	891	11	266	196	0	0	0	0	195	196	185
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		62.0	62.0	24.0	48.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		22.0	22.0	11.7	17.4					14.7	14.7	14.7
Actuated g/C Ratio		0.31	0.31	0.17	0.25					0.21	0.21	0.21
v/c Ratio		0.56	0.02	0.47	0.43					0.56	0.56	0.39
Control Delay		22.0	0.1	37.5	25.0					33.6	33.7	7.3
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		22.0	0.1	37.5	25.0					33.6	33.7	7.3
LOS		C	A	D	C					C	C	A
Approach Delay		21.7			32.2						25.2	
Approach LOS		C			C						C	
Queue Length 50th (m)		35.6	0.0	20.7	15.3					24.7	24.8	0.0
Queue Length 95th (m)		61.2	0.0	42.1	13.9					56.6	56.8	16.5
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		4066	1285	863	1153					729	729	797
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.22	0.01	0.31	0.17					0.27	0.27	0.23

Intersection Summary

Cycle Length: 123

Actuated Cycle Length: 70.3

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay: 25.2

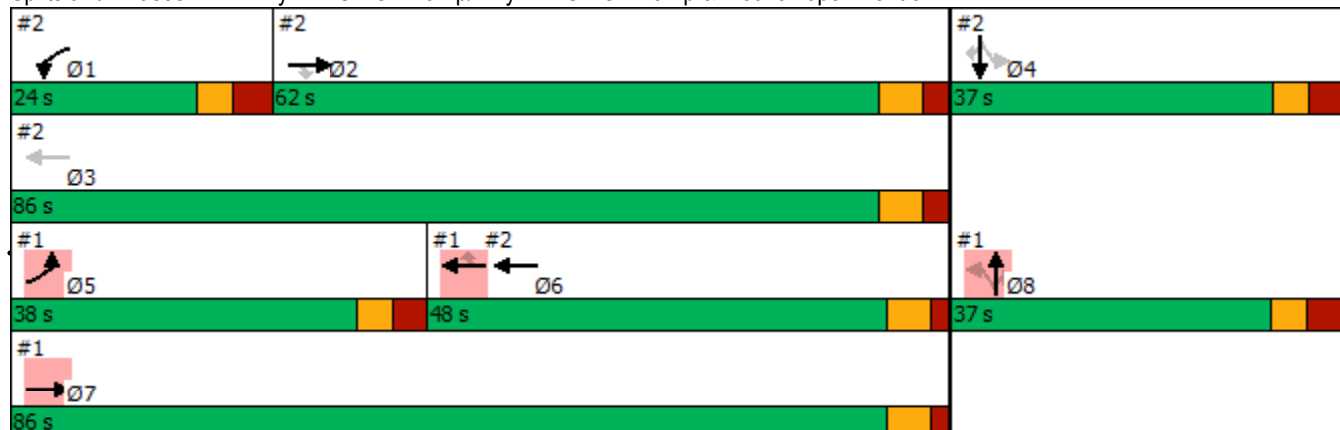
Intersection LOS: C

Intersection Capacity Utilization 59.4%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	165	325	0	0	440	290	5	0	155	0	0	0
Future Volume (vph)	165	325	0	0	440	290	5	0	155	0	0	0
Satd. Flow (prot)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Satd. Flow (RTOR)						315			168			
Lane Group Flow (vph)	179	353	0	0	478	315	0	5	168	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	18.0	80.0			62.0	62.0	40.0	40.0	40.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	9.0	31.4			15.8	15.8		12.1	12.1			
Actuated g/C Ratio	0.16	0.54			0.27	0.27		0.21	0.21			
v/c Ratio	0.35	0.19			0.51	0.49		0.01	0.37			
Control Delay	25.1	8.2			20.3	5.5		19.6	6.6			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	25.1	8.2			20.3	5.5		19.6	6.6			
LOS	C	A			C	A		B	A			
Approach Delay		13.9			14.4			7.0				
Approach LOS		B			B			A				
Queue Length 50th (m)	7.8	2.8			21.2	0.0		0.4	0.0			
Queue Length 95th (m)	26.8	24.1			46.2	17.5		3.0	13.7			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	708	3375			3169	1442		1008	971			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.25	0.10			0.15	0.22		0.00	0.17			

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 57.7

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 13.4

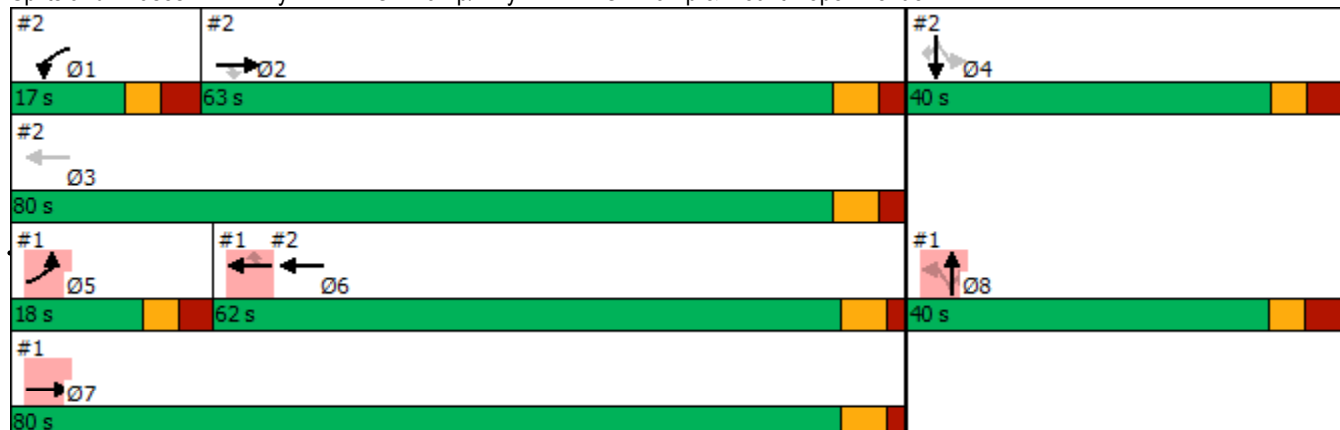
Intersection LOS: B

Intersection Capacity Utilization 61.0%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑↑	↑					↑	↑	↑
Traffic Volume (vph)	0	270	5	125	230	0	0	0	0	220	0	610
Future Volume (vph)	0	270	5	125	230	0	0	0	0	220	0	610
Satd. Flow (prot)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Satd. Flow (RTOR)			105									650
Lane Group Flow (vph)	0	293	5	136	250	0	0	0	0	119	120	663
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		63.0	63.0	17.0	62.0					40.0	40.0	40.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		18.8	18.8	8.3	15.8					12.3	12.3	12.3
Actuated g/C Ratio		0.33	0.33	0.14	0.27					0.21	0.21	0.21
v/c Ratio		0.18	0.01	0.28	0.50					0.34	0.34	0.79
Control Delay		16.7	0.0	33.5	25.0					23.3	23.3	10.1
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		16.7	0.0	33.5	25.0					23.3	23.3	10.1
LOS		B	A	C	C					C	C	B
Approach Delay		16.4			28.0						13.6	
Approach LOS		B			C						B	
Queue Length 50th (m)		8.4	0.0	8.3	20.4					11.1	11.2	1.1
Queue Length 95th (m)		19.0	0.0	22.1	15.9					29.4	29.7	31.4
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		4606	1442	617	1684					972	972	1182
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.06	0.00	0.22	0.15					0.12	0.12	0.56

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 57.7

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 17.6

Intersection LOS: B

Intersection Capacity Utilization 61.0%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	580	750	0	0	470	405	5	0	300	0	0	0
Future Volume (vph)	580	750	0	0	470	405	5	0	300	0	0	0
Satd. Flow (prot)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Satd. Flow (RTOR)						440			208			
Lane Group Flow (vph)	630	815	0	0	511	440	0	5	326	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	38.0	83.0			45.0	45.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	20.7	47.5			20.2	20.2		16.7	16.7			
Actuated g/C Ratio	0.26	0.61			0.26	0.26		0.21	0.21			
v/c Ratio	0.70	0.38			0.56	0.60		0.01	0.65			
Control Delay	42.4	7.8			29.3	6.8		28.6	18.5			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	42.4	7.8			29.3	6.8		28.6	18.5			
LOS	D	A			C	A		C	B			
Approach Delay		22.9			18.9			18.7				
Approach LOS		C			B			B				
Queue Length 50th (m)	54.7	28.7			34.7	0.0		0.6	15.2			
Queue Length 95th (m)	96.3	47.0			67.1	24.8		3.9	52.0			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	1462	3248			1859	1040		696	749			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.43	0.25			0.27	0.42		0.01	0.44			

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 78.5

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 21.0

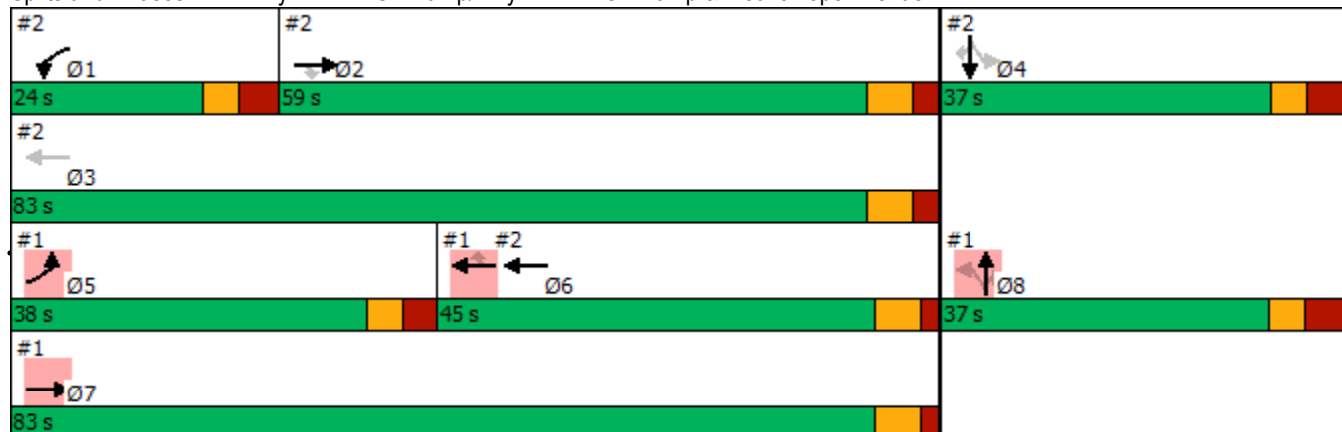
Intersection LOS: C

Intersection Capacity Utilization 64.0%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑↑	↑					↑	↑	↑
Traffic Volume (vph)	0	925	10	275	200	0	0	0	0	405	0	190
Future Volume (vph)	0	925	10	275	200	0	0	0	0	405	0	190
Satd. Flow (prot)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Satd. Flow (RTOR)			105									201
Lane Group Flow (vph)	0	1005	11	299	217	0	0	0	0	220	220	207
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		59.0	59.0	24.0	45.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		26.6	26.6	12.8	20.2					16.9	16.9	16.9
Actuated g/C Ratio		0.34	0.34	0.16	0.26					0.22	0.22	0.22
v/c Ratio		0.59	0.02	0.54	0.46					0.62	0.62	0.42
Control Delay		23.1	0.1	43.3	21.1					38.1	38.1	8.0
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		23.1	0.1	43.3	21.1					38.1	38.1	8.0
LOS		C	A	D	C					D	D	A
Approach Delay		22.8			34.0						28.4	
Approach LOS		C			C						C	
Queue Length 50th (m)		44.7	0.0	25.9	12.5					31.7	31.7	0.7
Queue Length 95th (m)		73.4	0.0	51.4	13.4					70.6	70.6	19.5
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		3546	1135	781	969					659	659	743
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.28	0.01	0.38	0.22					0.33	0.33	0.28

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 78.5

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 27.1

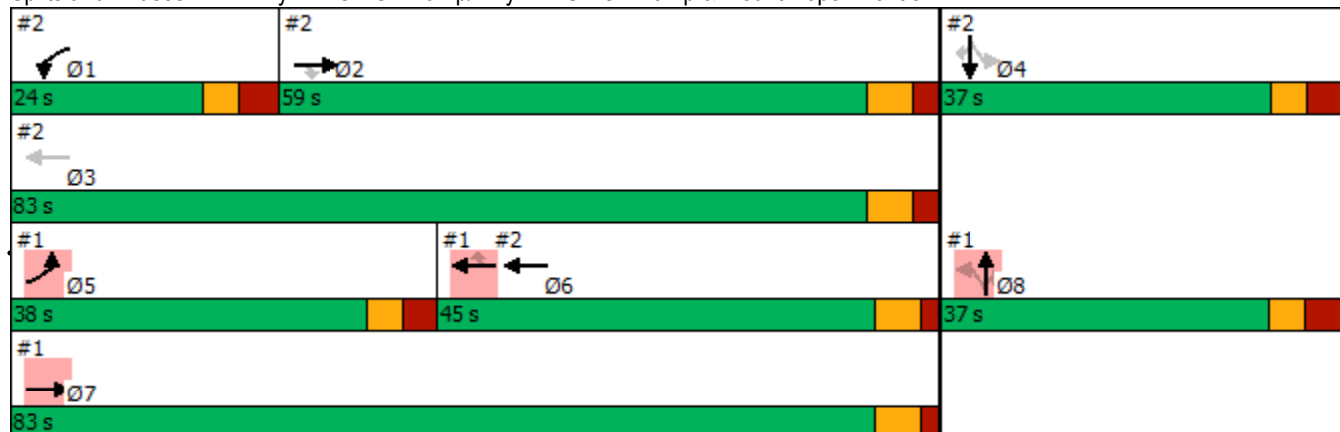
Intersection LOS: C

Intersection Capacity Utilization 64.0%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue



												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	264	358	0	0	452	290	17	0	155	0	0	0
Future Volume (vph)	264	358	0	0	452	290	17	0	155	0	0	0
Satd. Flow (prot)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Satd. Flow (RTOR)						315			168			
Lane Group Flow (vph)	287	389	0	0	491	315	0	18	168	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	20.0	73.0			53.0	53.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	11.6	42.5			24.2	24.2		21.7	21.7			
Actuated g/C Ratio	0.15	0.54			0.31	0.31		0.28	0.28			
v/c Ratio	0.59	0.21			0.46	0.46		0.04	0.31			
Control Delay	47.5	9.3			24.0	5.0		23.6	6.1			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	47.5	9.3			24.0	5.0		23.6	6.1			
LOS	D	A			C	A		C	A			
Approach Delay		25.5			16.6			7.8				
Approach LOS		C			B			A				
Queue Length 50th (m)	26.5	15.6			34.1	0.0		2.1	0.0			
Queue Length 95th (m)	46.9	25.5			52.2	17.4		8.0	15.1			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	616	2890			2185	1092		679	709			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.47	0.13			0.22	0.29		0.03	0.24			

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 78.6

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 19.2

Intersection LOS: B

Intersection Capacity Utilization 69.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↗	↖↗	↑					↖	↗	↗
Traffic Volume (vph)	0	402	39	125	344	0	0	0	0	220	0	647
Future Volume (vph)	0	402	39	125	344	0	0	0	0	220	0	647
Satd. Flow (prot)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Satd. Flow (RTOR)			115									496
Lane Group Flow (vph)	0	437	42	136	374	0	0	0	0	119	120	703
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		57.3	57.3	15.7	53.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		30.3	30.3	8.4	24.2					21.9	21.9	21.9
Actuated g/C Ratio		0.39	0.39	0.11	0.31					0.28	0.28	0.28
v/c Ratio		0.23	0.06	0.38	0.66					0.26	0.26	0.89
Control Delay		18.7	0.2	52.7	22.5					25.6	25.6	23.9
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		18.7	0.2	52.7	22.5					25.6	25.6	23.9
LOS		B	A	D	C					C	C	C
Approach Delay		17.1			30.6						24.3	
Approach LOS		B			C						C	
Queue Length 50th (m)		19.0	0.0	12.7	17.5					15.3	15.4	31.0
Queue Length 95th (m)		28.3	0.0	25.8	24.1					35.1	35.4	#121.5
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		3412	1098	400	1161					656	656	916
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.13	0.04	0.34	0.32					0.18	0.18	0.77

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 78.6

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 24.2

Intersection LOS: C

Intersection Capacity Utilization 69.3%

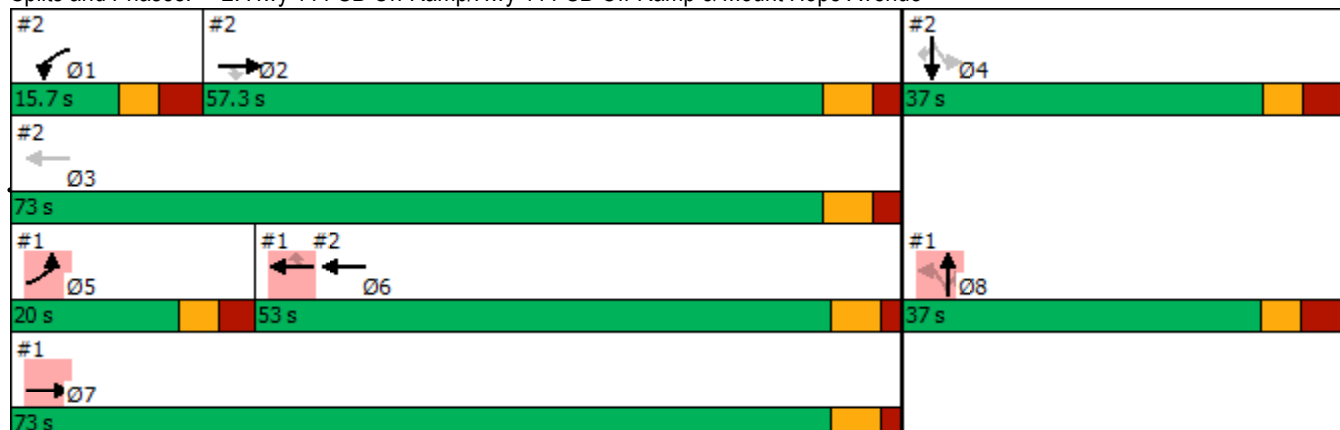
ICU Level of Service C

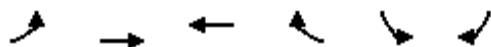
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	21	275	930	61	166	55
Future Volume (Veh/h)	21	275	930	61	166	55
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	299	1011	66	180	60
Pedestrians		10			10	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.2			1.2	
Percent Blockage		1			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)			238			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	1021				1366	1031
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	932				1341	944
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				0	77
cM capacity (veh/h)	614				135	264
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	23	299	1011	66	180	60
Volume Left	23	0	0	0	180	0
Volume Right	0	0	0	66	0	60
cSH	614	1700	1700	1700	135	264
Volume to Capacity	0.04	0.18	0.59	0.04	1.33	0.23
Queue Length 95th (m)	0.9	0.0	0.0	0.0	91.8	6.8
Control Delay (s)	11.1	0.0	0.0	0.0	252.6	22.6
Lane LOS	B				F	C
Approach Delay (s)	0.8		0.0		195.1	
Approach LOS					F	
Intersection Summary						
Average Delay			28.7			
Intersection Capacity Utilization			66.0%		ICU Level of Service	C
Analysis Period (min)			15			

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	643	771	0	0	501	405	35	0	300	0	0	0
Future Volume (vph)	643	771	0	0	501	405	35	0	300	0	0	0
Satd. Flow (prot)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Satd. Flow (RTOR)						440			183			
Lane Group Flow (vph)	699	838	0	0	545	440	0	38	326	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	32.0	63.0			31.0	31.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	20.7	46.8			19.5	19.5		16.4	16.4			
Actuated g/C Ratio	0.27	0.60			0.25	0.25		0.21	0.21			
v/c Ratio	0.76	0.39			0.61	0.60		0.10	0.68			
Control Delay	43.8	7.4			30.0	6.9		27.2	21.1			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	43.8	7.4			30.0	6.9		27.2	21.1			
LOS	D	A			C	A		C	C			
Approach Delay		24.0			19.7			21.8				
Approach LOS		C			B			C				
Queue Length 50th (m)	63.0	29.3			39.4	0.0		4.8	19.5			
Queue Length 95th (m)	95.8	42.6			66.7	24.4		13.6	52.0			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	1188	2694			1196	826		698	735			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.59	0.31			0.46	0.53		0.05	0.44			

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 77.4

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 22.2

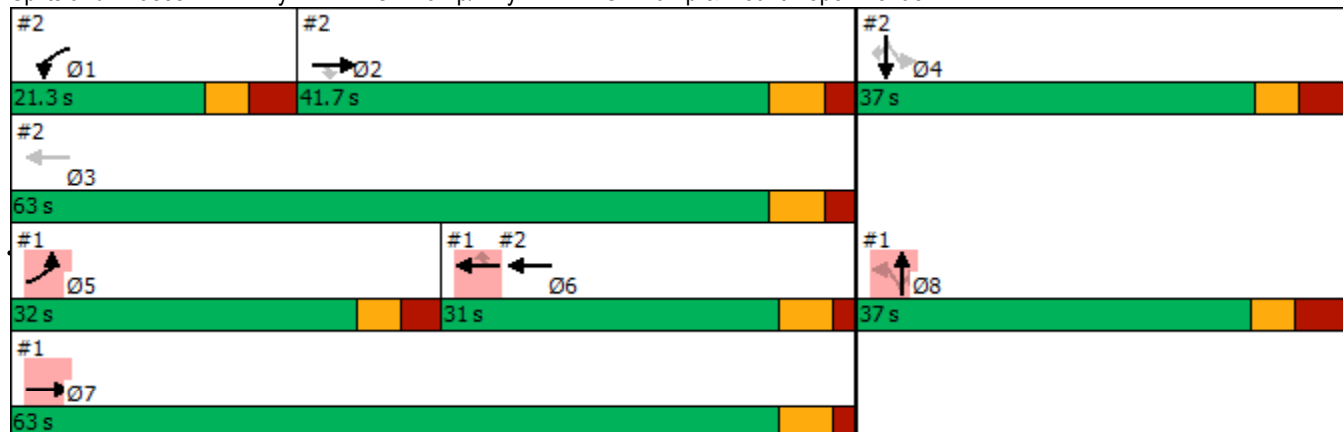
Intersection LOS: C

Intersection Capacity Utilization 65.8%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue (2034) with site (20%) - PM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↗	↘↘	↑					↗	↖	↗
Traffic Volume (vph)	0	1009	32	275	261	0	0	0	0	405	0	282
Future Volume (vph)	0	1009	32	275	261	0	0	0	0	405	0	282
Satd. Flow (prot)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Satd. Flow (RTOR)			127									307
Lane Group Flow (vph)	0	1097	35	299	284	0	0	0	0	220	220	307
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		41.7	41.7	21.3	31.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		26.8	26.8	12.1	19.5					16.6	16.6	16.6
Actuated g/C Ratio		0.35	0.35	0.16	0.25					0.21	0.21	0.21
v/c Ratio		0.63	0.06	0.57	0.61					0.62	0.62	0.53
Control Delay		23.3	0.2	40.7	31.2					37.0	37.0	7.3
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		23.3	0.2	40.7	31.2					37.0	37.0	7.3
LOS		C	A	D	C					D	D	A
Approach Delay		22.6			36.1						24.8	
Approach LOS		C			D						C	
Queue Length 50th (m)		51.1	0.0	26.9	20.6					32.9	32.9	0.0
Queue Length 95th (m)		77.8	0.0	47.0	36.6					62.5	62.5	20.0
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		2380	808	659	623					661	661	807
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.46	0.04	0.45	0.46					0.33	0.33	0.38

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 77.4

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 26.4

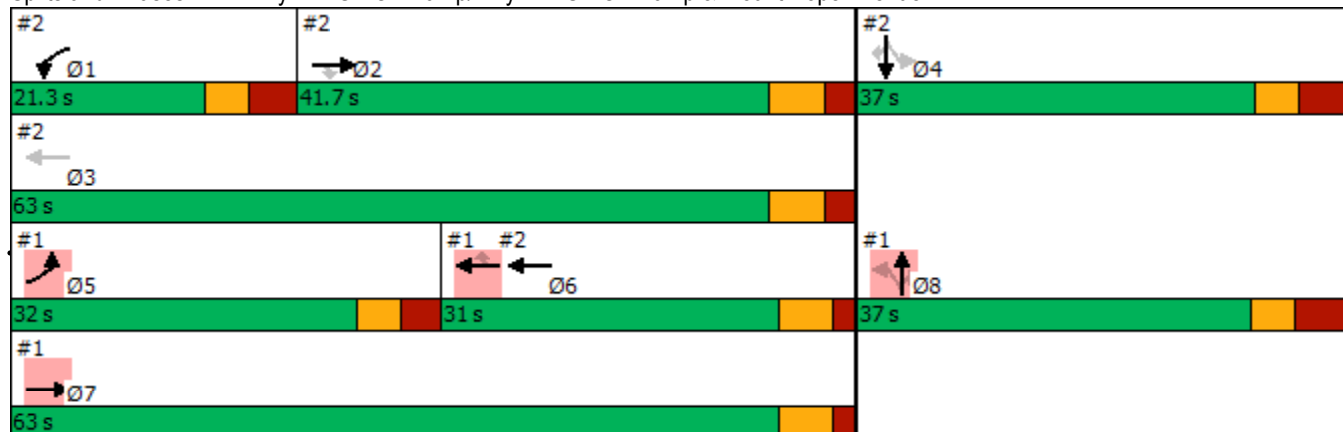
Intersection LOS: C

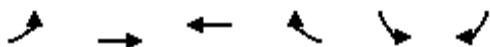
Intersection Capacity Utilization 65.8%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	51	935	390	153	106	35
Future Volume (Veh/h)	51	935	390	153	106	35
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	55	1016	424	166	115	38
Pedestrians		10			10	
Lane Width (m)		3.6			3.6	
Walking Speed (m/s)		1.2			1.2	
Percent Blockage		1			1	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)			238			
pX, platoon unblocked	0.95				0.95	0.95
vC, conflicting volume	434				1560	444
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	381				1563	392
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	95				0	94
cM capacity (veh/h)	1112				110	616
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	55	1016	424	166	115	38
Volume Left	55	0	0	0	115	0
Volume Right	0	0	0	166	0	38
cSH	1112	1700	1700	1700	110	616
Volume to Capacity	0.05	0.60	0.25	0.10	1.04	0.06
Queue Length 95th (m)	1.2	0.0	0.0	0.0	54.9	1.6
Control Delay (s)	8.4	0.0	0.0	0.0	170.9	11.2
Lane LOS	A				F	B
Approach Delay (s)	0.4		0.0		131.2	
Approach LOS					F	
Intersection Summary						
Average Delay			11.3			
Intersection Capacity Utilization			63.9%		ICU Level of Service	B
Analysis Period (min)			15			

1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue (2034) with site (0%) - AM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	289	366	0	0	455	290	21	0	155	0	0	0
Future Volume (vph)	289	366	0	0	455	290	21	0	155	0	0	0
Satd. Flow (prot)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3335	3438	0	0	3438	1538	0	1719	1538	0	0	0
Satd. Flow (RTOR)						315			168			
Lane Group Flow (vph)	314	398	0	0	495	315	0	23	168	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	21.0	73.0			52.0	52.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	12.3	44.1			25.1	25.1		23.5	23.5			
Actuated g/C Ratio	0.15	0.54			0.31	0.31		0.29	0.29			
v/c Ratio	0.63	0.22			0.47	0.46		0.05	0.30			
Control Delay	50.1	9.7			25.0	5.0		24.3	6.1			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	50.1	9.7			25.0	5.0		24.3	6.1			
LOS	D	A			C	A		C	A			
Approach Delay		27.5			17.2			8.3				
Approach LOS		C			B			A				
Queue Length 50th (m)	30.9	16.2			37.2	0.0		2.8	0.0			
Queue Length 95th (m)	51.2	25.4			53.4	17.4		9.7	15.5			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	630	2795			2037	1039		647	684			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.50	0.14			0.24	0.30		0.04	0.25			

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 81.9

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 20.5

Intersection LOS: C

Intersection Capacity Utilization 70.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑↑	↑					↑	↑	↑
Traffic Volume (vph)	0	435	47	125	351	0	0	0	0	220	0	656
Future Volume (vph)	0	435	47	125	351	0	0	0	0	220	0	656
Satd. Flow (prot)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	4988	1553	3367	1827	0	0	0	0	1649	1649	1553
Satd. Flow (RTOR)			115									488
Lane Group Flow (vph)	0	473	51	136	382	0	0	0	0	119	120	713
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		57.3	57.3	15.7	52.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		27.7	27.7	8.4	25.1					23.7	23.7	23.7
Actuated g/C Ratio		0.34	0.34	0.10	0.31					0.29	0.29	0.29
v/c Ratio		0.28	0.09	0.39	0.68					0.25	0.25	0.90
Control Delay		20.1	0.3	53.9	23.1					26.0	26.0	25.3
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		20.1	0.3	53.9	23.1					26.0	26.0	25.3
LOS		C	A	D	C					C	C	C
Approach Delay		18.2			31.2						25.5	
Approach LOS		B			C						C	
Queue Length 50th (m)		22.1	0.0	13.5	20.0					15.7	15.8	36.7
Queue Length 95th (m)		30.5	0.0	26.2	25.2					36.1	36.3	#131.0
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		3250	1052	380	1082					625	625	891
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.15	0.05	0.36	0.35					0.19	0.19	0.80

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 81.9

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 25.1

Intersection LOS: C

Intersection Capacity Utilization 70.3%

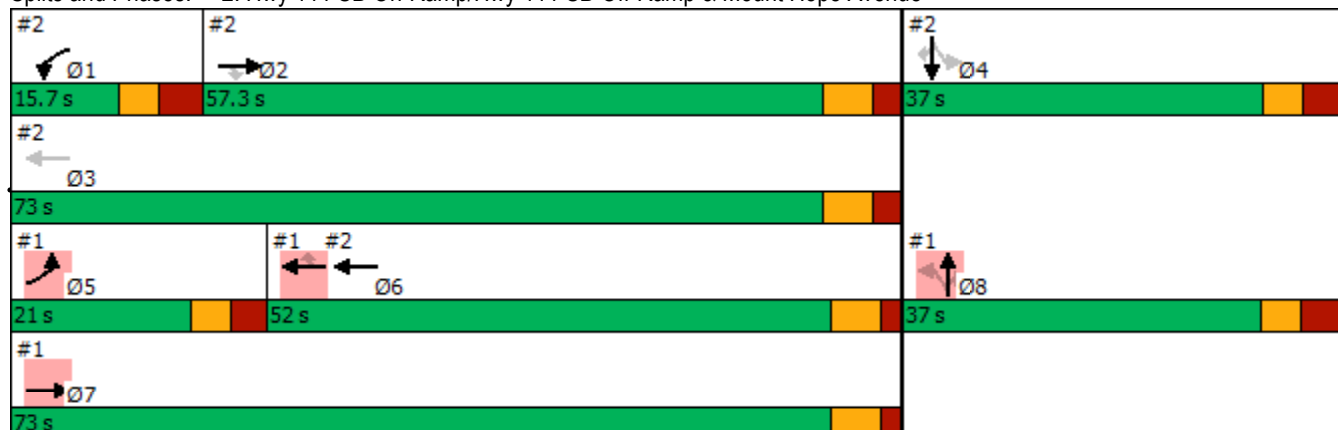
ICU Level of Service C

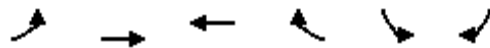
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue





Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	26	275	930	77	207	69
Future Volume (Veh/h)	26	275	930	77	207	69
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	299	1011	84	225	75
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)			238			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	1011				1366	1011
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	915				1340	915
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				0	73
cM capacity (veh/h)	623				134	276
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	28	299	1011	84	225	75
Volume Left	28	0	0	0	225	0
Volume Right	0	0	0	84	0	75
cSH	623	1700	1700	1700	134	276
Volume to Capacity	0.04	0.18	0.59	0.05	1.67	0.27
Queue Length 95th (m)	1.1	0.0	0.0	0.0	131.7	8.6
Control Delay (s)	11.1	0.0	0.0	0.0	391.5	22.8
Lane LOS	B				F	C
Approach Delay (s)	0.9		0.0		299.3	
Approach LOS					F	
Intersection Summary						
Average Delay			52.3			
Intersection Capacity Utilization			67.1%		ICU Level of Service	C
Analysis Period (min)			15			

1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue (2034) with site (0%) - PM Peak

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	659	776	0	0	508	405	43	0	300	0	0	0
Future Volume (vph)	659	776	0	0	508	405	43	0	300	0	0	0
Satd. Flow (prot)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Flt Permitted	0.950							0.950				
Satd. Flow (perm)	3433	3539	0	0	3539	1583	0	1770	1583	0	0	0
Satd. Flow (RTOR)						440			183			
Lane Group Flow (vph)	716	843	0	0	552	440	0	47	326	0	0	0
Turn Type	Prot	NA			NA	Perm	Perm	NA	Perm			
Protected Phases	5	7			6			8				
Permitted Phases						6	8		8			
Total Split (s)	33.0	63.0			30.0	30.0	37.0	37.0	37.0			
Total Lost Time (s)	6.3	5.9			5.9	5.9		7.7	7.7			
Act Effct Green (s)	21.1	47.2			19.5	19.5		16.4	16.4			
Actuated g/C Ratio	0.27	0.61			0.25	0.25		0.21	0.21			
v/c Ratio	0.77	0.39			0.62	0.61		0.13	0.68			
Control Delay	44.3	7.3			30.6	7.0		27.5	21.2			
Queue Delay	0.0	0.0			0.0	0.0		0.0	0.0			
Total Delay	44.3	7.3			30.6	7.0		27.5	21.2			
LOS	D	A			C	A		C	C			
Approach Delay		24.3			20.1			22.0				
Approach LOS		C			C			C				
Queue Length 50th (m)	65.7	29.6			40.4	0.0		6.1	19.9			
Queue Length 95th (m)	97.9	42.5			68.6	24.8		15.9	52.0			
Internal Link Dist (m)		152.9			124.5			164.2			93.9	
Turn Bay Length (m)	30.0											
Base Capacity (vph)	1226	2682			1141	808		694	731			
Starvation Cap Reductn	0	0			0	0		0	0			
Spillback Cap Reductn	0	0			0	0		0	0			
Storage Cap Reductn	0	0			0	0		0	0			
Reduced v/c Ratio	0.58	0.31			0.48	0.54		0.07	0.45			

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 77.8

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 22.6

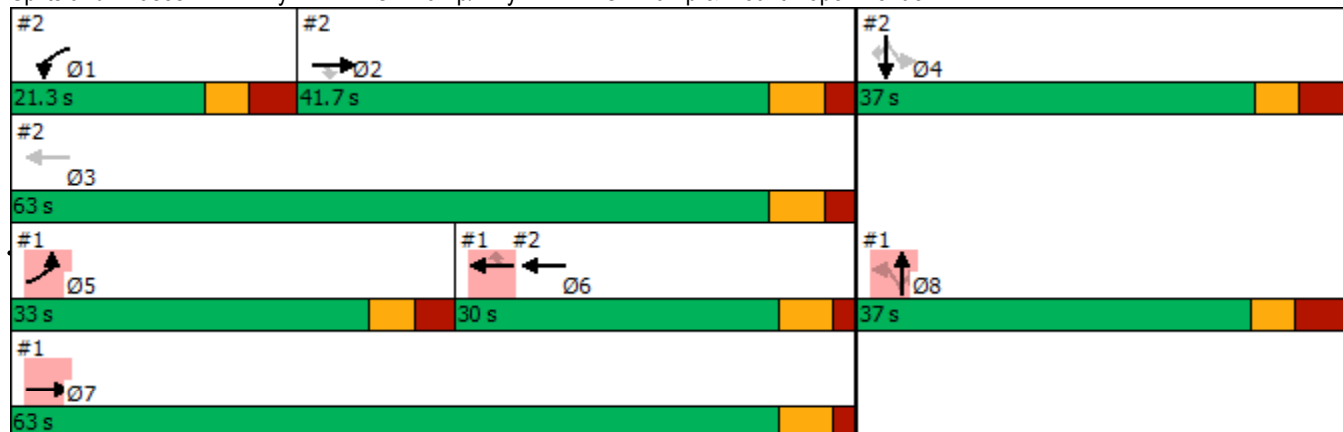
Intersection LOS: C

Intersection Capacity Utilization 66.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Hwy 111 NB Off-Ramp/Hwy 111 NB On-Ramp & Mount Hope Avenue



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑	↑	↑↑	↑					↑	↑	↑
Traffic Volume (vph)	0	1030	37	275	276	0	0	0	0	405	0	305
Future Volume (vph)	0	1030	37	275	276	0	0	0	0	405	0	305
Satd. Flow (prot)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Flt Permitted				0.950						0.950	0.950	
Satd. Flow (perm)	0	5036	1568	3400	1845	0	0	0	0	1665	1665	1568
Satd. Flow (RTOR)			127									332
Lane Group Flow (vph)	0	1120	40	299	300	0	0	0	0	220	220	332
Turn Type		NA	Perm	Prot	NA					Perm	NA	Perm
Protected Phases		2		1	6						4	
Permitted Phases			2		3					4		4
Total Split (s)		41.7	41.7	21.3	30.0					37.0	37.0	37.0
Total Lost Time (s)		6.6	6.6	6.9	5.9					7.5	7.5	7.5
Act Effect Green (s)		27.2	27.2	12.1	19.5					16.6	16.6	16.6
Actuated g/C Ratio		0.35	0.35	0.16	0.25					0.21	0.21	0.21
v/c Ratio		0.64	0.06	0.57	0.65					0.62	0.62	0.56
Control Delay		23.4	0.2	40.2	34.2					37.3	37.3	7.4
Queue Delay		0.0	0.0	0.0	0.0					0.0	0.0	0.0
Total Delay		23.4	0.2	40.2	34.2					37.3	37.3	7.4
LOS		C	A	D	C					D	D	A
Approach Delay		22.6			37.2						24.4	
Approach LOS		C			D						C	
Queue Length 50th (m)		52.5	0.0	27.3	20.1					33.6	33.6	0.0
Queue Length 95th (m)		79.6	0.0	47.0	44.7					62.5	62.5	20.7
Internal Link Dist (m)		87.4			152.9			70.9			164.8	
Turn Bay Length (m)			16.0									35.0
Base Capacity (vph)		2365	803	655	594					657	657	819
Starvation Cap Reductn		0	0	0	0					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.47	0.05	0.46	0.51					0.33	0.33	0.41

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 77.8

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.77

Intersection Signal Delay: 26.6

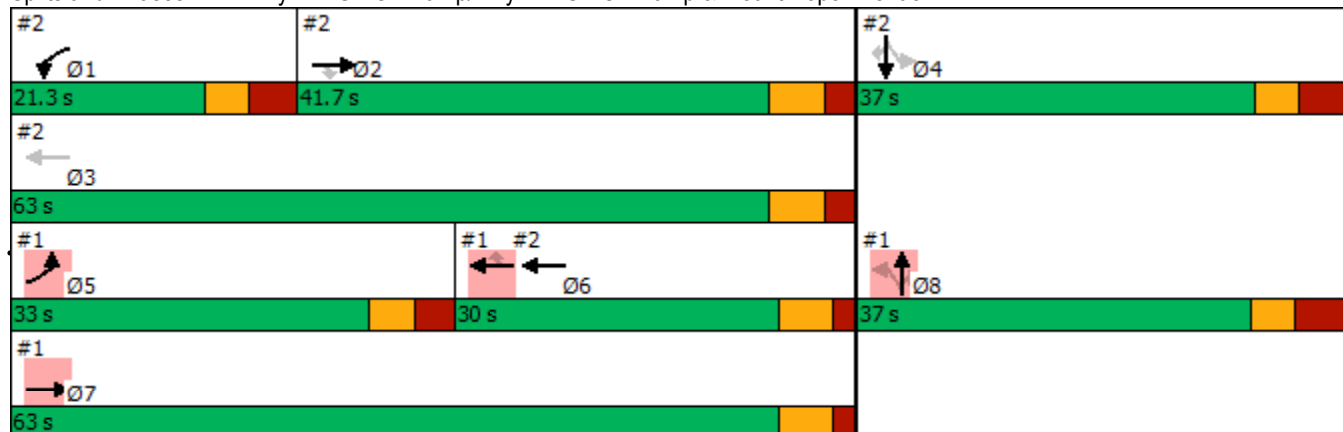
Intersection LOS: C

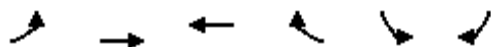
Intersection Capacity Utilization 66.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 2: Hwy 111 SB On-Ramp/Hwy 111 SB Off-Ramp & Mount Hope Avenue



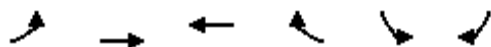


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	64	935	390	191	132	44
Future Volume (Veh/h)	64	935	390	191	132	44
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	70	1016	424	208	143	48
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh						
Upstream signal (m)			238			
pX, platoon unblocked	0.96				0.96	0.96
vC, conflicting volume	424				1580	424
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	383				1583	383
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				0	92
cM capacity (veh/h)	1132				108	640
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	70	1016	424	208	143	48
Volume Left	70	0	0	0	143	0
Volume Right	0	0	0	208	0	48
cSH	1132	1700	1700	1700	108	640
Volume to Capacity	0.06	0.60	0.25	0.12	1.32	0.08
Queue Length 95th (m)	1.6	0.0	0.0	0.0	78.6	1.9
Control Delay (s)	8.4	0.0	0.0	0.0	269.7	11.1
Lane LOS	A				F	B
Approach Delay (s)	0.5		0.0		204.7	
Approach LOS					F	
Intersection Summary						
Average Delay			20.8			
Intersection Capacity Utilization			63.2%		ICU Level of Service	B
Analysis Period (min)			15			

Mount Hope Development TIS

3: Mount Hope Avenue & Site Access

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DHV (2034) with site (20%) - AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	21	275	930	61	166	55
Future Volume (vph)	21	275	930	61	166	55
Satd. Flow (prot)	1770	1827	1827	1583	1770	1583
Flt Permitted	0.140				0.950	
Satd. Flow (perm)	261	1827	1827	1583	1770	1509
Satd. Flow (RTOR)				44		60
Lane Group Flow (vph)	23	299	1011	66	180	60
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Total Split (s)	84.0	84.0	84.0	84.0	26.0	26.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effect Green (s)	51.1	51.1	51.1	51.1	13.8	13.8
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.18	0.18
v/c Ratio	0.13	0.25	0.84	0.06	0.57	0.19
Control Delay	7.1	5.9	17.8	2.4	40.1	11.5
Queue Delay	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	7.1	5.9	17.9	2.4	40.1	11.5
LOS	A	A	B	A	D	B
Approach Delay		6.0	16.9		32.9	
Approach LOS		A	B		C	
Queue Length 50th (m)	1.0	15.0	94.9	0.9	22.8	0.0
Queue Length 95th (m)	4.6	31.2	192.5	5.1	60.8	11.7
Internal Link Dist (m)		255.3	43.3		269.1	
Turn Bay Length (m)	30.0			40.0	40.0	
Base Capacity (vph)	240	1681	1681	1460	482	454
Starvation Cap Reductn	0	0	47	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.18	0.62	0.05	0.37	0.13

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 77.5

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 17.1

Intersection LOS: B

Intersection Capacity Utilization 70.3%

ICU Level of Service C

Analysis Period (min) 15

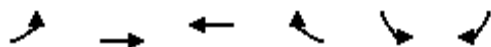
Splits and Phases: 3: Mount Hope Avenue & Site Access

84 s	26 s
84 s	

Mount Hope Development TIS

3: Mount Hope Avenue & Site Access

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DHV (2034) with site (20%) - PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	51	935	390	153	106	35
Future Volume (vph)	51	935	390	153	106	35
Satd. Flow (prot)	1770	1845	1845	1583	1770	1583
Flt Permitted	0.509				0.950	
Satd. Flow (perm)	936	1845	1845	1583	1770	1513
Satd. Flow (RTOR)				166		38
Lane Group Flow (vph)	55	1016	424	166	115	38
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Total Split (s)	74.0	74.0	74.0	74.0	26.0	26.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effect Green (s)	51.5	51.5	51.5	51.5	12.6	12.6
Actuated g/C Ratio	0.73	0.73	0.73	0.73	0.18	0.18
v/c Ratio	0.08	0.75	0.31	0.14	0.36	0.13
Control Delay	5.0	13.3	5.9	1.2	33.1	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.0	13.3	5.9	1.2	33.1	11.7
LOS	A	B	A	A	C	B
Approach Delay		12.9	4.5		27.8	
Approach LOS		B	A		C	
Queue Length 50th (m)	2.1	80.9	19.7	0.0	13.2	0.0
Queue Length 95th (m)	7.6	197.9	46.9	6.1	36.9	8.7
Internal Link Dist (m)		255.3	43.3		269.1	
Turn Bay Length (m)	30.0			40.0	40.0	
Base Capacity (vph)	858	1691	1691	1465	539	487
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.06	0.60	0.25	0.11	0.21	0.08

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 70.1

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 11.4

Intersection LOS: B

Intersection Capacity Utilization 69.9%

ICU Level of Service C

Analysis Period (min) 15

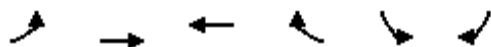
Splits and Phases: 3: Mount Hope Avenue & Site Access



Mount Hope Development TIS

3: Mount Hope Avenue & Site Access

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DHV (2034) with site (0%) - AM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	26	275	930	77	207	69
Future Volume (vph)	26	275	930	77	207	69
Satd. Flow (prot)	1770	1827	1827	1583	1770	1583
Flt Permitted	0.129				0.950	
Satd. Flow (perm)	240	1827	1827	1583	1770	1583
Satd. Flow (RTOR)				56		75
Lane Group Flow (vph)	28	299	1011	84	225	75
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Total Split (s)	84.0	84.0	84.0	84.0	26.0	26.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effect Green (s)	51.2	51.2	51.2	51.2	15.3	15.3
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.19	0.19
v/c Ratio	0.18	0.25	0.86	0.08	0.66	0.20
Control Delay	8.8	6.4	19.7	2.5	43.3	10.5
Queue Delay	0.0	0.0	0.1	0.0	0.0	0.0
Total Delay	8.8	6.4	19.7	2.5	43.3	10.5
LOS	A	A	B	A	D	B
Approach Delay		6.6	18.4		35.1	
Approach LOS		A	B		D	
Queue Length 50th (m)	1.5	16.8	106.4	1.4	31.6	0.0
Queue Length 95th (m)	5.7	31.2	192.5	6.0	#79.2	12.7
Internal Link Dist (m)		255.3	43.3		269.1	
Turn Bay Length (m)	30.0			40.0	40.0	
Base Capacity (vph)	218	1662	1662	1445	475	480
Starvation Cap Reductn	0	0	47	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.18	0.63	0.06	0.47	0.16

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 79.3

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.86

Intersection Signal Delay: 19.1

Intersection LOS: B

Intersection Capacity Utilization 70.4%

ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

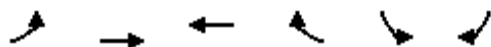
Splits and Phases: 3: Mount Hope Avenue & Site Access



Mount Hope Development TIS

3: Mount Hope Avenue & Site Access

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DHV (2034) with site (0%) - PM Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	64	935	390	191	132	44
Future Volume (vph)	64	935	390	191	132	44
Satd. Flow (prot)	1770	1845	1845	1583	1770	1583
Flt Permitted	0.498				0.950	
Satd. Flow (perm)	928	1845	1845	1583	1770	1583
Satd. Flow (RTOR)				208		48
Lane Group Flow (vph)	70	1016	424	208	143	48
Turn Type	Perm	NA	NA	Perm	Prot	Perm
Protected Phases		2	6		4	
Permitted Phases	2			6		4
Total Split (s)	74.0	74.0	74.0	74.0	26.0	26.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effect Green (s)	47.7	47.7	47.7	47.7	12.6	12.6
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.17	0.17
v/c Ratio	0.12	0.84	0.35	0.19	0.47	0.15
Control Delay	5.3	17.4	6.5	1.2	35.1	11.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.3	17.4	6.5	1.2	35.1	11.3
LOS	A	B	A	A	D	B
Approach Delay		16.7	4.8		29.1	
Approach LOS		B	A		C	
Queue Length 50th (m)	2.9	86.1	21.0	0.0	16.3	0.0
Queue Length 95th (m)	8.7	184.6	43.9	6.3	44.8	9.7
Internal Link Dist (m)		255.3	43.3		269.1	
Turn Bay Length (m)	30.0			40.0	40.0	
Base Capacity (vph)	844	1678	1678	1458	504	485
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.61	0.25	0.14	0.28	0.10

Intersection Summary

Cycle Length: 100

Actuated Cycle Length: 72.7

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.84

Intersection Signal Delay: 14.0

Intersection LOS: B

Intersection Capacity Utilization 67.5%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 3: Mount Hope Avenue & Site Access

