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APPENDICES

1 INTRODUCTION

Background

West Bedford is being developed as a Master Planned neighbourhood in Nova Scotia. There are several sub areas within West Bedford, this Traffic Impact Study is representative of Sub Areas 1 and 12 at the northern boundary of West Bedford.

Several Transportation Studies have been completed for the area including, but not limited to, *Bedford West Master Plan: Transportation Study* (Delphi-MRC, 2004), *Larry Uteck Interchange Traffic Impact Study* (CBCL, 2008), *Bedford West Master Plan Transportation Study Update* (HRM, 2014), *Broad Street Intersections Traffic Modeling Study* (Griffin, 2015), *Broad Street Traffic Operational Review – Forecasted Volumes* (Griffin, 2015), as well as Traffic Impact Statements and Warrant Analyses for many of the development phases (WSP).

Plans are currently being prepared for the development of Sub Areas 1 and 12, a proposed mixed-use development area bound by Hammonds Plains Road and Larry Uteck Boulevard (see Figure 1). While not all of the individual property access points have been determined, the proposed site configuration, access roads and driveways are currently being prepared, as shown in Figure 2. WSP Canada Inc. has been retained to complete a Traffic Impact Study (TIS), which focuses on impact to the primary Study Intersections identified in Figure 1.

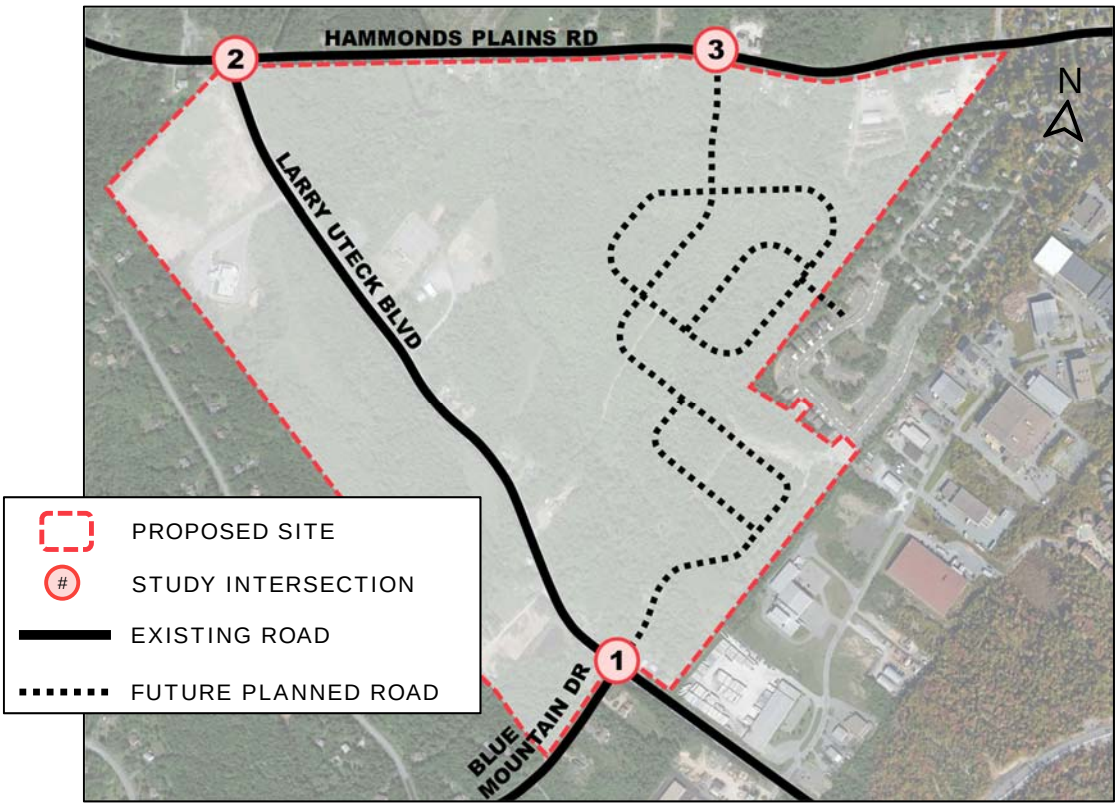


Figure 1 – Study Area

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 2030 background weekday AM and PM peak hourly volumes for Study Intersection that do not include trips generated by the proposed site.
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 2030 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.

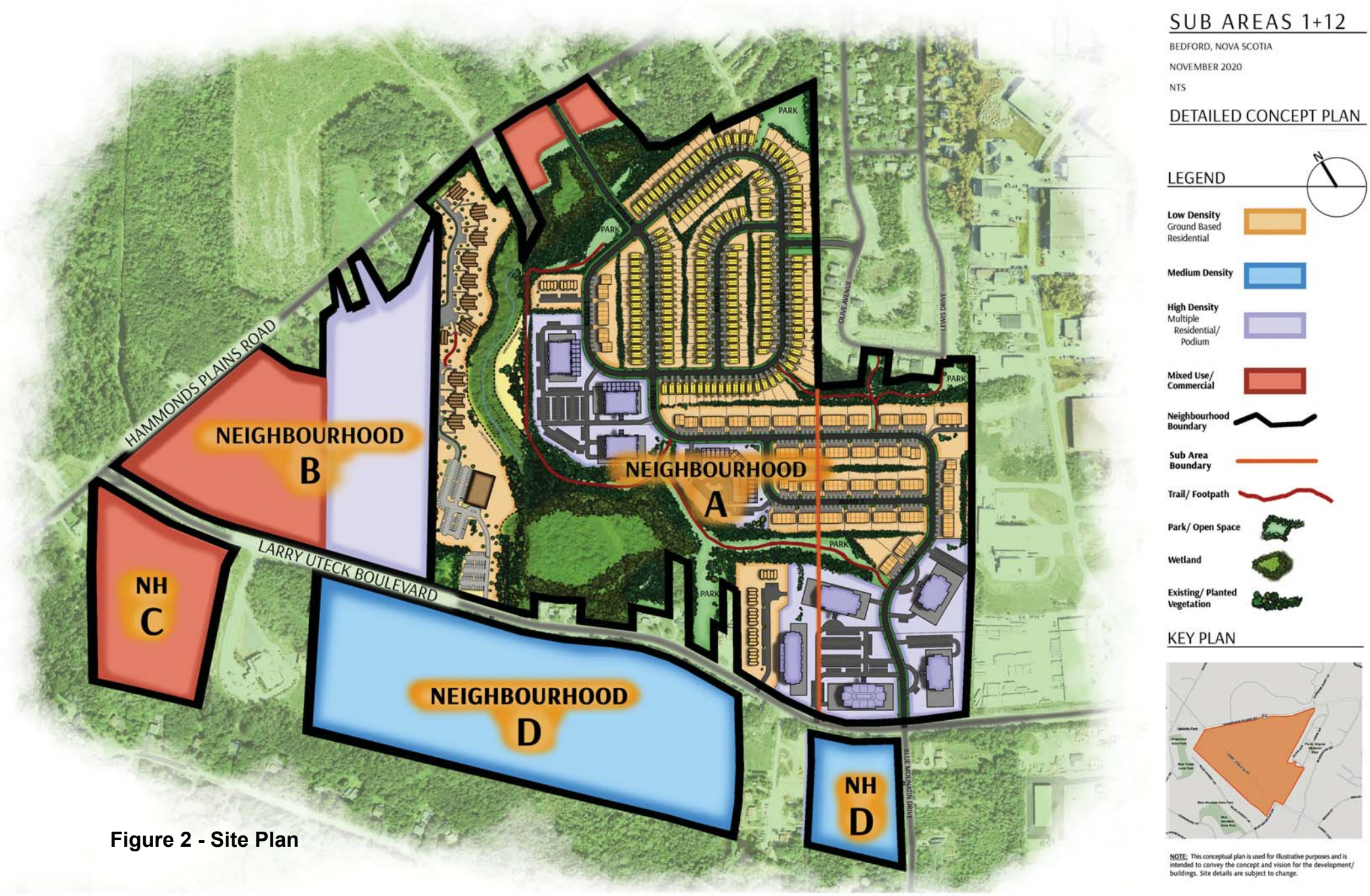


Figure 2 - Site Plan

2 STUDY AREA DESCRIPTIONS

Description of Proposed Development

The proposed mixed-use development is expected to be constructed on the undeveloped lands bound by Hammonds Plains Road and Larry Uteck Boulevard.

Sub Areas 1 and 12 are expected to consist of four (4) neighbourhoods, as shown in Figure 3. The proposed mixed-use development is expected to cover approximately 213 acres of land totalling approximately 2,111 apartment units, 428 single family dwellings, 26,500 ft^2 of institutional development and 128,700 ft^2 of commercial development. Sub Areas 1 and 12 are anticipated to be constructed and occupied by 2030.

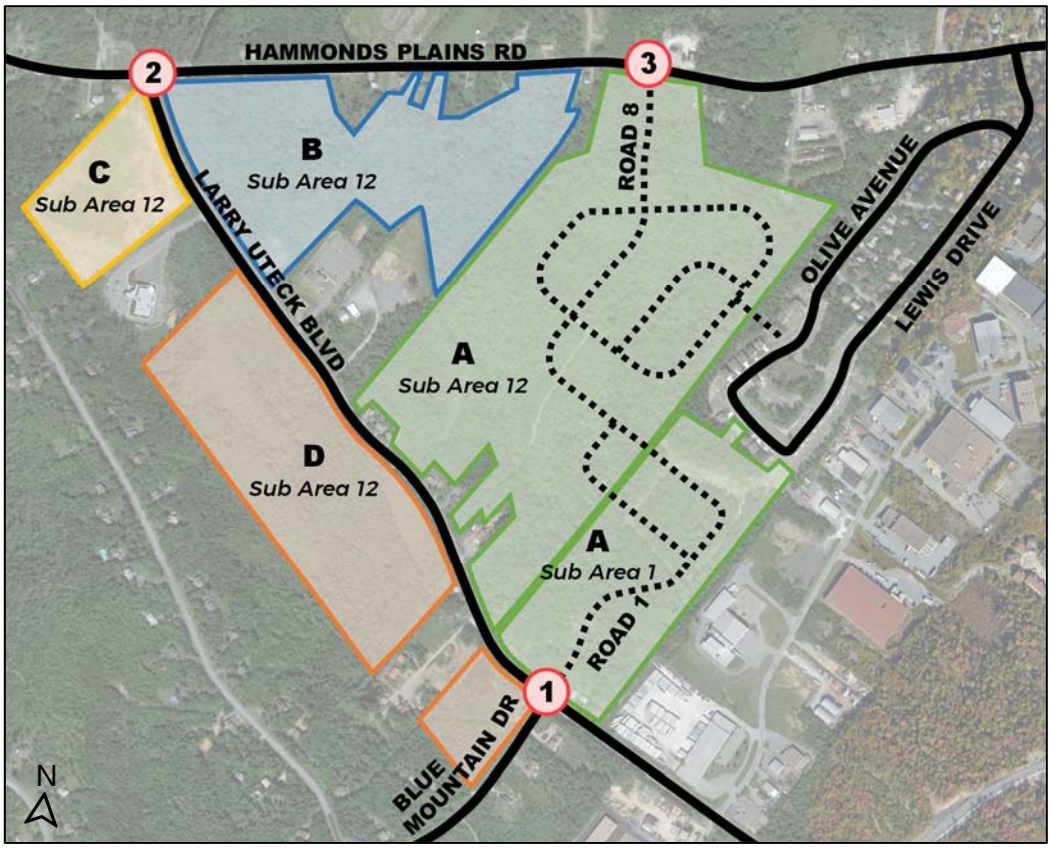


Figure 3 – Proposed Neighbourhoods

Proposed Site Access

It is expected that each neighbourhood will consist of a number of properties and will be provided with access to Larry Uteck Boulevard and Hammonds Plains Road.

Vehicular access to Neighbourhood A is expected from a planned access road across from Blue Mountain Drive (Road 1) and an additional planned access road (Road 8) via Hammonds Plains Road. Neighbourhood A is supplemented with a roadway connection to Olive Avenue and may also be indirectly accessed using Road 1 through to Larry Uteck Boulevard. In addition, a driveway is expected on Larry Uteck Boulevard to access a cluster of single family townhouse dwellings.

Vehicular access to Neighbourhood B is expected to be distributed between access driveways on Hammonds Plains Road and Larry Uteck Boulevard. Location of access for the area will be determined through further site plan development.

Vehicular access to Neighbourhood C and Neighbourhood D is expected to be distributed between access driveways on Larry Uteck Boulevard. Location of access for the area will be determined through further site plan development.

Existing Road Descriptions

Hammonds Plains Road is an arterial road that runs east-west approximately 19 km between St. Margarets Bay Road and the Bedford Highway, otherwise known as NS Route 213 between Upper Tantallon and NS Trunk 2. In the vicinity of the proposed development, Hammonds Plains Road has a two-lane cross section with paved shoulders and a 70 km/h posted speed limit.

Larry Uteck Boulevard is an arterial road that runs northwest-southeast approximately 7.5 km between Hammonds Plains Road and the Bedford Highway. In the vicinity of the proposed development, Larry Uteck Boulevard has a two-lane cross section with unpaved shoulders and an 80 km/h posted speed limit. With ongoing development of West Bedford, it is likely that this speed limit will be reviewed and reduced over the study horizon.

Blue Mountain Drive is a local residential street that extends approximately 1 km southwest from Larry Uteck Boulevard to Terradore Lane. Blue Mountain Drive consists of one travel lane in each direction and a 50 km/h posted speed limit.

Olive Avenue is a local loop road that connects to Lewis Drive on the north and south boundaries. Olive Avenue consists of a two-lane cross section with sidewalk on the east side. The posted speed limit is 50 km/h.

Existing & Planned Intersection Descriptions

Intersection 1 – Larry Uteck Boulevard and Blue Mountain Drive is a 3-leg unsignalized intersection with stop control on Blue Mountain Drive (see Photo 1). All of the approaches consist of a single travel lane. With Sub Areas 1 and 12 development, an access road (Road 1) is planned to extend from the existing intersection into Neighbourhood A.

Photo 1 – Larry Uteck Boulevard at Blue Mountain Drive

Intersection 2 – Hammonds Plains Road and Larry Uteck Boulevard is a 3-leg signalized intersection with pedestrian crosswalks on the south and east legs (see Photo 2). The eastbound approach consists of a through lane and a right turn lane. The northbound approach consists of a left turning lane and a right channelized turn. The westbound approach consists of a through lane and a left turn lane.

Existing & Planned Intersection Descriptions (Continued)

Photo 2 – Hammonds Plains Road at Larry Uteck Boulevard

Intersection 3 – Hammonds Plains Road and Road 8 is a planned 3-leg stop-controlled intersection with free flow on Hammonds Plains Road. The available stopping sight distance appears adequate for a driveway onto Hammonds Plains Road, as shown in Photo 3 and 4.

Photo 3 – Looking west (to the left) on Hammonds Plains Road from Road 8

Photo 4 – Looking west (to the left) on Hammonds Plains Road from Road 8

Turning Movement Counts

Turning movement counts were obtains from previously completed Transportation Studies in the area. The turning movement counts for Larry Uteck Boulevard at Blue Mountain Drive and Hammonds Plains Road at Larry Uteck Boulevard were collected in April 2018. The turning movement counts have been tabulated in Tables A-1 and A-2, Appendix A, with peak hour volumes indicated by shaded areas.

Annual Growth

The peak hour volumes on the Study Intersections have been increased by an annual growth rate of 1.0% to project background traffic volumes. This growth rate was determined based on review of previous studies, historical background volume information and is considered typical for this area.

Projected 2020 Traffic Volumes

The projected 2020 AM and PM peak hour volumes represent estimates of the current traffic volumes and are shown diagrammatically in Figure A-1, Appendix A.

Projected 2030 Background Traffic Volumes

The projected 2030 AM and PM peak hour background volumes are shown diagrammatically in Figure A-2, Appendix A. It should be noted that the volumes have been rounded to the nearest multiple of 5.

HRM Transit currently operates Route 433 (Tantallon) past the proposed development with additional routes surrounding the area such as Route 90 (Larry Uteck), Route 71 (Hemlock Ravine) and Route 194 (West Bedford Express).

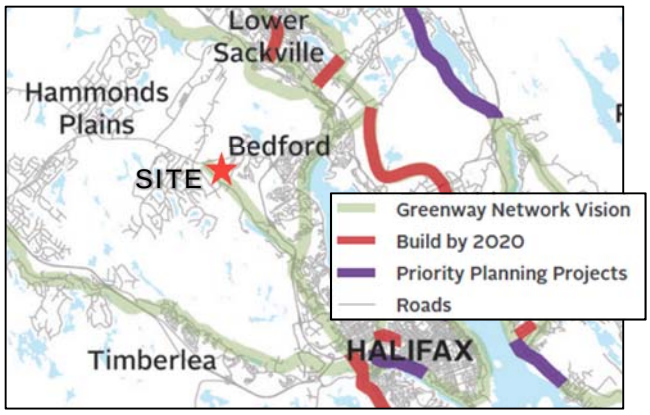


Figure 4 – Priority Connections for Multi-Use Pathways (IMP, 2017)

Although the existing site is not currently supplemented with active transportation (AT) facilities, HRM has plans to improve non-auto connectivity in the area. Integrated Mobility Plan (*IMP*) has identified Larry Uteck Boulevard, between the Highway 102 interchange and Hammonds Plains Road, as a priority connection for multi-use pathways. An active transportation greenway is planned near to the proposed site (see Figure 4).

3 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Anticipated Land Use for Proposed Development (Total)

The proposed mixed-use development is expected to include approximately:

- 428 Single Family Dwellings;
- 2,111 Mid-Ride Apartment Units;
- 26,500 ft^2 of Institutional Development; and,
- 128,700 ft^2 of Commercial Development.

For the purposes of this study, the following land use breakdowns have been used:

- 428 Single Family Dwellings;
- 2,111 Mid-Ride Apartment Units;
- 72,700 ft^2 of Specialty Retail;
- 51,000 ft^2 of General Office;
- 3,000 ft^2 of Convenience Market with Gasoline Pumps; and,
- 2,000 ft^2 of Fast-Food Restaurant without Drive-Through Window.

Trip generation estimates were not prepared for the Institutional Development since it is currently operational in the area, therefore, the trips generated by the Institutional Development are considered to be captured in the traffic counts collected in April 2018.

Estimation of Site Generated Trips

When using the published rates in *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.

Trips generated by Single Family Dwellings (Land Use 210) and Mid-Rise Apartment Units (Land Use 221), are estimated for the AM and PM peak hours of traffic by the number of units. Trip generated by General Office (Land Use 710), Speciality Retail (Land Use 826), Convenience Market with Gasoline Pumps (Land Use 853) and Fast-Food Restaurant without Drive-Through Window (Land Use 933) are estimated for the AM and PM peak hours of traffic by the leasable square footage available.

Trip generation estimates for Single Family Dwellings, Mid-Rise Apartment Units, General Office, Convenience Market with Gasoline Pumps and Fast-Food Restaurant without Drive-Through Window were prepared using published rates from *Trip Generation Manual, 10th Edition* (Institute of Transportation Engineers, Washington, 2017), and estimates for Speciality Retail were prepared using published rates from *Trip Generation Manual, 9th Edition* (Institute of Transportation Engineers, Washington, 2012). Speciality Retail is no longer listed as a potential land usage in the 10th Edition, instead more specific retail descriptions are provided (e.g. supermarket, apparel store, pet supply store, etc.). Detailed breakdowns of the commercial space within the proposed mixed-use development was unavailable, therefore, more general scenarios were explored.

Two types of trips are included in the external trips that will be generated by the proposed development:

- ***Pass-by trips*** are those which are made as 'intervening opportunity' stops to commercial and retail land uses by vehicle trips already passing by the site. Although these trips will be included in the site access volumes to the site, they will not increase the overall traffic volumes on Study Area roads. Diverted link and pass-by rates were determined using *Trip Generation Handbook, 3nd Edition* (Institute of Transportation Engineers, 2017) and local knowledge of the area.
- ***Primary trips*** for this study include all external site generated trips that are not considered pass-by trips.

Reductions to Trip Generation Estimates

Sub Areas 1 and 12 consists of four (4) neighbourhoods, which include high density areas with good access to transit service, as well as internal active transportation connections to employment and shopping opportunities in the 128,700 ft^2 of commercial areas proposed for the development.

The Halifax *Integrated Mobility Plan* has a 26% target for non-auto trips within the Suburban Region by 2031. Within the 2030 timeframe that Sub Areas 1 and 12 are expected to be occupied. A slightly more conservative reduction was considered at 20% for non-auto trips generated by residential, office, and specialty retail land uses has been used to account for all transit, bicycle and walking trips. Similarly, 10% reduction has also been used for trips generated by the convenience market, gas bar and restaurant land uses to account for cross shopping and on-site synergies between those land uses and the other land uses in the neighbourhood.

Trip Generation Estimates

Since the development is expected to consist of mixed land uses with different access configuration options to the street network, trip generation estimates were completed by zone, which were based on the designated neighbourhoods and land uses. The zones considered are:

- Neighbourhood A (Sub Area 1);
- Neighbourhood A (Sub Area 12);
- Neighbourhood B;
- Neighbourhood C; and,
- Neighbourhood D.

Sub Area 1 Portion of Neighbourhood A – The trip generation estimates for Neighbourhood A (Sub Area 1) are summarized in Table 1. It is estimated that Neighbourhood A (Sub Area 1) will generate:

- 180 two-way trips (46 entering and 133 exiting) during the AM peak hour; and,
- 229 two-way trips (141 entering and 88 exiting) during the PM peak hour.

Sub Area 12 Portion of Neighbourhood A – The trip generation estimates for Neighbourhood A (Sub Area 12) are summarized in Table 2.

During the AM peak hour, it is estimated that Neighbourhood A (Sub Area 12) will generate:

- 236 two-way primary vehicle trips (66 entering and 170 exiting); and,
- 8 two-way pass-by vehicle trips (4 entering and 4 exiting).

During the PM peak hour, it is estimated that Neighbourhood A (Sub Area 12) will generate:

- 312 two-way primary vehicle trips (186 entering and 126 exiting); and,
- 14 two-way pass-by vehicle trips (7 entering and 7 exiting).

Neighbourhood B – The trip generation estimates for Neighbourhood B are summarized in Table 3.

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

- 156 two-way primary vehicle trips (82 entering and 74 exiting); and,
- 94 two-way pass-by vehicle trips (47 entering and 47 exiting).

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

- 195 two-way primary vehicle trips (92 entering and 103 exiting); and,
- 124 two-way pass-by vehicle trips (62 entering and 62 exiting).

Neighbourhood C – The trip generation estimates for Neighbourhood C are summarized in Table 4.

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

- 43 two-way primary vehicle trips (32 entering and 11 exiting); and,
- 10 two-way pass-by vehicle trips (5 entering and 5 exiting).

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

- 59 two-way primary vehicle trips (18 entering and 41 exiting); and,
- 22 two-way pass-by vehicle trips (11 entering and 11 exiting).

Neighbourhood D – The trip generation estimates for Neighbourhood D are summarized in Table 5. It is estimated that Neighbourhood D will generate:

- 237 two-way trips (62 entering and 175 exiting) during the AM peak hour; and,
- 293 two-way trips (179 entering and 114 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates for Sub Area 1 Portion of Neighbourhood A

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
NEIGHBOURHOOD A (Sub Area 1)									
Single Family Homes (Land Use 210)	106 Units	0.19	0.56	0.62	0.37	20	59	66	39
Mid-Rise Apartments (Land Use 221)	454 Units	Equations from Pages 74 and 75 (Residential - Land Uses 200 - 299)				39	112	115	74
Removal of Existing Single Family Homes[4] (Land Use 210)	8 Units	0.19	0.56	0.62	0.37	-1	-4	-5	-3
Trip Generation Estimates for Neighbourhood A (Sub Area 1)						58	167	176	110
20% Reduction for Non-Auto Trips[5]						12	33	35	22
Primary Trip Estimate for Neighbourhood A (Sub Area 1)						46	134	141	88

NOTES:
1. Land Use Code 210 and 221 are from Trip Generation, 10th Edition, (Institute of Transportation Engineers, Washington, 2017).
2. 'Number of Residential Units' for Single Family Housing and Mid-Rise Apartment Buildings.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. Currently on the north side of Larry Uteck Boulevard, along frontage of proposed Neighbourhood A (Sub Area 1), there are 8 single family homes that are expected to be replaced with high density apartment buildings. The existing single family homes were applied as a credit to the trip generation estimate in order to determine the number of new trips generated by the redevelopment.
5. A 20% reduction for non-auto trips generated by neighbourhood land uses has been used to account for transit, cycling and walking trips.

Table 2 – Trip Generation Estimates for Sub Area 12 Portion of Neighbourhood A

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
NEIGHBOURHOOD A (Sub Area 12)									
Single Family Homes (Land Use 210)	322 Units	0.19	0.56	0.62	0.37	20	59	66	39
Mid-Rise Apartments (Land Use 221)	593 Units	Equations from Pages 74 and 75 (Residential - Land Uses 200 - 299)				51	145	149	95
Specialty Retail[4] (Land Use 826)[5]	15.0 KGLA	0.76	0.60	1.19	1.52	11	9	18	23
Trip Generation Estimates for Neighbourhood A (Sub Area 12)						82	213	233	157
20% Reduction for Non-Auto Trips[6]						16	43	47	31
35% Reduction for Pass-By Trips[7]						4	4	7	7
Primary Trip Estimate for Neighbourhood A (Sub Area 12)						66	170	186	126

NOTES:

1. Land Use Code 210 and 221 are from Trip Generation, 10th Edition, (Institute of Transportation Engineers, Washington, 2017) and Land Use Code 826 is from Trip Generation, 9th Edition, (Institute of Transportation Engineers, Washington, 2012).
2. 'Number of Residential Units' for Single Family Housing and Mid-Rise Apartment Buildings. 'Gross Leasable Area x 1000 SF' for Specialty Retail.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. The Specialty Retail (ITE Land Use 826) rate for 'Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 PM' has been used. Since there is no published rate for the AM peak hour of adjacent street traffic for this land use, and since AM peak hour trips to specialty retail are generally low, AM trip rates have been assumed to be 50% of the PM rate with reversal of the directional split.
5. Commercial uses associated with Neighbourhood A (Sub Area 12) have yet to be identified, therefore, the commercial space was assumed to be Specialty Retail.
6. A 20% reduction for non-auto trips generated by neighbourhood land uses has been used to account for transit, cycling and walking trips.
7. Trip Generation Handbook, 3rd Edition, (Institute of Transportation Engineers, Washington, 2017) indicates an average of 34% pass-by trips for a Variety Store (Land Use 814) during the PM peak hour and there is no published rate for the AM peak hour. A 35% reduction in Specialty Retail trips was assumed for Neighbourhood A during the AM and PM peak hour, which accounts for pass-by trips on Hammonds Plains Road.

Table 3 – Trip Generation Estimates for Neighbourhood B

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
NEIGHBOURHOOD B (Sub Area 12)									
Mid-Rise Apartments (Land Use 221)	159 Units	Equations from Pages 74 and 75 (Residential - Land Uses 200 - 299)				14	40	42	27
General Office (Land Use 710)	25.0 KGLA	1.00	0.16	0.18	0.97	25	4	5	24
Convenience Market with Gasoline Pumps (Land Use 853)	3.0 KGLA	20.30	20.30	24.65	24.65	61	61	74	74
Fast-Food Restaurant without Drive-Through Window (Land Use 933)	2.0 KGLA	15.06	10.04	14.17	14.17	30	20	28	28
Specialty Retail[4] (Land Use 826)[5]	31.7 KGLA	0.76	0.60	1.19	1.52	20	16	31	40
Trip Generation Estimates for Neighbourhood B						150	141	180	193
20% Reduction for Non-Auto Trips[6]						12	12	16	18
10% Reduction for Internal Trips[7]						9	8	10	10
45% Reduction for Commercial Pass-By Trips[8]						47	47	62	62
Primary Trip Estimate for Neighbourhood B						82	74	92	103

NOTES:

1. Land Use Code 210, 221, 710, 853 and 933 are from Trip Generation, 10th Edition, (Institute of Transportation Engineers, Washington, 2017) and Land Use Code 826 is from Trip Generation, 9th Edition, (Institute of Transportation Engineers, Washington, 2012).
2. 'Number of Residential Units' for Single Family Housing and Mid-Rise Apartment Buildings. 'Gross Leasable Area x 1000 SF' for General Office, Convenience Market with Gasoline Pumps, Fast-Food Restaurant without Drive-Through Window and Specialty Retail.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. The Specialty Retail (ITE Land Use 826) rate for 'Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 PM' has been used. Since there is no published rate for the AM peak hour of adjacent street traffic for this land use, and since AM peak hour trips to specialty retail are generally low, AM trip rates have been assumed to be 50% of the PM rate with reversal of the directional split.
5. Commercial uses associated with Neighbourhood B have yet to be identified, therefore, the commercial space was assumed to be a combination of General Office, Specialty Retail, Convenience Market with Gasoline Pumps and Fast-Food Restaurant without Drive-Through Window.
6. A 20% reduction for non-auto trips generated by residential, office, and specialty retail land uses has been used to account for transit, cycling and walking trips.
7. A 10% reduction has be used for trips generated by the convenience market and restaurant land uses to account for cross shopping and on-site synergies between those land uses and the other land uses in the neighbourhood.
8. Trip Generation Handbook, 3rd Edition, (Institute of Transportation Engineers, Washington, 2017) indicates the average pass-by trips for a Convenience Market with Gasoline Pumps (Land Use 853) is 63% during the AM peak hour and is 66% during the PM peak hour. It also indicates an average of 50% pass-by trips for a Fast-Food Restaurant with a Drive-Through Window (Land Use 934), however, a drive-through is not expected at this location, therefore, it was estimated that approximately half (25%) of trips generated to the site would be considered pass by trips. Lastly, it indicates an average of 34% pass-by trips for a Variety Store (Land Use 814). A weighted average of the associated pass-by rates was calculated to be 49%, therefore, a 45% reduction in commercial trips was assumed for Neighbourhood B, which accounts for pass-by trips on Larry Uteck Boulevard and diverted trips from Hammonds Plains Road.

Table 4 – Trip Generation Estimates for Neighbourhood C

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
NEIGHBOURHOOD C (Sub Area 12)									
General Office (Land Use 710)	26.0 KGLA	1.00	0.16	0.18	0.97	26	4	5	25
Specialty Retail[4] (Land Use 826)[5]	26.0 KGLA	0.76	0.60	1.19	1.52	20	16	31	40
Trip Generation Estimates for Neighbourhood C						46	20	36	65
20% Reduction for Non-Auto Trips[6]						9	4	7	13
30% Reduction for Commercial Pass-By Trips[7]						5	5	11	11
Primary Trip Estimate for Neighbourhood C						32	11	18	41

NOTES:
1. Land Use Code 710 is from Trip Generation, 10th Edition, (Institute of Transportation Engineers, Washington, 2017) and Land Use Code 826 is from Trip Generation, 9th Edition, (Institute of Transportation Engineers, Washington, 2012).
2. 'Gross Leasable Area x 1000 SF' for General Office and Specialty Retail.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. The Specialty Retail (ITE Land Use 826) rate for 'Peak Hour of Adjacent Street Traffic, One Hour Between 4 and 6 PM' has been used. Since there is no published rate for the AM peak hour of adjacent street traffic for this land use, and since AM peak hour trips to specialty retail are generally low, AM trip rates have been assumed to be 50% of the PM rate with reversal of the directional split.
5. Commercial uses associated with Neighbourhood C have yet to be identified, therefore, the commercial space was assumed to be 50% Specialty Retail and 50% General Office.
6. A 20% reduction for non-auto trips generated by office and specialty retail land uses has been used to account for transit, cycling and walking trips.
8. Trip Generation Handbook, 3rd Edition, (Institute of Transportation Engineers, Washington, 2017) indicates an average of 34% pass-by trips for a Variety Store (Land Use 814), therefore, a 30% reduction in commercial trips was assumed for Neighbourhood C, which accounts for pass-by trips on Larry Uteck Boulevard and diverted trips from Hammonds Plains Road.

Table 5 – Trip Generation Estimates for Neighbourhood D

Land Use[1]	Units[2]	Trip Generation Rates[3]				Trip Generation Estimates[3]			
		AM Peak		PM Peak		AM Peak		PM Peak	
		In	Out	In	Out	In	Out	In	Out
NEIGHBOURHOOD D (Sub Area 12)									
Mid-Rise Apartments (Land Use 221)	905 Units	Equations from Pages 74 and 75 (Residential - Land Uses 200 - 299)				77	219	224	143
20% Reduction for Non-Auto Trips[4]						15	44	45	29
Primary Trip Estimate for Neighbourhood D						62	175	179	114

NOTES:
1. Land Use Code 221 is from Trip Generation, 10th Edition, (Institute of Transportation Engineers, Washington, 2017).
2. 'Number of Residential Units' for Mid-Rise Apartment Buildings.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. A 20% reduction for non-auto trips generated has been used for all land uses to account for transit, cycling and walking trips.

Trip Distribution and Assignment

External trips generated by the proposed development were assigned to the roadway network based on review of past studies and WSP's local knowledge of the area considering major trip origins and destinations in the region.

Northeast	40%	(Bedford, Highway 102, Lower Sackville, Burnside)
South	50%	(Highway 102, Halifax, Bayers Lake)
Northwest	10%	(Hammonds Plains, Tantallon)

Trips were assigned to access points along Hammonds Plains Road and Larry Uteck Boulevard based on the development concept plan and the location of access roads and driveways.

Pass-by trips generated by the proposed development were assigned to the roadway based on the turning movement counts available.

Projected 2030 Traffic Volumes with Site Generated Trips

Trips generated by the proposed site (Figure A-3, Appendix A) have been added to the 2030 background traffic volumes (Figure A-2, Appendix A) to provide projected 2030 AM and PM peak hourly volumes that include site generated trips. The 2030 traffic volumes with the site generated trips are illustrated diagrammatically in Figure A-4, Appendix A.

4 INTERSECTION OPERATIONAL ANALYSIS

Intersection Level of Service (LOS) Analyses was completed to estimate how the Study Intersections are currently preforming and how they may be expected to operate in the future without and with site generated trips. This section of the report addresses how turning 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.

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.

Intersection Capacity Analysis Results

Synchro 10.0 or *Sidra 6.1* software were used to evaluate the performance of the Study Intersections for the following scenarios:

A. Existing 2020 AM and PM peak hour volumes;
B. Projected 2030 AM and PM peak hour volumes without site development; and,
C. Projected 2030 AM and PM peak hour volumes with site development.

Detailed results of the analyses are included in Appendix C.

Warrant/ Intersection Capacity Analysis Results

Intersection 1 – Larry Uteck Boulevard and Blue Mountain Drive/Road 1 (Table 6) – Based on the existing traffic control and lane configuration, traffic signal and left turn lane warrants were completed with respect to projected 2030 traffic volumes without and with site development. It was determined that:

- A northbound left turn lane is warranted without and with site development (Figure B-1, Appendix B);
- A southbound left turn lane is warranted with site development (Figure B-2, Appendix B); and,
- Traffic signals are not warranted without site development (Table B-1, Appendix B) but are warranted with site development (Table B-2, Appendix B).

The existing intersection (stop control) operates below capacity during the AM and PM peak hours. Without site development, the intersection is expected to continue operating at a satisfactory performance during the peak hours. Traffic signals become warranted with site development and the implementation of Road 1. With the additional turning lanes and traffic signals, the intersection is expected to operate within HRM guidelines.

Intersection 2 – Hammonds Plains Road and Larry Uteck Boulevard (Table 7 and Table 8) – Due to the existing traffic control and lane configuration, no additional warrants were conducted for this intersection prior to evaluating the operational performance.

The existing intersection is expected to operate within available capacity during the AM and PM peak hours. It should be noted that during the PM peak hour, the westbound through movement currently exceeds the HRM critical limit (v/c = 0.86) and the northbound left movement also experiences a high volume-to-capacity ratio (v/c = 0.87). By 2030, without site development, both movements are expected to nearly reach capacity. Minimal changes in the operational performance of this intersection are expected with the addition of Sub Areas 1 and 12.

Due to the exceeded capacity and movements beyond the HRM critical limit guidelines and continuous development in the area, this intersection was evaluated as a roundabout (Figure 5). The roundabout is expected to operate below capacity in 2030 without site development. Minimal changes in the operational performance of the roundabout are expected with the addition of Sub Areas 1 and 12. The roundabout is expected to operate within HRM guidelines.

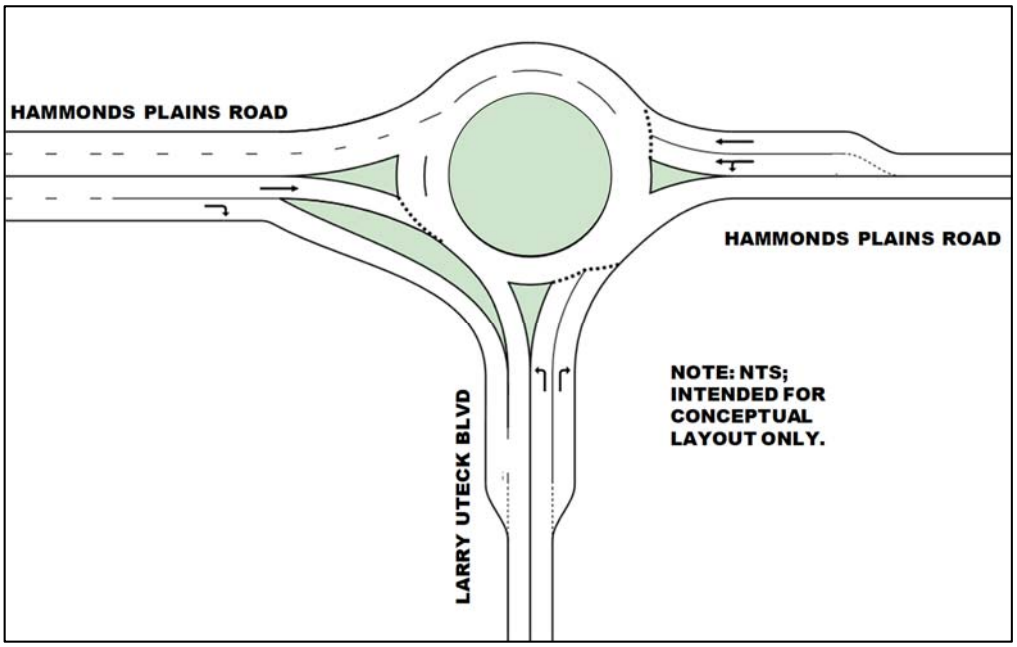


Figure 5 – Hammonds Plains Road at Larry Uteck Boulevard Roundabout Configuration

Intersection 3 – Hammonds Plains Road and Road 8 (Table 8) – Road 8 is a planned road to provide access to Sub Areas 1 and 12 development, therefore, this intersection was only evaluated with respect to projected 2030 traffic volumes with site development. It was determined that:

- A westbound left turn lane is warranted with site development (Figure B-2, Appendix B); and,
- Traffic signals are not warranted with site development (Table B-3, Appendix B).

With the implementation of a westbound left turn lane on Hammonds Plains Road, the intersection is expected to operate within HRM guidelines.

Table 6 – Intersection Capacity Analysis for Larry Uteck Boulevard at Blue Mountain Drive/Road 1

LOS Criteria	Control Delay (sec/veh), v/c Ratio and 95th %ile Queue (m) by Intersection Movement									Overall Intersection
	Blue Mountain Drive		Road 1		Larry Uteck Boulevard					
	EB-L	EB-TR	WB-L	WB-TR	NB-L	NB-T	NB-R	SB-L	SB-TR	Delay
2020 AM Peak Hour with **Existing Conditions** (Page C-1) - ***Stop Controlled***										
Delay	23.5				1.5			0.0		4.7
v/c	0.55				0.30			0.43		
Queue	25.5				0.9			0.0		
2020 PM Peak Hour with **Existing Conditions** (Page C-3) - ***Stop Controlled***										
Delay	13.0				4.4			0.0		3.8
v/c	0.16				0.71			0.21		
Queue	4.6				5.9			0.0		
2030 AM Peak Hour **without** Proposed Site (Page C-5) - ***Stop Controlled***										
Delay	33.3				9.7	0.0		0.0		6.6
v/c	0.69				0.05	0.13		0.49		
Queue	37.5				1.2	0.0		0.0		
2030 PM Peak Hour **without** Proposed Site (Page C-7) - ***Stop Controlled***										
Delay	14.3				9.1	0.0		0.0		2.6
v/c	0.20				0.23	0.41		0.24		
Queue	5.9				7.1	0.0		0.0		
2030 AM Peak Hour **with** Proposed Site (Page C-9) - ***Signalized***										
Delay	24.8		62.3	0.2	14.6	8.9		8.0	22.2	22.5
v/c	0.61		0.83	0.07	0.26	0.33		0.03	0.84	
Queue	47.4		46.9	0.0	11.4	53.7		3.9	245.5	
2030 PM Peak Hour **with** Proposed Site (Page C-12) - ***Signalized***										
Delay	8.7		29.5	0.5	10.4	16.0		9.6	7.1	13.0
v/c	0.27		0.41	0.09	0.47	0.79		0.23	0.42	
Queue	11.6		27.4	0.0	42.1	212.5		9.4	60.8	

Table 7 – Intersection Capacity Analysis for Hammonds Plains Road at Larry Uteck Boulevard (Signalized)

LOS Criteria	Control Delay (sec/veh), v/c Ratio and 95th %ile Queue (m) by Intersection Movement						Overall Intersection
	Hammonds Plains Road				Larry Uteck Boulevard		
	EB-T	EB-R	WB-L	WB-T	NB-L	NB-R	Delay
2020 AM Peak Hour with **Existing Conditions** (Page C-2) - ***Signalized***							
Delay	11.8	3.2	5.9	6.7	24.3	14.7	8.7
v/c	0.66	0.63	0.04	0.23	0.45	0.03	
Queue	83.4	8.8	2.4	24.1	34.7	4.3	
2020 PM Peak Hour with **Existing Conditions** (Page C-4) - ***Signalized***							
Delay	21.2	3.3	15.3	34.4	38.3	15.5	27.1
v/c	0.56	0.43	0.04	0.86	0.87	0.02	
Queue	79.8	8.1	4.5	180.1	178.6	4.5	
2030 AM Peak Hour **without** Proposed Site (Page C-6) - ***Signalized***							
Delay	12.4	3.1	5.9	6.7	25.8	15.6	9.0
v/c	0.69	0.63	0.04	0.25	0.46	0.03	
Queue	97.4	12.2	2.5	26.5	38.7	4.5	
2030 PM Peak Hour **without** Proposed Site (Page C-8) - ***Signalized***							
Delay	22.3	3.3	16.5	50.5	48.5	14.6	36.8
v/c	0.52	0.41	0.03	0.96	0.94	0.02	
Queue	94.1	16.3	4.7	246.4	200.9	4.3	
2030 AM Peak Hour **with** Proposed Site (Page C-10) - ***Signalized***							
Delay	14.4	3.5	10.5	7.6	27.6	14.9	10.7
v/c	0.73	0.66	0.29	0.28	0.53	0.33	
Queue	110.1	13.1	12.6	32.0	51.9	23.7	
2030 PM Peak Hour **with** Proposed Site (Page C-13) - **Signalized**							
Delay	23.4	3.4	25.7	58.9	53.4	14.2	39.0
v/c	0.55	0.45	0.45	1.00	0.96	0.16	
Queue	97.7	17.2	37.8	251.9	219.7	21.5	

Table 8 – Intersection Capacity Analysis for Hammonds Plains Road at Larry Uteck Boulevard (Roundabout)

LOS Criteria	Control Delay (sec/veh), v/c Ratio and 95th %ile Queue (m) by Intersection Movement						Overall Intersection
	Hammonds Plains Road				Larry Uteck Boulevard		
	EB-T	EB-R	WB-L	WB-T	NB-L	NB-R	Delay
2030 AM Peak Hour **without** Proposed Site (Page C-15) - ***Roundabout***							
Delay	2.2	2.5	10.3	2.8	13.1	7.1	3.4
v/c	0.44	0.42	0.10	0.10	0.15	0.02	
Queue	21.0	0.0	4.1	4.3	6.9	0.6	
2030 PM Peak Hour **without** Proposed Site (Page C-15) - ***Roundabout***							
Delay	2.2	2.5	15.6	7.3	12.2	5.1	7.0
v/c	0.26	0.20	0.49	0.49	0.53	0.01	
Queue	12.6	0.0	29.3	31.7	29.5	0.4	
2030 AM Peak Hour **with** Proposed Site (Page C-16) - ***Roundabout***							
Delay	2.6	2.5	10.5	3.0	13.2	11.0	4.1
v/c	0.49	0.43	0.13	0.13	0.20	0.17	
Queue	25.7	0.0	5.7	5.9	10.1	7.6	
2030 PM Peak Hour **with** Proposed Site (Page C-16) - ***Roundabout***							
Delay	2.8	2.5	18.7	10.0	12.9	5.5	8.5
v/c	0.34	0.23	0.61	0.61	0.59	0.13	
Queue	16.4	0.0	44.9	50.4	40.0	5.2	

Table 9 – Intersection Capacity Analysis for Hammonds Plains Road at Road 8

LOS Criteria	Control Delay (sec/veh), v/c Ratio and 95th %ile Queue (m) by Intersection Movement				Overall Intersection
	Hammonds Plains Road			Road 8	
	EB-TR	WB-L	WB-T	NB-LR	Delay
2030 AM Peak Hour **with** Proposed Site (Page C-11)					
Delay	0.0	10.0	0.0	26.3	2.5
v/c	0.53	0.05	0.21	0.42	
Queue	0.0	1.2	0.0	15.7	
2030 PM Peak Hour **with** Proposed Site (Page C-14)					
Delay	0.0	9.2	0.0	26.2	1.9
v/c	0.36	0.11	0.58	0.35	
Queue	0.0	3.0	0.0	12.0	

5 SUMMARY, RECOMMENDATIONS & CONCLUSIONS

5.1 SUMMARY

Description of the Proposed Development

1. Plans are being prepared for the development of Sub Areas 1 and 12, a proposed mixed-use development bound by Hammonds Plains Road and Larry Uteck Boulevard in West Bedford, Nova Scotia. Sub Areas 1 and 12 are expected to include approximately 2,111 apartment units, 428 single family dwellings, 26,500 ft^2 of institutional development and 128,700 ft^2 of commercial development. Sub Areas 1 and 12 are anticipated to be constructed and occupied by 2030.

Proposed Site Access

2. It is expected that vehicular access to the proposed site will be provided by a new access road opposite to Blue Mountain Drive and a new street to Hammonds Plains Road. Additional access points to Hammonds Plains Road and to Larry Uteck Boulevard will be determined as development plans progress.

Estimation of Site Generated Trips

3. Trip generation estimates were prepared using rates published in *Trip Generation, 10th Edition* (Institute of Transportation Engineers, Washington, 2017) as well as *Trip Generation Manual, 9th Edition (*Institute of Transportation Engineers, Washington, 2012).

   It is estimated that Sub Areas 1 and 12 will generate the following primary vehicle trips:
   - 852 two-way trips (288 entering and 564 exiting) during the AM peak hour; and,
   - 1088 two-way trips (616 entering and 472 exiting) during the PM peak hour.

Trip Distribution and Assignment

4. External trips generated by the proposed development were assigned to the roadway network based on review of past studies and WSP's local knowledge of the area considering major trip origins and destinations in the region. Trips were distributed to the northeast (40%), south (50%) and northwest (10%).

   Pass-by trips generated by the proposed development were assigned to the roadway based on the turning movement counts available.

Upgrade Warrant Analysis

5. Left turn lane warrants were completed for Larry Uteck Boulevard at Blue Mountain Drive/Road 1 and for Hammonds Plains Road at Road 8. A northbound left turn lane on Larry Uteck is warranted without and with site development and a southbound left turn lane is warranted with site development. In addition, a westbound left turn lane is warranted on Hammonds Plains Road at Road 8 with site development.

6. Traffic signal warrants were completed for Larry Uteck Boulevard at Blue Mountain Drive/Road 1 without and with site development and Hammonds Plains Road at Road 8 with site development. It was determined that traffic signals are warranted at Larry Uteck Boulevard at Blue Mountain Drive/Road 1 with site development.

Summary – Intersection Capacity Analysis

7. ***Intersection 1 – Larry Uteck Boulevard and Blue Mountain Drive/Road 1*** – With the addition of a northbound and southbound left turn lane on Larry Uteck Boulevard and upgrading the traffic control to signals, this intersection is expected to operation within HRM guidelines in 2030 with site development.

Intersection 2 – Hammonds Plains Road and Larry Uteck Boulevard – The existing intersection is operating outside of HRM guidelines and is approaching capacity. Minimal changes in the operational performance are expected as a result of site development. Upgrading to a roundabout is expected to improve performance and enable the intersection operations to remain within HRM guidelines for all scenarios.

Intersection 3 – Hammonds Plains Road and Road 8 – With the addition of a westbound left turn lane on Hammonds Plains Road, this intersection is expected to operate within HRM guidelines.

5.2 RECOMMENDATIONS

Recommendations

8. As site plans develop and during final design, confirmation of sightlines and access points will be required.
9. Consideration should be given to constructing northbound and southbound left turn lanes on Larry Uteck Boulevard at Blue Mountain Drive when connecting the fourth leg of the intersection (Road 1). Consideration should be given to installing conduit and underground infrastructure when installing left turn lanes on Larry Uteck Boulevard to prepare for a future signalized intersection.
10. Consideration should be given to planning for a future roundabout at the Hammonds Plains Road and Larry Uteck Boulevard intersection due to the current operational performance expected during the peak hours. The roundabout configuration is shown in Figure 5.
11. Consideration should be given to installing a westbound left turn lane on Hammonds Plains Road at Road 8 during the construction of Road 8.

5.3 CONCLUSIONS

Impacts to Vehicular Traffic

12. While delays have been recognized at the Hammonds Plains Road and Larry Uteck Boulevard intersection, particularly during the evening peak period, minimal changes are expected to occur as a result of trips generated by Sub Areas 1 and 12.
13. With the recommended left turn lanes and traffic signals at Road 1, and left turn lane at Road 8, external trips generated by the development are not expected to have a significant impact to levels of performance on the regional street system.

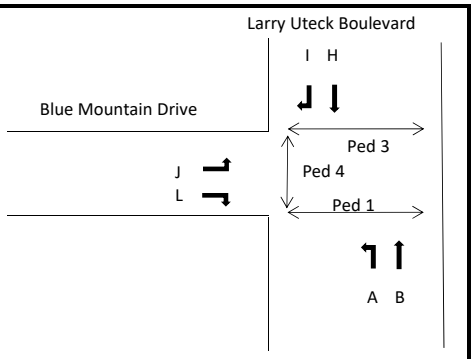
APPENDIX

A TRAFFIC VOLUME DATA

Table A-1

Larry Uteck Boulevard
@
Blue Mountain Drive

Bedford, Nova Scotia
Wednesday, April 18, 2018



AM Peak Period Volume Data

Time		Larry Uteck Boulevard Northbound Approach		Larry Uteck Boulevard Southbound Approach		Blue Mountain Drive Eastbound Approach		Total Vehicles
		A	B	H	I	J	L	
07:00	07:15	6	24	158	0	0	47	235
07:15	07:30	3	26	170	0	0	47	246
07:30	07:45	4	49	170	0	0	57	280
07:45	08:00	8	51	159	0	1	62	281
08:00	08:15	15	57	181	0	0	42	295
08:15	08:30	7	55	141	2	2	37	244
08:30	08:45	8	53	149	0	1	57	268
08:45	09:00	8	55	119	2	1	40	225
AM Peak Hour		**30**	**183**	**680**	**0**	**1**	**208**	**1102**
07:00	**08:00**	**21**	**150**	**657**	**0**	**1**	**213**	**1042**
08:00	**09:00**	**38**	**220**	**590**	**4**	**4**	**176**	**1032**

Midday Peak Period Volume Data

Time		Larry Uteck Boulevard Northbound Approach		Larry Uteck Boulevard Southbound Approach		Blue Mountain Drive Eastbound Approach		Total Vehicles
		A	B	H	I	J	L	
11:00	11:15	9	36	72	0	1	25	143
11:15	11:30	7	51	62	0	0	11	131
11:30	11:45	14	35	57	1	0	9	116
11:45	12:00	15	59	66	1	0	11	152
12:00	12:15	18	69	66	0	0	6	159
12:15	12:30	10	53	68	0	0	18	149
12:30	12:45	14	75	69	1	1	9	169
12:45	13:00	12	56	47	0	0	13	128
Midday Peak Hour		**57**	**256**	**269**	**2**	**1**	**44**	**629**
11:00	**12:00**	**45**	**181**	**257**	**2**	**1**	**56**	**542**
12:00	**13:00**	**54**	**253**	**250**	**1**	**1**	**46**	**605**

PM Peak Period Volume Data

Time		Larry Uteck Boulevard Northbound Approach		Larry Uteck Boulevard Southbound Approach		Blue Mountain Drive Eastbound Approach		Total Vehicles
		A	B	H	I	J	L	
16:00	16:15	43	129	62	0	0	9	243
16:15	16:30	50	148	82	1	2	19	302
16:30	16:45	48	135	86	1	0	18	288
16:45	17:00	58	134	77	0	0	17	286
17:00	17:15	62	151	86	4	1	20	324
17:15	17:30	62	121	87	2	1	21	294
17:30	17:45	42	118	81	2	0	20	263
17:45	18:00	41	104	84	4	0	17	250
PM Peak Hour		**218**	**568**	**331**	**6**	**3**	**74**	**1200**
16:00	**17:00**	**199**	**546**	**307**	**2**	**2**	**63**	**1119**
17:00	**18:00**	**207**	**494**	**338**	**12**	**2**	**78**	**1131**

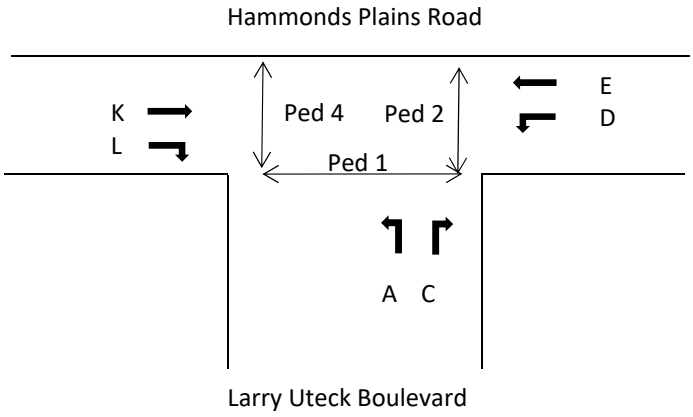
* Count *not* completed by WSP

Table A-2

Hammonds Plains Road @ Larry Uteck Boulevard

Hammonds Plains, NS

Thursday, April 19, 2018



AM Peak Period Volume Data

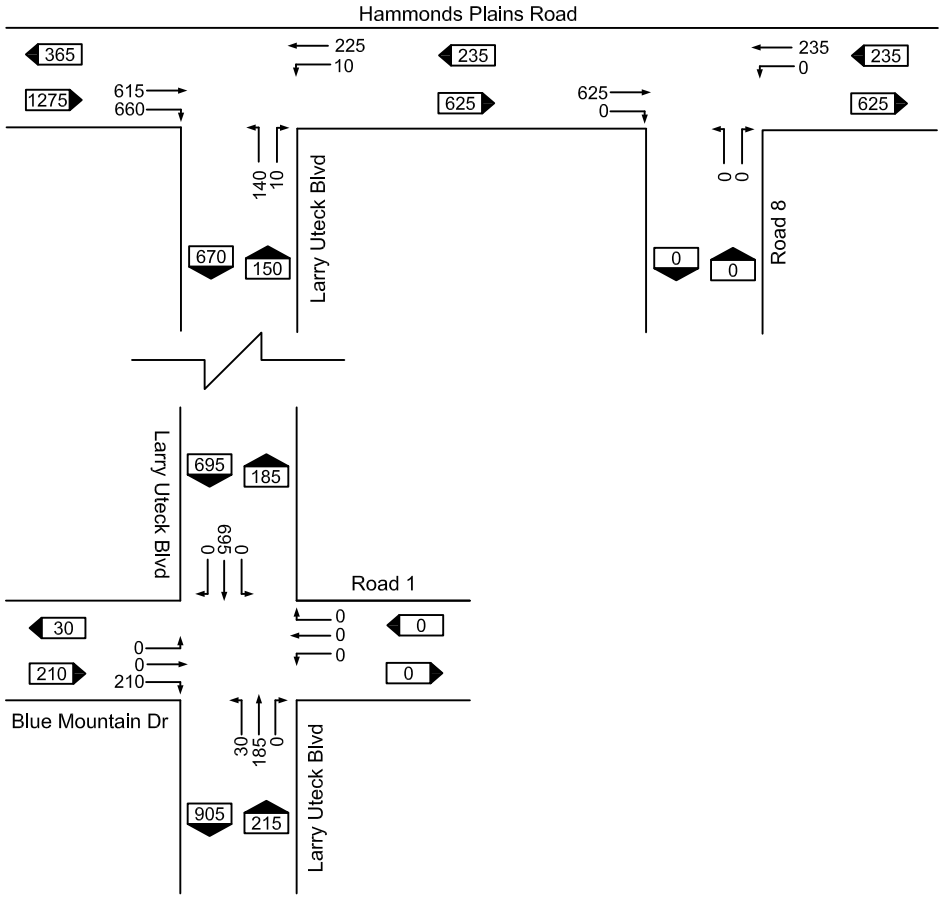
Time		Larry Uteck Boulevard Northbound Approach		Hammonds Plains Road Westbound Approach		Hammonds Plains Road Eastbound Approach		Total Vehicles
		A	C	D	E	K	L	
07:00	07:15	26	1	1	40	153	141	362
07:15	07:30	22	1	1	53	169	191	437
07:30	07:45	39	0	1	47	154	156	397
07:45	08:00	39	5	7	59	146	169	425
08:00	08:15	36	2	1	60	136	133	368
08:15	08:30	47	3	1	67	133	112	363
08:30	08:45	51	3	1	80	110	120	365
08:45	09:00	41	3	3	78	96	103	324
AM Peak Hour		**136**	**8**	**10**	**219**	**605**	**649**	**1627**
07:00	**08:00**	**126**	**7**	**10**	**199**	**622**	**657**	**1621**
08:00	**09:00**	**175**	**11**	**6**	**285**	**475**	**468**	**1420**

PM Peak Period Volume Data

Time		Larry Uteck Boulevard Northbound Approach		Hammonds Plains Road Westbound Approach		Hammonds Plains Road Eastbound Approach		Total Vehicles
		A	C	D	E	K	L	
16:00	16:15	136	1	2	146	85	73	443
16:15	16:30	124	1	1	155	78	78	437
16:30	16:45	147	0	0	165	113	97	522
16:45	17:00	125	5	3	165	81	61	440
17:00	17:15	156	2	3	173	75	70	479
17:15	17:30	143	3	5	167	91	78	487
17:30	17:45	93	3	4	164	86	78	428
17:45	18:00	68	3	2	128	112	73	386
PM Peak Hour		**571**	**10**	**11**	**670**	**360**	**306**	**1928**
16:00	**17:00**	**532**	**7**	**6**	**631**	**357**	**309**	**1842**
17:00	**18:00**	**460**	**11**	**14**	**632**	**364**	**299**	**1780**

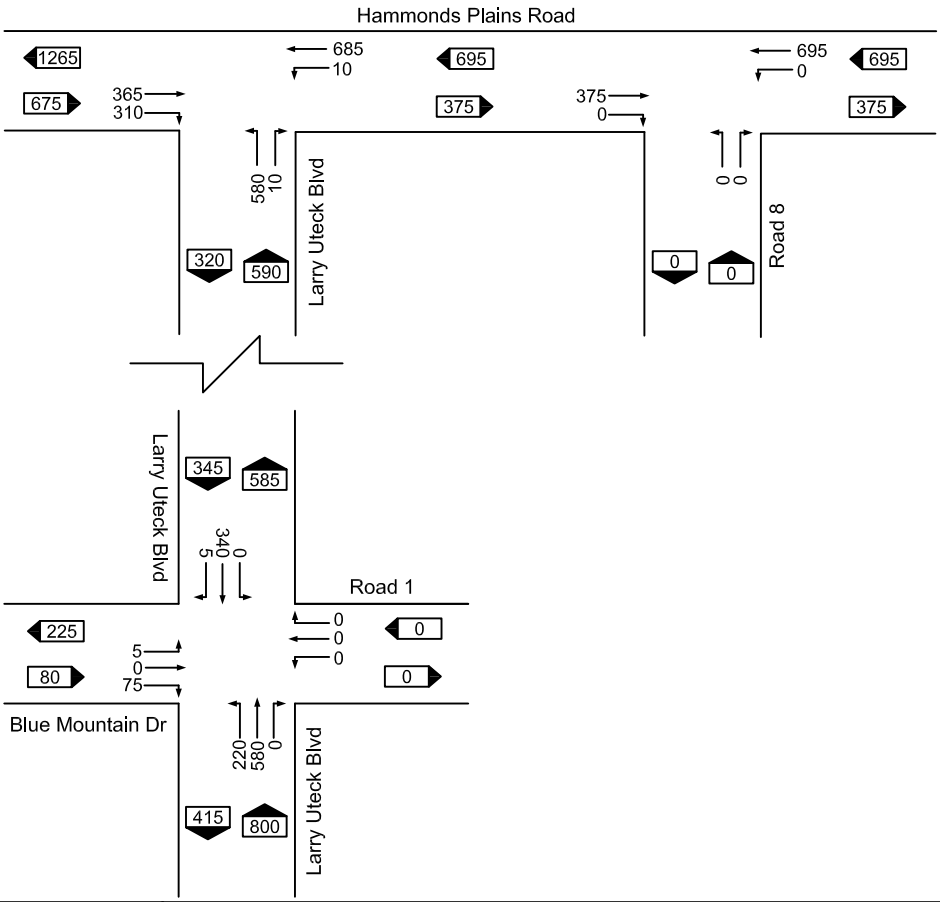
* Count *not* completed by WSP

A
AM Peak Hour



NOT TO SCALE

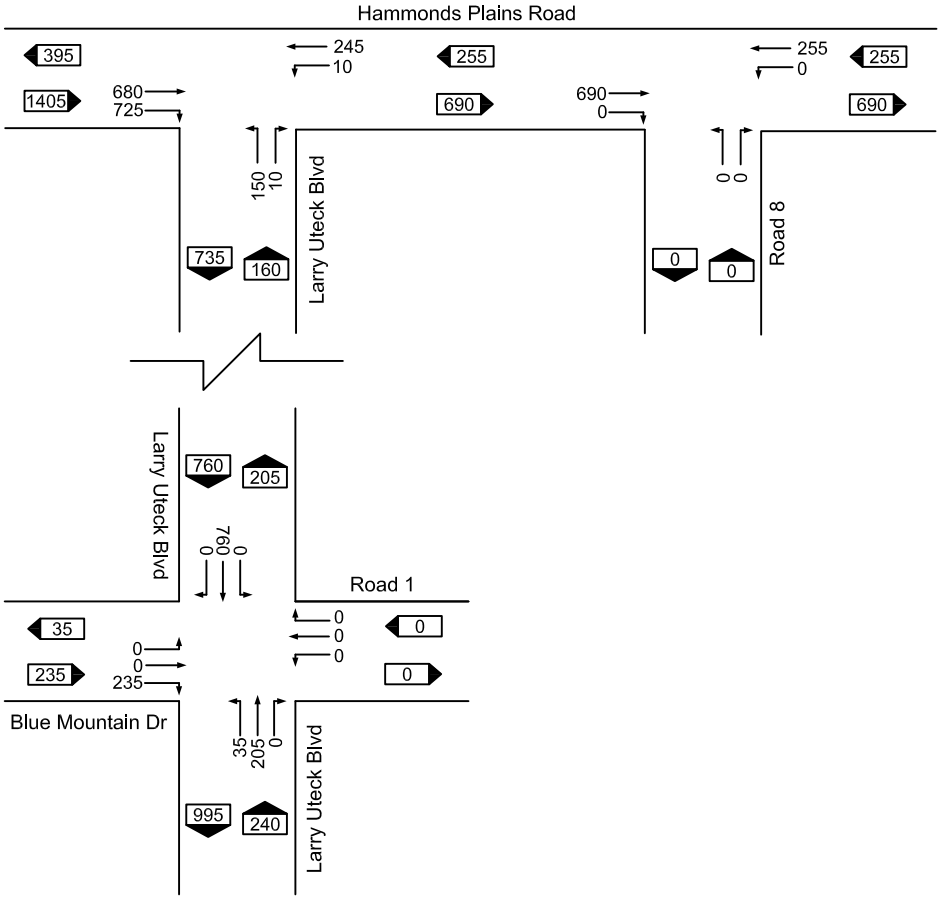
B
PM Peak Hour



NOT TO SCALE

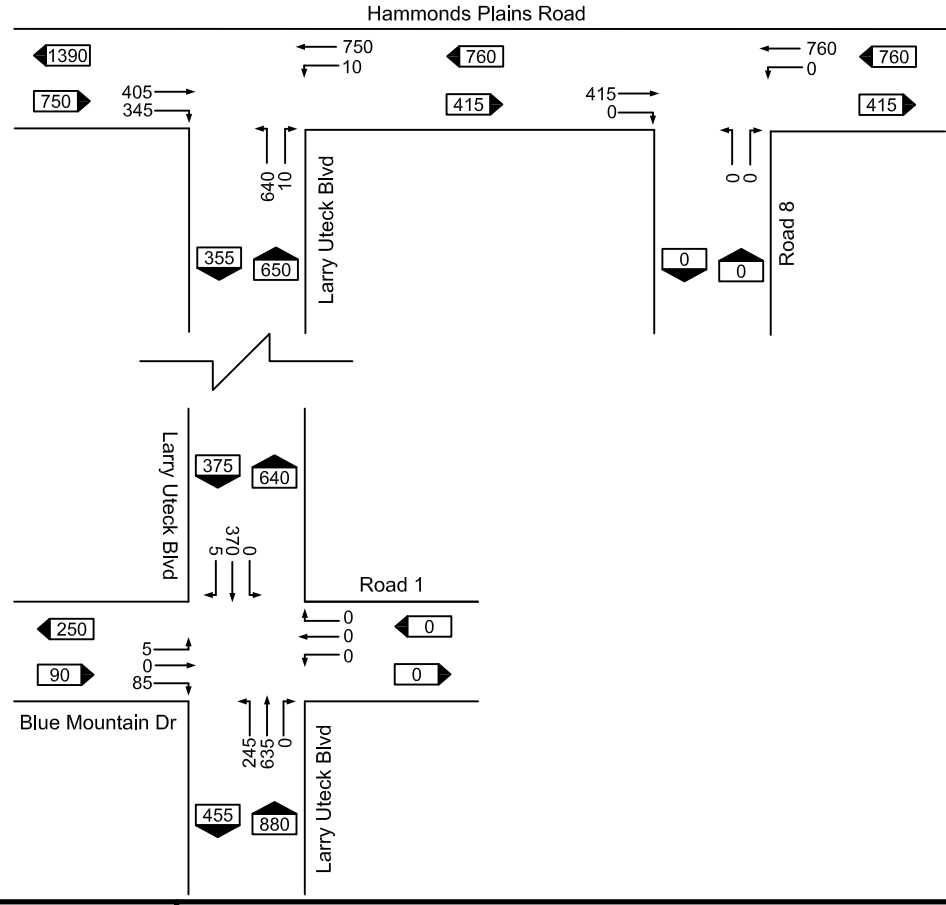
WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure A-1
	2020 Weekday AM and PM Peak Hour Existing Conditions	December 2020

A
AM Peak Hour



NOT TO SCALE

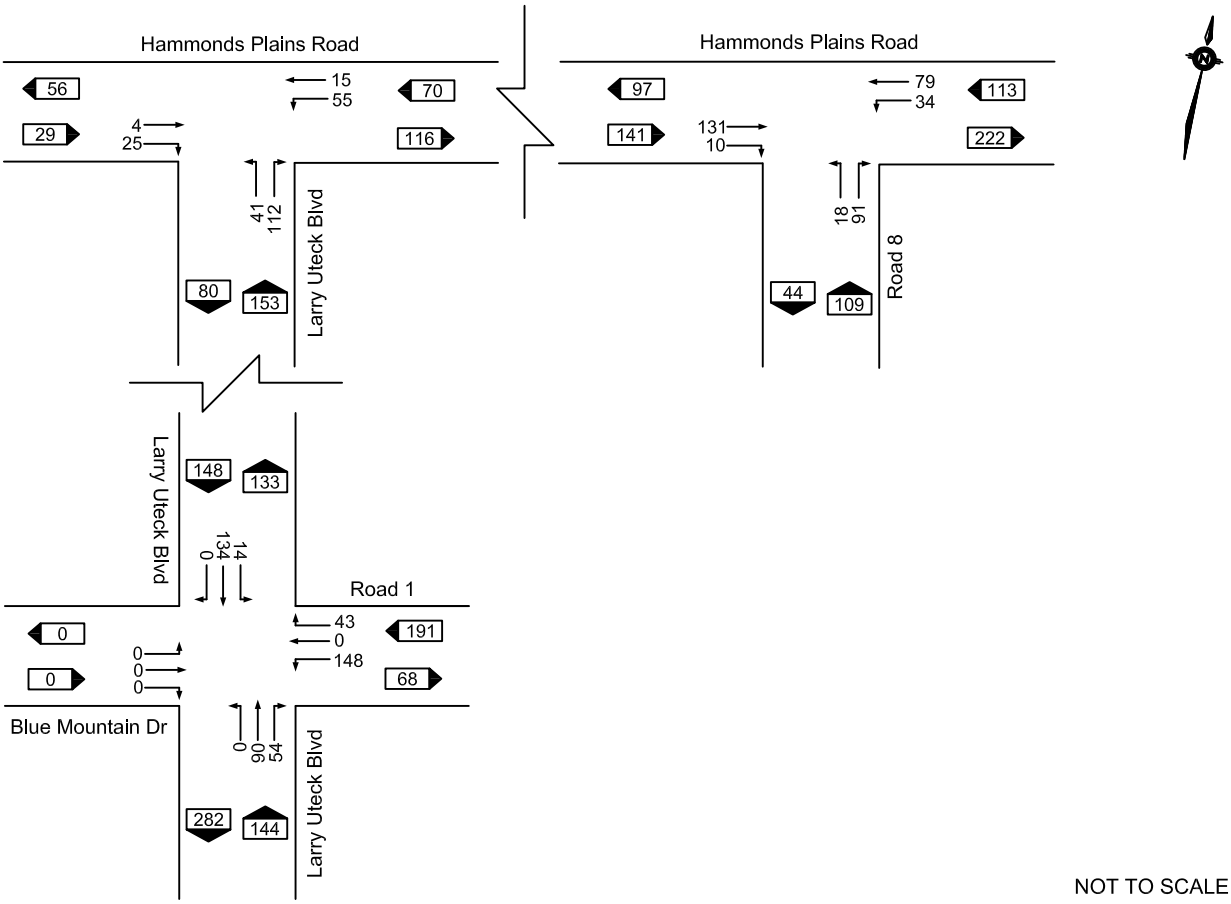
B
PM Peak Hour



NOT TO SCALE

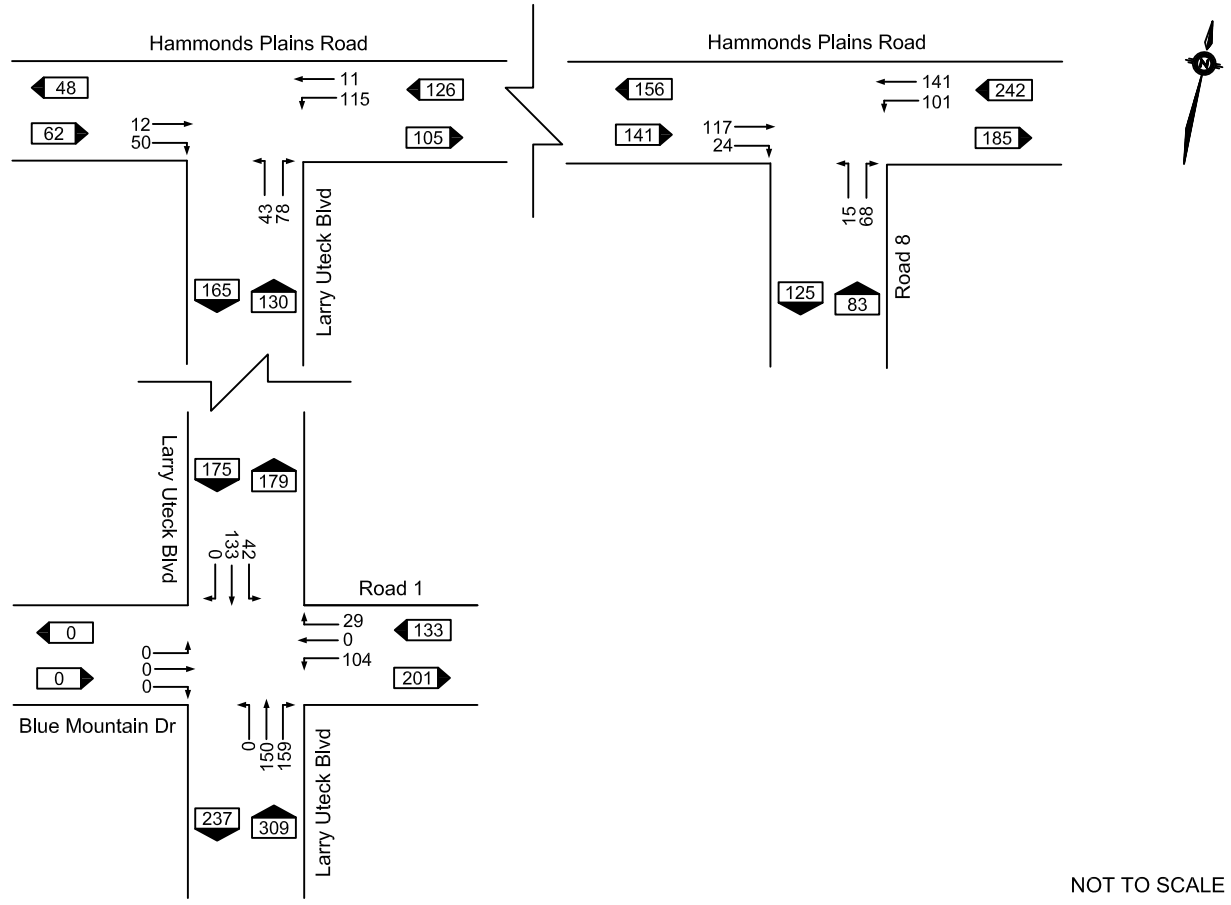
WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure A-2
	2030 Weekday AM and PM Peak Hour Future Background Without Site Generated Trips	December 2020

A
AM Peak Hour



NOT TO SCALE

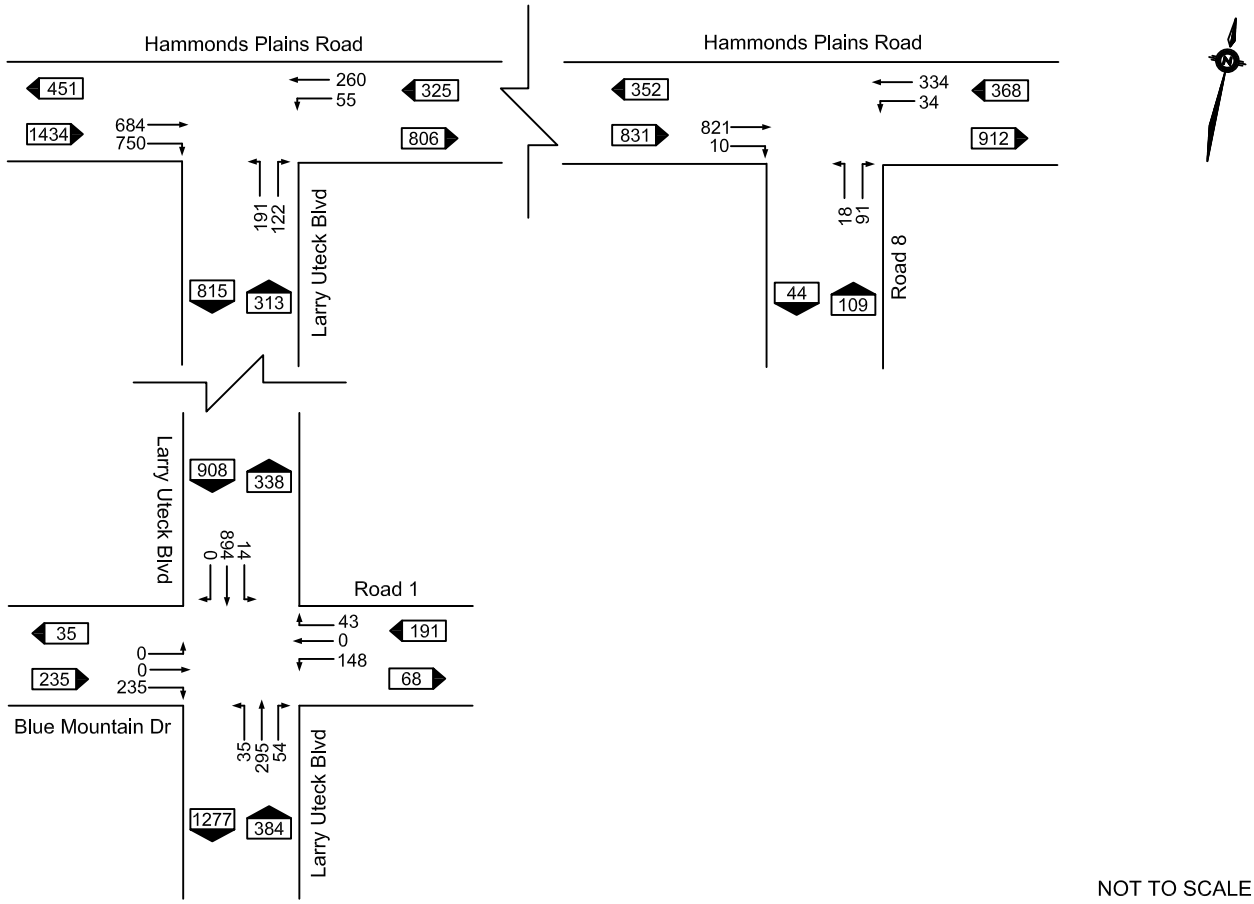
B
PM Peak Hour



NOT TO SCALE

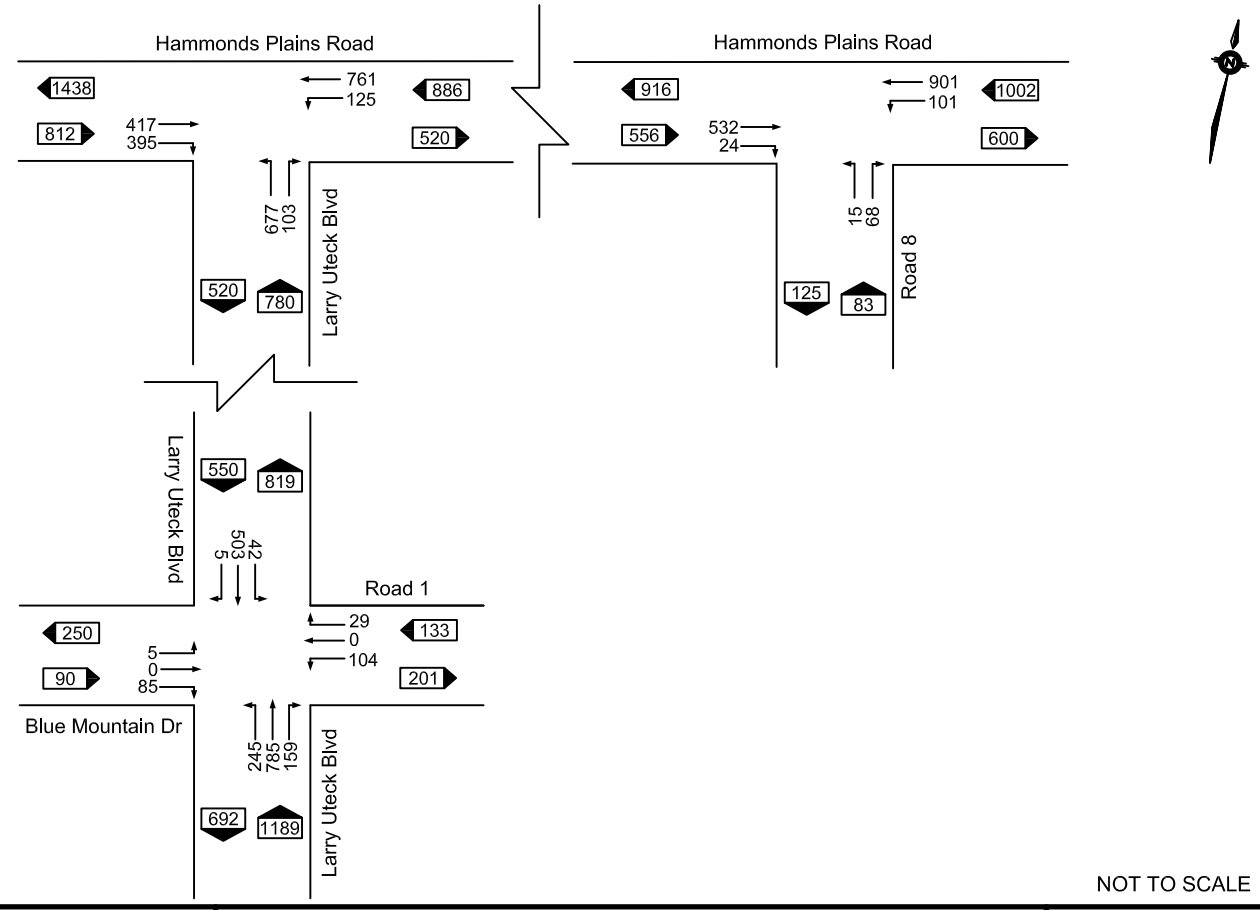
WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure A-3
	Weekday AM and PM Peak Hour Site Generated Trips	December 2020

A
AM Peak Hour



NOT TO SCALE

B
PM Peak Hour

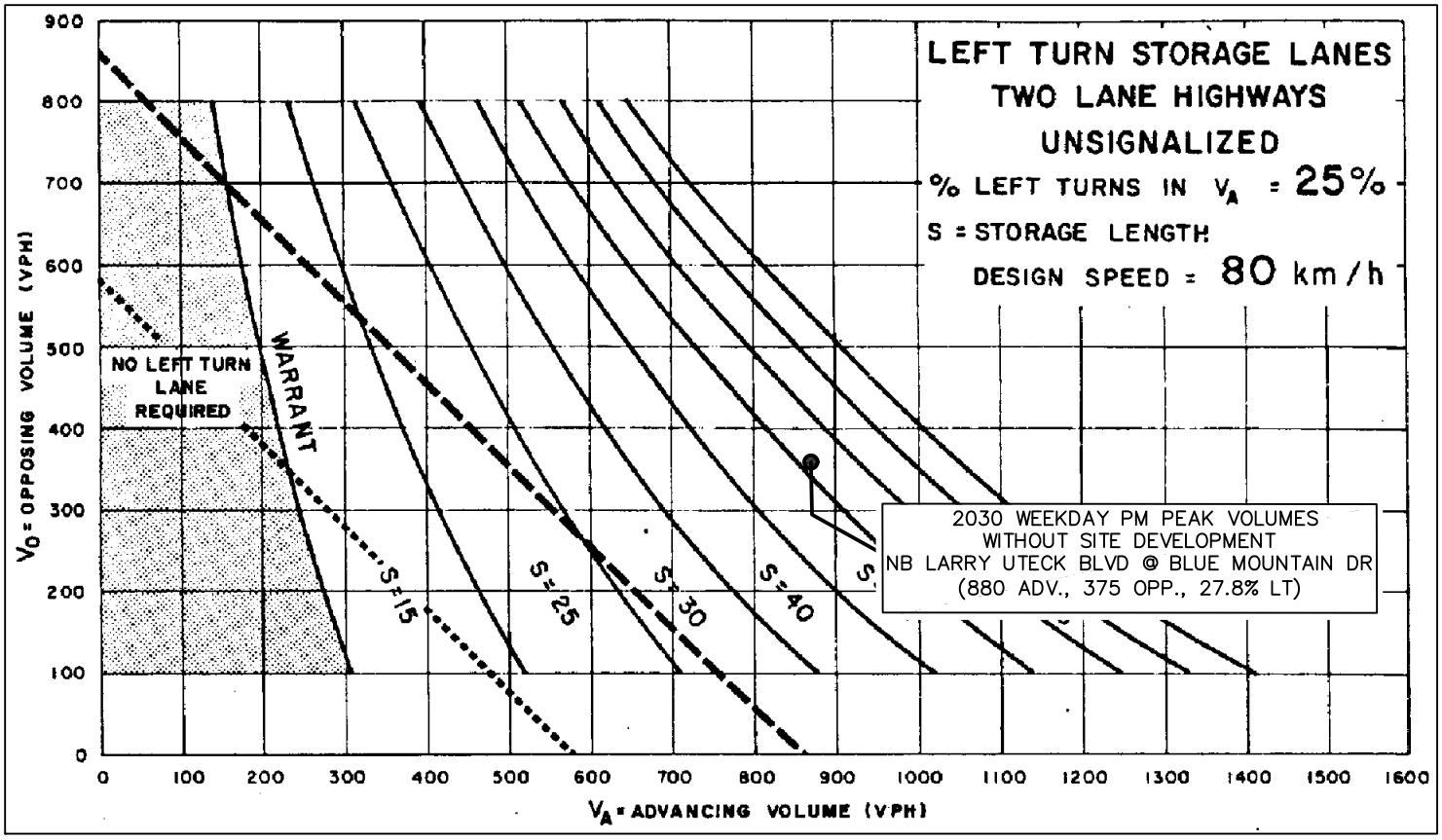


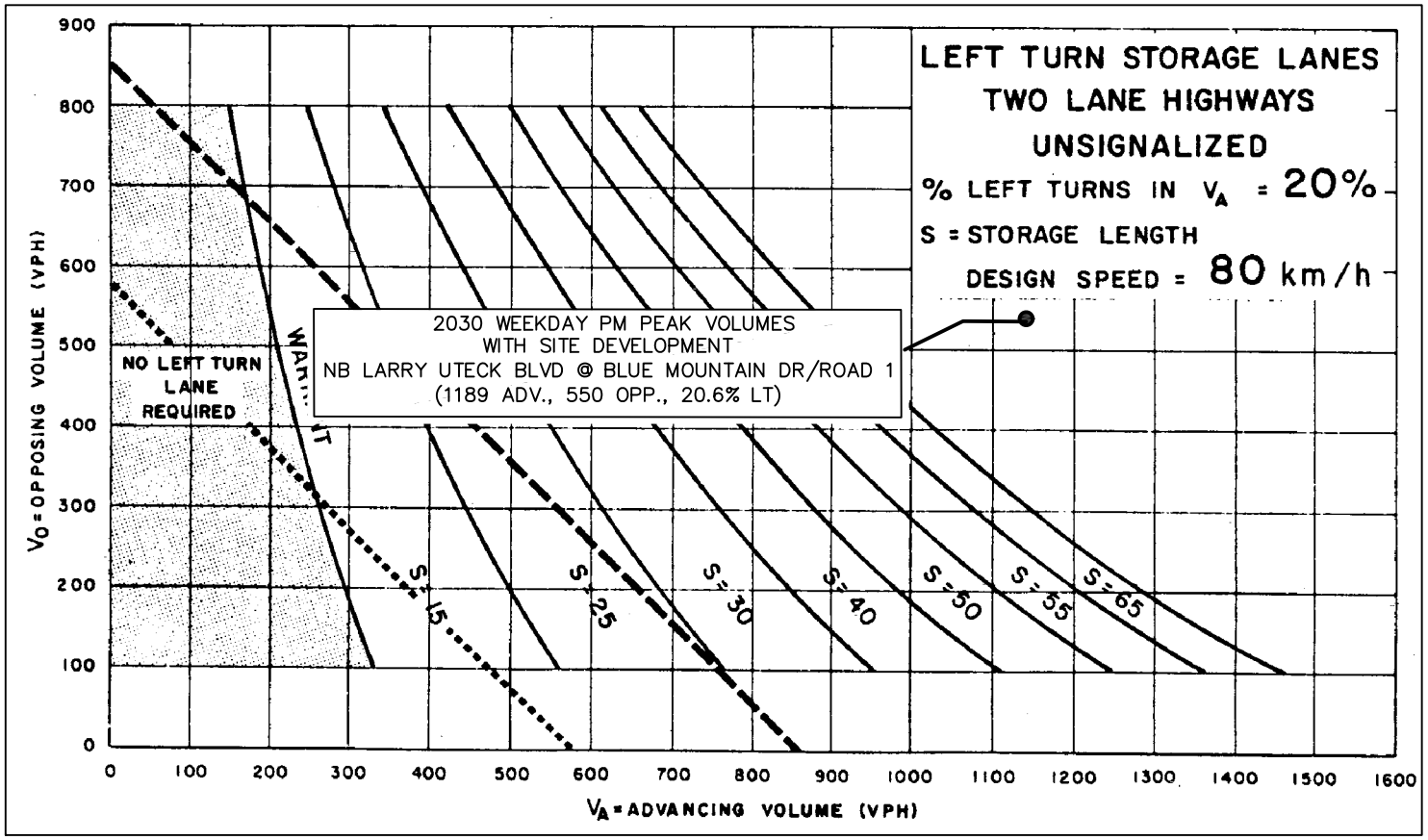
NOT TO SCALE

WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure A-4
	2030 Weekday AM and PM Peak Hour Future Background With Site Generated Trips	December 2020

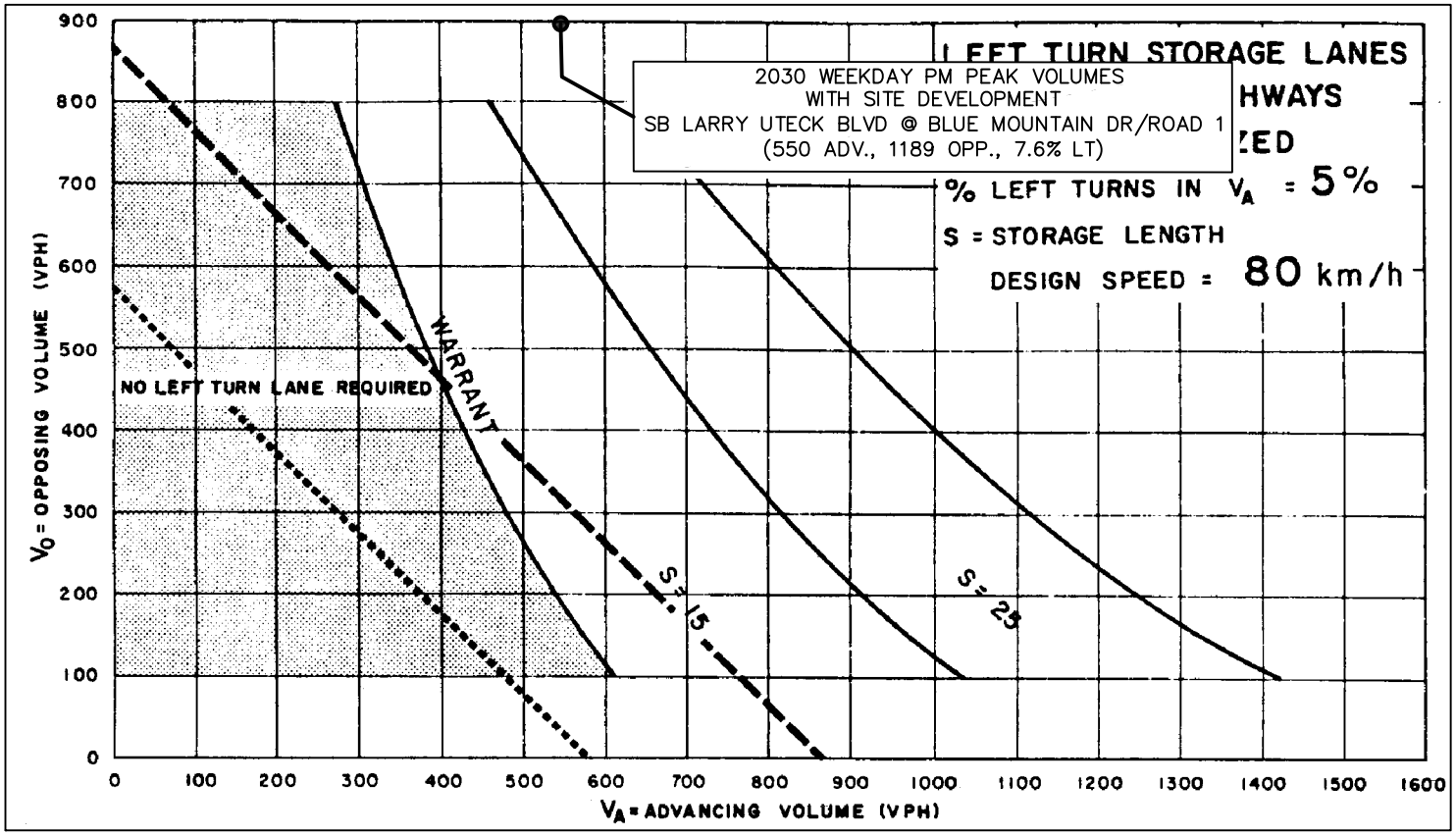
APPENDIX

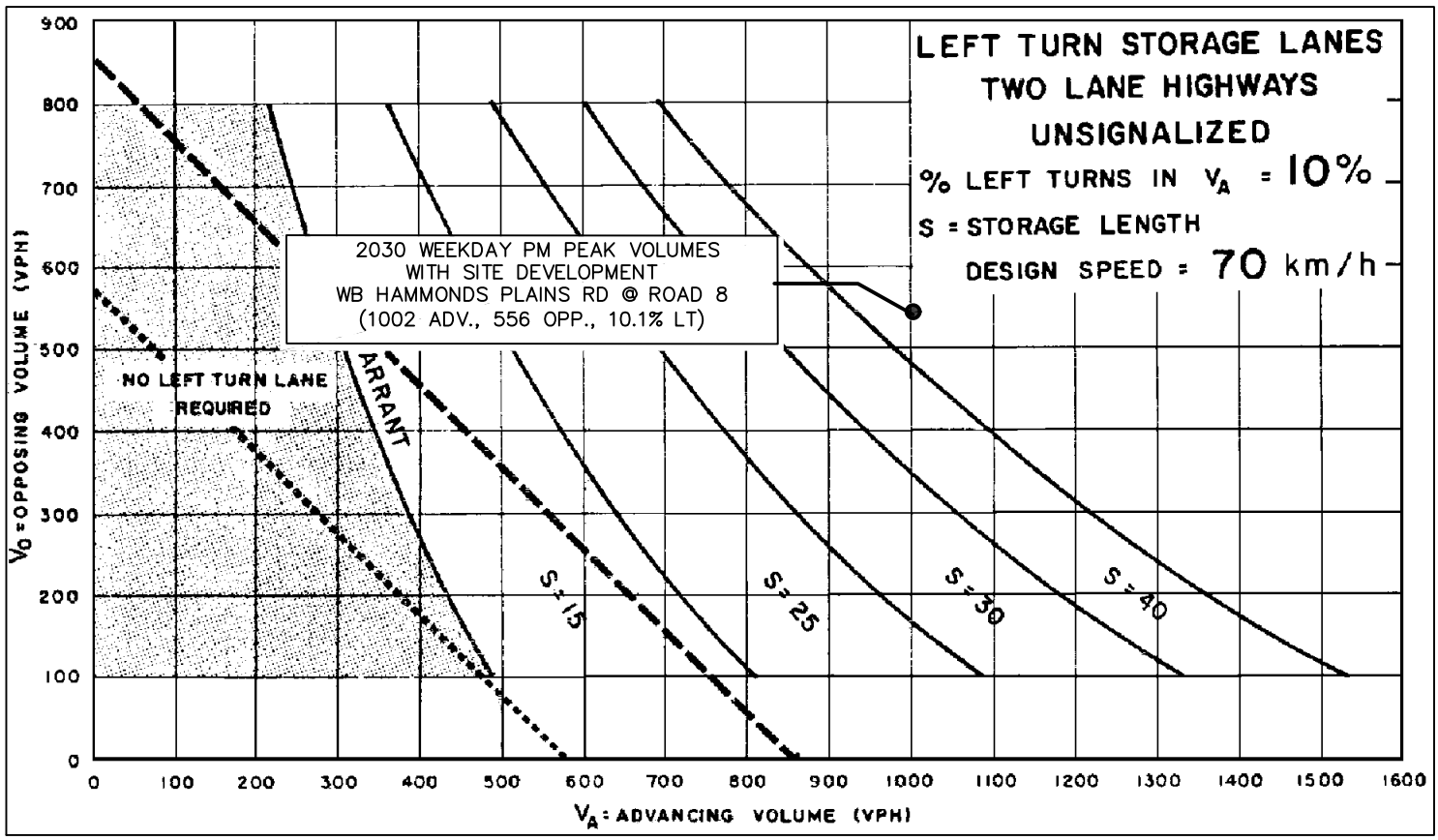
B WARRANT ANALYSES





WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure B-1
	Left Turn Lane Warrant Northbound Larry Uteck at Blue Mountain Drive/Road 1 2030 Future Background Volumes Without and With Site Development	December 2020





WSP	Traffic Impact Study - Sub Area 1 & 12 West Bedford, Nova Scotia	Figure B-2
	Left Turn Lane Warrant 2030 Future Background Volumes With Site Development	December 2020

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table B-1 - Larry Uteck Boulevard at Blue Mountain Drive

2030 Future Background Volumes without Site Development

Main Street (name)	Larry Uteck Boulevard	Direction (EW or NS)	NS	Date:	December 2020
Side Street (name)	Blue Mountain Drive	Direction (EW or NS)	EW	City:	West Bedford, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Larry Uteck Boulevard	NB	1			1		999	1	
Larry Uteck Boulevard	SB			1			590	1	
N/A	WB								
Blue Mountain Drive	EB			1					

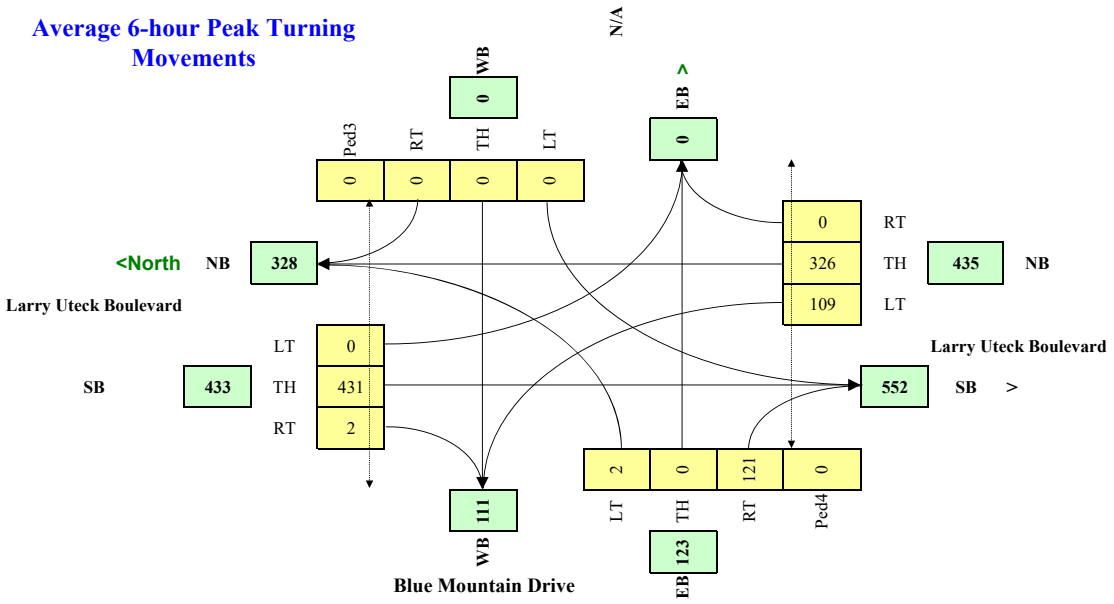
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Larry Uteck Boulevard	NS	80	2.0%	n	0.0
Blue Mountain Drive	EW	50	2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:00 - 8:00	0		0	0
8:00 - 9:00	0		0	0
11:30 - 12:30	0		0	0
12:30 - 13:30	0		0	0
15:30 - 16:30	0		0	0
16:30 - 17:30	0		0	0
Total (6-hour peak)	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**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	35	205	0	0	760	0	0	0	0	0	0	235
8:00 - 9:00	25	155	0	0	570	0	0	0	0	0	0	175
11:30 - 12:30	70	210	0	0	285	0	0	0	0	0	0	80
12:30 - 13:30	70	210	0	0	285	0	0	0	0	0	0	80
15:30 - 16:30	210	540	0	0	315	5	0	0	0	5	0	70
16:30 - 17:30	245	635	0	0	370	5	0	0	0	5	0	85
Total (6-hour peak)	**655**	**1,955**	**0**	**0**	**2,585**	**10**	**0**	**0**	**0**	**10**	**0**	**725**
Average (6-hour peak)	**109**	**326**	**0**	**0**	**431**	**2**	**0**	**0**	**0**	**2**	**0**	**121**

Average 6-hour Peak Turning Movements



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

W =	42	42	0
		Veh	*Ped*

NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table B-2 - Larry Uteck Boulevard at Blue Mountain Drive/Road 1
2030 Future Background Volumes without Site Development

Main Street (name)	Larry Uteck Boulevard	Direction (EW or NS)	NS	Date:	December 2020
Side Street (name)	Blue Mountain Drive	Direction (EW or NS)	EW	City:	West Bedford, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Larry Uteck Boulevard	NB	1			1		999	1	
Larry Uteck Boulevard	SB	1			1		590	1	
Road 1	WB	1			1				
Blue Mountain Drive	EB			1					

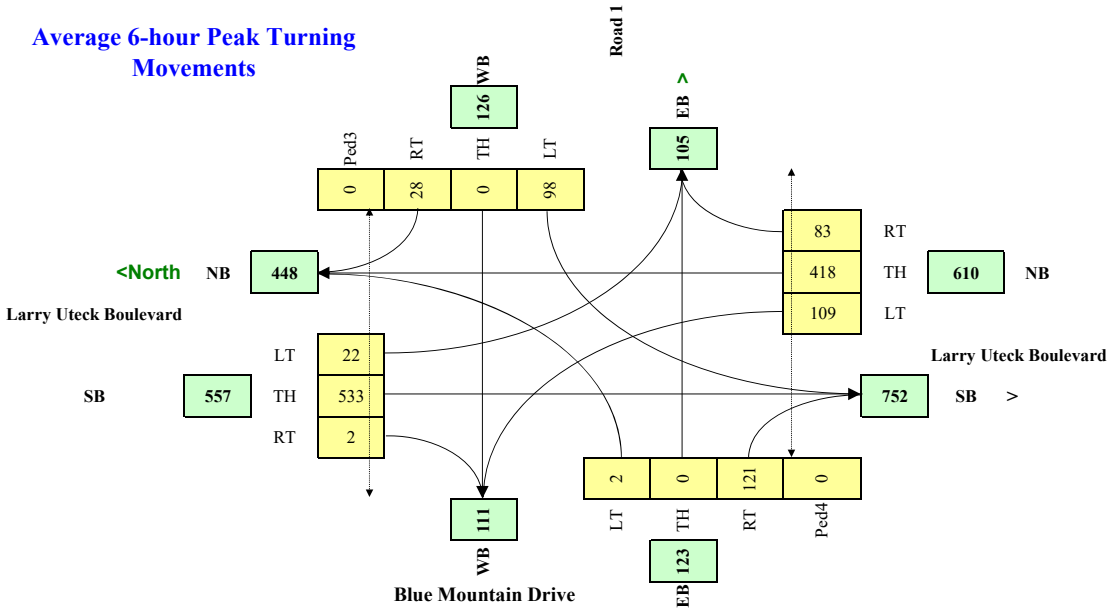
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Larry Uteck Boulevard	NS	80	2.0%	n	0.0
Blue Mountain Drive	EW	50	2.0%	n	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S side
7:00 - 8:00	0		0	0
8:00 - 9:00	0		0	0
11:30 - 12:30	0		0	0
12:30 - 13:30	0		0	0
15:30 - 16:30	0		0	0
16:30 - 17:30	0		0	0
Total (6-hour peak)	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**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	35	295	55	15	895	0	150	0	45	0	0	235
8:00 - 9:00	25	220	40	10	670	0	110	0	30	0	0	175
11:30 - 12:30	70	270	55	15	350	0	65	0	20	0	0	80
12:30 - 13:30	70	270	55	15	350	0	65	0	20	0	0	80
15:30 - 16:30	210	665	135	35	430	5	90	0	25	5	0	70
16:30 - 17:30	245	785	160	40	505	5	105	0	30	5	0	85
Total (6-hour peak)	**655**	**2,505**	**500**	**130**	**3,200**	**10**	**585**	**0**	**170**	**10**	**0**	**725**
Average (6-hour peak)	**109**	**418**	**83**	**22**	**533**	**2**	**98**	**0**	**28**	**2**	**0**	**121**

Average 6-hour Peak Turning Movements



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

W =	132	132	0
		Veh	*Ped*

Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table B-3 - Hammonds Plains Road @ Road 8

2030 Future Background Volumes with Site Development

Main Street (name)	Hammonds Plains Road	Direction (EW or NS)	EW	Date:	December 2020
Side Street (name)	Road 8	Direction (EW or NS)	NS	City:	West Bedford, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Hammonds Plains Road	WB	1		1			800	1	
Hammonds Plains Road	EB			1			999	1	
Road 8	NB	1				1			
N/A	SB								

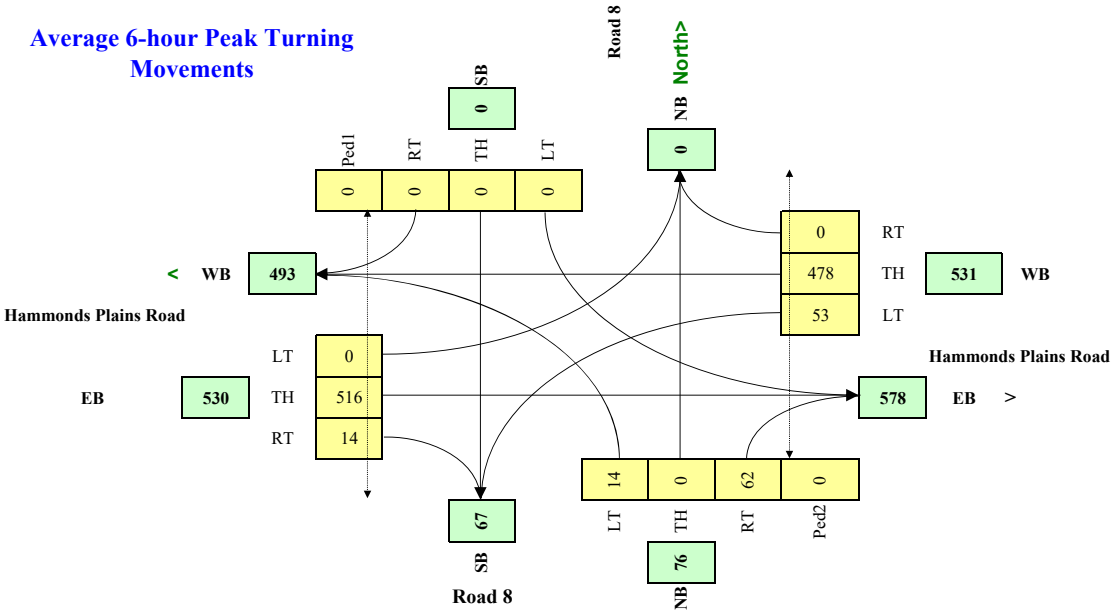
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Hammonds Plains Road	EW	80	2.0%	n	0.0
Road 8	NS	50	2.0%	n	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S side
7:00 - 8:00	0		0	0
8:00 - 9:00	0		0	0
11:30 - 12:30	0		0	0
12:30 - 13:30	0		0	0
15:30 - 16:30	0		0	0
16:30 - 17:30	0		0	0
Total (6-hour peak)	**0**	**0**	**0**	**0**
Average (6-hour peak)	**0**	**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	20	0	90	0	0	0	35	335	0	0	820	10
8:00 - 9:00	15	0	70	0	0	0	25	250	0	0	615	10
11:30 - 12:30	10	0	40	0	0	0	35	310	0	0	340	10
12:30 - 13:30	10	0	40	0	0	0	35	310	0	0	340	10
15:30 - 16:30	15	0	60	0	0	0	85	765	0	0	450	20
16:30 - 17:30	15	0	70	0	0	0	100	900	0	0	530	25
Total (6-hour peak)	**85**	**0**	**370**	**0**	**0**	**0**	**315**	**2,870**	**0**	**0**	**3,095**	**85**
Average (6-hour peak)	**14**	**0**	**62**	**0**	**0**	**0**	**53**	**478**	**0**	**0**	**516**	**14**

Average 6-hour Peak Turning Movements



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

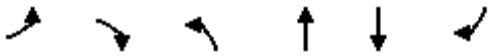
W =	35	35	0
		Veh	*Ped*

NOT Warranted

APPENDIX

C

INTERSECTION PERFORMANCE ANALYSIS



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	210	30	185	695	0
Future Volume (Veh/h)	0	210	30	185	695	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.92	0.92	0.80	0.94	0.92
Hourly flow rate (vph)	0	228	33	231	739	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1036	739	739			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1036	739	739			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	45	96			
cM capacity (veh/h)	247	417	867			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	228	264	739
Volume Left	0	33	0
Volume Right	228	0	0
cSH	417	867	1700
Volume to Capacity	0.55	0.04	0.43
Queue Length 95th (m)	25.5	0.9	0.0
Control Delay (s)	23.5	1.5	0.0
Lane LOS	C	A	
Approach Delay (s)	23.5	1.5	0.0
Approach LOS	C		

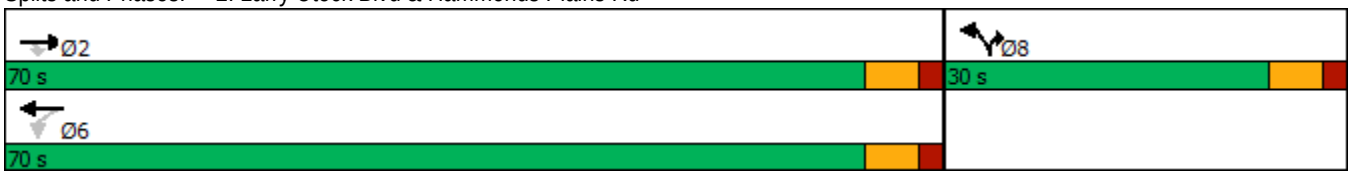
Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

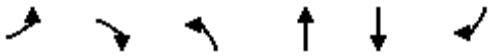
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	615	660	10	225	140	10
Future Volume (vph)	615	660	10	225	140	10
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.294		0.950	
Satd. Flow (perm)	1863	1583	548	1863	1770	1583
Satd. Flow (RTOR)		776				7
Lane Group Flow (vph)	691	776	11	247	161	11
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	70.0	70.0	70.0	70.0	30.0	30.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	30.2	30.2	30.2	30.2	10.7	10.7
Actuated g/C Ratio	0.57	0.57	0.57	0.57	0.20	0.20
v/c Ratio	0.66	0.63	0.04	0.23	0.45	0.03
Control Delay	11.8	3.2	5.9	6.7	24.3	14.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.8	3.2	5.9	6.7	24.3	14.7
LOS	B	A	A	A	C	B
Approach Delay	7.2			6.7	23.7	
Approach LOS	A			A	C	
Queue Length 50th (m)	39.4	0.0	0.4	10.2	12.5	0.3
Queue Length 95th (m)	83.4	8.8	2.4	24.1	34.7	4.3
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	1825	1566	537	1825	823	740
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	0.38	0.50	0.02	0.14	0.20	0.01

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 53.3
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 8.7
Intersection LOS: A
Intersection Capacity Utilization 63.4%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	75	220	580	340	5
Future Volume (Veh/h)	5	75	220	580	340	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.93	0.92	0.92	0.94	0.96	0.92
Hourly flow rate (vph)	5	82	239	617	354	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1452	356	359			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1452	356	359			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	88	80			
cM capacity (veh/h)	115	688	1200			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	87	856	359
Volume Left	5	239	0
Volume Right	82	0	5
cSH	535	1200	1700
Volume to Capacity	0.16	0.20	0.21
Queue Length 95th (m)	4.6	5.9	0.0
Control Delay (s)	13.0	4.4	0.0
Lane LOS	B	A	
Approach Delay (s)	13.0	4.4	0.0
Approach LOS	B		

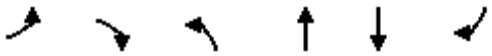
Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	365	310	10	685	580	10
Future Volume (vph)	365	310	10	685	580	10
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.368		0.950	
Satd. Flow (perm)	1863	1583	685	1863	1770	1583
Satd. Flow (RTOR)		392				2
Lane Group Flow (vph)	456	392	11	706	630	11
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	52.0	52.0	52.0	52.0	48.0	48.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	36.8	36.8	36.8	36.8	34.3	34.3
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.41	0.41
v/c Ratio	0.56	0.43	0.04	0.86	0.87	0.02
Control Delay	21.2	3.3	15.3	34.4	38.3	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.2	3.3	15.3	34.4	38.3	15.5
LOS	C	A	B	C	D	B
Approach Delay	12.9			34.1	37.9	
Approach LOS	B			C	D	
Queue Length 50th (m)	59.8	0.0	1.1	112.6	102.7	1.0
Queue Length 95th (m)	79.8	8.1	4.5	#180.1	#178.6	4.5
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	1081	1083	397	1081	938	840
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	0.42	0.36	0.03	0.65	0.67	0.01

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 83.7
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 27.1 Intersection LOS: C
Intersection Capacity Utilization 78.2% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	235	35	205	760	0
Future Volume (Veh/h)	0	235	35	205	760	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	255	38	223	826	0
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1125	826	826			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1125	826	826			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	31	95			
cM capacity (veh/h)	216	372	805			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	255	38	223	826
Volume Left	0	38	0	0
Volume Right	255	0	0	0
cSH	372	805	1700	1700
Volume to Capacity	0.69	0.05	0.13	0.49
Queue Length 95th (m)	39.2	1.2	0.0	0.0
Control Delay (s)	33.3	9.7	0.0	0.0
Lane LOS	D	A		
Approach Delay (s)	33.3	1.4		0.0
Approach LOS	D			

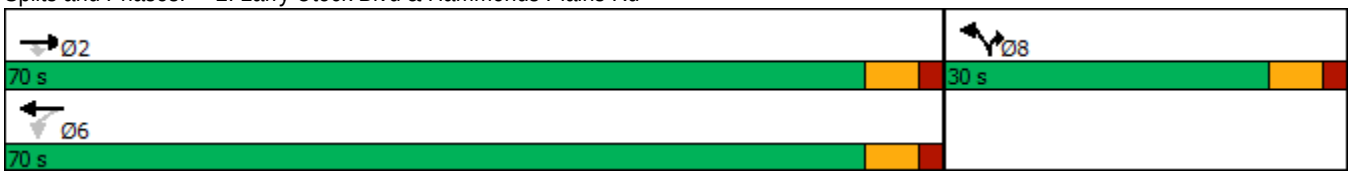
Intersection Summary			
Average Delay	6.6		
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

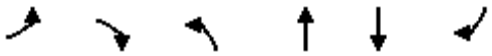
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	680	725	10	245	150	10
Future Volume (vph)	680	725	10	245	150	10
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.265		0.950	
Satd. Flow (perm)	1863	1583	494	1863	1770	1583
Satd. Flow (RTOR)		788				7
Lane Group Flow (vph)	739	788	11	266	163	11
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	70.0	70.0	70.0	70.0	30.0	30.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	32.4	32.4	32.4	32.4	11.1	11.1
Actuated g/C Ratio	0.58	0.58	0.58	0.58	0.20	0.20
v/c Ratio	0.69	0.63	0.04	0.25	0.46	0.03
Control Delay	12.4	3.1	5.9	6.7	25.8	15.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.4	3.1	5.9	6.7	25.8	15.6
LOS	B	A	A	A	C	B
Approach Delay	7.6			6.7	25.2	
Approach LOS	A			A	C	
Queue Length 50th (m)	44.9	0.0	0.4	11.4	13.5	0.3
Queue Length 95th (m)	97.4	12.2	2.5	26.5	38.7	4.5
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	1803	1557	478	1803	788	708
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	0.41	0.51	0.02	0.15	0.21	0.02

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 55.9
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 9.0
Intersection LOS: A
Intersection Capacity Utilization 67.4%
ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd





Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	85	245	635	370	5
Future Volume (Veh/h)	5	85	245	635	370	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	92	266	690	402	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1626	404	407			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1626	404	407			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	86	77			
cM capacity (veh/h)	86	646	1152			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	97	266	690	407
Volume Left	5	266	0	0
Volume Right	92	0	0	5
cSH	484	1152	1700	1700
Volume to Capacity	0.20	0.23	0.41	0.24
Queue Length 95th (m)	5.9	7.1	0.0	0.0
Control Delay (s)	14.3	9.1	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	14.3	2.5		0.0
Approach LOS	B			

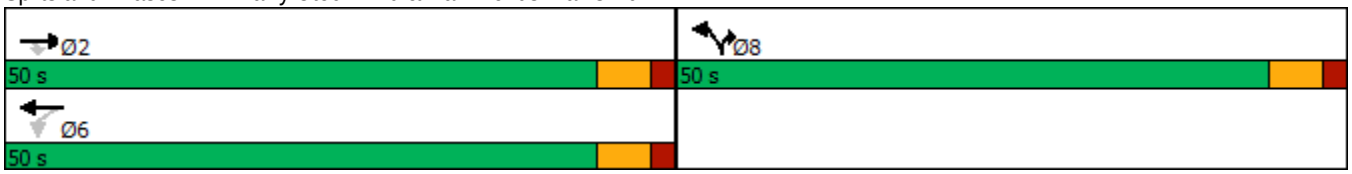
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	405	345	10	750	640	10
Future Volume (vph)	405	345	10	750	640	10
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.380		0.950	
Satd. Flow (perm)	1863	1583	708	1863	1770	1583
Satd. Flow (RTOR)		375				2
Lane Group Flow (vph)	440	375	11	815	696	11
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	43.9	43.9	43.9	43.9	40.5	40.5
Actuated g/C Ratio	0.46	0.46	0.46	0.46	0.42	0.42
v/c Ratio	0.52	0.41	0.03	0.96	0.94	0.02
Control Delay	22.3	3.3	16.5	50.5	48.5	14.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.3	3.3	16.5	50.5	48.5	14.6
LOS	C	A	B	D	D	B
Approach Delay	13.5			50.1	48.0	
Approach LOS	B			D	D	
Queue Length 50th (m)	64.0	0.0	1.3	161.1	127.5	1.0
Queue Length 95th (m)	94.1	16.3	4.7	#246.4	#200.9	4.3
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	852	927	324	852	810	725
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	0.52	0.40	0.03	0.96	0.86	0.02

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 96.4
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 36.8 Intersection LOS: D
Intersection Capacity Utilization 84.9% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd

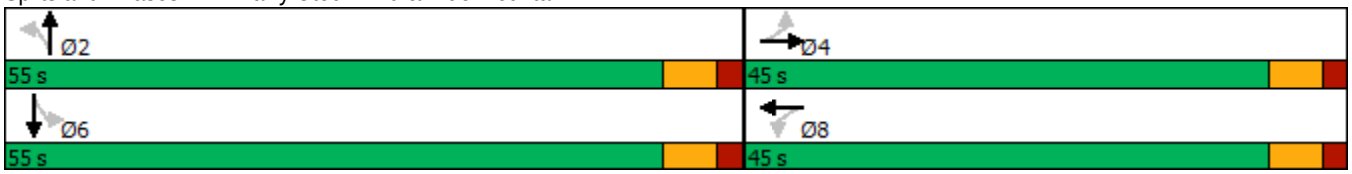


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	235	148	0	43	35	295	54	14	894	0
Future Volume (vph)	0	0	235	148	0	43	35	295	54	14	894	0
Satd. Flow (prot)	0	1611	0	1770	1583	0	1770	1820	0	1770	1863	0
Flt Permitted				0.462			0.127			0.515		
Satd. Flow (perm)	0	1611	0	861	1583	0	237	1820	0	959	1863	0
Satd. Flow (RTOR)		77			469			13				
Lane Group Flow (vph)	0	255	0	161	47	0	38	380	0	15	972	0
Turn Type		NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Total Split (s)	45.0	45.0		45.0	45.0		55.0	55.0		55.0	55.0	
Total Lost Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Act Effct Green (s)		17.8		17.8	17.8		49.3	49.3		49.3	49.3	
Actuated g/C Ratio		0.23		0.23	0.23		0.62	0.62		0.62	0.62	
v/c Ratio		0.61		0.83	0.07		0.26	0.33		0.03	0.84	
Control Delay		24.8		62.3	0.2		14.6	8.9		8.0	22.2	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		24.8		62.3	0.2		14.6	8.9		8.0	22.2	
LOS		C		E	A		B	A		A	C	
Approach Delay		24.8			48.3			9.4			21.9	
Approach LOS		C			D			A			C	
Queue Length 50th (m)		24.7		24.2	0.0		2.4	24.1		0.8	106.6	
Queue Length 95th (m)		47.4		46.9	0.0		11.4	53.7		3.9	#245.5	
Internal Link Dist (m)		297.2			138.6			441.3			532.6	
Turn Bay Length (m)				75.0			75.0			75.0		
Base Capacity (vph)		837		426	1020		147	1138		596	1160	
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		0.30		0.38	0.05		0.26	0.33		0.03	0.84	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 79.1
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 22.5 Intersection LOS: C
Intersection Capacity Utilization 84.9% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Larry Uteck Blvd & Blue Mountain Dr

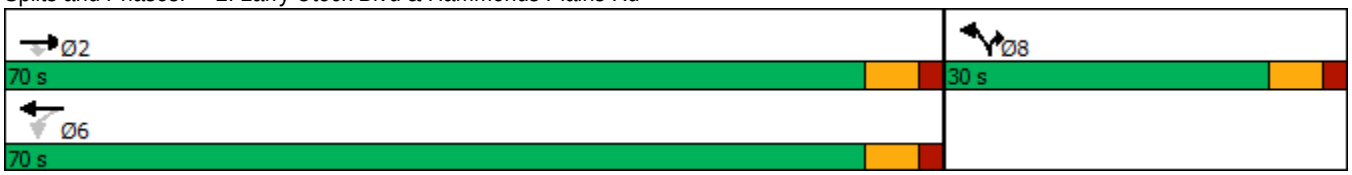


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	684	750	65	260	191	122
Future Volume (vph)	684	750	65	260	191	122
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.243		0.950	
Satd. Flow (perm)	1863	1583	453	1863	1770	1583
Satd. Flow (RTOR)		815				68
Lane Group Flow (vph)	743	815	71	286	208	133
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	70.0	70.0	70.0	70.0	30.0	30.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	31.3	31.3	31.3	31.3	12.8	12.8
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.22	0.22
v/c Ratio	0.73	0.66	0.29	0.28	0.53	0.33
Control Delay	14.4	3.5	10.5	7.6	27.6	14.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.4	3.5	10.5	7.6	27.6	14.9
LOS	B	A	B	A	C	B
Approach Delay	8.7			8.2	22.7	
Approach LOS	A			A	C	
Queue Length 50th (m)	49.6	0.0	3.4	13.5	18.7	5.4
Queue Length 95th (m)	110.1	13.1	12.6	32.0	51.9	23.7
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	1767	1543	429	1767	806	758
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	0.42	0.53	0.17	0.16	0.26	0.18

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 57.1
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 10.7
Intersection LOS: B
Intersection Capacity Utilization 74.1%
ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	821	10	34	334	18	91
Future Volume (Veh/h)	821	10	34	334	18	91
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)	892	11	37	363	20	99
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			903		1334	898
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			903		1334	898
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		88	71
cM capacity (veh/h)			753		161	338

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	903	37	363	119
Volume Left	0	37	0	20
Volume Right	11	0	0	99
cSH	1700	753	1700	286
Volume to Capacity	0.53	0.05	0.21	0.42
Queue Length 95th (m)	0.0	1.2	0.0	15.7
Control Delay (s)	0.0	10.0	0.0	26.3
Lane LOS		B		D
Approach Delay (s)	0.0	0.9		26.3
Approach LOS				D

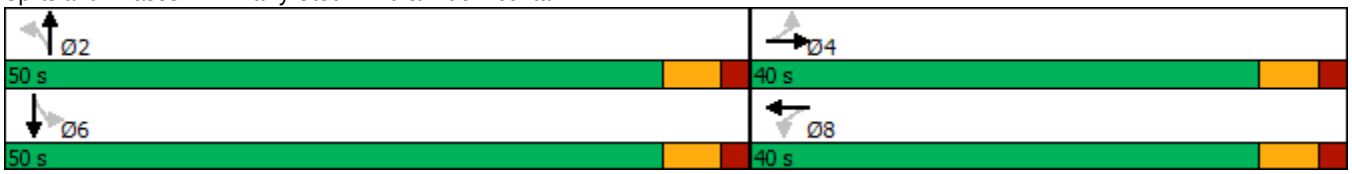
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	57.1%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	0	85	104	0	29	245	785	159	42	503	5
Future Volume (vph)	5	0	85	104	0	29	245	785	159	42	503	5
Satd. Flow (prot)	0	1619	0	1770	1583	0	1770	1816	0	1770	1861	0
Flt Permitted		0.983		0.841			0.422			0.150		
Satd. Flow (perm)	0	1597	0	1567	1583	0	786	1816	0	279	1861	0
Satd. Flow (RTOR)		92			108			16			1	
Lane Group Flow (vph)	0	97	0	113	32	0	266	1026	0	46	552	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Total Split (s)	40.0	40.0		40.0	40.0		50.0	50.0		50.0	50.0	
Total Lost Time (s)		6.0		6.0	6.0		6.0	6.0		6.0	6.0	
Act Effct Green (s)		12.0		12.0	12.0		48.4	48.4		48.4	48.4	
Actuated g/C Ratio		0.18		0.18	0.18		0.71	0.71		0.71	0.71	
v/c Ratio		0.27		0.41	0.09		0.47	0.79		0.23	0.42	
Control Delay		8.7		29.5	0.5		10.4	16.0		9.6	7.1	
Queue Delay		0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay		8.7		29.5	0.5		10.4	16.0		9.6	7.1	
LOS		A		C	A		B	B		A	A	
Approach Delay		8.7			23.1			14.9			7.3	
Approach LOS		A			C			B			A	
Queue Length 50th (m)		0.6		13.5	0.0		15.3	88.0		2.1	29.8	
Queue Length 95th (m)		11.6		27.4	0.0		42.1	#212.5		9.4	60.8	
Internal Link Dist (m)		297.2			138.6			441.3			532.6	
Turn Bay Length (m)				75.0			75.0			75.0		
Base Capacity (vph)		847		786	848		561	1301		199	1329	
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		0.11		0.14	0.04		0.47	0.79		0.23	0.42	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 67.8
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 13.0
Intersection LOS: B
Intersection Capacity Utilization 90.9%
ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Larry Uteck Blvd & Blue Mountain Dr



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	417	395	125	761	677	103
Future Volume (vph)	417	395	125	761	677	103
Satd. Flow (prot)	1863	1583	1770	1863	1770	1583
Flt Permitted			0.361		0.950	
Satd. Flow (perm)	1863	1583	672	1863	1770	1583
Satd. Flow (RTOR)		429				22
Lane Group Flow (vph)	453	429	136	827	736	112
Turn Type	NA	Perm	Perm	NA	Prot	Prot
Protected Phases	2			6	8	8
Permitted Phases		2	6			
Total Split (s)	50.0	50.0	50.0	50.0	50.0	50.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0
Act Effct Green (s)	44.0	44.0	44.0	44.0	42.6	42.6
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.43	0.43
v/c Ratio	0.55	0.45	0.45	1.00	0.96	0.16
Control Delay	23.4	3.4	25.7	58.9	53.4	14.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.4	3.4	25.7	58.9	53.4	14.2
LOS	C	A	C	E	D	B
Approach Delay	13.7			54.2	48.2	
Approach LOS	B			D	D	
Queue Length 50th (m)	66.5	0.0	19.0	~168.1	140.1	10.6
Queue Length 95th (m)	97.7	17.2	37.8	#251.9	#219.7	21.5
Internal Link Dist (m)	204.5			834.9	501.9	
Turn Bay Length (m)			100.0			10.0
Base Capacity (vph)	831	944	299	831	790	718
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	0.55	0.45	0.45	1.00	0.93	0.16

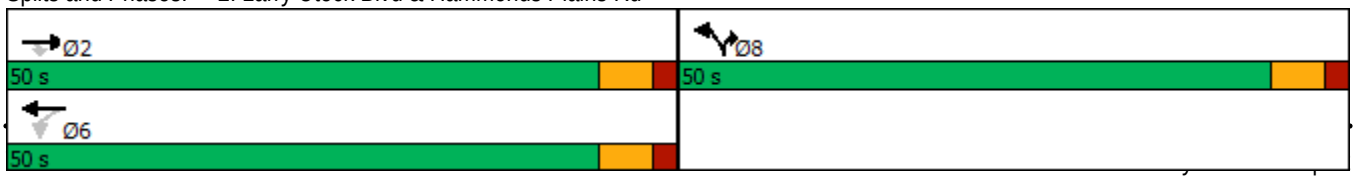
Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 98.6
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 39.0 Intersection LOS: D
Intersection Capacity Utilization 87.6% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

Splits and Phases: 2: Larry Uteck Blvd & Hammonds Plains Rd



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	532	24	101	901	15	68
Future Volume (Veh/h)	532	24	101	901	15	68
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)	578	26	110	979	16	74
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			604		1790	591
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			604		1790	591
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			89		80	85
cM capacity (veh/h)			974		79	507

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	604	110	979	90
Volume Left	0	110	0	16
Volume Right	26	0	0	74
cSH	1700	974	1700	258
Volume to Capacity	0.36	0.11	0.58	0.35
Queue Length 95th (m)	0.0	3.0	0.0	12.0
Control Delay (s)	0.0	9.2	0.0	26.2
Lane LOS		A		D
Approach Delay (s)	0.0	0.9		26.2
Approach LOS				D

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

SIDRA ANALYSIS – 2030 AM & PM PEAK HOUR

WITHOUT SITE DEVELOPMENT

Hammonds Plains Road at Larry Uteck Boulevard

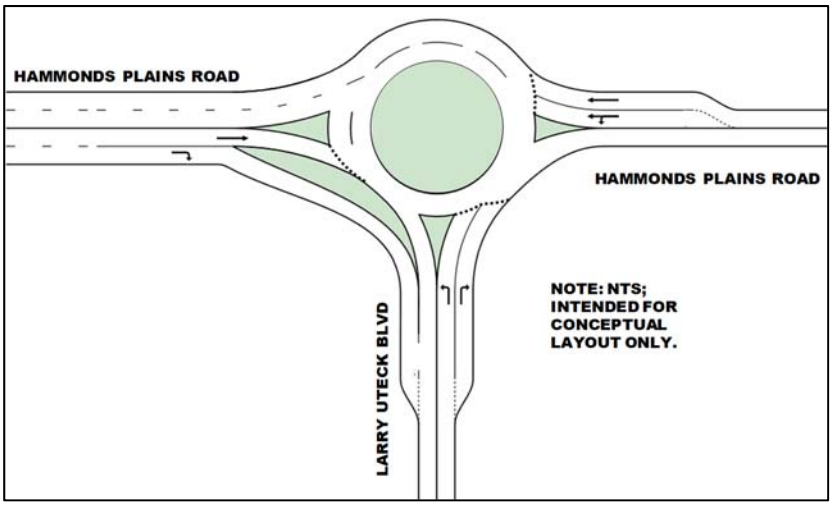


Table 1 - 2030 AM Peak Hour - Without Site Development

Movement Performance - Vehicles								
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Larry Uteck								
1	L2	163	2.0	0.151	13.1	LOS B	1.0	6.9
3	R2	11	2.0	0.015	7.1	LOS A	0.1	0.6
Approach		174	2.0	0.151	12.7	LOS B	1.0	6.9
East: Hammonds Plains								
4	L2	11	2.0	0.100	10.3	LOS B	0.6	4.1
5	T1	266	2.0	0.100	2.8	LOS A	0.6	4.3
Approach		277	2.0	0.100	3.1	LOS A	0.6	4.3
West: Hammonds Plains								
11	T1	739	2.0	0.435	2.2	LOS A	3.0	21.0
12	R2	788	2.0	0.415	2.5	LOS A	0.0	0.0
Approach		1527	2.0	0.435	2.4	LOS A	3.0	21.0
All Vehicles		1978	2.0	0.435	3.4	LOS A	3.0	21.0

Table 2 - 2030 PM Peak Hour - Without Site Development

Movement Performance - Vehicles								
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Larry Uteck								
1	L2	696	2.0	0.532	12.2	LOS B	4.1	29.5
3	R2	11	2.0	0.012	5.1	LOS A	0.1	0.4
Approach		707	2.0	0.532	12.0	LOS B	4.1	29.5
East: Hammonds Plains								
4	L2	11	2.0	0.487	15.6	LOS B	4.1	29.3
5	T1	815	2.0	0.487	7.3	LOS A	4.4	31.7
Approach		826	2.0	0.487	7.4	LOS A	4.4	31.7
West: Hammonds Plains								
11	T1	440	2.0	0.264	2.2	LOS A	1.8	12.6
12	R2	375	2.0	0.198	2.5	LOS A	0.0	0.0
Approach		815	2.0	0.264	2.3	LOS A	1.8	12.6
All Vehicles		2348	2.0	0.532	7.0	LOS A	4.4	31.7

SIDRA ANALYSIS – 2030 AM & PM PEAK HOUR

WITH SITE DEVELOPMENT

Hammonds Plains Road at Larry Uteck Boulevard

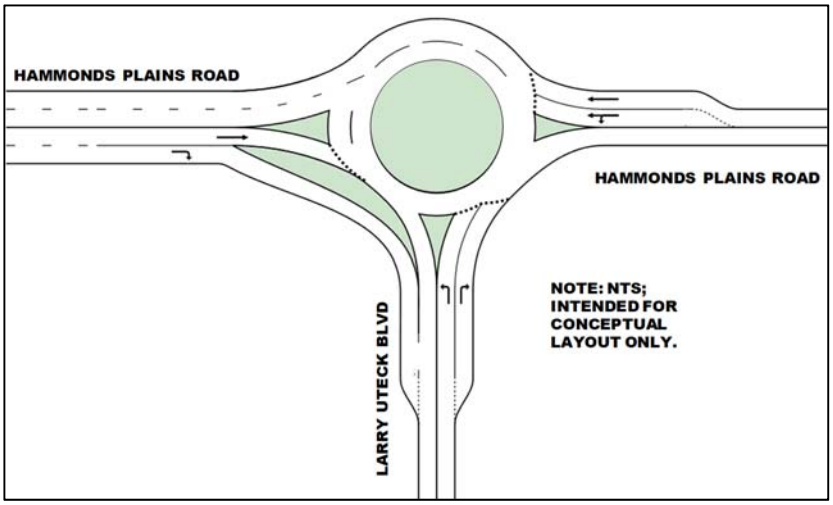


Table 3 - 2030 AM Peak Hour - With Site Development

Movement Performance - Vehicles								
Mov ID	OD Mov	Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Larry Uteck								
1	L2	208	2.0	0.202	13.2	LOS B	1.4	10.1
3	R2	133	2.0	0.172	7.4	LOS A	1.1	7.6
Approach		340	2.0	0.202	11.0	LOS B	1.4	10.1
East: Hammonds Plains								
4	L2	71	2.0	0.133	10.5	LOS B	0.8	5.7
5	T1	283	2.0	0.133	3.0	LOS A	0.8	5.9
Approach		353	2.0	0.133	4.5	LOS A	0.8	5.9
West: Hammonds Plains								
11	T1	743	2.0	0.494	2.6	LOS A	3.6	25.7
12	R2	815	2.0	0.430	2.5	LOS A	0.0	0.0
Approach		1559	2.0	0.494	2.5	LOS A	3.6	25.7
All Vehicles		2252	2.0	0.494	4.1	LOS A	3.6	25.7

Table 4 - 2030 PM Peak Hour - With Site Development

Movement Performance - Vehicles								
Mov ID	OD Mov	Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m
South: Larry Uteck								
1	L2	736	2.0	0.588	12.9	LOS B	5.6	40.0
3	R2	112	2.0	0.132	5.5	LOS A	0.7	5.2
Approach		848	2.0	0.588	11.9	LOS B	5.6	40.0
East: Hammonds Plains								
4	L2	136	2.0	0.610	18.7	LOS B	6.3	44.9
5	T1	827	2.0	0.610	10.0	LOS A	7.1	50.4
Approach		963	2.0	0.610	11.2	LOS B	7.1	50.4
West: Hammonds Plains								
11	T1	453	2.0	0.341	2.8	LOS A	2.3	16.4
12	R2	429	2.0	0.226	2.5	LOS A	0.0	0.0
Approach		883	2.0	0.341	2.6	LOS A	2.3	16.4
All Vehicles		2693	2.0	0.610	8.6	LOS A	7.1	50.4