MAINLAND COMMON TRAFFIC IMPACT STUDY

REVISED REPORT

PREPARED FOR:
QUAD-RAM CONSTRUCTION LIMITED

Project No. CA0004090.6438

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TABLE OF CONTENTS

APPENDICES

PREPARED BY: BRIANNA RIETZEL, EIT
PATRICK HATTON, P.ENG.

1 INTRODUCTION

Background

Plans are being prepared for a multi-use development consisting of about 3,510 residential units and 155,665 square feet of commercial space on vacant land north of the Bayers Lake Business Park in Halifax, Nova Scotia, see Figure 1. Buildout of the development is expected by 2034. The Halifax Regional Municipality (HRM) has requested that a Traffic Impact Study (TIS) be completed to review the impacts to the adjacent transportation network. WSP Canada Inc. has been retained to complete this TIS.

Figure 1 – Development Location

A Traffic Impact Study Usually Considers Four Questions

A TIS usually consists of determining answers to 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 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

The objectives of the traffic impact study are to:

1. Develop projected 2039 background weekday AM and PM peak hourly traffic volumes for Study Intersections. This includes connection of Regency Park Drive and diverted traffic but does not include site development.
2. Estimate the number of weekday AM and PM peak hour vehicle trips that will be generated by the proposed development.
3. Distribute and assign site generated trips to Study Intersections to project 2039 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.

2 STUDY AREA DESCRIPTIONS

Description of Existing Development

The proposed development area is on the vacant land bounded by Washmill Lake Drive and Thomas Raddall Drive.

Description of Proposed Development

The proposed development is planned to include 3,510 high-rise residential units and 155,665 square feet of ground floor retail space. The study will consider the build out development scenario with a study horizon year of 2039.

A concept of the proposed development is shown in Figure 2. The proposed development consists of 18 residential towers, of which ten are expected to have commercial space.

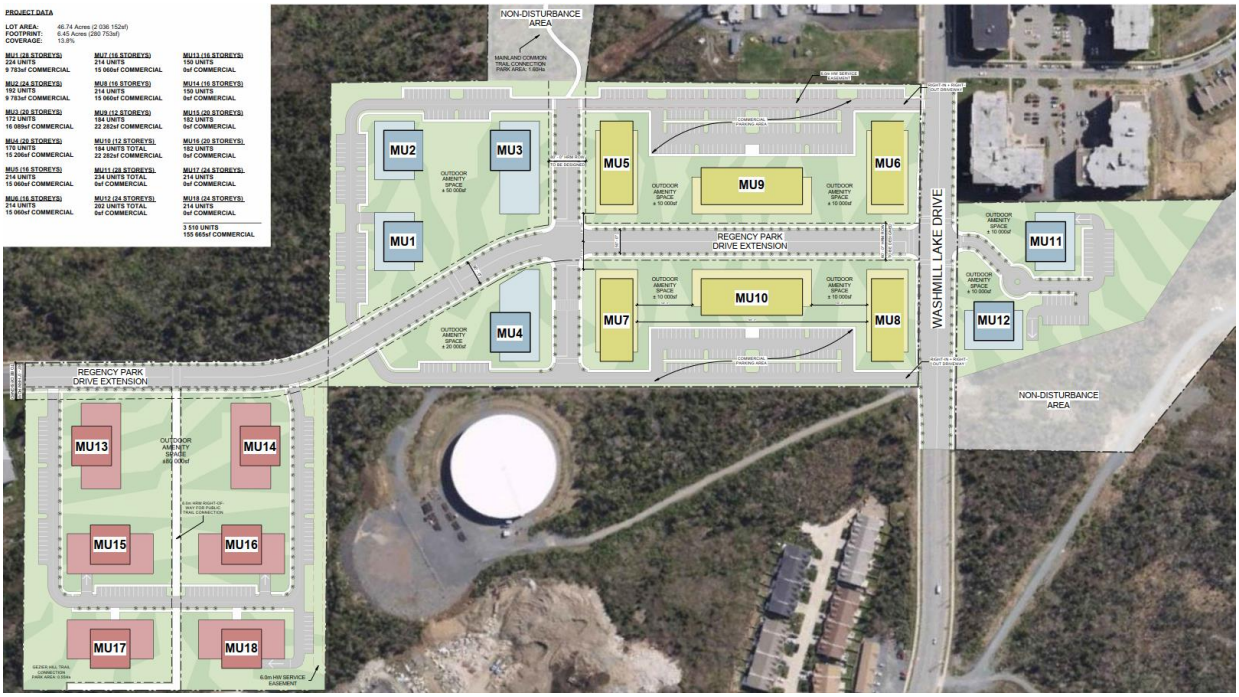


Figure 2 - Site Concept

Existing Study Road Descriptions

Washmill Lake Drive is a four-lane major collector through Clayton Park, running from Chain Lake Drive in the west to Dunbrack Street in the east with a speed limit of 60 km/h in this area. There are sidewalks and dedicated bicycle lanes on both sides of Washmill Lake Drive.

Regency Park Drive is a two-lane major collector with a speed limit of 50 km/h that runs south from Lacewood Drive about 850m to its current terminus. There are sidewalks on both sides of the road and no existing dedicated bicycle lanes.

Parkland Drive is a two-lane major collector with a speed limit of 50 km/h. Parkland Drive is a continuation of Regency Park Drive north of Lacewood Drive. There are sidewalks on both sides of the road and no dedicated bicycle lanes.

Lacewood Drive is a four-lane arterial with a posted speed limit of 60 km/h at the study intersection with Regency Park Drive. There are sidewalks on both sides of the road and no dedicated bicycle lanes.

Existing Study Intersection Descriptions

The traffic study includes review of one existing intersection north of the site as well as two proposed intersections. These intersections are shown in Figure 3 and a description of each is provided below.

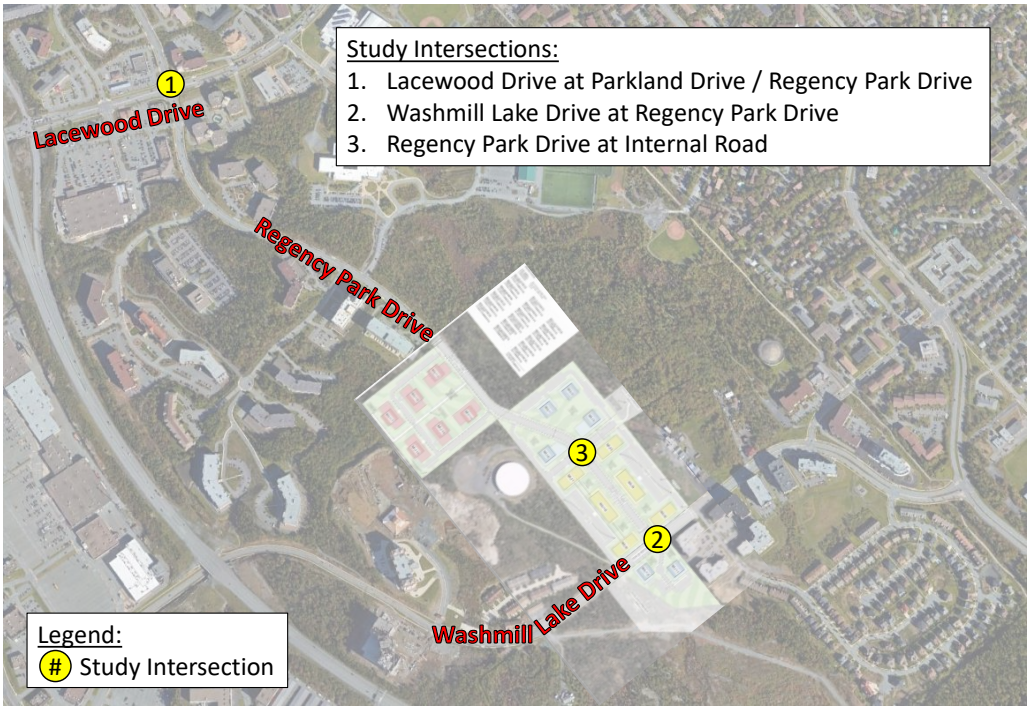


Figure 3 - Study Intersections

Intersection #1 – Lacewood Drive at Parkland Drive/Regency Park Drive is a 4-leg signalized intersection with a left-turn lane, two through lanes, and a right-turn channelized lane in the eastbound and westbound directions (Lacewood Drive approaches); and a left-turn lane, a through lane, and a right-turn channelized lane in the northbound and southbound directions. All approaches have marked pedestrian crossings.

Intersection #2 – Washmill Lake Drive at Regency Park Drive is a proposed 4-leg intersection. Washmill Lake Drive is a four-lane roadway running east-west with a proposed street connection (Regency Park Drive) as the southbound approach and a driveway for the proposed development forming the northbound approach.

Intersection #3 – Regency Park Drive at Internal Road is a proposed 4-leg intersection. Regency Park Drive is a proposed two-lane roadway running north-south with a proposed street connection (Internal Road) as the eastbound and westbound approaches.

3 BACKGROUND TRAFFIC

Turning Movement Counts

Turning movement counts were collected at the Lacewood Drive at Regency Park Drive / Parkland Drive and Washmill Lake Drive at Bently Drive intersections on Wednesday, June 21, 2023 for the PM peak period and on Thursday, June 22, 2023 for the AM peak period. The counts at the Bently Drive intersection were used to estimate the two-way volumes along Washmill Lake Drive fronting the site and project the future volumes at the Washmill Lake Drive at Regency Park Drive intersection.

Intersection counts have been tabulated in 15-minute intervals with peak hours indicated by shaded areas. Pedestrian volumes are summarized in hourly increments. Turning movement counts are summarized in Tables A-1 to A-2, Appendix A, and illustrated diagrammatically in Figure A-1, Appendix A. No Seasonal adjustment factor has been applied since the HRM factors for Wednesdays and Thursdays in June is below 1.0 and would result in a reduction from the observed volumes.

Traffic Growth Rate

An annual growth rate of 0.5% was applied to project the 2039 Future Background Volumes (see Figure A-2, Appendix A). This is expected to account for continuing development in the area in additional vehicle trips generated by population increases in the area and coincides with the HRM 0.5% annual traffic growth target.

Redistribution of Background Traffic to the Extended Regency Park Drive

With the proposed extension of Regency Park Drive, it is anticipated that some background traffic in the current roadway network will redistribute their trips to the extended roadway. The projected 2039 Future Background Volumes with the Extension of Regency Park Drive are shown in Figure A-3, Appendix A.

Background Development Trips

Trip Generation Study, Bayers Lake Expansion Lands (WSP, April 2022) estimates the generated trips for the new hospital in the Bayers Lake ara. It was estimated that that development will generate:

- 246 two-way trips (165 entering and 81 exiting) during the AM peak hour; and,
- 234 two-way trips (82 entering and 152 exiting) during the PM peak hour.

The hospital trips were applied to the 2039 future background volumes along Lacewood Drive and Washmill Lake Drive without site generated trips to provide a realistic estimate of traffic during this period.

4 ACTIVE TRANSPORTATION AND TRANSIT

Active Transportation

Sidewalk facilities are available along each of the study roads and sidewalk is planned for both sides along the extended Regency Park Drive. Bicycle facilities are also planned for the extended Regency Park Drive and the developer intends to work with HRM to ensure the desired bicycle facility type is put in place with the road extension. It is understood that HRM has recently completed a project to review and recommend the type of bicycle facilities on Parkland Drive up to Lacewood Drive and includes options for providing bicycle facilities crossing at the Lacewood Drive intersection. While the exact bicycle facility type proposed for Parkland Drive is not yet finalized and the design has not been completed, it is recommended that HRM consider extending the preferred bicycle facility type along the current and extended Regency Park Drive to connect to the existing bicycle lanes along Washmill Lake Drive. Figure 4 shows the existing and candidate bicycle facility routes within the surrounding area.

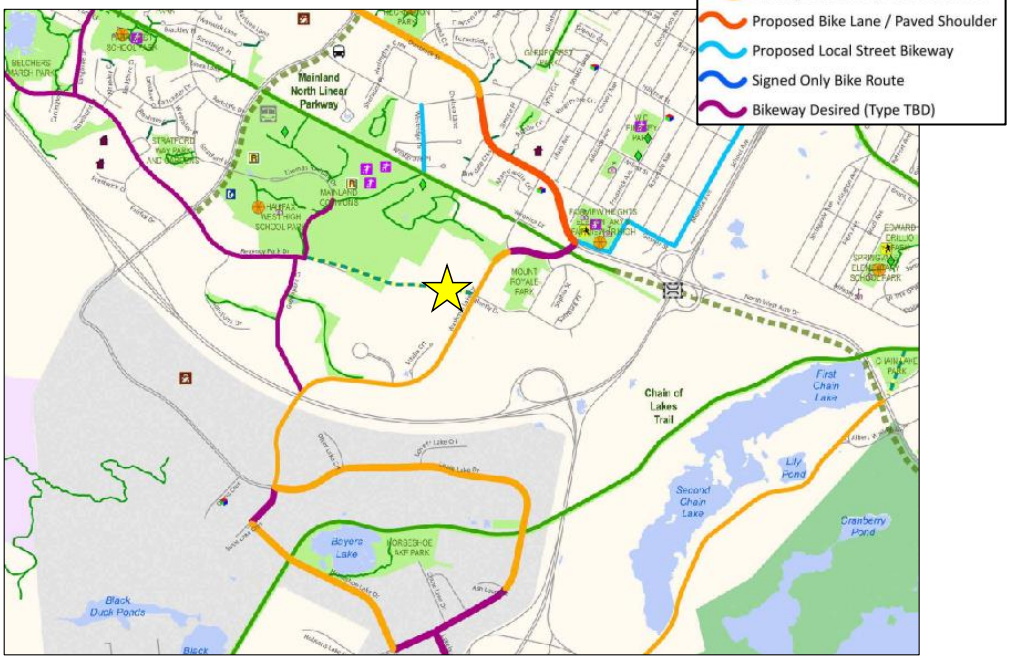


Figure 4 – Candidate Bicycle Facilities
Extracted from Map 2C, Making Connections, Halifax

Transit

There are many transit stops in the area. Transit stops #6719 and #7446 are along Washmill Lake Drive near Bently Drive just to the east of the site, and there are several transit stops and routes along the existing portion of Regency Park Drive and Thomas Raddall Drive. The site is about 1.3km from the Lacewood Terminal, which is serviced by Halifax Transit routes #2, #3, #4, #21, #28, #30, #39, #135, #136, #137, #138, and #433. The existing transit network in the area is shown in Figure 5.

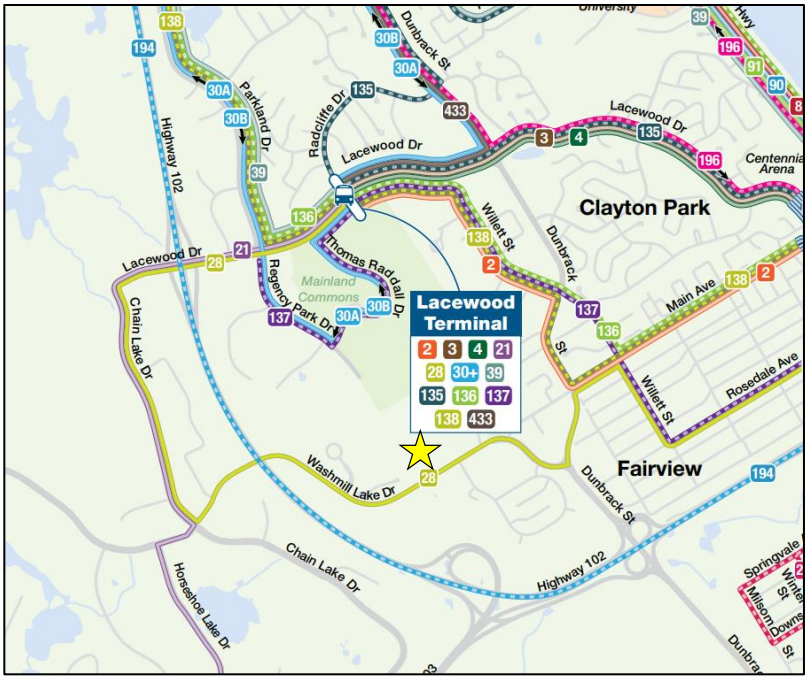


Figure 5 – Existing Halifax Transit Routes

A transit route (#137, Regency Park Express) running along the extended Regency Park Drive fronting the site and connecting to Scotia Square (AM) and Lacewood Terminal (PM) was proposed in Map 1 of the Council Approved Halifax Transit Moving Forward Together Plan (See Figure 6). It is anticipated that the extended street will include routing of transit fronting the site given the current routing along Regency Park Drive and Washmill Lake Drive (See Figure 5) and the proximity to the Lacewood Terminal.

Figure 6 – Proposed Transit Routes in the project area
Extracted from Map 1, Halifax Transit Moving Forward Together Plan

Transit (Continued)

HRM has completed a rapid transit strategy that would see the implementation of four Bus Rapid Transit (BRT) lines and three new ferry routes which will "promote the creation of more compact and walkable communities and increase mobility options alternative to private vehicles". The proposed green line is planned to travel between the Lacwood Terminal and SMU and would provide frequent and reliable transit service between the study area and Peninsular Halifax.

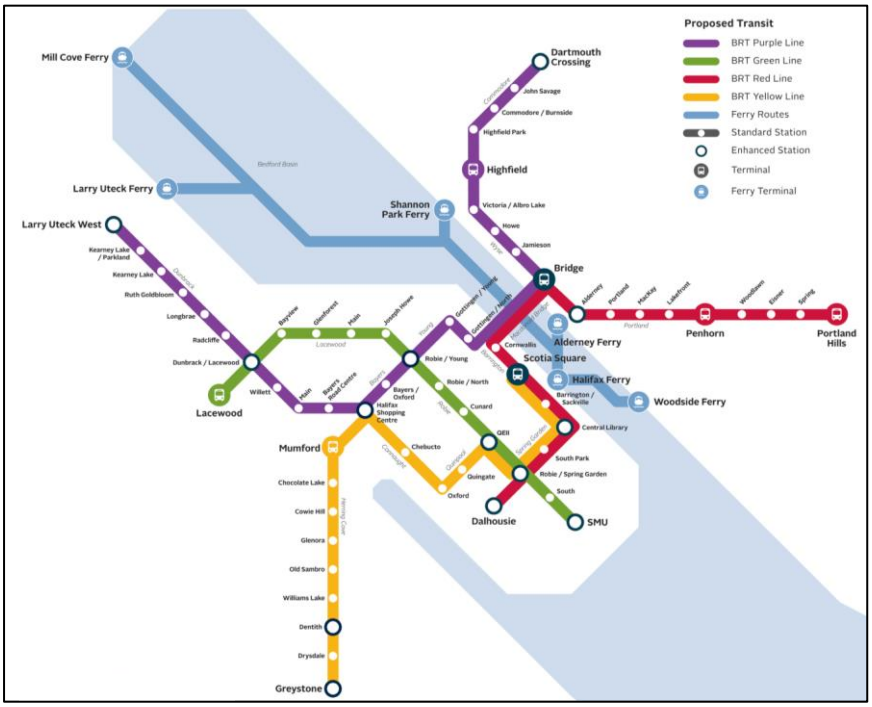


Figure 7 – HRM Rapid Transit Strategy – Proposed Routes

5 TRIP GENERATION, DISTRIBUTION, AND ASSIGNMENT

Prepared Trip Generation Estimates

When using the published trip generation rates in the Trip Generation Manual, 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.

Proposed Development

The proposed development is expected to include 3,510 high-rise residential units and 155,665 square feet of ground floor retail space.

Anticipated Land Use for the Proposed Development

Trip generation estimates for the proposed development were prepared using published rates and equations from *Trip Generation Manual, 11th Edition* (Institute of Transportation Engineers, Washington, 2021). Trip generation estimates for the AM and PM peak hours of adjacent streets have been prepared based on the number of units for residential developments and 1,000 square feet of leasable area for the retail space.

Based on the proposed development's proximity to numerous amenities and that the site lies within an area of HRM with high active transportation usage, many of the trips generated by the proposed development are anticipated to be non-auto trips. Using the methodology provided in *Trip Generation Handbook, 3rd Edition* (Institute of Transportation Engineers, Washington, 2017), estimates of the total person trips generated by the development were prepared (See Table 1).

With residential and retail land uses planned for this development, many of the trips generated by the site are expected to be internal trips, those that are made between complementary land uses within the development, such as a resident visiting a store on the ground level who never leaves the site. The National Cooperative Highway Research Program (NCHRP) Report 684 – *Enhancing Internal Trip Capture for Mixed-Use Developments* provides an estimation tool for considering internal trips. Output worksheets from this estimation tool are included in Appendix B.

Appendix B of the ITE Trip Generation Handbook, 3rd Edition (2017) includes baseline modal share data for a variety of land use types including apartments and shopping centers.

Appendix B of the Handbook indicates that the modal share of the sample trip data for apartment and shopping center land uses was 96%-100% vehicle trips.

For this development, it is expected that significantly more than 0-4% of the person trips will be by transit and active modes and the multimodal trip generation methodology identified in Figure 3.1 of the Handbook has been applied to the trip generation estimates for this development.

Trips Generated by the Proposed Development – Total Trips Generated

Trip generation estimates for the proposed development are summarized in Table 1. It is estimated that the development will generate:

- 1,279 two-way external person trips (481 entering and 798 exiting) during the AM peak hour; and,
- 1,938 two-way external person trips (1,095 entering and 843 exiting) during the PM peak hour.

Table 1 – Trip Generation Estimates for the Proposed Development

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
Multifamily Housing (High Rise) 222	3510	Equations from Page 307 & 308				206	585	580	356
Strip Retail Plaza (<40k GLA) 822 MU1, MU2, MU3, MU5, MU6, MU9	88.1 KGLA	Rates from Pages 230 & 231				125	83	290	290
Strip Retail Plaza (<40k GLA) 822 MU4, MU7, MU8, MU10	67.6 KGLA					96	64	223	223
Baseline Vehicle Trip Estimate for the Proposed Development						427	732	1093	869
Total Person Trips[4]						492	809	1288	1036
Internal Person Trips[5]						11	11	193	193
External Person Trips[5]						481	798	1095	843

NOTES:
1. Rates and equations are from *Trip Generation, 11th Edition* (Institute of Transportation Engineers, 2021). Directional splits were corrected using the Errata released by ITE.
2. KGLA is 'Gross Leasable Area x 1000 SF'.
3. Rates are 'vehicles per hour per unit'; trips generated are 'vehicles per hour for peak hours'.
4. Baseline vehicle trips using historical trip generation data from *Trip Generation, 11th Edition* have been converted to person trips using methodology and conversion factors provided in *Trip Generation Handbook, 3rd Edition* (Institute of Transportation Engineers, 2017).
5. Internal and external person trip estimates are based on methodology from National Cooperative Highway Research Program (NCHRP) 684 with associated worksheets included in Appendix B.

Estimated Modal Shares of Development Trips

The site is located near the Lacewood Transit Terminal and several transit routes and there are existing or planned bicycle facilities along Washmill Lake Drive, Regency Park Drive, and Parkland Drive with existing or planned active transportation connections to the Mainland North Trail, the Bayers Lake Business Park, and the Chain of Lakes Trail (See Section 4). HRM's Integrated Mobility Plan (IMP) sets a modal share target that by 2031 at least 26% of all person trips in the Inner Suburban Area will be made by transit or active transportation. The horizon year for this TIS is 2038 and this site is located within a five-minute bike ride of a major transit terminal as well as near several existing and planned active transportation facilities. While it is expected that the non-auto modal share of site trips will exceed the HRM targets for this area, a conservative 25% modal share of transit and active transportation has been applied to site generated person trips.

It is estimated that the development will generate:

- 831 two-way vehicle trips (313 entering and 518 exiting) during the AM peak hour; and,
- 1,259 two-way vehicle trips (711 entering and 548 exiting) during the PM peak hour.

Table 2 –Total Trip Generation Estimates for the Proposed Development

Travel Mode	Modal Share	AM Peak		PM Peak	
		In	Out	In	Out
External Person Trips		**481**	**798**	**1095**	**843**
Auto Driver	**65%**	313	518	711	548
Auto Passenger	**10%**	48	80	110	84
Transit	**20%**	96	160	219	169
Active Modes	**5%**	24	40	55	42

Rationalization of Estimated Modal Share

The projected transit modal share for the proposed development considers the proximity of the Lacewood terminal, the existing transit routes along Washmill Lake Drive fronting the site, and the planned transit route along the extended Regency Park Drive.

The projected active transportation modal share for the proposed development considers the existing bicycle lanes and sidewalk along Washmill Lake Drive, the sidewalk and bicycle facilities planned for the extended Regency Park Drive, and the proximity of the site to the

Bayers Lake business park, and several nearby facilities such as Halifax West High School, Canada Games Center, and the Lacewood Square retail development.

Trip Distribution and Assignment

The proposed development generated trips were distributed to the Study Intersections based on counted volumes and review of travel origin and destinations around the site. For retail development attraction, regional residential development has been considered. For new residential development, employment densities and retail draws have been considered. The estimated directional distributions are provided below.

Direction	Residential	Commercial
North on Parkland Drive	5%	5%
South/West on Washmill Lake Drive	25%	30%
North/East to Lacewood Drive	15%	15%
East on Washmill Lake Drive	30%	25%
North/West to Lacewood Drive	25%	25%

Volume Figures

Weekday AM and PM peak hourly estimated site generated vehicle volumes were distributed and assigned to external streets and intersections in the study area using the above assumptions. Assigned AM and PM peak hourly site generated volumes are illustrated diagrammatically in Figure A-4, Appendix A. Assigned site development trips were added to background volumes with redistribution for the extended Regency Park Drive (Figure A-3) to provide estimates of the AM and PM peak hour volumes at study area intersections for development build-out which are illustrated diagrammatically on Figure A-5, Appendix A.

6 INTERSECTION OPERATIONAL ANALYSIS

Intersection Operational 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 a nomograph for left-turn lane analysis for four lane undivided streets at unsignalized intersections. The analysis method, which is normally used by WSP Atlantic to evaluate the warrant for left-turn lanes along four lane roadways, uses a nomograph that considers left-turning volume and opposing volume. A point, based on left turning and 'opposing' volumes, plotted to the right of the 'warrant line' 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.

Evaluation of left turn lane warrants were completed for the Washmill Lake Drive at Regency Park Drive intersection using 2039 traffic volumes with redistribution of existing traffic onto the extended Regency Park Drive without and with the proposed development and for the Regency Park Drive at internal Road intersection. **A left-turn lane is warranted** in the eastbound direction on Washmill Lake Drive at Regency Park Drive without and with the addition of site generated trips. A westbound left turn lane is found to be warranted at that intersection with the addition of site generated trips. **A left-turn lane is warranted** in the northbound and southbound directions at the Regency Park Drive and Internal Road intersection (Study Intersection #3).

The addition of a warranted left-turn lane has been identified based on safety of left turning vehicles but are at the discretion of HRM based on operational needs and right-of-way limitations. Left-turn lane warrant results are available in Figure B-1 and B-2, 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.

Evaluation of traffic signal warrants were completed for the Washmill Lake Drive at Regency Park Drive intersection using 2039 traffic volumes with the proposed development and **traffic signals are warranted** (226 vehicle warrant points) with the addition of site generated trips. Evaluation of traffic signal warrants were completed for the Regency Park Drive at Internal Road intersection using 2039 traffic volumes with the proposed development and **traffic signals are not warranted** (56 vehicle warrant points). Signal warrant results are available in Tables B-1, B-2 and B-3, Appendix B.

Intersection Capacity Analysis Results

Synchro 11 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.

6.1 ANALYSIS SCENARIOS

Summary Analysis Scenarios Considered

Scenario 1A - Future 2039 without Site: Represents future 2039 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections.

Scenario 1B - Future 2039 without Site – Diverted Trips: Represents future 2039 traffic volumes with future diverted trips onto the Regency Park Drive connection. The study intersections have been modified to accommodate an eastbound left-turn lane on Washmill Lake Drive at Regency Park Drive based on the warrants summarized in Appendix B.

***Scenario 2 - Future 2039 with Site*:** Represents future 2039 traffic volumes on the existing road network, including the existing traffic control and lane configurations of the Study Intersections with buildout of the proposed development. The study intersections have been modified to accommodate left-turn lanes and traffic signalization at the Washmill Lake Drive at Regency Park Drive intersection based on the warrants summarized in Appendix B.

6.2 INT #1: LACEWOOD DRIVE AT REGENCY PARK DRIVE

Operational performance results for this intersection are provided in Table 3 for both the AM and PM peak hours for each of the analysis scenarios.

The intersection is expected to operate within HRM acceptable limits laid out in HRM's current TIS Guidelines during the AM and PM peak hours without and with site generated trips. The maximum v/c ratio is projected to be 0.81 for the northbound left-turn movement. Some changes in the operational performance of this intersection are expected with the addition of the proposed development.

Table 3 - Intersection Capacity Analysis: Lacewood Drive at Regency Park Drive

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement												Overall Intersection	
	Lacewood Drive						Regency Park Drive			Parkland Drive				
	EB-L	EB-TT	EB-R	WB-L	WB-TT	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R	Delay	Control
Scenario 1A - 2039 Future without Site AM Peak Hour - without diversions (Page C-1)														
Delay	6.4	15.8	9.2	6.5	13.7	7.0	21.1	15.2	5.7	21.3	16.2	5.6	12.4	
v/c	0.15	0.35	0.31	0.18	0.25	0.19	0.43	0.08	0.28	0.45	0.18	0.34		
Queue	9.6	26.2	17.8	11.0	22.3	11.9	24.2	8.0	10.3	25.7	14.6	11.6		
Scenario 1B - 2039 Future without Site AM Peak Hour (Page C-3)														
Delay	6.3	16.1	9.1	6.5	13.4	6.4	20.7	16.2	5.7	21.7	17.7	6.1	12.6	
v/c	0.13	0.34	0.27	0.22	0.26	0.18	0.39	0.14	0.33	0.45	0.28	0.29		
Queue	8.0	25.8	15.8	13.0	22.7	10.9	21.4	11.9	11.5	25.2	21.1	10.9		
Scenario 2 - 2039 Future with Site AM Peak Hour (Page C-7)														
Delay	9.9	21.5	13.1	11.1	17.0	7.9	26.8	14.7	4.3	17.8	15.7	4.8	14.8	
v/c	0.14	0.41	0.47	0.36	0.25	0.18	0.67	0.15	0.43	0.34	0.24	0.24		
Queue	12.4	32.5	28.8	29.1	29.7	13.4	47.8	15.9	13.8	24.9	23.3	10.5		
Scenario 1A - 2039 Future without Site PM Peak Hour - without diversions (Page C-2)														
Delay	11.5	18.3	13.6	8.5	20.0	10.0	28.0	17.7	5.6	22.5	18.6	5.5	16.1	
v/c	0.52	0.52	0.42	0.28	0.58	0.30	0.60	0.09	0.28	0.40	0.19	0.35		
Queue	30.6	54.9	37.7	17.5	50.9	19.7	42.3	11.3	11.6	29.4	19.2	13.4		
Scenario 1B - 2039 Future without Site PM Peak Hour (Page C-5)														
Delay	9.1	19.6	12.9	9.1	18.7	9.3	27.1	19.0	5.6	23.2	19.8	7.2	15.8	
v/c	0.39	0.59	0.42	0.39	0.53	0.28	0.56	0.23	0.38	0.42	0.30	0.32		
Queue	23.5	51.5	30.2	22.5	46.3	18.2	35.2	21.2	13.5	27.6	26.3	14.0		
Scenario 2 - 2039 Future with Site PM Peak Hour (Page C-9)														
Delay	13.8	27.2	27.0	18.9	22.8	10.8	41.9	20.6	6.4	22.8	21.3	9.2	22.3	
v/c	0.44	0.63	0.76	0.67	0.50	0.27	0.81	0.22	0.42	0.32	0.28	0.26		
Queue	31.0	66.4	78.3	47.6	56.5	20.8	90.7	30.0	21.7	31.4	37.7	19.1		

6.3 INT #2: WASHMILL LAKE DRIVE AT REGENCY PARK DRIVE

Operational performance results for this intersection are provided in Table 4 for both the AM and PM peak hours for each of the analysis scenarios. Left-turn lanes and signals are included as warranted.

With added left turn lanes as warranted and with signalization in Scenario 2, the intersection is expected to operate within HRM acceptable limits during the AM and PM peak hours without and with site generated trips. The maximum v/c ratio is projected to be 0.81 in the westbound direction during the PM peak hour. While the operations at this intersection are expected to meet HRM tresholds, consideration could be given to the construction of a westbound right turn lane (recommended 60 metre storage) to improve the delay and queueing on this approach. This lane would be particularly advantageous if transit vehicles are expected to complete this right turn movement during the PM peak period to travel to the Lacewood Terminal.

Table 4 - Intersection Capacity Analysis: Washmill Lake Drive at Regency Park Drive

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement							Overall Intersection	
	Washmill Lake Drive				Access	Regency Park Drive			
	EB-L	EB-TT	WB-TTR			SB-LR		Delay	Control
Scenario 1B - 2039 Future without Site AM Peak Hour (Page C-4)									
Delay	9.1	0.0	0.0		-	14.6		1.6	
v/c	0.07	0.13	0.24		-	0.20			
Queue	1.9	0.0	0.0		-	5.8			
	EB-L	EB-TT	WB-L	WB-TTR	NB-LTR	SB-L	SB-TR	Delay	Control
Scenario 2 - 2039 Future with Site AM Peak Hour (Page C-8)									
Delay	15.3	8.3	7.4	9.4	10.8	19.3	5.9	10.4	
v/c	0.48	0.28	0.01	0.46	0.13	0.49	0.25		
Queue	23.5	21.6	1.7	36.0	10.2	30.6	10.9		
	EB-L	EB-TT	WB-TTR			SB-LR		Delay	Control
Scenario 1B - 2039 Future without Site PM Peak Hour (Page C-6)									
Delay	10.4	0.0	0.0		-	29.4		2.6	
v/c	0.18	0.29	0.31		-	0.48			
Queue	5.1	0.0	0.0		-	19.8			
	EB-L	EB-TT	WB-L	WB-TTR	NB-LTR	SB-L	SB-TR	Delay	Control
Scenario 2 - 2039 Future with Site PM Peak Hour (Page C-10)									
Delay	21.2	10.1	19.9	28.5	19.4	47.5	9.4	21.6	
v/c	0.62	0.47	0.11	0.81	0.07	0.77	0.34		
Queue	50.5	66.9	7.8	115.8	9.7	82.0	19.8		

6.4 INT #3: REGENCY PARK DRIVE AT INTERNAL ROAD

Operational performance results for this intersection are provided in Table 5 for both the AM and PM peak hours for each of the analysis scenarios. Northbound and southbound left-turn lanes are included as warranted. Left turn lanes have been added to the internal street approaches (eastbound and westbound) based on intersection operations.

With STOP control on the side streets only, the intersection is expected to operate within HRM acceptable limits with site generated trips. The maximum v/c ratio is projected to be 0.85 in the westbound left-turning direction during the PM peak hour with a delay of 96.6 seconds per vehicle.

Table 5 - Intersection Capacity Analysis: Regency Park Drive at Internal Road

LOS Criteria	Control Delay (sec/veh), v/c Ratio, and 95th %ile Queue (m) by Intersection Movement								Overall Intersection	
	Internal Street (EW)				Regency Park Drive					
	EB-L	EB-TR	WB-L	WB-TR	NB-L	NB-TR	SB-L	SB-TR	Delay	Control
Scenario 2 - 2039 Future with Site AM Peak Hour (Page C-11)										
Delay	23.4	9.8	19.3	10.1	7.8	0.0	7.8	0.0	6.9	
v/c	0.28	0.06	0.23	0.14	0.03	0.11	0.06	0.13		
Queue	9.1	1.6	7.0	3.8	0.7	0.0	1.4	0.0		
Scenario 2 - 2039 Future with Site PM Peak Hour (Page C-12)										
Delay	82.9	10.5	96.6	11.2	8.1	0.0	8.5	0.0	18.3	
v/c	0.72	0.12	0.85	0.18	0.05	0.20	0.13	0.19		
Queue	32.3	3.3	44.7	5.2	1.4	0.0	3.6	0.0		

While the analysis summarized in Table 5 has been completed as a stand-alone intersection, the proposed traffic signals on Washmill Lake Drive with the nearby development may provide additional gaps on Regency Park Drive and assist the left-turn movement from the Internal Streets. The intersection performance of eleven 1-hour runs using *SimTraffic* software for the 2039 PM peak hour with site development is summarized in Table 6 with results included in Appendix C.

Table 6 – SimTraffic Analysis: Regency Park Drive at Internal Road

LOS Criteria	Control Delay (sec/veh) and 95th %ile Queue (m) by Intersection Movement										Overall Intersection	
	Internal Street (EW)				Regency Park Drive							
	EB-L	EB-TR	WB-L	WB-TR	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R	Delay	Control
Scenario 2 - 2039 Future with Site PM Peak Hour (Page C-13)												
Delay	19.0	5.7	20.4	6.8	4.7	2.3	1.6	7.6	3.1	2.1	6.7	
Queue	2.4	18.8	24.8	26.0	13.1	7.6	7.6	18.8	7.9	7.9		

7 SUMMARY & RECOMMENDATIONS

7.1 SUMMARY

Background	1.	Plans are being prepared for a multi-use development consisting of 3,510 high-rise residential units and 155,665 square feet of ground floor retail space on vacant land north of the Bayers Lake Business Park in Halifax, Nova Scotia. Buildout of the development is expected by 2034.
Description of Existing Development	2.	The proposed development area is on the vacant land bounded by Washmill Lake Drive and Thomas Raddall Drive.
Description of Proposed Development	3.	The proposed development is expected to include 3,510 high-rise residential units and 155,665 square feet of ground floor retail space.
Proposed Site Access	4.	The proposed development is along an extension of Regency Park Drive through to Washmill Lake Drive with several small accesses along the extended Regency Park Drive and Washmill Lake Drive.
Study Area Roads	5.	The study considers Washmill Lake Drive, Regency Park Drive, Lacewood Drive, and Parkland Drive.
Turning Movement Counts	6.	Turning movement counts were collected by WSP on Wednesday, June 21, 2023 (PM peak period), and on Thursday, June 22, 2023 (AM peak period).
Background Traffic Volumes	7.	Projected 2039 peak hour future background volumes include an annual growth of 0.5% between 2023 and 2039. Projected 2039 traffic volumes consider trips generated by the new Bayers Lake hospital separately.
	8.	Some background traffic in the current roadway network will be redistributed to the extension of Regency Park Drive. A separate volume scenario has been prepared that considers these redistributed background trips.
Estimation of Existing & Proposed Development Trips	9.	Trip generation estimates for the proposed development were prepared using rates and equations published in *Trip Generation, 11th Edition* (Institute of Transportation Engineers, Washington, 2021).
	10.	Based on the proposed development's proximity to numerous amenities including planned transit routes and active transportation connections, many of the trips generated by the proposed development are anticipated to be non-auto trips. The methodology provided in *Trip Generation Handbook, 3rd Edition* (Institute of Transportation Engineers, Washington, 2017), for estimating total person trips generated by a development was applied with consideration of onsite synergies – trips that are made between complementary land uses within a single site, such as residential and retail uses.
	11.	Using the trip generation methodology outlined in *Trip Generation, 11th Edition,* and *Trip Generation Handbook, 3rd Edition,* it is estimated that the development will generate: • 1,279 two-way external person trips (481 entering and 798 exiting) during the AM peak hour; and, • 1,938 two-way external person trips (1,095 entering and 843 exiting) during the PM peak hour.

Estimation of Existing & Proposed Development Trips (Cont)	12. Person trips were assigned by travel mode considering existing and planned transit and active transportation corridors for this area as well as HRM's target non-auto modal split for the Inner Suburban area. The following modal splits for the site generated trips have been applied: • 65% auto driver; • 10% auto passenger; • 20% transit; and, • 5% active modes. 13. Based on the above, it is estimated that the development will generate: • 831 two-way vehicle trips (313 entering and 518 exiting) during the AM peak hour; and, • 1,259 two-way vehicle trips (711 entering and 548 exiting) during the PM peak hour.
Trip Distribution and Assignment	14. Proposed development generated trips were distributed to the Study Intersections based on counted volumes considering major trip origins and destinations in the region. Retail trips have been assigned considering regional residential development, while residential trips have been assigned considering employment densities and retail draws.
Warrant Analysis Summary	15. Warrant reviews were completed for left-turn lanes and traffic signals with the projected traffic volumes without and with site generated trips. 16. It was determined that: • An eastbound left turn lane will be warranted along Washmill Lake Drive at Regency Park Drive without and with site generated trips. • A westbound left turn lane will be warranted along Washmill Lake Drive at Regency Park Drive with site generated trips. • Northbound and southbound left turn lanes will be warranted along Regency Park Drive at Internal Road intersection with site generated trips. • Traffic signals will be warranted at Washmill Lake Drive at Regency Park Drive with site generated trips.
Summary – Intersection Capacity Analysis	17. Intersection performance analysis was completed using *Synchro 11* at the Study Intersections. 18. The **Lacewood Drive at Regency Park Drive/Parkland Drive intersection** is expected to operate well and within HRM acceptable limits during the AM and PM peak periods in all scenarios. 19. The **Washmill Lake Drive at Regency Park Drive intersection** is expected to operate well and within HRM guidelines with added turn lanes and traffic signalization, as warranted, during both the AM and PM peak periods. 20. The **Regency Park Drive at Internal Road intersection** is expected to operate within HRM guidelines with added left turn lanes on each approach.

7.2 RECOMMENDATIONS

Recommend-ations

21. It is recommended that at the new Washmill Lake Drive at Regency Park Drive intersection:
    a) Install left turn eastbound and westbound left turn lanes on Washmill Lake Drive when connection to Regency Park Drive is completed.
    b) Install traffic signals at the Washmill Lake Drive at Regency Park Drive intersection (warranted with site development).
22. It is recommended that at the new Regency Park Drive and Internal Road intersection:
    a) Install separate left turn lanes on each approach.
23. HRM should consider the type of bicycle connections appropriate for the existing and new portions of Regency Park Drive. It is likely that the bicycle facilities along Regency Park Drive will extend what is selected for Parkland Drive and connect to the existing bicycle lanes along Washmill Lake Drive at the proposed signalized intersection.
24. Halifax Transit should continue to plan for transit routing along Regency Park Drive between Washmill Lake Drive and Lacewood Drive.

APPENDIX

A TRAFFIC VOLUME DATA

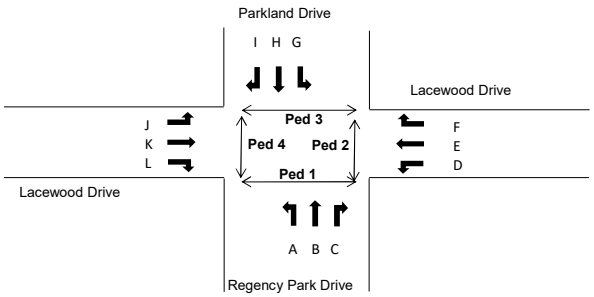
Table A-1

Lacewood Drive
@
Parkland Drive / Regency Park Drive

Halifax, NS

PM Peak: Wednesday, June 21, 2023

AM Peak: Thursday, June 22, 2023



AM Peak Period Volume Data

Time		Regency Park Drive Northbound Approach			Lacewood Drive Westbound Approach			Parkland Drive Southbound Approach			Lacewood Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
07:00	07:15	24	5	21	24	36	4	41	9	39	13	39	11	266
07:15	07:30	15	7	28	12	39	6	33	13	20	13	56	12	254
07:30	07:45	17	10	36	22	52	4	39	7	44	19	64	12	326
07:45	08:00	27	8	21	27	63	14	32	7	33	25	85	23	365
08:00	08:15	28	9	25	35	57	15	38	13	36	25	68	23	372
08:15	08:30	21	2	29	23	71	29	36	11	33	22	69	32	378
08:30	08:45	22	9	43	17	48	22	27	23	29	17	83	41	381
08:45	09:00	38	8	13	18	83	30	21	17	47	17	75	41	408
AM Peak Hour		**109**	**28**	**110**	**93**	**259**	**96**	**122**	**64**	**145**	**81**	**295**	**137**	**1539**
07:00	**08:00**	**83**	**30**	**106**	**85**	**190**	**28**	**145**	**36**	**136**	**70**	**244**	**58**	**1211**
08:00	**09:00**	**109**	**28**	**110**	**93**	**259**	**96**	**122**	**64**	**145**	**81**	**295**	**137**	**1539**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
07:00	**08:00**	**8**			**5**			**4**			**10**			**27**
08:00	**09:00**	**13**			**9**			**19**			**15**			**56**

PM Peak Period Volume Data

Time		Regency Park Drive Northbound Approach			Lacewood Drive Westbound Approach			Parkland Drive Southbound Approach			Lacewood Drive Eastbound Approach			Total Vehicles
		A	B	C	D	E	F	G	H	I	J	K	L	
16:00	16:15	49	25	28	43	135	30	31	21	48	67	113	39	629
16:15	16:30	34	22	23	42	114	27	27	16	39	56	123	40	563
16:30	16:45	35	16	35	41	108	36	28	22	36	57	123	41	578
16:45	17:00	36	10	25	34	119	37	26	22	47	52	139	62	609
17:00	17:15	50	8	44	24	134	28	33	22	35	53	145	62	638
17:15	17:30	39	9	25	25	130	26	20	12	41	63	109	40	539
17:30	17:45	42	11	27	36	130	42	38	16	40	49	159	59	649
17:45	18:00	26	12	20	22	98	23	33	26	27	69	148	58	562
PM Peak Hour		**167**	**38**	**121**	**119**	**513**	**133**	**117**	**72**	**163**	**217**	**552**	**223**	**2435**
16:00	**17:00**	**154**	**73**	**111**	**160**	**476**	**130**	**112**	**81**	**170**	**232**	**498**	**182**	**2379**
17:00	**18:00**	**157**	**40**	**116**	**107**	**492**	**119**	**124**	**76**	**143**	**234**	**561**	**219**	**2388**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
16:00	**17:00**	**19**			**6**			**23**			**10**			**58**
17:00	**18:00**	**17**			**3**			**12**			**14**			**46**

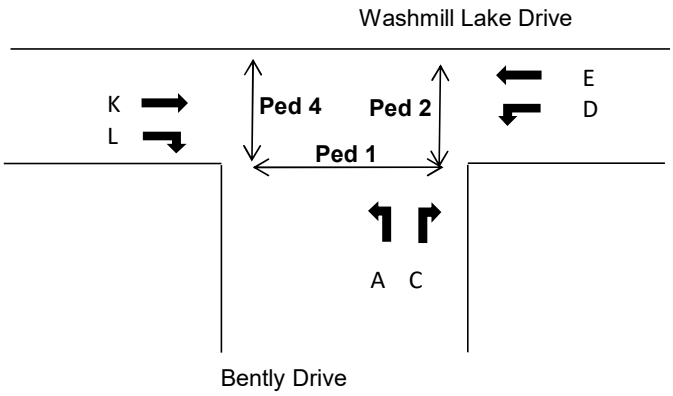
Table A-2

Washmill Lake Drive
@
Bently Drive

Halifax, NS

PM Peak: Wednesday, June 21, 2023

AM Peak: Thursday, June 22, 2023



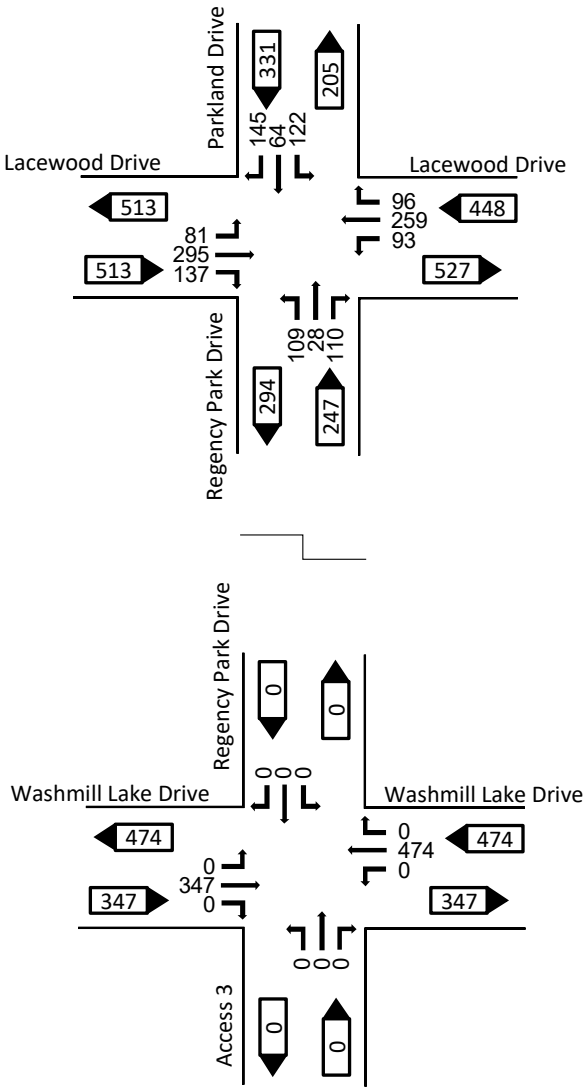
AM Peak Period Volume Data

Time		Bently Drive Northbound Approach		Washmill Lake Drive Westbound Approach		Washmill Lake Drive Eastbound Approach		Total Vehicles
		A	C	D	E	K	L	
07:00	07:15	3	20	3	65	63	2	156
07:15	07:30	2	14	4	89	58	2	169
07:30	07:45	2	25	6	79	55	0	167
07:45	08:00	4	15	8	122	80	2	231
08:00	08:15	5	27	8	102	86	2	230
08:15	08:30	7	18	11	112	80	6	234
08:30	08:45	4	25	5	118	88	3	243
08:45	09:00	3	8	8	126	64	3	212
AM Peak Hour		**20**	**85**	**32**	**454**	**334**	**13**	**938**
07:00	**08:00**	**11**	**74**	**21**	**355**	**256**	**6**	**723**
08:00	**09:00**	**19**	**78**	**32**	**458**	**318**	**14**	**919**
		Ped 1		**Ped 2**		**Ped 4**		**Total Peds**
07:00	**08:00**	**7**		**4**		**0**		**11**
08:00	**09:00**	**6**		**5**		**0**		**11**

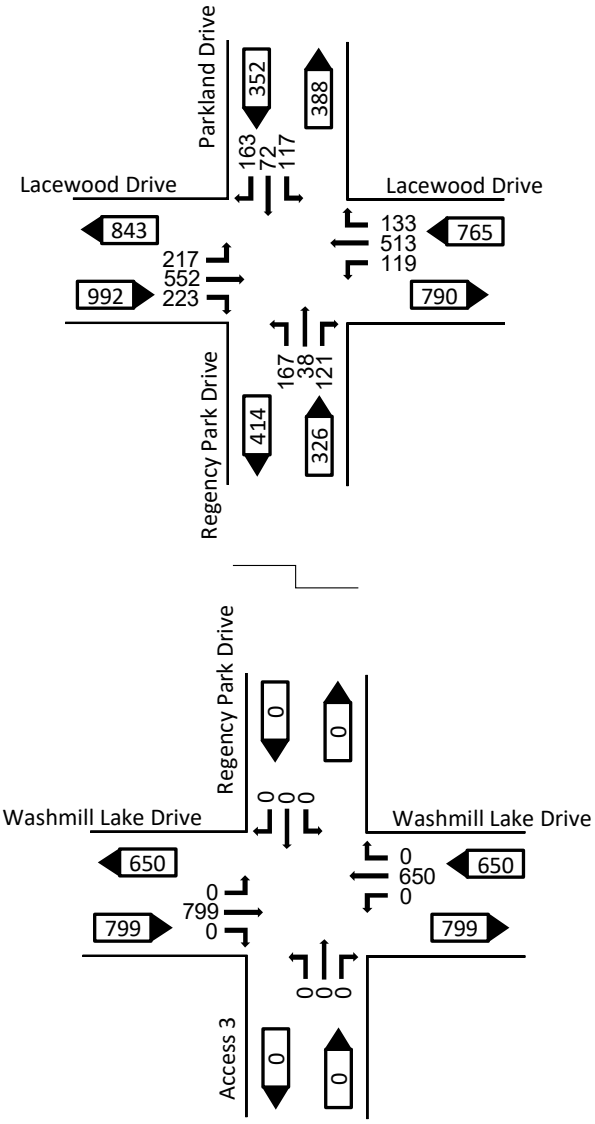
PM Peak Period Volume Data

Time		Bently Drive Northbound Approach		Washmill Lake Drive Westbound Approach		Washmill Lake Drive Eastbound Approach		Total Vehicles
		A	C	D	E	K	L	
16:00	16:15	4	11	15	158	174	8	370
16:15	16:30	3	7	16	161	150	5	342
16:30	16:45	4	16	10	161	181	6	378
16:45	17:00	3	8	20	174	199	9	413
17:00	17:15	4	10	21	153	219	9	416
17:15	17:30	4	13	19	147	169	7	359
17:30	17:45	3	13	17	144	163	13	353
17:45	18:00	5	18	14	170	147	8	362
PM Peak Hour		**15**	**47**	**70**	**635**	**768**	**31**	**1566**
16:00	**17:00**	**14**	**42**	**61**	**654**	**704**	**28**	**1503**
17:00	**18:00**	**16**	**54**	**71**	**614**	**698**	**37**	**1490**
		Ped 1		**Ped 2**		**Ped 4**		**Total Peds**
16:00	**17:00**	**5**		**1**		**0**		**6**
17:00	**18:00**	**2**		**3**		**0**		**5**

AM Peak Hour

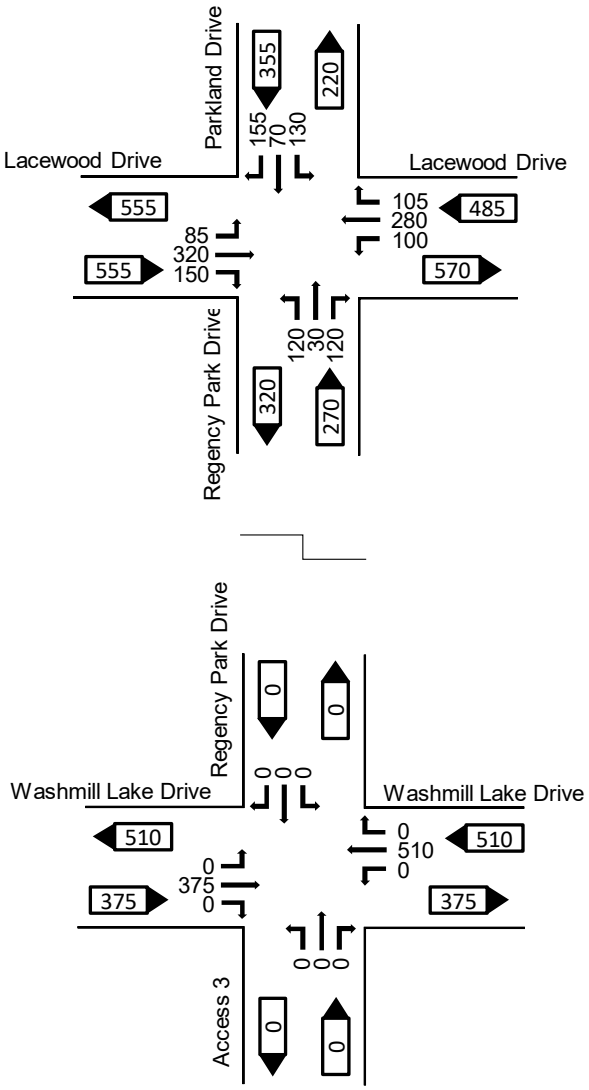


PM Peak Hour

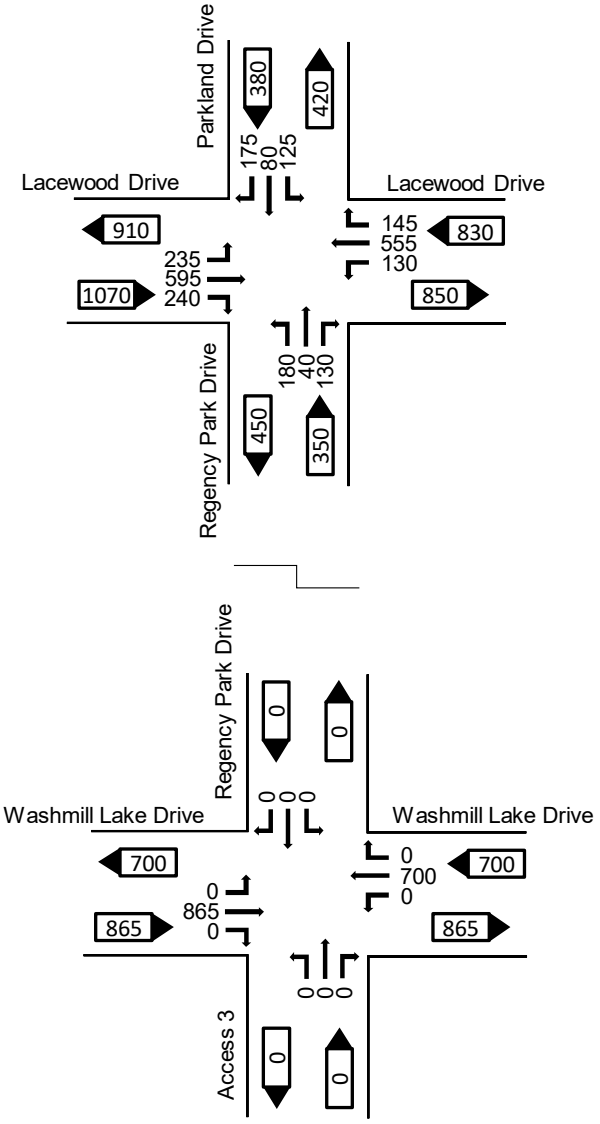


wsp	Mainland Common Development - TIS Halifax, NS	Figure A-1
	Weekday AM and PM Peak Hour 2023 Counted Traffic Volumes	October 2023

AM Peak Hour

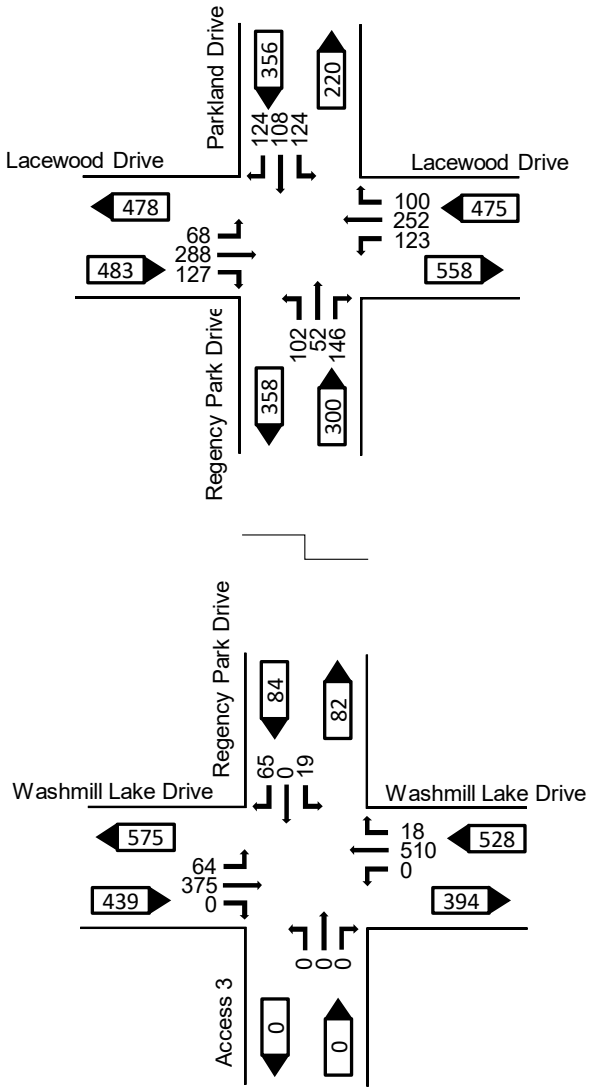


PM Peak Hour

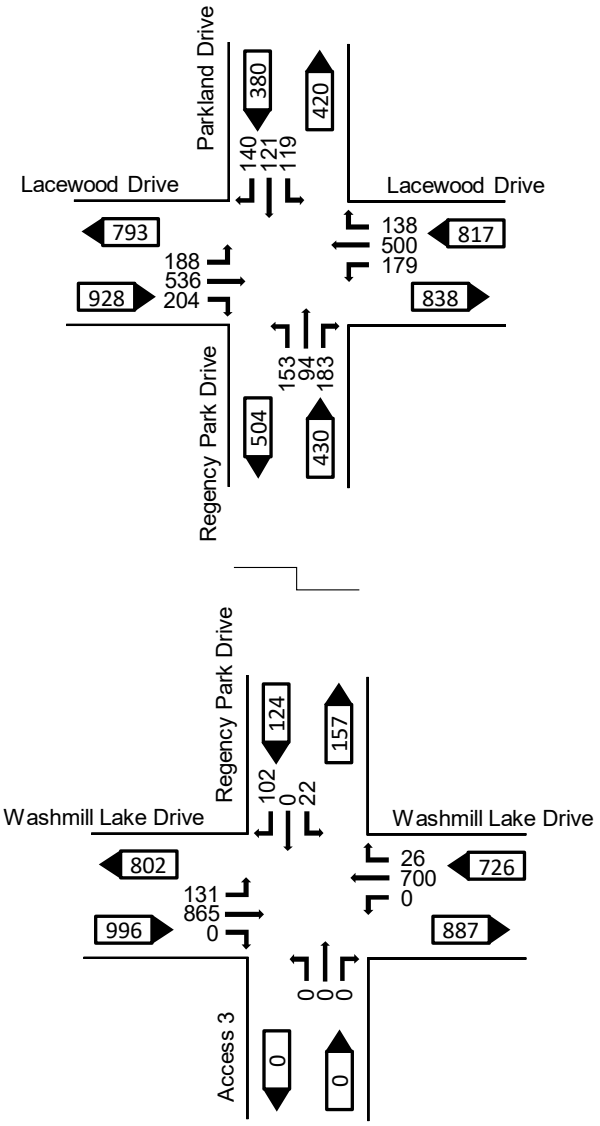


wsp	Mainland Common Development - TIS Halifax, NS	Figure A-2
	Weekday AM and PM Peak Hour 2034 Future Background Traffic Volumes	October 2023

AM Peak Hour

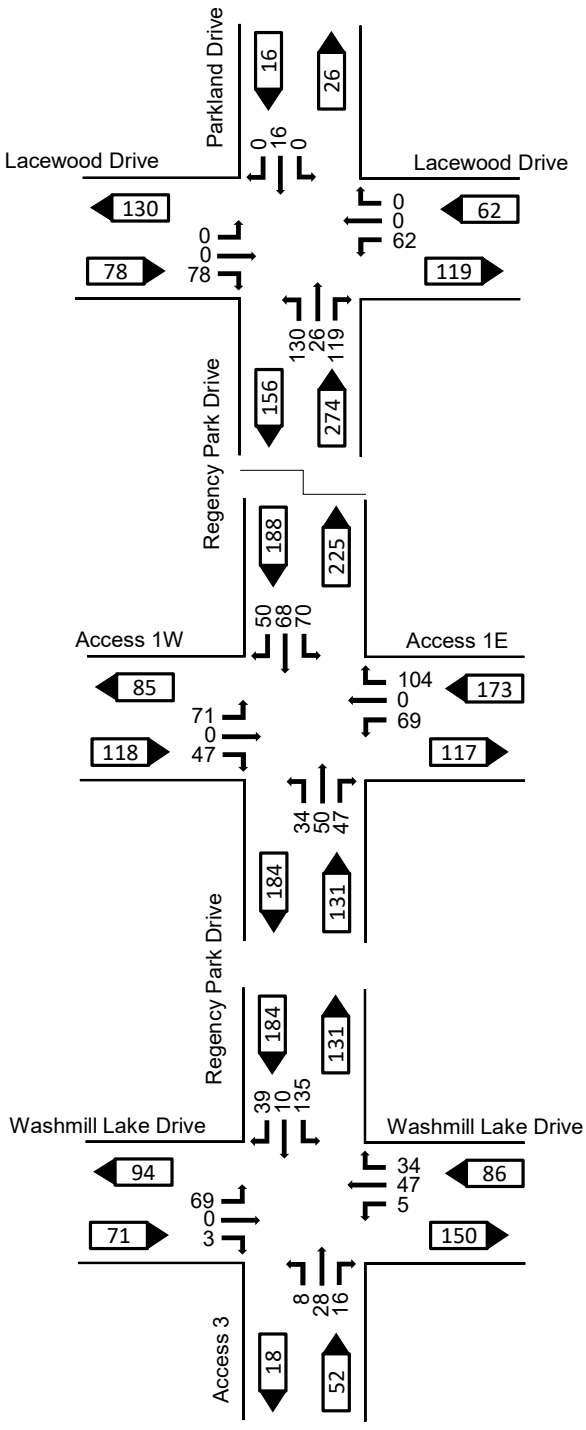


PM Peak Hour

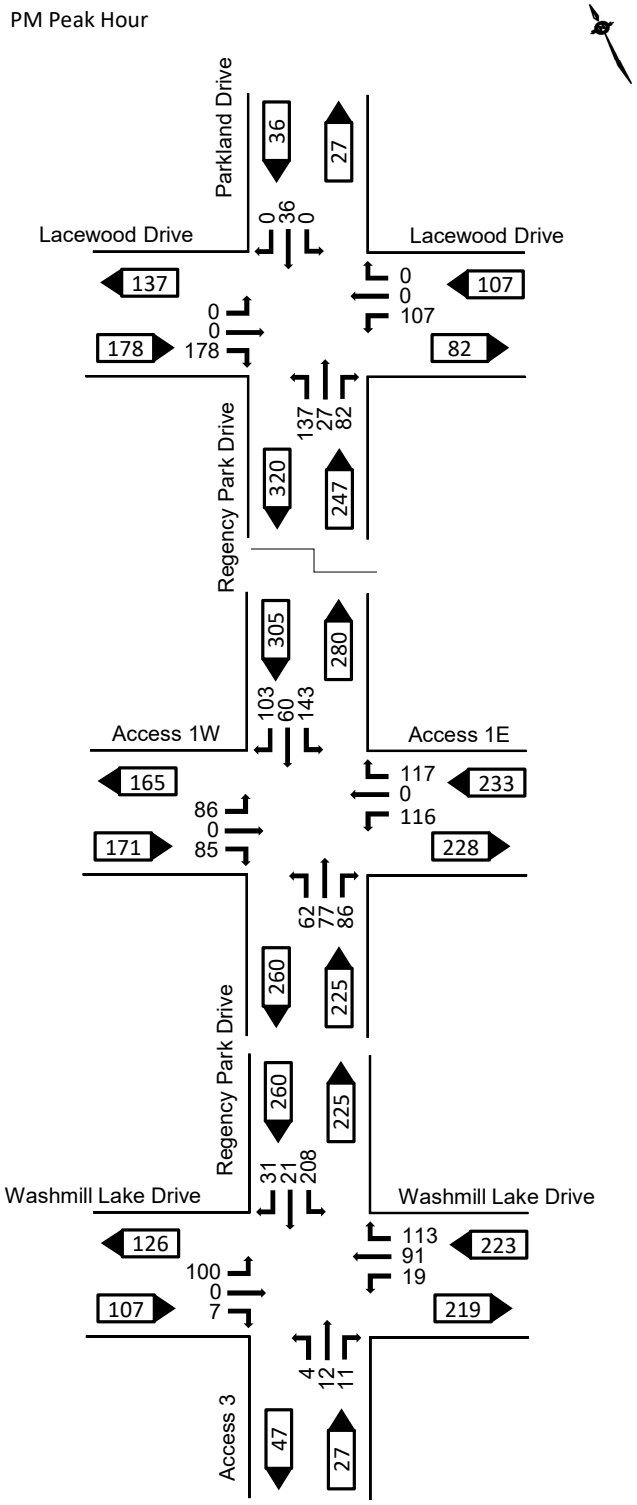


wsp	Mainland Common Development - TIS Halifax, NS	Figure A-3
	Weekday AM and PM Peak Hour 2034 Future Background Traffic Volumes - Diverted Trips	October 2023

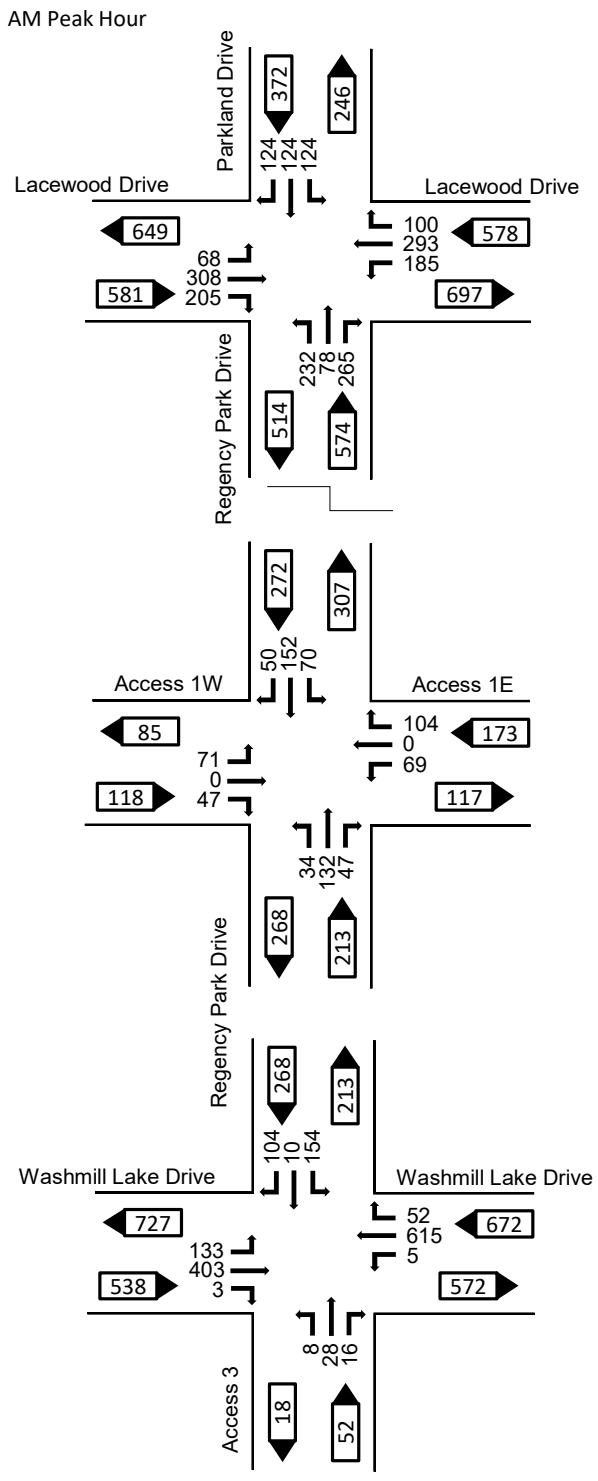
AM Peak Hour

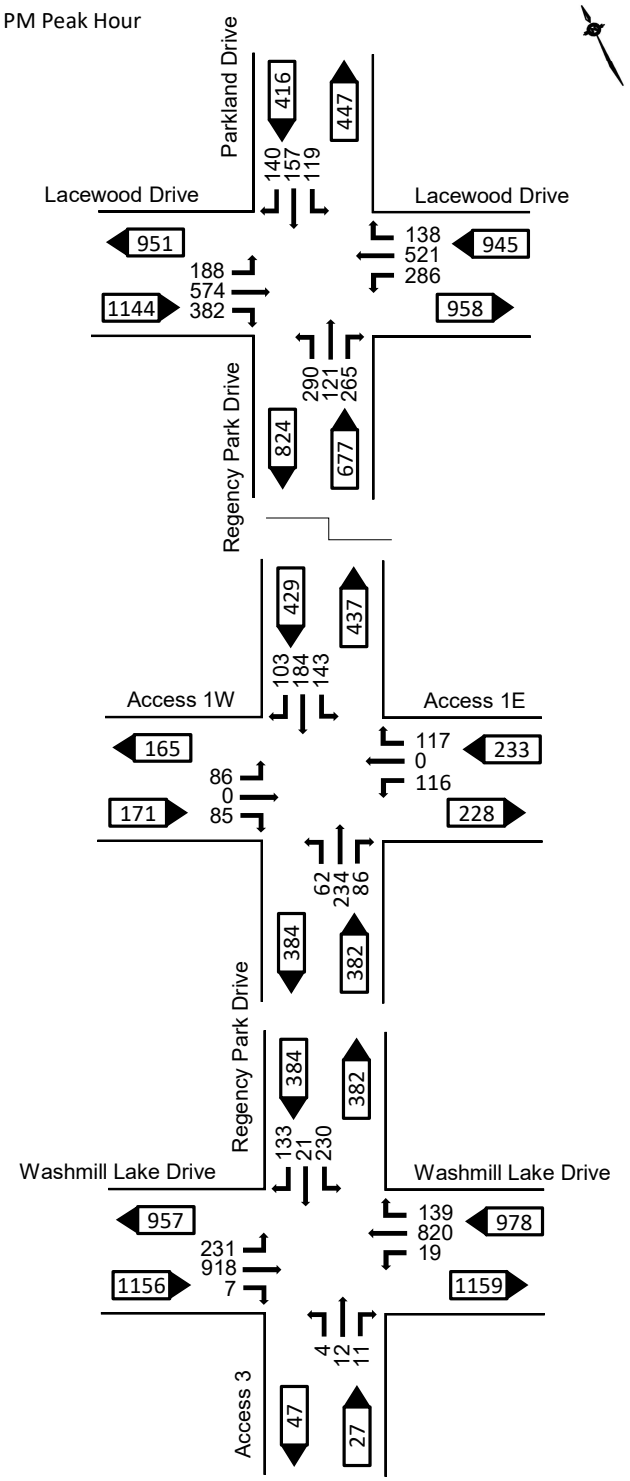


PM Peak Hour



wsp	Mainland Common Development - TIS Halifax, NS	Figure A-4
	Weekday AM and PM Peak Hour Trip Assignment	May 2024

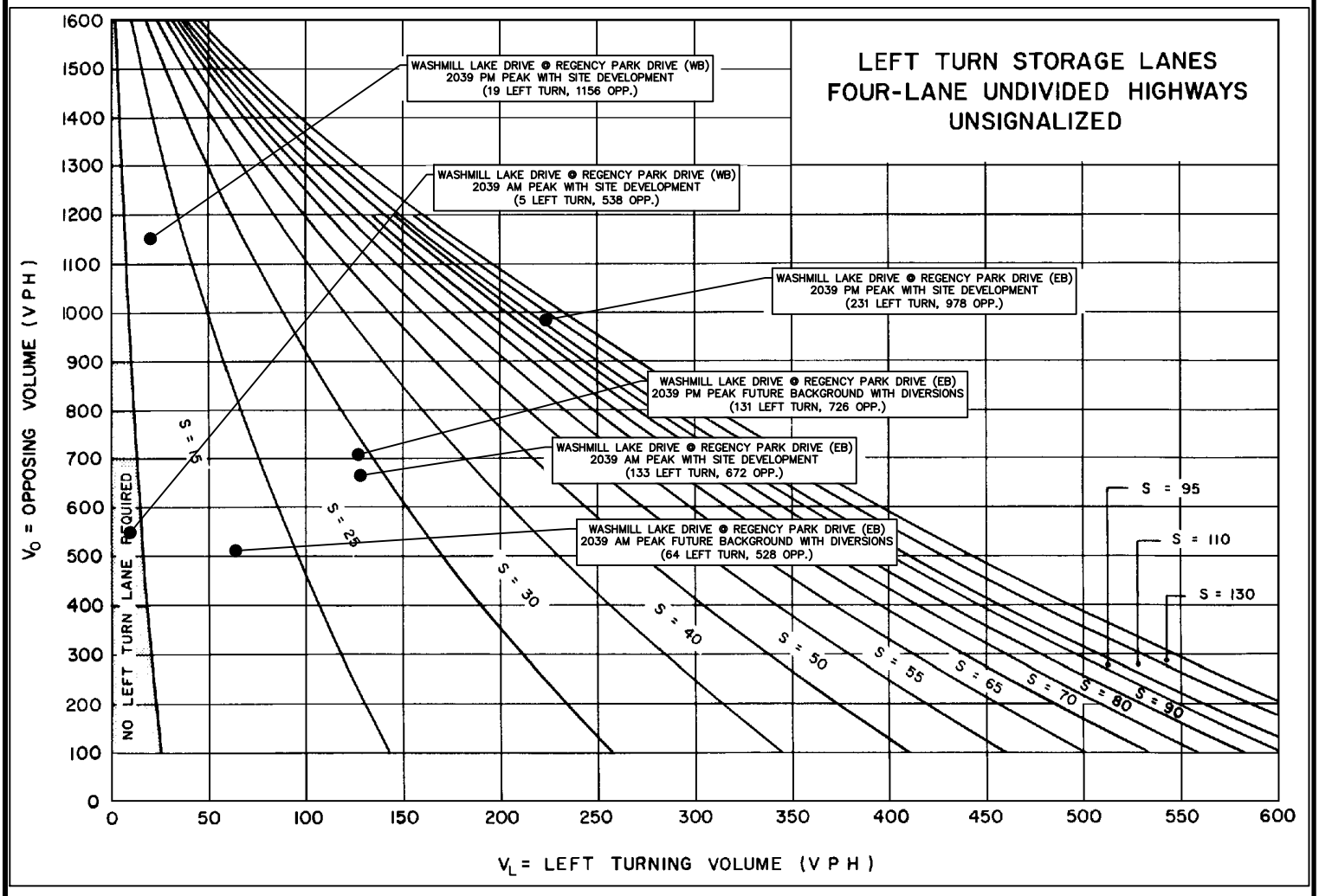




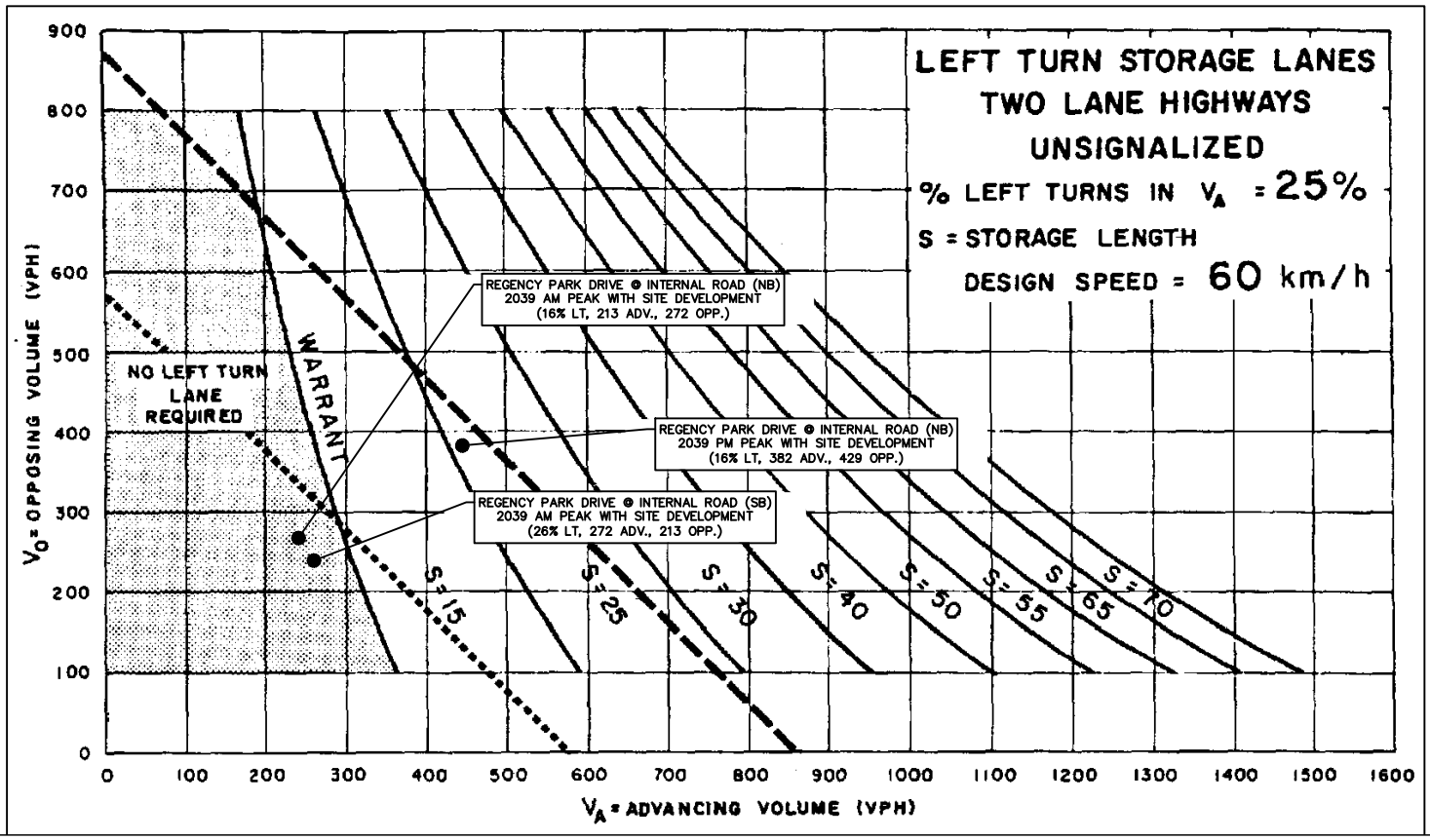
wsp	Mainland Common Development - TIS Halifax, NS	Figure A-5
	Weekday AM and PM Peak Hour 2034 Total Traffic with Site Generated Trips	May 2024

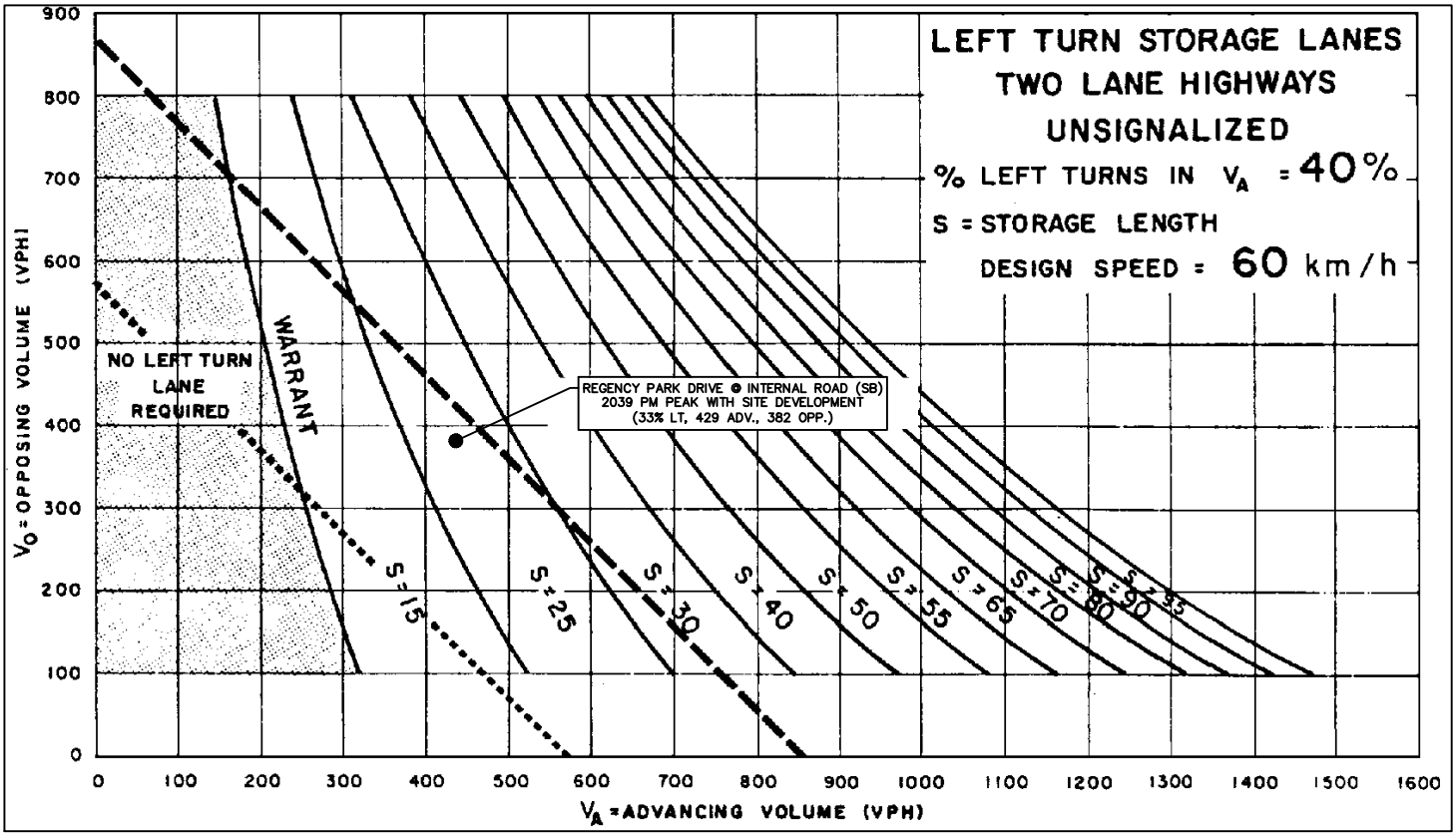
APPENDIX

B WARRANT ANALYSIS



wsp	Mainland Common - Traffic Impact Study Halifax, NS	Figure B-1
	Left Turn Lane Warrants - Washmill Lake Drive at Regency Park Drive	May 2024





wsp	Mainland Common - Traffic Impact Study Halifax, NS	Figure B-2
	Left Turn Lane Warrants - Internal Intersection	May 2024

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-1 - Washmill Lake Drive @ Regency Park Drive
2039 Future with Site Generated Trips

Main Street (name)	Washmill Lake Drive	Direction (EW or NS)	EW	Date:	May 2024
Side Street (name)	Regency Park Drive	Direction (EW or NS)	NS	City:	Halifax, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Washmill Lake Drive	WB		1		1				
Washmill Lake Drive	EB		1		1				
Site Access #3	NB			1					
Regency Park Drive	SB			1					

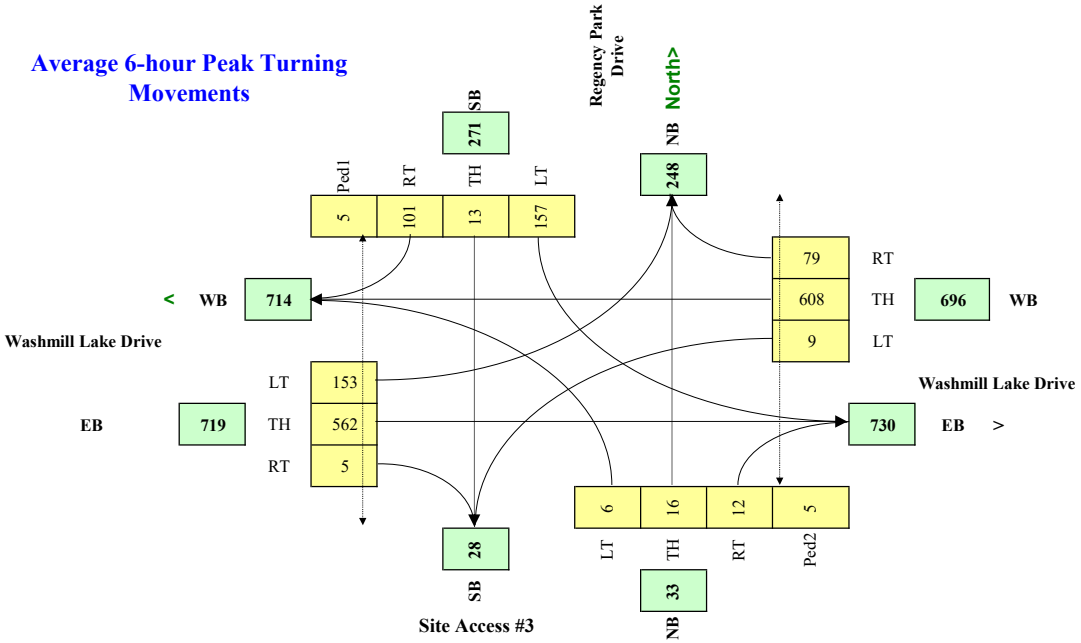
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Washmill Lake Drive	EW	50	2.0%	y	0.0
Regency Park Drive	NS	50	2.0%	y	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S side
7:00 - 8:00	5	5	5	5
8:00 - 9:00	5	5	5	5
11:30 - 12:30	5	5	5	5
12:30 - 13:30	5	5	5	5
16:00 - 17:00	5	5	5	5
17:00 - 18:00	5	5	5	5
Total (6-hour peak)	**30**	**30**	**30**	**30**
Average (6-hour peak)	**5**	**5**	**5**	**5**

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	500,000
Central Business District	(y/n)	y

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	5	25	15	130	10	90	5	525	45	115	345	5
8:00 - 9:00	10	30	15	155	10	105	5	615	50	135	405	5
11:30 - 12:30	5	10	10	115	10	80	5	495	60	120	460	5
12:30 - 13:30	5	10	10	115	10	80	5	495	60	120	460	5
16:00 - 17:00	5	10	10	230	20	135	20	820	140	230	920	5
17:00 - 18:00	5	10	10	195	20	115	15	695	120	195	780	5
Total (6-hour peak)	**35**	**95**	**70**	**940**	**80**	**605**	**55**	**3,645**	**475**	**915**	**3,370**	**30**
Average (6-hour peak)	**6**	**16**	**12**	**157**	**13**	**101**	**9**	**608**	**79**	**153**	**562**	**5**

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 =	244	226	18
		Veh	*Ped*
Warranted			

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-2 - Washmill Lake Drive @ Regency Park Drive
2039 Future Background with Trips Diverted

Main Street (name)	Washmill Lake Drive	Direction (EW or NS)	EW	Date:	October 2023
Side Street (name)	Regency Park Drive	Direction (EW or NS)	NS	City:	Halifax, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Washmill Lake Drive	WB			1	1				
Washmill Lake Drive	EB		1	1					
	NB								
Regency Park Drive	SB			1					

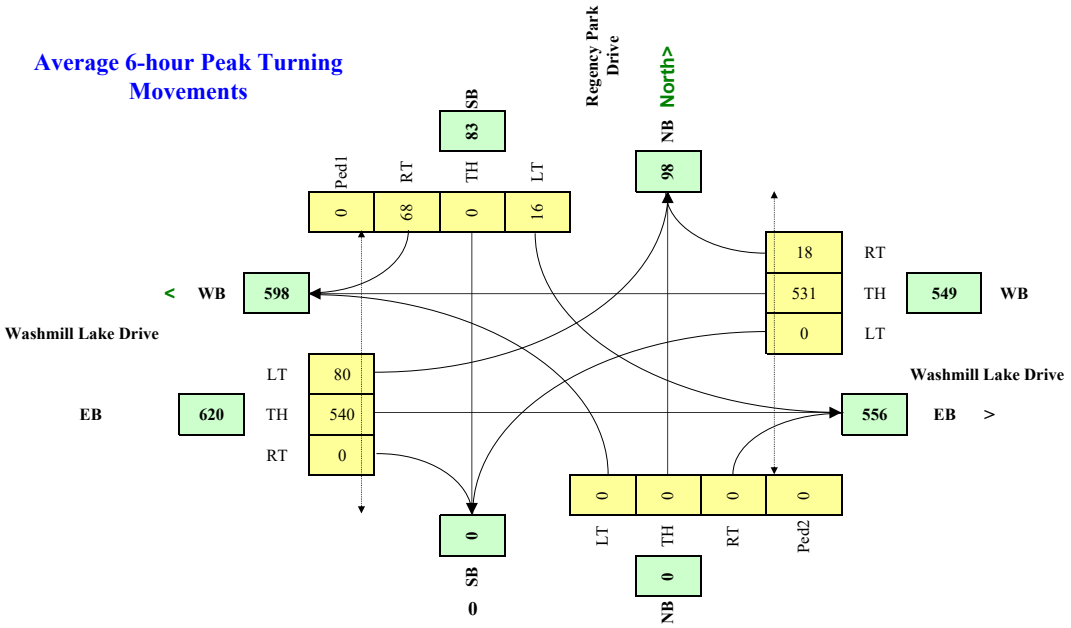
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Washmill Lake Drive	EW	50	2.0%	y	0.0
Regency Park Drive	NS	50	2.0%	y	

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

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	500,000
Central Business District	(y/n)	y

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	15	0	55	0	485	15	55	345	0
8:00 - 9:00	0	0	0	20	0	65	0	570	20	65	405	0
11:30 - 12:30	0	0	0	10	0	50	0	390	15	60	395	0
12:30 - 13:30	0	0	0	10	0	50	0	390	15	60	395	0
15:30 - 16:30	0	0	0	20	0	100	0	730	25	130	920	0
16:30 - 17:30	0	0	0	20	0	85	0	620	20	110	780	0
Total (6-hour peak)	**0**	**0**	**0**	**95**	**0**	**405**	**0**	**3,185**	**110**	**480**	**3,240**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**16**	**0**	**68**	**0**	**531**	**18**	**80**	**540**	**0**

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 =	44	44	0
		Veh	*Ped*

NOT Warranted

2005 Canadian Traffic Signal Warrant Matrix Analysis

Table: B-3 - Regency Park Drive @ Internal Intersection (EW)

2039 Future with Site Generated Trips

Main Street (name)	Regency Park Drive	Direction (EW or NS)	NS	Date:	May 2024
Side Street (name)	Internal Road	Direction (EW or NS)	EW	City:	Halifax, NS

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
Regency Park Drive	NB	1			1				
Regency Park Drive	SB	1			1				
Internal Road	WB			1					
Internal Road	EB			1					

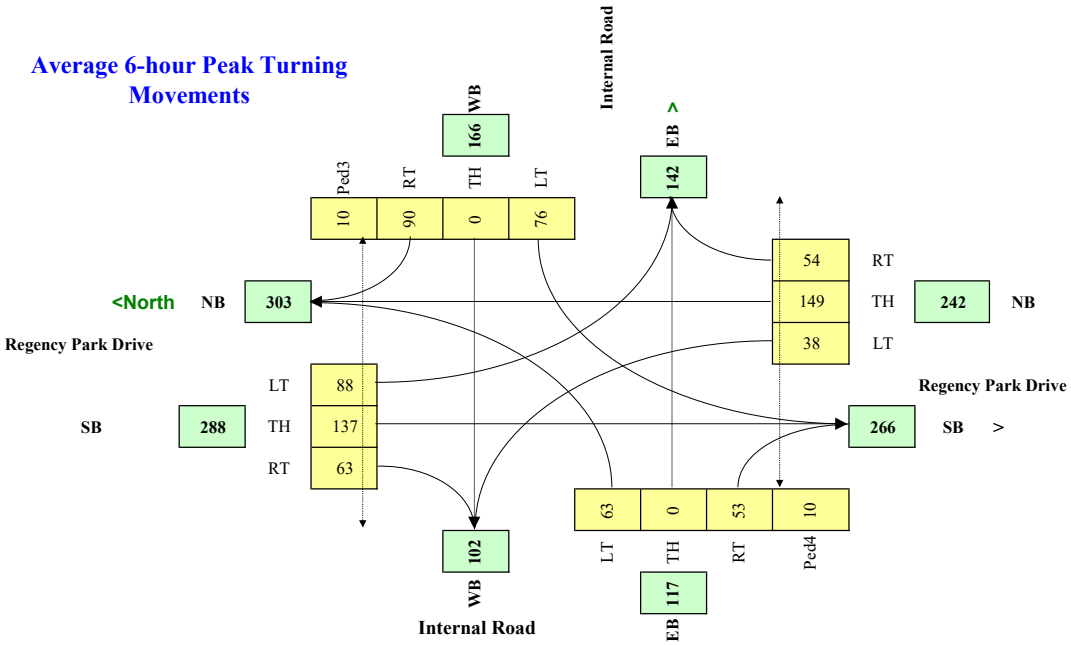
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
Regency Park Drive	NS	50	2.0%	y	0.0
Internal Road	EW	50	2.0%	y	

	Ped1 NS W Side	Ped2 NS E Side	Ped3 EW N Side	Ped4 EW S side
7:00 - 8:00	10	10	10	10
8:00 - 9:00	10	10	10	10
11:30 - 12:30	10	10	10	10
12:30 - 13:30	10	10	10	10
15:30 - 16:30	10	10	10	10
16:30 - 17:30	10	10	10	10
Total (6-hour peak)	**60**	**60**	**60**	**60**
Average (6-hour peak)	**10**	**10**	**10**	**10**

Demographics		
Elementary School	(y/n)	y
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	y
Metro Area Population	(#)	500,000
Central Business District	(y/n)	y

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:00 - 8:00	30	110	40	60	130	45	60	0	90	60	0	40
8:00 - 9:00	35	130	45	70	150	50	70	0	105	70	0	45
11:30 - 12:30	25	110	40	65	100	45	55	0	65	45	0	40
12:30 - 13:30	25	110	40	65	100	45	55	0	65	45	0	40
15:30 - 16:30	60	235	85	145	185	105	115	0	115	85	0	85
16:30 - 17:30	55	200	75	120	155	90	100	0	100	75	0	70
Total (6-hour peak)	**230**	**895**	**325**	**525**	**820**	**380**	**455**	**0**	**540**	**380**	**0**	**320**
Average (6-hour peak)	**38**	**149**	**54**	**88**	**137**	**63**	**76**	**0**	**90**	**63**	**0**	**53**

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 =	69	56	13
		Veh	*Ped*

NOT Warranted

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Mainland Common	**Organization:**	WSP
Project Location:	Regency Park Drive	**Performed By:**	Brianna Rietzel, Patrick Hatton
Scenario Description:	AM Peak Hour	**Date:**	2024-05-21
Analysis Year:	2039	**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				368	221	147
Restaurant				0		
Cinema/Entertainment				0		
Residential				791	206	585
Hotel				0		
All Other Land Uses[2]				0		
				1,159	427	732

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail	1.17			1.16		
Restaurant						
Cinema/Entertainment						
Residential	1.13			1.09		
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	5	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	6	0	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	1,301	492	809
Internal Capture Percentage	2%	2%	1%
External Vehicle-Trips[5]	1,141	418	723
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	2%	3%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	2%	1%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Mainland Common	**Organization:**	WSP
Project Location:	Regency Park Drive	**Performed By:**	Brianna Rietzel, Patrick Hatton
Scenario Description:	PM Peak Hour	**Date:**	2024-05-21
Analysis Year:	2039	**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				1,026	513	513
Restaurant				0		
Cinema/Entertainment				0		
Residential				936	580	356
Hotel				0		
All Other Land Uses[2]				0		
				1,962	1,093	869

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office						
Retail	1.21			1.18		
Restaurant						
Cinema/Entertainment						
Residential	1.15			1.21		
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail					1000	
Restaurant						
Cinema/Entertainment						
Residential		1000				
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		0	0	146	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	47	0	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	2,324	1,288	1,036
Internal Capture Percentage	17%	15%	19%
External Vehicle-Trips[5]	1,633	927	706
External Transit-Trips[6]	0	0	0
External Non-Motorized Trips[6]	0	0	0

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	8%	24%
Restaurant	N/A	N/A
Cinema/Entertainment	N/A	N/A
Residential	22%	11%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

APPENDIX

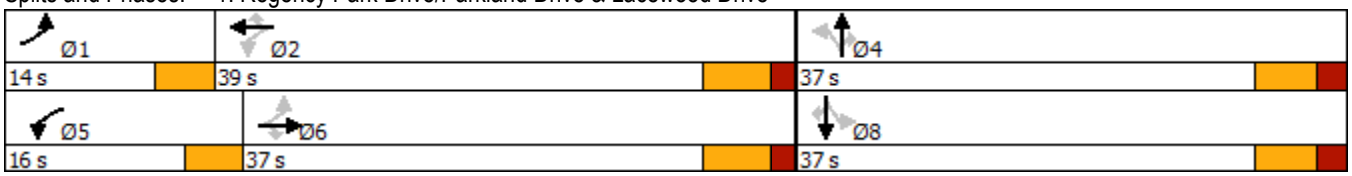
C

INTERSECTION PERFORMANCE ANALYSIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	85	320	150	100	280	105	120	30	120	130	70	155
Future Volume (vph)	85	320	150	100	280	105	120	30	120	130	70	155
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.567			0.480			0.708			0.736		
Satd. Flow (perm)	1056	3539	1583	894	3539	1583	1319	1863	1583	1371	1863	1583
Satd. Flow (RTOR)			101			88			130			168
Lane Group Flow (vph)	92	348	163	109	304	114	130	33	130	141	76	168
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	14.0	37.0	37.0	16.0	39.0	39.0	37.0	37.0	37.0	37.0	37.0	37.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	20.7	12.8	12.8	22.2	15.4	15.4	10.4	10.4	10.4	10.4	10.4	10.4
Actuated g/C Ratio	0.46	0.28	0.28	0.49	0.34	0.34	0.23	0.23	0.23	0.23	0.23	0.23
v/c Ratio	0.15	0.35	0.31	0.18	0.25	0.19	0.43	0.08	0.28	0.45	0.18	0.34
Control Delay	6.4	15.8	9.2	6.5	13.7	7.0	21.1	15.2	5.7	21.3	16.2	5.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.4	15.8	9.2	6.5	13.7	7.0	21.1	15.2	5.7	21.3	16.2	5.6
LOS	A	B	A	A	B	A	C	B	A	C	B	A
Approach Delay		12.6			10.8			13.6			13.5	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	3.1	12.4	4.0	3.7	10.7	1.6	9.5	2.2	0.0	10.3	5.2	0.0
Queue Length 95th (m)	9.6	26.2	17.8	11.0	22.3	11.9	24.2	8.0	10.3	25.7	14.6	11.6
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	695	2495	1145	717	2633	1200	930	1313	1154	966	1313	1165
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.14	0.14	0.15	0.12	0.10	0.14	0.03	0.11	0.15	0.06	0.14

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 45.1
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 12.4
Intersection LOS: B
Intersection Capacity Utilization 43.5%
ICU Level of Service A
Analysis Period (min) 15

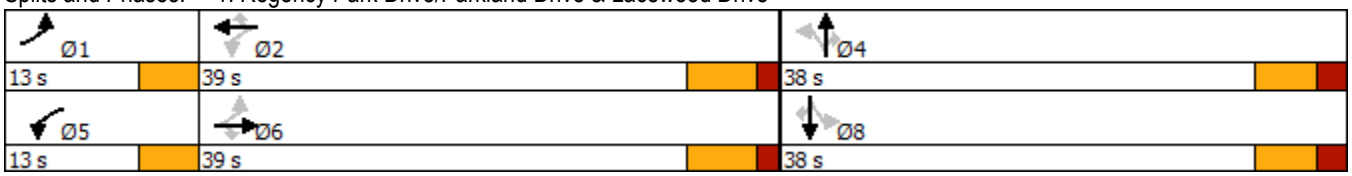
Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	235	595	240	130	555	145	180	40	130	125	80	175
Future Volume (vph)	235	595	240	130	555	145	180	40	130	125	80	175
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.330			0.404			0.701			0.729		
Satd. Flow (perm)	615	3539	1583	753	3539	1583	1306	1863	1583	1358	1863	1583
Satd. Flow (RTOR)			90			88			141			190
Lane Group Flow (vph)	255	647	261	141	603	158	196	43	141	136	87	190
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	13.0	39.0	39.0	13.0	39.0	39.0	38.0	38.0	38.0	38.0	38.0	38.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	29.3	20.1	20.1	27.3	16.8	16.8	14.2	14.2	14.2	14.2	14.2	14.2
Actuated g/C Ratio	0.52	0.35	0.35	0.48	0.30	0.30	0.25	0.25	0.25	0.25	0.25	0.25
v/c Ratio	0.52	0.52	0.42	0.28	0.58	0.30	0.60	0.09	0.28	0.40	0.19	0.35
Control Delay	11.5	18.3	13.6	8.5	20.0	10.0	28.0	17.7	5.6	22.5	18.6	5.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.5	18.3	13.6	8.5	20.0	10.0	28.0	17.7	5.6	22.5	18.6	5.5
LOS	B	B	B	A	B	B	C	B	A	C	B	A
Approach Delay		15.7			16.4			18.5			13.8	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	12.0	30.2	13.9	6.2	28.5	5.5	18.0	3.4	0.0	11.8	7.1	0.0
Queue Length 95th (m)	30.6	54.9	37.7	17.5	50.9	19.7	42.3	11.3	11.6	29.4	19.2	13.4
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	507	2105	978	543	2105	977	753	1074	972	782	1074	993
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.50	0.31	0.27	0.26	0.29	0.16	0.26	0.04	0.15	0.17	0.08	0.19

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 56.8
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 16.1
Intersection LOS: B
Intersection Capacity Utilization 58.8%
ICU Level of Service B
Analysis Period (min) 15

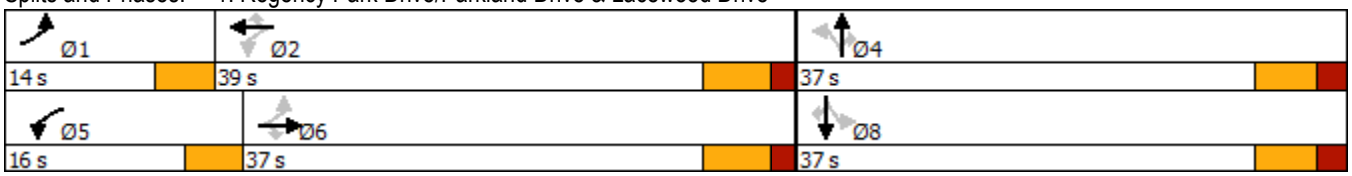
Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	308	127	123	293	100	102	52	146	124	108	124
Future Volume (vph)	68	308	127	123	293	100	102	52	146	124	108	124
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.559			0.471			0.682			0.720		
Satd. Flow (perm)	1041	3539	1583	877	3539	1583	1270	1863	1583	1341	1863	1583
Satd. Flow (RTOR)			89			88			159			131
Lane Group Flow (vph)	74	335	138	134	318	109	111	57	159	135	117	135
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	14.0	37.0	37.0	16.0	39.0	39.0	37.0	37.0	37.0	37.0	37.0	37.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	20.6	12.8	12.8	23.2	16.0	16.0	10.3	10.3	10.3	10.3	10.3	10.3
Actuated g/C Ratio	0.45	0.28	0.28	0.51	0.35	0.35	0.23	0.23	0.23	0.23	0.23	0.23
v/c Ratio	0.13	0.34	0.27	0.22	0.26	0.18	0.39	0.14	0.33	0.45	0.28	0.29
Control Delay	6.3	16.1	9.1	6.5	13.4	6.4	20.7	16.2	5.7	21.7	17.7	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.3	16.1	9.1	6.5	13.4	6.4	20.7	16.2	5.7	21.7	17.7	6.1
LOS	A	B	A	A	B	A	C	B	A	C	B	A
Approach Delay		13.0			10.4			12.6			15.1	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	2.5	12.1	3.2	4.6	11.2	1.3	8.1	3.9	0.0	10.1	8.4	0.3
Queue Length 95th (m)	8.0	25.8	15.8	13.0	22.7	10.9	21.4	11.9	11.5	25.2	21.1	10.9
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	685	2478	1135	716	2615	1192	889	1304	1156	939	1304	1148
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.14	0.12	0.19	0.12	0.09	0.12	0.04	0.14	0.14	0.09	0.12

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 45.5
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 12.6
Intersection LOS: B
Intersection Capacity Utilization 44.2%
ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	64	403	568	18	19	65
Future Volume (Veh/h)	64	403	568	18	19	65
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	438	617	20	21	71
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	637				986	318
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	637				986	318
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	93				91	90
cM capacity (veh/h)	943				227	677

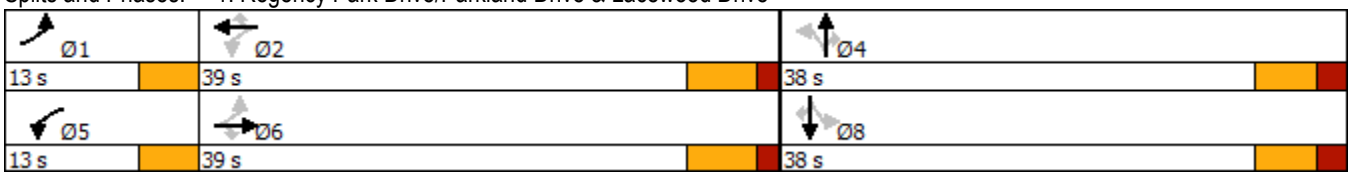
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	70	219	219	411	226	92
Volume Left	70	0	0	0	0	21
Volume Right	0	0	0	0	20	71
cSH	943	1700	1700	1700	1700	466
Volume to Capacity	0.07	0.13	0.13	0.24	0.13	0.20
Queue Length 95th (m)	1.9	0.0	0.0	0.0	0.0	5.8
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	14.6
Lane LOS	A					B
Approach Delay (s)	1.3			0.0		14.6
Approach LOS						B

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	34.9%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	574	204	179	521	138	153	94	183	119	121	140
Future Volume (vph)	188	574	204	179	521	138	153	94	183	119	121	140
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.409			0.357			0.673			0.691		
Satd. Flow (perm)	762	3539	1583	665	3539	1583	1254	1863	1583	1287	1863	1583
Satd. Flow (RTOR)			88			88			199			133
Lane Group Flow (vph)	204	624	222	195	566	150	166	102	199	129	132	152
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	13.0	39.0	39.0	13.0	39.0	39.0	38.0	38.0	38.0	38.0	38.0	38.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	27.2	16.5	16.5	27.6	16.7	16.7	13.1	13.1	13.1	13.1	13.1	13.1
Actuated g/C Ratio	0.49	0.30	0.30	0.50	0.30	0.30	0.24	0.24	0.24	0.24	0.24	0.24
v/c Ratio	0.39	0.59	0.42	0.39	0.53	0.28	0.56	0.23	0.38	0.42	0.30	0.32
Control Delay	9.1	19.6	12.9	9.1	18.7	9.3	27.1	19.0	5.6	23.2	19.8	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.1	19.6	12.9	9.1	18.7	9.3	27.1	19.0	5.6	23.2	19.8	7.2
LOS	A	B	B	A	B	A	C	B	A	C	B	A
Approach Delay		16.2			15.1			16.2			16.3	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	8.7	28.5	10.5	8.3	25.2	4.6	15.0	8.5	0.0	11.2	11.1	1.5
Queue Length 95th (m)	23.5	51.5	30.2	22.5	46.3	18.2	35.2	21.2	13.5	27.6	26.3	14.0
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	557	2157	999	526	2157	999	740	1100	1016	760	1100	989
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.29	0.22	0.37	0.26	0.15	0.22	0.09	0.20	0.17	0.12	0.15

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 55.2
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 15.8
Intersection LOS: B
Intersection Capacity Utilization 59.7%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	131	918	729	26	22	102
Future Volume (Veh/h)	131	918	729	26	22	102
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)	142	998	792	28	24	111
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	820				1589	410
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	820				1589	410
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	82				70	81
cM capacity (veh/h)	805				81	591

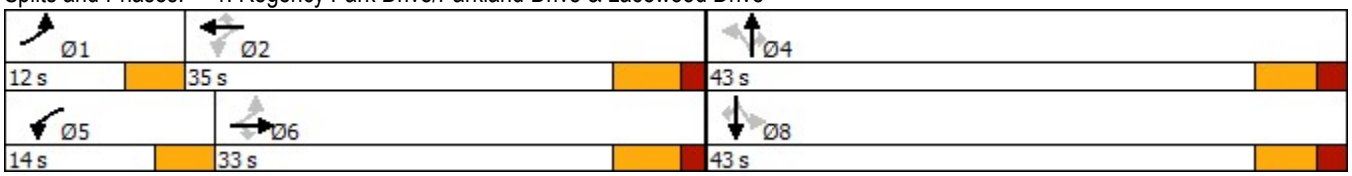
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	142	499	499	528	292	135
Volume Left	142	0	0	0	0	24
Volume Right	0	0	0	0	28	111
cSH	805	1700	1700	1700	1700	279
Volume to Capacity	0.18	0.29	0.29	0.31	0.17	0.48
Queue Length 95th (m)	5.1	0.0	0.0	0.0	0.0	19.8
Control Delay (s)	10.4	0.0	0.0	0.0	0.0	29.4
Lane LOS	B					D
Approach Delay (s)	1.3			0.0		29.4
Approach LOS						D

Intersection Summary				
Average Delay	2.6			
Intersection Capacity Utilization	45.7%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	68	308	205	185	293	100	232	78	265	124	124	124
Future Volume (vph)	68	308	205	185	293	100	232	78	265	124	124	124
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.559			0.434			0.671			0.702		
Satd. Flow (perm)	1041	3539	1583	808	3539	1583	1250	1863	1583	1308	1863	1583
Satd. Flow (RTOR)			135			88			288			127
Lane Group Flow (vph)	74	335	223	201	318	109	252	85	288	135	135	135
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	12.0	33.0	33.0	14.0	35.0	35.0	43.0	43.0	43.0	43.0	43.0	43.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	22.8	13.0	13.0	27.9	20.1	20.1	16.9	16.9	16.9	16.9	16.9	16.9
Actuated g/C Ratio	0.41	0.23	0.23	0.50	0.36	0.36	0.30	0.30	0.30	0.30	0.30	0.30
v/c Ratio	0.14	0.41	0.47	0.36	0.25	0.18	0.67	0.15	0.43	0.34	0.24	0.24
Control Delay	9.9	21.5	13.1	11.1	17.0	7.9	26.8	14.7	4.3	17.8	15.7	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	9.9	21.5	13.1	11.1	17.0	7.9	26.8	14.7	4.3	17.8	15.7	4.8
LOS	A	C	B	B	B	A	C	B	A	B	B	A
Approach Delay		17.2			13.5			14.8			12.8	
Approach LOS		B			B			B			B	
Queue Length 50th (m)	3.5	15.6	7.5	10.2	13.6	1.6	22.7	6.4	0.0	10.8	10.5	0.6
Queue Length 95th (m)	12.4	32.5	28.8	29.1	29.7	13.4	47.8	15.9	13.8	24.9	23.3	10.5
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	542	1719	838	577	1847	868	834	1243	1152	873	1243	1099
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.14	0.19	0.27	0.35	0.17	0.13	0.30	0.07	0.25	0.15	0.11	0.12

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 56.2
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.67
Intersection Signal Delay: 14.8
Intersection LOS: B
Intersection Capacity Utilization 58.7%
ICU Level of Service B
Analysis Period (min) 15

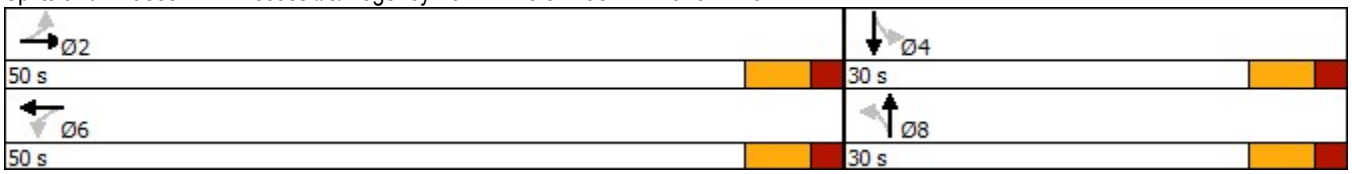
Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	133	403	3	5	615	52	8	28	16	154	10	104
Future Volume (vph)	133	403	3	5	615	52	8	28	16	154	10	104
Satd. Flow (prot)	1770	3534	0	1770	3482	0	0	1755	0	1770	1561	0
Flt Permitted	0.372			0.496				0.939		0.720		
Satd. Flow (perm)	685	3534	0	907	3482	0	0	1657	0	1316	1561	0
Satd. Flow (RTOR)		1			18			17			113	
Lane Group Flow (vph)	145	441	0	5	725	0	0	56	0	167	124	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Total Split (s)	50.0	50.0		50.0	50.0		30.0	30.0		30.0	30.0	
Total Lost Time (s)	6.0	6.0		6.0	6.0			6.0		6.0	6.0	
Act Effct Green (s)	19.1	19.1		19.1	19.1			11.1		11.1	11.1	
Actuated g/C Ratio	0.45	0.45		0.45	0.45			0.26		0.26	0.26	
v/c Ratio	0.48	0.28		0.01	0.46			0.13		0.49	0.25	
Control Delay	15.3	8.3		7.4	9.4			10.8		19.3	5.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay	15.3	8.3		7.4	9.4			10.8		19.3	5.9	
LOS	B	A		A	A			B		B	A	
Approach Delay		10.0			9.4			10.8			13.5	
Approach LOS		B			A			B			B	
Queue Length 50th (m)	6.6	9.4		0.2	16.6			1.8		8.5	0.5	
Queue Length 95th (m)	23.5	21.6		1.7	36.0			10.2		30.6	10.9	
Internal Link Dist (m)		518.2			383.0			43.2			228.7	
Turn Bay Length (m)	20.0			15.0						25.0		
Base Capacity (vph)	650	3353		861	3305			981		774	964	
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	0.13		0.01	0.22			0.06		0.22	0.13	

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 42.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.49
Intersection Signal Delay: 10.4
Intersection LOS: B
Intersection Capacity Utilization 56.3%
ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 2: Access #3/Regency Park Drive & Washmill Lake Drive



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	188	574	382	286	521	138	290	121	265	119	157	140
Future Volume (vph)	188	574	382	286	521	138	290	121	265	119	157	140
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.425			0.270			0.649			0.673		
Satd. Flow (perm)	792	3539	1583	503	3539	1583	1209	1863	1583	1254	1863	1583
Satd. Flow (RTOR)			139			88			253			103
Lane Group Flow (vph)	204	624	415	311	566	150	315	132	288	129	171	152
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6		6	2		2	4		4	8		8
Total Split (s)	14.0	35.0	35.0	17.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
Total Lost Time (s)	4.0	6.3	6.3	4.0	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3
Act Effct Green (s)	32.6	20.9	20.9	38.5	23.9	23.9	24.0	24.0	24.0	24.0	24.0	24.0
Actuated g/C Ratio	0.44	0.28	0.28	0.52	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
v/c Ratio	0.44	0.63	0.76	0.67	0.50	0.27	0.81	0.22	0.42	0.32	0.28	0.26
Control Delay	13.8	27.2	27.0	18.9	22.8	10.8	41.9	20.6	6.4	22.8	21.3	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.8	27.2	27.0	18.9	22.8	10.8	41.9	20.6	6.4	22.8	21.3	9.2
LOS	B	C	C	B	C	B	D	C	A	C	C	A
Approach Delay		24.9			19.9			24.1			17.6	
Approach LOS		C			B			C			B	
Queue Length 50th (m)	15.8	44.4	39.2	25.8	37.1	6.8	43.0	14.3	3.6	14.5	19.0	5.1
Queue Length 95th (m)	31.0	66.4	78.3	47.6	56.5	20.8	#90.7	30.0	21.7	31.4	37.7	19.1
Internal Link Dist (m)		125.4			242.6			314.2			320.2	
Turn Bay Length (m)	55.0		7.0	50.0		7.0	35.0		7.0	35.0		7.0
Base Capacity (vph)	496	1427	721	496	1576	754	538	830	845	558	830	762
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.44	0.58	0.63	0.36	0.20	0.59	0.16	0.34	0.23	0.21	0.20

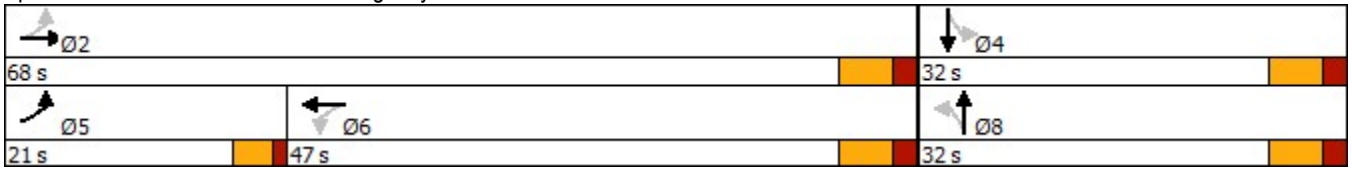
Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 74.6
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 22.3
Intersection LOS: C
Intersection Capacity Utilization 75.1%
ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Regency Park Drive/Parkland Drive & Lacewood Drive

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	231	918	7	19	820	139	4	12	11	230	21	133
Future Volume (vph)	231	918	7	19	820	139	4	12	11	230	21	133
Satd. Flow (prot)	1770	3534	0	1770	3424	0	0	1714	0	1770	1560	0
Flt Permitted	0.116			0.285				0.961		0.738		
Satd. Flow (perm)	216	3534	0	524	3424	0	0	1653	0	1331	1560	0
Satd. Flow (RTOR)		1			23			12			145	
Lane Group Flow (vph)	251	1006	0	21	1042	0	0	29	0	250	168	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Total Split (s)	21.0	68.0		47.0	47.0		32.0	32.0		32.0	32.0	
Total Lost Time (s)	4.0	6.0		6.0	6.0			6.0		6.0	6.0	
Act Effct Green (s)	50.7	48.6		30.2	30.2			19.8		19.8	19.8	
Actuated g/C Ratio	0.63	0.60		0.37	0.37			0.24		0.24	0.24	
v/c Ratio	0.62	0.47		0.11	0.81			0.07		0.77	0.34	
Control Delay	21.2	10.1		19.9	28.5			19.4		47.5	9.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0		0.0	0.0	
Total Delay	21.2	10.1		19.9	28.5			19.4		47.5	9.4	
LOS	C	B		B	C			B		D	A	
Approach Delay		12.3			28.3			19.4			32.2	
Approach LOS		B			C			B			C	
Queue Length 50th (m)	19.5	44.1		2.3	79.4			2.2		38.4	2.9	
Queue Length 95th (m)	50.5	66.9		7.8	115.8			9.7		#82.0	19.8	
Internal Link Dist (m)		518.2			383.0			43.2			228.7	
Turn Bay Length (m)	20.0			15.0						25.0		
Base Capacity (vph)	477	2750		278	1830			565		448	622	
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	0.53	0.37		0.08	0.57			0.05		0.56	0.27	

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 81
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 21.6 Intersection LOS: C
Intersection Capacity Utilization 72.9% 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: Access #3/Regency Park Drive & Washmill Lake Drive



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	71	0	47	69	0	104	34	132	47	70	152	50
Future Volume (Veh/h)	71	0	47	69	0	104	34	132	47	70	152	50
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	0	51	75	0	113	37	143	51	76	165	54
Pedestrians		15			15			15			15	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								253				
pX, platoon unblocked												
vC, conflicting volume	704	642	222	640	644	198	234			209		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	704	642	222	640	644	198	234			209		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	72	100	94	77	100	86	97			94		
cM capacity (veh/h)	272	351	797	325	350	822	1317			1345		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	77	51	75	113	37	194	76	219
Volume Left	77	0	75	0	37	0	76	0
Volume Right	0	51	0	113	0	51	0	54
cSH	272	797	325	822	1317	1700	1345	1700
Volume to Capacity	0.28	0.06	0.23	0.14	0.03	0.11	0.06	0.13
Queue Length 95th (m)	9.1	1.6	7.0	3.8	0.7	0.0	1.4	0.0
Control Delay (s)	23.4	9.8	19.3	10.1	7.8	0.0	7.8	0.0
Lane LOS	C	A	C	B	A		A	
Approach Delay (s)	18.0		13.8		1.3		2.0	
Approach LOS	C		B					

Intersection Summary					
Average Delay	6.9				
Intersection Capacity Utilization	37.2%	ICU Level of Service		A	
Analysis Period (min)	15				

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	86	0	85	116	0	117	62	234	86	143	186	103
Future Volume (Veh/h)	86	0	85	116	0	117	62	234	86	143	186	103
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	93	0	92	126	0	127	67	254	93	155	202	112
Pedestrians		10			10			10			10	
Lane Width (m)		3.6			3.6			3.6			3.6	
Walking Speed (m/s)		1.2			1.2			1.2			1.2	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)								253				
pX, platoon unblocked												
vC, conflicting volume	1103	1069	278	1058	1078	320	324			357		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1103	1069	278	1058	1078	320	324			357		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	28	100	88	15	100	82	95			87		
cM capacity (veh/h)	130	179	748	149	177	708	1225			1192		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	93	92	126	127	67	347	155	314
Volume Left	93	0	126	0	67	0	155	0
Volume Right	0	92	0	127	0	93	0	112
cSH	130	748	149	708	1225	1700	1192	1700
Volume to Capacity	0.72	0.12	0.85	0.18	0.05	0.20	0.13	0.18
Queue Length 95th (m)	32.3	3.3	44.7	5.2	1.4	0.0	3.6	0.0
Control Delay (s)	82.9	10.5	96.6	11.2	8.1	0.0	8.5	0.0
Lane LOS	F	B	F	B	A		A	
Approach Delay (s)	46.9		53.7		1.3		2.8	
Approach LOS	E		F					

Intersection Summary					
Average Delay	18.3				
Intersection Capacity Utilization	48.9%	ICU Level of Service		A	
Analysis Period (min)	15				

3: Regency Park Drive & Internal Road Performance by movement

Movement	EBL	EBR	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	3.8	0.4	3.7	0.5	0.0	0.0	0.0	2.8	0.6	0.6	1.2
Total Del/Veh (s)	15.2	5.3	16.7	6.3	4.7	2.3	1.6	4.8	2.5	1.5	5.5

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	TR	L	TR	L	TR
Maximum Queue (m)	25.6	23.5	28.6	37.7	13.6	13.2	22.9	15.0
Average Queue (m)	11.5	10.7	14.6	12.6	5.0	1.3	9.4	1.3
95th Queue (m)	21.4	18.8	24.8	26.0	13.1	7.6	18.8	7.9
Link Distance (m)		70.0		125.7		228.6		332.9
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)	25.0		25.0		25.0		25.0	
Storage Blk Time (%)	1	0	2	0		0	0	0
Queuing Penalty (veh)	1	0	2	1		0	0	0