Atlantic Road & Traffic Management

Traffic Engineering Specialists

Traffic Impact Study
Pleasantville Redevelopment
St. John's, NL

Prepared for

Tract Consulting Inc.
St. John's, NL

and

Canada Lands Company Limited

December 2008

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December 31, 2008

Mr. Neil Dawe, President
Tract Consulting Inc.
100 Lemarchant Road
St. Johns NL A1C 2H2

RE: Traffic Impact Study - Pleasantville Redevelopment , St. John's, Newfoundland

Dear Mr. Dawe:

I am pleased to provide the final report for the ***Traffic Impact Study - Pleasantville Redevelopment - St. John's, Newfoundland.***

While the Report is based on a mixed use development concept plan which included 987 residential units and 148,000 square feet of commercial space, it is understood that the current concept plan has been revised to include 958 residential units and about 62,500 square feet of commercial space.

Since both residential and commercial land use intensities included in the current concept plan are less than those used in the Traffic Impact Study, the conclusions and recommendations included in the Report are still considered to be valid.

If you have questions, or require additional information, please contact me by Email or telephone 902-443-7747.

Sincerely:

Ken O'Brien, P. Eng.

REGISTERED PROFESSIONAL ENGINEER
KENNETH O'BRIEN
SIGNATURE
Dec. 31/08
DATE
NEWFOUNDLAND & LABRADOR

PROVINCE OF NEWFOUNDLAND
PERMIT HOLDER
This Permit Allows
ATLANTIC ROAD AND TRAFFIC MANAGEMENT
To practice Professional Engineering in Newfoundland and Labrador.
Permit No. as issued by APEGN L0196
which is valid for the year 2008

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1.0 Introduction

Background

Canada Lands Company Limited (CLC) is planning to redevelop an 80 acre Pleasantville site in the City of St. John's. The site which was formerly Fort Pepperell, a United States World War II military base, still includes most of the street infrastructure and some of the buildings. The site, located between the Bally Haly Golf and Country Club and Quidi Vidi Lake (Figure 1), presents an excellent opportunity for redevelopment as a new mixed use residential community.

Due to the magnitude of land available for development, and the potential traffic impacts of site generated traffic on adjacent streets and intersections, the City of St. John's has required completion of a Traffic Impact Study.

A Traffic Impact Study Usually Considers Four Questions

A Traffic Impact Study for a proposed commercial and retail development usually consists of four steps to answer the following questions:

1. **What are the existing traffic situations** on streets adjacent to the study site? How have traffic volumes increased historically? How many collisions have occurred during the past five years?
2. **What traffic changes are expected** at Study Area intersections? How many vehicle trips will be generated by the proposed development during weekday AM and PM peak hours? How will the traffic be distributed at the exits from the development and to Study Area streets and intersections?
3. **What traffic impacts will occur** on Study Area streets and intersections? How will level of service at intersections be affected?
4. **What road or intersection improvements are required** to mitigate project impacts on Study Area traffic movements?

Study Objectives

Specific concerns to be included in the Traffic Impact Study are:

1. Examine, quantify and comment on existing traffic conditions in the Study Area, without addition of site generated trips;
2. Evaluate the traffic related impacts of the proposed redevelopment of the 80 acre Pleasantville site; and
3. Identify street and intersection improvements that will be required to accommodate site generated trips while ensuring satisfactory levels of performance on Study Area streets and intersections.

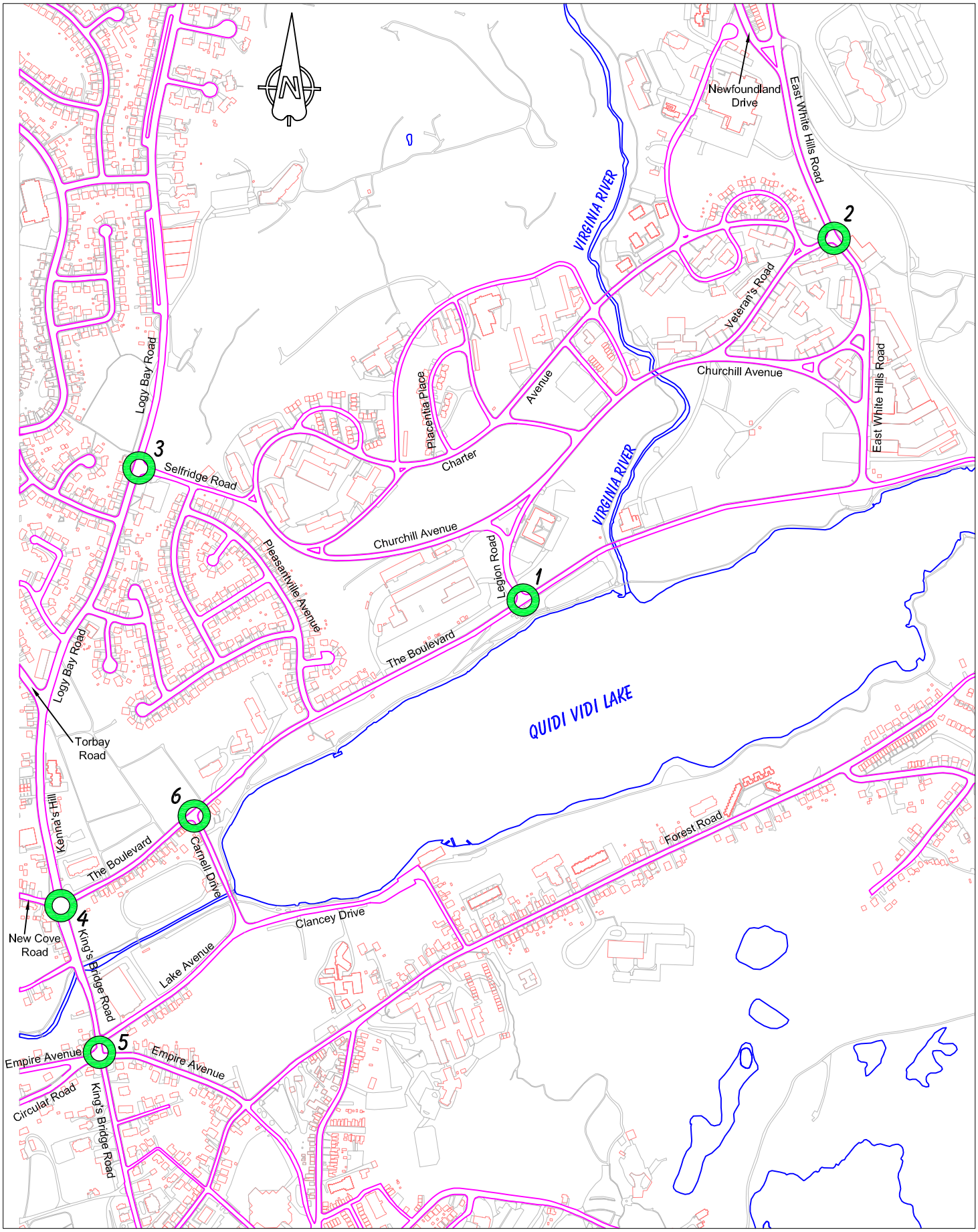

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Figure 1
Study Area

December 2008

2.0 Descriptions of Proposed Development and Study Area

Description of Proposed Redevelopment

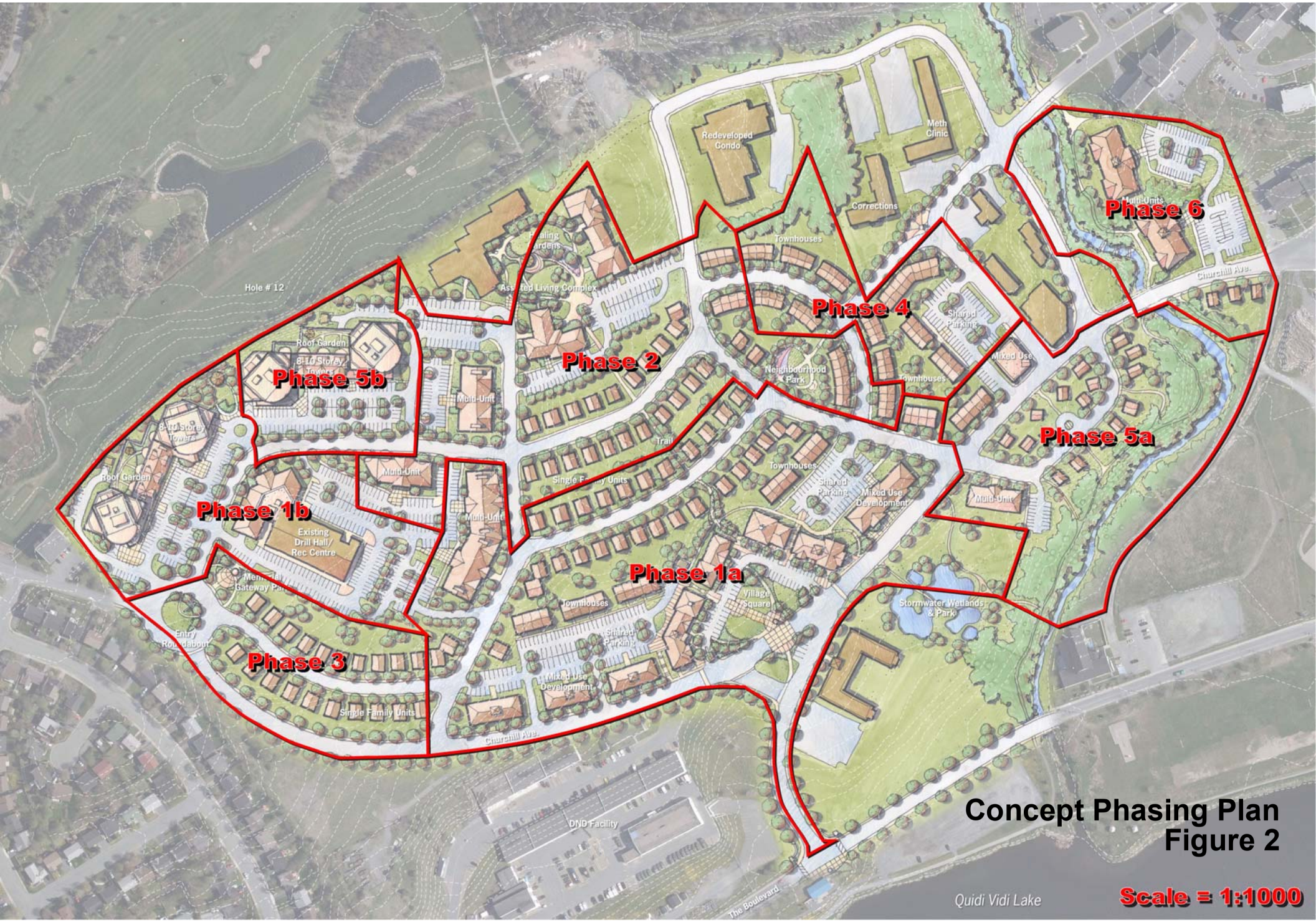
The Pleasantville redevelopment area includes about 80 acres of land bounded approximately by the Bally Haly Golf and Country Club to the north, Virginia River to the east, The Boulevard and Churchill Drive to the south, and Churchill Drive and existing residential development to the west (Figure 1).

The Concept Plan (Figure 2) for the proposed development includes about 987 residential units and 148,000 square feet of commercial area. The Concept Plan includes six development phases, with development expected to start during 2009 and site build-out anticipated by 2012. Distribution of residential land use types and numbers of units, as well as commercial floor area, are summarized in Table 1.

Table 1 - Development Types and Numbers of Units

Year	Phases	Number of Residential Units				Retail Floor Area [1]		Office Floor Area [1]	
		Single Family	Town Houses	Low-Rise Apts	High-Rise Apts	Neighbour-hood	Local	Neighbour-hood	Local
2009	1a	30	26	173	-	-	45.75	-	45.75
2009	1b	-	-	38	181	10.75	-	10.75	-
2009	2	23	18	127	-	-	-	-	-
2010	3	33	-	-	-	-	-	-	-
2010	4	-	44	-	-	-	-	-	-
2009-10	1 to 4	86	88	338	181	10.75	45.75	10.75	45.75
2011	5a	15	5	31	-	6.75	-	6.75	-
2012	5b	-	-	-	181	10.75	-	10.75	-
2012	6	-	-	62	-	-	-	-	-
2011-12	5 to 6	15	5	93	181	17.5	0	17.5	0
Full Build-out		101	93	431	362	28.25	45.75	28.25	45.75
Totals		987 Residential Units				148 KGFA Commercial			

NOTES: 1. Commercial floor area has been considered as 50% Retail and 50% Office use.
Floor area is indicated as '1000 square feet' Gross Floor Area or KGFA
Neighbourhood uses are those associated with significant apartment developments where there will be high walking rates and with most clients being from the immediate area within the Development.
Local uses are those associated with the Village Square that will attract clients from a wider area.



Concept Phasing Plan
Figure 2

Scale = 1:1000

Development Area Intersections

External site generated traffic from the Pleasantville redevelopment is expected to access the St. John's street system at the following intersections:

- Legion Road at The Boulevard (STOP controlled)
- Veterans Road at East While Hills Road (STOP controlled)
- Selfridge Road at Logy Bay Road (Traffic signals).

Other intersections in the Study Area that have been considered in this study include:

- The Boulevard / New Cove Road at King's Bridge Road / Kenna's Hill (Traffic signals)
- Empire Avenue at King's Bridge Road (Traffic signals)
- Carnell Drive at The Boulevard (STOP controlled).

Intersection Collision History (2003 to 2006)

Collision data, supplied from the City of St. John's collision database, for STOP sign controlled The Boulevard / Carnell Drive intersection are summarized in Table 2. Information provided indicated that the three right angle collisions involved east bound vehicles on The Boulevard in collision with vehicles turning from Carnell Drive. This may indicate that sight distance in the southwest intersection quadrant is obstructed by parked vehicles on The Boulevard near the intersection.

Table 2 - Collision Experience at The Boulevard / Carnell Drive Intersection (2003 to 2006)

Year	Number of Reported Collisions by Type						
	Right Angle	Rear End	Sideswipe	Turning Movement	Single Vehicle	Other	TOTAL
2003							0
2004	1			1			2
2005							0
2006	2	1					3
TOTALS	3	1	0	1	0	0	5

Source: City of St. John's, Engineering Department

Machine Traffic Count Volumes

City of St. John's Engineering Department staff provided machine traffic count data for five street locations. Average hourly traffic volumes for each count are tabulated in Tables A-1 to A-5, Appendix A, and weekday average hourly volumes for a 24 hour day are shown diagrammatically in Figures A-1 to A-5. Traffic volume data from the counts are summarized in Table 3.

Table 3 - Summary of Machine Traffic Count Data					
Count Location	**Count Dates**	**Table / Figure**	**Weekday Volume**	**AM Peak Hour Volume**	**PM Peak Hour Volume**
The Boulevard - west of Carnell Drive	Oct. 16 / 17, 2006	A-1	6,430	520	560
The Boulevard - east of Legion Road	Oct. 16 / 17, 2006	A-2	2,680	220	270
Churchill Avenue - west of Legion Road	Oct. 11 / 12, 2007	A-3	1,160	80	100
Churchill Avenue - west of Veterans Road	Oct. 11 / 12, 2007	A-4	1,980	170	180
Charter Avenue - east of Placentia Place	Oct. 11 / 12, 2007	A-5	1,310	100	110
Source: City of St. John's, Engineering Department					

Manual Turning Movement Counts

Manual turning movement counts were obtained by TRACT Consultants staff on a during mid-October, 2007. Counts for six Study Area intersections are tabulated in Tables A-6 to A-11, Appendix A, with peak hours indicated by shaded areas:

Table A-6 Legion Road at The Boulevard
Table A-7 Veterans Road at East White Hills Road
Table A-8 Selfridge Road at Logy Bay Road
Table A-9 The Boulevard / New Cove Road at King's Bridge Road / Kenna's Hill
Table A-10 Empire Avenue at King's Bridge Road
Table A-11 Carnell Drive at The Boulevard.

A turning movement count was also obtained at the King's Bridge Road / Lake Avenue intersection and count results are tabulated in Table A-12.

Determination of 2007 Design Hourly Volumes (DHVs)

Since counts obtained during mid-October are generally considered to represent 'normal' or 'average' conditions that do not require seasonal adjustment, the AM and PM peak hourly volumes from Tables A-6 to A-11, have been rounded to provide reasonable estimates of 2007 design hourly volumes (DHVs). Estimated 2007 DHVs for Study Area intersections are shown diagrammatically on Figure B-1, Appendix B.

An Annual Traffic Volume Growth Rate of 1.0% has been used for this Study

An annual traffic volume growth rate of 1.0% per year, typical of the growth rate experienced on major streets, such as King's Bridge Road, has been used in this study.

Estimated 2007 DHVs (Figure B-1, Appendix B) have been increased by 1.0 % per year to provide projected background DHVs for 2010 and 2012 that do not include trips generated by proposed site development. Projected 2010 DHVs for Study Area intersections are shown diagrammatically on Figure B-2, and projected 2012 DHVs are shown on Figure B-5.

3.0 Trip Generation, Trip Distribution and Assignment

Trip Generation is Based on Number of Residential Units and Gross Floor Area (GFA) for Commercial Land Uses

Estimation of the number of trips that will be generated by a proposed development are usually based on the number of units for residential development and Gross Floor Area (GFA) for commercial development. *Trip Generation, 7th Edition* (Institute of Transportation Engineers (ITE), Washington, 2003) contains trip generation rates for various land uses which are recorded as 'trips per unit' for residential development and 'trips per 1000 square feet of Gross Floor Area (GFA)' for commercial land uses.

Calculation of Total Trip Generation Estimates for the Study Area

Total trip generation estimates for the Pleasantville redevelopment concept plan have been estimated for AM and PM peak hours for the land use data in Table 1 using rates published in *Trip Generation, 7th Edition*. Trip generation estimates, prepared for two stages of development of the six phase project, are included in Table 4. Before consideration of walking trips and reductions for pass-by trips made by vehicle using existing and future streets within the development, it is estimated that the development will generate 664 vehicles per hour (vph) two-way (256 entering and 408 exiting) during an AM peak hour and 974 vph (523 entering and 451 exiting) during a PM peak hour.

Calculation of Walking Trips Within the Development

Commercial land uses have been considered as 'neighbourhood' land uses for areas associated with high rise and significant apartment developments (Phases 1b, 5a, and 5b) and 'local' land uses for the development at the Village Square (Phase 1a). Since walking trips are expected to represent a significant number of the trips generated by 'neighbourhood' commercial developments, 40% of trips to neighbourhood retail and 10% of trips to neighbourhood office have been considered to be walking trips. Also, 20% of trips to local retail and 10% of trips to local office have been considered to be walking trips. The calculation of walking (non-vehicle) trips is included in Table 5.

Calculation of Pass-By Trips for the Development

Pass-by trips are those which are made as 'intervening opportunity' stops to commercial and retail land uses for vehicle trips already passing by the sites. Although these trips will be included in traffic near the individual business locations, they will not increase the external trips entering and exiting the development area to the regional street system. A pass-by rate of 30% has been used for all retail land uses in the development. The calculation of pass-by trips is included in Table 6.

Estimate of External Trips Generated by the Development

After consideration of walking and pass-by trips, it is estimated that the built-out development will generate 580 vehicles per hour (vph) two-way (214 entering and 366 exiting) during an AM peak hour and 738 vph (405 entering and 333 exiting) during a PM peak hour.

Table 4 - Trip Generation Estimates for Pleasantville Redevelopment

Land Use[1]	Number Units[4]	Trip Generation Rates[2]					Trips Generated [3]				
		AM Peak		PM Peak		Day	AM Peak		PM Peak		Day
		In	Out	In	Out	2-Way	In	Out	In	Out	2-Way
Land Use and Trip Generation Estimates for Phases 1 to 4 - 2010											
SingleFamily (ITE 210)	174 Units	0.19	0.56	0.64	0.37	9.57	33	97	111	64	1665
Apartment (ITE 220)	338 Apts	0.10	0.41	0.40	0.22	6.72	34	139	135	74	2271
Hi-Rise Apt (ITE 222)	181 Apts	0.08	0.22	0.21	0.14	4.20	14	40	38	25	760
Total Residential	693						81	276	284	163	4696
Phase 1a Retail [5] (ITE 820)	45.75 KGLA	0.63	0.40	1.80	1.95	42.94	29	18	82	89	1965
Phase 1a Offices [6] (ITE 710)	45.75 KGFA	1.36	0.19	0.25	1.24	11.01	62	9	11	57	504
Phase 1b Retail [5] (ITE 820)	10.75 KGLA	0.63	0.40	1.80	1.95	42.94	7	4	19	21	462
Phase 1b Offices [6] (ITE 710)	10.75 KGFA	1.36	0.19	0.25	1.24	11.01	15	2	3	13	118
Total Commercial	113						113	33	115	180	3049
Total Estimated Trips for Phases 1 to 4							194	309	399	343	7745
Land Use and Trip Generation Estimates for Phases 5 and 6 - 2012											
SingleFamily (ITE 210)	20 Units	0.19	0.56	0.64	0.37	9.57	4	11	13	7	191
Apartment (ITE 220)	93 Apts	0.10	0.41	0.40	0.22	6.72	9	38	37	20	625
Hi-Rise Apt (ITE 222)	181 Apts	0.08	0.22	0.21	0.14	4.20	14	40	38	25	760
Total Residential	294						27	89	88	52	1576
Phase 5a / 5b Retail [5] (ITE 820)	17.5 KGLA	0.63	0.40	1.80	1.95	42.94	11	7	32	34	751
Phase 5a / 5b Offices [6] (ITE 710)	17.5 KGFA	1.36	0.19	0.25	1.24	11.01	24	3	4	22	193
Total Commercial	35						35	10	36	56	944
Total Estimated Trips for Phases 5 and 6							62	99	124	108	2520

Land Use and Trip Generation Estimates for Full Development										
Total Residential	987		108	365	372	215	6272
Total Commercial	148		148	43	151	236	3993
Total Estimated Trips for Full Development			256	408	523	451	10265

NOTES:
1. Land uses are for phases shown on Pleasantville Redevelopment Concept Plan (Figure 2).
   Land Use Codes are from *Trip Generation 7th Edition* , Institute of Transportation Engineers, 2003.
2. Trip generation rates are 'vehicles per hour per unit' for the peak hour and 'two-way vehicles per day per unit' for the daily rates.
   Rates as are for indicated Land Uses and Land Use Codes, *Trip Generation 7th Edition* .
3. Vehicles per hour for peak hours; vehicles per weekday for 'Day 2-Way
4. Units are as indicated; KGLA is '1000 square feet gross leasable area'
5. Shopping Centre rate has been used
6. General Office rate has been used

Table 5 - Calculation of Estimated Walking Trips and Vehicle Trips Generated by the Proposed Pleasantville Redevelopment

Land Use [1]	Number Units [2]	Estimated Total Trips Generated [3]					Estimated Walking (Non-Vehicle)Trips [4]					Estimated Total Vehicle Trips Generated [5]				
		AM Peak		PM Peak		Day	AM Peak		PM Peak		Day	AM Peak		PM Peak		Day
		In	Out	In	Out	2-Way	In	Out	In	Out	2-Way	In	Out	In	Out	2-Way
Phases 1 to 4 - 2010	**Land Use and Trip Generation Estimates [3]**						**Estimated Walking (Non-Vehicle)Trips [4]**					**Estimated VehicleTrips [5]**				
SingleFamily (ITE 210)	174 Units	33	97	111	64	1665										
Apartment (ITE 220)	338 Apts	34	139	135	74	2271										
Hi-Rise Apt (ITE 222)	181 Apts	14	40	38	25	760										
Total Residential	693	81	276	284	163	4696	7	17	33	25	640	74	259	251	138	4056
Phase 1a Retail (ITE 820)	45.75 KGLA	29	18	82	89	1965	6	4	16	18	393	23	14	66	71	1572
Phase 1a Offices (ITE 710)	45.75 KGFA	62	9	11	57	504	6	1	1	6	50	56	8	10	51	454
Phase 1b Retail (ITE 820)	10.75 KGLA	7	4	19	21	462	3	2	8	8	185	4	2	11	13	277
Phase 1b Offices (ITE 710)	10.75 KGFA	15	2	3	13	118	2	0	0	1	12	13	2	3	12	106
Total Commercial	113	113	33	115	180	3049	17	7	25	33	640	96	26	90	147	2409
Total Trips Phases 1 to 4		194	309	399	343	7745	24	24	58	58	1280	170	285	341	285	6465
Phases 5 and 6 - 2012	**Land Use and Trip Generation Estimates [3]**						**Estimated Walking (Non-Vehicle)Trips [4]**					**Estimated VehicleTrips [5]**				
SingleFamily (ITE 210)	20 Units	4	11	13	7	191										
Apartment (ITE 220)	93 Apts	9	38	37	20	625										
Hi-Rise Apt (ITE 222)	181 Apts	14	40	38	25	760										
Total Residential	294	27	89	88	52	1576	3	6	16	13	319	24	83	72	39	1257
Phase 5a / 5b Retail (ITE 820)	17.5 KGLA	11	7	32	34	751	4	3	13	14	300	7	4	19	20	451
Phase 5a / 5b Offices (ITE 710)	17.5 KGFA	24	3	4	22	193	2	0	0	2	19	22	3	4	20	174
Total Commercial	35	35	10	36	56	944	6	3	13	16	319	29	7	23	40	625
Total Trips for Phases 5 and 6		62	99	124	108	2520	9	9	29	29	638	53	90	95	79	1882
Full Development	**Land Use and Trip Generation Estimates [3]**						**Estimated Walking (Non-Vehicle)Trips [4]**					**Estimated VehicleTrips [5]**				
Total Residential	987	108	365	372	215	6272	10	23	49	38	959	98	342	323	177	5313
Total Commercial	148	148	43	151	236	3993	23	10	38	49	959	125	33	113	187	3034
Total Trips Full Development		256	408	523	451	10265	33	33	87	87	1918	223	375	436	364	8347

NOTES:
1. Land uses are for phases shown on Pleasantville Redevelopment Concept Plan (Figure 2).
   Land Use Codes are from *Trip Generation 7th Edition* , Institute of Transportation Engineers, 2003.
2. Units are as indicated; KGLA is '1000 square feet gross leasable area'
3. Estimated Total Trips are from Table 4; vehicles per hour for peak hours; vehicles per weekday for 'Day 2-Way
4. 20% of Phase 1a Retail and 40% of Phases 1b, 5a, and 5b Retail Trips have been considered as walking trips; 10% of all Office Trips have been considered walking trips.
   Residential walking trip estimates have been considered equal to Retail and Commercial walking trips with Enter / Exit reversed.
5. The Estimated Total VehicleTrips generated by the development are equal to Total Trip Generation estimates less Walking Trips

Table 6 - Calculation of Pass-By Trips and Estimated External Trips Generated by the Proposed Pleasantville Redevelopment

Land Use [1]	Number Units [2]	Estimated Vehicle Trips Generated [3]					Estimated Pass-By Trips [4]					Estimated External Vehicle Trips Generated [5]				
		AM Peak		PM Peak		Day	AM Peak		PM Peak		Day	AM Peak		PM Peak		Day
		In	Out	In	Out	2-Way	In	Out	In	Out	2-Way	In	Out	In	Out	2-Way
Phases 1 to 4 - 2010		**Estimated Vehicle Trips Generated [3]**					**Estimated Pass-By Trips [4]**					**Estimated External Vehicle Trips Generated [5]**				
Total Residential	693	74	259	251	138	4056	0	0	0	0	0	74	259	251	138	4056
Phase 1a Retail (ITE 820)	45.75 KGLA	23	14	66	71	1572	6	6	21	21	472	17	8	45	50	1100
Phase 1a Office (ITE 710)	45.75 KGFA	56	8	10	51	454	0	0	0	0	0	56	8	10	51	454
Phase 1b Retail (ITE 820)	10.75 KGLA	4	2	11	13	277	1	1	4	4	83	3	1	7	9	194
Phase 1b Office (ITE 710)	10.75 KGFA	13	2	3	12	106	0	0	0	0	0	13	2	3	12	106
Total Commercial	113	96	26	90	147	2409	7	7	25	25	555	89	19	65	122	1854
Total Trips Phases 1 to 4		170	285	341	285	6465	7	7	25	25	555	163	278	316	260	5910
Phases 5 and 6 - 2012		**Estimated Vehicle Trips Generated [3]**					**Estimated Pass-By Trips [4]**					**Estimated External Vehicle Trips Generated [5]**				
Total Residential	294	24	83	72	39	1257	0	0	0	0	0	24	83	72	39	1257
Phase 5a / 5b Retail (ITE 820)	17.5 KGLA	7	4	19	20	451	2	2	6	6	135	5	2	13	14	316
Phase 5a / 5b Office (ITE 710)	17.5 KGFA	22	3	4	20	174	0	0	0	0	0	22	3	4	20	174
Total Commercial	35	29	7	23	40	625	2	2	6	6	135	27	5	17	34	490
Total Trips for Phases 5 and 6		53	90	95	79	1882	2	2	6	6	135	51	88	89	73	1747
Full Development		**Estimated Vehicle Trips Generated [3]**					**Estimated Pass-By Trips [4]**					**Estimated External Vehicle Trips Generated [5]**				
Total Residential	987	98	342	323	177	5313	0	0	0	0	0	98	342	323	177	5313
Total Commercial	148	125	33	113	187	3034	9	9	31	31	690	116	24	82	156	2344
Total Trips Full Development		223	375	436	364	8347	9	9	31	31	690	214	366	405	333	7657

NOTES:
1. Land uses are for phases shown on Pleasantville Redevelopment Concept Plan (Figure 2).
   Land Use Codes are from *Trip Generation 7th Edition* , Institute of Transportation Engineers, 2003.
2. Units are as indicated; KGLA is '1000 square feet gross leasable area'
3. Estimated Vehicle Trips are from Table 5; vehicles per hour for peak hours; vehicles per weekday for 'Day 2-Way
4. A Pass-By rate of 30% has been used for trips generated by retail landuses.
5. These are the number of External Trips that will be distributed to the regional street network from the three Pleasantville access points.

Distribution of Site Generated Trips

The City of St. John's QRS II Transportation Planning Model and local knowledge of the Study Area were used to determine the following distribution for site generated trips:

- Northeast - Logy Bay area 10%
- South - West end of Quidi Vidi Lake area 2%
- Southeast - Quidi Vidi Village and Signal Hill areas 5%
- Southwest - Downtown and areas south of Empire Avenue 30%
- West - Elizabeth Avenue Area 3%
- Northwest and west - Torbay Road, Portugal Cove Road, Prince Philip Drive, and Kenmount Road area 50%

Site Generated Trips for Stage 1 Development by 2010

Site generated trips for the first development stage that includes Phases 1 to 4 being completed by 2010 have been assigned to Study Area intersections in accordance with the trip distribution discussed above. Site generated trips for Stage 1 development which are shown diagrammatically on Figure B-3, Appendix B, been added to projected 2010 background trips (Figure B-2) to provide projected 2010 trips which include Stage 1 development trips, illustrated diagrammatically in Figure B-4.

Site Generated Trips for Full Build-out Development by 2012

Site generated trips for the full build-out of the development by 2012 have been assigned to Study Area intersections in accordance with the trip distribution discussed above. Site generated trips for full build-out which are shown diagrammatically on Figure B-6, Appendix B, been added to projected 2012 background trips (Figure B-5) to provide projected 2012 trips which full build-out trips, illustrated diagrammatically in Figure B-7.

4.0 Intersection Performance Analysis

4.1 Signal Warrant Analysis

Traffic Signal Warrant Principles

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.

Traffic Signal Warrant Analyses for Study Area STOP Controlled Intersections

Signal warrant analyses were completed for the three Study Area STOP controlled intersections using existing 2007 volumes and projected 2012 volumes that include 1.0% annual background traffic growth plus trips generated by full build-out of the Pleasantville redevelopment concept. The *Canadian Traffic Signal Warrant Matrix Analysis* work sheets are included as Tables B-1 to B-6 (Appendix B pages B-16 to B-21) and results are summarized in Table 7. Since existing priority points are considerably less than the 100 required to justify installation of traffic signals, and since priority points calculated with projected 2012 volumes are also considerably less than 100, installation of signals is not required at any of the intersections.

Table 7 - Summary of Signal Warrant Analyses for STOP Controlled Intersections

Intersection	Existing 2007 Volumes		Projected 2012 Volumes	
	Table	Priority Points	Table	Priority Points
The Boulevard and Legion Road	B-1	12	B-4	33
East While Hills Road and Veterans Road	B-2	15	B-5	28
The Boulevard and Carnell Drive	B-3	25	B-6	45

4.2 Left Turn Lane Analysis

Left Turn Lane Analysis Procedure

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. The analysis method, which is usually used by *ARTM* to evaluate need for construction of 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 required.

Left Turn Lane Warrant Analysis - The Boulevard at Legion Road

Left turn warrant analyses (Figure B-8, Appendix B, Page B-22) were completed for The Boulevard intersection with Legion Road for existing 2007 AM and PM peak hour volumes, and projected 2012 AM and PM peak hour volumes that include site generated trips from full development. The analyses indicated that while a left turn lane is not required for existing 2007 volumes, a left turn lane will be required on The Boulevard by 2012 with the addition of site generated trips.

4.3 Level of Service Analysis

Intersection Level of Service Analysis

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

Table 8 - Level of Service (LOS) Criteria

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

LOS Criteria

LOS criteria (Table 8) are stated in terms of average control delay per vehicle which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. LOS 'A' describes an intersection approach with a very low control delay of up to ten seconds per vehicle. On the other hand, LOS 'F' describes an intersection with control delay greater than 80 seconds (50 seconds for STOP control), which is considered unacceptable by most drivers.

LOS Analysis - Years and Development Scenarios

Level of service (LOS) analyses have been completed using *Synchro 6.0.* Analyses results for the following six intersections are included in Appendix C and are summarized in Tables D-1 to D-12, Appendix D:

1. The Boulevard at Legion Road
2. Veterans Road at East White Hills Road
3. Selfridge Road at Logy Bay Road
4. The Boulevard / New Cove Rd. at Kings's Bridge Rd. / Kenna's Hill
5. Empire Avenue at Kings's Bridge Road
6. The Boulevard at Carnell Drive.

LOS analyses have been completed for weekday AM and PM peak hour volumes for the following development scenarios:

1. 2007 existing volumes (Figure B-1)
2. 2010 projected background volumes without site trips (Figure B-2).
3. 2010 projected volumes with completion of development Phases 1 to 4 (Figure B-4)
4. 2012 projected background volumes without site trips (Figure B-5)
5. 2012 projected volumes with full site build-out on completion of development Phases 5 and 6 (Figure B-7).

LOS Analyses - Intersection Configurations and Traffic Control

The following intersection configurations and traffic control were used for the LOS analyses completed for this Study:

1. ***The Boulevard at Legion Road*** - The existing lane configuration on The Boulevard and a two-lane Legion Road approach with STOP control were used for all analyses.
2. ***Veterans Road at East White Hills Road*** - The existing lane configuration and STOP control were used for all analyses.
3. ***Selfridge Road at Logy Bay Road*** - The existing lane configurations and traffic signal phasing were used for all analyses.
4. ***The Boulevard / New Cove Road at Kings's Bridge Road / Kenna's Hill*** - The existing lane configurations and traffic signal phasing were used for 2007 and 2010 analyses, however, an advance westbound left turn phase was added for the 2012 analyses with site generated traffic.
5. ***Empire Avenue at Kings's Bridge Road*** - All analyses were completed using the existing lane configurations and traffic signal phasing. Also, due to high v/c ratios for some intersection movements indicated by the 2012 analyses, additional AM and PM analyses with site generated traffic (Pages C-61 and C-62) were prepared with the following intersection improvements:
   - The King's Bridge Road northbound approach has been modified to provide a through-left lane rather than the existing exclusive left turn lane. Since left turning volumes are very low, this will effectively provide two northbound through lanes.
   - The through-right lane usage for the Empire Avenue eastbound approach has been modified to allow left-through-right movements. This will provide for some dual left turn lane capabilities on this approach.
   - Signal phasing has been changed to provide split-phase for the Empire Avenue approaches. This will permit the dual-left turn movement from the eastbound approach.
6. ***The Boulevard at Carnell Drive*** - The existing lane configuration and STOP control were used for all analyses.

Summary of LOS Analyses

The level of performance analyses completed using Synchro 6.0 indicate that the following intersections now operate at LOS 'A' and will continue to operate at LOS 'A' during 2012 with addition of site generated trip:

- The Boulevard at Legion Road (Tables D-1 and D-2)
- Veterans Road at East White Hills Road (Tables D-3 and D-4)
- Selfridge Road at Logy Bay Road (Tables D-5 and D-6)
- The Boulevard at Carnell Drive (Tables D-11 and D-12).

The Boulevard / New Cove Road at Kings's Bridge Road / Kenna's Hill intersection operates at LOS 'B' during 2007 without added site generated traffic, and will continue to operate at LOS 'B' with addition of Stage 1 development traffic during 2010 (Tables D-7 and D-8). While performance is reduced to LOS 'C' during 2012 with added traffic from full site build-out, with the addition of a left-turn phase to The Boulevard westbound approach, the intersection will provide satisfactory levels of performance during 2012 peak hour periods. The maximum reported v/c ratio is 0.72 for the WB-L during the PM peak hour (Table D-8).

The Empire Avenue / Kings's Bridge Road intersection is heavily traveled during peak hours. During 2007, 2010 and 2012 peak hours, without added site generated trips, the intersection operates at LOS 'C' with EB-L, NB-TR and SB-TR movements having high v/c ratios (up to 0.85) and long queues (Tables D-9 and D-10). While the addition of site generated trips does not significantly affect overall intersection operation during AM peak hours, intersection level of service for the existing lane configuration and traffic signal phasing is reduced to LOS 'D' during PM peak hours, with the 2012 EB-L v/c ratio increasing to 0.96 (Table D-10). The implementation of traffic lane and signal phasing changes discussed on the preceding page will result in improvements to the EB-L v/c ratio (reduced from 0.96 to 0.75) and the NB-T v/c ratio (reduced from 0.88 to 0.52) as illustrated in Table D-10.

5.0 Summary and Conclusions

Description of the Proposed Development

1. The Pleasantville redevelopment area includes about 80 acres of land bounded approximately by the Bally Haly Golf and Country Club to the north, Virginia River to the east, Virginia River, The Boulevard and Churchill Drive to the south, and Churchill Drive and existing residential development to the west. The Concept Plan for the proposed development includes about 987 residential units and 148,000 square feet of commercial area. The redevelopment is expected to occur in six phases, with development expected to start during 2009 and site build-out anticipated by 2012.

Study Objectives

2. Specific concerns to be included in the Traffic Impact Study are:
   - Examine, quantify and comment on existing traffic conditions in the Study Area, without addition of site generated trips;
   - Evaluate the traffic related impacts of the proposed redevelopment of the 80 acre Pleasantville site; and
   - Identify street and intersection improvements that will be required to accommodate site generated trips while ensuring satisfactory levels of performance on Study Area streets and intersections.

Study Area Intersections

3. External site generated traffic from the Pleasantville redevelopment is expected to access the St. John's street system at the following intersections:
   - Legion Road at The Boulevard (STOP controlled)
   - Veterans Road at East While Hills Road (STOP controlled)
   - Selfridge Road at Logy Bay Road (Traffic signals).

   Other intersections in the Study Area that have been considered in this study include:
   - The Boulevard / New Cove Road at King's Bridge Road / Kenna's Hill (Traffic signals)
   - Empire Avenue at King's Bridge Road (Traffic signals)
   - Carnell Drive at The Boulevard (STOP controlled).

Trip Generation

4. After consideration of walking and pass-by trips, it is estimated that the built-out development will generate 580 vehicles per hour (vph) two-way (214 entering and 366 exiting) during an AM peak hour and 738 vph (405 entering and 333 exiting) during a PM peak hour.

Trip Distribution and Assignment

5. The City of St. John's QRS II Transportation Planning Model and local knowledge of the Study Area were used to determine the following distribution for site generated trips:
   - Northeast - Logy Bay area 10%

- South - West end of Quidi Vidi Lake area 2%
- Southeast - Quidi Vidi Village and Signal Hill areas 5%
- Southwest - Downtown and areas south of Empire Ave 30%
- West - Elizabeth Avenue Area 3%
- Northwest and west - Torbay Road, Portugal Cove Road, Prince Philip Drive, and Kenmount Road area 50%

Traffic Signal Warrant Analyses for Study Area STOP Controlled Intersections

6. Signal warrant analyses were completed for the three Study Area STOP controlled intersections using the *Canadian Traffic Signal Warrant Matrix Analysis* methodology. Analyses were completed for existing 2007 volumes and projected 2012 volumes that include 1.0% annual background traffic growth plus trips generated by full build-out of the Pleasantville redevelopment concept. Since existing priority points are considerably less than 100 points required to justify installation traffic signals, and since priority points calculated with projected 2012 volumes are also considerably less than 100 priority points, installation of signals is not required at any of the intersections.

Left Turn Lane Warrant Analyses

7. Left turn warrant analyses were completed for The Boulevard eastbound approach to Legion Road using the *Geometric Design Standards for Ontario Highways Manual* nomograph left turn lane analysis methodology for two lane streets. Left turn warrant analyses were completed for existing 2007 AM and PM peak hour volumes, and projected 2012 AM and PM peak hour volumes that include site generated trips from full development. The analyses indicated that while a left turn lane is not required for existing 2007 volumes, a left turn lane will be required on The Boulevard by 2012 with the addition of site generated trips.

Intersection Configuration and Traffic Control Used for Level of Service Analyses

8. The following intersection configurations and traffic control were used for the LOS analyses completed for this Study:
   - The Boulevard at Legion Road - The existing lane configuration on The Boulevard and a two-lane Legion Road approach with STOP control were used for all analyses.
   - Veterans Road at East White Hills Road - The existing lane configuration and STOP control were used for all analyses.
   - Selfridge Road at Logy Bay Road - The existing lane configurations and traffic signal phasing were used for all analyses.
   - The Boulevard / New Cove Road at Kings's Bridge Road / Kenna's Hill - The existing lane configurations and traffic signal phasing were used for 2007 and 2010 analyses, however, an advance westbound left turn phase was added for the 2012 analyses with site generated traffic.

- Empire Avenue at Kings's Bridge Road - All analyses were completed using the existing lane configurations and traffic signal phasing. Also, due to high v/c ratios for some intersection movements indicated by the 2012 analyses, additional AM and PM analyses with site generated traffic were prepared with the following intersection improvements:
  - The King's Bridge Road northbound approach was modified to include a through-left lane rather than an exclusive left turn lane. Since left turn volumes are low, this will effectively provide two northbound through lanes.
  - The through-right lane usage for the Empire Avenue eastbound approach has been modified to allow left-through-right movements. This will provide for some dual left turn lane capabilities on this approach.
  - Signal phasing has been changed to provide split-phase for the Empire Avenue approaches. This will permit the dual-left turn movement from the eastbound approach.
- The Boulevard at Carnell Drive - The existing lane configuration and STOP control were used for all analyses.

Summary Level of Service Analysis

9. Level of performance analyses indicate that the following intersections now operate at LOS 'A' and will continue to operate at LOS 'A' during 2012 with addition of site generated trip:
   - The Boulevard at Legion Road
   - Veterans Road at East White Hills Road
   - Selfridge Road at Logy Bay Road
   - The Boulevard at Carnell Drive.

   The Boulevard / New Cove Road at Kings's Bridge Road / Kenna's Hill intersection operates at LOS 'B' during 2007 without added site generated traffic, and will continue to operate at LOS 'B' with addition of Stage 1 development traffic during 2010. While performance is reduced to LOS 'C' during 2012 with added traffic from full site build-out, with the addition of a left-turn phase to The Boulevard westbound approach, the intersection will provide satisfactory levels of performance during 2012 peak hour periods with the maximum reported v/c ratio being 0.72 for the WB-L during the PM peak hour.

   The Empire Avenue / Kings's Bridge Road intersection is heavily traveled during peak hours. During 2007, 2010 and 2012 peak hours, without added site generated trips, the intersection operates at LOS 'C' with EB-L, NB-TR and SB-TR movements having high v/c ratios (up to 0.85) and long queues. While the addition of site generated trips does not significantly affect overall intersection

operation during AM peak hours, intersection level of service for the existing lane configuration and traffic signal phasing is reduced to LOS 'D' during PM peak hours, with the 2012 EB-L v/c ratio increasing to 0.96. The implementation of recommended traffic lane and signal phasing changes discussed in Item 8.0 above will result in improvements to the EB-L v/c ratio (reduced from 0.96 to 0.75) and the NB-T v/c ratio (reduced from 0.88 to 0.52).

Conclusions and Recommended Actions

10. A. Site generated trips from full site build-out in 2012 do not have any significant impacts on the following intersections:
    - The Boulevard at Legion Road
    - Veterans Road at East White Hills Road
    - Selfridge Road at Logy Bay Road
    - The Boulevard at Carnell Drive.

    B. With implementation of recommended lane configuration and phasing changes, The Boulevard / New Cove Road at Kings's Bridge Road / Kenna's Hill, and Empire Avenue / Kings's Bridge Road, intersections will provide satisfactory levels of performance during 2012 with full site development.

    C. The following intersection and signal phasing changes are recommended by 2012:
    - Add an advance left turn phase to The Boulevard westbound approach to King's Bridge Road / Kenna's Hill intersection.
    - Modify the King's Bridge Road northbound approach to Empire Avenue to include a through-left lane rather than the existing exclusive left turn lane.
    - Modify the through-right lane usage for the Empire Avenue eastbound approach to King's Bridge Road to allow left-through-right movements. This will provide for some dual left turn lane capabilities on this approach.
    - Modify signal phasing at the Empire Avenue / King's Bridge Road intersection to provide split-phase operation for the Empire Avenue approaches. This will permit the dual-left turn movement from the eastbound approach.

    D. A left turn lane should be constructed on The Boulevard at the Legion Road intersection by 2012.

    E. Sight distances, approach angles, and intersection configurations for intersections internal to the Pleasantville Redevelopment should be reviewed when appropriate digital drawings become available.

Appendix A

Machine Counts

Manual Turning Movement Counts

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Table A-1 - Hourly Volumes - The Boulevard (October 16 / 17, 2006)
(West of Carnell Drive)

Hour Ending	Eastbound Hourly Volumes				Westbound Hourly Volumes				Two - Way Volumes
	Day and Date			Average Day	Day and Date			Average Day	
	Mon-16	Tue-17	Wed-18		Mon-16	Tue-17	Wed-18		
1		20		20		30		30	50
2		13		13		20		20	33
3		4		4		11		11	15
4		3		3		4		4	7
5		4		4		8		8	12
6		21		21		8		8	29
7		48		48		43		43	91
8		182		182		131		131	313
9		261		261		255		255	516
10		165		165		175		175	340
11		160		160		263		263	423
12		185		185		275		275	460
13		195		195		266		266	461
14		209		209		290		290	499
15		170		170		294		294	464
16	195			195	374			374	569
17	181			181	377			377	558
18	135			135	267			267	402
19	118			118	200			200	318
20	90			90	148			148	238
21	84			84	137			137	221
22	62			62	120			120	182
23	26			26	103			103	129
24	32			32	64			64	96
TOTALS	923	1640		2563	1790	2073		3863	6426

Source: Machine count data were provided by the City of St. John's Engineering Department

Table A-2 - Hourly Volumes - The Boulevard (October 16 / 17, 2006)
(East of Legion Road)

Hour Ending	Eastbound Hourly Volumes				Westbound Hourly Volumes				Two - Way Volumes
	Day and Date			Average Day	Day and Date			Average Day	
	Mon-16	Tue-17	Wed-18		Mon-16	Tue-17	Wed-18		
0									
1		8		8		9		9	17
2		4		4		1		1	5
3		5		5		3		3	8
4		0		0		1		1	1
5		1		1		5		5	6
6		6		6		3		3	9
7		7		7		14		14	21
8		72		72		51		51	123
9		150		150		71		71	221
10		56		56		66		66	122
11		54		54		61		61	115
12		81		81		86		86	167
13		108		108		123		123	231
14		113		113		108		108	221
15		91		91		88		88	179
16	104			104	120			120	224
17	98			98	175			175	273
18	77			77	129			129	206
19	59			59	60			60	119
20	58			58	70			70	128
21	36			36	46			46	82
22	52			52	47			47	99
23	29			29	31			31	60
24	22			22	20			20	42
TOTALS	535	756		1291	698	690		1388	2679

Source: Machine count data were provided by the City of St. John's Engineering Department

Figure A-1 - The Boulevard - West of Carnell Drive
Average Weekday Hourly Volumes - October 16 / 17, 2006

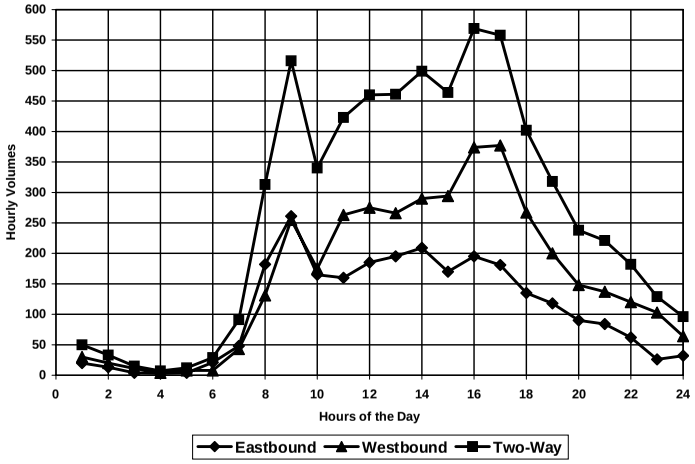


Figure A-2 - The Boulevard - East of Legion Road
Average Weekday Hourly Volumes - October 16 / 17, 2006

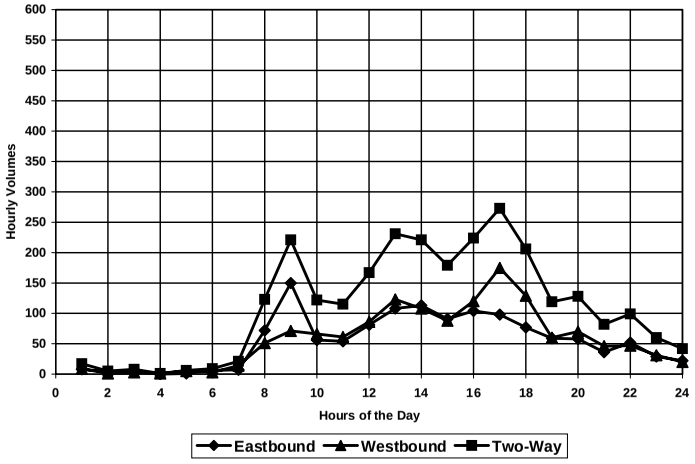


Table A-3 - Hourly Volumes - Churchill Avenue (October 11 / 12, 2007)
(West of Legion Road)

Hour Ending	Eastbound Hourly Volumes				Westbound Hourly Volumes				Two - Way Volumes
	Day and Date			Average Day	Day and Date			Average Day	
	Wed-10	Thu-11	Fri-12		Wed-10	Thu-11	Fri-12		
1			2	2			0	0	2
2			5	5			1	1	6
3			0	0			1	1	1
4			0	0			0	0	0
5			1	1			1	1	2
6			2	2			1	1	3
7			9	9			8	8	17
8			21	21			24	24	45
9			52	52			27	27	79
10			35	35			27	27	62
11			34	34			32	32	66
12			40	40			27	27	67
13			64	64			43	43	107
14			56	56			36	36	92
15			40	40			41	41	81
16		50		50		46		46	96
17		52		52		47		47	99
18		42		42		33		33	75
19		28		28		42		42	70
20		27		27		20		20	47
21		25		25		11		11	36
22		22		22		15		15	37
23		36		36		12		12	48
24		8		8		14		14	22
TOTALS		290	361	651		240	269	509	1160

Source: Machine count data were provided by the City of St. John's Engineering Department

Table A-4 - Hourly Volumes - Churchill Avenue (October 11 / 12, 2007)
(West of Veterans Road)

Hour Ending	Eastbound Hourly Volumes				Westbound Hourly Volumes				Two - Way Volumes
	Day and Date			Average Day	Day and Date			Average Day	
	Wed-10	Thu-11	Fri-12		Wed-10	Thu-11	Fri-12		
0									
1			7	7			2	2	9
2			6	6			2	2	8
3			1	1			0	0	1
4			1	1			1	1	2
5			2	2			1	1	3
6			6	6			1	1	7
7			11	11			13	13	24
8			32	32			50	50	82
9			83	83			87	87	170
10			52	52			66	66	118
11			74	74			62	62	136
12			91	91			66	66	157
13			91	91			74	74	165
14			68	68			77	77	145
15			81	81			71	71	152
16		77		77		75		75	152
17		103		103		78		78	181
18		54		54		45		45	99
19		47		47		51		51	98
20		50		50		45		45	95
21		27		27		28		28	55
22		29		29		20		20	49
23		25		25		13		13	38
24		16		16		17		17	33
TOTALS		428	606	1034		372	573	945	1979

Source: Machine count data were provided by the City of St. John's Engineering Department

Figure A-3 - Churchill Avenue - West of Legion Road
Average Weekday Hourly Volumes - October 11 / 12, 2007

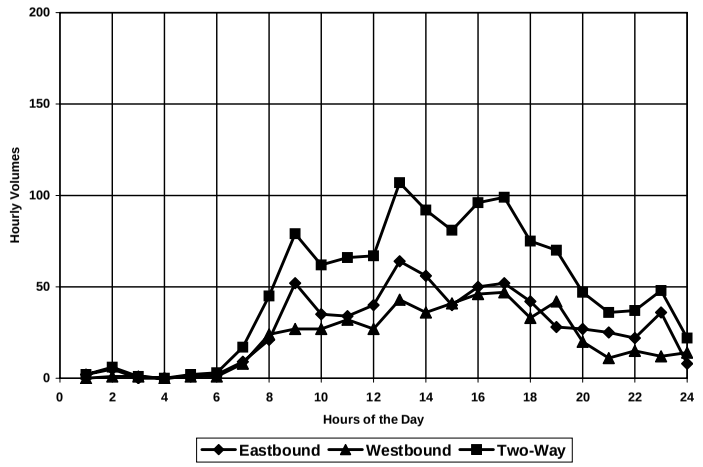


Figure A-4 - Churchill Avenue - West of Veternas Road
Average Weekday Hourly Volumes - October 11 / 12, 2007

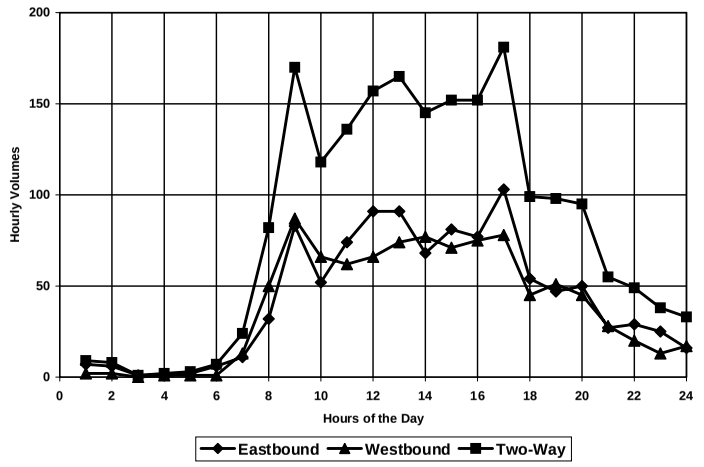


Table A-5 - Hourly Volumes - Charter Avenue (October 11 / 12, 2007)
(East of Placentia Place)

Hour Ending	Eastbound Hourly Volumes				Westbound Hourly Volumes				Two - Way Volumes
	Day and Date			Average Day	Day and Date			Average Day	
	Wed-10	Thu-11	Fri-12		Wed-10	Thu-11	Fri-12		
1			2	2			5	5	7
2			1	1			2	2	3
3			0	0			0	0	0
4			0	0			1	1	1
5			1	1			0	0	1
6			1	1			3	3	4
7			2	2			5	5	7
8			14	14			33	33	47
9			42	42			59	59	101
10			29	29			39	39	68
11			24	24			30	30	54
12			48	48			63	63	111
13			43	43			68	68	111
14			39	39			39	39	78
15			39	39			40	40	79
16		43		43		36		36	79
17		40		40		45		45	85
18		62		62		48		48	110
19		36		36		62		62	98
20		37		37		38		38	75
21		27		27		29		29	56
22		36		36		24		24	60
23		40		40		14		14	54
24		18		18		7		7	25
TOTALS		339	285	624		303	387	690	1314

Source: Machine count data were provided by the City of St. John's Engineering Department

Figure A-5 - Charter Avenue - East of Placentia Place
Average Weekday Hourly Volumes - October 11 / 12, 2007

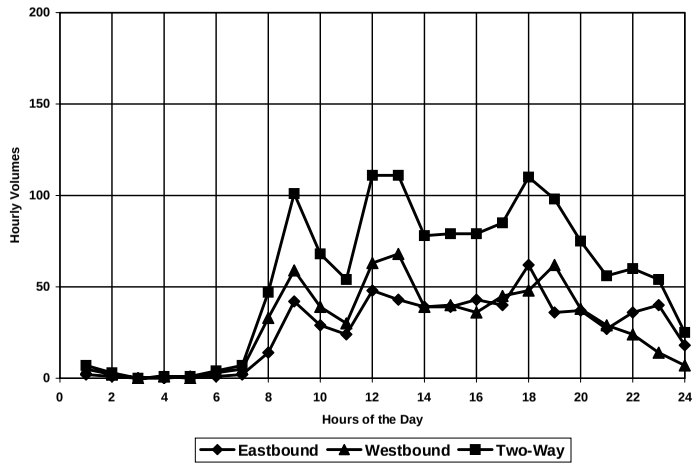
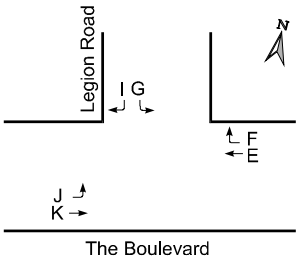


Table A-6

Legion Road
@
The Boulevard

St. John's, NL



AM / PM Period: Wed, October 17, 2007 ; Noon: Tues, October 16, 2007

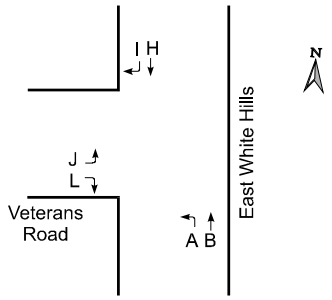
Time	The Boulevard Westbound Approach		Legion Road Southbound Approach		The Boulevard Eastbound Approach		Total Vehicles
	E	F	G	I	J	K	
07:30-07:45	23	0	1	9	10	28	71
07:45-08:00	26	0	3	23	22	58	132
08:00-08:15	50	2	1	27	23	44	147
08:15-08:30	46	4	4	30	30	45	159
08:30-08:45	40	0	0	23	26	34	123
08:45-09:00	32	0	0	24	18	37	111
09:00-09:15	24	0	0	18	22	34	98
09:15-09:30	28	0	0	11	18	22	79
07:30 to 08:30	145	6	9	89	85	175	509
08:30 to 09:30	124	0	0	76	84	127	411
AM Peak Hour	162	6	8	103	101	181	561
11:00-11:15	25	1	1	24	33	30	114
11:15-11:30	26	2	1	32	16	34	111
11:30-11:45	38	2	6	20	19	26	111
11:45-12:00	51	1	7	40	23	28	150
12:00-12:15	36	1	1	21	23	31	113
12:15-12:30	45	2	3	35	21	34	140
12:30-12:45	36	1	6	23	32	70	168
12:45-13:00	30	4	6	45	29	46	160
11:00 to 12:00	140	6	15	116	91	118	486
12:00 to 13:00	147	8	16	124	105	181	581
Noon Peak Hour	147	8	16	124	105	181	581
16:00-16:15	43	2	4	58	33	33	173
16:15-16:30	47	1	2	28	20	31	129
16:30-16:45	60	1	2	33	20	35	151
16:45-17:00	40	0	0	21	20	29	110
17:00-17:15	47	2	0	23	16	43	131
17:15-17:30	31	1	1	13	22	33	101
17:30-17:45	23	0	0	9	15	35	82
17:45-18:00	22	0	0	7	17	21	67
16:00 to 17:00	190	4	8	140	93	128	563
17:00 to 18:00	123	3	1	52	70	132	381
PM Peak Hour	190	4	8	140	93	128	563

Table A-7

Veterans Road @ East White Hills Road

St. John's, NL

AM Period: Thur, October 18, 2007 ; Noon / PM Period: Wed, October 17, 2007



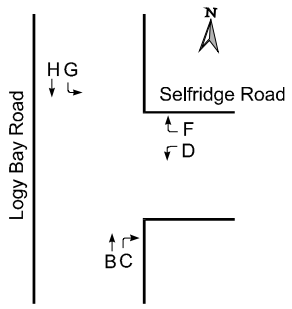
Time	East White Hills Northbound Approach		East White Hills Southbound Approach		Veterans Road Eastbound Approach		Total Vehicles
	A	B	H	I	J	L	
07:30-07:45	2	28	43	17	9	2	101
07:45-08:00	0	45	67	21	12	2	147
08:00-08:15	1	52	51	31	19	1	155
08:15-08:30	1	45	93	28	19	2	188
08:30-08:45	1	45	71	26	23	1	167
08:45-09:00	3	38	51	14	10	2	118
09:00-09:15	2	36	30	14	13	0	95
09:15-09:30	0	31	30	8	4	0	73
07:30 to 08:30	4	170	254	97	59	7	591
08:30 to 09:30	6	150	182	62	50	3	453
AM Peak Hour	3	187	282	106	73	6	657
11:00-11:15	1	36	27	20	11	0	95
11:15-11:30	1	32	22	9	11	3	78
11:30-11:45	2	40	30	22	24	1	119
11:45-12:00	6	33	37	15	23	1	115
12:00-12:15	5	43	31	19	20	0	118
12:15-12:30	2	44	35	19	18	1	119
12:30-12:45	8	51	35	13	18	3	128
12:45-13:00	1	52	65	21	16	2	157
11:00 to 12:00	10	141	116	66	69	5	407
12:00 to 13:00	16	190	166	72	72	6	522
Noon Peak Hour	16	190	166	72	72	6	522
16:00-16:15	0	61	45	18	39	2	165
16:15-16:30	2	53	53	22	28	1	159
16:30-16:45	1	64	57	16	23	2	163
16:45-17:00	3	58	37	16	17	0	131
17:00-17:15	3	74	44	12	20	0	153
17:15-17:30	6	66	46	13	14	2	147
17:30-17:45	0	43	25	4	15	2	89
17:45-18:00	3	24	23	9	7	2	68
16:00 to 17:00	6	236	192	72	107	5	618
17:00 to 18:00	12	207	138	38	56	6	457
PM Peak Hour	6	236	192	72	107	5	618

Table A-8

Selfridge Road
@
Logy Bay Road

St. John's, NL

AM Period: Thur, October 18, 2007 ; PM Period: Fri, October 19, 2007



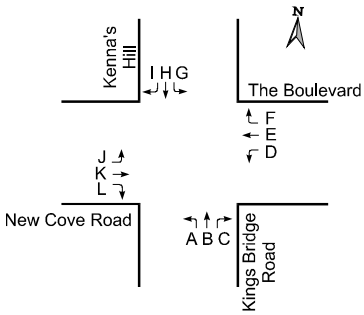
Time	Logy Bay Road Northbound Approach		Selfridge Road Westbound Approach		Logy Bay Road Southbound Approach		Total Vehicles
	B	C	D	F	G	H	
07:30-07:45	45	11	8	13	26	40	143
07:45-08:00	44	18	16	13	24	77	192
08:00-08:15	40	15	19	14	22	100	210
08:15-08:30	44	14	14	23	38	121	254
08:30-08:45	39	15	12	24	27	92	209
08:45-09:00	51	16	14	21	13	66	181
09:00-09:15	50	10	11	16	13	44	144
09:15-09:30	32	15	18	19	15	34	133
AM Peak Hour	167	62	61	74	111	390	865
16:00-16:15	63	18	10	36	17	43	187
16:15-16:30	73	25	8	22	19	67	214
16:30-16:45	106	20	20	34	23	57	260
16:45-17:00	101	23	17	21	18	41	221
17:00-17:15	123	25	16	27	26	51	268
17:15-17:30	114	17	8	14	19	50	222
17:30-17:45	68	17	8	17	16	41	167
17:45-18:00	43	18	11	14	12	51	149
PM Peak Hour	444	85	61	96	86	199	971

Table A-9

The Boulevard / New Cove Road @ King's Bridge Road / Kenna's Hill

St. John's, NL

AM Period: Tues / Wed, October 23 / 17, 2007
PM Period: Friday, October 19, 2007



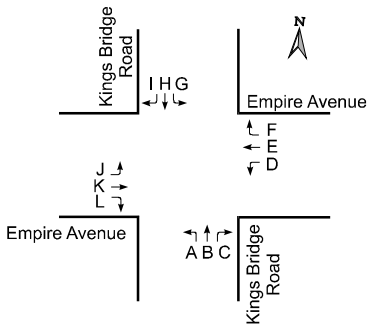
Time	Kings Bridge Road Northbound Approach			The Boulevard Westbound Approach			Kenna's Hill Southbound Approach			New Cove Road Eastbound Approach			Total Vehicles
	A	B	C	D	E	F	G	H	I	J	K	L	
07:30-07:45	25	66	34	29	18	29		97	1		15	31	345
07:45-08:00	25	110	48	25	13	4		140	1		18	57	441
08:00-08:15	31	105	49	45	17	5		172	4		21	64	513
08:15-08:30	35	87	48	48	18	7		218	0		27	74	562
08:30-08:45	46	101	35	51	21	6		200	1		22	55	538
08:45-09:00	46	88	29	43	24	4		151	2		15	67	469
09:00-09:15	29	76	28	28	11	14		103	2		16	28	335
09:15-09:30	24	63	22	30	15	6		99	6		9	38	312
AM Peak Hour	158	381	161	187	80	22	0	741	7	0	85	260	2082
16:00-16:15	64	157	20	63	22	9		109	3		17	54	518
16:15-16:30	68	170	35	47	27	11		117	0		21	46	542
16:30-16:45	65	215	33	73	43	13		126	3		34	59	664
16:45-17:00	61	198	31	47	19	9		108	5		35	61	574
17:00-17:15	71	241	30	60	16	19		121	3		23	52	636
17:15-17:30	58	222	28	38	27	11		108	3		35	41	571
17:30-17:45	53	151	24	35	10	3		123	2		19	58	478
17:45-18:00	38	127	18	30	9	12		108	1		19	54	416
PM Peak Hour	255	876	122	218	105	52	0	463	14	0	127	213	2445

Table A-10

Empire Avenue
@
King's Bridge Road

St. John's, NL

AM Period: Thurs / Fri, October 25 / 26, 2007
PM Period: Tue / Thurs, October 23 / 25, 2007



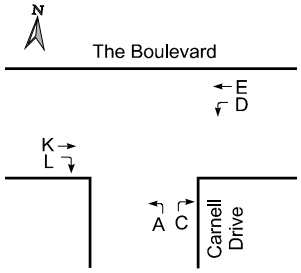
Time	Kings Bridge Road Northbound Approach			Empire Avenue Westbound Approach			Kings Bridge Road Southbound Approach			Empire Avenue Eastbound Approach			Total Vehicles
	A	B	C	D	E	F	G	H	I	J	K	L	
07:30-07:45	1	87	0	4	18	18	34	70	32	52	8	1	325
07:45-08:00	0	92	1	1	20	37	47	118	47	79	31	0	473
08:00-08:15	1	36	1	0	6	8	56	109	43	83	23	7	373
08:15-08:30	2	36	2	0	9	11	68	114	42	78	35	3	400
08:30-08:45	0	48	4	3	33	50	84	119	64	86	44	2	537
08:45-09:00	0	89	2	4	31	33	75	139	66	78	40	6	563
09:00-09:15	3	101	2	6	18	37	58	97	50	81	24	3	480
09:15-09:30	2	123	3	6	35	30	41	74	33	69	5	7	428
AM Peak Hour	5	361	11	19	117	150	258	429	213	314	113	18	2008
16:00-16:15	1	146	5	7	37	69	49	136	68	120	24	4	666
16:15-16:30	1	131	4	3	30	43	25	85	34	65	16	2	439
16:30-16:45	0	157	5	12	59	107	30	104	43	61	14	1	593
16:45-17:00	0	142	4	8	44	67	16	48	38	54	12	4	437
17:00-17:15	0	157	0	7	40	85	28	128	55	81	25	6	612
17:15-17:30	2	151	3	4	34	59	21	86	29	87	16	4	496
17:30-17:45	2	138	5	3	22	54	21	78	29	74	10	0	436
17:45-18:00	2	71	3	0	17	34	39	115	44	103	12	5	445
PM Peak Hour	2	576	18	30	170	286	120	373	183	300	66	11	2135

Table A-11

Carnell Drive
@
The Boulevard

St. John's, NL

AM Period: Thur, October 18, 2007 ; Noon / PM Period: Wed, October 17, 2007



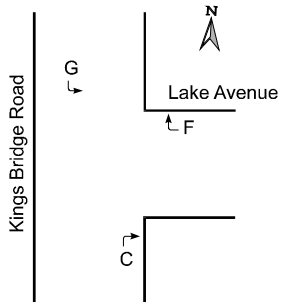
Time	Carnell Drive Northbound Approach		The Boulevard Westbound Approach		The Boulevard Eastbound Approach		Total Vehicles
	A	C	D	E	K	L	
07:30-07:45	6	13	15	35	52	4	125
07:45-08:00	6	25	19	56	68	10	184
08:00-08:15	9	15	28	57	61	5	175
08:15-08:30	15	19	45	60	62	7	208
08:30-08:45	13	15	28	64	57	7	184
08:45-09:00	9	30	19	53	37	4	152
09:00-09:15	12	18	10	37	48	4	129
09:15-09:30	7	16	8	40	39	4	114
07:30 to 08:30	36	72	107	208	243	26	692
08:30 to 09:30	41	79	65	194	181	19	579
AM Peak Hour	43	74	120	237	248	29	751
11:00-11:15	13	19	10	38	28	10	118
11:15-11:30	11	17	10	43	37	5	123
11:30-11:45	10	30	10	52	32	2	136
11:45-12:00	19	32	20	59	33	4	167
12:00-12:15	18	20	14	66	42	3	163
12:15-12:30	14	34	10	48	36	4	146
12:30-12:45	21	33	15	61	42	8	180
12:45-13:00	10	27	16	74	62	7	196
11:00 to 12:00	53	98	50	192	130	21	544
12:00 to 13:00	63	114	55	249	182	22	685
Noon Peak Hour	58	99	54	220	144	14	589
16:00-16:15	22	44	10	109	33	6	224
16:15-16:30	16	32	12	75	36	7	178
16:30-16:45	30	37	20	85	39	14	225
16:45-17:00	24	40	14	46	33	14	171
17:00-17:15	38	44	17	60	33	8	200
17:15-17:30	21	36	6	44	34	8	149
17:30-17:45	13	30	11	21	41	8	124
17:45-18:00	17	19	14	28	27	5	110
16:00 to 17:00	92	153	56	315	141	41	798
17:00 to 18:00	89	129	48	153	135	29	583
PM Peak Hour	92	153	56	315	141	41	798

Table A-12

King's Bridge Road
@
Lake Avenue

St. John's, NL

Wednesday, October 24, 2007



Time	Kings Bridge Road Northbound Approach	Lake Avenue Westbound Approach	Kings Bridge Road Southbound Approach	Total Vehicles
	C	F	G	
07:30-07:45	10	4	3	17
07:45-08:00	21	5	8	34
08:00-08:15	17	4	9	30
08:15-08:30	21	4	6	31
08:30-08:45	27	2	6	35
08:45-09:00	37	3	5	45
09:00-09:15	20	3	13	36
09:15-09:30	18	6	6	30
AM Peak Hour	102	14	30	146
16:00-16:15	29	22	5	56
16:15-16:30	26	12	17	55
16:30-16:45	35	18	14	67
16:45-17:00	31	11	13	55
17:00-17:15	39	18	6	63
17:15-17:30	35	20	14	69
17:30-17:45	39	15	8	62
17:45-18:00	31	16	16	63
PM Peak Hour	121	63	49	233

Appendix B

Traffic Volume Diagrams

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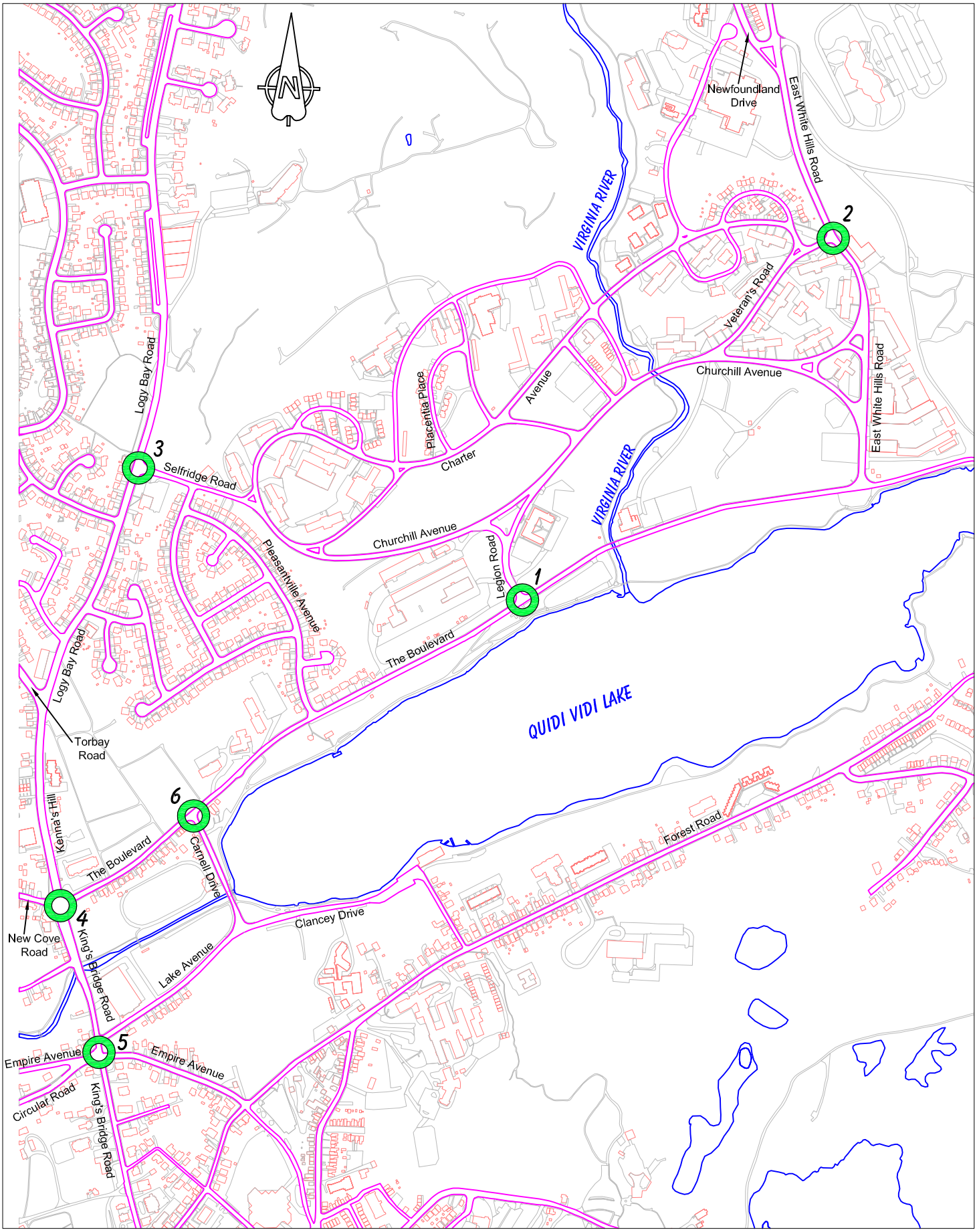

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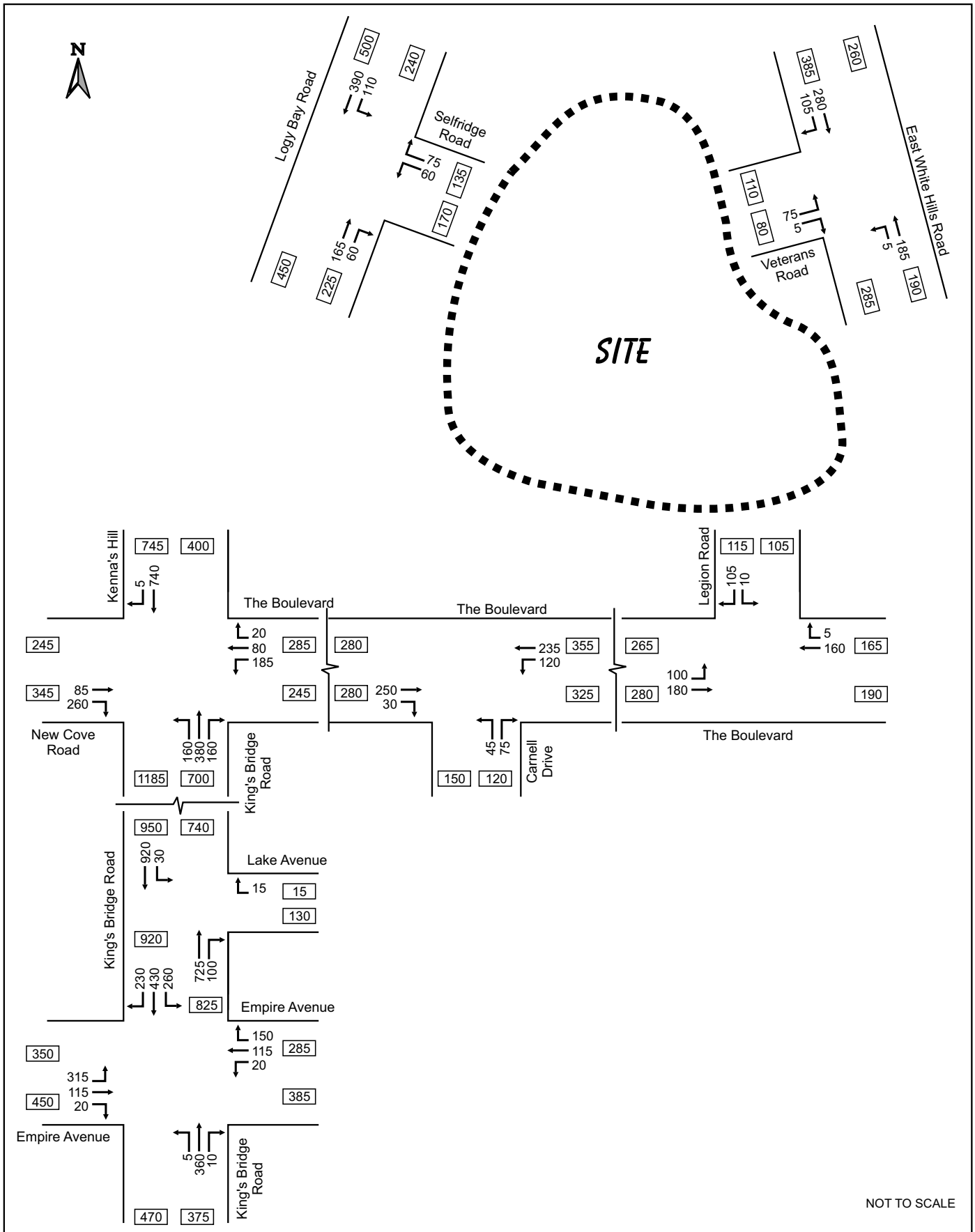
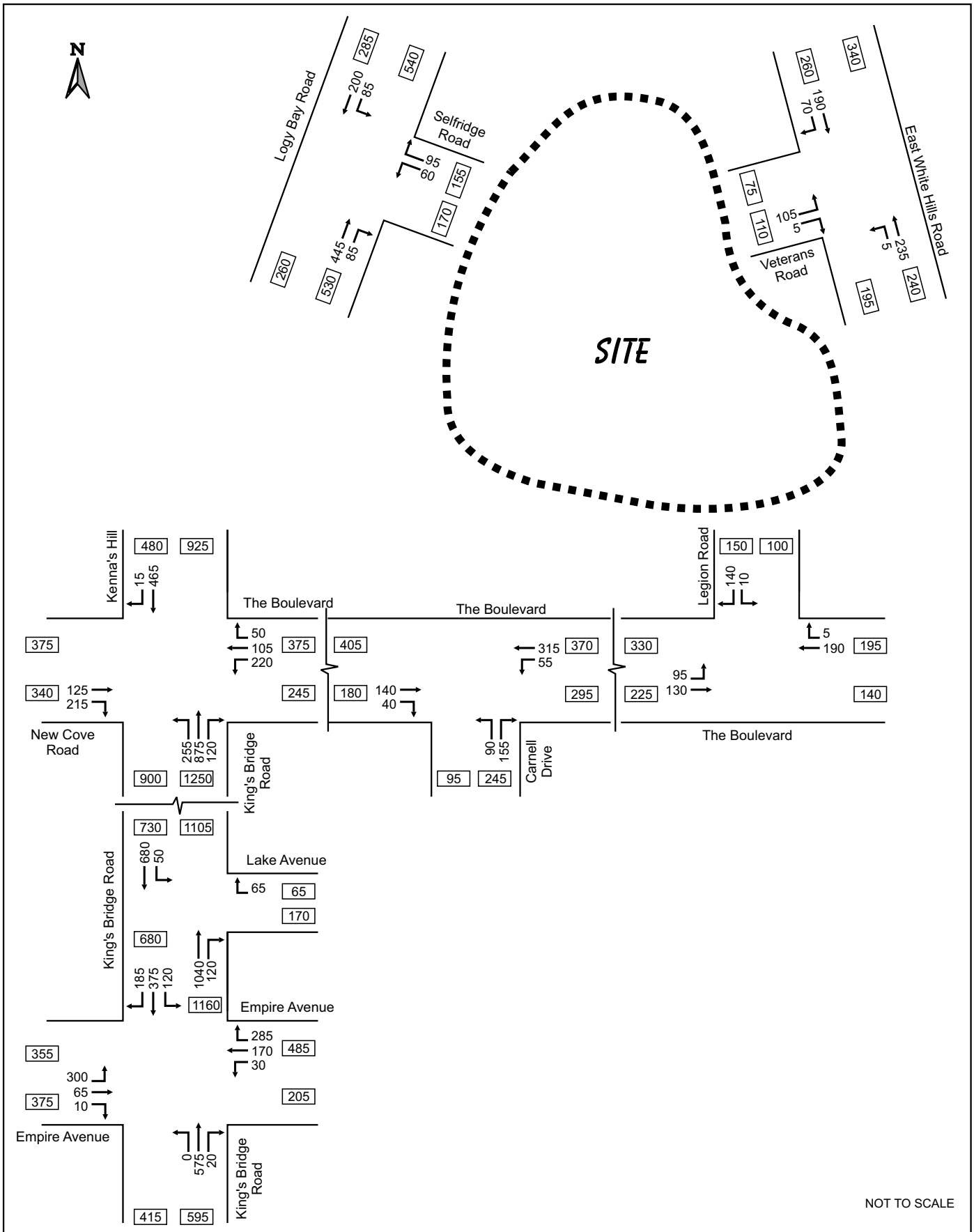
Study Area Intersections

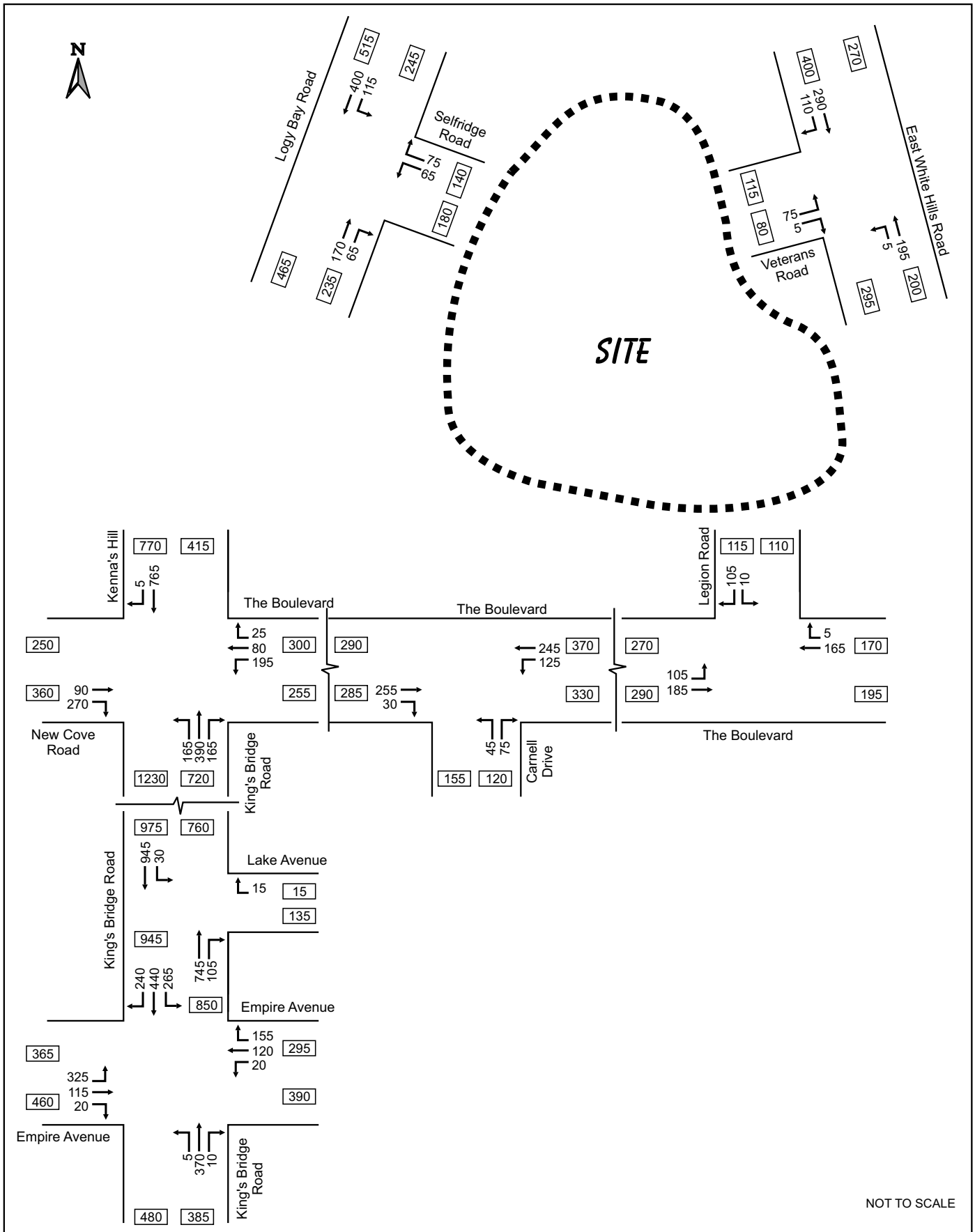
December 2007



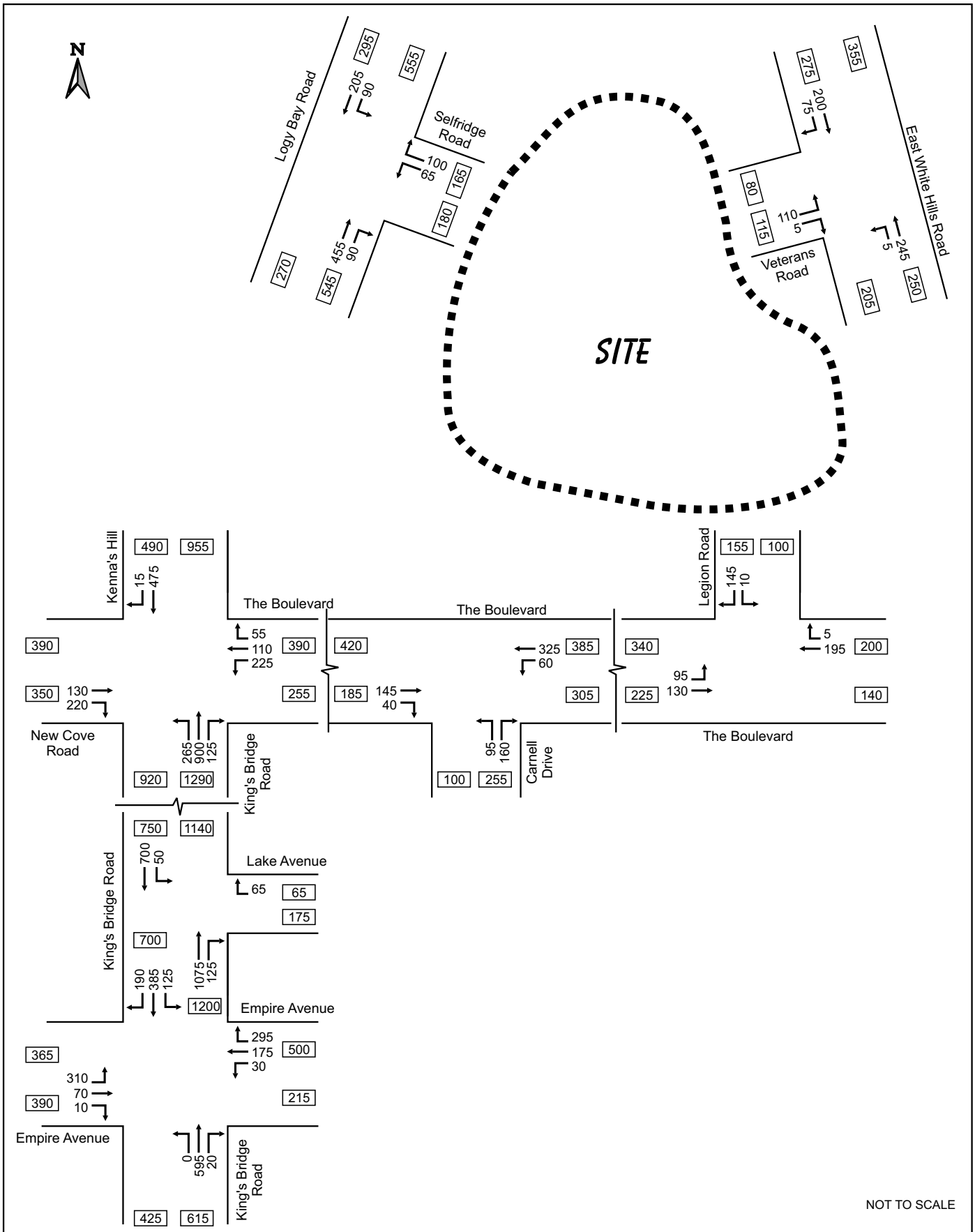
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-1A**
	2007 AM Peak Hour without Site Development	**December 2007**



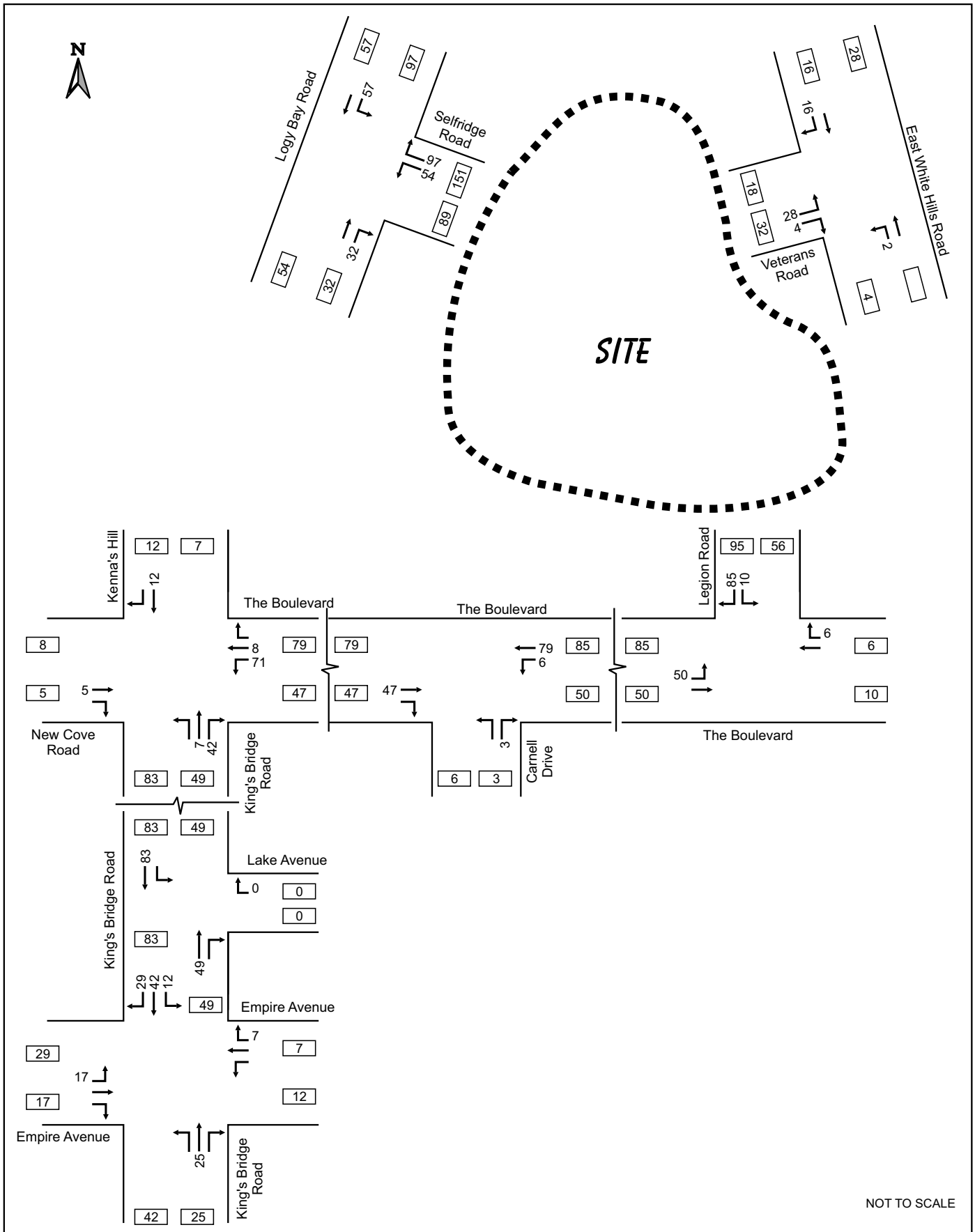
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-1B**
	2007 PM Peak Hour without Site Development	**December 2007**



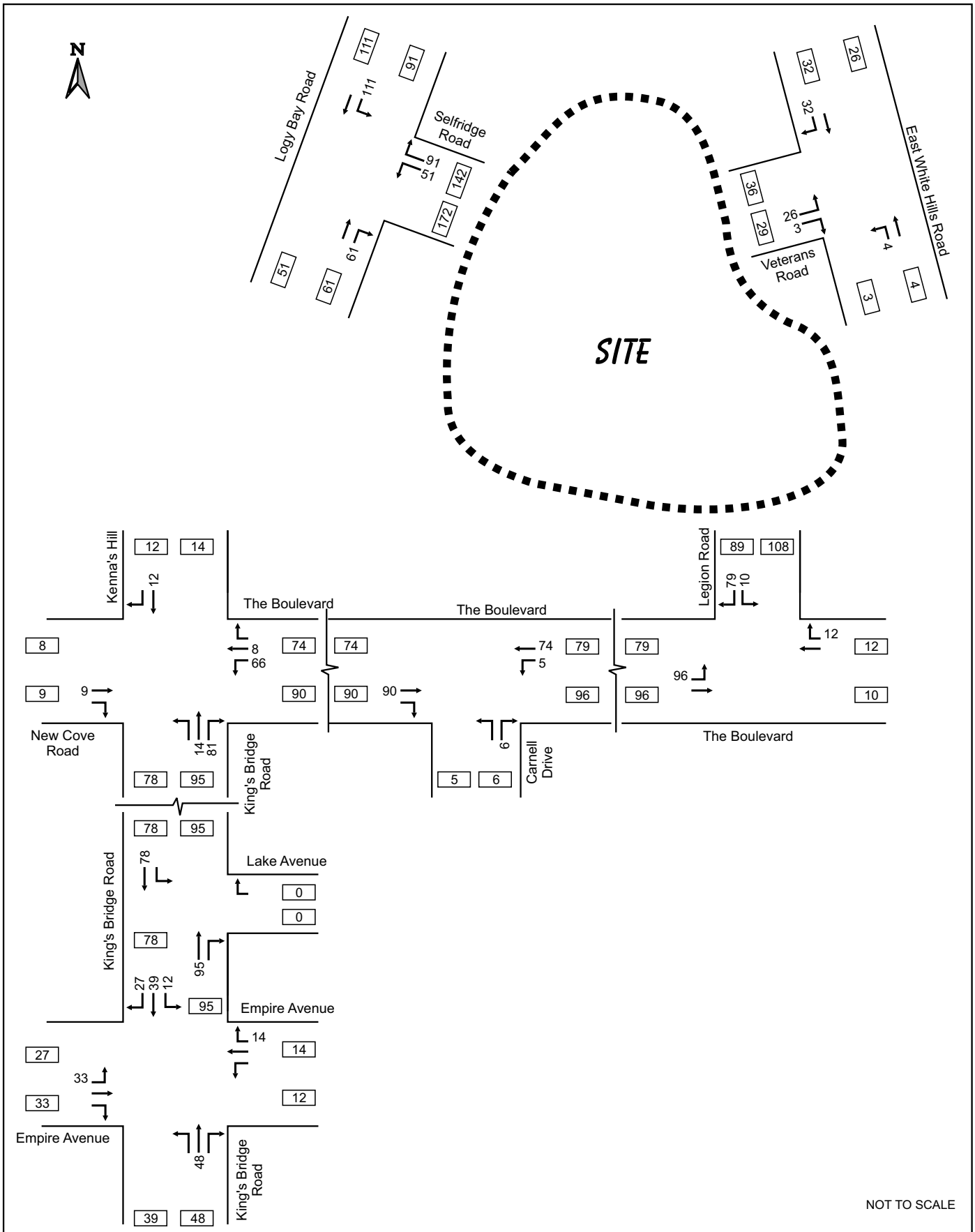
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-2A**
	2010 AM Peak Hour without Site Development	**December 2007**



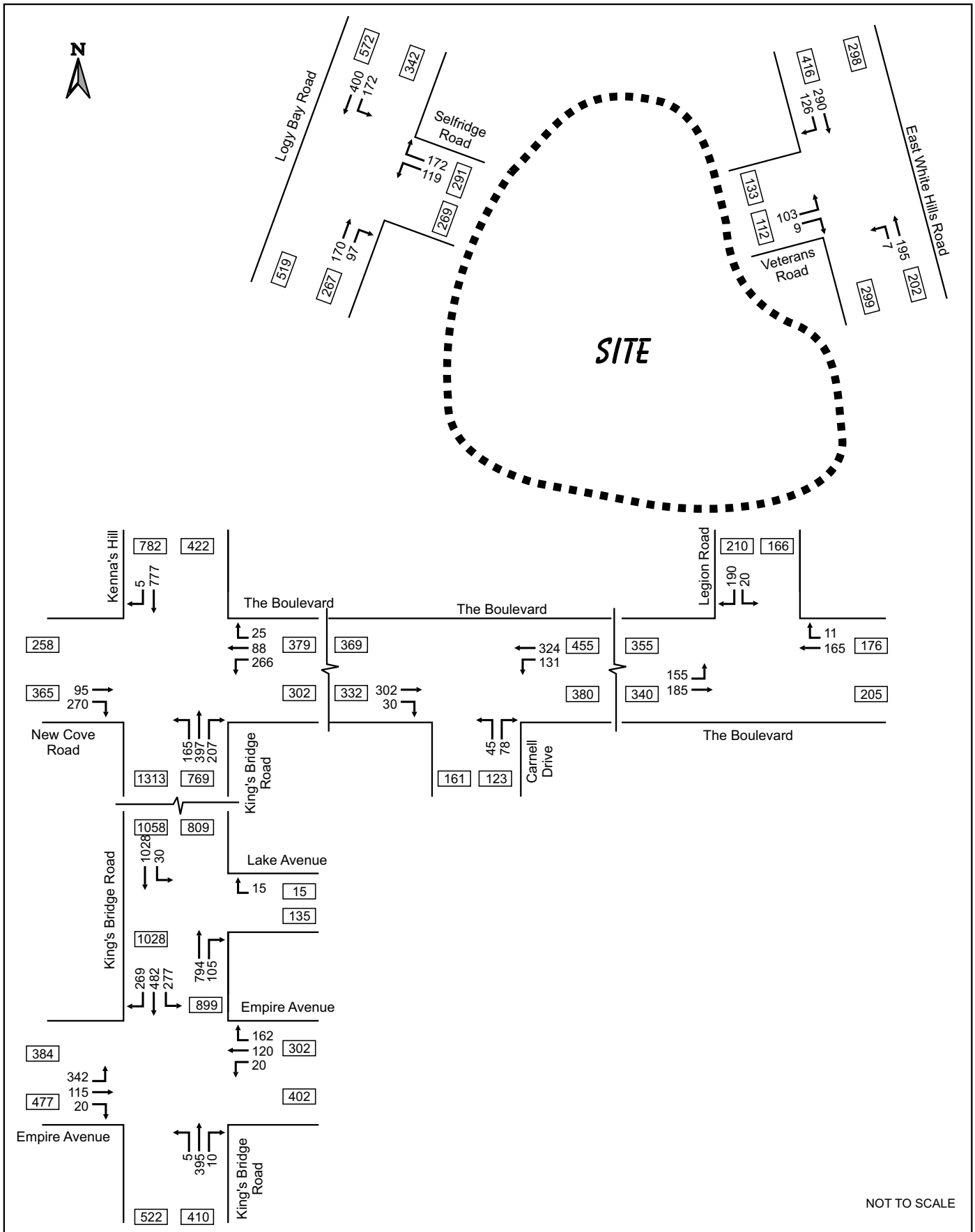
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-2B**
	2010 PM Peak Hour without Site Development	**December 2007**



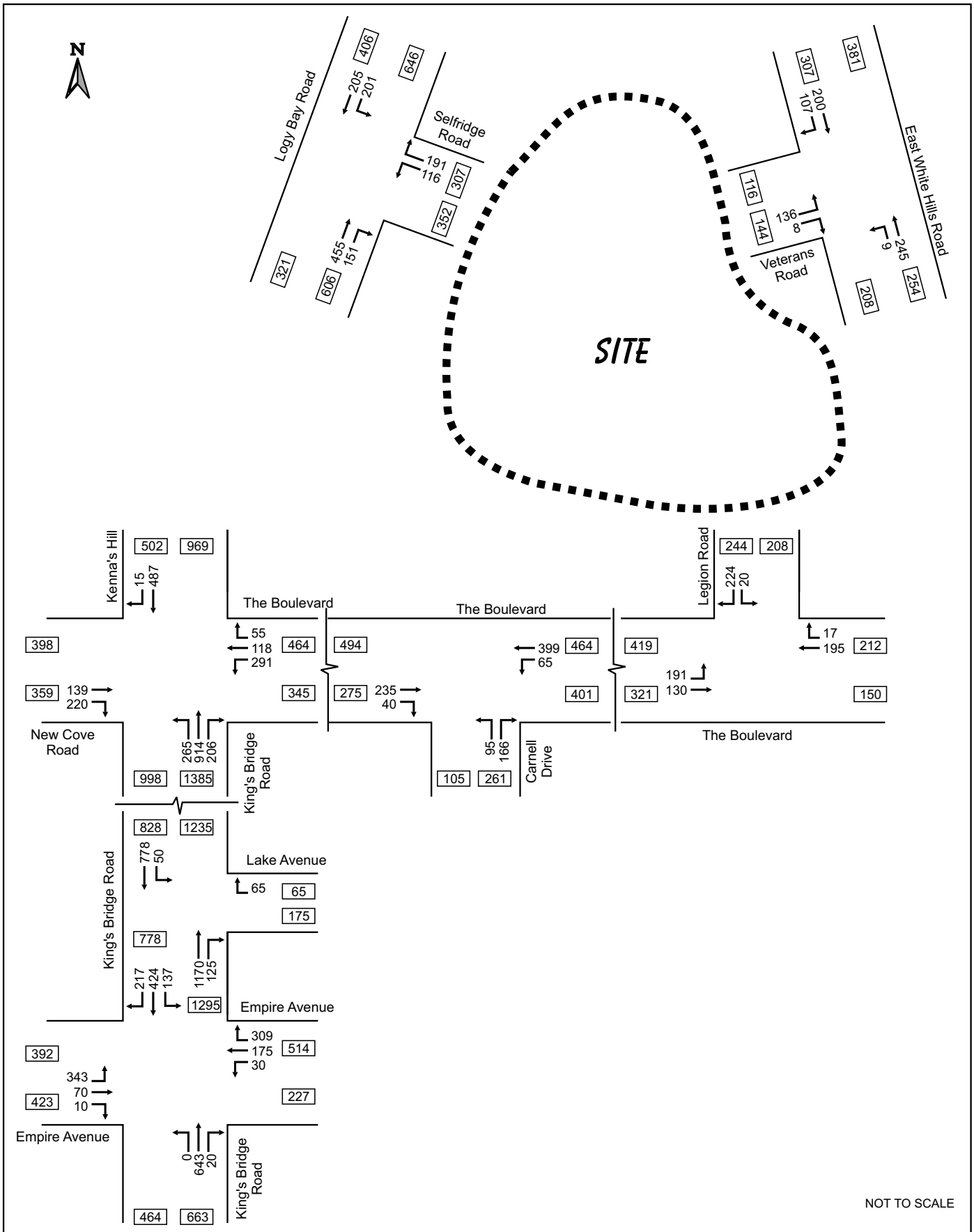
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development** **St. John's, NL**	**Figure B-3A**
	Site Generated Trips **Stage 1 AM Peak Hour**	**December 2007**



Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development** **St. John's, NL**	**Figure B-3B**
	Site Generated Trips **Stage 1 PM Peak Hour**	**December 2007**



Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-4A**
	2010 AM Peak Hour with Stage 1 Site Development	**December 2007**



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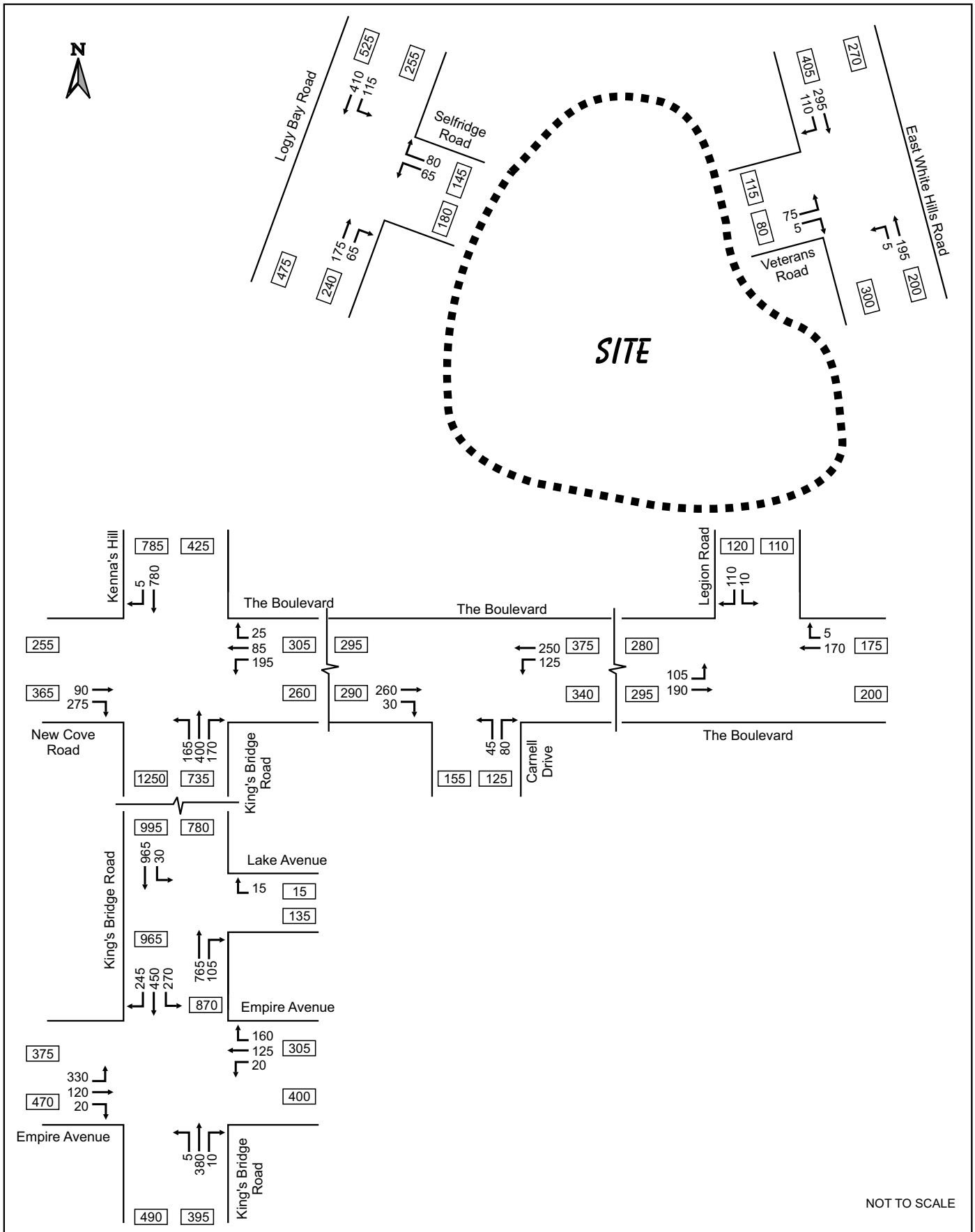
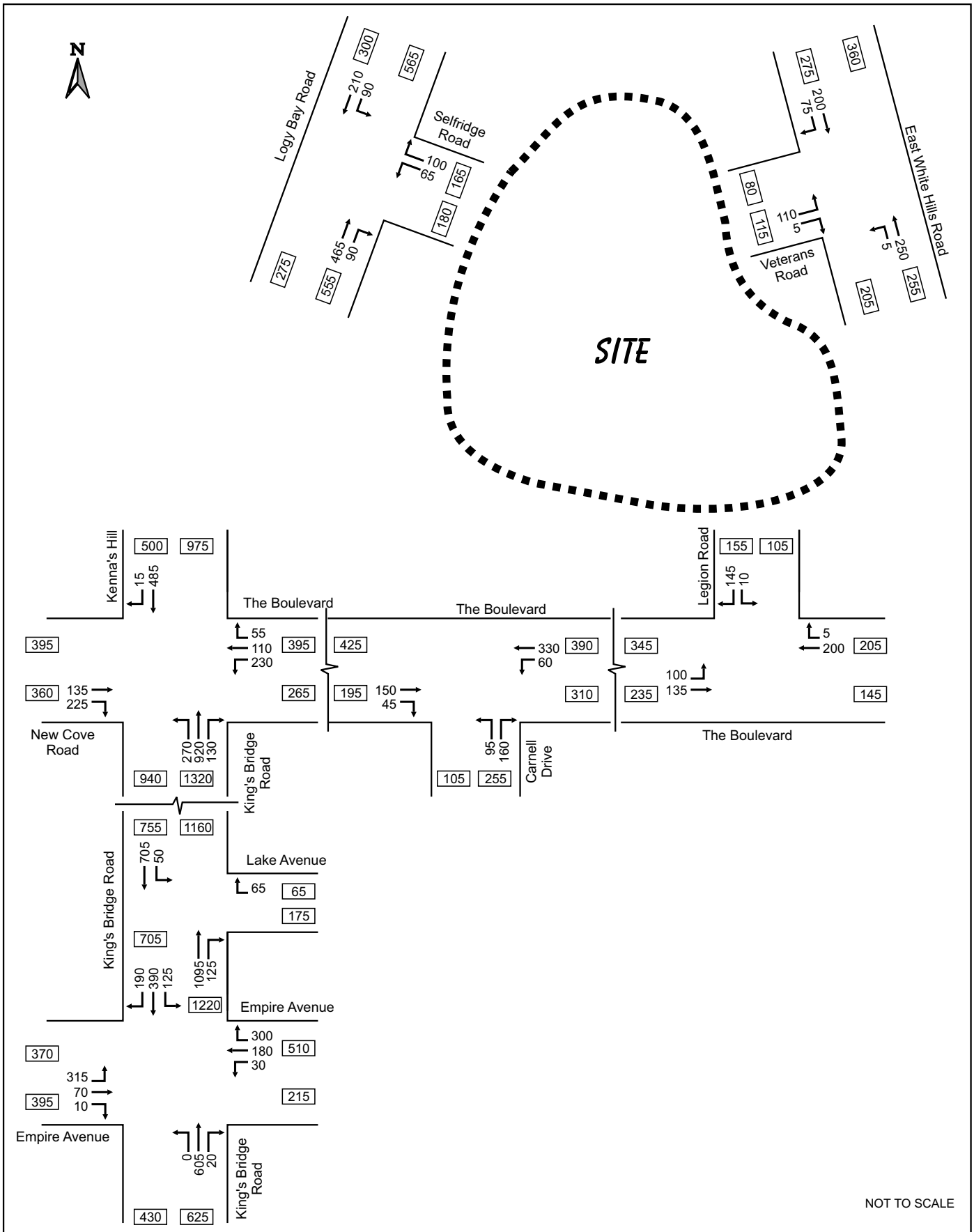
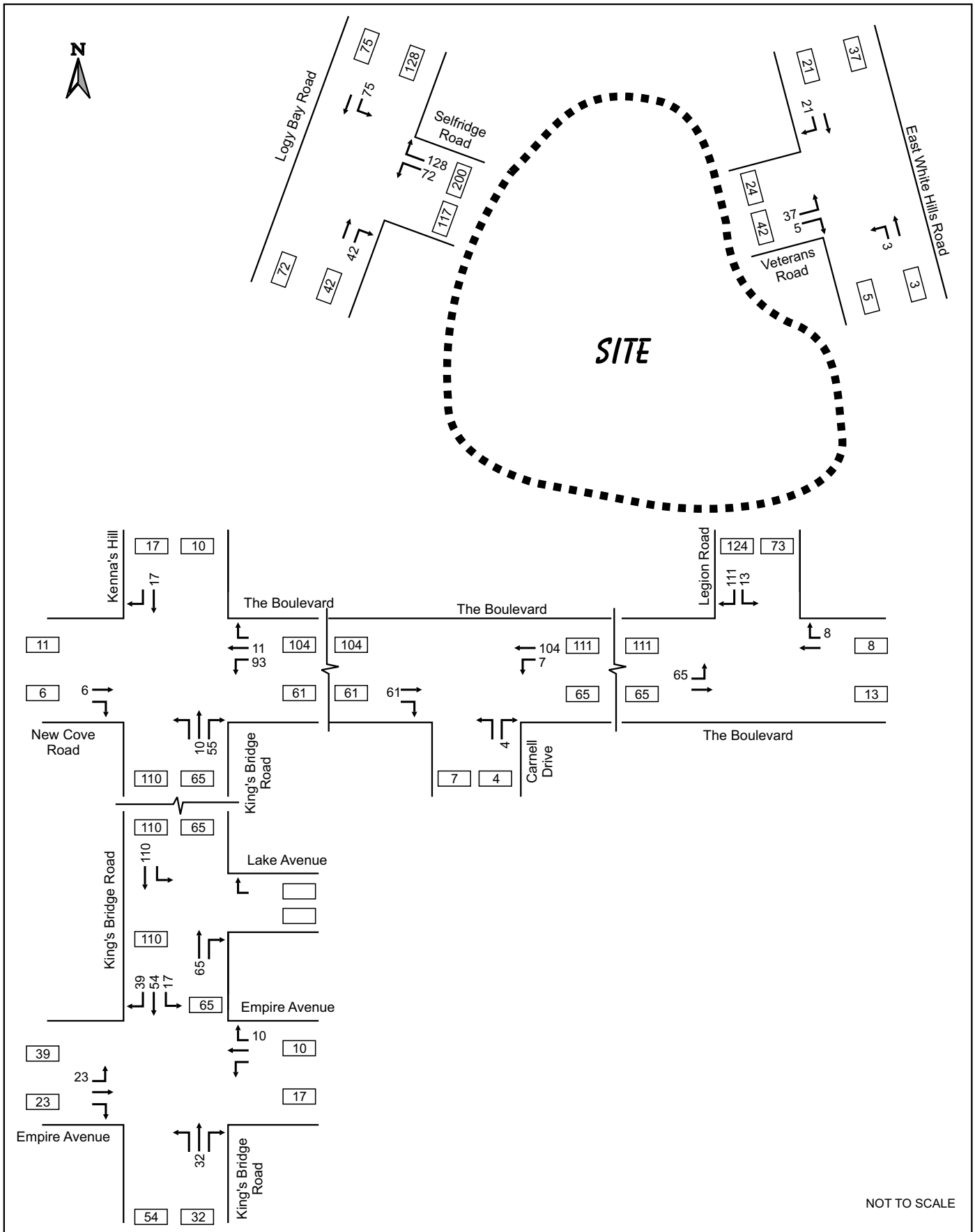
Traffic Impact Study - Pleasantville Development St. John's, NL	**Figure B-4B**
2010 PM Peak Hour with Stage 1 Site Development	**December 2007**



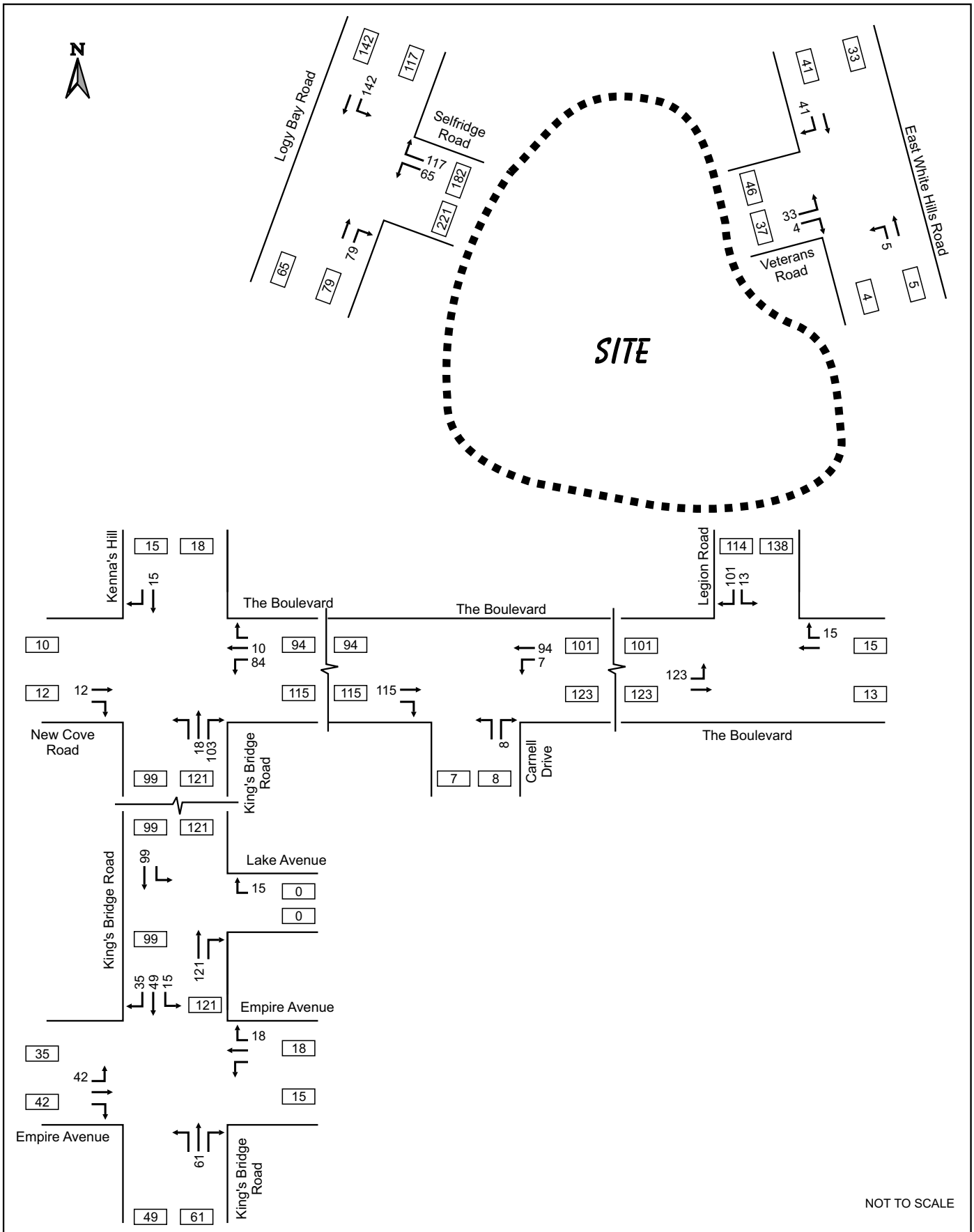
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-5A**
	2012 AM Peak Hour without Site Development	**December 2007**



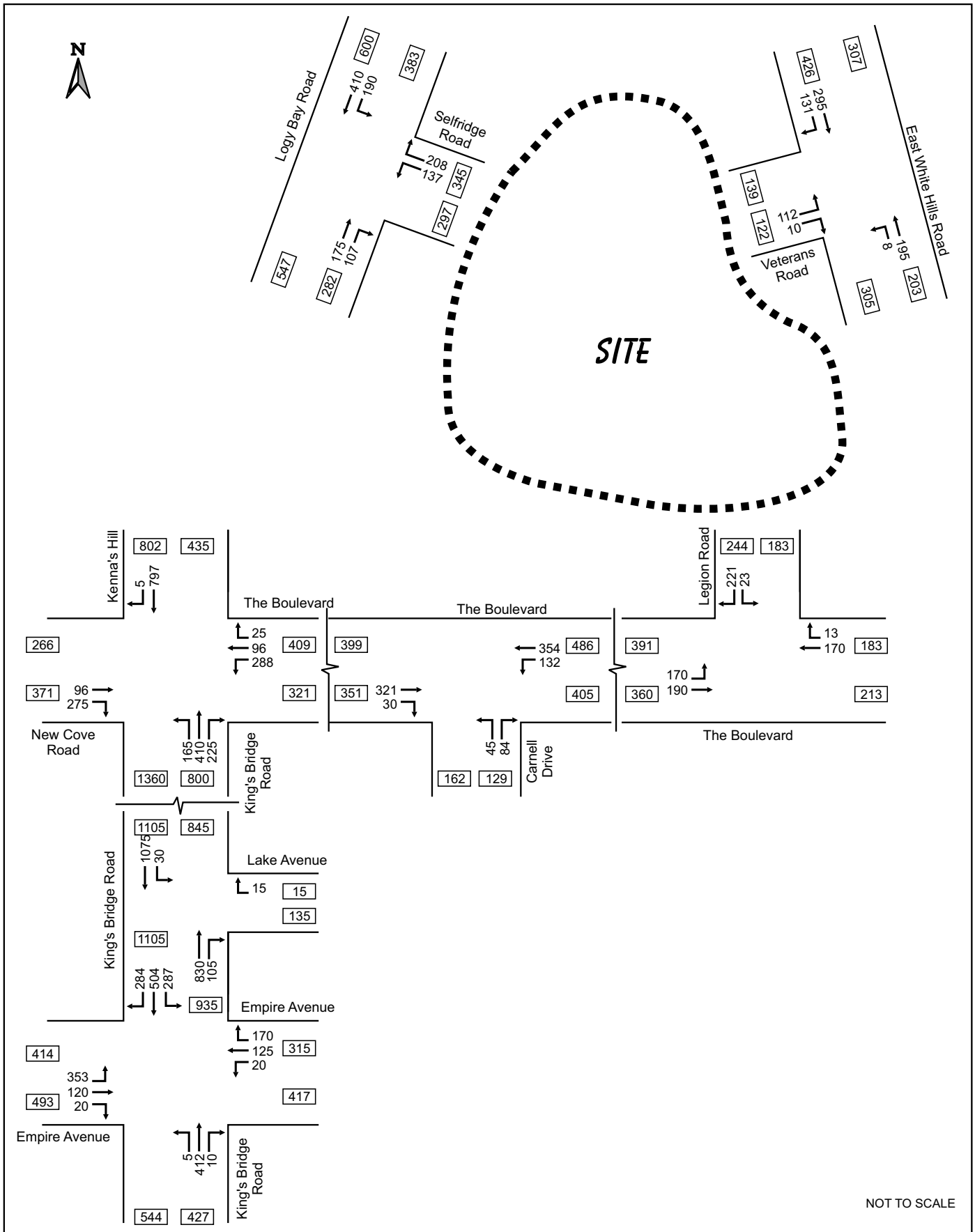
Atlantic Road & Traffic Management Traffic Engineering Specialists	Traffic Impact Study - Pleasantville Development St. John's, NL	Figure B-5B
	2012 PM Peak Hour without Site Development	December 2007



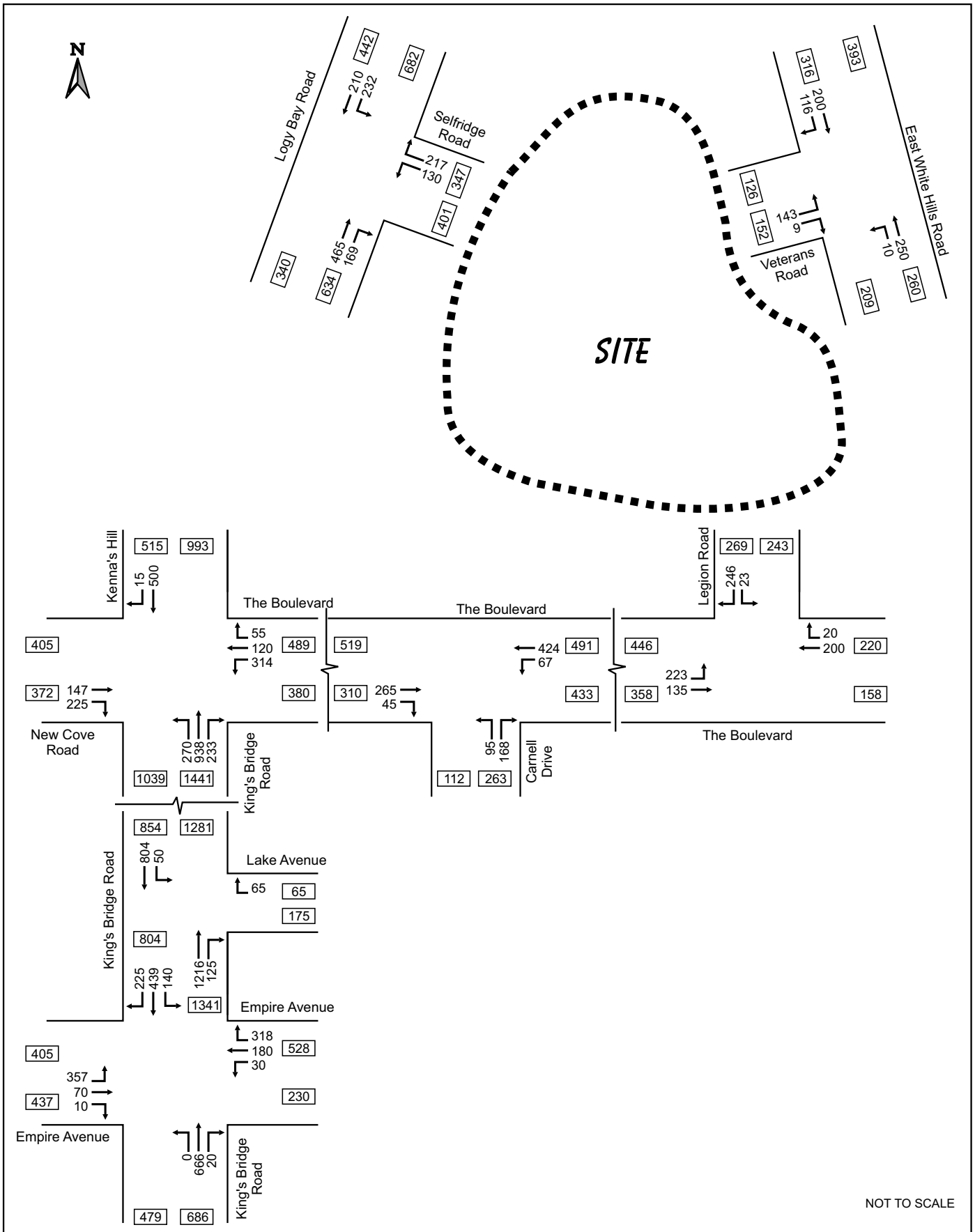
Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development** **St. John's, NL**	**Figure B-6A**
	Site Generated Trips **Buildout - AM Peak Hour**	**December 2007**



Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development** **St. John's, NL**	**Figure B-6B**
	Site Generated Trips **Buildout - PM Peak Hour**	**December 2007**



Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-7A**
	2012 AM Peak Hour with Buildout Site Development	**December 2007**



Atlantic Road & Traffic Management Traffic Engineering Specialists	**Traffic Impact Study - Pleasantville Development St. John's, NL**	**Figure B-7B**
	2012 PM Peak Hour with Buildout Site Development	**December 2007**

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-1 The Boulevard and Legion Road - Existing 2007 Volumes

Main Street (name)	The Boulevard	Direction (EW or NS)	EW	Date:	December 7, 2007
Side Street (name)	Legion Road	Direction (EW or NS)	NS	City:	St. John's

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
The Boulevard	WB				1		isolated	1	
The Boulevard	EB		1				450	1	
Legion Road	NB								
Legion Road	SB			1					

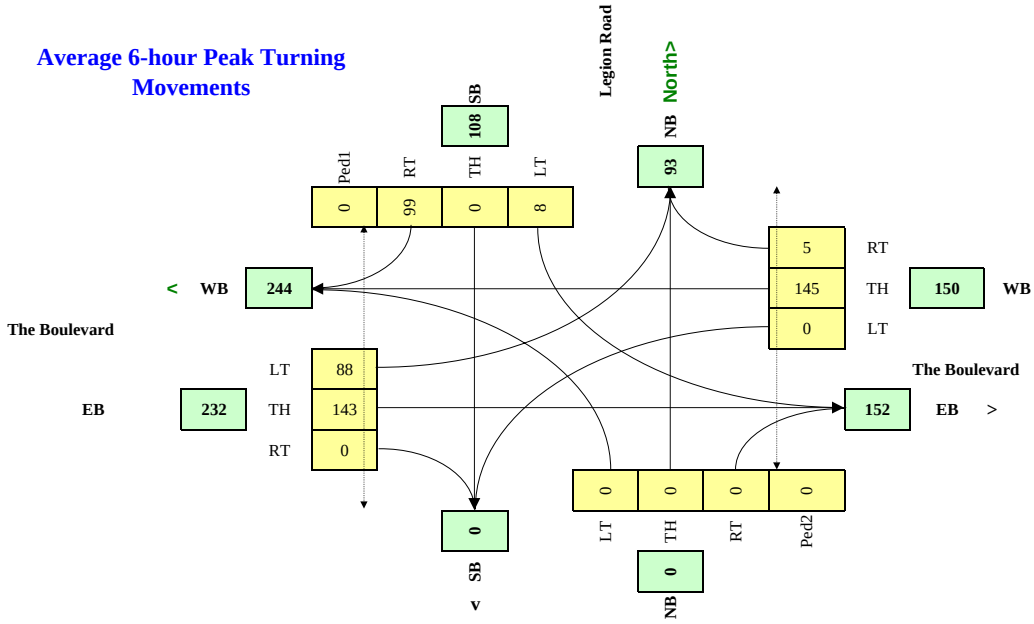
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
The Boulevard	EW	50	2.0%	n	0.0
Legion Road	NS		2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:30 - 8:30	0	0	0	0
8:30 - 9:30	0	0	0	0
11:00 - 12:00	0	0	0	0
12:00 - 13:00	0	0	0	0
16:00 - 17:00	0	0	0	0
17:00 - 18:00	0	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	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:30 - 8:30	0	0	0	10	0	90	0	145	5	85	175	0
8:30 - 9:30	0	0	0	0	0	75	0	125	0	85	125	0
11:00 - 12:00	0	0	0	15	0	115	0	140	5	90	120	0
12:00 - 13:00	0	0	0	15	0	125	0	145	10	105	180	0
16:00 - 17:00	0	0	0	10	0	140	0	190	5	95	130	0
17:00 - 18:00	0	0	0	0	0	50	0	125	5	70	130	0
Total (6-hour peak)	0	0	0	50	0	595	0	870	30	530	860	0
Average (6-hour peak)	0	0	0	8	0	99	0	145	5	88	143	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 =	12	12	0
		Veh	*Ped*

NOT Warranted

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-2 East White Hills Road and Veterans Road - Existing 2007 Volumes

Main Street (name)	East White Hills Rd	Direction (EW or NS)	NS	Date:	December 7, 2007
Side Street (name)	Veterans Road	Direction (EW or NS)	EW	City:	St. John's

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
East White Hills Rd	NB		1				isolated	1	
East White Hills Rd	SB				1		isolated	1	
Veterans Road	WB								
Veterans Road	EB			1					

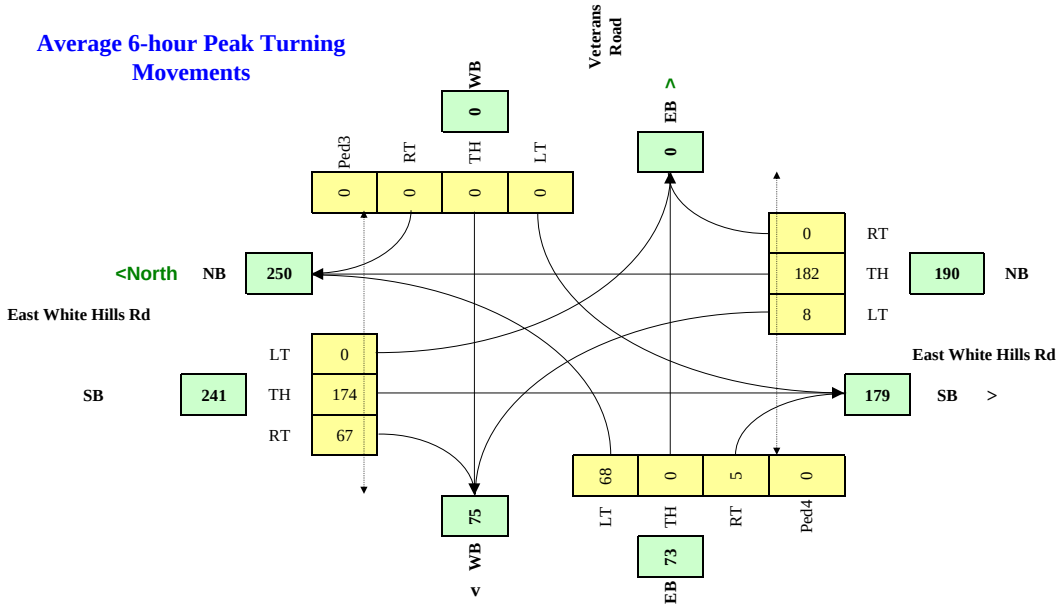
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
East White Hills Rd	NS	50	2.0%	n	0.0
Veterans Road	EW		2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:30 - 8:30	0	0	0	0
8:30 - 9:30	0	0	0	0
11:00 - 12:00	0	0	0	0
12:00 - 13:00	0	0	0	0
16:00 - 17:00	0	0	0	0
17:00 - 18:00	0	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	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:30 - 8:30	5	170	0	0	255	95	0	0	0	60	0	5
8:30 - 9:30	5	150	0	0	180	60	0	0	0	50	0	5
11:00 - 12:00	10	140	0	0	115	65	0	0	0	70	0	5
12:00 - 13:00	15	190	0	0	165	70	0	0	0	70	0	5
16:00 - 17:00	5	235	0	0	190	70	0	0	0	105	0	5
17:00 - 18:00	10	205	0	0	140	40	0	0	0	55	0	5
Total (6-hour peak)	**50**	**1,090**	**0**	**0**	**1,045**	**400**	**0**	**0**	**0**	**410**	**0**	**30**
Average (6-hour peak)	**8**	**182**	**0**	**0**	**174**	**67**	**0**	**0**	**0**	**68**	**0**	**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 =	15	15	0
		Veh	*Ped*

Not Warranted - Vs<75

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-3 The Boulevard and Carnell Drive - Existing 2007 Volumes

Main Street (name)	The Boulevard	Direction (EW or NS)	EW	Date:	December 7, 2007
Side Street (name)	Carnell Drive	Direction (EW or NS)	NS	City:	St. John's

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
The Boulevard	WB		1				isolated	1	
The Boulevard	EB				1		200	1	
Carnell Drive	NB			1					
Carnell Drive	SB			0					

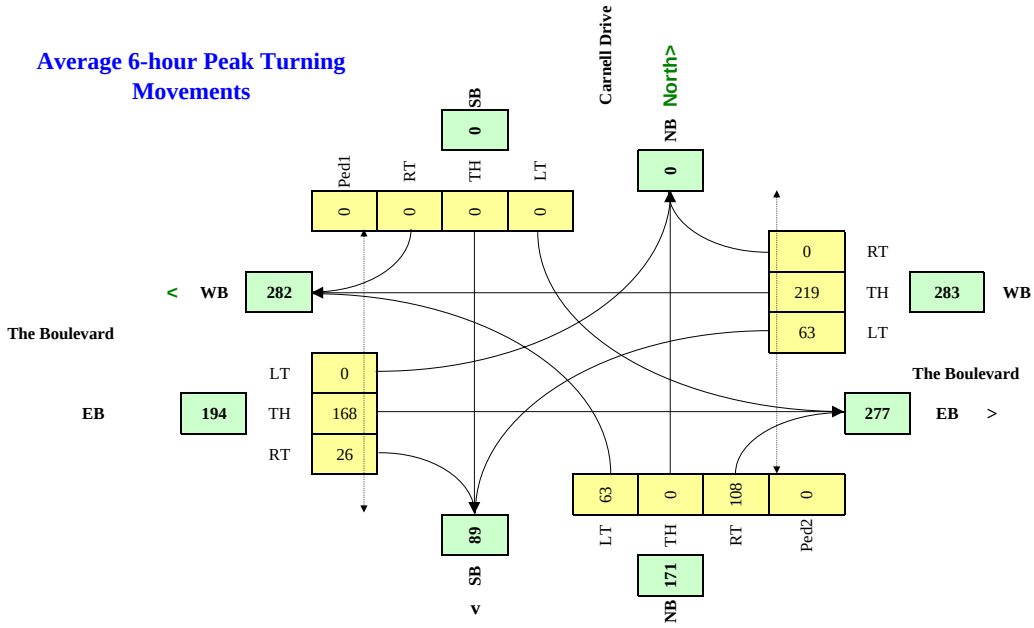
Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
The Boulevard	EW	50	2.0%	n	0.0
Carnell Drive	NS		2.0%	n	

	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:30 - 8:30	0	0	0	0
8:30 - 9:30	0	0	0	0
11:00 - 12:00	0	0	0	0
12:00 - 13:00	0	0	0	0
16:00 - 17:00	0	0	0	0
17:00 - 18:00	0	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	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:30 - 8:30	35	0	70	0	0	0	105	210	0	0	245	25
8:30 - 9:30	40	0	80	0	0	0	65	195	0	0	180	20
11:00 - 12:00	55	0	100	0	0	0	50	190	0	0	130	20
12:00 - 13:00	65	0	115	0	0	0	55	250	0	0	180	20
16:00 - 17:00	90	0	155	0	0	0	55	315	0	0	140	40
17:00 - 18:00	90	0	130	0	0	0	50	155	0	0	135	30
Total (6-hour peak)	375	0	650	0	0	0	380	1,315	0	0	1,010	155
Average (6-hour peak)	63	0	108	0	0	0	63	219	0	0	168	26

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 =	25	25	0
		Veh	Ped

NOT Warranted

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-4 The Boulevard and Legion Road - Projected 2012 Volumes

Main Street (name)	**The Boulevard**	**Direction (EW or NS)**	**EW**	**Date:**	**December 7, 2007**
Side Street (name)	**Legion Road**	**Direction (EW or NS)**	**NS**	**City:**	**St. John's**

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
The Boulevard	WB				1		isolated	1	
The Boulevard	EB		1				450	1	
Legion Road	NB								
Legion Road	SB			1					

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
The Boulevard	EW	50	2.0%	n	0.0
Legion Road	NS		2.0%	n	

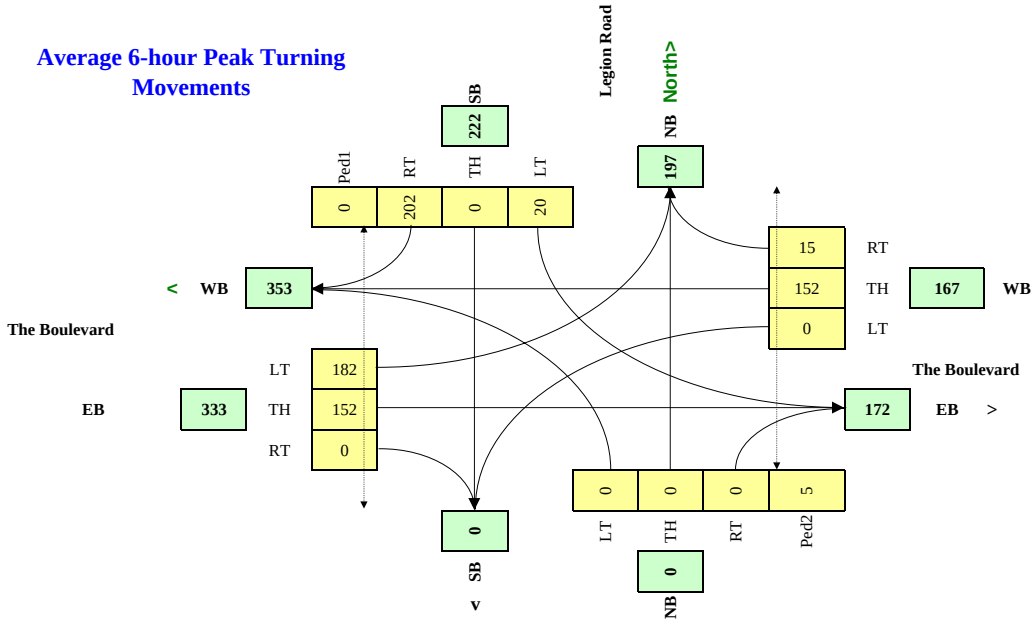
	Ped1	**Ped2**	**Ped3**	**Ped4**
	NS	**NS**	**EW**	**EW**
	W Side	**E Side**	**N Side**	**S side**
7:30 - 8:30	0	5	0	0
8:30 - 9:30	0	5	0	0
11:00 - 12:00	0	5	0	0
12:00 - 13:00	0	5	0	0
16:00 - 17:00	0	5	0	0
17:00 - 18:00	0	5	0	0
Total (6-hour peak)	**0**	**30**	**0**	**0**
Average (6-hour peak)	**0**	**5**	**0**	**0**

Assumed pedestrian volumes

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	**NB**			**SB**			**WB**			**EB**		
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**
7:30 - 8:30	0	0	0	20	0	205	0	150	15	155	185	0
8:30 - 9:30	0	0	0	10	0	180	0	130	5	145	135	0
11:00 - 12:00	0	0	0	25	0	210	0	145	15	185	125	0
12:00 - 13:00	0	0	0	30	0	220	0	155	20	200	190	0
16:00 - 17:00	0	0	0	20	0	250	0	200	20	220	135	0
17:00 - 18:00	0	0	0	15	0	145	0	130	15	185	140	0
Total (6-hour peak)	**0**	**0**	**0**	**120**	**0**	**1,210**	**0**	**910**	**90**	**1,090**	**910**	**0**
Average (6-hour peak)	**0**	**0**	**0**	**20**	**0**	**202**	**0**	**152**	**15**	**182**	**152**	**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 =	**33**	**31**	**2**
		Veh	***Ped***

NOT Warranted

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-5 East White Hills Road and Veterans Road - Projected 2012 Volumes

Main Street (name)	**East White Hills Rd**	**Direction (EW or NS)**	**NS**	**Date:**	**December 7, 2007**
Side Street (name)	**Veterans Road**	**Direction (EW or NS)**	**EW**	**City:**	**St. John's**

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
East White Hills Rd	NB		1				isolated	1	
East White Hills Rd	SB				1		isolated	1	
Veterans Road	WB								
Veterans Road	EB			1					

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
East White Hills Rd	NS	50	2.0%	n	0.0
Veterans Road	EW		2.0%	n	

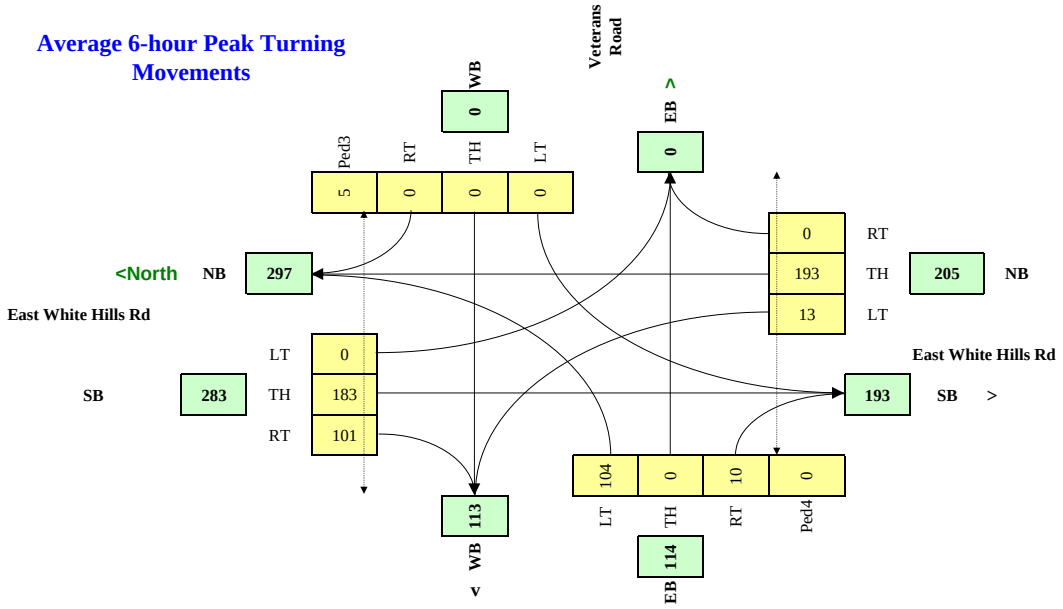
	Ped1	**Ped2**	**Ped3**	**Ped4**
	NS	**NS**	**EW**	**EW**
	W Side	**E Side**	**N Side**	**S side**
7:30 - 8:30	0	0	5	0
8:30 - 9:30	0	0	5	0
11:00 - 12:00	0	0	5	0
12:00 - 13:00	0	0	5	0
16:00 - 17:00	0	0	5	0
17:00 - 18:00	0	0	5	0
Total (6-hour peak)	**0**	**0**	**30**	**0**
Average (6-hour peak)	**0**	**0**	**5**	**0**

Assumed pedestrian volumes

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	**NB**			**SB**			**WB**			**EB**		
	LT	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**	**LT**	**Th**	**RT**
7:30 - 8:30	5	180	0	0	265	125	0	0	0	100	0	10
8:30 - 9:30	10	160	0	0	190	85	0	0	0	85	0	10
11:00 - 12:00	15	150	0	0	120	100	0	0	0	100	0	10
12:00 - 13:00	20	200	0	0	175	105	0	0	0	105	0	10
16:00 - 17:00	10	250	0	0	200	115	0	0	0	145	0	10
17:00 - 18:00	15	215	0	0	145	75	0	0	0	90	0	10
Total (6-hour peak)	**75**	**1,155**	**0**	**0**	**1,095**	**605**	**0**	**0**	**0**	**625**	**0**	**60**
Average (6-hour peak)	**13**	**193**	**0**	**0**	**183**	**101**	**0**	**0**	**0**	**104**	**0**	**10**

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 =	**28**	**25**	**3**
		Veh	***Ped***

NOT Warranted

Atlantic Road & Traffic Management
Traffic Engineering Specialists

2005 Canadian Traffic Signal Warrant Matrix Analysis

Scenario: Table B-6 The Boulevard and Carnell Drive - Projected 2012 Volumes

Main Street (name)	The Boulevard	Direction (EW or NS)	EW	Date:	December 7, 2007
Side Street (name)	Carnell Drive	Direction (EW or NS)	NS	City:	St. John's

Lane Configuration		Excl LT	Th & LT	Through or Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes	
The Boulevard	WB		1				isolated	1	
The Boulevard	EB				1		200	1	
Carnell Drive	NB			1					
Carnell Drive	SB			0					

Other input		Speed (Km/h)	Trucks %	Bus Rt (y/n)	Median (m)
The Boulevard	EW	50	2.0%	n	0.0
Carnell Drive	NS		2.0%	n	

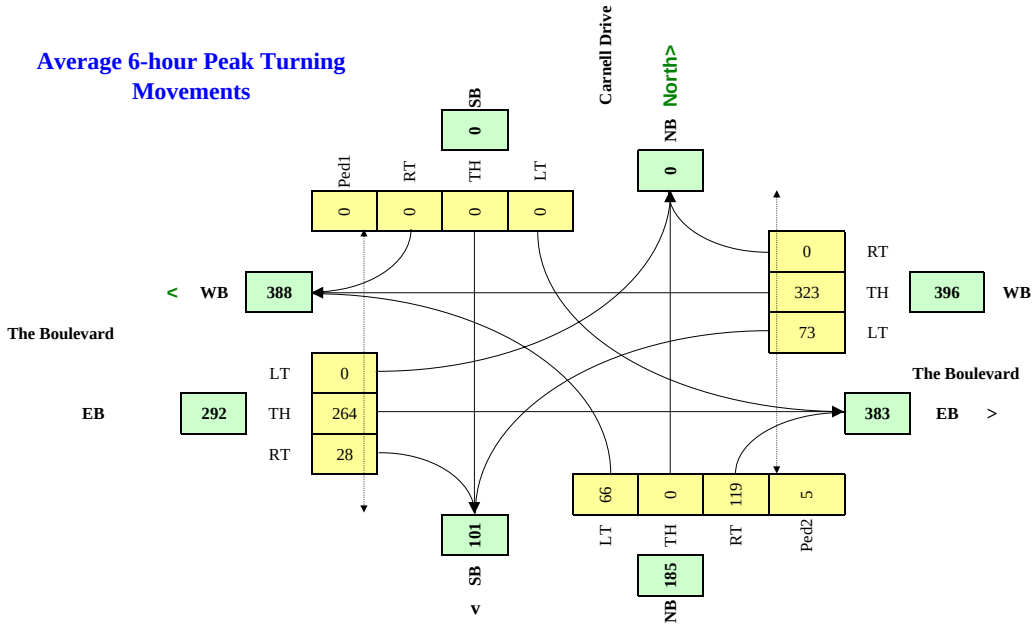
	Ped1	Ped2	Ped3	Ped4
	NS	NS	EW	EW
	W Side	E Side	N Side	S side
7:30 - 8:30	0	5	0	0
8:30 - 9:30	0	5	0	0
11:00 - 12:00	0	5	0	0
12:00 - 13:00	0	5	0	0
16:00 - 17:00	0	5	0	0
17:00 - 18:00	0	5	0	0
Total (6-hour peak)	**0**	**30**	**0**	**0**
Average (6-hour peak)	**0**	**5**	**0**	**0**

Assumed pedestrian volumes

Demographics		
Elementary School	(y/n)	n
Senior's Complex	(y/n)	n
Pathway to School	(y/n)	n
Metro Area Population	(#)	181,000
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB		
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT
7:30 - 8:30	40	0	80	0	0	0	120	320	0	0	315	25
8:30 - 9:30	45	0	85	0	0	0	75	295	0	0	245	20
11:00 - 12:00	55	0	110	0	0	0	60	295	0	0	230	20
12:00 - 13:00	65	0	125	0	0	0	65	355	0	0	285	25
16:00 - 17:00	95	0	170	0	0	0	65	425	0	0	265	45
17:00 - 18:00	95	0	145	0	0	0	55	245	0	0	245	30
Total (6-hour peak)	**395**	**0**	**715**	**0**	**0**	**0**	**440**	**1,935**	**0**	**0**	**1,585**	**165**
Average (6-hour peak)	**66**	**0**	**119**	**0**	**0**	**0**	**73**	**323**	**0**	**0**	**264**	**28**

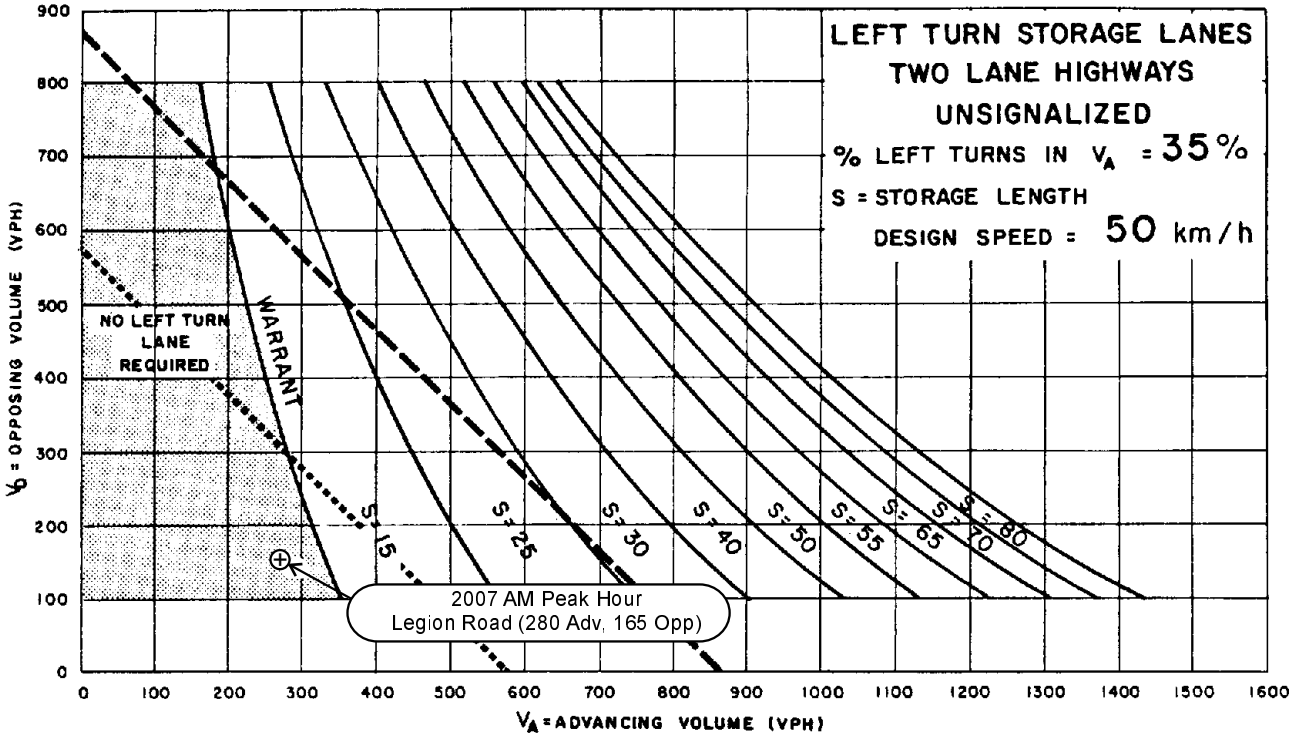
Average 6-hour Peak Turning Movements

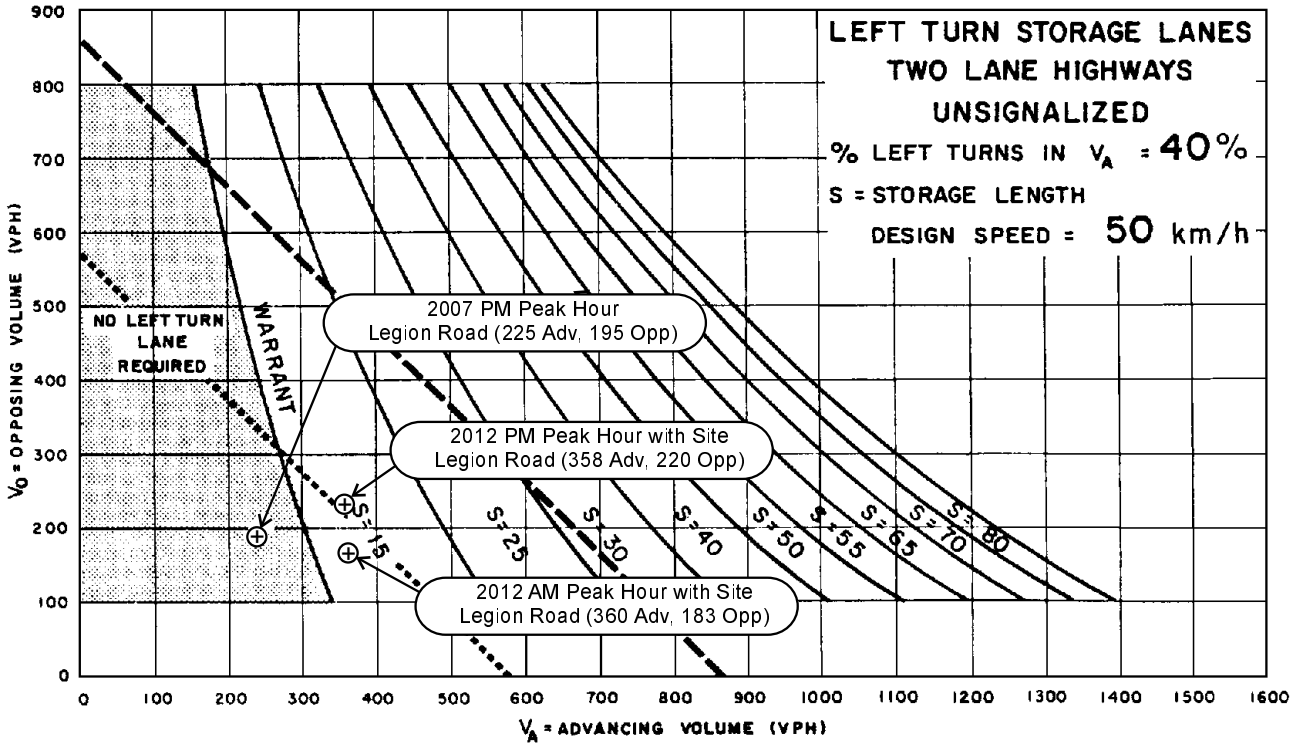


$$W = [C_{bt}(X_{v\text{-}v}) / K_1 + (F\ (X_{v\text{-}p})\ L) / K_2] \times C_i$$

W =	45	42	3
		Veh	*Ped*

NOT Warranted





Atlantic Road & Traffic Management Traffic Engineering Specialists	Traffic Impact Study - Pleasantville Development St. John's, NL	Figure B-8
	Left Turn Lane Warrants 35% and 40% Left Turning Traffic	December 2007

Appendix C

Level of Service Analysis

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Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	100	180	160	5	10	105
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	196	174	5	11	114
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	179				590	177
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	179				590	177
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	87
cM capacity (veh/h)	1396				434	866

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	304	179	11	114
Volume Left	109	0	11	0
Volume Right	0	5	0	114
cSH	1396	1700	434	866
Volume to Capacity	0.08	0.11	0.03	0.13
Queue Length 95th (m)	2.0	0.0	0.6	3.6
Control Delay (s)	3.2	0.0	13.5	9.8
Lane LOS	A		B	A
Approach Delay (s)	3.2	0.0	10.1	
Approach LOS			B	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	75	5	5	185	280	105
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	5	5	201	304	114
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	573	361	418			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	573	361	418			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	83	99	100			
cM capacity (veh/h)	478	683	1141			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	87	207	418
Volume Left	82	5	0
Volume Right	5	0	114
cSH	488	1141	1700
Volume to Capacity	0.18	0.00	0.25
Queue Length 95th (m)	5.1	0.1	0.0
Control Delay (s)	14.0	0.3	0.0
Lane LOS	B	A	
Approach Delay (s)	14.0	0.3	0.0
Approach LOS	B		

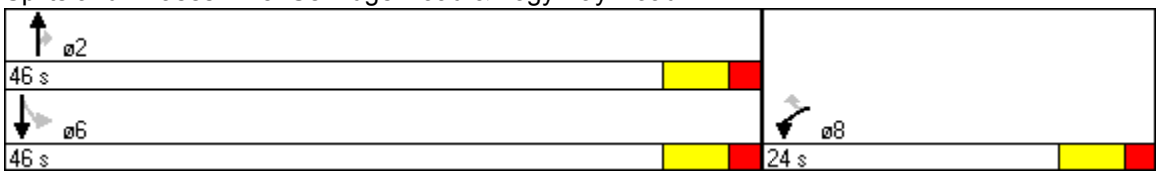
Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	32.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.644	
Satd. Flow (perm)	1770	1583	1863	1583	1200	1863
Satd. Flow (RTOR)		82		65		
Volume (vph)	60	75	165	60	110	390
Lane Group Flow (vph)	65	82	179	65	120	424
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	10.9	10.9	59.5	59.5	59.5	59.5
Actuated g/C Ratio	0.14	0.14	0.78	0.78	0.78	0.78
v/c Ratio	0.27	0.28	0.12	0.05	0.13	0.29
Control Delay	24.4	8.5	3.1	1.1	3.3	3.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	8.5	3.1	1.1	3.3	3.8
LOS	C	A	A	A	A	A
Approach Delay	15.5		2.6			3.7
Approach LOS	B		A			A
Queue Length 50th (m)	7.3	0.0	5.2	0.0	3.5	14.4
Queue Length 95th (m)	15.9	9.8	11.9	2.8	9.1	29.1
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	427	444	1444	1242	930	1444
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	0.15	0.18	0.12	0.05	0.13	0.29

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 76.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.29
Intersection Signal Delay: 5.3 Intersection LOS: A
Intersection Capacity Utilization 30.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

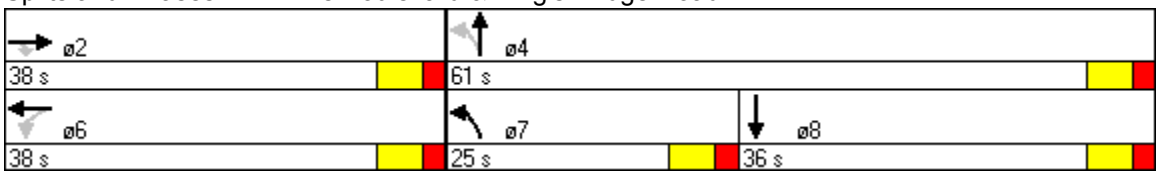


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1807	0	1770	3383	0	0	3536	0
Flt Permitted				0.697			0.147					
Satd. Flow (perm)	0	1863	1583	1298	1807	0	274	3383	0	0	3536	0
Satd. Flow (RTOR)			283		14			110			1	
Volume (vph)	0	85	260	185	80	20	160	380	160	0	740	5
Lane Group Flow (vph)	0	92	283	201	109	0	174	587	0	0	809	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		20.1	20.1	20.1	20.1		57.3	57.3			42.5	
Actuated g/C Ratio		0.24	0.24	0.24	0.24		0.67	0.67			0.50	
v/c Ratio		0.21	0.48	0.66	0.25		0.47	0.25			0.46	
Control Delay		26.5	6.2	40.0	23.6		10.6	5.5			16.6	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.5	6.2	40.0	23.6		10.6	5.5			16.6	
LOS		C	A	D	C		B	A			B	
Approach Delay		11.2			34.2			6.6			16.6	
Approach LOS		B			C			A			B	
Queue Length 50th (m)		12.7	0.0	31.2	13.1		9.6	14.4			45.0	
Queue Length 95th (m)		24.5	18.0	53.6	26.3		23.3	29.3			80.0	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	729	446	630		493	2305			1758	
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		0.14	0.39	0.45	0.17		0.35	0.25			0.46	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 85.4
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 14.8 Intersection LOS: B
Intersection Capacity Utilization 57.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

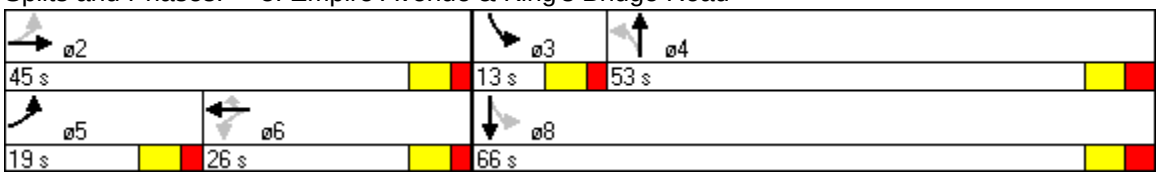


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1822	0	1770	1863	1583	1770	1855	0	1770	1766	0
Flt Permitted	0.504			0.663			0.269			0.349		
Satd. Flow (perm)	939	1822	0	1235	1863	1583	501	1855	0	650	1766	0
Satd. Flow (RTOR)		9				163		2			39	
Volume (vph)	315	115	20	20	115	150	5	360	10	260	430	230
Lane Group Flow (vph)	342	147	0	22	125	163	5	402	0	283	717	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	38.3	38.3		19.3	19.3	19.3	49.1	49.1		62.2	62.2	
Actuated g/C Ratio	0.35	0.35		0.18	0.18	0.18	0.45	0.45		0.57	0.57	
v/c Ratio	0.77	0.23		0.10	0.38	0.39	0.02	0.48		0.61	0.70	
Control Delay	41.1	23.8		37.8	42.4	8.9	18.0	23.7		19.2	20.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	41.1	23.8		37.8	42.4	8.9	18.0	23.7		19.2	20.7	
LOS	D	C		D	D	A	B	C		B	C	
Approach Delay		35.9			24.4			23.6			20.3	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	60.3	21.2		4.1	24.7	0.0	0.6	63.6		32.2	108.2	
Queue Length 95th (m)	#91.0	36.8		11.4	43.0	18.0	3.0	92.2		48.9	155.9	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	459	679		245	369	444	227	841		466	1029	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.75	0.22		0.09	0.34	0.37	0.02	0.48		0.61	0.70	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 108.5
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 24.9 Intersection LOS: C
Intersection Capacity Utilization 74.1% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	250	30	120	235	45	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	272	33	130	255	49	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			304		804	288
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			304		804	288
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			90		84	89
cM capacity (veh/h)			1256		316	751

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	304	386	130
Volume Left	0	130	49
Volume Right	33	0	82
cSH	1700	1256	495
Volume to Capacity	0.18	0.10	0.26
Queue Length 95th (m)	0.0	2.8	8.4
Control Delay (s)	0.0	3.4	14.9
Lane LOS		A	B
Approach Delay (s)	0.0	3.4	14.9
Approach LOS			B

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	95	130	190	5	10	140
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	141	207	5	11	152
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	212				557	209
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	212				557	209
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				98	82
cM capacity (veh/h)	1358				454	831

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	245	212	11	152
Volume Left	103	0	11	0
Volume Right	0	5	0	152
cSH	1358	1700	454	831
Volume to Capacity	0.08	0.12	0.02	0.18
Queue Length 95th (m)	2.0	0.0	0.6	5.3
Control Delay (s)	3.7	0.0	13.1	10.3
Lane LOS	A		B	B
Approach Delay (s)	3.7	0.0	10.5	
Approach LOS			B	

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	105	5	5	235	190	70
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	5	5	255	207	76
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	511	245	283			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	511	245	283			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	99	100			
cM capacity (veh/h)	520	794	1280			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	120	261	283
Volume Left	114	5	0
Volume Right	5	0	76
cSH	529	1280	1700
Volume to Capacity	0.23	0.00	0.17
Queue Length 95th (m)	6.9	0.1	0.0
Control Delay (s)	13.8	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	13.8	0.2	0.0
Approach LOS	B		

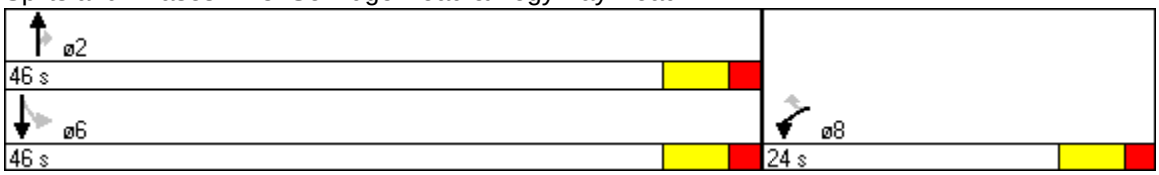
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.414	
Satd. Flow (perm)	1770	1583	1863	1583	771	1863
Satd. Flow (RTOR)		103		92		
Volume (vph)	60	95	445	85	85	200
Lane Group Flow (vph)	65	103	484	92	92	217
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	10.9	10.9	58.0	58.0	58.0	58.0
Actuated g/C Ratio	0.14	0.14	0.77	0.77	0.77	0.77
v/c Ratio	0.26	0.33	0.34	0.07	0.15	0.15
Control Delay	24.4	8.3	4.1	1.0	3.9	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.4	8.3	4.1	1.0	3.9	3.2
LOS	C	A	A	A	A	A
Approach Delay	14.5		3.6			3.4
Approach LOS	B		A			A
Queue Length 50th (m)	7.0	0.0	17.0	0.0	2.7	6.4
Queue Length 95th (m)	15.9	10.9	34.4	3.4	8.1	14.2
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	435	467	1435	1241	594	1435
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	0.15	0.22	0.34	0.07	0.15	0.15

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 75.3
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.34
Intersection Signal Delay: 5.3 Intersection LOS: A
Intersection Capacity Utilization 41.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

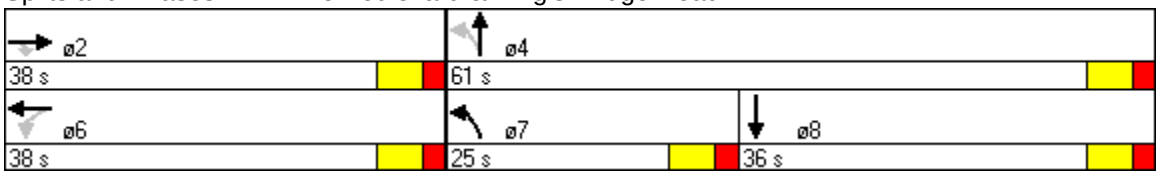


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1773	0	1770	3476	0	0	3536	0
Flt Permitted				0.644			0.313					
Satd. Flow (perm)	0	1863	1583	1200	1773	0	583	3476	0	0	3536	0
Satd. Flow (RTOR)			234		26			25			1	
Volume (vph)	0	125	215	220	105	50	255	875	120	0	465	5
Lane Group Flow (vph)	0	136	234	239	168	0	277	1081	0	0	510	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		24.1	24.1	24.1	24.1		57.3	57.3			39.4	
Actuated g/C Ratio		0.27	0.27	0.27	0.27		0.64	0.64			0.44	
v/c Ratio		0.27	0.39	0.74	0.34		0.50	0.48			0.33	
Control Delay		26.3	5.3	43.8	23.2		11.4	10.1			19.3	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.3	5.3	43.8	23.2		11.4	10.1			19.3	
LOS		C	A	D	C		B	B			B	
Approach Delay		13.0			35.3			10.3			19.3	
Approach LOS		B			D			B			B	
Queue Length 50th (m)		19.3	0.0	39.1	20.3		19.5	47.6			30.7	
Queue Length 95th (m)		33.9	16.0	65.5	36.9		41.1	81.9			56.9	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	697	412	626		604	2236			1558	
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		0.21	0.34	0.58	0.27		0.46	0.48			0.33	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 89.5
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.74
Intersection Signal Delay: 16.3 Intersection LOS: B
Intersection Capacity Utilization 59.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

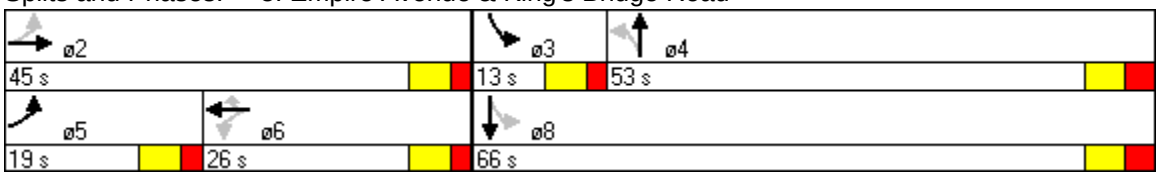


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1825	0	1770	1863	1583	1770	1853	0	1770	1770	0
Flt Permitted	0.390			0.704			0.363			0.144		
Satd. Flow (perm)	726	1825	0	1311	1863	1583	676	1853	0	268	1770	0
Satd. Flow (RTOR)		8				268		2			36	
Volume (vph)	300	65	10	30	170	285	1	575	20	120	375	185
Lane Group Flow (vph)	326	82	0	33	185	310	1	647	0	130	609	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	40.2	40.2		21.1	21.1	21.1	49.1	49.1		62.0	62.0	
Actuated g/C Ratio	0.36	0.36		0.19	0.19	0.19	0.45	0.45		0.56	0.56	
v/c Ratio	0.80	0.12		0.13	0.52	0.60	0.00	0.78		0.48	0.60	
Control Delay	44.3	21.5		38.3	45.7	12.8	17.0	34.3		17.7	18.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	44.3	21.5		38.3	45.7	12.8	17.0	34.3		17.7	18.1	
LOS	D	C		D	D	B	B	C		B	B	
Approach Delay		39.7			25.9			34.3			18.0	
Approach LOS		D			C			C			B	
Queue Length 50th (m)	56.9	11.0		6.3	37.9	8.0	0.1	123.3		13.4	82.8	
Queue Length 95th (m)	#95.9	21.9		15.3	61.0	35.6	1.1	173.8		23.2	119.3	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	409	679		260	369	529	301	827		273	1013	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.80	0.12		0.13	0.50	0.59	0.00	0.78		0.48	0.60	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 110.2
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 28.2 Intersection LOS: C
Intersection Capacity Utilization 77.0% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	140	40	55	315	90	155
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	152	43	60	342	98	168
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			196		636	174
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			196		636	174
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		77	81
cM capacity (veh/h)			1377		423	870

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	196	402	266
Volume Left	0	60	98
Volume Right	43	0	168
cSH	1700	1377	626
Volume to Capacity	0.12	0.04	0.43
Queue Length 95th (m)	0.0	1.1	16.9
Control Delay (s)	0.0	1.5	14.9
Lane LOS		A	B
Approach Delay (s)	0.0	1.5	14.9
Approach LOS			B

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	105	185	165	5	10	105
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	201	179	5	11	114
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	185				611	182
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	185				611	182
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	87
cM capacity (veh/h)	1390				419	860

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	315	185	11	114
Volume Left	114	0	11	0
Volume Right	0	5	0	114
cSH	1390	1700	419	860
Volume to Capacity	0.08	0.11	0.03	0.13
Queue Length 95th (m)	2.1	0.0	0.6	3.7
Control Delay (s)	3.3	0.0	13.8	9.8
Lane LOS	A		B	A
Approach Delay (s)	3.3	0.0	10.2	
Approach LOS			B	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	75	5	5	195	290	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	5	5	212	315	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	598	375	435			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	598	375	435			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	99	100			
cM capacity (veh/h)	463	671	1125			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	87	217	435
Volume Left	82	5	0
Volume Right	5	0	120
cSH	472	1125	1700
Volume to Capacity	0.18	0.00	0.26
Queue Length 95th (m)	5.3	0.1	0.0
Control Delay (s)	14.3	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	14.3	0.2	0.0
Approach LOS	B		

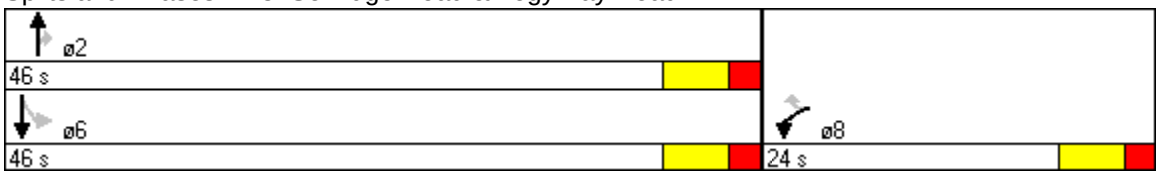
Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	33.1%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.641	
Satd. Flow (perm)	1770	1583	1863	1583	1194	1863
Satd. Flow (RTOR)		82		71		
Volume (vph)	65	75	170	65	115	400
Lane Group Flow (vph)	71	82	185	71	125	435
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	11.2	11.2	59.0	59.0	59.0	59.0
Actuated g/C Ratio	0.14	0.14	0.77	0.77	0.77	0.77
v/c Ratio	0.28	0.28	0.13	0.06	0.14	0.30
Control Delay	24.6	8.3	3.2	1.1	3.5	3.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.6	8.3	3.2	1.1	3.5	3.9
LOS	C	A	A	A	A	A
Approach Delay	15.9		2.6			3.8
Approach LOS	B		A			A
Queue Length 50th (m)	7.9	0.0	5.4	0.0	3.7	15.0
Queue Length 95th (m)	17.0	9.8	12.6	3.0	9.7	30.7
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	429	446	1438	1238	921	1438
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	0.17	0.18	0.13	0.06	0.14	0.30

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 76.5
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.30
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 31.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

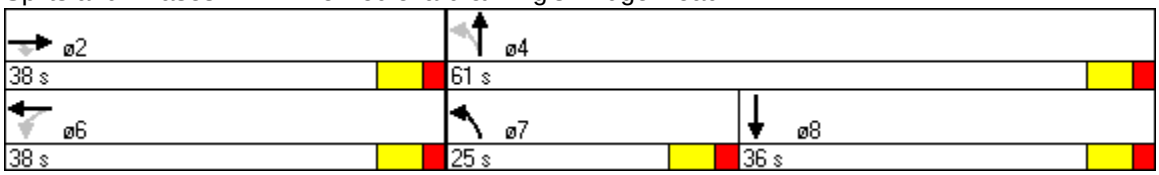


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1796	0	1770	3380	0	0	3536	0
Flt Permitted				0.694			0.134					
Satd. Flow (perm)	0	1863	1583	1293	1796	0	250	3380	0	0	3536	0
Satd. Flow (RTOR)			293		17			111			1	
Volume (vph)	0	90	270	195	80	25	165	390	165	0	765	5
Lane Group Flow (vph)	0	98	293	212	114	0	179	603	0	0	837	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		21.0	21.0	21.0	21.0		57.3	57.3			42.1	
Actuated g/C Ratio		0.24	0.24	0.24	0.24		0.66	0.66			0.49	
v/c Ratio		0.22	0.48	0.68	0.25		0.49	0.26			0.48	
Control Delay		26.4	6.0	40.4	22.8		12.6	5.8			17.8	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.4	6.0	40.4	22.8		12.6	5.8			17.8	
LOS		C	A	D	C		B	A			B	
Approach Delay		11.1			34.3			7.3			17.8	
Approach LOS		B			C			A			B	
Queue Length 50th (m)		13.6	0.0	33.2	13.5		10.2	15.5			48.4	
Queue Length 95th (m)		25.8	18.0	56.5	26.8		28.3	31.5			87.9	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	736	444	628		482	2281			1726	
Starvation Cap Reductn		0	0	0	0		0	0			0	
Spillback Cap Reductn		0	0	0	0		0	0			0	
Storage Cap Reductn		0	0	0	0		0	0			0	
Reduced v/c Ratio		0.15	0.40	0.48	0.18		0.37	0.26			0.48	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 86.3
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 15.5 Intersection LOS: B
Intersection Capacity Utilization 58.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

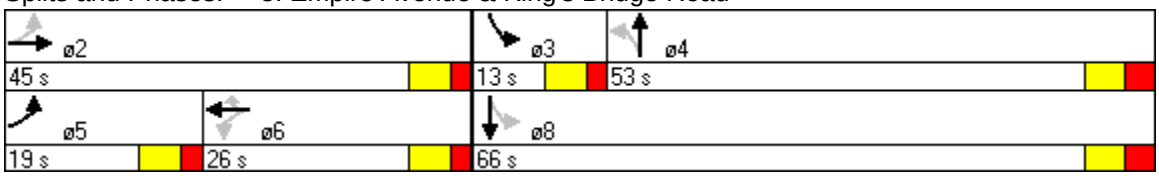


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1822	0	1770	1863	1583	1770	1855	0	1770	1764	0
Flt Permitted	0.494			0.663			0.250			0.339		
Satd. Flow (perm)	920	1822	0	1235	1863	1583	466	1855	0	631	1764	0
Satd. Flow (RTOR)		9				168		2			40	
Volume (vph)	325	115	20	20	120	155	5	370	10	265	440	240
Lane Group Flow (vph)	353	147	0	22	130	168	5	413	0	288	739	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	38.9	38.9		19.9	19.9	19.9	49.1	49.1		62.1	62.1	
Actuated g/C Ratio	0.36	0.36		0.18	0.18	0.18	0.45	0.45		0.57	0.57	
v/c Ratio	0.79	0.22		0.10	0.38	0.40	0.02	0.49		0.63	0.72	
Control Delay	43.1	23.7		37.8	42.4	8.8	18.2	24.1		20.3	21.8	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	43.1	23.7		37.8	42.4	8.8	18.2	24.1		20.3	21.8	
LOS	D	C		D	D	A	B	C		C	C	
Approach Delay		37.4			24.4			24.1			21.4	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	62.7	21.2		4.1	25.8	0.0	0.6	65.8		32.9	114.1	
Queue Length 95th (m)	#99.2	36.8		11.4	44.3	18.0	3.0	95.2		49.7	165.0	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	455	679		245	369	448	210	836		454	1022	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.78	0.22		0.09	0.35	0.38	0.02	0.49		0.63	0.72	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 109
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 25.8 Intersection LOS: C
Intersection Capacity Utilization 75.8% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	255	30	125	245	45	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	277	33	136	266	49	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			310		832	293
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			310		832	293
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		84	89
cM capacity (veh/h)			1251		302	746

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	310	402	130
Volume Left	0	136	49
Volume Right	33	0	82
cSH	1700	1251	481
Volume to Capacity	0.18	0.11	0.27
Queue Length 95th (m)	0.0	2.9	8.7
Control Delay (s)	0.0	3.5	15.2
Lane LOS		A	C
Approach Delay (s)	0.0	3.5	15.2
Approach LOS			C

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	95	130	195	5	10	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	141	212	5	11	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	217				562	215
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	217				562	215
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				98	81
cM capacity (veh/h)	1352				451	825

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	245	217	11	158
Volume Left	103	0	11	0
Volume Right	0	5	0	158
cSH	1352	1700	451	825
Volume to Capacity	0.08	0.13	0.02	0.19
Queue Length 95th (m)	2.0	0.0	0.6	5.6
Control Delay (s)	3.7	0.0	13.2	10.4
Lane LOS	A		B	B
Approach Delay (s)	3.7	0.0	10.6	
Approach LOS			B	

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	110	5	5	245	200	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	120	5	5	266	217	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	535	258	299			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535	258	299			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	99	100			
cM capacity (veh/h)	504	780	1262			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	125	272	299
Volume Left	120	5	0
Volume Right	5	0	82
cSH	512	1262	1700
Volume to Capacity	0.24	0.00	0.18
Queue Length 95th (m)	7.6	0.1	0.0
Control Delay (s)	14.3	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	14.3	0.2	0.0
Approach LOS	B		

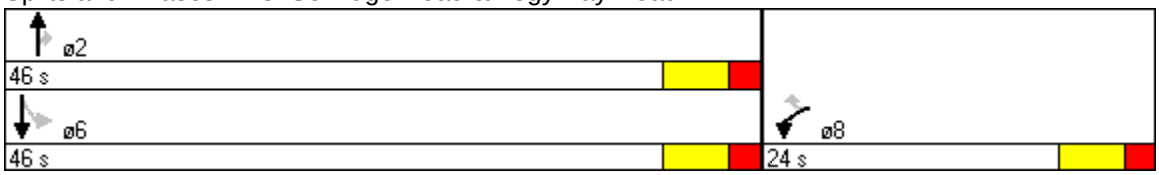
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	30.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.414	
Satd. Flow (perm)	1770	1583	1863	1583	771	1863
Satd. Flow (RTOR)		109		98		
Volume (vph)	65	100	445	90	90	205
Lane Group Flow (vph)	71	109	484	98	98	223
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	11.2	11.2	57.4	57.4	57.4	57.4
Actuated g/C Ratio	0.15	0.15	0.77	0.77	0.77	0.77
v/c Ratio	0.28	0.34	0.34	0.08	0.17	0.16
Control Delay	24.5	8.1	4.2	1.0	4.1	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	8.1	4.2	1.0	4.1	3.3
LOS	C	A	A	A	A	A
Approach Delay	14.6		3.7			3.5
Approach LOS	B		A			A
Queue Length 50th (m)	7.5	0.0	17.2	0.0	3.0	6.7
Queue Length 95th (m)	17.0	11.1	34.9	3.5	8.7	14.9
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	438	474	1427	1235	591	1427
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	0.16	0.23	0.34	0.08	0.17	0.16

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 74.9
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.34
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 42.0% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

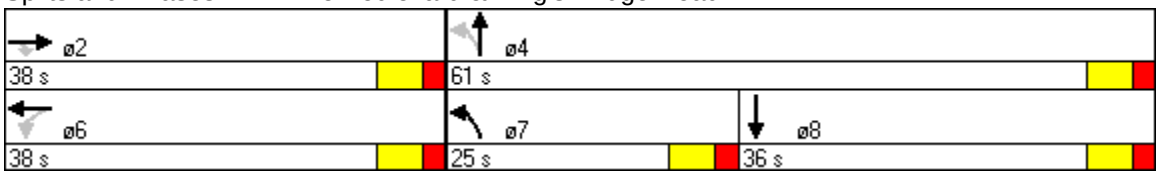


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1770	0	1770	3476	0	0	3522	0
Flt Permitted				0.637			0.299					
Satd. Flow (perm)	0	1863	1583	1187	1770	0	557	3476	0	0	3522	0
Satd. Flow (RTOR)			239		28			26			3	
Volume (vph)	0	130	220	225	110	55	265	900	125	0	475	15
Lane Group Flow (vph)	0	141	239	245	180	0	288	1114	0	0	532	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		24.7	24.7	24.7	24.7		57.4	57.4			39.0	
Actuated g/C Ratio		0.27	0.27	0.27	0.27		0.64	0.64			0.43	
v/c Ratio		0.28	0.39	0.75	0.36		0.53	0.50			0.35	
Control Delay		26.3	5.3	44.7	23.3		12.1	10.5			20.1	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.3	5.3	44.7	23.3		12.1	10.5			20.1	
LOS		C	A	D	C		B	B			C	
Approach Delay		13.1			35.6			10.8			20.1	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		20.0	0.0	40.5	21.8		21.0	51.3			33.2	
Queue Length 95th (m)		34.9	16.1	67.7	39.2		42.7	85.5			59.8	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	701	408	626		593	2222			1527	
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	0.34	0.60	0.29		0.49	0.50			0.35	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 90.1
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 16.8 Intersection LOS: B
Intersection Capacity Utilization 60.9% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

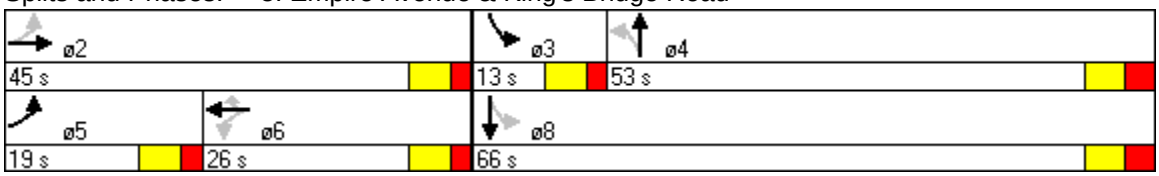


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1827	0	1770	1863	1583	1770	1853	0	1770	1770	0
Flt Permitted	0.380			0.701			0.349			0.126		
Satd. Flow (perm)	708	1827	0	1306	1863	1583	650	1853	0	235	1770	0
Satd. Flow (RTOR)		7				257		2			36	
Volume (vph)	310	70	10	30	175	295	1	595	20	125	385	190
Lane Group Flow (vph)	337	87	0	33	190	321	1	669	0	136	625	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	41.0	41.0		22.0	22.0	22.0	49.0	49.0		62.0	62.0	
Actuated g/C Ratio	0.37	0.37		0.20	0.20	0.20	0.44	0.44		0.56	0.56	
v/c Ratio	0.83	0.13		0.13	0.51	0.62	0.00	0.82		0.53	0.62	
Control Delay	47.2	21.9		38.2	45.4	15.1	17.0	36.7		19.6	18.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	47.2	21.9		38.2	45.4	15.1	17.0	36.7		19.6	18.9	
LOS	D	C		D	D	B	B	D		B	B	
Approach Delay		42.0			27.1			36.7			19.0	
Approach LOS		D			C			D			B	
Queue Length 50th (m)	59.3	11.9		6.2	39.0	12.3	0.1	130.0		14.1	86.4	
Queue Length 95th (m)	#104.0	23.2		15.3	62.6	42.0	1.1	#183.2		24.1	124.3	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	405	679		259	369	520	287	819		256	1005	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.83	0.13		0.13	0.51	0.62	0.00	0.82		0.53	0.62	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 111
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 29.9 Intersection LOS: C
Intersection Capacity Utilization 79.2% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	145	40	60	325	95	160
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	158	43	65	353	103	174
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			201		663	179
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			201		663	179
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		75	80
cM capacity (veh/h)			1371		406	863

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	201	418	277
Volume Left	0	65	103
Volume Right	43	0	174
cSH	1700	1371	608
Volume to Capacity	0.12	0.05	0.46
Queue Length 95th (m)	0.0	1.2	19.0
Control Delay (s)	0.0	1.6	15.8
Lane LOS		A	C
Approach Delay (s)	0.0	1.6	15.8
Approach LOS			C

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	155	185	165	11	20	190
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	201	179	12	22	207
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	191				723	185
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	191				723	185
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	88				94	76
cM capacity (veh/h)	1382				345	857

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	370	191	22	207
Volume Left	168	0	22	0
Volume Right	0	12	0	207
cSH	1382	1700	345	857
Volume to Capacity	0.12	0.11	0.06	0.24
Queue Length 95th (m)	3.3	0.0	1.6	7.5
Control Delay (s)	4.2	0.0	16.1	10.5
Lane LOS	A		C	B
Approach Delay (s)	4.2	0.0	11.1	
Approach LOS			B	

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	103	9	7	195	290	126
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	112	10	8	212	315	137
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	611	384	452			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	611	384	452			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	99	99			
cM capacity (veh/h)	454	664	1108			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	122	220	452
Volume Left	112	8	0
Volume Right	10	0	137
cSH	466	1108	1700
Volume to Capacity	0.26	0.01	0.27
Queue Length 95th (m)	8.3	0.2	0.0
Control Delay (s)	15.4	0.3	0.0
Lane LOS	C	A	
Approach Delay (s)	15.4	0.3	0.0
Approach LOS	C		

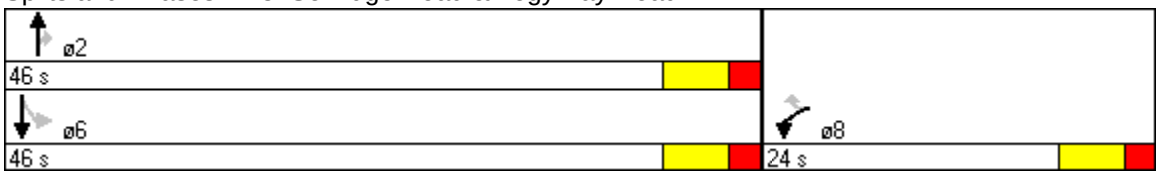
Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.641	
Satd. Flow (perm)	1770	1583	1863	1583	1194	1863
Satd. Flow (RTOR)		187		105		
Volume (vph)	119	172	170	97	172	400
Lane Group Flow (vph)	129	187	185	105	187	435
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	12.0	12.0	45.2	45.2	45.2	45.2
Actuated g/C Ratio	0.18	0.18	0.69	0.69	0.69	0.69
v/c Ratio	0.40	0.42	0.14	0.09	0.23	0.34
Control Delay	25.4	7.0	4.3	1.3	5.1	5.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.4	7.0	4.3	1.3	5.1	5.4
LOS	C	A	A	A	A	A
Approach Delay	14.5		3.2			5.3
Approach LOS	B		A			A
Queue Length 50th (m)	13.6	0.0	6.3	0.0	6.8	17.4
Queue Length 95th (m)	27.2	14.0	15.1	4.4	17.3	37.1
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	486	571	1290	1129	827	1290
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	0.27	0.33	0.14	0.09	0.23	0.34

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 65.2
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.42
Intersection Signal Delay: 7.2 Intersection LOS: A
Intersection Capacity Utilization 35.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

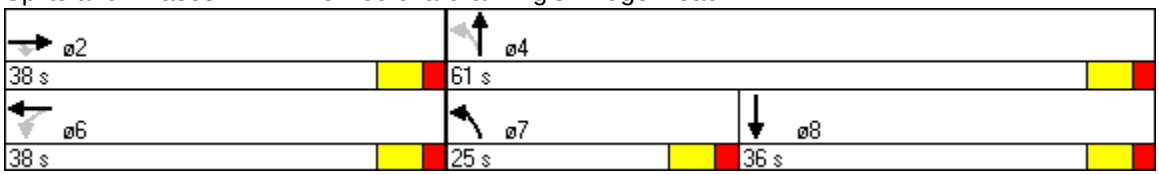


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1801	0	1770	3359	0	0	3536	0
Flt Permitted				0.690			0.128					
Satd. Flow (perm)	0	1863	1583	1285	1801	0	238	3359	0	0	3536	0
Satd. Flow (RTOR)			293		16			159			1	
Volume (vph)	0	95	270	266	88	25	165	397	207	0	777	5
Lane Group Flow (vph)	0	103	293	289	123	0	179	657	0	0	850	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		26.4	26.4	26.4	26.4		57.3	57.3			41.5	
Actuated g/C Ratio		0.29	0.29	0.29	0.29		0.62	0.62			0.45	
v/c Ratio		0.19	0.44	0.78	0.23		0.52	0.30			0.53	
Control Delay		24.7	5.1	45.2	21.9		15.4	7.0			21.5	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		24.7	5.1	45.2	21.9		15.4	7.0			21.5	
LOS		C	A	D	C		B	A			C	
Approach Delay		10.2			38.3			8.8			21.5	
Approach LOS		B			D			A			C	
Queue Length 50th (m)		14.3	0.0	48.9	14.9		13.1	20.2			58.9	
Queue Length 95th (m)		26.8	17.7	79.5	28.6		31.3	35.4			95.5	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	736	441	629		455	2159			1599	
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		0.16	0.40	0.66	0.20		0.39	0.30			0.53	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 91.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 18.2 Intersection LOS: B
Intersection Capacity Utilization 63.1% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

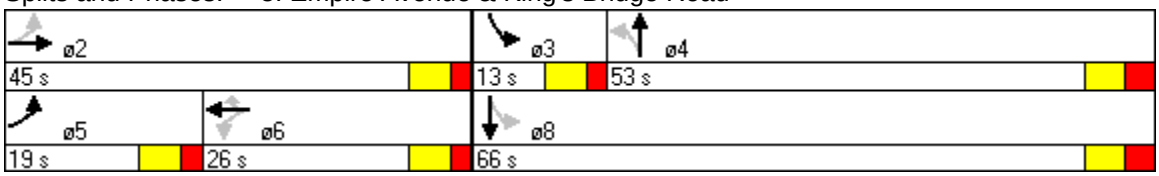


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1822	0	1770	1863	1583	1770	1855	0	1770	1762	0
Flt Permitted	0.494			0.663			0.185			0.315		
Satd. Flow (perm)	920	1822	0	1235	1863	1583	345	1855	0	587	1762	0
Satd. Flow (RTOR)		9				176		1			41	
Volume (vph)	342	115	20	20	120	162	5	395	10	277	482	269
Lane Group Flow (vph)	372	147	0	22	130	176	5	440	0	301	816	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	39.6	39.6		20.6	20.6	20.6	49.0	49.0		62.0	62.0	
Actuated g/C Ratio	0.36	0.36		0.19	0.19	0.19	0.45	0.45		0.57	0.57	
v/c Ratio	0.83	0.22		0.09	0.37	0.40	0.03	0.53		0.70	0.80	
Control Delay	46.3	23.7		37.7	42.1	8.6	18.6	25.2		23.8	26.0	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	46.3	23.7		37.7	42.1	8.6	18.6	25.2		23.8	26.0	
LOS	D	C		D	D	A	B	C		C	C	
Approach Delay		39.9			23.8			25.1			25.4	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	67.0	21.2		4.1	25.8	0.0	0.6	71.6		34.7	137.1	
Queue Length 95th (m)	#112.2	36.8		11.4	44.3	18.4	3.1	103.1		52.4	199.1	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	455	679		245	369	455	154	830		429	1015	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.82	0.22		0.09	0.35	0.39	0.03	0.53		0.70	0.80	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 109.6
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 28.2 Intersection LOS: C
Intersection Capacity Utilization 80.7% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	302	30	131	324	45	78
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	328	33	142	352	49	85
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			361		982	345
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			361		982	345
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			88		80	88
cM capacity (veh/h)			1198		244	698

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	361	495	134
Volume Left	0	142	49
Volume Right	33	0	85
cSH	1700	1198	415
Volume to Capacity	0.21	0.12	0.32
Queue Length 95th (m)	0.0	3.2	11.0
Control Delay (s)	0.0	3.3	17.7
Lane LOS		A	C
Approach Delay (s)	0.0	3.3	17.7
Approach LOS			C

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	191	130	195	17	20	224
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	208	141	212	18	22	243
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	230				778	221
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	230				778	221
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	84				93	70
cM capacity (veh/h)	1337				308	818

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	349	230	22	243
Volume Left	208	0	22	0
Volume Right	0	18	0	243
cSH	1337	1700	308	818
Volume to Capacity	0.16	0.14	0.07	0.30
Queue Length 95th (m)	4.4	0.0	1.8	10.0
Control Delay (s)	5.4	0.0	17.6	11.3
Lane LOS	A		C	B
Approach Delay (s)	5.4	0.0	11.8	
Approach LOS			B	

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	42.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	136	8	9	245	200	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	148	9	10	266	217	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	561	276	334			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	561	276	334			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	99	99			
cM capacity (veh/h)	485	763	1226			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	157	276	334
Volume Left	148	10	0
Volume Right	9	0	116
cSH	495	1226	1700
Volume to Capacity	0.32	0.01	0.20
Queue Length 95th (m)	10.8	0.2	0.0
Control Delay (s)	15.6	0.4	0.0
Lane LOS	C	A	
Approach Delay (s)	15.6	0.4	0.0
Approach LOS	C		

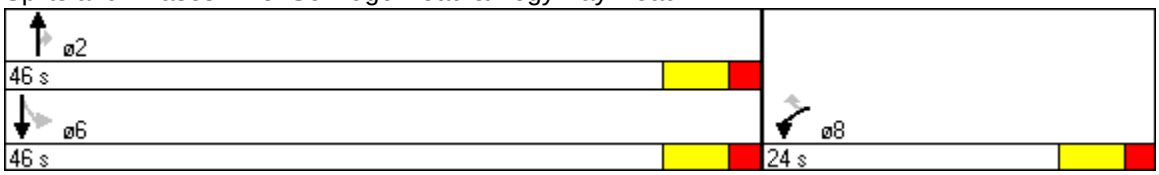
Intersection Summary			
Average Delay	3.3		
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.406	
Satd. Flow (perm)	1770	1583	1863	1583	756	1863
Satd. Flow (RTOR)		208		164		
Volume (vph)	116	191	455	151	201	205
Lane Group Flow (vph)	126	208	495	164	218	223
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	11.8	11.8	44.5	44.5	44.5	44.5
Actuated g/C Ratio	0.18	0.18	0.69	0.69	0.69	0.69
v/c Ratio	0.39	0.45	0.38	0.14	0.42	0.17
Control Delay	25.3	7.1	5.7	1.2	8.0	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	7.1	5.7	1.2	8.0	4.4
LOS	C	A	A	A	A	A
Approach Delay	14.0		4.6			6.2
Approach LOS	B		A			A
Queue Length 50th (m)	13.3	0.0	20.4	0.0	9.3	7.7
Queue Length 95th (m)	26.8	14.8	43.1	5.3	26.8	17.9
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	490	589	1289	1146	523	1289
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	0.26	0.35	0.38	0.14	0.42	0.17

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 64.4
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.45
Intersection Signal Delay: 7.3 Intersection LOS: A
Intersection Capacity Utilization 51.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

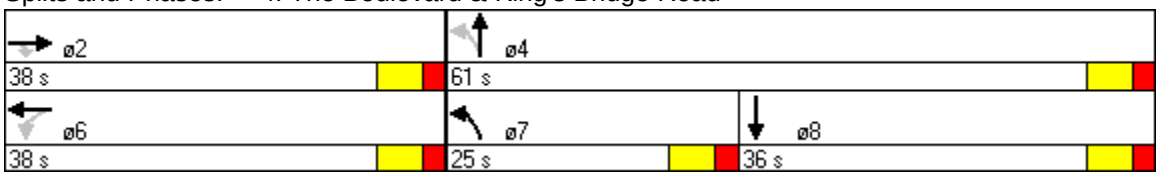


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1773	0	1770	3440	0	0	3525	0
Flt Permitted				0.623			0.290					
Satd. Flow (perm)	0	1863	1583	1160	1773	0	540	3440	0	0	3525	0
Satd. Flow (RTOR)			239		26			46			3	
Volume (vph)	0	139	220	291	118	55	265	914	206	0	487	15
Lane Group Flow (vph)	0	151	239	316	188	0	288	1217	0	0	545	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		30.1	30.1	30.1	30.1		57.2	57.2			37.9	
Actuated g/C Ratio		0.32	0.32	0.32	0.32		0.60	0.60			0.40	
v/c Ratio		0.26	0.36	0.86	0.33		0.55	0.58			0.39	
Control Delay		25.1	4.8	54.3	22.5		14.3	13.3			23.0	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		25.1	4.8	54.3	22.5		14.3	13.3			23.0	
LOS		C	A	D	C		B	B			C	
Approach Delay		12.7			42.4			13.5			23.0	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		21.6	0.0	57.0	23.4		27.5	75.8			41.6	
Queue Length 95th (m)		37.2	16.1	#103.0	41.3		42.7	96.5			61.3	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	701	398	626		561	2082			1405	
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		0.24	0.34	0.79	0.30		0.51	0.58			0.39	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 95.3
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 20.1 Intersection LOS: C
Intersection Capacity Utilization 65.4% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: The Boulevard & King's Bridge Road

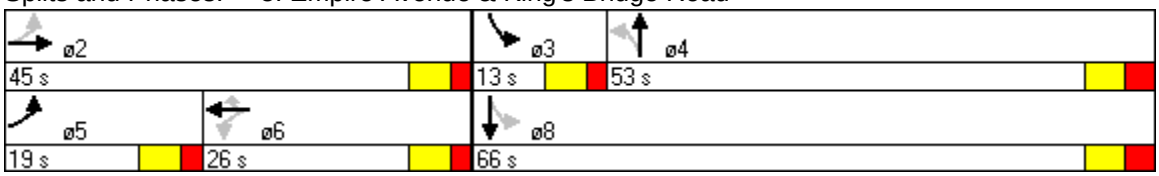


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1827	0	1770	1863	1583	1770	1853	0	1770	1768	0
Flt Permitted	0.380			0.701			0.286			0.085		
Satd. Flow (perm)	708	1827	0	1306	1863	1583	533	1853	0	158	1768	0
Satd. Flow (RTOR)		7				235		2			38	
Volume (vph)	343	70	10	30	175	309	1	643	20	137	424	217
Lane Group Flow (vph)	373	87	0	33	190	336	1	721	0	149	697	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	41.0	41.0		22.0	22.0	22.0	49.0	49.0		62.0	62.0	
Actuated g/C Ratio	0.37	0.37		0.20	0.20	0.20	0.44	0.44		0.56	0.56	
v/c Ratio	0.92	0.13		0.13	0.51	0.67	0.00	0.88		0.68	0.69	
Control Delay	59.6	21.9		38.2	45.4	20.0	18.0	42.2		33.6	21.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	59.6	21.9		38.2	45.4	20.0	18.0	42.2		33.6	21.1	
LOS	E	C		D	D	C	B	D		C	C	
Approach Delay		52.5			29.8			42.2			23.3	
Approach LOS		D			C			D			C	
Queue Length 50th (m)	67.2	11.9		6.2	39.0	19.9	0.1	146.4		15.6	103.3	
Queue Length 95th (m)	#128.4	23.2		15.3	62.6	53.2	1.1	#222.1		#42.2	148.6	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	405	679		259	369	502	235	819		219	1004	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.92	0.13		0.13	0.51	0.67	0.00	0.88		0.68	0.69	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 111
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 35.2 Intersection LOS: D
Intersection Capacity Utilization 84.2% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	235	40	65	399	95	166
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	255	43	71	434	103	180
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			299		852	277
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			299		852	277
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		67	76
cM capacity (veh/h)			1262		311	762

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	299	504	284
Volume Left	0	71	103
Volume Right	43	0	180
cSH	1700	1262	499
Volume to Capacity	0.18	0.06	0.57
Queue Length 95th (m)	0.0	1.4	28.0
Control Delay (s)	0.0	1.6	21.3
Lane LOS		A	C
Approach Delay (s)	0.0	1.6	21.3
Approach LOS			C

Intersection Summary			
Average Delay	6.3		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	105	190	170	5	10	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	207	185	5	11	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	190				622	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	190				622	188
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				97	86
cM capacity (veh/h)	1384				413	855

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	321	190	11	120
Volume Left	114	0	11	0
Volume Right	0	5	0	120
cSH	1384	1700	413	855
Volume to Capacity	0.08	0.11	0.03	0.14
Queue Length 95th (m)	2.2	0.0	0.6	3.9
Control Delay (s)	3.3	0.0	14.0	9.9
Lane LOS	A		B	A
Approach Delay (s)	3.3	0.0	10.2	
Approach LOS			B	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	75	5	5	195	295	110
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	5	5	212	321	120
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	603	380	440			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	603	380	440			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	99	100			
cM capacity (veh/h)	460	667	1120			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	87	217	440
Volume Left	82	5	0
Volume Right	5	0	120
cSH	469	1120	1700
Volume to Capacity	0.19	0.00	0.26
Queue Length 95th (m)	5.4	0.1	0.0
Control Delay (s)	14.4	0.3	0.0
Lane LOS	B	A	
Approach Delay (s)	14.4	0.3	0.0
Approach LOS	B		

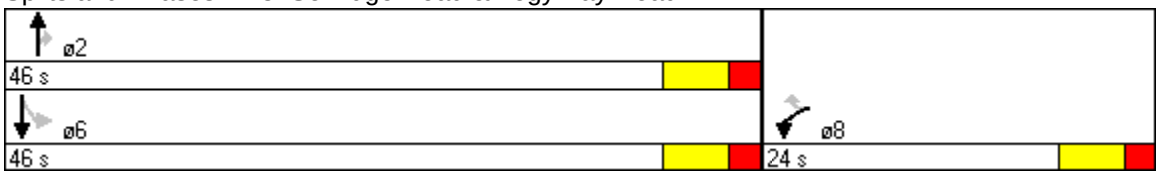
Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.638	
Satd. Flow (perm)	1770	1583	1863	1583	1188	1863
Satd. Flow (RTOR)		87		71		
Volume (vph)	65	80	175	65	115	410
Lane Group Flow (vph)	71	87	190	71	125	446
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	11.2	11.2	58.7	58.7	58.7	58.7
Actuated g/C Ratio	0.14	0.14	0.77	0.77	0.77	0.77
v/c Ratio	0.28	0.29	0.13	0.06	0.14	0.31
Control Delay	24.6	8.3	3.2	1.1	3.5	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.6	8.3	3.2	1.1	3.5	4.0
LOS	C	A	A	A	A	A
Approach Delay	15.6		2.6			3.9
Approach LOS	B		A			A
Queue Length 50th (m)	7.8	0.0	5.6	0.0	3.7	15.5
Queue Length 95th (m)	17.0	10.0	12.9	3.0	9.7	31.6
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	431	451	1435	1236	915	1435
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	0.16	0.19	0.13	0.06	0.14	0.31

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 76.2
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.31
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 31.8% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

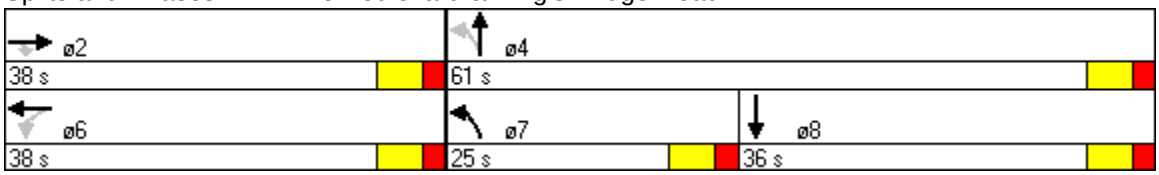


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1799	0	1770	3380	0	0	3536	0
Flt Permitted				0.694			0.127					
Satd. Flow (perm)	0	1863	1583	1293	1799	0	237	3380	0	0	3536	0
Satd. Flow (RTOR)			299		16			112			1	
Volume (vph)	0	90	275	195	85	25	165	400	170	0	780	5
Lane Group Flow (vph)	0	98	299	212	119	0	179	620	0	0	853	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		21.0	21.0	21.0	21.0		57.3	57.3			42.0	
Actuated g/C Ratio		0.24	0.24	0.24	0.24		0.66	0.66			0.49	
v/c Ratio		0.22	0.49	0.68	0.27		0.50	0.27			0.50	
Control Delay		26.4	6.0	40.4	23.4		13.2	5.9			18.0	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.4	6.0	40.4	23.4		13.2	5.9			18.0	
LOS		C	A	D	C		B	A			B	
Approach Delay		11.0			34.3			7.5			18.0	
Approach LOS		B			C			A			B	
Queue Length 50th (m)		13.6	0.0	33.2	14.3		10.2	16.2			49.6	
Queue Length 95th (m)		25.8	18.1	56.5	27.9		29.6	32.6			90.6	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	740	444	628		477	2282			1723	
Starvation Cap Reductn		0	0	0	0		0	0			0	
Spillback Cap Reductn		0	0	0	0		0	0			0	
Storage Cap Reductn		0	0	0	0		0	0			0	
Reduced v/c Ratio		0.15	0.40	0.48	0.19		0.38	0.27			0.50	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 86.3
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 15.6 Intersection LOS: B
Intersection Capacity Utilization 59.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

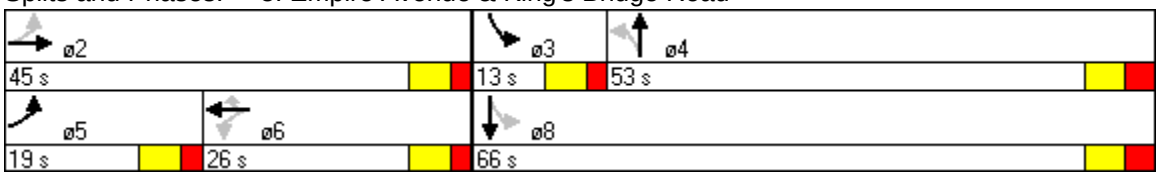


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1822	0	1770	1863	1583	1770	1855	0	1770	1764	0
Flt Permitted	0.483			0.660			0.237			0.329		
Satd. Flow (perm)	900	1822	0	1229	1863	1583	441	1855	0	613	1764	0
Satd. Flow (RTOR)		9				174		2			40	
Volume (vph)	330	120	20	20	125	160	5	380	10	270	450	245
Lane Group Flow (vph)	359	152	0	22	136	174	5	424	0	293	755	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	39.3	39.3		20.3	20.3	20.3	49.1	49.1		62.1	62.1	
Actuated g/C Ratio	0.36	0.36		0.19	0.19	0.19	0.45	0.45		0.57	0.57	
v/c Ratio	0.81	0.23		0.10	0.39	0.40	0.03	0.51		0.66	0.74	
Control Delay	44.6	23.9		37.7	42.6	8.6	18.2	24.6		21.5	22.7	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	44.6	23.9		37.7	42.6	8.6	18.2	24.6		21.5	22.7	
LOS	D	C		D	D	A	B	C		C	C	
Approach Delay		38.5			24.5			24.5			22.3	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	64.1	22.1		4.1	27.1	0.0	0.6	68.1		33.6	118.7	
Queue Length 95th (m)	#104.8	37.7		11.4	46.2	18.5	3.0	98.2		50.6	171.3	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	450	679		244	369	453	198	833		443	1018	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.80	0.22		0.09	0.37	0.38	0.03	0.51		0.66	0.74	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 109.4
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 26.6 Intersection LOS: C
Intersection Capacity Utilization 80.1% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	260	30	125	250	45	80
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	283	33	136	272	49	87
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			315		842	299
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			315		842	299
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		84	88
cM capacity (veh/h)			1245		298	741

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	315	408	136
Volume Left	0	136	49
Volume Right	33	0	87
cSH	1700	1245	482
Volume to Capacity	0.19	0.11	0.28
Queue Length 95th (m)	0.0	2.9	9.2
Control Delay (s)	0.0	3.5	15.4
Lane LOS		A	C
Approach Delay (s)	0.0	3.5	15.4
Approach LOS			C

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	100	135	200	5	10	145
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	147	217	5	11	158
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	223				584	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	223				584	220
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				98	81
cM capacity (veh/h)	1346				436	820

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	255	223	11	158
Volume Left	109	0	11	0
Volume Right	0	5	0	158
cSH	1346	1700	436	820
Volume to Capacity	0.08	0.13	0.02	0.19
Queue Length 95th (m)	2.1	0.0	0.6	5.7
Control Delay (s)	3.8	0.0	13.5	10.4
Lane LOS	A		B	B
Approach Delay (s)	3.8	0.0	10.6	
Approach LOS			B	

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	110	5	5	250	200	75
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	120	5	5	272	217	82
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	541	258	299			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	541	258	299			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	99	100			
cM capacity (veh/h)	500	780	1262			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	125	277	299
Volume Left	120	5	0
Volume Right	5	0	82
cSH	508	1262	1700
Volume to Capacity	0.25	0.00	0.18
Queue Length 95th (m)	7.7	0.1	0.0
Control Delay (s)	14.4	0.2	0.0
Lane LOS	B	A	
Approach Delay (s)	14.4	0.2	0.0
Approach LOS	B		

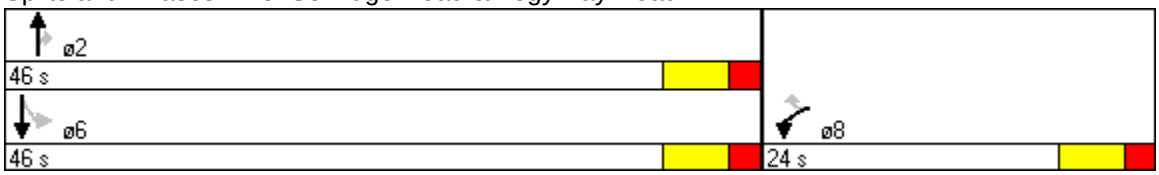
Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.399	
Satd. Flow (perm)	1770	1583	1863	1583	743	1863
Satd. Flow (RTOR)		109		98		
Volume (vph)	65	100	465	90	90	210
Lane Group Flow (vph)	71	109	505	98	98	228
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	11.2	11.2	57.4	57.4	57.4	57.4
Actuated g/C Ratio	0.15	0.15	0.77	0.77	0.77	0.77
v/c Ratio	0.28	0.34	0.35	0.08	0.17	0.16
Control Delay	24.5	8.1	4.3	1.0	4.1	3.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.5	8.1	4.3	1.0	4.1	3.3
LOS	C	A	A	A	A	A
Approach Delay	14.6		3.8			3.6
Approach LOS	B		A			A
Queue Length 50th (m)	7.5	0.0	18.2	0.0	3.0	6.8
Queue Length 95th (m)	17.0	11.1	37.0	3.5	8.8	15.2
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	438	474	1427	1235	569	1427
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	0.16	0.23	0.35	0.08	0.17	0.16

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 74.9
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.35
Intersection Signal Delay: 5.5 Intersection LOS: A
Intersection Capacity Utilization 43.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

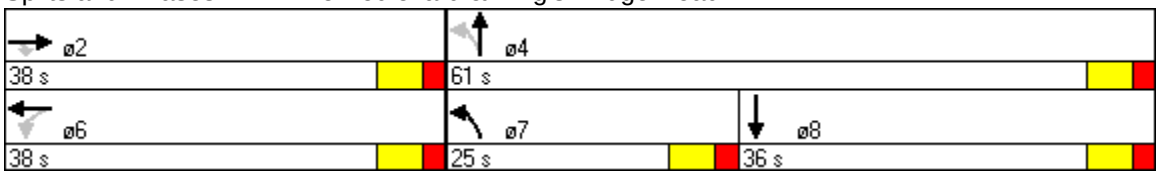


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1770	0	1770	3472	0	0	3525	0
Flt Permitted				0.629			0.292					
Satd. Flow (perm)	0	1863	1583	1172	1770	0	544	3472	0	0	3525	0
Satd. Flow (RTOR)			245		28			26			3	
Volume (vph)	0	135	225	230	110	55	270	920	130	0	485	15
Lane Group Flow (vph)	0	147	245	250	180	0	293	1141	0	0	543	0
Turn Type			Perm	Perm			pm+pt					
Protected Phases		2			6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	38.0	38.0	38.0	38.0	0.0	25.0	61.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		25.3	25.3	25.3	25.3		57.4	57.4			38.8	
Actuated g/C Ratio		0.28	0.28	0.28	0.28		0.63	0.63			0.43	
v/c Ratio		0.28	0.40	0.76	0.35		0.54	0.52			0.36	
Control Delay		26.3	5.2	45.5	23.1		12.6	10.9			20.6	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		26.3	5.2	45.5	23.1		12.6	10.9			20.6	
LOS		C	A	D	C		B	B			C	
Approach Delay		13.1			36.1			11.3			20.6	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		20.9	0.0	41.7	21.8		22.1	54.7			34.7	
Queue Length 95th (m)		36.1	16.3	69.8	39.2		43.7	88.5			61.3	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		640	705	403	626		586	2205			1509	
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		0.23	0.35	0.62	0.29		0.50	0.52			0.36	

Intersection Summary

Cycle Length: 99
Actuated Cycle Length: 90.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 17.2 Intersection LOS: B
Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

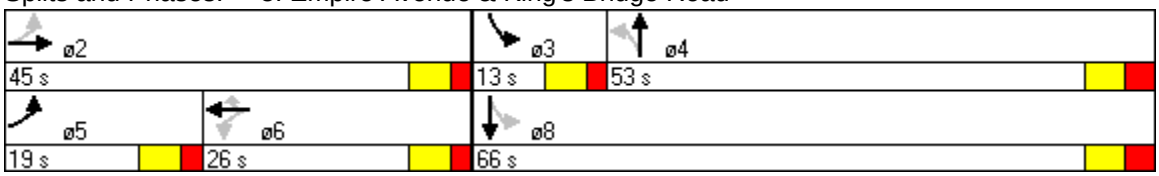


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1827	0	1770	1863	1583	1770	1853	0	1770	1771	0
Flt Permitted	0.369			0.701			0.343			0.118		
Satd. Flow (perm)	687	1827	0	1306	1863	1583	639	1853	0	220	1771	0
Satd. Flow (RTOR)		7				252		2			36	
Volume (vph)	315	70	10	30	180	300	1	605	20	125	390	190
Lane Group Flow (vph)	342	87	0	33	196	326	1	680	0	136	631	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	19.0	45.0	0.0	26.0	26.0	26.0	53.0	53.0	0.0	13.0	66.0	0.0
Act Effct Green (s)	41.0	41.0		22.0	22.0	22.0	49.0	49.0		62.0	62.0	
Actuated g/C Ratio	0.37	0.37		0.20	0.20	0.20	0.44	0.44		0.56	0.56	
v/c Ratio	0.85	0.13		0.13	0.53	0.63	0.00	0.83		0.55	0.63	
Control Delay	49.9	21.9		38.2	45.9	16.4	17.0	37.7		20.4	19.0	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	49.9	21.9		38.2	45.9	16.4	17.0	37.7		20.4	19.0	
LOS	D	C		D	D	B	B	D		C	B	
Approach Delay		44.3			28.1			37.7			19.3	
Approach LOS		D			C			D			B	
Queue Length 50th (m)	60.3	11.9		6.2	40.4	14.3	0.1	133.2		14.1	87.6	
Queue Length 95th (m)	#109.0	23.2		15.3	64.4	45.2	1.1	#193.4		24.3	126.0	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	400	679		259	369	516	282	819		249	1005	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.85	0.13		0.13	0.53	0.63	0.00	0.83		0.55	0.63	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 111
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 30.9 Intersection LOS: C
Intersection Capacity Utilization 80.2% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	150	45	60	330	95	160
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	163	49	65	359	103	174
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			212		677	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			212		677	188
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		74	80
cM capacity (veh/h)			1358		398	855

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	212	424	277
Volume Left	0	65	103
Volume Right	49	0	174
cSH	1700	1358	599
Volume to Capacity	0.12	0.05	0.46
Queue Length 95th (m)	0.0	1.2	19.5
Control Delay (s)	0.0	1.6	16.1
Lane LOS		A	C
Approach Delay (s)	0.0	1.6	16.1
Approach LOS			C

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	170	190	170	13	23	221
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	185	207	185	14	25	240
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	199				768	192
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	199				768	192
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	87				92	72
cM capacity (veh/h)	1373				320	850

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	391	199	25	240
Volume Left	185	0	25	0
Volume Right	0	14	0	240
cSH	1373	1700	320	850
Volume to Capacity	0.13	0.12	0.08	0.28
Queue Length 95th (m)	3.7	0.0	2.0	9.3
Control Delay (s)	4.4	0.0	17.2	10.9
Lane LOS	A		C	B
Approach Delay (s)	4.4	0.0	11.5	
Approach LOS			B	

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	112	10	8	195	295	131
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	122	11	9	212	321	142
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	621	392	463			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	621	392	463			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	73	98	99			
cM capacity (veh/h)	447	657	1098			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	133	221	463
Volume Left	122	9	0
Volume Right	11	0	142
cSH	459	1098	1700
Volume to Capacity	0.29	0.01	0.27
Queue Length 95th (m)	9.5	0.2	0.0
Control Delay (s)	16.0	0.4	0.0
Lane LOS	C	A	
Approach Delay (s)	16.0	0.4	0.0
Approach LOS	C		

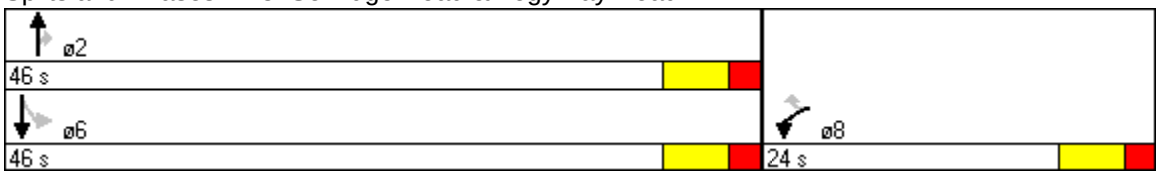
Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.638	
Satd. Flow (perm)	1770	1583	1863	1583	1188	1863
Satd. Flow (RTOR)		226		116		
Volume (vph)	137	208	175	107	190	410
Lane Group Flow (vph)	149	226	190	116	207	446
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	12.8	12.8	43.8	43.8	43.8	43.8
Actuated g/C Ratio	0.20	0.20	0.68	0.68	0.68	0.68
v/c Ratio	0.42	0.46	0.15	0.10	0.26	0.35
Control Delay	25.4	6.6	4.7	1.4	5.8	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.4	6.6	4.7	1.4	5.8	6.0
LOS	C	A	A	A	A	A
Approach Delay	14.1		3.5			5.9
Approach LOS	B		A			A
Queue Length 50th (m)	15.9	0.0	6.8	0.0	8.1	18.9
Queue Length 95th (m)	30.7	14.9	17.2	5.0	21.3	42.3
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	495	605	1262	1110	805	1262
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	0.30	0.37	0.15	0.10	0.26	0.35

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 64.6
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.46
Intersection Signal Delay: 7.7 Intersection LOS: A
Intersection Capacity Utilization 37.3% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

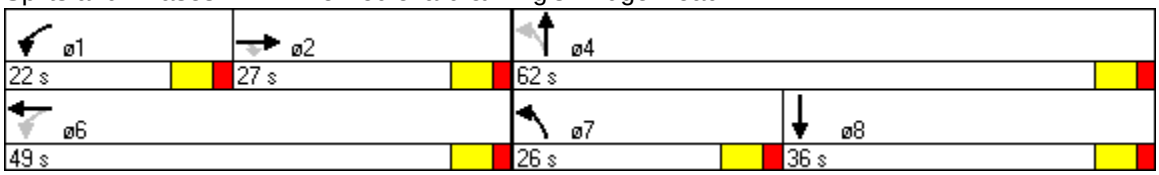


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1805	0	1770	3352	0	0	3536	0
Flt Permitted				0.552			0.111					
Satd. Flow (perm)	0	1863	1583	1028	1805	0	207	3352	0	0	3536	0
Satd. Flow (RTOR)			299		14			140			1	
Volume (vph)	0	96	275	288	96	25	165	410	225	0	797	5
Lane Group Flow (vph)	0	104	299	313	131	0	179	691	0	0	871	0
Turn Type			Perm	pm+pt			pm+pt					
Protected Phases		2		1	6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	27.0	27.0	22.0	49.0	0.0	26.0	62.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		16.1	16.1	37.4	37.4		58.2	58.2			41.0	
Actuated g/C Ratio		0.16	0.16	0.36	0.36		0.56	0.56			0.40	
v/c Ratio		0.36	0.60	0.63	0.20		0.57	0.36			0.62	
Control Delay		42.2	9.8	31.7	20.4		22.5	11.0			29.7	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		42.2	9.8	31.7	20.4		22.5	11.0			29.7	
LOS		D	A	C	C		C	B			C	
Approach Delay		18.2			28.4			13.4			29.7	
Approach LOS		B			C			B			C	
Queue Length 50th (m)		20.1	0.0	50.7	16.7		17.8	31.5			77.0	
Queue Length 95th (m)		36.4	23.3	76.0	30.0		40.7	50.3			119.8	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		388	567	537	740		414	1944			1397	
Starvation Cap Reductn		0	0	0	0		0	0			0	
Spillback Cap Reductn		0	2	1	0		0	0			0	
Storage Cap Reductn		0	0	0	0		0	0			0	
Reduced v/c Ratio		0.27	0.53	0.58	0.18		0.43	0.36			0.62	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 103.7
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 22.2 Intersection LOS: C
Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

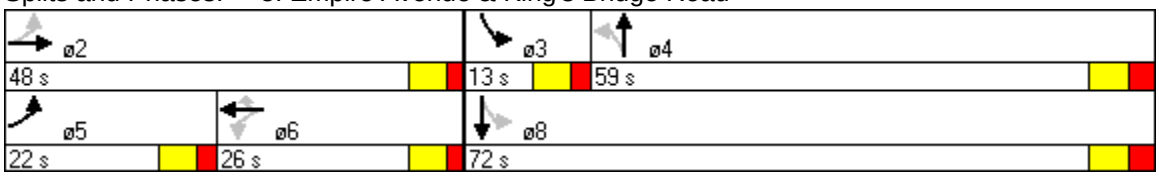


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1822	0	1770	1863	1583	1770	1855	0	1770	1762	0
Flt Permitted	0.464			0.660			0.155			0.311		
Satd. Flow (perm)	864	1822	0	1229	1863	1583	289	1855	0	579	1762	0
Satd. Flow (RTOR)		8				185		1			39	
Volume (vph)	353	120	20	20	125	170	5	412	10	287	504	284
Lane Group Flow (vph)	384	152	0	22	136	185	5	459	0	312	857	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	22.0	48.0	0.0	26.0	26.0	26.0	59.0	59.0	0.0	13.0	72.0	0.0
Act Effct Green (s)	43.8	43.8		21.8	21.8	21.8	55.0	55.0		68.0	68.0	
Actuated g/C Ratio	0.37	0.37		0.18	0.18	0.18	0.46	0.46		0.57	0.57	
v/c Ratio	0.85	0.23		0.10	0.40	0.42	0.04	0.54		0.75	0.84	
Control Delay	50.4	25.9		42.2	47.3	9.1	19.2	26.2		27.7	29.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.1	
Total Delay	50.4	25.9		42.2	47.3	9.1	19.2	26.2		27.7	30.0	
LOS	D	C		D	D	A	B	C		C	C	
Approach Delay		43.5			26.4			26.1			29.4	
Approach LOS		D			C			C			C	
Queue Length 50th (m)	76.4	24.3		4.6	30.0	0.0	0.7	79.9		38.7	162.1	
Queue Length 95th (m)	#127.9	40.8		12.4	50.2	20.0	3.3	112.5		#59.1	231.0	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	453	673		225	342	441	132	852		418	1017	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	4	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.85	0.23		0.10	0.40	0.42	0.04	0.54		0.75	0.85	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 119.8
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 31.4 Intersection LOS: C
Intersection Capacity Utilization 86.6% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	321	30	132	354	45	84
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	349	33	143	385	49	91
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			382		1037	365
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			382		1037	365
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			88		78	87
cM capacity (veh/h)			1177		225	680

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	382	528	140
Volume Left	0	143	49
Volume Right	33	0	91
cSH	1700	1177	399
Volume to Capacity	0.22	0.12	0.35
Queue Length 95th (m)	0.0	3.3	12.4
Control Delay (s)	0.0	3.3	18.9
Lane LOS		A	C
Approach Delay (s)	0.0	3.3	18.9
Approach LOS			C

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	223	135	200	20	23	246
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	242	147	217	22	25	267
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	239				860	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	239				860	228
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	82				91	67
cM capacity (veh/h)	1328				267	811

Direction, Lane #	EB 1	WB 1	SB 1	SB 2
Volume Total	389	239	25	267
Volume Left	242	0	25	0
Volume Right	0	22	0	267
cSH	1328	1700	267	811
Volume to Capacity	0.18	0.14	0.09	0.33
Queue Length 95th (m)	5.3	0.0	2.5	11.6
Control Delay (s)	5.8	0.0	19.9	11.6
Lane LOS	A		C	B
Approach Delay (s)	5.8	0.0	12.3	
Approach LOS			B	

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	143	9	10	250	200	116
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	155	10	11	272	217	126
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	574	280	343			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	574	280	343			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	99	99			
cM capacity (veh/h)	476	758	1216			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	165	283	343
Volume Left	155	11	0
Volume Right	10	0	126
cSH	487	1216	1700
Volume to Capacity	0.34	0.01	0.20
Queue Length 95th (m)	11.9	0.2	0.0
Control Delay (s)	16.1	0.4	0.0
Lane LOS	C	A	
Approach Delay (s)	16.1	0.4	0.0
Approach LOS	C		

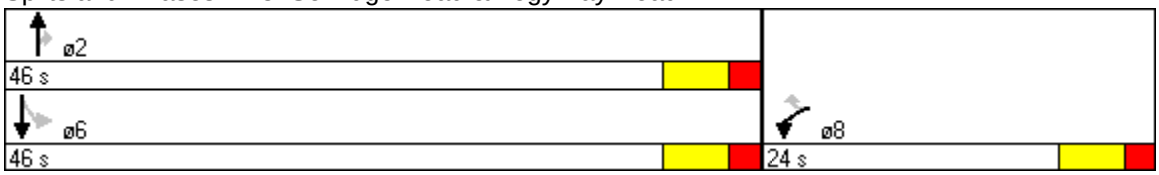
Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	36.4%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1583	1863	1583	1770	1863
Flt Permitted	0.950				0.399	
Satd. Flow (perm)	1770	1583	1863	1583	743	1863
Satd. Flow (RTOR)		236		184		
Volume (vph)	130	217	465	169	232	210
Lane Group Flow (vph)	141	236	505	184	252	228
Turn Type		Perm		Perm	Perm	
Protected Phases	8		2			6
Permitted Phases		8		2	6	
Total Split (s)	24.0	24.0	46.0	46.0	46.0	46.0
Act Effct Green (s)	12.5	12.5	43.8	43.8	43.8	43.8
Actuated g/C Ratio	0.19	0.19	0.68	0.68	0.68	0.68
v/c Ratio	0.41	0.47	0.40	0.16	0.50	0.18
Control Delay	25.3	6.8	6.2	1.3	10.2	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.3	6.8	6.2	1.3	10.2	4.7
LOS	C	A	A	A	B	A
Approach Delay	13.7		4.9			7.6
Approach LOS	B		A			A
Queue Length 50th (m)	15.0	0.0	22.0	0.0	12.1	8.3
Queue Length 95th (m)	29.3	15.4	48.5	6.1	37.4	19.9
Internal Link Dist (m)	176.4		167.9			146.8
Turn Bay Length (m)		50.0				
Base Capacity (vph)	495	612	1269	1137	506	1269
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	0.28	0.39	0.40	0.16	0.50	0.18

Intersection Summary

Cycle Length: 70
Actuated Cycle Length: 64.3
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.50
Intersection Signal Delay: 7.9 Intersection LOS: A
Intersection Capacity Utilization 54.5% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 3: Selfridge Road & Logy Bay Road

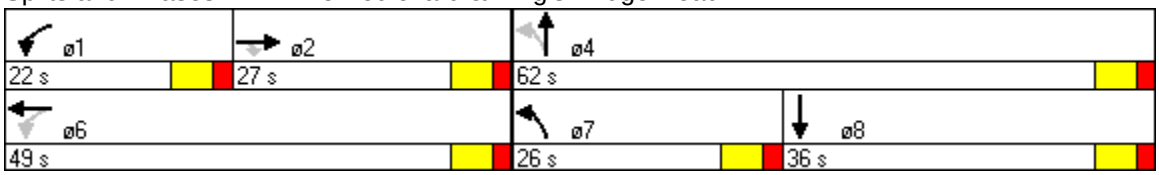


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	0	1863	1583	1770	1775	0	1770	3433	0	0	3525	0
Flt Permitted				0.447			0.253					
Satd. Flow (perm)	0	1863	1583	833	1775	0	471	3433	0	0	3525	0
Satd. Flow (RTOR)			245		25			41			3	
Volume (vph)	0	147	225	314	120	55	270	938	233	0	500	15
Lane Group Flow (vph)	0	160	245	341	190	0	293	1273	0	0	559	0
Turn Type			Perm	pm+pt			pm+pt					
Protected Phases		2		1	6		7	4			8	
Permitted Phases			2	6			4					
Total Split (s)	0.0	27.0	27.0	22.0	49.0	0.0	26.0	62.0	0.0	0.0	36.0	0.0
Act Effct Green (s)		20.1	20.1	41.7	41.7		58.2	58.2			36.9	
Actuated g/C Ratio		0.19	0.19	0.39	0.39		0.54	0.54			0.34	
v/c Ratio		0.46	0.49	0.72	0.27		0.63	0.68			0.46	
Control Delay		43.4	8.5	34.7	20.3		21.3	20.5			30.9	
Queue Delay		0.0	0.0	0.0	0.0		0.0	0.0			0.0	
Total Delay		43.4	8.5	34.7	20.3		21.3	20.5			30.9	
LOS		D	A	C	C		C	C			C	
Approach Delay		22.3			29.5			20.6			30.9	
Approach LOS		C			C			C			C	
Queue Length 50th (m)		31.9	0.0	56.4	24.3		36.7	107.2			53.3	
Queue Length 95th (m)		52.6	21.2	83.6	41.3		55.4	133.0			74.4	
Internal Link Dist (m)		379.8			276.9			80.8			138.4	
Turn Bay Length (m)			30.0	30.0			30.0					
Base Capacity (vph)		388	523	489	734		498	1870			1206	
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		0.41	0.47	0.70	0.26		0.59	0.68			0.46	

Intersection Summary

Cycle Length: 111
Actuated Cycle Length: 107.9
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 24.3 Intersection LOS: C
Intersection Capacity Utilization 68.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 4: The Boulevard & King's Bridge Road

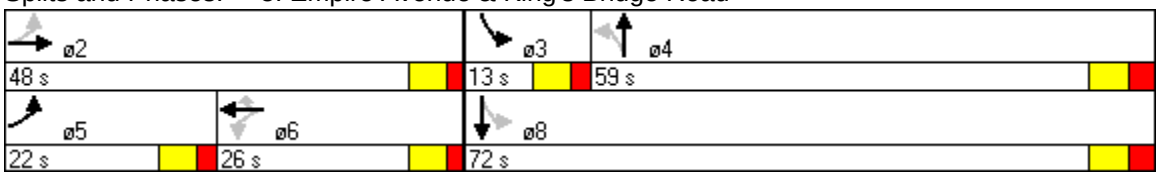


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1770	1827	0	1770	1863	1583	1770	1855	0	1770	1768	0
Flt Permitted	0.342			0.701			0.264			0.084		
Satd. Flow (perm)	637	1827	0	1306	1863	1583	492	1855	0	156	1768	0
Satd. Flow (RTOR)		7				221		2			36	
Volume (vph)	357	70	10	30	180	318	1	666	20	140	439	225
Lane Group Flow (vph)	388	87	0	33	196	346	1	746	0	152	722	0
Turn Type	pm+pt			Perm		Perm	Perm			pm+pt		
Protected Phases	5	2			6			4		3	8	
Permitted Phases	2			6		6	4			8		
Total Split (s)	22.0	48.0	0.0	26.0	26.0	26.0	59.0	59.0	0.0	13.0	72.0	0.0
Act Effct Green (s)	44.0	44.0		22.0	22.0	22.0	55.0	55.0		68.0	68.0	
Actuated g/C Ratio	0.37	0.37		0.18	0.18	0.18	0.46	0.46		0.57	0.57	
v/c Ratio	0.96	0.13		0.14	0.57	0.73	0.00	0.88		0.73	0.71	
Control Delay	69.4	23.9		42.9	52.2	26.7	18.0	42.5		38.9	22.6	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	69.4	23.9		42.9	52.2	26.7	18.0	42.5		38.9	22.6	
LOS	E	C		D	D	C	B	D		D	C	
Approach Delay		61.1			36.4			42.5			25.4	
Approach LOS		E			D			D			C	
Queue Length 50th (m)	77.3	13.0		6.9	44.8	29.0	0.1	163.3		17.0	117.9	
Queue Length 95th (m)	#121.7	24.9		16.7	70.2	65.7	1.2	#241.1		#48.0	166.3	
Internal Link Dist (m)		77.3			105.1			202.5			161.1	
Turn Bay Length (m)	40.0			35.0		35.0	35.0					
Base Capacity (vph)	404	674		239	342	471	226	851		209	1017	
Starvation Cap Reductn	0	0		0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0		0	0	
Storage Cap Reductn	0	0		0	0	0	0	0		0	0	
Reduced v/c Ratio	0.96	0.13		0.14	0.57	0.73	0.00	0.88		0.73	0.71	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 38.9 Intersection LOS: D
Intersection Capacity Utilization 86.6% 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: 5: Empire Avenue & King's Bridge Road



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Volume (veh/h)	265	45	67	424	95	168
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	288	49	73	461	103	183
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage veh)						
Upstream signal (m)	301					
pX, platoon unblocked						
vC, conflicting volume			337		919	312
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			337		919	312
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			94		64	75
cM capacity (veh/h)			1222		283	728

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	337	534	286
Volume Left	0	73	103
Volume Right	49	0	183
cSH	1700	1222	464
Volume to Capacity	0.20	0.06	0.62
Queue Length 95th (m)	0.0	1.5	32.5
Control Delay (s)	0.0	1.7	24.4
Lane LOS		A	C
Approach Delay (s)	0.0	1.7	24.4
Approach LOS			C

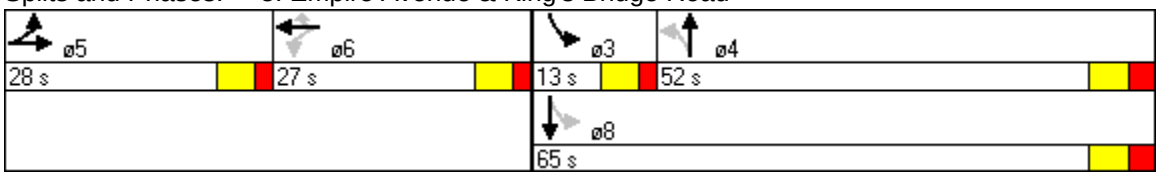
Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1681	1710	0	1770	1863	1583	0	3522	0	1770	1762	0
Flt Permitted	0.950	0.978		0.584				0.893		0.380		
Satd. Flow (perm)	1681	1710	0	1088	1863	1583	0	3148	0	708	1762	0
Satd. Flow (RTOR)		3				185		2			34	
Volume (vph)	353	120	20	20	125	170	5	412	10	287	504	284
Lane Group Flow (vph)	263	273	0	22	136	185	0	464	0	312	857	0
Turn Type	custom			Perm		Perm	Perm			pm+pt		
Protected Phases	5	5			6			4		3	8	
Permitted Phases	5			6		6	4			8		
Total Split (s)	28.0	28.0	0.0	27.0	27.0	27.0	52.0	52.0	0.0	13.0	65.0	0.0
Act Effct Green (s)	21.9	21.9		15.2	15.2	15.2		48.2		61.2	61.2	
Actuated g/C Ratio	0.20	0.20		0.14	0.14	0.14		0.44		0.55	0.55	
v/c Ratio	0.79	0.80		0.15	0.53	0.49		0.34		0.65	0.86	
Control Delay	60.3	60.4		44.3	52.3	10.8		22.3		23.0	32.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	60.3	60.4		44.3	52.3	10.8		22.3		23.0	32.3	
LOS	E	E		D	D	B		C		C	C	
Approach Delay		60.3			29.4			22.3			29.9	
Approach LOS		E			C			C			C	
Queue Length 50th (m)	60.1	61.8		4.6	29.7	0.0		37.0		38.2	161.0	
Queue Length 95th (m)	#105.6	#109.4		12.6	49.9	20.0		54.6		63.4	#273.9	
Internal Link Dist (m)		160.2			105.1			202.5			161.1	
Turn Bay Length (m)				35.0		35.0						
Base Capacity (vph)	359	368		212	363	458		1375		480	993	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.73	0.74		0.10	0.37	0.40		0.34		0.65	0.86	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 110.4
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 34.9 Intersection LOS: C
Intersection Capacity Utilization 89.1% 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: 5: Empire Avenue & King's Bridge Road

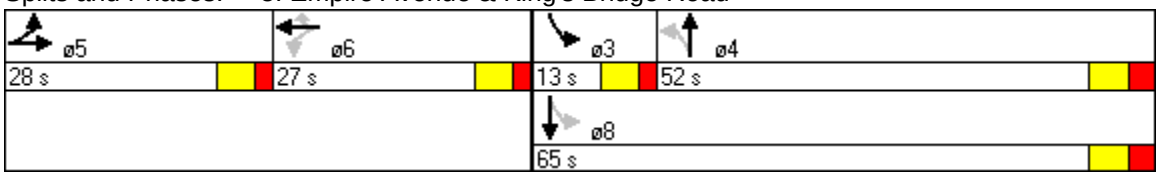


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Satd. Flow (prot)	1681	1703	0	1770	1863	1583	0	3525	0	1770	1768	0
Flt Permitted	0.950	0.969		0.601				0.954		0.226		
Satd. Flow (perm)	1681	1703	0	1120	1863	1583	0	3363	0	421	1768	0
Satd. Flow (RTOR)		2				188		3			31	
Volume (vph)	357	70	10	30	180	318	1	666	20	140	439	225
Lane Group Flow (vph)	233	242	0	33	196	346	0	747	0	152	722	0
Turn Type	custom			Perm		Perm	Perm			pm+pt		
Protected Phases	5	5			6			4		3	8	
Permitted Phases	5			6		6	4			8		
Total Split (s)	28.0	28.0	0.0	27.0	27.0	27.0	52.0	52.0	0.0	13.0	65.0	0.0
Act Effct Green (s)	21.0	21.0		18.8	18.8	18.8		48.3		61.3	61.3	
Actuated g/C Ratio	0.19	0.19		0.17	0.17	0.17		0.43		0.54	0.54	
v/c Ratio	0.75	0.76		0.18	0.63	0.82		0.52		0.45	0.74	
Control Delay	59.7	60.3		43.4	54.1	37.6		26.5		19.1	26.4	
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0		0.0	0.0	
Total Delay	59.7	60.3		43.4	54.1	37.6		26.5		19.1	26.4	
LOS	E	E		D	D	D		C		B	C	
Approach Delay		60.0			43.6			26.5			25.1	
Approach LOS		E			D			C			C	
Queue Length 50th (m)	55.6	57.4		6.9	44.2	37.6		71.2		18.7	131.0	
Queue Length 95th (m)	87.7	#90.8		16.7	69.4	#78.0		93.6		32.3	193.0	
Internal Link Dist (m)		160.2			105.1			202.5			161.1	
Turn Bay Length (m)				35.0		35.0						
Base Capacity (vph)	348	354		220	366	462		1438		336	972	
Starvation Cap Reductn	0	0		0	0	0		0		0	0	
Spillback Cap Reductn	0	0		0	0	0		0		0	0	
Storage Cap Reductn	0	0		0	0	0		0		0	0	
Reduced v/c Ratio	0.67	0.68		0.15	0.54	0.75		0.52		0.45	0.74	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 113.2
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 35.7 Intersection LOS: D
Intersection Capacity Utilization 90.7% 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: 5: Empire Avenue & King's Bridge Road



Appendix D

Intersection Level of Service

Summary Tables

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Summary Tables for Intersection Level of Service Analyses		
Intersection	**LOS Tables**	**Pages**
The Boulevard and Legion Road	D-1 and D-2	D-2 and D-3
Veterans Road and East White Hills Road	D-3 and D-4	D-4 and D-5
Selfridge Road and Logy Bay Road	D-5 and D-6	D-6 and D-7
The Boulevard and King's Bridge Road	D-7 and D-8	D-8 and D-9
Empire Avenue and King's Bridge Road	D-9 and D-10	D-10 and D-11
The Boulevard and Carnell Drive	D-11 and D-12	D-12 and D-13
NOTE: Level of service analysis sheets are included in Appendix C		

Table D-1 - LOS Summary The Boulevard and Legion Road - AM Peak Hours					
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement				Intersection LOS
	EB-LT	WB-TR	SB-L	SB-R	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-1)					
Delay	3.2	0.0	13.5	9.8	3.7
LOS	A	A	B	B	A
v/c	0.22	0.11	0.03	0.13	-
Queue	2.0	0.0	0.6	3.6	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-13)					
Delay	3.3	0.0	13.8	9.8	3.7
LOS	A	A	B	A	A
v/c	0.23	0.11	0.03	0.13	-
Queue	2.1	0.0	0.6	3.7	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-25)					
Delay	4.2	0.0	16.1	10.5	5.2
LOS	A	A	C	B	A
v/c	0.27	0.11	0.06	0.24	-
Queue	3.3	0.0	1.6	7.5	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-37)					
Delay	3.3	0.0	14.0	9.9	3.7
LOS	A	A	B	A	A
v/c	0.23	0.11	0.03	0.14	-
Queue	2.2	0.0	0.6	3.9	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development (Page C-49)					
Delay	4.4	0.0	17.2	10.9	5.6
LOS	A	A	C	B	A
v/c	0.28	0.12	0.08	0.28	-
Queue	3.7	0.0	2.0	9.3	-

Table D-2 - LOS Summary The Boulevard and Legion Road - PM Peak Hours					
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement				Intersection LOS
	EB-LT	WB-TR	SB-L	SB-R	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-7)					
Delay	3.7	0.0	13.1	10.3	4.2
LOS	A	A	B	B	A
v/c	0.18	0.12	0.02	0.18	-
Queue	2.0	0.0	0.6	5.3	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-19)					
Delay	3.7	0.0	13.2	10.4	4.3
LOS	A	A	B	B	A
v/c	0.18	0.13	0.02	0.19	-
Queue	2.0	0.0	0.6	5.6	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-31)					
Delay	5.4	0.0	17.6	11.3	5.9
LOS	A	A	C	B	A
v/c	0.26	0.14	0.07	0.30	-
Queue	4.4	0.0	1.8	10.0	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-43)					
Delay	3.8	0.0	13.5	10.4	4.3
LOS	A	A	B	B	A
v/c	0.19	0.13	0.02	0.19	-
Queue	2.1	0.0	0.6	5.7	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development (Page C-55)					
Delay	5.8	0.0	19.9	11.6	6.4
LOS	A	A	C	B	A
v/c	0.29	0.14	0.09	0.33	-
Queue	5.3	0.0	2.5	11.6	-

Table D-3 - LOS Summary Veterans Road and East White Hills Road - AM Peak Hours				
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement			Intersection LOS
	EB-LR	NB-LT	SB-TR	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-2)				
Delay	14.0	0.3	0.0	1.8
LOS	B	A	A	A
v/c	0.18	0.18	0.25	-
Queue	5.1	0.1	0.0	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-14)				
Delay	14.3	0.2	0.0	1.8
LOS	B	A	A	A
v/c	0.18	0.19	0.26	-
Queue	5.3	0.1	0.0	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-26)				
Delay	15.4	0.3	0.0	2.5
LOS	C	A	A	A
v/c	0.26	0.20	0.27	-
Queue	8.3	0.2	0.0	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-38)				
Delay	14.4	0.3	0.0	1.8
LOS	B	A	A	A
v/c	0.19	0.19	0.26	-
Queue	5.4	0.1	0.0	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development (Page C-50)				
Delay	16.0	0.4	0.0	2.7
LOS	C	A	A	A
v/c	0.29	0.20	0.27	-
Queue	9.5	0.2	0.0	-

Table D-4 - LOS Summary Veterans Road and East White Hills Road - PM Peak Hours				
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement			Intersection LOS
	EB-LR	NB-LT	SB-TR	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-8)				
Delay	13.8	0.2	0.0	2.6
LOS	B	A	A	A
v/c	0.23	0.20	0.17	-
Queue	6.9	0.1	0.0	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-20)				
Delay	14.3	0.2	0.0	2.6
LOS	B	A	A	A
v/c	0.24	0.22	0.18	-
Queue	7.6	0.1	0.0	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-32)				
Delay	15.6	0.4	0.0	3.3
LOS	C	A	A	A
v/c	0.32	0.23	0.20	-
Queue	10.8	0.2	0.0	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-44)				
Delay	14.4	0.2	0.0	2.6
LOS	B	A	A	A
v/c	0.25	0.22	0.18	-
Queue	7.7	0.1	0.0	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development (Page C-56)				
Delay	16.1	0.4	0.0	3.5
LOS	C	A	A	A
v/c	0.34	0.23	0.20	-
Queue	11.9	0.2	0.0	-

Table D-5 - LOS Summary Selfridge Road and Logy Bay Road - AM Peak Hours							
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement						Intersection LOS
	WB-L	WB-R	NB-T	NB-R	SB-L	SB-T	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-3)							
Delay	24.4	8.5	3.1	1.1	3.3	3.8	5.3
LOS	C	A	A	A	A	A	A
v/c	0.27	0.28	0.12	0.05	0.13	0.29	-
Queue	15.9	9.8	11.9	2.8	9.1	29.1	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-15)							
Delay	24.6	8.3	3.2	1.1	3.5	3.9	5.4
LOS	C	A	A	A	A	A	A
v/c	0.28	0.28	0.13	0.06	0.14	0.30	-
Queue	17.0	9.8	12.6	3.0	9.7	30.7	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-27)							
Delay	25.4	7.0	4.3	1.3	5.1	5.4	7.2
LOS	C	A	A	A	A	A	A
v/c	0.40	0.42	0.14	0.09	0.23	0.34	-
Queue	27.2	14.0	15.1	4.4	17.3	37.1	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-39)							
Delay	24.6	8.3	3.2	1.1	3.5	4.0	5.4
LOS	C	A	A	A	A	A	A
v/c	0.28	0.29	0.13	0.06	0.14	0.31	-
Queue	17.0	10.0	12.9	3.0	9.7	31.6	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development (Page C-51)							
Delay	25.4	6.6	4.7	1.4	5.8	6.0	7.7
LOS	C	A	A	A	A	A	A
v/c	0.42	0.46	0.15	0.10	0.26	0.35	-
Queue	30.7	14.9	17.2	5.0	21.3	42.3	-

Table D-6 - LOS Summary Selfridge Road and Logy Bay Road - PM Peak Hours							
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement						Intersection LOS
	WB-L	WB-R	NB-T	NB-R	SB-L	SB-T	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-9)							
Delay	24.4	8.3	4.1	1.0	3.9	3.2	5.3
LOS	C	A	A	A	A	A	A
v/c	0.26	0.33	0.34	0.07	0.15	0.15	-
Queue	15.9	10.9	34.4	3.4	8.1	14.2	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-21)							
Delay	24.5	8.1	4.2	1.0	4.1	3.3	5.4
LOS	C	A	A	A	A	A	A
v/c	0.28	0.34	0.34	0.08	0.17	0.16	-
Queue	17.0	11.1	34.9	3.5	8.7	14.9	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-33)							
Delay	25.3	7.1	5.7	1.2	8.0	4.4	7.3
LOS	C	A	A	A	A	A	A
v/c	0.39	0.45	0.38	0.14	0.42	0.17	-
Queue	26.8	14.8	43.1	5.3	26.8	17.9	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-45)							
Delay	24.5	8.1	4.3	1.0	4.1	3.3	5.5
LOS	C	A	A	A	A	A	A
v/c	0.28	0.34	0.35	0.08	0.17	0.16	-
Queue	17.0	11.1	37.0	3.5	8.8	15.2	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development (Page C-57)							
Delay	25.3	6.8	6.2	1.3	10.2	4.7	7.9
LOS	C	A	A	A	B	A	A
v/c	0.41	0.47	0.40	0.16	0.50	0.18	-
Queue	29.3	15.4	48.5	6.1	37.4	19.9	-

Table D-7 - LOS Summary The Boulevard and King's Bridge Road - AM Peak Hours								
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement							Intersection LOS
	EB-T	EB-R	WB-L	WB-TR	NB-L	NB-TR	SB-TR	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-4)								
Delay	26.5	6.2	40.0	23.6	10.6	5.5	16.6	14.8
LOS	C	A	D	C	B	A	B	B
v/c	0.21	0.48	0.66	0.25	0.47	0.25	0.46	-
Queue	24.5	18.0	53.6	26.3	23.3	29.3	80.0	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-16)								
Delay	26.4	6.0	40.4	22.8	12.6	5.8	17.8	15.5
LOS	C	A	D	C	B	A	B	B
v/c	0.22	0.48	0.68	0.25	0.49	0.26	0.48	-
Queue	25.8	18.0	56.5	26.8	28.3	31.5	87.9	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-28)								
Delay	24.7	5.1	45.2	21.9	15.4	7.0	21.5	18.2
LOS	C	A	D	C	B	A	C	B
v/c	0.19	0.44	0.78	0.23	0.52	0.30	0.53	-
Queue	26.8	17.7	79.5	28.6	13.3	35.4	95.5	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-40)								
Delay	26.4	6.0	40.4	23.4	13.2	5.9	18.0	15.6
LOS	C	A	D	C	B	A	B	B
v/c	0.22	0.49	0.68	0.27	0.50	0.27	0.50	-
Queue	25.8	18.1	56.5	27.9	29.6	32.6	90.6	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development (Page C-52)								
Delay	42.2	9.8	31.7	20.4	22.5	11.0	29.7	22.2
LOS	D	A	C	C	C	B	C	C
v/c	0.36	0.60	0.63	0.20	0.57	0.36	0.62	-
Queue	36.4	23.3	76.0	30.0	40.7	50.3	119.8	-

Table D-8 - LOS Summary The Boulevard and King's Bridge Road - PM Peak Hours								
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement							Intersection LOS
	EB-T	EB-R	WB-L	WB-TR	NB-L	NB-TR	SB-TR	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-10)								
Delay	26.3	5.3	43.8	23.2	11.4	10.1	19.3	16.3
LOS	C	A	D	C	B	B	B	B
v/c	0.27	0.39	0.74	0.34	0.50	0.48	0.33	-
Queue	33.9	16.0	65.5	36.9	41.1	81.9	56.9	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-22)								
Delay	26.3	5.5	44.7	23.3	12.1	10.5	20.1	16.8
LOS	C	A	D	C	B	B	C	B
v/c	0.28	0.39	0.75	0.36	0.53	0.50	0.35	-
Queue	34.9	16.1	67.7	39.2	42.7	85.5	59.8	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-34)								
Delay	25.1	4.8	54.3	2.5	14.3	13.3	23.0	20.1
LOS	C	A	D	C	B	B	C	C
v/c	0.26	0.36	0.86	0.33	0.55	0.58	0.39	-
Queue	37.2	16.1	103.0	41.3	42.7	96.5	61.3	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-46)								
Delay	26.3	5.2	45.5	23.1	12.6	10.9	20.6	17.2
LOS	C	A	D	C	B	B	C	B
v/c	0.28	0.40	0.76	0.35	0.54	0.52	0.36	-
Queue	36.1	16.3	69.8	39.2	43.7	88.5	61.3	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development (Page C-58)								
Delay	43.4	8.5	34.7	20.3	21.3	20.5	30.9	24.3
LOS	D	A	C	C	C	C	C	C
v/c	0.46	0.49	0.72	0.27	0.63	0.68	0.46	-
Queue	52.6	21.2	83.6	41.3	55.4	133.0	74.4	-

Table D-9 - LOS Summary Empire Avenue and King's Bridge Road - AM Peak Hours

LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement									Intersection LOS
	EB-L	EB-TR	WB-L	WB-T	WB-R	NB-L	NB-TR	SB-L	SB-TR	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-5)										
Delay	41.1	23.8	37.8	42.4	8.9	18.0	23.7	19.2	20.7	24.9
LOS	D	C	D	D	A	B	C	B	C	C
v/c	0.77	0.23	0.10	0.38	0.39	0.02	0.48	0.61	0.70	-
Queue	91.0	36.8	11.4	43.0	18.0	3.0	92.2	48.9	155.9	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-17)										
Delay	43.1	23.7	37.8	42.4	8.8	18.2	24.1	20.3	21.8	25.8
LOS	D	C	D	D	A	B	C	C	C	C
v/c	0.79	0.22	0.10	0.38	0.40	0.02	0.49	0.63	0.72	-
Queue	99.2	36.8	11.4	44.3	18.0	3.0	95.2	49.7	165.0	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-29)										
Delay	46.3	23.7	37.7	42.1	8.6	18.6	25.2	23.8	26.0	28.2
LOS	D	C	D	D	A	B	C	C	C	C
v/c	0.83	0.22	0.09	0.37	0.40	0.03	0.53	0.70	0.80	-
Queue	112.2	36.8	11.4	44.3	18.4	3.1	103.1	52.4	199.1	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-41)										
Delay	44.6	23.9	37.7	42.6	8.6	18.2	24.6	21.5	22.7	26.6
LOS	D	C	D	D	A	B	C	C	C	C
v/c	0.81	0.23	0.10	0.39	0.40	0.03	0.51	0.66	0.74	-
Queue	104.8	37.7	11.4	46.2	18.5	3.0	98.2	50.6	171.3	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development - Existing Phasing (Page C-53)										
Delay	50.4	25.9	42.2	47.2	9.1	19.2	26.2	27.7	30.0	31.4
LOS	D	C	D	D	A	B	C	C	C	C
v/c	0.85	0.23	0.10	0.40	0.42	0.04	0.54	0.75	0.84	-
Queue	127.9	40.8	12.4	50.2	20.0	3.3	112.5	59.1	231.0	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development - Revised Phasing (Page C-61										
Delay	60.3	60.4	44.3	52.3	10.8	22.3		23.0	32.3	34.9
LOS	E	E	D	D	B	C		C	C	C
v/c	0.79	0.80	0.15	0.53	0.49	0.34		0.65	0.86	-
Queue	105.6	109.4	12.6	49.9	20.0	54.6		63.4	273.9	-

Table D-10 - LOS Summary Empire Avenue and King's Bridge Road - PM Peak Hours										
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement									Intersection LOS
	EB-L	EB-TR	WB-L	WB-T	WB-R	NB-L	NB-TR	SB-L	SB-TR	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-11)										
Delay	44.3	21.5	38.3	45.7	12.8	17.0	34.3	17.7	18.1	28.2
LOS	D	C	D	D	B	B	C	B	B	C
v/c	0.80	0.12	0.13	0.52	0.60	0.00	0.78	0.48	0.60	-
Queue	95.9	21.9	15.3	61.0	35.6	1.1	173.8	23.2	119.3	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-23)										
Delay	47.2	21.9	38.2	45.4	15.1	17.0	36.7	19.6	18.9	29.9
LOS	D	C	D	D	B	B	D	B	B	C
v/c	0.83	0.13	0.13	0.51	0.62	0.00	0.82	0.53	0.62	-
Queue	104.0	23.2	15.3	62.6	42.0	1.1	183.2	24.1	124.3	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-35)										
Delay	59.6	21.9	38.2	45.4	20.0	18.0	42.2	33.6	21.1	35.2
LOS	E	C	D	D	C	B	D	C	C	D
v/c	0.92	0.13	0.13	0.51	0.67	0.00	0.88	0.68	0.69	-
Queue	128.4	23.2	15.3	62.6	53.2	1.1	222.1	42.2	148.6	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-47)										
Delay	49.9	21.9	38.2	45.9	16.4	17.0	37.7	20.4	19.0	30.9
LOS	D	C	D	D	B	B	D	C	B	C
v/c	0.85	0.13	0.13	0.53	0.63	0.00	0.83	0.55	0.63	-
Queue	109.0	23.2	15.3	64.4	45.2	1.1	193.4	24.3	126.0	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development - Existing Phasing (Page C-59)										
Delay	69.4	23.9	42.9	52.2	26.7	18.0	42.5	38.9	22.6	38.9
LOS	E	C	D	D	C	B	D	D	C	D
v/c	0.96	0.13	0.14	0.57	0.73	0.00	0.88	0.73	0.71	-
Queue	121.7	24.9	16.7	70.2	65.7	1.2	241.1	48.0	166.3	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development - Revised Phasing (Page C-62)										
Delay	59.7	60.3	43.4	54.1	37.6	26.5		19.1	26.4	35.7
LOS	E	E	D	D	D	C		B	C	D
v/c	0.75	0.76	0.18	0.63	0.82	0.52		0.45	0.74	-
Queue	87.7	90.8	16.7	69.4	78.0	93.6		32.3	193.0	-

Table D-11 - LOS Summary The Boulevard and Carnell Drive - AM Peak Hours				
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement			Intersection LOS
	EB-TR	WB-LT	NB-LR	
Projected 2007 AM Design Hourly Volumes Without Development (Page C-6)				
Delay	0.0	3.4	14.9	4.0
LOS	A	A	B	A
v/c	0.18	0.31	0.26	-
Queue	0.0	2.8	8.4	-
Projected 2010 AM Design Hourly Volumes Without Development (Page C-18)				
Delay	0.0	3.5	15.2	4.0
LOS	A	A	C	A
v/c	0.18	0.32	0.27	-
Queue	0.0	3.5	15.2	-
Projected 2010 AM Design Hourly Volumes With Stage 1 Development (Page C-30)				
Delay	0.0	3.3	17.7	4.1
LOS	A	A	C	A
v/c	0.21	0.41	0.32	-
Queue	0.0	3.2	11.0	-
Projected 2012 AM Design Hourly Volumes Without Development (Page C-42)				
Delay	0.0	3.5	15.4	4.1
LOS	A	A	C	A
v/c	0.19	0.33	0.28	-
Queue	0.0	2.9	9.2	-
Projected 2012 AM Design Hourly Volumes With Full Built-out Development (Page C-54)				
Delay	0.03	3.3	18.9	4.2
LOS	A	A	C	A
v/c	0.22	0.45	0.35	-
Queue	0.0	3.3	12.4	-

Table D-12 - LOS Summary The Boulevard and Carnell Drive - PM Peak Hours				
LOS Criteria	Control Delay (sec/veh), LOS, v/c Ratio, and 95% Queue (m) by Intersection Movement			Intersection LOS
	EB-TR	WB-LT	NB-LR	
Projected 2007 PM Design Hourly Volumes Without Development (Page C-12)				
Delay	0.0	1.5	14.9	5.3
LOS	A	A	B	A
v/c	0.12	0.29	0.43	-
Queue	0.0	1.1	16.9	-
Projected 2010 PM Design Hourly Volumes Without Development (Page C-24)				
Delay	0.0	1.6	15.8	5.6
LOS	A	A	C	A
v/c	0.12	0.30	0.46	-
Queue	0.0	1.2	19.0	-
Projected 2010 PM Design Hourly Volumes With Stage 1 Development (Page C-36)				
Delay	0.0	1.6	21.3	6.3
LOS	A	A	C	A
v/c	0.18	0.40	0.57	-
Queue	0.0	1.4	28.0	-
Projected 2012 PM Design Hourly Volumes Without Development (Page C-48)				
Delay	0.0	1.6	16.1	5.6
LOS	A	A	C	A
v/c	0.12	0.31	0.46	-
Queue	0.0	1.2	19.5	-
Projected 2012 PM Design Hourly Volumes With Full Built-out Development (Page C-60)				
Delay	0.0	1.7	24.4	6.8
LOS	A	A	C	A
v/c	0.20	0.44	0.62	-
Queue	0.0	1.5	32.5	-

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