THE CITY OF OTTAWA

King Edward Avenue Lane Reduction Impact Study

Phase 2 Final Report - August 27, 2010

DILLON CONSULTING

August 27, 2010

The City of Ottawa
Community Sustainability Department
110 Laurier Avenue West, 4th Floor East
Ottawa, Ontario K1P 1J1

Attention: Michael Murr, Director of Community Sustainability

Re: King Edward Avenue Lane Reduction Impact Study
Phase 2 Draft Report

Dear Mr. Murr:

Enclosed, please find our Final Report for Phase 2 of the King Edward Lane Reduction Impact Study.

We look forward to presenting our findings at Transportation Committee.

Should you have any questions, please do not hesitate to contact the undersigned.

Yours sincerely,

DILLON CONSULTING LIMITED

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Encl.

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Executive Summary

Introduction

King Edward Avenue is a six lane arterial street which currently serves multiple roles in the transportation network in central Ottawa.

During infrastructure renewal construction, the six-lane roadway cross-section has operated as a four-lane roadway. While congestion has been evident in the corridor, the King Edward Avenue Task Force ("Task Force") believes that traffic demands are fundamentally being served, and a request was made to consider the feasibility of permanently reducing the cross-section of King Edward Avenue to four lanes between Rideau Street and Sussex Avenue.

Phase 1 of the Study considered the feasibility of lane reduction scenarios. It identified the transportation system impacts and effects on the community of reducing King Edward Avenue from a six lane to a four lane cross-section. Among other things, Phase 1 of the study confirmed that there was sufficient merit to consider a lane reduction and that an evaluation was necessary to determine which specific lane reduction was appropriate. The report describing the work completed during Phase 1 is available under separate cover as the "King Edward Avenue Lane Reduction Impact Study, Final Report – August 14, 2009."

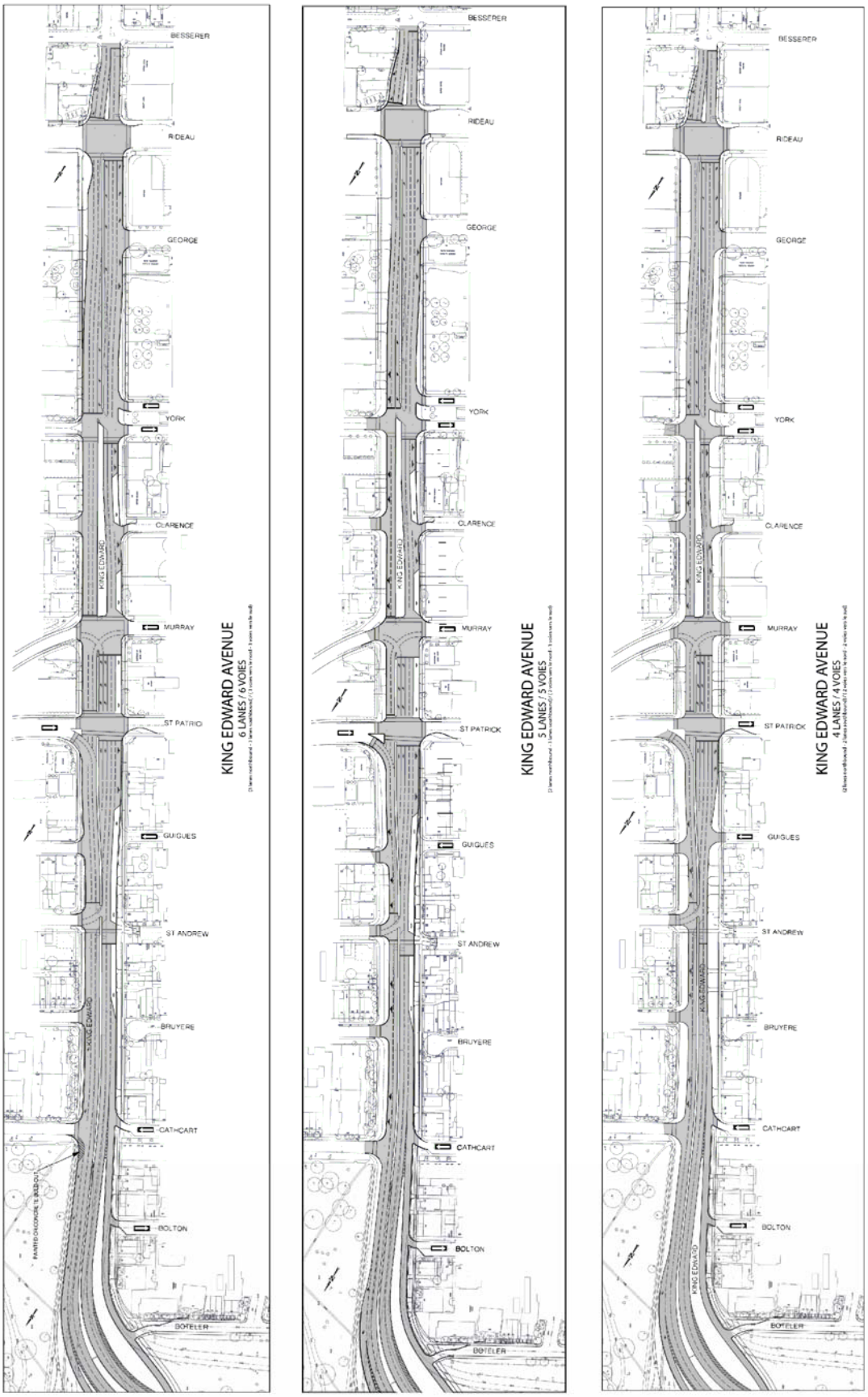
Phase 2 of the study comprised:

- An update to the computer modelling of traffic, noise, and air quality undertaken during Phase 1 as a result of updated information;
- Stakeholder consultation, including two "roundtable" workshops and a public information centre; and,
- An evaluation that weighs the positive and negative impacts and clearly provides a rationale for a particular scenario.

This report summarizes the work completed as part of Phase 2.

Review of Roadway Scenarios

Three roadway configurations were considered for comparative purposes in this study. These scenarios are illustrated below:


KING EDWARD AVENUE
6 LANES / 6 VOIES
KING EDWARD AVENUE
5 LANES / 5 VOIES
KING EDWARD AVENUE
4 LANES / 4 VOIES
BESSERER
RIDEAU
GEORGE
YORK
CLARENCE
KING EDWARD
MURRAY
ST PATRICK
GUIGUES
ST ANDREW
BRUYERE
CATHCART
BOLTON
BOTELER

Computer Modelling Overview

Phase 2 of the study included additional computer modelling tasks to account for changes to the scenarios being assessed. Modelling was undertaken at both the corridor level (using VISSIM) and at the intersection level (using Synchro).

At the outset of the study it was agreed that the traffic volumes used in modelling should reflect the conditions experienced during construction. A consensus was reached at the time to use traffic volumes based on those counted during construction. Prior to construction, King Edward Avenue was operating as an unimpeded six lane arterial road and peak period traffic volumes were higher than during construction. As the reconstruction project nears completion and the street is back to six lanes, traffic volume during the peak hour had returned, for the most part, to pre-construction levels.

Dillon used all available City of Ottawa intersection count data (up to and including 2008) and bridge count data (up to 2007 was available when we initiated our analysis) in order to generate traffic volumes for a "baseline" 2008 traffic model. It is important to recognize that the traffic volume counts in recent years are affected by the fact that the corridor has been under construction. The final traffic volumes, used in Phase 1, represent the expected volumes in the year 2010 assuming traffic trends continue as observed over the past number of years -- based on traffic counts conducted during construction along the King Edward Avenue corridor.

It was found that the initial signal timing plans provided by the City of Ottawa (in January 2009) did not capture the full complexity of the operations of both the intersections of King Edward Avenue / Murray Street / St. Patrick Street and King Edward Avenue / Rideau Street. The updated VISSIM model used the corrected signal timing plans provided by the City of Ottawa in June 2009.

A summary of the computer modelling results relevant to Phase 2 are illustrated on the following page and discussed below.

Motorists: Results of the VISSIM modelling suggests that, in the AM peak period, there is only a minor impact to vehicle travel time in the 4-Lane Configuration. In the PM peak period, the modelling suggests that northbound automobiles will take up to 20% longer to travel through the corridor in the 5-Lane Configuration (6 minutes 33 seconds) and in the 4-Lane Configuration (6 minutes 27 seconds). As noted earlier, the traffic volumes modelled are based on traffic volumes counted during construction.

Transportation Modelling Results			Scenario 1 – 6-lane Configuration				Scenario 2 – 5-lane Configuration				Scenario 3 – 4-lane Configuration			
			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Motorists														
Criteria 1	Traffic volume in corridor [vehicles][†]	Peak direction flow between NB	550	1,300	1,700	4,050	550	1,300	1,600	4,000	550	1,300	1,650	4,050
		St. Patrick & Murray SB	1,900	4,500	1,500	3,600	1,900	4,500	1,500	3,600	1,900	4,500	1,500	3,650
Criteria 2	Corridor congestion [min:sec]	NB average travel time	04:08	04:07	05:29	05:23	04:15	04:11	06:33	06:33	04:14	04:11	06:58	06:27
		SB average travel time	03:02	03:01	03:29	03:26	03:00	02:59	03:35	03:35	03:09	03:06	03:50	03:47
Criteria 3	Traffic impact to local streets in the King Edward corridor [vehicles]		Expected to be negligible				Expected to be negligible				Expected to be negligible			
Criteria 4	Ability to accommodate on-street parking [parking stall hours 7am to 7pm]		556				200				0			
Pedestrians														
Criteria 5A	Pedestrian walking time along primary pedestrian route* [min]	Sussex to Rideau	21	21	22	21.5	21	21	22	21.5	21	21	21.5	21.5
		MacKenzie to Vanier	27.5	27	28	28	27	27	28	28	27	27	27.5	28
Criteria 5B	Average pedestrian waiting + crossing time at a key intersection [min:sec]	St. Patrick	01:11	01:10	01:21	01:21	01:11	01:10	01:20	01:20	01:11	01:10	01:17	01:20
		Murray	01:02	01:02	01:10	01:10	01:02	01:02	01:11	01:11	01:00	01:01	01:12	01:10
Cyclists														
Criteria 6	Cycling travel time for commuter cyclists* [min]	Sussex to Rideau	8.5	8.5	9.5	9	8	8.5	9	9	8	8	9	9
		MacKenzie to Vanier	10.5	10.5	11	11	10.5	10.5	11	11	10.5	10.5	11	11
Criteria 7	Effect on cycling network connectivity		To be discussed in the report				To be discussed in the report				To be discussed in the report			
Transit														
Criteria 8	Transit travel time [min:sec]	Average time	-	-	02:11	02:10	-	-	02:08	02:08	-	-	02:40	02:39
Criteria 9	Travel time reliability [min:sec]	90th percentile time	-	-	02:48	02:53	-	-	02:37	02:46	-	-	03:23	03:45
Criteria 10	Transit vehicle volume [# buses per period]		-	-	119	298	-	-	119	298	-	-	119	298
Goods Movement														
Criteria 11	Truck corridor travel time [min:sec]	Northbound time	03:42	03:40	04:08	04:03	03:50	03:47	05:09	05:09	03:49	03:45	05:32	05:05
		Southbound time	03:01	02:59	03:12	03:10	03:00	02:58	03:06	03:06	03:12	03:08	03:30	03:29
Criteria 12	Peak truck flow [# trucks per period]	Northbound flow	76	180	64	154	75	180	62	154	73	178	65	150
		Southbound flow	107	262	56	137	108	262	54	135	114	268	58	140
Impacts on Other Communities														
Criteria 13	Potential external impacts on other communities due to traffic displacement [vehicles]		Negligible	Negligible	150 (NB)	300 (NB)	Negligible	Negligible	250 (NB)	350 (NB)	Negligible	Negligible	200 (NB)	300 (NB)
Criteria 14	Potential duration of impact on other communities due to dispersed traffic [hours]		Negligible	Negligible	~2.5 hours	~2.5 hours	Negligible	Negligible	>2.5 hours	>2.5 hours	Negligible	Negligible	>2.5 hours	>2.5 hours

† The computer modelling uses traffic counts during construction that were factored up for the year 2010

*Approximate; calculation based on typical walking / cycling speed plus the waiting times at the intersection

Air Quality			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Criteria 15	Carbon monoxide (CO) concentrations [parts per million]		-	-	5.2 - 10.6	-	-	-	5.6 - 11.3	-	-	-	5.0 - 8.7	-
Criteria 16	Nitrous oxides (NO_x) concentrations [parts per million]		-	-	0.2 - 0.8	-	-	-	0.4 - 0.8	-	-	-	0.4 - 0.6	-
Criteria 17	Particulate ($PM_{2.5}$) concentrations [micrograms]		-	-	20 - 26	-	-	-	20 - 25	-	-	-	19 - 23	-
Criteria 18	Sulphur dioxide (SO_2) concentrations [parts per billion]		-	-	3.0 - 4.4	-	-	-	3.4 - 4.0	-	-	-	3.0 - 3.9	-

Noise			AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
			Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Criteria 19	Predicted noise levels [decibels - dBA]		-	-	67.9 - 74.3	-	-	-	66.6 - 72.7	-	-	-	66.0 - 73.6	-

Pedestrians: Results of the VISSIM modelling suggests that pedestrian walking time along area corridors are not significantly affected by changes to the lane configuration. However, waiting times to cross King Edward Avenue are reduced with the 5-Lane and 4-Lane Configurations.[1] The results speak only to travel time and not the pedestrian environment under any particular lane configuration.

Cyclists: The cycling results of the model mirror those of the pedestrian findings (i.e., not significantly affected by changes to the lane configuration). The results speak only to travel time and not the cycling environment under any particular lane configuration.

Transit: Results of the VISSIM modelling suggests that STO buses through King Edward Avenue are expected to experience an increased travel time (around 22% at 2 minutes 39 seconds) and decreased reliability with the 4-Lane Configuration. However, the modelling indicates that all the necessary buses are expected to be able to get through the corridor in the peak hour.

Goods movement: In the PM peak period, the VISSIM modelling suggests that northbound trucks will take up to 25% longer to travel through the corridor in the 5-Lane Configuration (5 minutes 9 seconds) and in the 4-Lane Configuration (5 minutes 5 seconds). The volume of trucks able to pass through the corridor is not expected to change.

Impacts on other communities: The empirical modelling results do not indicate a great variation in vehicles able to pass through the King Edward corridor between lane configurations. During the simulation, it was observed that constraints on King Edward Avenue cause extended queues to build up to the edge of the study area. This has the potential to cause traffic disturbances outside the study area. Based on these observations it is expected that the potential disturbance caused by the 5-lane and 4-lane configurations may last longer than 2.5 hours whereas the potential disturbance caused by the 6-lane configuration may last approximately 2.5 hours.[2]

Safety considerations: Pedestrian exposure to traffic is reduced in both the 5-Lane and 4-Lane Configurations as crossing distances are shorter with fewer lanes. Similarly the modelling demonstrates an increase in travel time along King Edward Avenue for these scenarios. This can be interpreted as a reduction in average travel speed which has positive implications on safety.[3]

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[1] If longer cycle lengths are required over time to improve north/south traffic flow, then this could increase pedestrian waiting time at the intersections.

[2] If there are concerns about impacts to other communities, this can be addressed as part of a monitoring program which is discussed later in this report.

[3] An intersection may be blocked with vehicles during peak times; the safety of pedestrians crossing the intersection under this condition has not been modelled.

Synchro Modelling: In general the Synchro results support the findings of the VISSIM analysis which show that a reduction in lanes is expected to negatively affect the efficiency of vehicular movements through the intersections. At a corridor level all scenarios perform more or less adequately during the AM peak hour (level of service E or better). In the PM peak hour the 6-Lane Configuration experiences difficulty processing the traffic at the intersection of Rideau Street and King Edward Avenue (level of service F). The remaining intersections in the corridor operate acceptably (level of service E or better). However, the 5-Lane and 4-Lane Configurations operate at level of service F at both the intersection of Rideau Street with King Edward Avenue and the intersection of St. Patrick Street / Murray Street with King Edward Avenue.[4]

6 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	D
109	St. Patrick Street & King Edward Avenue	E
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	A
114	Rideau Street & King Edward Avenue	F

5 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	F
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	F
112	York Street & King Edward Avenue	B
114	Rideau Street & King Edward Avenue	F

4 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	F
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	E
114	Rideau Street & King Edward Avenue	F

NOTES:
Average Delay and Queue values based on SimTraffic Results.
SimTraffic network seeded for 30 minutes and recorded for 60 minutes, data gathered over five simulation runs.
Maximum v/c and Weighted v/c values based on HCM Signalized intersection results from Synchro 6.

Overall, the transportation modelling suggests that most vehicles will be able to travel through the corridor during peak periods in the 5-Lane and 4-Lane Configurations. The evaluation identifies that with either the 5-Lane or 4-Lane Configuration there will likely be reduced speeds, greater vehicle travel time, more bus travel time and less bus reliability. These effects may be particularly evident in the short term causing some operational difficulties. It is expected, and supported through research reported in *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence*, that the majority of these difficulties will be transitional in nature.

It is expected that traffic will still flow regardless of the scenario and, over the long term, improvements in motorist behaviour and travel patterns acknowledging fewer lanes in the corridor will emerge.

[4] The intersection of St. Andrew Street and King Edward Avenue operates at level of service F for the 5-Lane and 4-Lane configuration; however, for vehicles travelling along King Edward Avenue, this intersection is not as important as the other intersections.

Summary of Public Consultation

Two roundtable sessions and a public information centre were held to provide public consultation opportunities. A wide range of feedback was received, mostly supportive of reducing lanes on King Edward Avenue, but some concerns about traffic congestion, delays, and inter-jurisdictional coordination were expressed by participants.

Evaluation of the Scenarios

The evaluation approach assesses the scenarios relative to the values we have as a community and city. The evaluation approach asks the question, "Which scenario fits best with the city we want for our future?" The evaluation framework is supported by one current planning exercise and two existing plans which express our values for the future as a community and city. They are:

1. The City of Ottawa Official Plan;
2. The City of Ottawa Transportation Master Plan; and,
3. "Choosing Our Future" and its End-State Goals.

The following scale was developed to assist with formulating a judgement for each policy considered in the Evaluation Framework:

Poor: The scenario does not support the municipality's policy or goes against it.

Acceptable: The scenario basically supports the municipality's direction.

Good: The scenario helps to advance us towards the future.

Better: The scenario helps us to advance towards the future, by some degree further than just "Good."

It should be noted that the judgement of whether a scenario is a poor, acceptable, good or better fit with the City's policies is not entirely subjective. If a policy can be related to the modelling results, then that modelling result was considered in making the judgement.

A summary of the evaluation results are provided on the following page.

	How well does the 6 Lane scenario fit with the policies?	How well does the 5 Lane scenario fit with these policies?	How well does the 4 Lane scenario fit with these policies?
Collective Summary: **Evaluation of Official Plan policies, Transportation Master Plan policies, and Choosing Our Future End-State Goals**	**Poor fit with 12 policies** **Acceptable fit with 33 policies** **Good fit with 6 policies** **Better fit with 1 policy**	**Poor fit with 2 policies** **Acceptable fit with 17 policies** **Good fit with 31 policies** **Better fit with 2 policies**	**Poor fit with 7 policies** **Acceptable fit with 11 policies** **Good fit with 10 policies** **Better fit with 24 policies**
FINAL EVALUATION	**The 4 Lane Scenario, as an ultimate configuration, is the best fit with the city we want for the future as articulated by the Official Plan, the Transportation Master Plan, and Choosing Our Future.**		

The 4-Lane Scenario, as an ultimate configuration, helps us to advance towards the future by a significant degree (it is a "better fit" with 24 of the City's Official Plan policies, Transportation Master Plan policies, and End-State Goals). We recognize that the End-State Goals of Choosing Our Future have not yet been approved by Council. If the results using the End-State Goals are excluded from the Evaluation Framework, the evaluation results are not materially affected.

While there is strong policy support for the 4-Lane scenario as the ultimate configuration, we recognize that the transportation modelling data presents more of a mixed picture about reducing King Edward Avenue from six lanes to four lanes. It is therefore noteworthy to highlight the extensive research which has studied the effects of lane reductions in large urban cities which concludes that:

> …the balance of evidence is that measures which reduce or reallocate road capacity, when well-designed and favoured by strong reasons of policy, need not be

automatically rejected for fear that they must inevitably cause unacceptable road congestion.[5]

Implementation Considerations

The following considerations have been made in terms of making the transition from six lanes to four lanes for King Edward Avenue and maximizing the potential synergies:

- Functional design with consultation: determine how the lanes being reclaimed will be used (i.e., wider sidewalks, dedicated cycling route, additional landscaping/streetscaping) in collaboration with stakeholders;
- Opportunities to advance implementation timing including:
  - Adjacent road work or capital works;
  - Annual line painting program;
  - Final landscaping or streetscaping on King Edward Avenue;
- Strategies for early implementation including:
  - On-street parking in both directions during off-peak hours;
  - Temporary 5-lane configuration (i.e., implement the northbound adjustments in advance of the southbound adjustments);
  - Line painting;
  - Steering Committee collaboration;
- Tools for a smooth transition[6] from six to four lanes including:
  - Traffic monitoring program / protocol;
  - Deployment of traffic police to manage motorist behaviour;
- Strategies to support long-term quality of life including:
  - Neighbourhood planning initiative for Lowertown;
  - Community Design Plan for King Edward Avenue / Lowertown; and,
  - Community Improvement Plan for Lowertown.

[5] Cairns, Sally, et. al. 1998. *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence*. P.62.

[6] Experience of staff during construction along King Edward Avenue was that a reduced capacity in the corridor affected other sections of the network. Queues developed as a result of capacity constraints, delays increased on upstream streets and it was reported that traffic infiltrated into adjacent communities. These issues may again impact the area should a lane reduction on King Edward Avenue be implemented.

Summary and Next Steps

The following is a summary of the findings and recommended next steps resulting from Phase 2 of the King Edward Lane Reduction Study:

- It is recommended that the City of Ottawa accept the 4-Lane Scenario as the ultimate future for King Edward Avenue;
- It is recommended that the City of Ottawa proceed with implementation of interim measures as described in this report, including but not limited to, on-street parking;
- It is recommended that the Steering Committee continue to be involved in all aspects of the reduction of King Edward Avenue to 4 lanes, with additional representation from staff to be added as necessary; and,
- It is recommended that the City of Ottawa implement a follow-up program comprising at minimum a neighbourhood plan and a community improvement plan within the next two years.

Table of Contents

1. Introduction

King Edward Avenue is a six lane arterial street which currently serves multiple roles in the transportation network in central Ottawa. King Edward Avenue provides local neighbourhood access to Lowertown, an interprovincial link for commuters and commercial traffic to the Macdonald-Cartier Bridge, a public transit corridor for STO buses, and sidewalks for pedestrians. As the primary connection to one of only two interprovincial bridges permitted to carry truck traffic, King Edward Avenue has evolved into perhaps the primary interprovincial economic artery in Ottawa.

The corridor is presently undergoing a program of infrastructure renewal. During this period of construction, the six-lane roadway cross-section has operated as a four-lane roadway due to construction activities. While congestion has been evident in the corridor, the King Edward Avenue Task Force ("Task Force") believes that traffic demands are fundamentally being served.

Given the community's perceived effectiveness of King Edward Avenue during construction, a request was made to consider the feasibility of permanently reducing the cross-section on this segment of King Edward Avenue to four lanes. Transportation Committee directed staff to undertake a feasibility study to consider this network change in October 2008, consistent with direction from Council during approval of 2002 Environmental Study Report to look at this issue after a number of future milestones.

In response to the community request, Dillon Consulting Limited was retained by the City of Ottawa to undertake a feasibility study that would investigate the transportation and community impacts of reducing the cross-section on King Edward Avenue from six lanes to potentially four lanes between Rideau Street and Sussex Drive.

1.1 Phase 1 - Feasibility of Lane Reduction Scenarios

There were two principal objectives for Phase 1 of the Study:

1. Identify the transportation system impacts of reducing the cross-section of King Edward Avenue from Rideau Street to Sussex Drive from a six lane to a potential four lane cross-section; and,

2. Identify the effects on the community of reducing the cross-section of King Edward Avenue from Rideau Street to Sussex Drive from a six lane to a potential four lane cross-section.

Phase 1 of the study was primarily a technical evaluation of transportation system and community impacts that would result from reducing the cross-section of King Edward Avenue from six lanes to potentially four lanes between Rideau Street and Sussex Drive. The project's mandate did not include an evaluation of the impacts or recommending a specific lane configuration.

Phase 1 of the study resulted in the following conclusions and recommendations:

- The lane reduction scenarios have sufficient merit to be considered further;
- Undertake broader consultation; and,
- Complete an evaluation and submit a recommendation for a specific lane reduction.

The report describing the work completed during Phase 1 is available under separate cover as the "King Edward Avenue Lane Reduction Impact Study, Final Report – August 14, 2009."

1.2 Phase 2 - Evaluation of Which Lane Reduction Scenario is Appropriate

In August 2009, staff received direction from Transportation Committee to proceed with the consultation and evaluation which was recommended in the Phase 1 report.

Phase 2 of the study comprised:

- An update to the computer modelling of traffic, noise, and air quality undertaken during Phase 1 as a result of updated information;
- Stakeholder consultation, including two "roundtable" workshops and a public information centre; and,
- An evaluation that assesses the positive and negative impacts and clearly provides a rationale for a particular scenario.

This report summarizes the work completed as part of Phase 2.

2. Review of Roadway Scenarios

A number of alternative roadway configurations were considered for comparative purposes in this study, which was limited to evaluating a total of three scenarios. The two primary configurations consisted of a six-lane cross-section as per the recently completed construction work on King Edward Avenue, and a four-lane cross-section, as suggested by the community.

For evaluation purposes, the 6-Lane Configuration was considered to be the "status quo" or baseline condition since it is the current configuration of King Edward Avenue. The 4-Lane Configuration is essentially the same cross-section that was proposed in the EA study. Finally, a 5-Lane Configuration was developed that combines aspects of the six-lane and the four-lane designs. All are described in more detail below and illustrated in *Figure 1*.

It should be noted that the 5-Lane Configuration is new to Phase 2 and was not originally one of the scenarios in the Phase 1 report. The 5-Lane Configuration was developed through discussions with City Staff, members of the Task Force, and the consulting team.

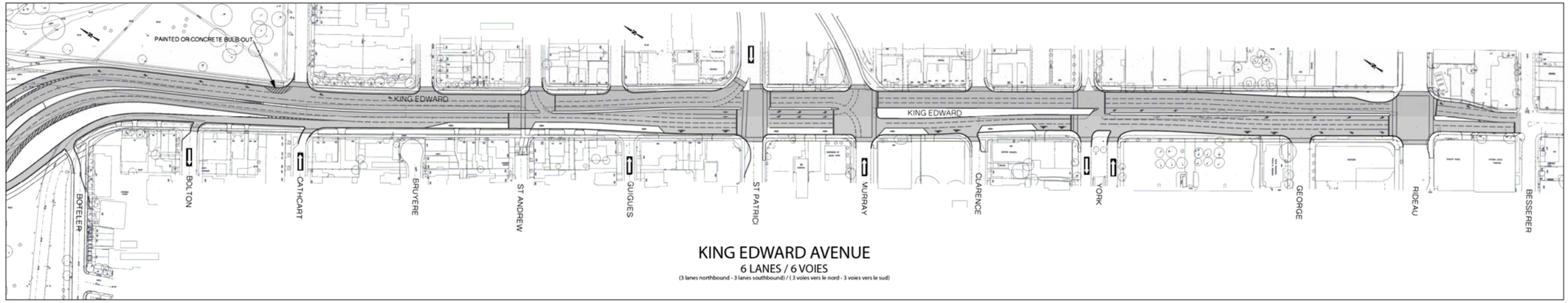
Scenario 1: 6-Lane Configuration

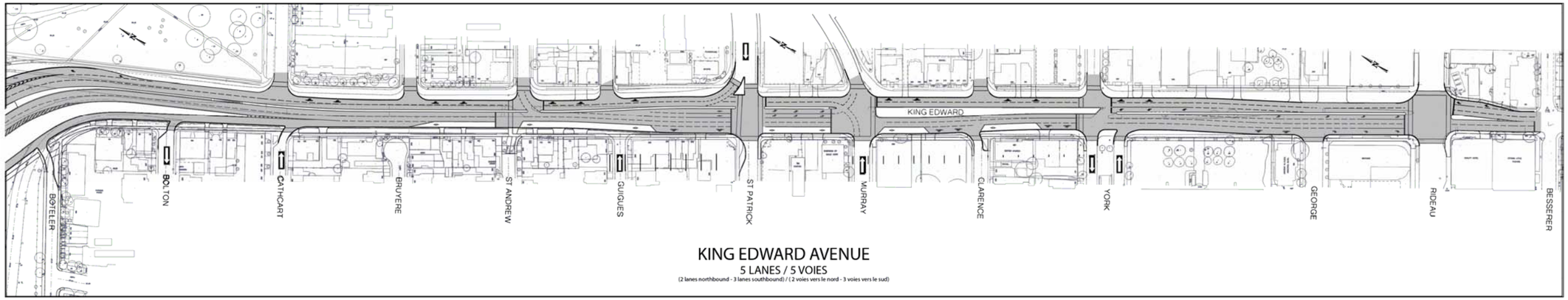
The 6-Lane Configuration includes three "through lanes" in the southbound direction with the curb lane (between Bruyère Street and York Street) being designated for "transit vehicles only" during the afternoon peak period and parking during all other periods. This configuration also includes double left turn lanes at St. Patrick Avenue and Murray Street and shared through-right lanes at all intersections except Rideau Street where the third through lane becomes an exclusive right-turn lane. In the northbound direction, a third through lane is developed immediately north of Rideau Street and is carried through to St. Andrew Street at which point the curb lane is designated as a "right-turn only" lane to facilitate access into the neighbourhood and to prevent motorists from using the curb lane as a queue jump lane to gain faster access to the bridge. A bulb out, pavement markings or other measures located north of Cathcart Street would further encourage motorists destined for the bridge to remain in the two through lanes after which point motorists could access the Sussex Drive ramp.

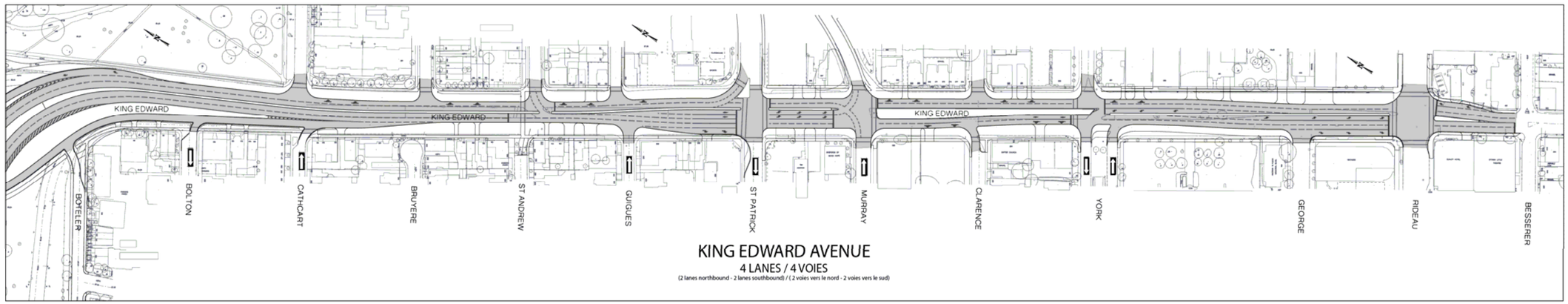
Scenario 2: 5-Lane Configuration

On the west side of King Edward Avenue (southbound traffic direction) the configuration is identical to Scenario 1. On the east side of King Edward Avenue (northbound traffic direction) the configuration is the same as that proposed in the King Edward Avenue EA study: two "through lanes" are maintained in from Rideau Street to the MacDonald-Cartier Bridge ramp. One refinement from the EA study configuration is that the additional lane northbound to access Sussex Drive develops after the intersection at Cathcart Street, not immediately at this intersection.

Figure 1: Roadway Scenarios







Scenario 3: 4-Lane Configuration

The 4-Lane Configuration is essentially the same cross-section that was proposed in the previous EA study; two "through lanes" are maintained in both southbound and northbound directions from Rideau Street to the MacDonald-Cartier Bridge ramp with auxiliary turn lanes at key locations (southbound double left turn lanes at St. Patrick Street, an exclusive southbound right turn lane at St. Patrick Street, a southbound right turn lane at Rideau Street, and a northbound lane to access the Sussex Drive ramp developing north of Cathcart Street, all other right turns are shared with a through lane).

3. Computer Modeling Overview

Traffic modelling was undertaken at both the corridor level (using VISSIM) and at the intersection level (using Synchro). Phase 2 of the study included additional computer modelling tasks to account for changes to the scenarios being assessed. As such, it became necessary to update the Phase 1 VISSIM model to ensure that the all traffic modelling results were directly comparable.

As an extension of the traffic modelling work conducted during Phase 1, a traffic model using Synchro software was developed (the Phase 1 Synchro Model) to supplement the VISSIM modelling. During the construction of this model, a data gap in the original VISSIM model (the Phase 1 VISSIM model) was identified. This required that the previous modelling work be updated in addition to modelling the new 5-Lane Configuration.

A summary of the computer modelling results relevant to Phase 2 can be found on *Figure 2* on the following page with details provided in *Appendix A*. Additional details on the computer modelling basis, assumptions and conclusions can be found below.

Figure 2: Summary of Modelling

Transportation Modelling Results				Scenario 1 – 6-lane Configuration				Scenario 2 – 5-lane Configuration				Scenario 3 – 4-lane Configuration			
				AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
				Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Motorists															
Criteria 1	Traffic volume in corridor [vehicles][†]	Peak direction flow between	NB	550	1,300	1,700	4,050	550	1,300	1,600	4,000	550	1,300	1,650	4,050
		St. Patrick & Murray	SB	1,900	4,500	1,500	3,600	1,900	4,500	1,500	3,600	1,900	4,500	1,500	3,650
Criteria 2	Corridor congestion [min:sec]	NB average travel time		04:08	04:07	05:29	05:23	04:15	04:11	06:33	06:33	04:14	04:11	06:58	06:27
		SB average travel time		03:02	03:01	03:29	03:26	03:00	02:59	03:35	03:35	03:09	03:06	03:50	03:47
Criteria 3	Traffic impact to local streets in the King Edward corridor [vehicles]			Expected to be negligible				Expected to be negligible				Expected to be negligible			
Criteria 4	Ability to accommodate on-street parking [parking stall hours 7am to 7pm]			556				200				0			
Pedestrians															
Criteria 5A	Pedestrian walking time along primary pedestrian route* [min]	Sussex to Rideau		21	21	22	21.5	21	21	22	21.5	21	21	21.5	21.5
		MacKenzie to Vanier		27.5	27	28	28	27	27	28	28	27	27	27.5	28
Criteria 5B	Average pedestrian waiting + crossing time at a key intersection [min:sec]	St. Patrick		01:11	01:10	01:21	01:21	01:11	01:10	01:20	01:20	01:11	01:10	01:17	01:20
		Murray		01:02	01:02	01:10	01:10	01:02	01:02	01:11	01:11	01:00	01:01	01:12	01:10
Cyclists															
Criteria 6	Cycling travel time for commuter cyclists* [min]	Sussex to Rideau		8.5	8.5	9.5	9	8	8.5	9	9	8	8	9	9
		MacKenzie to Vanier		10.5	10.5	11	11	10.5	10.5	11	11	10.5	10.5	11	11
Criteria 7	Effect on cycling network connectivity			To be discussed in the report				To be discussed in the report				To be discussed in the report			
Transit															
Criteria 8	Transit travel time [min:sec]	Average time		-	-	02:11	02:10	-	-	02:08	02:08	-	-	02:40	02:39
Criteria 9	Travel time reliability [min:sec]	90th percentile time		-	-	02:48	02:53	-	-	02:37	02:46	-	-	03:23	03:45
Criteria 10	Transit vehicle volume [# buses per period]			-	-	119	298	-	-	119	298	-	-	119	298
Goods Movement															
Criteria 11	Truck corridor travel time [min:sec]	Northbound time		03:42	03:40	04:08	04:03	03:50	03:47	05:09	05:09	03:49	03:45	05:32	05:05
		Southbound time		03:01	02:59	03:12	03:10	03:00	02:58	03:06	03:06	03:12	03:08	03:30	03:29
Criteria 12	Peak truck flow [# trucks per period]	Northbound flow		76	180	64	154	75	180	62	154	73	178	65	150
		Southbound flow		107	262	56	137	108	262	54	135	114	268	58	140
Impacts on Other Communities															
Criteria 13	Potential external impacts on other communities due to traffic displacement [vehicles]			Negligible	Negligible	150 (NB)	300 (NB)	Negligible	Negligible	250 (NB)	350 (NB)	Negligible	Negligible	200 (NB)	300 (NB)
Criteria 14	Potential duration of impact on other communities due to dispersed traffic [hours]			Negligible	Negligible	~2.5 hours	~2.5 hours	Negligible	Negligible	>2.5 hours	>2.5 hours	Negligible	Negligible	>2.5 hours	>2.5 hours

[†] The computer modelling uses traffic counts during construction that were factored up for the year 2010

*Approximate; calculation based on typical walking / cycling speed plus the waiting times at the intersection

Air Quality		Scenario 1 – 6-lane Configuration				Scenario 2 – 5-lane Configuration				Scenario 3 – 4-lane Configuration			
		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Criteria 15	Carbon monoxide (CO) concentrations [parts per million]	-	-	5.2 - 10.6	-	-	-	5.6 - 11.3	-	-	-	5.0 - 8.7	-
Criteria 16	Nitrous oxides (NO_x) concentrations [parts per million]	-	-	0.2 - 0.8	-	-	-	0.4 - 0.8	-	-	-	0.4 - 0.6	-
Criteria 17	Particulate ($PM_{2.5}$) concentrations [micrograms]	-	-	20 - 26	-	-	-	20 - 25	-	-	-	19 - 23	-
Criteria 18	Sulphur dioxide (SO_2) concentrations [parts per billion]	-	-	3.0 - 4.4	-	-	-	3.4 - 4.0	-	-	-	3.0 - 3.9	-

Noise		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
		Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period	Hour	Period
Criteria 19	Predicted noise levels [decibels - dBA]	-	-	67.9 - 74.3	-	-	-	66.6 - 72.7	-	-	-	66.0 - 73.6	-

3.1 Transportation Modelling Foundations

Use of Traffic Volumes During Construction for Modelling

At the outset of the King Edward Avenue Lane Reduction Impact Study it was agreed that the traffic volumes used in modelling should reflect the conditions experienced during construction. This experience suggested that 4 lanes of through traffic along King Edward Avenue was a viable option to serve traffic. Understanding that conditions for traffic operation were less than optimal with 4 lanes and that 4 lanes without construction might operate better, a consensus was reached at the time to use traffic volumes based on those counted during construction.

Traffic Volumes Before and After Construction

Prior to construction, King Edward Avenue was operating as an unimpeded six lane arterial road and peak period traffic volumes were higher than during construction. Traffic volumes used in this assessment were 40 to 45 percent lower in the AM peak period, and approximately 20 percent lower in the PM peak period, when compared to the pre-construction volumes. City staff conducted new traffic volume counts in March and April of 2010, these volumes are discussed in **Section 6.4**.

Base Volume Development

Dillon used all available City of Ottawa intersection count data (up to and including 2008) and bridge count data (up to 2007 was available when we initiated our analysis) in order to generate traffic volumes for a "baseline" 2008 traffic model. It is important to recognize that the traffic volume counts in recent years are affected by the fact that the corridor has been under construction.

Traffic volumes generally fluctuate from day to day and year to year. Those used in our analysis were adjusted (i.e. “balanced”) to account for these and other potential differences in traffic flows resulting from counts being carried out on Mondays, Fridays, near a national holiday or during years other than in 2008.

Once an acceptable 2008 baseline was established, historical traffic volume growth on the MacDonald-Cartier Bridge was examined. The City of Ottawa annually collects traffic data on all five inter-provincial bridges on an hour-by-hour basis. Based on historical analysis for a 2.5 hour peak period, trends for the MacDonald-Cartier Bridge were established for inbound (i.e. from Gatineau into Ottawa) and outbound (i.e. from Ottawa into Gatineau) traffic flows. These trends were applied to the 2008 baseline to estimate the 2010 traffic volumes.

The final traffic volumes, used in Phase 1, represent the expected volumes in the year 2010 assuming traffic trends continue as observed over the past number of years. These volumes

can be reviewed in the Phase 1 Report and continue to be the basis of computer modelling our efforts.

3.2 Update to Transportation Modelling

King Edward Avenue is a complex corridor to model using traffic software. An update to the Phase 1 VISSIM model was carried out to ensure comparability between all modelling scenarios completed for the King Edward Avenue Lane Reduction Study. Additional Synchro analysis was also required to evaluate the new 5-Lane Configuration.

VISSIM Modelling

It was found that the initial signal timing plans provided by the City of Ottawa (in January 2009) did not capture the full complexity of the operations of both the intersections of King Edward Avenue / Murray Street / St. Patrick Street and King Edward Avenue / Rideau Street. These two intersections are vital to the operation of the King Edward Avenue corridor. The updated VISSIM model used the corrected signal timing plans provided by the City of Ottawa in June 2009. A brief summary of modelling results for each of the assessment criteria categories is given below.

Motorists: Results of the VISSIM modelling demonstrate that, in the AM peak period, there is only a very minor impact to vehicle travel time in the 4-Lane Configuration. In the PM peak period, the modelling suggests that northbound automobiles will take up to 20% longer to travel through the corridor in the 5-Lane Configuration (6 minutes 33 seconds) and in the 4-Lane Configuration (6 minutes 27 seconds). As noted earlier, the traffic volumes modelled are based on traffic volumes counted during construction.

Pedestrians: Results of the VISSIM modelling suggests that pedestrian walking time along area corridors are not significantly affected by changes to the lane configuration. However, waiting times to cross King Edward Avenue are reduced with the 5-Lane and 4-Lane Configurations.[7] These modelling results speak only to pedestrian travel time and not to the pedestrian environment that may exist on King Edward Avenue under any particular lane configuration.

Cyclists: The cycling results of the model mirror those of the pedestrian findings. Cycling time along area corridors are not significantly affected by changes to the lane configuration. However, these modelling results speak only to cycling travel time and not to the cycling environment that may exist on King Edward Avenue under any particular lane configuration.

[7] If longer cycle lengths are required over time to improve north/south traffic flow, then this could increase pedestrian waiting time at the intersections.

Transit: The modelling suggests that STO buses through King Edward Avenue are expected to experience an increased travel time (around 22% at 2 minutes 39 seconds) and decreased reliability with the 4-Lane Configuration. However, the modelling indicates that all the necessary buses are expected to be able to get through the corridor in the peak hour.

Goods movement: In the PM peak period, the modelling suggests that northbound trucks will take up to 25% longer to travel through the corridor in the 5-Lane Configuration (5 minutes 9 seconds) and in the 4-Lane Configuration (5 minutes 5 seconds). The volume of trucks able to pass through the corridor is not expected to change.

Impacts on other communities: The empirical modelling results do not indicate a great variation in vehicles able to pass through the King Edward corridor between lane configurations. During the simulation, it was observed that constraints on King Edward Avenue cause extended queues to build up to the edge of the study area. This has the potential to cause traffic disturbances outside the study area. Based on these observations it is expected that the potential disturbance caused by the 5-lane and 4-lane configurations may last longer than 2.5 hours whereas the potential disturbance caused by the 6-lane configuration may last approximately 2.5 hours. This possibility is discussed further in **Section 6.4**.

Safety considerations: Pedestrian exposure to traffic is reduced in both the 5-Lane and 4-Lane Configurations as crossing distances are shorter with fewer lanes. Similarly the modelling demonstrates an increase in travel time along King Edward Avenue for these scenarios. This can be interpreted as a reduction in average travel speed which has positive implications on safety.[8]

VISSIM is modelling software designed to accurately simulate real world conditions considering a wide variety of factors including driver behaviour, roadway geometry, traffic control and traffic volumes. VISSIM models corridors as a continuous element within the transportation network. This is an advantage to modelling with VISSIM as conditions are considered more holistically and network constraints are recognized. Due to its complexity VISSIM compiles data only for measures that have been pre-defined and, as such, does not necessarily provide measurements for all common performance criteria.

Synchro Modelling

The Phase 1 Synchro modelling remained valid through to Phase 2. As a result only the new scenario (the 5-Lane Configuration) needed additional modelling efforts.

In general the Synchro results in *Figure 3* support the findings of the VISSIM analysis which show that a reduction in lanes is expected to negatively affect the efficiency of vehicular

[8] An intersection may be blocked with vehicles during peak times; the safety of pedestrians crossing the intersection under this condition has not been modelled.

movements through the intersections. At a corridor level all scenarios perform more or less adequately during the AM peak hour (level of service E or better). In the PM peak hour the 6-Lane Configuration experiences difficulty processing the traffic at the intersection of Rideau Street and King Edward Avenue (level of service F). The remaining intersections in the corridor operate acceptably (level of service E or better). However, the 5-Lane and 4-Lane Configurations operate at level of service F at both the intersection of Rideau Street with King Edward Avenue and the intersection of St. Patrick Street / Murray Street with King Edward Avenue.[9]

Figure 3: Synchro Summary

6 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	D
109	St. Patrick Street & King Edward Avenue	E
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	A
114	Rideau Street & King Edward Avenue	F

5 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	F
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	F
112	York Street & King Edward Avenue	B
114	Rideau Street & King Edward Avenue	F

4 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	F
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	E
114	Rideau Street & King Edward Avenue	F

NOTES:
Average Delay and Queue values based on SimTraffic Results.
SimTraffic network seeded for 30 minutes and recorded for 60 minutes, data gathered over five simulation runs.
Maximum v/c and Weighted v/c values based on HCM Signalized intersection results from Synchro 6.

These results indicate that with either the 5-Lane or 4-Lane Configuration operational difficulties are expected. However, experience in other jurisdictions reported in *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence* indicates that these issues can be expected to subside after a short term transition period. Potential operational difficulties during this transition period include extended vehicle delays and queuing (which have been noted by staff in the past to significantly impact east-west OC Transpo operations across the Mackenzie King Bridge) and to potentially cause motorists to seek alternate routes through the community. Again, research suggests that these difficulties will be temporary and can be mitigated with advance notice of the change.[10]

The Synchro modelling also recognised that traffic conditions outside the modelled corridor may be impacted by a change in lane arrangements along King Edward Avenue. Again, this possibility is discussed further in **Section 6.4**.

[9] The intersection of St. Andrew Street and King Edward Avenue operates at level of service F for the 5-Lane and 4-Lane configuration; however, for vehicles travelling along King Edward Avenue, this intersection is not as important as the other intersections.

[10] Cairns, Sally, et. al. 1998. *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence*. P.59.

In addition to this summary of results the detailed Synchro performance reports are included in *Appendix A*.

Synchro uses deterministic methods to evaluate the performance of individual intersections. It estimates the operational characteristics of an intersection based on empirical traffic engineering research and calculations. Synchro is used by the City's Traffic Operations staff for evaluating typical traffic conditions. Synchro evaluates intersections in relative isolation and does not consider traffic in the surrounding network in the same way as VISSIM.

Transportation Modelling Summary

The results of both VISSIM and Synchro models were taken into consideration in the evaluation of scenarios. This evaluation is discussed in detail in Section 5.

Overall, the transportation modelling suggests that most vehicles will be able to travel through the corridor during peak periods in the 5-Lane and 4-Lane Configurations. The evaluation identifies that with either the 5-Lane or 4-Lane Configuration there will likely be reduced speeds, greater vehicle travel time, more bus travel time and less bus reliability. These effects may be particularly evident in the short term causing some operational difficulties. It is expected, and supported through research, that the majority of these difficulties will be transitional in nature.

Due to the dynamic nature of downtown urban areas, it is difficult to predict the specific reactions of roadway users during this transition period, although it has been suggested that the lengthening of rush hour and non-compliant behaviour of motorists (causing infiltration of traffic on local streets and private vehicles blocking OC Transpo transitway operations) may occur. Discussions in Section 6 provide suggestions to mitigate any transitional issues should they arise.

It is expected that traffic will still flow regardless of the scenario and, over the long term, improvements in motorist behaviour and travel patterns acknowledging fewer lanes in the corridor will emerge.

3.3 Update to Air Quality and Noise Impact Modelling

New air quality and noise impact modelling was conducted for the 5-lane Configuration as this roadway scenario was not previously considered during Phase 1.

To ensure that the results between the air quality modelling for this new scenario and that for the previous scenarios would be comparable, all modelling assumptions were held static. This means that, while the lane arrangements and traffic conditions changed, the receptors, receptor locations and meteorological conditions did not. Similarly, the noise impact

modelling used all the same base assumptions to assess the 5-Lane Configuration as the 6-Lane and 4-Lane Configurations.

4. Summary of Public Consultation

Through the course of Phase 1, public engagement was focussed on members of the Task Force and Lowertown, and broader consultation was recommended since there are a wide range of other stakeholders (including adjacent neighbourhoods, transit operators, the goods movement industry, various agencies, commuters, and the public at-large) that had not yet been consulted.

4.1 Results from Two Stakeholder Roundtables

Two roundtable-style discussions were held in mid-October 2009 with invitations extended to a wide range of stakeholder groups and agencies. The roundtable session included a presentation of the findings from Phase 1 and a discussion about concerns and necessary improvements related to King Edward Avenue and a potential lane reduction.

Attendance at the roundtable included representatives from the Task Force, Lowertown neighbourhood, adjacent neighbourhoods, and a variety of agencies.

Some of the feedback received during the roundtable sessions echoed the concerns and issues that had been raised by the Task Force, such as traffic speed, noise, vibration, pollution, and lack of attractiveness in the corridor.

Other feedback received during the roundtable sessions identified concerns or issues related to potential / perceived negative impacts to adjacent areas from a lane reduction. The concerns included traffic back-ups on Dalhousie Street and into the Byward Market area. It was also remarked that if it took longer for STO buses to get through the corridor, then additional buses might be needed by STO to compensate for the delay. Feedback was also received that a larger study might be needed to describe external impacts.

Additionally, feedback suggested that better coordination between the City of Ottawa, City of Gatineau, OC Transpo, and STO would be beneficial.

4.2 Results from the Public Information Centre

One public information centre (PIC) was held in February 2010 with invitations extended to a wide range of stakeholder groups and agencies (including those previously invited to the

roundtables). The event was also advertised in the local media. The PIC included a presentation of the study's history, the modelling described in Section 3 of this report, as well as the evaluation approach described in Section 5 of this report. The PIC also included a break-out session into three table discussions to review a preliminary version of the evaluation results.

Attendance at the public information centre was predominantly from residents in the Lowertown neighbourhood.

Feedback received during the public information centre was supportive of a lane reduction on King Edward and many participants expressed a preference for a four lane scenario. Matters raised by participants during discussions included the potential for further disruption with additional reconstruction to implement the lane reduction and questions regarding the cost and timing of a lane reduction.

5. Evaluation of the Scenarios

As noted in the Phase 1 report, the study was initiated to determine whether alternative roadway configurations might be feasible for King Edward Avenue. The comparative assessment undertaken during Phase 1 demonstrated that the lane reduction scenarios had sufficient merit to be considered further.

The analysis of the lane options for King Edward during Phase 1 provided insight on the community and transportation impacts from each lane option. However, since there are both positive and negative impacts, the analysis itself does not provide any justification for a particular lane reduction option. An evaluation has been undertaken during Phase 2 that considers the community and transportation impacts and clearly provides the rationale for a particular scenario.

5.1 Approach to the Evaluation

It is recognized that the modelling undertaken and described in Section 3 of this report is only able to address a portion of the issues relating to King Edward Avenue. It also does not suggest what public good or societal value we should place on the factors which have been analyzed. Therefore, it is up to the evaluation approach to assess the scenarios relative to the values we have as a community and city.

The evaluation approach asks the question, "Which scenario fits best with the city we want for our future?"

The evaluation is supporting by one current planning exercise and two existing plans which express our values for the future as a community and city. They are:

1. The City of Ottawa Official Plan; and,
2. The City of Ottawa Transportation Master Plan; and,
3. "Choosing Our Future" and its End-State Goals.

Additional information on the relevance of these plans and how they relate to the evaluation framework are provided below.

The City of Ottawa Official Plan (As Amended by OPA #76)

The Official Plan (OP) is the primary planning document that the City uses to guide decision-making about the long-term vitality, health, prosperity, and development of our community. It has been adopted by Council.

The OP contains principles and policies that guide us towards the Ottawa of the future over the next 20 years. We can understand how well each scenario fits with our city vision by comparing them to the principles and policies of the OP.

The City of Ottawa Transportation Master Plan:

The Transportation Master Plan (TMP) is the primary tool that the City uses to guide decision-making and investment in our transportation system. The TMP addresses all aspects of transportation and makes many important linkages between transportation and elements of our community such as liveability, efficiency, and cost-effectiveness. It has been adopted by Council.

The TMP contains principles and policies that guide us towards Ottawa's future transportation vision over the next 20 years. We can understand how well each scenario fits with our transportation vision by comparing them to the principles and policies of the TMP.

Choosing Our Future and the End-State Goals

The Choosing Our Future project is an innovative exercise that will help guide us towards a sustainable region over the next 100 years. A series of End-State Goals have been produced that describe our long-term vision for the city with respect to social, cultural, environmental, economic, and governance aspects.[11]

We can understand how well each scenario fits with our sustainability vision by comparing them to the End-State Goals. Since the End-State Goals are general, they may relate directly or indirectly to King Edward Avenue, so this relationship has been identified in the evaluation.

[11] Note: The End-State Goals have not yet been adopted by Council.

5.2 Evaluation Framework

The Evaluation Framework requires that a judgement be made on which scenario fits best with the city we want for our future, for each end-state goal or planning policy being considered.

The following scale was developed to assist with formulating a judgement for each policy in the Evaluation Framework:

Poor: The scenario does not support the municipality's policy or goes against it.

Acceptable: The scenario basically supports the municipality's direction.

Good: The scenario helps to advance us towards the future.

Better: The scenario helps us to advance towards the future, by some degree further than just "Good."

It should be noted that the judgement of whether a scenario is a poor, acceptable, good or better fit with the City's policies is not entirely subjective. If a policy can be related to a modelling result from Section 3 of this report, then that modelling result was considered in making the judgement.

The Evaluation Framework presented on the following pages provides a comprehensive evaluation of the scenarios, broken down into four sections:

1. Part A evaluates the scenarios against the City of Ottawa's Official Plan (including any new additions as a result of Amendment #76);
2. Part B evaluates the scenarios against the City of Ottawa's Transportation Master Plan;
3. Part C evaluates the scenarios against the "Choosing Our Future" project's End State Goals; and,
4. A summary collectively considers the results of Parts A, B and C to identify the recommended scenario.

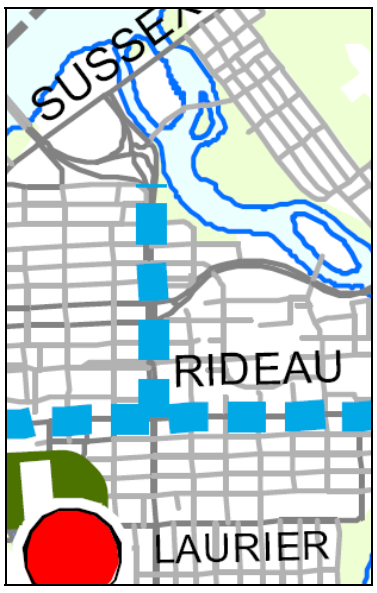
EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
2.1	**The Challenge Ahead Strategic Directions**			
2.1	Providing Infrastructure: A transportation system that emphasizes transit, walking, and cycling will be built.	**Poor** ▪ Emphasizes transit ▪ Provides for walking ▪ Does not emphasize cycling	**Good** ▪ Emphasizes transit ▪ Provides an opportunity to emphasize walking on the east side with wider sidewalks ▪ Provides an opportunity to emphasize cycling on the east side with a potential dedicated cycling lane	**Good** ▪ Provides for transit ▪ Provides an opportunity to emphasize walking on both sides with wider sidewalks ▪ Provides an opportunity to emphasize cycling on both sides with potential dedicated cycling lanes
2.1	Maintaining Environmental Integrity: Air quality will be supported by a transportation system that that emphasizes transit, walking, and cycling… While transit, walking and cycling are mentioned, the emphasis is on air quality.	**Poor** ▪ Maintaining the status quo does not help improve air quality (based on modelling of the peak p.m. period)	**Good** ▪ The reduction of one lane helps improve air quality (based on modelling of the peak p.m. period)	**Better** ▪ The reduction of two lanes helps improve air quality (based on modelling of the peak p.m. period)
2.1	Creating Liveable Communities: Attention to design will help create attractive communities where buildings, open space, and transportation work well together.	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to increase the area's civic beauty	**Good** ▪ Reducing one lane may allow for additional streetscaping to improve the area's civic beauty	**Better** ▪ Reducing two lanes may allow for additional streetscaping to improve the area's civic beauty
2.3.1	**Providing Infrastructure Strategic Directions**			
2.3.1(4)	The City will minimize the effect of excessive traffic speed and volumes on residential neighbourhoods by researching and implementing measures and programs as part of its Area Traffic Management programs to enforce speed limits, discourage speeding, cut through traffic and reckless driving, and encourage walking, cycling and transit as preferred methods for trips in or through neighbourhoods. Note: The Area Traffic Management program tries to improve traffic flow on the arterial road network as a means to reduce traffic infiltration into neighbourhoods.	**Acceptable** ▪ Maintains the status quo of traffic speed, volume, etc. ▪ Does not help encourage walking or cycling as preferred methods for trips ▪ Maintains current traffic flow	**Acceptable** ▪ The lane reduction on the east side slows northbound traffic down in the afternoon peak with the potential to displace up to 350 vehicles ▪ Helps encourage walking and/or cycling with potential boulevard improvements ▪ Does not maintain traffic flow	**Acceptable** ▪ The lane reduction on the east side helps slow northbound traffic down in the afternoon peak with the potential to displace up to 300 vehicles ▪ Helps encourage walking and/or cycling with potential boulevard improvements ▪ Does not maintain traffic flow
2.3.1(5)	The City will implement a comprehensive Transportation System Management (TSM) program. TSM refers to strategies that can be implemented to make more efficient use of existing facilities through improved management and operation of transportation infrastructure. TSM focuses on optimizing existing infrastructure, for example, adjusting traffic control devices to maximize car flow, or to provide priority to transit vehicles.	**Good** ▪ Allows the use of TSM programs on existing infrastructure and allows for transit priority	**Poor** ▪ Requires alteration of existing infrastructure, even though there is transit priority	**Poor** ▪ Requires alteration of existing infrastructure and there is no transit priority

EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
2.3.1(8)	In the construction or reconstruction of transportation facilities, such as roadways, bridges, and transit stations, and public buildings, such as community centres and libraries, the City will ensure the provision of facilities to address the needs of pedestrians where feasible.	**Acceptable** ▪ Sidewalks are provided on both sides of the street ▪ There are no opportunities for wider sidewalks	**Good** ▪ Sidewalks are provided on both sides of the street ▪ There is an opportunity for wider sidewalks on the east side	**Better** ▪ Sidewalks are provided on both sides of the street ▪ There is an opportunity for wider sidewalks on both sides
2.3.1(14)	In the construction or reconstruction of transportation facilities (roadways, bridges, transit stations, etc.) and public buildings (community centres, libraries, etc.), the City will ensure, to the extent possible, the provision of facilities to address the needs and safety of cyclists.	**Poor** ▪ No facilities to address cyclists needs and safety	**Acceptable** ▪ Lane reduction provides an opportunity for a cycling lane that could address cyclists needs and safety on the east side	**Good** ▪ Lane reductions provide an opportunity for cycling lanes that could address cyclists needs and safety on both sides
2.3.1(19)	The City will protect corridors for and develop the Primary and Supplementary Rapid-Transit Network and transit-priority network as shown on Schedule D… 	**Acceptable** ▪ Provides a transit priority lane	**Acceptable** ▪ Provides a transit priority lane	**Poor** ▪ No transit priority is provided
2.3.1(22)	The City will improve the speed and reliability of transit service by providing transit-priority measures to lessen delays on transit vehicles caused by other traffic and traffic control signals. Transit-priority measures will be implemented for those transit-priority corridors identified on Schedule D and at other opportune locations.	**Acceptable** ▪ Provides a transit priority lane	**Acceptable** ▪ Provides a transit priority lane	**Poor** ▪ No transit priority is provided
2.3.1(28)	The City will work with the City of Gatineau and the federal government to improve transit service between the Cities of Ottawa and Gatineau and investigate means to reduce or discontinue the use of King Edward Avenue and Rideau Street as bus waiting areas…	**Acceptable** ▪ Provides a transit priority lane that supports transit service between Gatineau and Ottawa ▪ King Edward is no longer used as a bus waiting area	**Acceptable** ▪ Provides a transit priority lane that supports transit service between Gatineau and Ottawa ▪ King Edward is no longer used as a bus waiting area	**Poor** ▪ Although transit is able to get through, service is not improved from the status quo ▪ King Edward is no longer used as a bus waiting area

EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
2.3.1(35)	Priority use of lanes on a road or planned new lanes may be given exclusively to certain classes of roadway users if it contributes to the implementation of transportation and land-use objectives of this Plan. This may result in roadway lanes reserved for transit vehicles in identified locations supportive of rapid-transit and the transit-priority network. The City may give priority to lanes used for high occupancy vehicles on selected roads. Additional truck-priority lanes (e.g., Waller to Nicholas Streets) may also be implemented.	**Acceptable** (supports one user) ▪ Provides a transit priority lane ▪ Does not provide an opportunity for a dedicated cycling lane	**Good** (supports two users) ▪ Provides a transit priority lane ▪ Provides an opportunity for a dedicated cycling lane on the east side	**Acceptable** (supports one user) ▪ No transit priority is provided ▪ Provides opportunities for dedicated cycling lanes on both sides
2.3.1(36)	The City will ensure that road corridors function as public spaces, while providing the necessary public infrastructure by implementing approved corridor or street design guidelines, including those for road classification types and for heritage districts, tourist areas and business improvement areas. It is recognized that the parkway network in the city, primarily developed by the National Capital Commission, contributes greatly to the distinct open space character of Ottawa.	**Acceptable** ▪ Recent streetscaping has attempted to enhance the public space character of the street	**Good** ▪ Lane reduction could provide for additional streetscaping to enhance the public space character of the street on the east side	**Better** ▪ Lane reductions could provide for additional streetscaping to enhance the public space character of the street on both sides
2.3.1(44a)	To provide short-term parking that supports the vital interests of local businesses, institutions and tourism destinations;	**Better** ▪ Could provide many street parking opportunities during off-peak periods	**Good** ▪ Could provide some street parking opportunities during off-peak periods	**Acceptable** ▪ Lane configuration does not consider street parking; however, on-street parking has not been entirely ruled out as a possibility
2.3.1(48)	The City will minimize the impact of truck traffic on residential neighbourhoods caused by the presence of these vehicles and their noise, vibration and emissions by ensuring the availability of a comprehensive truck route network based on the arterial road system.	**Acceptable** ▪ King Edward continues as an arterial road to serve its role as a link in the goods movement system	**Acceptable** ▪ King Edward continues as an arterial road to serve its role as a link in the goods movement system	**Acceptable** ▪ King Edward continues as an arterial road to serve its role as a link in the goods movement system
2.3.1(49)	The City will explore alternative means to accommodate interprovincial truck travel to minimize impacts on the Central Area, in particular along and in the vicinity of King Edward Avenue. Upon the completion of a new interprovincial corridor to accommodate trucks in a safe and efficient manner, the City will remove Rideau Street and King Edward Avenue from the City's identified truck route system. (See also, policy 8 in Section 3.6.6 on the Central Area.)	*Not Applicable. The City is obligated to explore alternative means to accommodate trucks regardless of the lane configuration. The new interprovincial corridor, not the lane configuration, will result in King Edward being removed from the truck route system.*	*Not Applicable. The City is obligated to explore alternative means to accommodate trucks regardless of the lane configuration. The new interprovincial corridor, not the lane configuration, will result in King Edward being removed from the truck route system.*	*Not Applicable. The City is obligated to explore alternative means to accommodate trucks regardless of the lane configuration. The new interprovincial corridor, not the lane configuration, will result in King Edward being removed from the truck route system.*

EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
2.4	**Maintaining Environmental Integrity Strategic Directions**			
2(a)	The City will reduce air emissions and GHG emissions resulting from the transportation sector by: Providing opportunities for the use of energy efficient transportation modes in order to minimize individual motor vehicle travel in favour of walking, cycling and transit.	**Acceptable** ▪ Provides sidewalks on both sides ▪ Does not provide specific cycling facilities, although cycling is still possible ▪ Provides transit priority	**Good** ▪ Provides sidewalks on both sides ▪ Provides an opportunity for a dedicated cycling lane ▪ Provides transit priority	**Better** ▪ Provides sidewalks on both sides ▪ Provides opportunities for dedicated cycling lanes on both sides ▪ Although it does not provide transit priority, buses are accommodated
2.5	**Building Liveable Communities – Design Principles**			
2.5.1	To enhance the sense of community by creating and maintaining places with their own distinct identity. Design should:			
2.5.1.1 (2nd bullet)	Recognize and reflect on the history of the city or community	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to encourage a heritage theme	**Good** ▪ A reduction to five lanes is a step towards the former historic configuration of King Edward	**Better** ▪ A reduction to four lanes is the most substantial step towards the former historic configuration of King Edward
2.5.1.1 (4th bullet)	Create distinctive places and appreciate local identity in patterns of development, landscape and culture	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to encourage a local identity	**Good** ▪ A reduction to five lanes provides an opportunity for additional streetscaping on the east side for local identity	**Better** ▪ A reduction to four lanes provides an opportunity for additional streetscaping on both sides for local identity
2.5.1.1 (5th bullet)	Reflect a thorough and sensitive understanding of place, context, and setting	*Not Applicable. The urban design theme for King Edward which has been established through the recent reconstruction would not be impacted by any specific lane configuration.*	*Not Applicable. The urban design theme for King Edward which has been established through the recent reconstruction would not be impacted by any specific lane configuration.*	*Not Applicable. The urban design theme for King Edward which has been established through the recent reconstruction would not be impacted by any specific lane configuration.*
2.5.1.2	To define quality public and private spaces through development... Design should:			
2.5.1.2 (3rd bullet)	Consider streets as public spaces	**Acceptable** ▪ Existing sidewalks and boulevards provide the minimum for "public space" on the street	**Good** ▪ A lane reduction provides an opportunity to increase the perceived amount of public space (if the space is formally landscaped) on the east side	**Better** ▪ Lane reductions provide an opportunity to increase the perceived amount of public space (if the space is formally landscaped) on both sides

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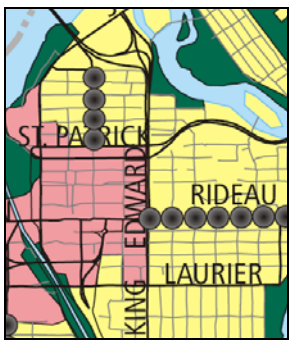
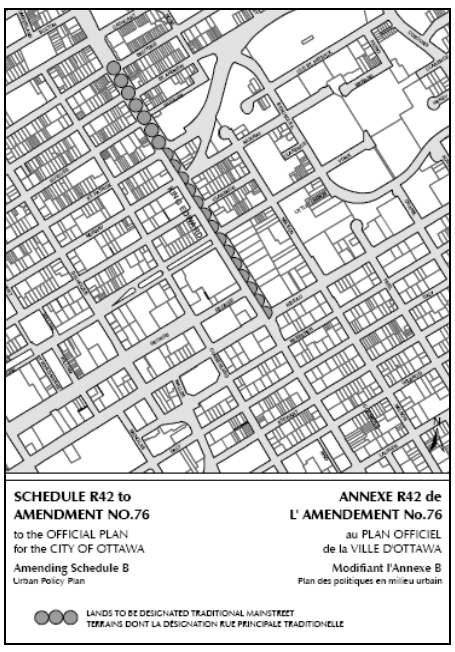
Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
2.5.1.2 (6th bullet)	Meet the needs of pedestrians as a priority	**Acceptable** ▪ Sidewalks are provided on both sides of the street	**Good** ▪ Sidewalks are provided on both sides of the street ▪ There is the potential to further meet pedestrian needs with a wider sidewalk on the east side	**Better** ▪ Sidewalks are provided on both sides of the street ▪ There is the potential to further meet pedestrian needs with wider sidewalks on both sides
2.5.1.2 (7th bullet)	Contribute to attractive public spaces and important vistas This interpretation relies on Policy 2.5.1.2 (3rd bullet) in which streets are considered as public spaces.	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to improve the street's attractiveness	**Good** ▪ Reducing one lane may allow for additional streetscaping to further improve the street's attractiveness	**Better** ▪ Reducing two lanes may allow for additional streetscaping to further improve the street's attractiveness
2.5.1.2 (8th bullet)	Minimize the exposure of inhabitants to noise levels that could adversely impact their health and well-being	**Poor** ▪ Status quo does not alter citizens exposure to noise	**Poor** ▪ Lane reduction would not noticeably reduce the forecasted noise exposure to citizens	**Poor** ▪ Lane reduction would not noticeably reduce the forecasted noise exposure to citizens
2.5.1.3	To create places that are safe, accessible and are easy to get to, and move through.... Design should:			
2.5.1.3 (4th bullet)	Create places and spaces that are visible and safe and can be confidently used at all hours of the day and at night where it is appropriate to do so.	**Acceptable** ▪ It is anticipated that the design of the recent renewal addresses day-time and night-time visibility and safety of King Edward Avenue as a place/space	**Acceptable** ▪ It is anticipated that any redesign might only marginally improve the day-time and night-time visibility and/or safety of King Edward Avenue as a place/space	**Acceptable** ▪ It is anticipated that any redesign might only marginally improve the day-time and night-time visibility and/or safety of King Edward Avenue as a place/space
2.5.1.7	To maximize energy-efficiency and promote sustainable design to reduce the resource consumption, energy use, and carbon footprint of the built environment.... Design should:			
2.5.1.7 (3rd bullet)	Maximize opportunities for sustainable transportation modes (walking, cycling, transit facilities and connections). This is urban design policy, not transportation policy; since transit on King Edward Avenue is not local, then transit is not considered relevant in this specific line of the evaluation.	**Poor** ▪ Does not offer any opportunity to maximize walking ▪ Does not offer any opportunity to maximize cycling	**Acceptable** ▪ Offers an opportunity to maximize walking on the east side ▪ Offers an opportunity to maximize cycling on the east side	**Good** ▪ Offers an opportunity to maximize walking on both sides ▪ Offers an opportunity to maximize cycling on both sides

EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
3.6	**Urban Designations**			
3.6.3	***Mainstreets***			
3.6.3(1)	Traditional Mainstreets and Arterial Mainstreets are each designated on Schedule B. The former are planned as compact, mixed-use, pedestrian-oriented streets that provide for access by foot, cycle, transit and automobile… Both Traditional and Arterial Mainstreets will fulfill and take advantage of their multi-modal transportation corridor function…  Schedule B from the Official Plan (before OPA #76)  Schedule R42 to OPA #76 designating portions of King Edward Avenue as a “Traditional Main Street”	**Acceptable** ▪ Provides access and function, although no opportunity for a dedicated on-street cycling route	**Good** ▪ Provides access and function, with an opportunity for a wider pedestrian-oriented sidewalk and/or dedicated on-street cycling route on the east side	**Better** ▪ Provides access and function, with opportunities for a wider pedestrian-oriented sidewalk and/or dedicated on-street cycling route on both sides
3.6.3(8)	Redevelopment and infill are encouraged on Traditional and Arterial Mainstreets in order to optimize the use of land through intensification, in a building format that encloses and defines the street edge and provides direct pedestrian access to the sidewalk…	**Acceptable** ▪ It is anticipated that redevelopment would be able to enclose and define the street edge, and provide direct pedestrian access to the street	**Acceptable** ▪ It is anticipated that redevelopment would be able to enclose and define the street edge, and provide direct pedestrian access to the street	**Acceptable** ▪ It is anticipated that redevelopment would be able to enclose and define the street edge, and provide direct pedestrian access to the street

EVALUATION FRAMEWORK

Part A – Official Plan Policies

Section Number	Policy	How well does the 6 Lane scenario fit with this policy?	How well does the 5 Lane scenario fit with this policy?	How well does the 4 Lane scenario fit with this policy?
3.6.3(11)	To achieve the vision for Mainstreets, changes within the public environment as well as within the abutting private property environment may be necessary. The function and design of a road may influence the nature of land use along it and changes to the street may be necessary in order to facilitate a more intense, pedestrian-oriented form of development adjacent to it. Where the City is proposing public works within a Mainstreet's right-of-way, it will consider changes such as the institution of on-street parking, improvements to the pedestrian and cycling environment, streetscape enhancements, lane reductions and measures to enhance transit ridership in the area. King Edward Avenue is not served by local transit so transit is not considered relevant in this specific line of the evaluation.	**Acceptable** ▪ On-street parking is considered in this scenario ▪ Does not contemplate further changes to the pedestrian and cycling environment ▪ Streetscape enhancements have been undertaken as part of the recent reconstruction ▪ Does not contemplate a lane reduction	**Good** ▪ On-street parking is considered in this scenario ▪ Has the potential for improved pedestrian and cycling environments on the east side ▪ Provides an opportunity for further streetscape enhancements on the east side ▪ Contemplates a one lane reduction	**Better** ▪ On-street parking is not considered in this scenario (but has not entirely been ruled out) ▪ Has the potential for improved pedestrian and cycling environments on both sides ▪ Provides an opportunity for further streetscape enhancements on both sides ▪ Contemplates a two lane reduction
3.6.6	***Central Area***			
3.6.6(2)(d)	The City will support the Central Area's role … by ensuring… public works have regard for the Central Area Secondary Plan policies to enhance the physical character, identity and unique heritage resources of the Central Area's distinctive streets. King Edward Avenue is identified as a distinctive street in Policy 3.6.6(7)(h).	**Acceptable** ▪ Streetscape enhancements have been undertaken as part of the recent reconstruction	**Good** ▪ Provides an opportunity to implement further enhancements on the east side of the street	**Better** ▪ Provides an opportunity to implement further enhancements on both sides of the street
3.6.6(8)(c)	To give walking, cycling and public transit priority in the Central Area: The City will, working with other levels of government, remove Rideau Street and King Edward Avenue from the City's identified truck route system upon the completion of a new inter provincial corridor to accommodate trucks;	*Not Applicable. The removal of King Edward Avenue from the truck route system is contingent upon a new interprovincial corridor, not a specific lane configuration.*	*Not Applicable. The removal of King Edward Avenue from the truck route system is contingent upon a new interprovincial corridor, not a specific lane configuration.*	*Not Applicable. The removal of King Edward Avenue from the truck route system is contingent upon a new interprovincial corridor, not a specific lane configuration.*
Part A – Summary		Poor fit with 5 policies Acceptable fit with 20 policies Good fit with 1 policy Better fit with 1 policy	Poor fit with 2 policies Acceptable fit with 9 policies Good fit with 16 policies Better fit with no policies	Poor fit with 5 policies Acceptable fit with 6 policies Good fit with 3 policies Better fit with 13 policies

EVALUATION FRAMEWORK

Part B – Transportation Master Plan Policies				
Section Number	**Policy**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
3.1	**Ottawa's Transportation Vision**			
Element 1 Principle (a)	Give priority to public transit in meeting future growth in travel demand	**Good** ▪ Provides a dedicated transit lane	**Good** ▪ Provides a dedicated transit lane	**Acceptable** ▪ Street still allows for buses to get through, but not on a dedicated lane
Element 1 Principle (b)	Make walking and cycling more attractive than driving for short trips	**Poor** ▪ Sidewalks on both sides of the street are the minimum needed to encourage walking ▪ With no dedicated cycling facilities, it not more attractive than driving	**Acceptable** ▪ Sidewalks on both sides of the street, plus the opportunity for a wider sidewalk or a designated cycle route on the east side, helps make walking and cycling more attractive than driving	**Good** ▪ Sidewalks on both sides of the street, plus the opportunity for wider sidewalks or designated cycle routes on both sides of the street, helps make walking and cycling more attractive than driving
Element 2 Principle (a)	Provide a continuous, integrated system of multimodal facilities and services [to meet mobility needs]	**Good** ▪ Six lanes provide an opportunity to serve vehicles, pedestrian needs, transit ridership, but not a dedicated cycling route ▪ King Edward continues to serve its role as a link in the goods movement system	**Better** ▪ Five lanes provide an opportunity to serve vehicles, pedestrian needs, and transit ridership with a lane reduction that could provide a dedicated cycling route on the east side ▪ King Edward continues to serve its role as a link in the goods movement system	**Good** ▪ Four lanes provide an opportunity to serve vehicles and pedestrian needs with lane reductions on both sides that could provide a dedicated cycling route, but no transit priority ▪ King Edward continues to serve its role as a link in the goods movement system
Element 2 Principle (b)	Aim to provide an acceptable standard of service for each mode of travel Evaluation is based on northbound p.m. peak period modelling results.	**Acceptable** ▪ Walking time is acceptable ▪ Cycling time is acceptable ▪ Transit time, reliability, and volume are acceptable ▪ Vehicular traffic time and volume are acceptable ▪ Goods movement time and volume are acceptable	**Acceptable** ▪ Walking time is acceptable ▪ Cycling time is acceptable ▪ Transit time, reliability, and volume are acceptable ▪ Vehicular volume is acceptable; time is about one additional minute more than the 6 Lane ▪ Goods movement volume is acceptable; time is about one additional minute more than the 6 Lane	**Acceptable** ▪ Walking time is acceptable ▪ Cycling time is acceptable ▪ Although there is some effect on time and reliability, volume is maintained, which is acceptable ▪ Vehicular volume is acceptable; time is about one additional minute more than the 6 Lane ▪ Goods movement volume is acceptable; time is about one additional minute more than the 6 Lane

EVALUATION FRAMEWORK

Part B – Transportation Master Plan Policies				
Section Number	**Policy**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Element 2 Principle (c)	Give priority to public transit, walking and cycling over cars when conflicts arise	**Poor** ▪ Gives priority to transit ▪ Provides for walking ▪ Does not provide priority for cycling	**Good** ▪ Gives priority to transit ▪ Provides an opportunity to prioritize walking on the east side with wider sidewalks ▪ Provides an opportunity to prioritize cycling on the east side with a potential dedicated cycling lane	**Good** ▪ Does not give priority to transit ▪ Provides an opportunity to prioritize walking on both sides with wider sidewalks ▪ Provides an opportunity to prioritize cycling on both sides with potential dedicated cycling lanes
Element 3 Principle (a)	Build walkable communities	**Acceptable** ▪ Sidewalks are provided on both sides of the street ▪ Pedestrians have to cross at least six lanes of traffic	**Good** ▪ Sidewalks are provided on both sides of the street ▪ There is an opportunity to provide wider sidewalks on the east side ▪ Pedestrians have to cross at least five lanes of traffic	**Better** ▪ Sidewalks are provided on both sides of the street ▪ There is an opportunity to provide wider sidewalks on both sides of the street ▪ Pedestrians have to cross at least four lanes of traffic
Element 3 Principle (b)	Provide rapid transit and other quality transit services to community cores and employment areas	**Acceptable** ▪ Provides a transit priority lane	**Acceptable** ▪ Provides a transit priority lane	**Poor** ▪ No transit priority is provided
Element 3 Principle (e)	Foster a vibrant downtown by improving transit, walking and cycling access	**Good** ▪ Six lanes provide an opportunity to serve pedestrian needs and transit ridership, but not a dedicated cycling route	**Better** ▪ Five lanes provide an opportunity to serve pedestrian needs, and transit ridership with a lane reduction that could provide a dedicated cycling route	**Good** ▪ Four lanes provide an opportunity to serve pedestrian needs with a lane reduction that could provide a dedicated cycling route, but no transit improvement
Element 4 Principle (a)	Give priority to safety and security when planning, designing and operating transportation systems	**Acceptable** ▪ There is a basic sense of pedestrian safety	**Good** ▪ There could be an improved sense of pedestrian safety on the east side with a widened boulevard and/or an improved sense of cyclist safety on the east side with a potential dedicate cycling lane	**Better** ▪ There could be an improved sense of pedestrian safety on both sides with widened boulevards and/or an improved sense of cyclist safety on both sides with potential dedicate cycling lanes

EVALUATION FRAMEWORK

Part B – Transportation Master Plan Policies				
Section Number	**Policy**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Element 4 Principle (d)	Minimize the impacts of truck and automobile traffic on sensitive communities	**Poor** ▪ Maintains the status quo of traffic speed, volume, etc.	**Good** ▪ Reduces traffic speed and provides an opportunity to physically increase the separation distance between traffic and the east side of the community	**Better** ▪ Reduces traffic speed and provides an opportunity to physically increase the separation distance between traffic and both sides of the community
Element 4 Principle (e)	Minimize air pollution from transportation sources	**Poor** ▪ Maintaining the status quo does not help the city minimize air pollution (based on modelling of the peak p.m. period)	**Good** ▪ The reduction of one lane reduces traffic and air pollution (based on modelling of the peak p.m. period)	**Better** ▪ The reduction of two lanes reduces traffic and air pollution (based on modelling of the peak p.m. period)
Element 5 Principle (b)	Minimize transportation energy use, greenhouse gas emissions and other impacts on air, water, and land	**Poor** ▪ Maintaining the status quo does not help the city minimize greenhouse gas emissions (based on modelling of the peak p.m. period)	**Good** ▪ The reduction of one lane reduces traffic and greenhouse gas emissions (based on modelling of the peak p.m. period)	**Better** ▪ The reduction of two lanes reduces traffic and greenhouse gas emissions (based on modelling of the peak p.m. period)
Element 5 Principle (c)	Maximize greening within transportation rights of way	**Acceptable** ▪ Although the street is six lanes, recent tree planting has attempted to improve the streetscape	**Good** ▪ Reducing one lane may provide an area for additional tree planting	**Better** ▪ Reducing two lanes may provide an area for additional tree planting
Element 6 Principle (b)	Support efficient freight movement to, from and within the city	**Good** ▪ Six lanes is the most efficient configuration for freight movement (during the afternoon peak period)	**Acceptable** ▪ Five lanes allows the same volume of trucks through the corridor although it takes each truck roughly one minute longer than the 6 Lane (during the afternoon peak period)	**Acceptable** ▪ Four lanes allows the same volume of trucks through the corridor although it takes each truck roughly one minute longer than the 6 Lane (during the afternoon peak period)
Element 7 Principle (a)	Make the best possible use of existing facilities before adding new infrastructure [to deliver cost-effective services] In the context of King Edward Avenue, the new infrastructure potentially possible by the lane configurations includes wider sidewalks and/or dedicated cycling lanes.	**Acceptable** ▪ It is anticipated that the street serves as much pedestrians and cyclists that are willing to walk and bike through the corridor	**Acceptable** ▪ It is anticipated that potentially wider sidewalks and/or a dedicated cycling lane on the east side could encourage more walking and cycling, especially during off-peak periods when four lanes for traffic is presumed to be adequate	**Acceptable** ▪ It is anticipated that potentially wider sidewalks and/or a dedicated cycling lane on both sides could encourage more walking and cycling, especially during off-peak periods when four lanes for traffic is presumed to be adequate

EVALUATION FRAMEWORK

Part B – Transportation Master Plan Policies				
Section Number	**Policy**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
3.4	**Managing the Transportation System**			
1)	The City will endeavour to maintain a maximum 90% volume-to-capacity ratio for mixed traffic at signalized intersections during weekday peak hours, where feasible, except in the Central Area where a 100% ratio will be acceptable. Supporting initiatives will give due consideration to City objectives for road safety and improvements to conditions for walking, cycling and transit.	**Acceptable** ▪ The assumed volume-to-capacity ratio was 100% during peak periods	**Acceptable** ▪ The assumed volume-to-capacity ratio was 100% during peak periods	**Acceptable** ▪ The assumed volume-to-capacity ratio was 100% during peak periods
6.4	**Roads**			
1)	The City will apply design guidelines for new, widened and reconstructed roads... Reference is made to the City's "Urban Design Guidelines for Development Along Traditional Main Streets" in the interpretation of this policy.	**Poor** ▪ Urban design guidelines for wider sidewalks and increased landscaped areas along traditional main streets can not be implemented	**Acceptable** ▪ Urban design guidelines for wider sidewalks and increased landscaped areas along traditional main streets can potentially be implemented on the east side	**Good** ▪ Urban design guidelines for wider sidewalks and increased landscaped areas along traditional main streets can potentially be implemented on both sides
2)	The City will consider measures such as on-street parking, walking and cycling improvements, streetscaping, lane reductions or transit enhancements for roads identified as mainstreets or collectors in the Official Plan, particularly in Town Centres and Mixed-Use Centres. King Edward Avenue is not served by local transit so transit is not considered relevant in this specific line of the evaluation.	**Acceptable** ▪ On-street parking is considered in this scenario ▪ Does not contemplate further changes to the pedestrian and cycling environment ▪ Streetscape enhancements have been undertaken as part of the recent reconstruction ▪ Does not contemplate a lane reduction	**Good** ▪ On-street parking is considered in this scenario ▪ Has the potential for improved pedestrian and cycling environments on the east side ▪ Provides an opportunity for further streetscape enhancements on the east side ▪ Contemplates a one lane reduction	**Better** ▪ On-street parking is not considered in this scenario (but has not entirely been ruled out) ▪ Has the potential for improved pedestrian and cycling environments on both sides ▪ Provides an opportunity for further streetscape enhancements on both sides ▪ Contemplates a two lane reduction
6.11	**Parking**			
4a)	The City will support the availability of short-term parking for business (retail and service), institutional, residential and tourism uses, particularly those in the Central Area and inner city neighbourhoods, by providing on-street parking that does not compromise multimodal safety or service level targets	**Good** ▪ Provides the most availability of on-street parking of the three scenarios	**Acceptable** ▪ Provides for the availability of on-street parking, but not as much as the 6 Lane	**Poor** ▪ On-street parking is not considered in this scenario (but has not entirely been ruled out)
Part B – Transportation Master Plan Policies		Poor fit with 6 policies Acceptable fit with 8 policies Good fit with 5 policies Better fit with no policies	Poor fit with no policies Acceptable fit with 8 policies Good fit with 9 policies Better fit with 2 policies	Poor fit with 2 policies Acceptable fit with 5 policies Good fit with 5 policies Better fit with 7 policies

EVALUATION FRAMEWORK

Part C – Draft End State Goals from "Choosing Our Future"				
End-State Goal	**Description**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Health and Quality of Life	**Goal: All residents enjoy a high quality of life and contribute to community well-being** Our communities are healthy, safe, secure, accessible, and inclusive places, where all residents have the opportunities required to enjoy a high quality of life and be involved in community life. Indirect: The street's configuration may relate to citizen's perceptions of safety and accessibility.	**Acceptable** ▪ There is a basic sense of pedestrian accessibility and safety	**Good** ▪ There could be an improved sense of pedestrian accessibility and safety on the east side with a widened boulevard ▪ There could be an improved sense of cyclist accessibility and safety on the east side with the potential for a dedicated cycling lane	**Better** ▪ There could be an improved sense of pedestrian safety and accessibility on both sides with widened boulevards ▪ There could be an improved sense of cyclist accessibility and safety on both sides with the potential for dedicated cycling lanes
Economic Prosperity	**Goal: Economic prosperity supports residents, community well-being, and ecological health** Wealth is generated with a fraction of today's material and energy throughput and with respect for the limits of planetary ecosystems and resources. The region's economy supports regional self-reliance, good jobs for local people, and contributes to a high quality-of-life for all residents. Residents and businesses also support responsibly-produced goods and services from around the world. Not applicable. While there could be an opportunity to stimulate redevelopment with a road reconfiguration, an economic relationship is difficult to quantify for the lane configurations.	*Not Applicable. It is anticipated that economic prosperity would require a synergy of various factors such as overall market forces, possible land assembly, financial incentive programs, etc., with the lane reduction being one of them, rather than the primary stimulus.*	*Not Applicable. It is anticipated that economic prosperity would require a synergy of various factors such as overall market forces, possible land assembly, financial incentive programs, etc., with the lane reduction being one of them, rather than the primary stimulus.*	*Not Applicable. It is anticipated that economic prosperity would require a synergy of various factors such as overall market forces, possible land assembly, financial incentive programs, etc., with the lane reduction being one of them, rather than the primary stimulus.*
Culture and Identity	**Goal: Cultural vitality and diversity contribute to the region's strong identity** Ethnic diversity, artistic expression, and distinctive cultural heritage are supported and valued, contributing to a strong sense of place, identity, inclusivity and meaning. The culture of the region reflects a strong ethic of community and sustainability. Direct: The former configuration of King Edward as a local street has some relationship to the area's cultural heritage.	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to encourage a heritage theme	**Good** ▪ A reduction to five lanes is a step towards the former historic configuration of King Edward	**Better** ▪ A reduction to four lanes is the most substantial step towards the former historic configuration of King Edward

EVALUATION FRAMEWORK

Part C – Draft End State Goals from "Choosing Our Future"				
End-State Goal	**Description**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Biodiversity and Ecosystem Health	**Goal: Ecosystems are healthy, protected and support biodiversity** The region continues to fulfill its traditional ecological functions, supporting connected habitats, regulating water and nutrient cycles, and providing food and shelter to all species living in the region. Residents value biodiversity and ecosystem health and understand the interconnectedness between humans, other species, and the ecosystems in which we all live. Not applicable. The lane configurations do not impact ecological functions (e.g., water cycle) which are predominantly addressed through urban engineered systems within the study area.	*Not Applicable*	*Not Applicable*	*Not Applicable*
Governance and Decision-Making	**Goal: Decision-making is open, informed and inclusive** All voices in the region are heard, and each resident has the opportunity to collaborate and help set shared directions that are open, informed, and characterized by accountability and equity. As a region we can make decisions effectively and efficiently while fostering a shared sense of ownership and pride in our collective sustainability journey. We are a model for other regions and we share our knowledge openly in the hope that others will learn from our progress. Not applicable. The lane configurations do not impact the ability of citizens to participate in decision making.	*Not Applicable*	*Not Applicable*	*Not Applicable*
Climate Change	**Goal: The region is carbon neutral and adapts to a changing climate** The region is carbon neutral in that greenhouse emissions are reduced to the point where they can be absorbed (sequestered) by its ecosystems and technologies. The region has also ensured that it can adapt to deal with the impacts of climate change. Direct: Air quality has been modelled for the scenarios.	**Poor** ▪ Maintaining the status quo does not help the city adapt to climate change (based on modelling of the peak p.m. period)	**Good** ▪ The reduction of one lane reduces traffic and greenhouse gas emissions (based on modelling of the peak p.m. period)	**Better** ▪ The reduction of two lanes reduces traffic and greenhouse gas emissions (based on modelling of the peak p.m. period)
Energy	**Goal: Energy is used efficiently and supplied from green, renewable sources** Energy is used efficiently and responsibly in the region and comes from a diverse portfolio of resources that are renewable, low-impact, and contribute to local economic development. The region also manages demand for energy through community planning, transportation initiatives, and building design. Indirect: A street configuration that is conductive to walking and cycling provides local transportation alternatives to the private automobile.	**Acceptable** ▪ Sidewalks on both sides of the street are the minimum needed to encourage walking	**Good** ▪ Sidewalks on both sides of the street, plus the opportunity for wider sidewalks or a designated cycle route, encourages walking and cycling	**Good** ▪ Sidewalks on both sides of the street, plus the opportunity for wider sidewalks or a designated cycle route, encourages walking and cycling

EVALUATION FRAMEWORK

Part C – Draft End State Goals from "Choosing Our Future"				
End-State Goal	**Description**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Connectivity and Mobility	**Goal: Walking, cycling, and transit are residents' first choices for transportation** Through careful land use planning, the need to travel long distances has been greatly reduced because jobs and most of our daily needs are provided in complete, livable communities. Transportation networks are well-connected between and within communities, minimizing environmental impacts, moving people and goods safely, efficiently, and affordably, and encouraging social interaction. Residents choose walking, cycling and transit and mobility is enhanced by electronic communications, good planning and urban design. Direct: Walking, cycling, and transit have been analyzed for the scenarios.	**Acceptable** ▪ Provides a dedicated transit lane ▪ No potential for enhanced pedestrian and/or cycling facilities	**Good** ▪ Provides a dedicated transit lane ▪ There is the potential for enhanced pedestrian and/or cycling facilities on the east side of the street	**Good** ▪ Street still allows for buses to get through, but with less efficient service since they are not on a dedicated lane ▪ There is the potential for enhanced pedestrian and/or cycling facilities on both sides of the street
Materials and Solid Waste	**Goal: Waste is reduced towards zero** Waste is reduced to the point where it can be managed in the region without compromising human and ecological health. The use of virgin materials is greatly reduced because waste is used as a resource (recycled) wherever possible. Not applicable. The lane configurations do not impact solid waste generation.	*Not Applicable*	*Not Applicable*	*Not Applicable*
Water and Wastewater	**Goal: Water resources are cherished, conserved and protected** Regional water demand and management is consistent with the region's available water resources and meets the needs of ecological systems and other species. Wastewater and pollution are managed effectively so that the region's water supports natural aquatic ecosystems as well as our needs for fresh drinking water. Not applicable. The lane configurations do not impact regional water resources.	*Not Applicable*	*Not Applicable*	*Not Applicable*
Housing	**Goal: Housing options are green, healthy and meet the needs of the whole community** A variety of housing options provide affordable, attractive and accessible choices for all the people within the region. This range of housing choices exists within every community and allows people of various abilities and incomes to live in a community throughout various life stages. Housing is energy-efficient, healthy, and attractive, and uses sustainable building materials and practices. Indirect. The lane configuration may impact citizen's perspectives on the attractiveness of housing in the study area.	**Acceptable** ▪ Although the street is six lanes, recent streetscaping has attempted to increase the area's civic beauty, which may help with the attractiveness of housing	**Good** ▪ Reducing one lane may help with the attractiveness of housing on the east side of the street	**Better** ▪ Reducing two lanes may help with the attractiveness of housing on both sides of the street

EVALUATION FRAMEWORK

Part C – Draft End State Goals from "Choosing Our Future"				
End-State Goal	**Description**	**How well does the 6 Lane scenario fit with this policy?**	**How well does the 5 Lane scenario fit with this policy?**	**How well does the 4 Lane scenario fit with this policy?**
Food and Agriculture	**Goal: The local food system is sustainable and provides residents with healthy and affordable food** The region's farmers, working on a well-protected, highly productive land base, produce a great variety of foods using diverse, sustainable practices. While residents consume food from outside the region as well as modest amounts from urban areas, the region's farms and the local food system provide residents and businesses with a high-quality, healthy, and affordable supply of food. Not applicable. The lane configurations do not impact food production or agriculture.	*Not Applicable*	*Not Applicable*	*Not Applicable*
Part C – Summary		Poor fit with 1 policy Acceptable fit with 5 policies Good fit with no policies Better fit with no policies	Poor fit with no policies Acceptable fit with no policies Good fit with 6 policies Better fit with no polices	Poor fit with no policies Acceptable fit with no policies Good fit with 2 policies Better fit with 4 policies

EVALUATION FRAMEWORK

FINAL EVALUATION			
	How well does the 6 Lane scenario fit with these policies?	**How well does the 5 Lane scenario fit with these policies?**	**How well does the 4 Lane scenario fit with these policies?**
Part A – Official Plan - Recap	Poor fit with 5 policies Acceptable fit with 20 policies Good fit with 1 policy Better fit with 1 policy	Poor fit with 2 policies Acceptable fit with 9 policies Good fit with 16 policies Better fit with no policies	Poor fit with 5 policies Acceptable fit with 6 policies Good fit with 3 policies Better fit with 13 policies
Part B – Transportation Master Plan – Recap	Poor fit with 6 policies Acceptable fit with 8 policies Good fit with 5 policies Better fit with no policies	Poor fit with no policies Acceptable fit with 8 policies Good fit with 9 policies Better fit with 2 policies	Poor fit with 2 policies Acceptable fit with 5 policies Good fit with 5 policies Better fit with 7 policies
Part C – Choosing Our Future - Recap	Poor fit with 1 policy Acceptable fit with 5 policies Good fit with no policies Better fit with no policies	Poor fit with no policies Acceptable fit with no policies Good fit with 6 policies Better fit with no polices	Poor fit with no policies Acceptable fit with no policies Good fit with 2 policies Better fit with 4 policies
Collective Summary of A, B and C	**Poor fit with 12 policies** **Acceptable fit with 33 policies** **Good fit with 6 policies** **Better fit with 1 policy**	**Poor fit with 2 policies** **Acceptable fit with 17 policies** **Good fit with 31 policies** **Better fit with 2 policies**	**Poor fit with 7 policies** **Acceptable fit with 11 policies** **Good fit with 10 policies** **Better fit with 24 policies**
FINAL EVALUATION	**The 4 Lane Scenario, as an ultimate configuration, is the best fit with the city we want for the future as articulated by Choosing Our Future, the Official Plan, and the Transportation Master Plan.**		

5.3 Evaluation Observations, Result, and Recommendation

The Evaluation Framework has compared the scenarios against the values of our community and city and determined the following:

- The 6-Lane Scenario – essentially the status quo – goes against municipal policy more frequently than the other scenarios (it is a "poor fit" with 12 policies), however it does basically support municipal direction (it is an "acceptable fit" with 33 policies);
- The 5-Lane Scenario advances us to the future (it is a "good fit" with 31 policies); and,
- The 4-Lane Scenario helps us to advance towards the future by a significant degree (it is a "better fit" with 24 policies).

It has been previously noted that the End-State Goals of Choosing Our Future have not yet been approved by Council. If the results using the End-State Goals are excluded from the Evaluation Framework, the evaluation results are not materially affected.

It is recognized that the 4-Lane Scenario is a "poor fit" with seven policies but it should be noted that this is a matter of interpretation of policies in which transit service improvements or transit priority improvements are the subject matter. King Edward Avenue is used as a thoroughfare for STO buses beginning their route and no local transit service is provided directly on King Edward Avenue, so it could be argued that it is unfair for the 4-Lane Scenario to be a "poor fit" with these policies simply because it does not accommodate a transit priority lane. If this argument is accepted, then even stronger policy support exists for the 4-Lane Scenario as suggested in the Evaluation Framework.

The Evaluation Framework has determined that the 4-Lane Scenario, as an ultimate configuration, is the best fit with the city we want for the future as articulated by Choosing Our Future, the Official Plan, and the Transportation Master Plan.

While there is strong policy support for the 4-lane scenario as the ultimate configuration, we recognize that the transportation modelling data presents more of a mixed picture about reducing King Edward Avenue from six lanes to four lanes. It is therefore noteworthy to highlight the extensive research which has studied the effects of lane reductions in large urban cities, which concludes that:

> …the balance of evidence is that measures which reduce or reallocate road capacity, when well-designed and favoured by strong reasons of policy, need not be

automatically rejected for fear that they must inevitably cause unacceptable road congestion.[12]

It is recommended that the City of Ottawa accept the 4-Lane Scenario for King Edward Avenue as the ultimate future configuration for the corridor. Section 6 of this report discusses the considerations for implementation given the complexity inherent to moving toward the ultimate 4-Lane Scenario, the context in which King Edward Avenue exists, and the desire to achieve the 4-Lane Scenario as soon as opportunities arise.

6. Implementation Considerations

This section of the report describes key considerations necessary to finalize the design of the ultimate 4-Lane Scenario for King Edward Avenue. There are, however, several items that can be addressed in advance of a final design and full funding that will allow the transformation of King Edward Avenue to begin sooner rather than later. Some of these opportunities are discussed below along with considerations appropriate to each.

6.1 Functional[13] Design with Consultation

In moving from the current design of King Edward Avenue to the recommended ultimate 4-Lane Configuration there are a few key steps that will need to take place. However, a functional design is the primary first step in order to determine how the lanes being reclaimed will be used (i.e., wider sidewalks, dedicated cycling route, additional landscaping/streetscaping).

This design must be undertaken in collaboration with stakeholders, including representatives from the Task Force and Lowertown community. The lane reduction study has achieved success using a collaborative, consensus-based approach through much of the process. It is recommended that this approach continue to be used.

Once a functional design has been determined, then detailed design, costing, dependencies, staging and construction can follow.

[12] Cairns, Sally, et. al. 1998. *Traffic Impact of Highway Capacity Reductions: Assessment of the Evidence*. P.62.

[13] In engineering terms, functional design refers to laying out the details of the street's configuration with consideration for specific design requirements such as turning radii and other local constraints.

6.2 Opportunities to Advance Implementation Timing

Given King Edward's important role as an interprovincial link for commuters and commercial traffic, the number of significant interprovincial studies underway that have implications for King Edward, and other major road works in the area, particularly on Sussex Drive, the City of Ottawa may choose to delay final implementation of the recommended lane configuration until these studies or works are completed. While roadwork is on-going on Sussex Drive, roadway capacity may be needed for redirected traffic, which may impact the ability to implement the recommended lane configuration for King Edward Avenue.

Those opportunities that would see a portion of the King Edward Avenue implementation completed as part of other work would need to ensure that continuity is maintained. That is, individual intersections should not be altered without consideration to corridor continuity. If done, this could create a safety hazard as drivers are presented with conflicting information and are not able to predict upcoming lane arrangements.

Despite the opportunities discussed below there is one constraint that applies to all attempts to advance the implementation timeframe of the recommended ultimate 4-Lane Configuration. Traffic control devices and, in particular, traffic control signals will need to be relocated to accommodate the return of any traffic lane to community uses.

Adjacent road work or capital works

Any road work or capital works planned for streets adjacent to King Edward Avenue creates an opportunity to construct the recommended configuration at that location. However, consideration must be given to how a small piece of roadwork would fit in the overall configuration of King Edward Avenue before individual reconfigurations are made.

Annual line painting program

The annual repainting of lane markings provides the opportunity to make paint only adjustments to King Edward Avenue.

Final landscaping or streetscaping on King Edward Avenue

Funds designated for the final landscaping or streetscaping may be diverted to perform adjustments to King Edward Avenue. The ultimate landscaping and streetscaping can then be performed when final design, approval and funding are received.

6.3 Strategies for Early Implementation

On-Street Parking

Through the use of lane markings and signage, lanes recommended to be returned to the community may be designated as parking lanes. This would promote the development of long term travel patterns supportive of the 4 lane configuration and help discourage the persistence of travel patterns of the existing six lane configuration within the vehicular flow. As such, the final implementation of the 4-Lane Configuration would be transitional in nature rather than an immediate alteration in the transportation system.

An initial on-street parking configuration that would have minimal impact on traffic operations would be to provide for on-street parking along the length of King Edward Avenue in both directions during off peak periods. Additionally, on-street parking could be provided on the east side (northbound travel direction) of King Edward Avenue during morning peak hours.

Future provisions for bulb-outs or police enforcement may be used in conjunction with this strategy to ensure lane use compliance. However, care should be taken with implementing interim on-street parking to avoid creating any misconceptions of permanent on-street parking where it is not intended to be permanent.

Temporary 5-Lane Configuration

Recognizing the impact to STO transit service that the 4-Lane Configuration will have and, similarly, recognizing the long term plans for STO to relocate their service, then it may be possible to implement the east side (northbound) adjustments in advance of the west side (southbound) adjustments. This will allow some of the major community benefits to be realized on the east side while providing a specific transition period for transit operations.

Line Painting

Even considering the constraints identified previously regarding traffic control devices, line painting does present the opportunity to more rapidly implement the recommended changes with relatively little throwaway cost (traffic signals will need to be relocated eventually regardless). In addition, real benefits may be realized as traffic patterns adjust and become familiar with the ultimate 4-Lane Configuration.

Steering Committee

Regardless which implementation strategies are taken forward it is necessary to maintain the Steering Committee that has been established. The committee may require additional representation from certain city staff, emergency and police personnel or other stakeholders. The Steering Committee would identify any issues with proposed early implementation strategies and disseminate information about changes being made. This would allow feedback on changes to be recognized and the community, city staff and enforcement personnel to be fully aware of the current state of the project.

6.4 Tools for a Smooth Transition from Six to Four Lanes

As noted in Section 3, there is expected to be a transition period as roadway users adjust to a change in the corridor but the specific reactions of roadway users are difficult to define. We believe that being proactive rather than reactive is the best way for the city to smooth the transition from six lanes to the ultimate four lane configuration.

Understanding Transition Issues: Traffic Volume and Upstream Network Considerations

On March 23rd through 25th and April 27th through 29th, City of Ottawa staff monitored traffic on King Edward during the AM and PM peak hours. At the time being monitored King Edward Avenue was operating with three lanes of traffic in each direction similar to the 6-Lane Configuration. It was found that traffic volume during the peak hour had returned, for the most part, to pre-construction levels. This demonstrates that if three lanes in each direction are provided then motorists will take advantage of those lanes. It also indicates that inter-provincial drivers will adjust their behaviour or travel patterns to reflect the capacity available in the King Edward Corridor.

Experience of staff during construction along King Edward Avenue was that a reduced capacity in the corridor affected other sections of the network. Queues developed as a result of capacity constraints, delays increased on upstream streets and it was reported that traffic infiltrated into adjacent communities. These issues may again impact the area should a lane reduction on King Edward Avenue be implemented.

In order to ensure a smooth transition to the 4-Lane Configuration we have considered this experience and provide the mitigating suggestions below.

Traffic Monitoring Program / Protocol as a Transition Tool

Implementing the 4-Lane Configuration along King Edward Avenue will require a period of adjustment for the corridor's users. Any constraints, which are expected to be short-term in nature, should be monitored to ensure that they do not evolve into long term impact (such as real or perceived traffic infiltration issues) which might negatively affect adjacent neighbourhood streets.

To this end, a monitoring program will be useful. This program would monitor existing traffic volumes on neighbourhood streets and compare them against volumes measured after implementation. The monitoring program would then determine the need for traffic management (such as time of day turn restrictions) or neighbourhood traffic calming measures (such as speed humps) required to mitigate impacts on the local community. This follow up monitoring program would likely be managed by the Transportation Planning Branch.

In terms of protocol, the manager assigned would become the contact point within the record tracking system (RTS) for any public inquiries, calls to the 311 line or city councillor requests related to traffic in the King Edward Avenue area. Rather than reacting to each individual inquiry/request, the feedback would be held until an appropriate milestone in the monitoring program. At that milestone, all feedback would be considered collectively as an input to the next stage of the on-going monitoring program. Ultimately any required mitigation measures or further studies would be recommended based on the data collected pre- and post-implementation as well as community feedback.

Deployment of Traffic Police to Manage Motorist Behaviour as a Transition Tool

Transportation Planning Branch and Roads and Traffic Operations and Maintenance Branch staff have indicated that they can take an active role in managing the system (e.g., adjusting the timing of traffic signals) and can monitor whether motorists are using inappropriate ways to "get around" King Edward Avenue, but these approaches have limits to their effect.

We therefore recommend that an important part of a proactive strategy is the dedication of police resources when King Edward Avenue is reduced to four lanes or when one of the early implementation strategies is advanced. Staff noted that traffic police officers are the most capable officers for ensuring that roadway users share the road and that traffic police officers are also the most capable of addressing inappropriate behaviour of motorists especially during the rush hour periods when there is traffic congestion. Additionally, based on the advice of staff, we recommend that a sergeant be present at the traffic control centre to coordinate the traffic police.

We anticipate that the presence of the traffic police is a temporary measure to encourage good behaviour (e.g., to ensure vehicles do not block an intersection causing an OC Transpo bus to be delayed). Once a pattern of good motorist behaviour has been established, the presence of the traffic police would not be necessary. They may return from time-to-time to encourage continued good behaviour, similar to the approach that the police take for many of their other campaigns.

6.5 Strategies to Support Long-Term Quality of Life

The underlying impetus for the study and the change from six lanes to four lanes on King Edward Avenue is improving the quality of life in the neighbourhood. While the change on King Edward Avenue is a step forward, the summary of the social context in the Phase 1 Report confirmed that there are social issues that impact on quality of life. We believe that these issues will continue to prevail if they are left unaddressed.

The acceptance of change from six lanes to four lanes on King Edward Avenue provides a unique catalyst to address the other quality of life needs of the neighbourhood, which in turn helps create a more liveable city. Important follow-up work is recommended and described

below. In order to take advantage of the catalyst effect, this work needs to be completed within the next few years.

Neighbourhood Planning Initiative for Lowertown

The Neighbourhood Planning Initiative is a collaborative planning initiative that integrates social, economic, physical development, and land planning issues at a local neighbourhood level. Neighbourhood planning engages citizens and builds on local knowledge to better reflect the needs, priorities, and concerns of local citizens. It also builds collaboration among city departments.

Undertaking a neighbourhood plan for Lowertown will help the neighbourhood and city identify key priorities for improving quality of life and implement changes that, among other things, will address the long-standing social issues in Lowertown.

Through the neighbourhood planning exercise, specific consideration should be given to determining the need and timing for completion of a Community Design Plan.

Community Design Plan for King Edward Avenue / Lowertown

A Community Design Plan (CDP) addresses growth and change and focuses primarily on land use and development issues. Given that King Edward Avenue is identified as a Traditional Main Street in the Official Plan, it is considered a priority area for a CDP.

Lowertown residents have expressed a concern about the lack of private development, redevelopment and investment in the area and along King Edward Avenue. The CDP would provide an opportunity to define the scale and intensity of redevelopment appropriate along King Edward Avenue and the adjacent neighbourhood, and provide the necessary guidance for the land use, scale, and urban design of redevelopment proposals.

Community Improvement Plan for Lowertown

A Community Improvement Plan (CIP), among other things, enables the City of Ottawa to implement programs that support private sector investment. Programs such as grants, loans, and tax assistance can help encourage development that would not otherwise occur without the incentive programs in place.

As noted previously, residents are concerned about the stagnation of development in the area and along King Edward Avenue. The financial incentive programs of a CIP would encourage the redevelopment of the area's stagnant properties. This redevelopment would create the much-needed cohesion between the improvement of King Edward Avenue and the improvement of the neighbourhood's built form.

7. Summary and Next Steps

The following is a summary of the findings and recommended next steps resulting from Phase 2 of the King Edward Lane Reduction Study:

- It is recommended that the City of Ottawa accept the 4-Lane Scenario as the ultimate future for King Edward Avenue;
- It is recommended that the City of Ottawa proceed with implementation of interim measures as described in this report, including but not limited to, on-street parking;
- It is recommended that the Steering Committee continue to be involved in all aspects of the reduction of King Edward Avenue to 4 lanes, with additional representation from staff to be added as necessary;
- It is recommended that the City of Ottawa implement a follow-up program comprising at minimum a neighbourhood plan and a community improvement plan within the next two years.

Appendix A: Computer Modelling Results

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	WBR2	NBT	SBT	SER	All
Delay / Veh (s)	9.0	0.7	31.4	2366.8	48.1

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	1.1	14.4	10.4

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	23.2	1.4	4.1	1.2	16.5	12.7

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	1.3	1.5	1.6	1.5

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	34.5	29.8	21.3	6.6	3.3	2.3	10.4

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	28.7	30.1	19.5	30.8	4.7	13.8	3.7	15.6

111: Clarence Street & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	0.9	1.2	1.5	1.3	1.3

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	2.4	0.6	7.0	13.6	3.5	19.0	11.9	15.7

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBT	SBT	All
Delay / Veh (s)	10.3	4.2	1.5	2.9	3.1

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	35.9	16.2	13.8	37.7	20.7	39.3	12.9	24.7	15.2	9.9	24.0

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	2.8	1.9	1.1	1.6

Total Network Performance

Delay / Veh (s) 75.1

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	WB	SB	SB	SE
Directions Served	>	T	T	R
Maximum Queue (m)	14.0	49.9	49.8	43.3
Average Queue (m)	5.3	38.0	32.1	32.0
95th Queue (m)	11.7	62.3	61.7	50.8
Link Distance (m)	96.2	39.5	39.5	38.7
Upstream Blk Time (%)		20	4	77
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (m)	117.8	118.1	122.0
Average Queue (m)	110.0	69.3	36.2
95th Queue (m)	128.6	119.7	114.1
Link Distance (m)	68.9	68.9	68.9
Upstream Blk Time (%)	33	4	1
Queuing Penalty (veh)	214	25	4
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	NB	SB	SB	SB
Directions Served	LR	T	T	TR	T	T	T
Maximum Queue (m)	13.7	39.2	49.3	28.6	91.6	91.3	88.9
Average Queue (m)	3.2	19.9	29.1	8.0	88.6	69.6	48.8
95th Queue (m)	10.4	36.9	43.4	23.2	90.4	101.8	79.4
Link Distance (m)	215.7	43.2	43.2	43.2	67.5	67.5	67.5
Upstream Blk Time (%)		0	0	0	39	8	2
Queuing Penalty (veh)		0	1	0	251	53	10
Storage Bay Dist (m)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 108: Guigues Ave & King Edward Avenue

Movement
Directions Served
Maximum Queue (m)
Average Queue (m)
95th Queue (m)
Link Distance (m)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (m)
Storage Blk Time (%)
Queuing Penalty (veh)

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	T	TR
Maximum Queue (m)	73.0	67.1	72.0	63.2	26.9	24.2	23.3	11.6	17.9	19.9	21.8	25.5
Average Queue (m)	43.8	37.7	41.3	30.4	14.5	10.0	8.6	2.5	9.0	4.2	9.9	8.5
95th Queue (m)	64.9	60.0	65.0	54.2	22.8	21.2	19.2	8.6	16.2	13.1	19.1	19.9
Link Distance (m)	87.2	87.2			69.0	69.0	69.0			71.8	71.8	71.8
Upstream Blk Time (%)			0									
Queuing Penalty (veh)			0									
Storage Bay Dist (m)			75.0	75.0				55.0	55.0			
Storage Blk Time (%)		0	0	0								
Queuing Penalty (veh)		0	0	0								

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	T	TR	L	L	T	T	T
Maximum Queue (m)	44.0	65.0	62.0	71.1	68.2	61.1	67.6	72.3	25.4	27.5	24.1
Average Queue (m)	21.4	39.7	35.8	42.3	39.0	29.7	45.9	54.3	8.8	10.5	5.3
95th Queue (m)	37.5	58.5	56.8	67.6	63.1	54.8	65.2	73.6	20.2	23.3	17.0
Link Distance (m)	131.1	131.1	131.1	60.3	60.3	60.3	69.0	69.0	69.0	69.0	69.0
Upstream Blk Time (%)				2	1	0	0	1			
Queuing Penalty (veh)				3	2	0	0	4			
Storage Bay Dist (m)											
Storage Blk Time (%)											
Queuing Penalty (veh)											

Intersection: 111: Clarence Street & King Edward Avenue

Movement	NB	SB	SB	SB
Directions Served	T	T	T	TR
Maximum Queue (m)	1.5	15.5	25.5	24.0
Average Queue (m)	0.1	0.8	2.4	1.5
95th Queue (m)	1.1	7.2	13.1	11.2
Link Distance (m)	63.9	60.3	60.3	60.3
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	R	R	L	T	T	TR	T	T	TR
Maximum Queue (m)	15.6	8.4	30.0	34.4	35.6	25.3	85.5	87.0	86.0
Average Queue (m)	2.2	0.6	10.8	14.3	14.1	9.5	58.7	64.0	56.3
95th Queue (m)	9.2	4.1	22.8	29.4	29.4	21.3	82.8	89.5	81.9
Link Distance (m)	123.4	145.6		139.4	139.4	139.4	63.9	63.9	63.9
Upstream Blk Time (%)							3	6	3
Queuing Penalty (veh)							11	18	10
Storage Bay Dist (m)			65.0						
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 113: George Street & King Edward Avenue

Movement	EB	WB	SB
Directions Served	R	R	T
Maximum Queue (m)	35.9	12.7	1.9
Average Queue (m)	16.4	3.4	0.1
95th Queue (m)	28.5	10.9	1.3
Link Distance (m)	61.8	42.4	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			24.0
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	77.9	78.3	32.5	131.1	34.0	61.1	60.5	29.8	63.8	40.9	52.3	58.5
Average Queue (m)	37.1	28.7	6.4	73.9	10.6	34.7	29.5	7.3	23.3	17.7	24.0	21.1
95th Queue (m)	67.7	55.4	22.1	121.5	32.2	53.9	51.7	22.1	49.8	34.6	42.3	49.0
Link Distance (m)		333.4		149.1		67.9	67.9		63.5	63.5	63.5	63.5
Upstream Blk Time (%)				0		0	0		0		0	1
Queuing Penalty (veh)				0		0	0		1		0	1
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	0	10	0	40	0		17	0				
Queuing Penalty (veh)	0	17	0	27	0		7	0				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	SB
Directions Served	LT	R
Maximum Queue (m)	7.3	1.2
Average Queue (m)	0.4	0.0
95th Queue (m)	3.8	0.8
Link Distance (m)	119.5	173.9
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 661

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.91			0.91
Frpb, ped/bikes	0.99		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.98		1.00			1.00
Flt Protected	0.96		1.00			1.00
Satd. Flow (prot)	1627		4366			4499
Flt Permitted	0.96		1.00			1.00
Satd. Flow (perm)	1627		4366			4499
Volume (vph)	13	3	815	18	0	1942
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	14	3	867	19	0	2066
RTOR Reduction (vph)	2	0	2	0	0	0
Lane Group Flow (vph)	15	0	884	0	0	2066
Confl. Peds. (#/hr)		20		19		
Heavy Vehicles (%)	2%	2%	11%	2%	2%	8%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	30.0		63.4			63.4
Effective Green, g (s)	31.9		65.1			65.1
Actuated g/C Ratio	0.30		0.62			0.62
Clearance Time (s)	5.9		5.7			5.7
Lane Grp Cap (vph)	494		2707			2789
v/s Ratio Prot			0.20			c0.46
v/s Ratio Perm	c0.01					
v/c Ratio	0.03		0.33			0.74
Uniform Delay, d1	25.7		9.5			14.0
Progression Factor	1.00		0.39			1.00
Incremental Delay, d2	0.1		0.3			1.8
Delay (s)	25.8		4.0			15.8
Level of Service	C		A			B
Approach Delay (s)	25.8		4.0			15.8
Approach LOS	C		A			B

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	
Lane Util. Factor					0.95	0.88		0.91			0.81	
Frpb, ped/bikes					1.00	0.98		1.00			1.00	
Flpb, ped/bikes					1.00	1.00		1.00			1.00	
Frt					1.00	0.85		1.00			0.99	
Flt Protected					0.99	1.00		1.00			1.00	
Satd. Flow (prot)					3284	2565		4189			6640	
Flt Permitted					0.99	1.00		1.00			1.00	
Satd. Flow (perm)					3284	2565		4189			6640	
Volume (vph)	0	0	0	72	414	555	0	542	0	0	1861	94
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	77	440	590	0	577	0	0	1980	100
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	8	0
Lane Group Flow (vph)	0	0	0	0	517	590	0	577	0	0	2072	0
Confl. Peds. (#/hr)				14		12						1
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	16%	2%	2%	8%	2%
Turn Type				Perm		custom						
Protected Phases					4	1		2			6	
Permitted Phases				4		4						
Actuated Green, G (s)					30.8	41.6		45.2			58.3	
Effective Green, g (s)					33.4	45.9		47.1			63.6	
Actuated g/C Ratio					0.32	0.44		0.45			0.61	
Clearance Time (s)					6.6	5.7		5.9			9.3	
Lane Grp Cap (vph)					1045	1219		1879			4022	
v/s Ratio Prot						c0.06		0.14			c0.31	
v/s Ratio Perm					0.16	0.17						
v/c Ratio					0.49	0.48		0.31			0.52	
Uniform Delay, d1					29.0	21.1		18.5			11.9	
Progression Factor					0.98	0.97		0.33			0.19	
Incremental Delay, d2					1.7	1.4		0.4			0.3	
Delay (s)					30.1	21.9		6.5			2.6	
Level of Service					C	C		A			A	
Approach Delay (s)		0.0			25.7			6.5			2.6	
Approach LOS		A			C			A			A	

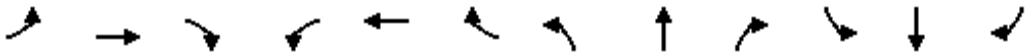
Intersection Summary			
HCM Average Control Delay	10.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.91		0.97	0.91	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.97						0.99		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3054						4000		3216	4226	
Flt Permitted	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3054						4000		3216	4226	
Volume (vph)	134	398	101	0	0	0	0	408	36	948	985	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	143	423	107	0	0	0	0	434	38	1009	1048	0
RTOR Reduction (vph)	0	20	0	0	0	0	0	10	0	0	0	0
Lane Group Flow (vph)	143	510	0	0	0	0	0	462	0	1009	1048	0
Confl. Peds. (#/hr)			29						19	19		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	21%	2%	2%	15%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	30.8	30.8						13.3		38.7	61.3	
Effective Green, g (s)	33.4	33.4						18.6		41.0	63.6	
Actuated g/C Ratio	0.32	0.32						0.18		0.39	0.61	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	480	971						709		1256	2560	
v/s Ratio Prot	0.09	c0.17						c0.12		c0.31	0.25	
v/s Ratio Perm												
v/c Ratio	0.30	0.53						0.65		0.80	0.41	
Uniform Delay, d1	27.0	29.3						40.2		28.4	10.9	
Progression Factor	1.00	1.00						0.57		0.50	0.10	
Incremental Delay, d2	1.6	2.0						4.5		4.8	0.4	
Delay (s)	28.6	31.3						27.6		18.9	1.5	
Level of Service	C	C						C		B	A	
Approach Delay (s)		30.8			0.0			27.6			10.0	
Approach LOS		C			A			C			B	

Intersection Summary				
HCM Average Control Delay	17.0	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.67			
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	12.0	
Intersection Capacity Utilization	75.0%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor			1.00			1.00	1.00	0.91			0.91	
Frpb, ped/bikes			0.99			0.97	1.00	1.00			0.99	
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	
Frt			0.86			0.86	1.00	0.99			0.99	
Flt Protected			1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)			1489			1459	1656	4037			4231	
Flt Permitted			1.00			1.00	0.20	1.00			1.00	
Satd. Flow (perm)			1489			1459	344	4037			4231	
Volume (vph)	0	0	43	0	0	14	111	432	28	0	943	50
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	46	0	0	15	118	460	30	0	1003	53
RTOR Reduction (vph)	0	0	0	0	0	0	0	7	0	0	5	0
Lane Group Flow (vph)	0	0	46	0	0	15	118	483	0	0	1051	0
Confl. Peds. (#/hr)			5			74	76		30	30		76
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	20%	2%	2%	14%	2%
Turn Type			custom			custom	pm+pt					
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					
Actuated Green, G (s)			105.0			105.0	93.6	46.6			46.6	
Effective Green, g (s)			105.0			105.0	97.0	48.4			48.4	
Actuated g/C Ratio			1.00			1.00	0.92	0.46			0.46	
Clearance Time (s)							5.6	5.8			5.8	
Lane Grp Cap (vph)			1489			1459	925	1861			1950	
v/s Ratio Prot							c0.06	0.12			c0.25	
v/s Ratio Perm			0.03			0.01	0.06					
v/c Ratio			0.03			0.01	0.13	0.26			0.54	
Uniform Delay, d1			0.0			0.0	1.2	17.3			20.3	
Progression Factor			1.00			1.00	15.43	0.39			0.93	
Incremental Delay, d2			0.0			0.0	0.3	0.3			1.0	
Delay (s)			0.0			0.0	18.5	7.1			19.8	
Level of Service			A			A	B	A			B	
Approach Delay (s)		0.0			0.0			9.3			19.8	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91		1.00	0.83		1.00	0.88	1.00	1.00	0.90
Flpb, ped/bikes	0.96	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1053	1745	1355		1745	1231		3316	1309	1578	3316	931
Flt Permitted	0.32	1.00	1.00		1.00	1.00		1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)	356	1745	1355		1745	1231		3316	1309	846	3316	931
Volume (vph)	144	267	28	0	392	66	0	346	42	210	666	248
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	153	284	30	0	417	70	0	368	45	223	709	264
RTOR Reduction (vph)	0	0	15	0	0	25	0	0	30	0	0	178
Lane Group Flow (vph)	153	284	15	0	417	45	0	368	15	223	709	86
Confl. Peds. (#/hr)	270		128	128		270			65	65		54
Heavy Vehicles (%)	55%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	46%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	51.5	56.5	51.5		32.5	51.5		20.0	32.9	32.9	36.6	32.9
Effective Green, g (s)	52.8	57.8	52.8		33.8	52.8		22.6	34.2	34.2	39.2	34.2
Actuated g/C Ratio	0.50	0.55	0.50		0.32	0.50		0.22	0.33	0.33	0.37	0.33
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	312	961	681		562	619		714	426	363	1238	303
v/s Ratio Prot	c0.09	0.16			c0.24			0.11		0.07	c0.21	
v/s Ratio Perm	0.15		0.01			0.04			0.01	0.13		0.09
v/c Ratio	0.49	0.30	0.02		0.74	0.07		0.52	0.03	0.61	0.57	0.28
Uniform Delay, d1	26.3	12.7	13.1		31.7	13.5		36.4	24.1	31.7	26.2	26.3
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	0.27	0.26	0.47
Incremental Delay, d2	5.4	0.8	0.1		8.6	0.2		2.6	0.2	6.9	1.8	2.1
Delay (s)	31.8	13.5	13.2		40.3	13.7		39.0	24.3	15.4	8.5	14.5
Level of Service	C	B	B		D	B		D	C	B	A	B
Approach Delay (s)		19.4			36.5			37.4			11.1	
Approach LOS		B			D			D			B	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	105.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	SER	All
Delay / Veh (s)	2.0	1.2	9.9	1.8

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	4.5	2.7	3.8

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	41.3	10.7	12.5	8.2	8.9	11.3

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	5.6	2.5	1.2	4.0

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	27.1	21.6	57.2	8.8	7.6	2.2	20.1

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	36.0	37.0	26.3	26.8	9.2	38.1	3.5	26.5

111: Clarence Street & King Edward Avenue Performance by movement

Movement	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	8.8	2.2	1.4	0.9	2.7

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	2.3	1.5	8.2	10.2	2.7	35.5	19.8	17.4

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	NBT	SBT	All
Delay / Veh (s)	1037.0	1.6	20.1	38.9

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	271.5	161.0	175.1	1189.3	1152.5	727.1	727.6	170.2	25.1	16.0	509.2

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	6.7	3.6	214.9	113.2

Total Network Performance

Delay / Veh (s)	346.2

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	SB	SB	SE
Directions Served	T	T	R
Maximum Queue (m)	7.0	8.1	16.4
Average Queue (m)	0.2	0.4	2.1
95th Queue (m)	3.2	3.5	8.5
Link Distance (m)	39.5	39.5	38.7
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	NB	NB	NB	SB	SB
Directions Served	T	T	TR	T	T
Maximum Queue (m)	62.7	93.2	72.8	82.3	65.8
Average Queue (m)	6.6	29.6	7.4	14.3	5.6
95th Queue (m)	38.3	92.9	42.8	53.0	34.4
Link Distance (m)	67.5	67.5	67.5	68.9	68.9
Upstream Blk Time (%)	0	2	0	0	0
Queuing Penalty (veh)	1	17	1	2	1
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	NB	SB	SB
Directions Served	LR	T	T	TR	T	T
Maximum Queue (m)	15.0	65.8	65.2	64.4	89.1	82.3
Average Queue (m)	4.6	60.1	62.5	50.9	71.8	46.2
95th Queue (m)	13.1	70.5	68.2	72.0	101.7	79.8
Link Distance (m)	215.7	43.2	43.2	43.2	67.5	67.5
Upstream Blk Time (%)		23	34	12	9	1
Queuing Penalty (veh)		197	294	106	61	8
Storage Bay Dist (m)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 108: Guigues Ave & King Edward Avenue

Movement	NB	NB	NB	SB
Directions Served	T	T	TR	T
Maximum Queue (m)	62.0	67.8	50.1	1.7
Average Queue (m)	22.4	28.6	8.5	0.1
95th Queue (m)	52.2	58.6	31.3	1.2
Link Distance (m)	71.8	71.8	71.8	43.2
Upstream Blk Time (%)	0	0		
Queuing Penalty (veh)	0	1		
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	T	R
Maximum Queue (m)	46.1	123.4	87.0	82.7	66.2	67.4	47.3	36.8	40.9	45.7	30.6	1.2
Average Queue (m)	29.5	113.6	85.3	79.9	36.6	34.0	24.4	10.5	15.0	5.0	3.6	0.0
95th Queue (m)	45.6	150.0	89.0	90.7	53.4	51.5	41.8	36.8	41.3	25.7	15.7	0.7
Link Distance (m)	87.2	87.2			69.1	69.1	69.1			71.8	71.8	
Upstream Blk Time (%)		35	13	1	0	0				0		
Queuing Penalty (veh)		235	0	0	0	0				1		
Storage Bay Dist (m)			75.0	75.0				55.0	55.0			25.0
Storage Blk Time (%)		0	41	6				0	1	0	0	
Queuing Penalty (veh)		2	59	9				1	3	0	0	

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	T	TR	L	L	T	T
Maximum Queue (m)	77.1	75.5	75.4	84.1	83.9	80.2	73.0	75.0	20.2	25.2
Average Queue (m)	51.7	51.1	43.5	69.8	69.0	55.1	59.1	62.9	8.9	7.2
95th Queue (m)	73.0	71.8	67.1	87.8	88.4	81.2	79.4	81.4	19.2	19.0
Link Distance (m)	134.6	134.6	134.6	60.2	60.2	60.2	69.1	69.1	69.1	69.1
Upstream Blk Time (%)				10	11	5	6	10		
Queuing Penalty (veh)				48	55	24	21	32		
Storage Bay Dist (m)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 111: Clarence Street & King Edward Avenue

Movement	WB	NB	NB	NB	SB	SB
Directions Served	R	T	T	TR	T	T
Maximum Queue (m)	44.9	45.3	38.2	18.6	20.1	28.4
Average Queue (m)	18.3	7.5	5.3	0.9	1.6	2.8
95th Queue (m)	32.8	27.5	22.2	8.0	12.8	16.4
Link Distance (m)	148.7	63.8	63.8	63.8	60.2	60.2
Upstream Blk Time (%)						0
Queuing Penalty (veh)						0
Storage Bay Dist (m)						
Storage Blk Time (%)						1
Queuing Penalty (veh)						0

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	NB	SB	SB	SB
Directions Served	R	R	L	T	T	TR	T	T	R
Maximum Queue (m)	22.0	20.5	30.6	35.1	37.0	27.7	85.8	87.6	34.0
Average Queue (m)	4.4	5.9	12.5	19.6	21.0	11.4	61.0	65.1	6.0
95th Queue (m)	14.7	16.1	24.9	31.3	32.6	23.4	85.8	89.8	23.2
Link Distance (m)	123.4	145.6		139.4	139.4	139.4	63.8	63.8	
Upstream Blk Time (%)							9	13	
Queuing Penalty (veh)							33	48	
Storage Bay Dist (m)			65.0						25.0
Storage Blk Time (%)								45	0
Queuing Penalty (veh)								11	0

Intersection: 113: George Street & King Edward Avenue

Movement	EB	SB	SB	SB	SB
Directions Served	R	T	T	T	TR
Maximum Queue (m)	52.1	31.0	76.3	70.3	41.5
Average Queue (m)	32.1	15.1	34.8	28.0	3.3
95th Queue (m)	72.0	39.7	116.2	100.3	22.5
Link Distance (m)	61.8		139.4	139.4	139.4
Upstream Blk Time (%)	36		2	0	
Queuing Penalty (veh)	0		5	0	
Storage Bay Dist (m)		24.0			
Storage Blk Time (%)		27	1		
Queuing Penalty (veh)		63	2		

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	98.5	343.8	22.1	158.4	36.2	77.8	76.3	31.0	84.8	65.8	70.2	81.6
Average Queue (m)	88.1	230.8	2.8	153.9	22.5	72.6	72.4	8.2	72.4	26.9	29.6	37.1
95th Queue (m)	113.1	435.5	14.5	156.0	44.9	74.7	74.5	26.0	102.7	50.3	53.2	71.8
Link Distance (m)		333.4		149.1		67.9	67.9		63.5	63.5	63.5	63.5
Upstream Blk Time (%)		22		54		69	67		50	1	1	2
Queuing Penalty (veh)		0		0		0	0		126	2	2	5
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	45	24	0	60	1		73	0				
Queuing Penalty (veh)	176	58	0	132	7		69	0				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	NB	SB	SB
Directions Served	LT	T	R	R
Maximum Queue (m)	68.8	62.3	166.8	184.2
Average Queue (m)	27.2	12.2	19.6	162.5
95th Queue (m)	63.7	44.8	99.6	240.2
Link Distance (m)	119.5	119.5	173.9	173.9
Upstream Blk Time (%)			0	42
Queuing Penalty (veh)			0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Nework Summary

Network wide Queuing Penalty: 1918

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.91			0.95
Frpb, ped/bikes	0.96		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.93		1.00			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1518		4668			3191
Flt Permitted	0.98		1.00			1.00
Satd. Flow (perm)	1518		4668			3191
Volume (vph)	11	11	2588	12	0	1267
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	12	12	2753	13	0	1348
RTOR Reduction (vph)	3	0	0	0	0	0
Lane Group Flow (vph)	21	0	2766	0	0	1348
Confl. Peds. (#/hr)		58		23		
Heavy Vehicles (%)	2%	2%	4%	2%	2%	6%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	23.0		75.1			75.1
Effective Green, g (s)	24.9		77.1			77.1
Actuated g/C Ratio	0.23		0.70			0.70
Clearance Time (s)	5.9		6.0			6.0
Lane Grp Cap (vph)	344		3272			2237
v/s Ratio Prot			c0.59			0.42
v/s Ratio Perm	c0.01					
v/c Ratio	0.06		0.85			0.60
Uniform Delay, d1	33.4		12.1			8.5
Progression Factor	1.00		0.51			1.00
Incremental Delay, d2	0.3		1.0			1.2
Delay (s)	33.7		7.2			9.7
Level of Service	C		A			A
Approach Delay (s)	33.7		7.2			9.7
Approach LOS	C		A			A

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	4.0
Lane Util. Factor					0.95	0.88		0.91			0.86	1.00
Frpb, ped/bikes					1.00	0.99		1.00			1.00	1.00
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3291	2579		4628			5777	1127
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3291	2579		4628			5777	1127
Volume (vph)	0	0	0	46	291	993	0	1860	0	0	1254	24
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	49	310	1056	0	1979	0	0	1334	26
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	0	0	359	1056	0	1979	0	0	1334	17
Confl. Peds. (#/hr)				4		6				1		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	6%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	60
Turn Type				Perm		custom						Perm
Protected Phases					4	1		2			6	
Permitted Phases				4		4						6
Actuated Green, G (s)					28.7	44.1		47.7			65.4	65.4
Effective Green, g (s)					31.3	48.4		49.6			70.7	70.7
Actuated g/C Ratio					0.28	0.44		0.45			0.64	0.64
Clearance Time (s)					6.6	5.7		5.9			9.3	9.3
Lane Grp Cap (vph)					936	1229		2087			3713	724
v/s Ratio Prot						c0.13		c0.43			0.23	
v/s Ratio Perm					0.11	0.28						0.01
v/c Ratio					0.38	0.86		0.95			0.36	0.02
Uniform Delay, d1					31.6	27.7		29.0			9.1	7.1
Progression Factor					0.97	0.96		0.18			0.20	0.03
Incremental Delay, d2					1.2	7.9		5.6			0.2	0.0
Delay (s)					31.8	34.6		10.9			2.0	0.3
Level of Service					C	C		B			A	A
Approach Delay (s)		0.0			33.9			10.9			2.0	
Approach LOS		A			C			B			A	

Intersection Summary			
HCM Average Control Delay	15.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.91		0.97	0.95	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.98						1.00		1.00	1.00	
Flt Protected	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3058						4528		3216	3103	
Flt Permitted	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3058						4528		3216	3103	
Volume (vph)	379	388	68	0	0	0	0	1481	29	636	664	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	403	413	72	0	0	0	0	1576	31	677	706	0
RTOR Reduction (vph)	0	9	0	0	0	0	0	2	0	0	0	0
Lane Group Flow (vph)	291	588	0	0	0	0	0	1605	0	677	706	0
Confl. Peds. (#/hr)			65				61		16	16		61
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	9%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	28.7	28.7						36.3		22.8	68.4	
Effective Green, g (s)	31.3	31.3						41.6		25.1	70.7	
Actuated g/C Ratio	0.28	0.28						0.38		0.23	0.64	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	429	870						1712		734	1994	
v/s Ratio Prot	c0.19	0.19						c0.35		c0.21	0.23	
v/s Ratio Perm												
v/c Ratio	0.68	0.68						0.94		0.92	0.35	
Uniform Delay, d1	34.9	34.9						32.9		41.5	9.1	
Progression Factor	1.00	1.00						0.31		0.79	0.34	
Incremental Delay, d2	8.4	4.2						10.5		18.2	0.5	
Delay (s)	43.3	39.0						20.6		51.0	3.6	
Level of Service	D	D						C		D	A	
Approach Delay (s)		40.4			0.0			20.6			26.8	
Approach LOS		D			A			C			C	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	4.0
Lane Util. Factor			1.00			1.00	1.00	0.91			0.95	1.00
Frpb, ped/bikes			0.99			0.97	1.00	1.00			1.00	0.90
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	1.00
Frt			0.86			0.86	1.00	1.00			1.00	0.85
Flt Protected			1.00			1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)			1489			1461	1652	4526			3103	1014
Flt Permitted			1.00			1.00	0.29	1.00			1.00	1.00
Satd. Flow (perm)			1489			1461	497	4526			3103	1014
Volume (vph)	0	0	114	0	0	143	138	1140	26	0	697	25
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	121	0	0	152	147	1213	28	0	741	27
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	0	10
Lane Group Flow (vph)	0	0	121	0	0	152	147	1239	0	0	741	17
Confl. Peds. (#/hr)			5			68	78		23			78
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	9%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	60
Turn Type			custom			custom	pm+pt					Perm
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					6
Actuated Green, G (s)			110.0			110.0	98.3	50.3			50.3	50.3
Effective Green, g (s)			110.0			110.0	102.0	52.4			52.4	52.4
Actuated g/C Ratio			1.00			1.00	0.93	0.48			0.48	0.48
Clearance Time (s)							5.6	6.1			6.1	6.1
Lane Grp Cap (vph)			1489			1461	982	2156			1478	483
v/s Ratio Prot							c0.07	c0.27			0.24	
v/s Ratio Perm			0.08			0.10	0.07					0.02
v/c Ratio			0.08			0.10	0.15	0.57			0.50	0.04
Uniform Delay, d1			0.0			0.0	1.2	20.8			19.8	15.3
Progression Factor			1.00			1.00	5.17	0.18			1.39	1.84
Incremental Delay, d2			0.1			0.1	0.1	0.3			1.1	0.1
Delay (s)			0.1			0.1	6.1	4.0			28.8	28.4
Level of Service			A			A	A	A			C	C
Approach Delay (s)		0.1			0.1			4.2			28.7	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.89		1.00	0.69		1.00	0.83	1.00	1.00	0.77
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1311	1745	1314		1745	1021		3316	1238	1658	3316	649
Flt Permitted	0.10	1.00	1.00		1.00	1.00		1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)	144	1745	1314		1745	1021		3316	1238	268	3316	649
Volume (vph)	229	377	15	0	638	218	0	857	94	207	574	227
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	244	401	16	0	679	232	0	912	100	220	611	241
RTOR Reduction (vph)	0	0	6	0	0	48	0	0	27	0	0	156
Lane Group Flow (vph)	244	401	10	0	679	184	0	912	73	220	611	85
Confl. Peds. (#/hr)	534		169	169		534			104	104		152
Heavy Vehicles (%)	29%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	79%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	52.1	57.1	52.1		38.1	52.1		24.4	37.3	37.3	41.0	37.3
Effective Green, g (s)	53.4	58.4	53.4		39.4	53.4		27.0	38.6	38.6	43.6	38.6
Actuated g/C Ratio	0.49	0.53	0.49		0.36	0.49		0.25	0.35	0.35	0.40	0.35
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	229	926	638		625	496		814	434	253	1314	228
v/s Ratio Prot	c0.15	0.23			c0.39			c0.28		c0.10	0.18	
v/s Ratio Perm	0.37		0.01			0.18			0.06	0.20		0.13
v/c Ratio	1.07	0.43	0.02		1.09	0.37		1.12	0.17	0.87	0.46	0.37
Uniform Delay, d1	43.9	15.7	14.7		35.3	17.8		41.5	24.6	44.0	24.6	26.6
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	0.68	0.67	1.51
Incremental Delay, d2	77.9	1.5	0.0		61.7	2.1		70.1	0.8	29.9	1.1	4.4
Delay (s)	121.8	17.2	14.7		97.0	19.9		111.6	25.5	60.0	17.6	44.5
Level of Service	F	B	B		F	B		F	C	E	B	D
Approach Delay (s)		55.7			77.4			103.1			32.3	
Approach LOS		E			E			F			C	

Intersection Summary			
HCM Average Control Delay	67.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	WBR2	NBT	SBT	SER	All
Delay / Veh (s)	7.5	0.7	71.3	103	13.6	93.9

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	1.1	15.9	11.4

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	31.4	6.9	8.1	6.3	17.3	14.5

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	1.7	1.8	1.6	1.7

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	33.5	27.1	18.6	7.4	4.5	1.7	10.3

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	26.6	27.7	18.1	55.3	26.3	18.8	4.3	20.4

111: Clarence Street & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	2.4	0.8	1.3	1.1	1.6

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	2.8	0.9	7.8	12.7	7.0	8.8	3.8	9.3

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBT	SBT	All
Delay / Veh (s)	10.6	4.4	1.2	2.6	2.9

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	40.2	17.8	11.2	35.8	20.0	35.1	11.0	27.2	19.8	12.9	25.1

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	3.0	1.9	1.2	1.6

Total Network Performance

Delay / Veh (s)	103.3

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	WB	SB	SB	SE
Directions Served	>	T	T	R
Maximum Queue (m)	19.2	49.9	49.9	42.8
Average Queue (m)	7.7	42.6	34.9	36.7
95th Queue (m)	15.8	57.5	62.7	50.7
Link Distance (m)	100.3	39.5	39.5	38.7
Upstream Blk Time (%)		26	6	89
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	SB	SB	SB
Directions Served	T	T	T
Maximum Queue (m)	118.4	116.8	122.7
Average Queue (m)	112.2	68.6	36.2
95th Queue (m)	123.6	119.3	113.6
Link Distance (m)	68.9	68.9	68.9
Upstream Blk Time (%)	38	3	0
Queuing Penalty (veh)	248	21	3
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB	SB
Directions Served	LR	T	TR	T	T	T
Maximum Queue (m)	13.2	63.1	58.7	90.6	91.1	85.5
Average Queue (m)	3.1	37.7	33.1	88.6	71.9	47.5
95th Queue (m)	10.3	58.8	53.2	90.1	102.8	77.8
Link Distance (m)	219.2	43.2	43.2	67.5	67.5	67.5
Upstream Blk Time (%)		3	2	41	10	2
Queuing Penalty (veh)		14	8	265	63	10
Storage Bay Dist (m)						
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 108: Guigues Ave & King Edward Avenue

Movement	NB	NB
Directions Served	T	TR
Maximum Queue (m)	18.4	14.9
Average Queue (m)	1.1	0.6
95th Queue (m)	8.5	6.5
Link Distance (m)	71.7	71.7
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	TR
Maximum Queue (m)	77.9	62.8	60.4	58.5	31.6	29.8	16.1	22.4	20.7	22.6	19.8
Average Queue (m)	38.8	33.0	34.0	31.9	17.2	14.5	5.3	11.3	3.9	5.1	3.2
95th Queue (m)	61.7	54.2	52.4	50.8	29.2	28.2	12.7	20.5	12.7	14.9	12.4
Link Distance (m)	90.7	90.7			69.1	69.1			71.7	71.7	71.7
Upstream Blk Time (%)	0	0									
Queuing Penalty (veh)	0	0									
Storage Bay Dist (m)			75.0	75.0			55.0	55.0			
Storage Blk Time (%)		0	0	0							
Queuing Penalty (veh)		0	0	0							

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	SB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	TR	L	L	T	T	T
Maximum Queue (m)	42.0	67.7	68.5	78.4	78.3	72.9	74.2	37.2	36.5	33.6
Average Queue (m)	21.1	38.1	35.7	54.2	54.9	52.6	64.6	10.5	11.0	7.6
95th Queue (m)	36.8	56.4	57.2	79.8	79.6	72.1	78.7	24.7	25.3	22.9
Link Distance (m)	131.1	131.1	131.1	60.3	60.3	69.1	69.1	69.1	69.1	69.1
Upstream Blk Time (%)				13	14	0	3	0	0	0
Queuing Penalty (veh)				28	30	1	13	0	0	0
Storage Bay Dist (m)										
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 111: Clarence Street & King Edward Avenue

Movement	NB	NB	SB	SB	SB
Directions Served	T	TR	T	T	TR
Maximum Queue (m)	15.7	18.3	3.4	6.1	8.9
Average Queue (m)	1.8	1.7	0.2	0.3	0.3
95th Queue (m)	12.3	12.4	2.6	3.8	4.1
Link Distance (m)	63.9	63.9	60.3	60.3	60.3
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	R	R	L	T	TR	T	T	TR
Maximum Queue (m)	16.5	8.3	32.0	37.8	36.7	72.6	80.4	59.2
Average Queue (m)	2.8	0.5	12.8	15.6	15.4	32.7	35.4	24.2
95th Queue (m)	10.3	3.9	24.4	32.4	31.4	59.5	62.7	49.5
Link Distance (m)	123.4	149.1		139.4	139.4	63.9	63.9	63.9
Upstream Blk Time (%)						0	0	0
Queuing Penalty (veh)						1	1	0
Storage Bay Dist (m)			65.0					
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 113: George Street & King Edward Avenue

Movement	EB	WB	SB	SB	SB	SB
Directions Served	R	R	T	T	T	TR
Maximum Queue (m)	38.1	10.4	3.6	4.4	3.0	22.4
Average Queue (m)	16.6	3.3	0.1	0.3	0.1	0.9
95th Queue (m)	29.6	10.6	1.8	4.0	1.5	9.6
Link Distance (m)	61.8	45.9		139.4	139.4	139.4
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (m)			24.0			
Storage Blk Time (%)				0		
Queuing Penalty (veh)				0		

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	80.8	60.5	22.9	143.3	35.0	58.0	52.1	25.0	61.7	55.4	73.0	74.7
Average Queue (m)	33.7	28.9	3.6	72.6	10.9	33.2	23.7	6.0	24.5	24.5	30.4	29.2
95th Queue (m)	66.3	51.5	14.3	124.7	33.3	51.0	42.3	17.9	47.0	45.8	53.5	61.1
Link Distance (m)		333.4		149.1		67.9	67.9		63.5	63.5	63.5	63.5
Upstream Blk Time (%)				0		0			0	0	1	2
Queuing Penalty (veh)				0		0			0	0	3	5
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	0	11	0	39	0		9	0				
Queuing Penalty (veh)	1	19	0	25	0		4	0				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	SB
Directions Served	LT	R
Maximum Queue (m)	10.8	4.0
Average Queue (m)	0.9	0.1
95th Queue (m)	5.8	2.1
Link Distance (m)	123.0	173.9
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Nework Summary

Network wide Queuing Penalty: 766

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.95			0.91
Frpb, ped/bikes	0.99		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.98		1.00			1.00
Flt Protected	0.96		1.00			1.00
Satd. Flow (prot)	1627		3039			4499
Flt Permitted	0.96		1.00			1.00
Satd. Flow (perm)	1627		3039			4499
Volume (vph)	13	3	815	18	0	1942
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	14	3	867	19	0	2066
RTOR Reduction (vph)	2	0	2	0	0	0
Lane Group Flow (vph)	15	0	884	0	0	2066
Confl. Peds. (#/hr)		20		19		
Heavy Vehicles (%)	2%	2%	11%	2%	2%	8%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	29.0		59.4			59.4
Effective Green, g (s)	30.9		61.1			61.1
Actuated g/C Ratio	0.31		0.61			0.61
Clearance Time (s)	5.9		5.7			5.7
Lane Grp Cap (vph)	503		1857			2749
v/s Ratio Prot			0.29			c0.46
v/s Ratio Perm	c0.01					
v/c Ratio	0.03		0.48			0.75
Uniform Delay, d1	24.1		10.7			14.0
Progression Factor	1.00		0.54			1.00
Incremental Delay, d2	0.1		0.8			1.9
Delay (s)	24.2		6.6			15.9
Level of Service	C		A			B
Approach Delay (s)	24.2		6.6			15.9
Approach LOS	C		A			B

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	
Lane Util. Factor					0.95	0.88		0.95			0.81	
Frpb, ped/bikes					1.00	0.97		1.00			1.00	
Flpb, ped/bikes					1.00	1.00		1.00			1.00	
Frt					1.00	0.85		1.00			0.99	
Flt Protected					0.99	1.00		1.00			1.00	
Satd. Flow (prot)					3284	2536		2916			6640	
Flt Permitted					0.99	1.00		1.00			1.00	
Satd. Flow (perm)					3284	2536		2916			6640	
Volume (vph)	0	0	0	72	414	555	0	542	0	0	1861	94
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	77	440	590	0	577	0	0	1980	100
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	9	0
Lane Group Flow (vph)	0	0	0	0	517	590	0	577	0	0	2071	0
Confl. Peds. (#/hr)				14		12						1
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	16%	2%	2%	8%	2%
Turn Type				Perm		custom						
Protected Phases					4	1		2			6	
Permitted Phases				4		4						
Actuated Green, G (s)					30.8	41.2		40.6			53.3	
Effective Green, g (s)					33.4	45.5		42.5			58.6	
Actuated g/C Ratio					0.33	0.46		0.42			0.59	
Clearance Time (s)					6.6	5.7		5.9			9.3	
Lane Grp Cap (vph)					1097	1255		1239			3891	
v/s Ratio Prot						c0.06		0.20			c0.31	
v/s Ratio Perm					0.16	0.18						
v/c Ratio					0.47	0.47		0.47			0.53	
Uniform Delay, d1					26.3	18.9		20.6			12.5	
Progression Factor					0.97	0.96		0.30			0.09	
Incremental Delay, d2					1.5	1.3		0.9			0.3	
Delay (s)					27.1	19.4		7.1			1.4	
Level of Service					C	B		A			A	
Approach Delay (s)		0.0			23.0			7.1			1.4	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.95		0.97	0.91	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.97						0.99		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3055						2784		3216	4226	
Flt Permitted	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3055						2784		3216	4226	
Volume (vph)	134	398	101	0	0	0	0	408	36	948	985	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	143	423	107	0	0	0	0	434	38	1009	1048	0
RTOR Reduction (vph)	0	21	0	0	0	0	0	6	0	0	0	0
Lane Group Flow (vph)	143	509	0	0	0	0	0	466	0	1009	1048	0
Confl. Peds. (#/hr)			29						19	19		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	21%	2%	2%	15%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	30.8	30.8						15.3		31.7	56.3	
Effective Green, g (s)	33.4	33.4						20.6		34.0	58.6	
Actuated g/C Ratio	0.33	0.33						0.21		0.34	0.59	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	504	1020						574		1093	2476	
v/s Ratio Prot	0.09	c0.17						c0.17		c0.31	0.25	
v/s Ratio Perm												
v/c Ratio	0.28	0.50						0.81		0.92	0.42	
Uniform Delay, d1	24.5	26.6						37.8		31.7	11.4	
Progression Factor	1.00	1.00						1.06		0.57	0.22	
Incremental Delay, d2	1.4	1.7						11.2		12.5	0.5	
Delay (s)	25.9	28.4						51.2		30.6	3.0	
Level of Service	C	C						D		C	A	
Approach Delay (s)		27.8			0.0			51.2			16.6	
Approach LOS		C			A			D			B	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor			1.00			1.00	1.00	0.95			0.91	
Frpb, ped/bikes			0.99			0.97	1.00	1.00			0.99	
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	
Frt			0.86			0.86	1.00	0.99			0.99	
Flt Protected			1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)			1489			1459	1656	2809			4231	
Flt Permitted			1.00			1.00	0.19	1.00			1.00	
Satd. Flow (perm)			1489			1459	337	2809			4231	
Volume (vph)	0	0	43	0	0	14	111	432	28	0	943	50
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	46	0	0	15	118	460	30	0	1003	53
RTOR Reduction (vph)	0	0	0	0	0	0	0	5	0	0	6	0
Lane Group Flow (vph)	0	0	46	0	0	15	118	485	0	0	1050	0
Confl. Peds. (#/hr)			5			74	76		30	30		76
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	20%	2%	2%	14%	2%
Turn Type			custom			custom	pm+pt					
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					
Actuated Green, G (s)			100.0			100.0	88.6	42.6			42.6	
Effective Green, g (s)			100.0			100.0	92.0	44.4			44.4	
Actuated g/C Ratio			1.00			1.00	0.92	0.44			0.44	
Clearance Time (s)							5.6	5.8			5.8	
Lane Grp Cap (vph)			1489			1459	938	1247			1879	
v/s Ratio Prot							c0.06	0.17			c0.25	
v/s Ratio Perm			0.03			0.01	0.06					
v/c Ratio			0.03			0.01	0.13	0.39			0.56	
Uniform Delay, d1			0.0			0.0	1.2	18.7			20.6	
Progression Factor			1.00			1.00	14.40	0.36			0.46	
Incremental Delay, d2			0.0			0.0	0.3	0.8			1.1	
Delay (s)			0.0			0.0	17.5	7.6			10.7	
Level of Service			A			A	B	A			B	
Approach Delay (s)		0.0			0.0			9.5			10.7	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91		1.00	0.82		1.00	0.89	1.00	1.00	0.90
Flpb, ped/bikes	0.96	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1052	1745	1349		1745	1219		3316	1316	1578	3316	935
Flt Permitted	0.33	1.00	1.00		1.00	1.00		1.00	1.00	0.52	1.00	1.00
Satd. Flow (perm)	371	1745	1349		1745	1219		3316	1316	871	3316	935
Volume (vph)	144	267	28	0	392	66	0	346	42	210	666	248
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	153	284	30	0	417	70	0	368	45	223	709	264
RTOR Reduction (vph)	0	0	16	0	0	26	0	0	30	0	0	174
Lane Group Flow (vph)	153	284	14	0	417	44	0	368	15	223	709	90
Confl. Peds. (#/hr)	270		128	128		270			65	65		54
Heavy Vehicles (%)	55%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	46%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	46.5	51.5	46.5		31.5	46.5		20.0	32.9	32.9	36.6	32.9
Effective Green, g (s)	47.8	52.8	47.8		32.8	47.8		22.6	34.2	34.2	39.2	34.2
Actuated g/C Ratio	0.48	0.53	0.48		0.33	0.48		0.23	0.34	0.34	0.39	0.34
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	286	921	645		572	583		749	450	387	1300	320
v/s Ratio Prot	c0.09	0.16			c0.24			0.11		0.07	c0.21	
v/s Ratio Perm	0.17		0.01			0.04			0.01	0.12		0.10
v/c Ratio	0.53	0.31	0.02		0.73	0.08		0.49	0.03	0.58	0.55	0.28
Uniform Delay, d1	26.8	13.3	13.8		29.7	14.1		33.7	21.9	29.0	23.5	24.0
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	0.43	0.45	0.60
Incremental Delay, d2	7.0	0.9	0.1		7.9	0.3		2.3	0.1	5.5	1.5	2.0
Delay (s)	33.8	14.2	13.8		37.6	14.4		36.0	22.0	17.9	12.2	16.4
Level of Service	C	B	B		D	B		D	C	B	B	B
Approach Delay (s)		20.6			34.3			34.5			14.2	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	SER	All
Delay / Veh (s)	1.6	1.1	9.4	1.6

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	1.6	2.8	2.1

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	52.3	18.0	7.2	6.9	7.8	7.6

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	6.4	6.1	2.6	5.1

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	53.9	48.6	87.9	9.3	15.3	1.5	29.5

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	65.3	75.6	72.0	42.4	27.7	60.3	4.3	45.5

111: Clarence Street & King Edward Avenue Performance by movement

Movement	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	3267.1	10.5	6.3	3.6	198.5

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	8.8	9.4	16.3	10.3	7.7	44.2	9.0	21.3

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	NBT	SBT	All
Delay / Veh (s)	64487.4	1.4	186.9	179.3

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	72.3	29.0	22.3	1284.0	1243.5	607.2	561.0	263.7	38.5	18.0	477.6

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	6.6	3.9	785.4	380.7

Total Network Performance

Delay / Veh (s) 554.9

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	SB	SB	SE
Directions Served	T	T	R
Maximum Queue (m)	11.4	12.7	11.2
Average Queue (m)	0.5	0.6	2.2
95th Queue (m)	7.2	7.1	7.4
Link Distance (m)	39.5	39.5	38.7
Upstream Blk Time (%)	0	0	
Queuing Penalty (veh)	0	0	
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	SB	SB
Directions Served	T	T
Maximum Queue (m)	75.8	53.5
Average Queue (m)	13.2	4.9
95th Queue (m)	49.3	31.5
Link Distance (m)	68.9	68.9
Upstream Blk Time (%)	1	0
Queuing Penalty (veh)	5	1
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	TR	T	T
Maximum Queue (m)	17.6	64.5	64.4	88.8	88.7
Average Queue (m)	5.0	62.3	61.8	68.7	42.8
95th Queue (m)	14.1	69.3	70.2	103.4	77.5
Link Distance (m)	219.2	43.2	43.2	67.5	67.5
Upstream Blk Time (%)		19	18	8	1
Queuing Penalty (veh)		247	237	57	5
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 108: Guigues Ave & King Edward Avenue

Movement	NB	NB	SB	SB
Directions Served	T	TR	T	T
Maximum Queue (m)	86.2	80.8	28.9	18.1
Average Queue (m)	58.2	57.4	9.1	2.0
95th Queue (m)	95.0	90.1	41.0	16.4
Link Distance (m)	71.7	71.7	43.2	43.2
Upstream Blk Time (%)	4	4	5	0
Queuing Penalty (veh)	60	57	34	2
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	R
Maximum Queue (m)	72.6	127.6	86.3	82.7	78.0	81.1	56.1	59.5	75.9	33.6	2.1
Average Queue (m)	38.7	121.4	85.5	80.3	62.5	58.7	25.4	30.1	26.1	10.4	0.1
95th Queue (m)	61.7	135.2	86.5	86.2	86.0	85.6	64.7	68.2	85.7	25.0	1.1
Link Distance (m)	90.7	90.7			69.2	69.2			71.7	71.7	
Upstream Blk Time (%)		50	8		4	3		0	8		
Queuing Penalty (veh)		330	0		40	25		0	54		
Storage Bay Dist (m)			75.0	75.0			55.0	55.0			25.0
Storage Blk Time (%)		0	51	32			6	11		1	
Queuing Penalty (veh)		0	74	47			20	35		0	

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	TR	L	L	T	T
Maximum Queue (m)	110.9	116.1	115.7	85.7	83.0	74.7	75.5	33.1	33.0
Average Queue (m)	73.5	78.5	73.0	79.8	81.0	67.9	70.3	9.5	7.5
95th Queue (m)	108.9	114.7	113.0	85.3	84.7	79.8	77.5	30.3	27.8
Link Distance (m)	134.6	134.6	134.6	60.2	60.2	69.2	69.2	69.2	69.2
Upstream Blk Time (%)	0	3	2	37	55	24	29	0	1
Queuing Penalty (veh)	0	0	0	282	412	76	93	0	2
Storage Bay Dist (m)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 111: Clarence Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB	SB
Directions Served	R	T	TR	T	T	R
Maximum Queue (m)	161.4	70.6	72.4	36.8	41.3	6.6
Average Queue (m)	156.4	51.0	52.6	8.4	7.2	0.2
95th Queue (m)	160.2	80.5	80.2	38.1	36.5	4.6
Link Distance (m)	152.2	63.8	63.8	60.2	60.2	
Upstream Blk Time (%)	96	4	5	4	2	
Queuing Penalty (veh)	0	29	33	14	8	
Storage Bay Dist (m)						25.0
Storage Blk Time (%)					4	
Queuing Penalty (veh)					0	

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	R	R	L	T	TR	T	T	R
Maximum Queue (m)	30.3	44.0	72.4	115.2	119.9	85.4	87.0	32.0
Average Queue (m)	9.9	14.1	21.3	31.8	36.1	61.6	58.2	3.4
95th Queue (m)	24.0	30.1	46.7	82.5	87.1	95.8	90.0	16.1
Link Distance (m)	123.4	149.1		139.4	139.4	63.8	63.8	
Upstream Blk Time (%)					0	27	10	
Queuing Penalty (veh)					0	97	36	
Storage Bay Dist (m)			65.0					25.0
Storage Blk Time (%)				1			28	0
Queuing Penalty (veh)				2			7	0

Intersection: 113: George Street & King Edward Avenue

Movement	EB	SB	SB	SB	SB
Directions Served	R	T	T	T	TR
Maximum Queue (m)	64.0	34.1	146.1	150.4	5.9
Average Queue (m)	60.1	31.3	129.0	57.4	0.6
95th Queue (m)	72.3	35.6	181.4	158.1	5.3
Link Distance (m)	61.8		139.4	139.4	139.4
Upstream Blk Time (%)	95		39	1	
Queuing Penalty (veh)	0		105	2	
Storage Bay Dist (m)		24.0			
Storage Blk Time (%)		86	0		
Queuing Penalty (veh)		199	0		

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	94.4	211.1	28.1	159.5	34.0	75.8	75.1	31.0	84.8	66.5	68.3	72.7
Average Queue (m)	61.5	67.9	2.2	153.7	17.7	72.4	71.6	10.3	84.2	31.1	35.9	31.5
95th Queue (m)	101.5	168.7	11.4	156.2	39.2	74.5	76.4	28.4	86.1	53.7	56.9	68.2
Link Distance (m)		333.4		149.1		67.9	67.9		63.5	63.5	63.5	63.5
Upstream Blk Time (%)		0		56		69	63		92	0	0	2
Queuing Penalty (veh)		0		0		0	0		233	1	1	5
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	7	22	0	61	1		71	1				
Queuing Penalty (veh)	26	54	0	134	8		67	4				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	NB	SB	SB
Directions Served	LT	T	R	R
Maximum Queue (m)	80.5	82.7	149.9	182.0
Average Queue (m)	28.5	15.6	11.8	178.6
95th Queue (m)	69.4	57.3	79.4	180.8
Link Distance (m)	123.0	123.0	173.9	173.9
Upstream Blk Time (%)			0	56
Queuing Penalty (veh)			0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Nework Summary

Network wide Queuing Penalty: 3260

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.95			0.95
Frpb, ped/bikes	0.95		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.93		1.00			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1502		3249			3191
Flt Permitted	0.98		1.00			1.00
Satd. Flow (perm)	1502		3249			3191
Volume (vph)	11	11	2588	12	0	1267
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	12	12	2753	13	0	1348
RTOR Reduction (vph)	6	0	0	0	0	0
Lane Group Flow (vph)	18	0	2766	0	0	1348
Confl. Peds. (#/hr)		58		23		
Heavy Vehicles (%)	2%	2%	4%	2%	2%	6%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	23.0		105.1			105.1
Effective Green, g (s)	24.9		107.1			107.1
Actuated g/C Ratio	0.18		0.76			0.76
Clearance Time (s)	5.9		6.0			6.0
Lane Grp Cap (vph)	267		2485			2441
v/s Ratio Prot			c0.85			0.42
v/s Ratio Perm	c0.01					
v/c Ratio	0.07		1.11			0.55
Uniform Delay, d1	47.9		16.5			6.7
Progression Factor	1.00		0.60			1.00
Incremental Delay, d2	0.5		51.5			0.9
Delay (s)	48.4		61.4			7.6
Level of Service	D		E			A
Approach Delay (s)	48.4		61.4			7.6
Approach LOS	D		E			A

Intersection Summary			
HCM Average Control Delay	43.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

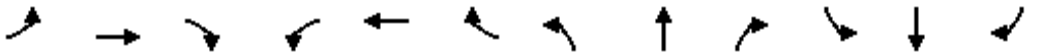
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	4.0
Lane Util. Factor					0.95	0.88		0.95			0.86	1.00
Frpb, ped/bikes					1.00	0.98		1.00			1.00	1.00
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3291	2557		3221			5777	1127
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3291	2557		3221			5777	1127
Volume (vph)	0	0	0	46	291	993	0	1860	0	0	1254	24
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	49	310	1056	0	1979	0	0	1334	26
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	0	0	0	359	1056	0	1979	0	0	1334	19
Confl. Peds. (#/hr)				4		6				1		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	6%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	60
Turn Type				Perm		custom						Perm
Protected Phases					4	1		2			6	
Permitted Phases				4		4						6
Actuated Green, G (s)					28.7	48.0		73.8			95.4	95.4
Effective Green, g (s)					31.3	52.3		75.7			100.7	100.7
Actuated g/C Ratio					0.22	0.37		0.54			0.72	0.72
Clearance Time (s)					6.6	5.7		5.9			9.3	9.3
Lane Grp Cap (vph)					736	1028		1742			4155	811
v/s Ratio Prot						c0.15		c0.61			0.23	
v/s Ratio Perm					0.11	0.26						0.02
v/c Ratio					0.49	1.03		1.14			0.32	0.02
Uniform Delay, d1					47.4	43.9		32.1			7.2	5.6
Progression Factor					0.97	0.97		0.27			0.26	0.24
Incremental Delay, d2					2.3	35.2		62.0			0.2	0.0
Delay (s)					48.5	77.8		70.7			2.0	1.4
Level of Service					D	E		E			A	A
Approach Delay (s)		0.0			70.3			70.7			2.0	
Approach LOS		A			E			E			A	

Intersection Summary			
HCM Average Control Delay	50.9	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	125.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.95		0.97	0.95	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.98						1.00		1.00	1.00	
Flt Protected	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3050						3151		3216	3103	
Flt Permitted	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3050						3151		3216	3103	
Volume (vph)	379	388	68	0	0	0	0	1481	29	636	664	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	403	413	72	0	0	0	0	1576	31	677	706	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	291	590	0	0	0	0	0	1606	0	677	706	0
Confl. Peds. (#/hr)			65				61		16	16		61
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	9%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	28.7	28.7						60.6		28.5	98.4	
Effective Green, g (s)	31.3	31.3						65.9		30.8	100.7	
Actuated g/C Ratio	0.22	0.22						0.47		0.22	0.72	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	337	682						1483		708	2232	
v/s Ratio Prot	0.19	c0.19						c0.51		c0.21	0.23	
v/s Ratio Perm												
v/c Ratio	0.86	0.87						1.08		0.96	0.32	
Uniform Delay, d1	52.3	52.3						37.0		53.9	7.1	
Progression Factor	1.00	1.00						0.35		0.88	0.26	
Incremental Delay, d2	24.2	13.8						48.0		24.0	0.4	
Delay (s)	76.5	66.1						61.0		71.6	2.2	
Level of Service	E	E						E		E	A	
Approach Delay (s)		69.5			0.0			61.0			36.2	
Approach LOS		E			A			E			D	

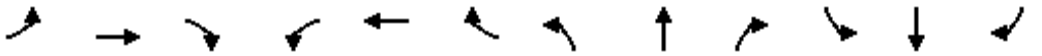
Intersection Summary			
HCM Average Control Delay	54.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	125.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	4.0
Lane Util. Factor			1.00			1.00	1.00	0.95			0.95	1.00
Frpb, ped/bikes			0.99			0.97	1.00	1.00			1.00	0.92
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	1.00
Frt			0.86			0.86	1.00	1.00			1.00	0.85
Flt Protected			1.00			1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)			1489			1461	1651	3151			3103	1032
Flt Permitted			1.00			1.00	0.32	1.00			1.00	1.00
Satd. Flow (perm)			1489			1461	550	3151			3103	1032
Volume (vph)	0	0	114	0	0	143	138	1140	26	0	697	25
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	121	0	0	152	147	1213	28	0	741	27
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	8
Lane Group Flow (vph)	0	0	121	0	0	152	147	1240	0	0	741	19
Confl. Peds. (#/hr)			5			68	78		23			78
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	9%	2%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	60
Turn Type			custom			custom	pm+pt					Perm
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					6
Actuated Green, G (s)			140.0			140.0	128.3	80.3			80.3	80.3
Effective Green, g (s)			140.0			140.0	132.0	82.4			82.4	82.4
Actuated g/C Ratio			1.00			1.00	0.94	0.59			0.59	0.59
Clearance Time (s)							5.6	6.1			6.1	6.1
Lane Grp Cap (vph)			1489			1461	909	1855			1826	607
v/s Ratio Prot							c0.06	c0.39			0.24	
v/s Ratio Perm			0.08			0.10	0.10					0.02
v/c Ratio			0.08			0.10	0.16	0.67			0.41	0.03
Uniform Delay, d1			0.0			0.0	0.9	19.5			15.6	12.1
Progression Factor			1.00			1.00	2.27	0.25			0.81	0.77
Incremental Delay, d2			0.1			0.1	0.1	0.7			0.6	0.1
Delay (s)			0.1			0.1	2.2	5.5			13.2	9.4
Level of Service			A			A	A	A			B	A
Approach Delay (s)		0.1			0.1			5.2			13.1	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.89		1.00	0.69		1.00	0.83	1.00	1.00	0.77
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1311	1745	1325		1745	1028		3316	1235	1658	3316	647
Flt Permitted	0.08	1.00	1.00		1.00	1.00		1.00	1.00	0.12	1.00	1.00
Satd. Flow (perm)	113	1745	1325		1745	1028		3316	1235	201	3316	647
Volume (vph)	229	377	15	0	638	218	0	857	94	207	574	227
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	244	401	16	0	679	232	0	912	100	220	611	241
RTOR Reduction (vph)	0	0	4	0	0	38	0	0	21	0	0	158
Lane Group Flow (vph)	244	401	12	0	679	194	0	912	79	220	611	83
Confl. Peds. (#/hr)	534		169	169		534			104	104		152
Heavy Vehicles (%)	29%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	79%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	72.2	77.2	72.2		48.7	72.2		33.1	47.2	47.2	50.9	47.2
Effective Green, g (s)	73.5	78.5	73.5		50.0	73.5		35.7	48.5	48.5	53.5	48.5
Actuated g/C Ratio	0.52	0.56	0.52		0.36	0.52		0.26	0.35	0.35	0.38	0.35
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	269	978	696		623	540		846	428	213	1267	224
v/s Ratio Prot	c0.16	0.23			c0.39			c0.28		c0.10	0.18	
v/s Ratio Perm	0.32		0.01			0.19			0.06	0.26		0.13
v/c Ratio	0.91	0.41	0.02		1.09	0.36		1.08	0.18	1.03	0.48	0.37
Uniform Delay, d1	53.1	17.5	15.9		45.0	19.5		52.1	31.9	58.9	32.8	34.3
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.06	1.09	2.02
Incremental Delay, d2	35.4	1.3	0.0		63.0	1.9		54.2	1.0	69.6	1.3	4.6
Delay (s)	88.4	18.8	16.0		108.0	21.3		106.3	32.9	132.0	37.1	73.9
Level of Service	F	B	B		F	C		F	C	F	D	E
Approach Delay (s)		44.4			85.9			99.1			64.8	
Approach LOS		D			F			F			E	

Intersection Summary			
HCM Average Control Delay	75.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	WBR2	NBT	SBT	SER	All
Delay / Veh (s)	5.8	0.7	5.1	365.4	10.6

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	0.9	7.9	5.8

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	37.7	8.0	4.1	2.2	11.2	9.1

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	1.6	1.7	1.9	1.8

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	33.0	27.8	19.2	6.3	6.2	2.4	11.2

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	25.7	28.8	22.2	59.6	30.4	18.4	4.6	21.4

111: Clarence Street & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	2.8	0.9	1.8	1.7	2.1

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	4.7	0.7	7.6	15.1	10.9	6.5	5.5	8.8

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBT	SBT	All
Delay / Veh (s)	10.5	3.8	1.2	2.4	2.6

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	41.1	18.7	12.4	34.8	19.9	32.9	11.3	27.9	15.0	10.4	23.4

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	3.0	2.0	1.2	1.7

Total Network Performance

Delay / Veh (s) 52.5

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	WB	SB	SB	SE
Directions Served	>	T	T	R
Maximum Queue (m)	15.5	48.6	45.8	45.6
Average Queue (m)	7.8	13.4	10.4	20.2
95th Queue (m)	14.8	44.8	37.8	47.9
Link Distance (m)	100.3	39.5	39.5	38.7
Upstream Blk Time (%)		3	1	31
Queuing Penalty (veh)		0	0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	SB	SB
Directions Served	T	T
Maximum Queue (m)	117.6	122.7
Average Queue (m)	78.5	46.1
95th Queue (m)	139.6	109.1
Link Distance (m)	68.9	68.9
Upstream Blk Time (%)	11	3
Queuing Penalty (veh)	107	26
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	TR	T	T
Maximum Queue (m)	13.7	48.6	47.5	89.9	93.6
Average Queue (m)	3.5	19.1	18.3	86.7	74.8
95th Queue (m)	11.0	43.4	37.5	100.6	104.2
Link Distance (m)	219.2	43.2	43.2	67.5	67.5
Upstream Blk Time (%)		0	0	23	8
Queuing Penalty (veh)		1	1	227	82
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 108: Guigues Ave & King Edward Avenue

Movement	NB	SB	SB
Directions Served	T	T	T
Maximum Queue (m)	3.2	8.1	7.9
Average Queue (m)	0.2	0.3	0.3
95th Queue (m)	2.6	3.7	4.3
Link Distance (m)	71.7	43.2	43.2
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	R
Maximum Queue (m)	63.0	60.4	62.7	59.4	29.1	29.2	36.8	39.5	61.5	75.2	29.5
Average Queue (m)	39.0	33.5	35.0	31.7	15.5	13.7	15.7	21.6	26.4	34.4	1.6
95th Queue (m)	57.2	51.4	53.2	49.7	25.5	25.5	28.8	33.0	50.1	60.5	14.3
Link Distance (m)	90.7	90.7			69.2	69.2			71.7	71.7	
Upstream Blk Time (%)									0	0	
Queuing Penalty (veh)									0	1	
Storage Bay Dist (m)			75.0	75.0			55.0	55.0			60.0
Storage Blk Time (%)		0	0	0					0	0	0
Queuing Penalty (veh)		0	0	0					0	0	0

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	TR	L	L	T	T
Maximum Queue (m)	38.4	69.6	66.1	81.6	80.1	76.1	76.0	28.6	31.0
Average Queue (m)	19.4	38.8	36.9	56.2	57.1	58.6	65.0	11.7	14.0
95th Queue (m)	33.5	58.0	56.9	83.7	83.0	77.0	81.2	24.6	27.9
Link Distance (m)	134.6	134.6	134.6	60.3	60.3	69.2	69.2	69.2	69.2
Upstream Blk Time (%)				14	15	2	5		
Queuing Penalty (veh)				32	33	8	24		
Storage Bay Dist (m)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 111: Clarence Street & King Edward Avenue

Movement	NB	NB	SB	SB
Directions Served	T	TR	T	TR
Maximum Queue (m)	27.4	25.8	16.8	31.0
Average Queue (m)	2.5	2.3	0.6	1.5
95th Queue (m)	17.3	17.0	7.7	17.7
Link Distance (m)	63.8	63.8	60.3	60.3
Upstream Blk Time (%)	0	0		0
Queuing Penalty (veh)	0	0		0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	SB	SB
Directions Served	R	R	L	T	TR	T	TR
Maximum Queue (m)	16.6	8.2	30.6	40.7	47.4	67.0	76.2
Average Queue (m)	4.0	0.6	11.7	18.4	19.5	22.7	29.8
95th Queue (m)	12.2	3.9	23.4	33.4	38.0	45.8	56.8
Link Distance (m)	126.9	149.1		139.4	139.4	63.8	63.8
Upstream Blk Time (%)						0	0
Queuing Penalty (veh)						1	2
Storage Bay Dist (m)			65.0				
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 113: George Street & King Edward Avenue

Movement	EB	WB	SB
Directions Served	R	R	T
Maximum Queue (m)	44.8	13.2	7.0
Average Queue (m)	14.2	3.9	0.2
95th Queue (m)	28.4	11.7	3.9
Link Distance (m)	61.2	45.9	
Upstream Blk Time (%)	0		
Queuing Penalty (veh)	0		
Storage Bay Dist (m)			24.0
Storage Blk Time (%)			0
Queuing Penalty (veh)			0

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	74.2	97.9	21.6	132.4	32.8	54.2	52.5	26.1	67.1	53.0	50.5	57.1
Average Queue (m)	34.5	30.8	3.4	69.4	11.9	32.2	24.6	5.9	29.5	21.0	25.4	24.7
95th Queue (m)	64.7	66.7	12.5	117.4	33.6	50.5	44.0	17.0	58.4	40.2	43.6	48.9
Link Distance (m)		333.4		149.1		67.9	67.9		63.7	63.7	63.7	63.7
Upstream Blk Time (%)				0			0		1	0	0	0
Queuing Penalty (veh)				0			0		2	0	0	1
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	0	11		39	0		9	0				
Queuing Penalty (veh)	0	19		26	0		4	0				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	SB
Directions Served	LT	R
Maximum Queue (m)	10.5	4.9
Average Queue (m)	0.7	0.2
95th Queue (m)	5.0	2.1
Link Distance (m)	123.0	173.9
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

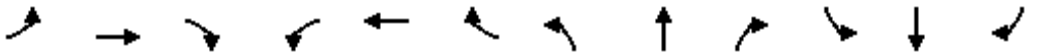
Nework Summary

Network wide Queuing Penalty: 598

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.95			0.95
Frpb, ped/bikes	0.99		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.98		1.00			1.00
Flt Protected	0.96		1.00			1.00
Satd. Flow (prot)	1624		3039			3131
Flt Permitted	0.96		1.00			1.00
Satd. Flow (perm)	1624		3039			3131
Volume (vph)	13	3	815	18	0	1942
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	14	3	867	19	0	2066
RTOR Reduction (vph)	2	0	2	0	0	0
Lane Group Flow (vph)	15	0	884	0	0	2066
Confl. Peds. (#/hr)		20		19		
Heavy Vehicles (%)	2%	2%	11%	2%	2%	8%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	16.0		67.4			67.4
Effective Green, g (s)	17.9		69.1			69.1
Actuated g/C Ratio	0.19		0.73			0.73
Clearance Time (s)	5.9		5.7			5.7
Lane Grp Cap (vph)	306		2210			2277
v/s Ratio Prot			0.29			c0.66
v/s Ratio Perm	c0.01					
v/c Ratio	0.05		0.40			0.91
Uniform Delay, d1	31.6		5.0			10.4
Progression Factor	1.00		0.28			1.00
Incremental Delay, d2	0.3		0.5			6.7
Delay (s)	31.9		1.9			17.1
Level of Service	C		A			B
Approach Delay (s)	31.9		1.9			17.1
Approach LOS	C		A			B

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	4.0
Lane Util. Factor					0.95	0.88		0.95			0.86	1.00
Frpb, ped/bikes					1.00	0.97		1.00			1.00	0.99
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3284	2536		2916			5670	1462
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3284	2536		2916			5670	1462
Volume (vph)	0	0	0	72	414	555	0	542	0	0	1861	94
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	77	440	590	0	577	0	0	1980	100
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	39
Lane Group Flow (vph)	0	0	0	0	517	590	0	577	0	0	1980	61
Confl. Peds. (#/hr)				14		12						1
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	16%	2%	2%	8%	2%
Turn Type				Perm		custom						Perm
Protected Phases					4	1		2			6	
Permitted Phases				4		4						6
Actuated Green, G (s)					26.4	37.3		39.5			52.7	52.7
Effective Green, g (s)					29.0	41.6		41.4			58.0	58.0
Actuated g/C Ratio					0.31	0.44		0.44			0.61	0.61
Clearance Time (s)					6.6	5.7		5.9			9.3	9.3
Lane Grp Cap (vph)					1002	1217		1271			3462	893
v/s Ratio Prot						c0.06		0.20			c0.35	
v/s Ratio Perm					0.16	0.17						0.04
v/c Ratio					0.52	0.48		0.45			0.57	0.07
Uniform Delay, d1					27.2	19.1		18.9			11.1	7.5
Progression Factor					0.98	0.97		0.28			0.42	0.53
Incremental Delay, d2					1.9	1.4		0.8			0.3	0.1
Delay (s)					28.6	19.9		6.2			5.0	4.1
Level of Service					C	B		A			A	A
Approach Delay (s)		0.0			24.0			6.2			4.9	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.95		0.97	0.95	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.97						0.99		1.00	1.00	
Flt Protected	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3053						2785		3216	2941	
Flt Permitted	0.95	1.00						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3053						2785		3216	2941	
Volume (vph)	134	398	101	0	0	0	0	408	36	948	985	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	143	423	107	0	0	0	0	434	38	1009	1048	0
RTOR Reduction (vph)	0	22	0	0	0	0	0	7	0	0	0	0
Lane Group Flow (vph)	143	508	0	0	0	0	0	465	0	1009	1048	0
Confl. Peds. (#/hr)			29						19	19		
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	21%	2%	2%	15%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	26.4	26.4						14.4		32.0	55.7	
Effective Green, g (s)	29.0	29.0						19.7		34.3	58.0	
Actuated g/C Ratio	0.31	0.31						0.21		0.36	0.61	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	461	932						578		1161	1796	
v/s Ratio Prot	0.09	c0.17						c0.17		c0.31	0.36	
v/s Ratio Perm												
v/c Ratio	0.31	0.54						0.80		0.87	0.58	
Uniform Delay, d1	25.3	27.5						35.8		28.3	11.2	
Progression Factor	1.00	1.00						1.05		0.53	0.15	
Incremental Delay, d2	1.7	2.3						11.0		7.6	1.2	
Delay (s)	27.1	29.8						48.6		22.4	2.8	
Level of Service	C	C						D		C	A	
Approach Delay (s)		29.2			0.0			48.6			12.4	
Approach LOS		C			A			D			B	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor			1.00			1.00	1.00	0.95			0.95	
Frpb, ped/bikes			0.99			0.97	1.00	1.00			1.00	
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	
Frt			0.86			0.86	1.00	0.99			0.99	
Flt Protected			1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)			1489			1459	1656	2810			2946	
Flt Permitted			1.00			1.00	0.18	1.00			1.00	
Satd. Flow (perm)			1489			1459	320	2810			2946	
Volume (vph)	0	0	43	0	0	14	111	432	28	0	943	50
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	46	0	0	15	118	460	30	0	1003	53
RTOR Reduction (vph)	0	0	0	0	0	0	0	5	0	0	4	0
Lane Group Flow (vph)	0	0	46	0	0	15	118	485	0	0	1052	0
Confl. Peds. (#/hr)			5			74	76		30	30		76
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	20%	2%	2%	14%	2%
Turn Type			custom			custom	pm+pt					
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					
Actuated Green, G (s)			95.0			95.0	83.6	48.1			48.1	
Effective Green, g (s)			95.0			95.0	87.0	49.9			49.9	
Actuated g/C Ratio			1.00			1.00	0.92	0.53			0.53	
Clearance Time (s)							5.6	5.8			5.8	
Lane Grp Cap (vph)			1489			1459	815	1476			1547	
v/s Ratio Prot							c0.06	0.17			c0.36	
v/s Ratio Perm			0.03			0.01	0.08					
v/c Ratio			0.03			0.01	0.14	0.33			0.68	
Uniform Delay, d1			0.0			0.0	2.2	12.9			16.7	
Progression Factor			1.00			1.00	11.21	0.57			0.36	
Incremental Delay, d2			0.0			0.0	0.3	0.5			2.0	
Delay (s)			0.0			0.0	24.9	7.9			8.0	
Level of Service			A			A	C	A			A	
Approach Delay (s)		0.0			0.0			11.2			8.0	
Approach LOS		A			A			B			A	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.90		1.00	0.81		1.00	0.89	1.00	1.00	0.91
Flpb, ped/bikes	0.96	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1049	1745	1342		1745	1204		3316	1322	1580	3316	939
Flt Permitted	0.36	1.00	1.00		1.00	1.00		1.00	1.00	0.53	1.00	1.00
Satd. Flow (perm)	397	1745	1342		1745	1204		3316	1322	886	3316	939
Volume (vph)	144	267	28	0	392	66	0	346	42	210	666	248
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	153	284	30	0	417	70	0	368	45	223	709	264
RTOR Reduction (vph)	0	0	16	0	0	27	0	0	29	0	0	169
Lane Group Flow (vph)	153	284	14	0	417	43	0	368	16	223	709	95
Confl. Peds. (#/hr)	270		128	128		270			65	65		54
Heavy Vehicles (%)	55%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	46%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	41.5	46.5	41.5		31.5	41.5		20.0	32.9	32.9	36.6	32.9
Effective Green, g (s)	42.8	47.8	42.8		32.8	42.8		22.6	34.2	34.2	39.2	34.2
Actuated g/C Ratio	0.45	0.50	0.45		0.35	0.45		0.24	0.36	0.36	0.41	0.36
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	254	878	605		602	542		789	476	411	1368	338
v/s Ratio Prot	c0.07	0.16			c0.24			0.11		0.07	c0.21	
v/s Ratio Perm	0.20		0.01			0.04			0.01	0.12		0.10
v/c Ratio	0.60	0.32	0.02		0.69	0.08		0.47	0.03	0.54	0.52	0.28
Uniform Delay, d1	27.5	14.0	14.5		26.8	14.9		31.0	19.7	26.0	20.8	21.6
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	0.49	0.44	0.15
Incremental Delay, d2	10.2	1.0	0.1		6.4	0.3		2.0	0.1	4.2	1.2	1.7
Delay (s)	37.7	15.0	14.6		33.2	15.1		33.0	19.8	17.0	10.4	4.9
Level of Service	D	B	B		C	B		C	B	B	B	A
Approach Delay (s)		22.4			30.6			31.6			10.4	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

105: Cathcart Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	SER	All
Delay / Veh (s)	1.6	2.9	55.2	2.9

106: Bruyere Street & King Edward Avenue Performance by movement

Movement	NBT	SBT	All
Delay / Veh (s)	1.6	5.9	3.3

107: St. Andrew Street & King Edward Avenue Performance by movement

Movement	WBL	WBR	NBT	NBR	SBT	All
Delay / Veh (s)	73.1	28.0	7.0	5.2	11.4	9.0

108: Guigues Ave & King Edward Avenue Performance by movement

Movement	NBT	NBR	SBT	All
Delay / Veh (s)	6.6	6.1	4.9	6.0

109: St. Patrick Street & King Edward Avenue Performance by movement

Movement	WBL	WBT	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	66.7	60.6	92.1	10.0	25.1	1.2	33.6

110: Murray Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	NBT	NBR	SBL	SBT	All
Delay / Veh (s)	65.9	70.9	60.7	33.5	28.8	69.1	2.2	40.9

111: Clarence Street & King Edward Avenue Performance by movement

Movement	WBR	NBT	SBT	SBR	All
Delay / Veh (s)	603.8	18.9	1.6	1.2	67.6

112: York Street & King Edward Avenue Performance by movement

Movement	EBR	WBR	NBL	NBT	NBR	SBT	SBR	All
Delay / Veh (s)	4.1	14.6	11.9	28.2	27.0	15.9	14.1	20.4

113: George Street & King Edward Avenue Performance by movement

Movement	EBR	NBT	SBT	All
Delay / Veh (s)	257.9	1.5	13.0	16.0

114: Rideau Street & King Edward Avenue Performance by movement

Movement	EBL	EBT	EBR	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Delay / Veh (s)	734.2	579.4	503.9	906.2	903.7	708.9	682.8	155.8	26.6	21.0	519.2

700: St. Patrick Street & Murray Street Performance by movement

Movement	NBL	NBT	SBR	All
Delay / Veh (s)	6.2	3.8	1183.2	550.8

Total Network Performance

Delay / Veh (s) 557.8

Intersection: 105: Cathcart Street & King Edward Avenue

Movement	SB	SB	SE
Directions Served	T	T	R
Maximum Queue (m)	28.1	31.0	20.3
Average Queue (m)	5.9	4.7	5.2
95th Queue (m)	29.7	26.3	21.9
Link Distance (m)	39.5	39.5	38.7
Upstream Blk Time (%)	3	1	6
Queuing Penalty (veh)	0	0	0
Storage Bay Dist (m)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 106: Bruyere Street & King Edward Avenue

Movement	SB	SB
Directions Served	T	T
Maximum Queue (m)	94.0	91.3
Average Queue (m)	32.5	18.2
95th Queue (m)	101.2	76.4
Link Distance (m)	68.9	68.9
Upstream Blk Time (%)	7	2
Queuing Penalty (veh)	52	15
Storage Bay Dist (m)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 107: St. Andrew Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	TR	T	T
Maximum Queue (m)	19.7	64.1	64.4	89.9	90.1
Average Queue (m)	6.0	61.3	61.0	75.9	55.4
95th Queue (m)	15.8	70.6	70.7	104.0	88.4
Link Distance (m)	219.2	43.2	43.2	67.5	67.5
Upstream Blk Time (%)		19	18	18	3
Queuing Penalty (veh)		242	234	126	18
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 108: Guigues Ave & King Edward Avenue

Movement	NB	NB	SB	SB
Directions Served	T	TR	T	T
Maximum Queue (m)	85.2	82.9	41.9	31.8
Average Queue (m)	57.0	55.1	22.0	5.3
95th Queue (m)	97.5	95.5	67.1	28.2
Link Distance (m)	71.7	71.7	43.2	43.2
Upstream Blk Time (%)	4	4	15	0
Queuing Penalty (veh)	60	57	103	1
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 109: St. Patrick Street & King Edward Avenue

Movement	WB	WB	WB	WB	NB	NB	SB	SB	SB	SB	SB
Directions Served	LT	T	R	R	T	T	T	T	T	T	R
Maximum Queue (m)	66.4	127.5	86.0	82.7	76.7	79.6	57.3	61.1	85.0	60.9	15.6
Average Queue (m)	37.4	121.0	85.4	79.9	62.6	58.3	42.0	45.9	52.0	26.3	0.5
95th Queue (m)	57.9	133.4	87.3	86.2	84.5	84.1	79.3	84.2	115.8	53.0	9.3
Link Distance (m)	90.7	90.7			69.2	69.2			71.7	71.7	
Upstream Blk Time (%)	0	49	13		5	3		0	19	0	
Queuing Penalty (veh)	0	328	0		42	28		0	136	0	
Storage Bay Dist (m)			75.0	75.0			55.0	55.0			60.0
Storage Blk Time (%)		0	52	32			15	25	0	0	
Queuing Penalty (veh)		0	76	46			52	85	0	0	

Intersection: 110: Murray Street & King Edward Avenue

Movement	EB	EB	EB	NB	NB	SB	SB	SB	SB
Directions Served	L	LT	TR	T	TR	L	L	T	T
Maximum Queue (m)	100.8	107.3	105.4	86.5	84.2	75.7	75.5	20.0	23.2
Average Queue (m)	69.6	77.3	71.0	79.9	80.9	70.1	71.4	5.4	4.1
95th Queue (m)	97.8	103.2	98.7	85.8	84.5	78.6	77.5	14.8	14.4
Link Distance (m)	134.6	134.6	134.6	60.3	60.3	69.2	69.2	69.2	69.2
Upstream Blk Time (%)				36	43	35	38		
Queuing Penalty (veh)				274	324	126	135		
Storage Bay Dist (m)									
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 111: Clarence Street & King Edward Avenue

Movement	WB	NB	NB	SB	SB
Directions Served	R	T	TR	T	TR
Maximum Queue (m)	160.2	71.7	72.0	30.0	44.4
Average Queue (m)	141.7	54.6	57.3	2.6	5.2
95th Queue (m)	191.2	76.4	78.9	15.6	24.3
Link Distance (m)	152.2	63.8	63.8	60.3	60.3
Upstream Blk Time (%)	60	10	14	0	0
Queuing Penalty (veh)	0	62	89	0	0
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 112: York Street & King Edward Avenue

Movement	EB	WB	NB	NB	NB	SB	SB
Directions Served	R	R	L	T	TR	T	TR
Maximum Queue (m)	29.4	49.7	72.4	134.0	125.2	87.3	88.1
Average Queue (m)	8.0	16.5	16.0	75.3	76.9	44.1	58.1
95th Queue (m)	20.2	38.7	47.7	120.0	118.3	76.3	92.8
Link Distance (m)	126.9	149.1		139.3	139.3	63.8	63.8
Upstream Blk Time (%)				1	0	2	7
Queuing Penalty (veh)				3	3	8	31
Storage Bay Dist (m)			65.0				
Storage Blk Time (%)				11			
Queuing Penalty (veh)				15			

Intersection: 113: George Street & King Edward Avenue

Movement	EB	NB	SB	SB	SB
Directions Served	R	T	T	T	TR
Maximum Queue (m)	59.2	3.5	33.7	111.8	115.9
Average Queue (m)	29.1	0.1	15.1	31.2	31.0
95th Queue (m)	69.5	2.5	38.9	100.8	98.5
Link Distance (m)	61.2	63.6		139.3	139.3
Upstream Blk Time (%)	24			1	0
Queuing Penalty (veh)	0			4	0
Storage Bay Dist (m)			24.0		
Storage Blk Time (%)			23	2	
Queuing Penalty (veh)			71	6	

Intersection: 114: Rideau Street & King Edward Avenue

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB	SB
Directions Served	L	T	R	T	R	T	T	R	L	T	T	R
Maximum Queue (m)	98.5	343.8	32.8	158.4	32.8	76.8	78.3	29.9	86.8	83.2	76.6	84.2
Average Queue (m)	95.1	322.2	4.0	153.9	19.5	72.7	72.7	10.6	73.4	40.9	43.1	48.3
95th Queue (m)	99.6	396.2	19.0	155.7	42.0	74.7	75.2	30.3	103.8	68.9	69.1	79.4
Link Distance (m)		333.4		149.1		67.9	67.9		63.6	63.6	63.6	63.6
Upstream Blk Time (%)		53		55		72	66		57	1	2	4
Queuing Penalty (veh)		0		0		0	0		144	3	4	11
Storage Bay Dist (m)	85.0		25.0		25.0			22.0				
Storage Blk Time (%)	71	23	0	60	1		74	1				
Queuing Penalty (veh)	277	55	0	131	8		69	4				

Intersection: 700: St. Patrick Street & Murray Street

Movement	NB	NB	SB	SB
Directions Served	LT	T	R	R
Maximum Queue (m)	78.0	68.0	163.6	181.9
Average Queue (m)	23.2	9.5	10.1	178.5
95th Queue (m)	61.9	42.5	72.4	180.6
Link Distance (m)	123.0	123.0	173.9	173.9
Upstream Blk Time (%)			0	59
Queuing Penalty (veh)			0	0
Storage Bay Dist (m)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

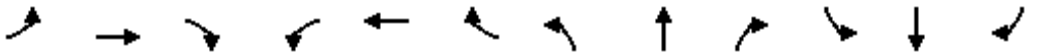
Nework Summary

Network wide Queuing Penalty: 3560

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0		4.0			4.0
Lane Util. Factor	1.00		0.95			0.95
Frpb, ped/bikes	0.94		1.00			1.00
Flpb, ped/bikes	1.00		1.00			1.00
Frt	0.93		1.00			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1497		3249			2941
Flt Permitted	0.98		1.00			1.00
Satd. Flow (perm)	1497		3249			2941
Volume (vph)	11	11	2588	12	0	1387
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	12	12	2753	13	0	1476
RTOR Reduction (vph)	7	0	0	0	0	0
Lane Group Flow (vph)	17	0	2766	0	0	1476
Confl. Peds. (#/hr)		58		23		
Heavy Vehicles (%)	2%	2%	4%	2%	2%	15%
Turn Type						
Protected Phases			2			6
Permitted Phases	8					
Actuated Green, G (s)	23.0		115.1			115.1
Effective Green, g (s)	24.9		117.1			117.1
Actuated g/C Ratio	0.17		0.78			0.78
Clearance Time (s)	5.9		6.0			6.0
Lane Grp Cap (vph)	249		2536			2296
v/s Ratio Prot			c0.85			0.50
v/s Ratio Perm	c0.01					
v/c Ratio	0.07		1.09			0.64
Uniform Delay, d1	52.8		16.5			7.2
Progression Factor	1.00		0.59			1.00
Incremental Delay, d2	0.5		41.5			1.4
Delay (s)	53.3		51.2			8.6
Level of Service	D		D			A
Approach Delay (s)	53.3		51.2			8.6
Approach LOS	D		D			A

Intersection Summary			
HCM Average Control Delay	36.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)					4.0	4.0		4.0			4.0	4.0
Lane Util. Factor					0.95	0.88		0.95			0.86	1.00
Frpb, ped/bikes					1.00	0.98		1.00			1.00	1.00
Flpb, ped/bikes					1.00	1.00		1.00			1.00	1.00
Frt					1.00	0.85		1.00			1.00	0.85
Flt Protected					0.99	1.00		1.00			1.00	1.00
Satd. Flow (prot)					3290	2563		3221			5325	1483
Flt Permitted					0.99	1.00		1.00			1.00	1.00
Satd. Flow (perm)					3290	2563		3221			5325	1483
Volume (vph)	0	0	0	46	291	993	0	1860	0	0	1374	24
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	0	49	310	1056	0	1979	0	0	1462	26
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	0	0	0	359	1056	0	1979	0	0	1462	19
Confl. Peds. (#/hr)				4		5						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	15%	2%
Turn Type				Perm		custom						Perm
Protected Phases					4	1		2			6	
Permitted Phases				4		4						6
Actuated Green, G (s)					28.7	52.0		79.8			105.4	105.4
Effective Green, g (s)					31.3	56.3		81.7			110.7	110.7
Actuated g/C Ratio					0.21	0.38		0.54			0.74	0.74
Clearance Time (s)					6.6	5.7		5.9			9.3	9.3
Lane Grp Cap (vph)					687	1030		1754			3930	1094
v/s Ratio Prot						c0.17		c0.61			0.27	
v/s Ratio Perm					0.11	0.24						0.01
v/c Ratio					0.52	1.03		1.13			0.37	0.02
Uniform Delay, d1					52.7	46.9		34.1			7.1	5.2
Progression Factor					0.98	0.97		0.25			0.37	0.38
Incremental Delay, d2					2.8	34.6		58.5			0.2	0.0
Delay (s)					54.3	80.1		67.2			2.9	2.0
Level of Service					D	F		E			A	A
Approach Delay (s)		0.0			73.5			67.2			2.8	
Approach LOS		A			E			E			A	

Intersection Summary			
HCM Average Control Delay	49.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	127.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0						4.0		4.0	4.0	
Lane Util. Factor	0.91	0.91						0.95		0.97	0.95	
Frpb, ped/bikes	1.00	0.99						1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00						1.00		1.00	1.00	
Frt	1.00	0.98						1.00		1.00	1.00	
Flt Protected	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (prot)	1509	3048						3150		3216	2727	
Flt Permitted	0.95	0.99						1.00		0.95	1.00	
Satd. Flow (perm)	1509	3048						3150		3216	2727	
Volume (vph)	379	388	68	0	0	0	0	1481	29	636	784	0
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	403	413	72	0	0	0	0	1576	31	677	834	0
RTOR Reduction (vph)	0	7	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	291	590	0	0	0	0	0	1606	0	677	834	0
Confl. Peds. (#/hr)			65						16	16		61
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	24%	2%
Turn Type	Split									Prot		
Protected Phases	4	4						10		9	14	
Permitted Phases												
Actuated Green, G (s)	28.7	28.7						69.0		30.1	108.4	
Effective Green, g (s)	31.3	31.3						74.3		32.4	110.7	
Actuated g/C Ratio	0.21	0.21						0.50		0.22	0.74	
Clearance Time (s)	6.6	6.6						9.3		6.3	6.3	
Lane Grp Cap (vph)	315	636						1560		695	2013	
v/s Ratio Prot	0.19	c0.19						c0.51		c0.21	0.31	
v/s Ratio Perm												
v/c Ratio	0.92	0.93						1.03		0.97	0.41	
Uniform Delay, d1	58.2	58.2						37.9		58.4	7.4	
Progression Factor	1.00	1.00						0.61		0.87	0.15	
Incremental Delay, d2	34.5	21.7						27.2		27.4	0.6	
Delay (s)	92.7	80.0						50.3		78.0	1.7	
Level of Service	F	E						D		E	A	
Approach Delay (s)		84.1			0.0			50.3			35.9	
Approach LOS		F			A			D			D	

Intersection Summary			
HCM Average Control Delay	52.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	127.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)			4.0			4.0	4.0	4.0			4.0	
Lane Util. Factor			1.00			1.00	1.00	0.95			0.95	
Frpb, ped/bikes			0.99			0.97	1.00	1.00			1.00	
Flpb, ped/bikes			1.00			1.00	1.00	1.00			1.00	
Frt			0.86			0.86	1.00	1.00			1.00	
Flt Protected			1.00			1.00	0.95	1.00			1.00	
Satd. Flow (prot)			1489			1461	1655	3150			2742	
Flt Permitted			1.00			1.00	0.21	1.00			1.00	
Satd. Flow (perm)			1489			1461	363	3150			2742	
Volume (vph)	0	0	114	0	0	143	138	1140	26	0	817	25
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	121	0	0	152	147	1213	28	0	869	27
RTOR Reduction (vph)	0	0	0	0	0	0	0	2	0	0	3	0
Lane Group Flow (vph)	0	0	121	0	0	152	147	1239	0	0	893	0
Confl. Peds. (#/hr)			5			68	78		23			78
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	7%	2%	2%	23%	2%
Turn Type			custom			custom	pm+pt					
Protected Phases							7	2			6	
Permitted Phases			6 7			2 7	2					
Actuated Green, G (s)			75.0			75.0	63.3	30.3			30.3	
Effective Green, g (s)			75.0			75.0	67.0	32.4			32.4	
Actuated g/C Ratio			1.00			1.00	0.89	0.43			0.43	
Clearance Time (s)							5.6	6.1			6.1	
Lane Grp Cap (vph)			1489			1461	920	1361			1185	
v/s Ratio Prot							c0.07	c0.39			0.33	
v/s Ratio Perm			0.08			0.10	0.07					
v/c Ratio			0.08			0.10	0.16	0.91			0.75	
Uniform Delay, d1			0.0			0.0	1.6	19.9			17.9	
Progression Factor			1.00			1.00	1.00	1.00			0.84	
Incremental Delay, d2			0.1			0.1	0.4	10.6			4.1	
Delay (s)			0.1			0.1	2.0	30.6			19.1	
Level of Service			A			A	A	C			B	
Approach Delay (s)		0.1			0.1			27.5			19.1	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00		1.00	1.00		0.95	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.88		1.00	0.69		1.00	0.84	1.00	1.00	0.77
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00		1.00	1.00	0.99	1.00	1.00
Frt	1.00	1.00	0.85		1.00	0.85		1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00		1.00	1.00		1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1305	1745	1307		1745	1016		3316	1241	1649	3316	652
Flt Permitted	0.11	1.00	1.00		1.00	1.00		1.00	1.00	0.17	1.00	1.00
Satd. Flow (perm)	155	1745	1307		1745	1016		3316	1241	302	3316	652
Volume (vph)	229	377	15	0	638	218	0	857	94	207	574	227
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	244	401	16	0	679	232	0	912	100	220	611	241
RTOR Reduction (vph)	0	0	6	0	0	53	0	0	29	0	0	151
Lane Group Flow (vph)	244	401	10	0	679	179	0	912	71	220	611	90
Confl. Peds. (#/hr)	534		169	169		534			104	104		152
Heavy Vehicles (%)	29%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	79%
Turn Type	custom		custom			custom			custom	custom		custom
Protected Phases	11	10			14			12		13	16	
Permitted Phases	1		1			3			5	7		7
Actuated Green, G (s)	45.1	50.1	45.1		35.1	45.1		21.4	34.3	34.3	38.0	34.3
Effective Green, g (s)	46.4	51.4	46.4		36.4	46.4		24.0	35.6	35.6	40.6	35.6
Actuated g/C Ratio	0.46	0.51	0.46		0.36	0.46		0.24	0.36	0.36	0.41	0.36
Clearance Time (s)	5.3	5.3	5.3		5.3	5.3		6.6	5.3	6.6	6.6	5.3
Lane Grp Cap (vph)	198	897	606		635	471		796	442	277	1346	232
v/s Ratio Prot	c0.14	0.23			c0.39			c0.28		c0.10	0.18	
v/s Ratio Perm	c0.43		0.01			0.18			0.06	0.18		0.14
v/c Ratio	1.23	0.45	0.02		1.07	0.38		1.15	0.16	0.79	0.45	0.39
Uniform Delay, d1	40.4	15.3	14.5		31.8	17.5		38.0	22.0	38.7	21.6	24.0
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	140.4	1.6	0.1		55.7	2.3		80.1	0.8	20.5	1.1	4.8
Delay (s)	180.8	16.9	14.5		87.5	19.8		118.1	22.8	59.2	22.7	28.8
Level of Service	F	B	B		F	B		F	C	E	C	C
Approach Delay (s)		77.4			70.2			108.7			31.6	
Approach LOS		E			E			F			C	

Intersection Summary			
HCM Average Control Delay	70.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Appendix B: Supplementary Synchro Summary

6 Lane Configuration – Preconstruction Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	E
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	B
114	Rideau Street & King Edward Avenue	F

4 Lane Configuration – Future Volumes (P.M.)

Intersection #	Intersection Name	LOS
107	St. Andrew Street & King Edward Avenue	F
109	St. Patrick Street & King Edward Avenue	F
110	Murray Street & King Edward Avenue	E
112	York Street & King Edward Avenue	E
114	Rideau Street & King Edward Avenue	F

NOTES:
Average Delay and Queue values based on SimTraffic Results.
SimTraffic network seeded for 30 minutes and recorded for 60 minutes, data gathered over five simulation runs.
Maximum v/c and Weighted v/c values based on HCM Signalized intersection results from Synchro 6.