

Richcraft 879 River Road

TIA Forecasting and Strategy Report



Richcraft 879 River Road

TIA Forecasting and Strategy Report

prepared for:
Richcraft Homes
2280 St Laurent Boulevard, Suite 201
Ottawa, Ontario
K1G 4K1

prepared by:
PARSONS
1223 Michael Street North
Suite 100
Ottawa, ON K1J 7T2

March 12, 2018

476606-01000

Table of Contents

1. SCREENING FORM.....	1
2. DESCRIPTION OF PROPOSED DEVELOPMENT.....	1
2.1. PROPOSED DEVELOPMENT.....	1
3. EXISTING CONDITIONS.....	3
3.1. AREA ROAD NETWORK	3
3.2. PEDESTRIAN/CYCLING NETWORK.....	3
3.3. TRANSIT NETWORK	3
3.4. EXISTING STUDY AREA INTERSECTION.....	4
3.5. EXISTING INTERSECTION OPERATIONS.....	4
3.6. EXISTING ROAD SAFETY CONDITIONS	4
4. PLANNED CONDITIONS	5
4.1. PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES	5
4.2. OTHER AREA DEVELOPMENTS.....	5
4.2.1. Riverside South Cdp	5
4.2.2. Claridge Homes Riverside South Phase 2	7
4.2.3. Riverside South Development Corporation Riverside South Phase 15.....	8
4.2.4. Cardel Ironwood (673 Rideau Road)	9
4.2.5. Richcraft Pud (240 Poplin Street).....	10
4.2.6. Claridge Homes (76 Nutting Crescent).....	10
4.2.7. Shoppers Drug Mart (671 River Road)	10
5. STUDY AREA.....	11
5.1. TRANSIT.....	11
5.2. NETWORK CONCEPT.....	11
5.3. INTERSECTION DESIGN	11
6. TIME PERIODS	11
7. HORIZON YEARS	12
8. EXEMPTIONS REVIEW.....	12
9. DEVELOPMENT GENERATED TRAVEL DEMAND	12
9.1. TRIP GENERATION	12
9.1.1. Trip Generation	12
9.1.2. Mode Shares	13
9.2. TRIP DISTRIBUTION.....	13
9.3. TRIP ASSIGNMENT.....	13
10. BACKGROUND NETWORK TRAVEL DEMANDS.....	14
10.1. TRANSPORTATION NETWORK PLANS.....	14
10.2. BACKGROUND GROWTH	14
10.2.1. Projected Background 2020 Operations.....	15
10.2.2. Projected Background 2025 Operations.....	16

10.3.	OTHER DEVELOPMENTS	17
11.	DEMAND RATIONALIZATION.....	18
12.	DEVELOPMENT DESIGN.....	18
12.1.	DESIGN FOR SUSTAINABLE MODES.....	18
12.2.	NEW STREET NETWORKS	18
13.	BOUNDARY STREET DESIGN.....	18
14.	ACCESS INTERSECTION DESIGN	19
14.1.	LOCATION AND DESIGN OF ACCESS	19
14.2.	INTERSECTION CONTROL.....	19
14.3.	INTERSECTION DESIGN.....	19
14.3.1.	Projected Total 2020 Conditions	19
14.3.2.	Projected Total 2025 Conditions	21
15.	TRANSPORTATION DEMAND MANAGEMENT	22
15.1.	CONTEXT FOR TDM.....	22
15.2.	NEED AND OPPORTUNITY	22
15.3.	TDM PROGRAM	22
16.	TRANSIT	22
16.1.	ROUTE CAPACITY	22
17.	SUMMARY OF IMPROVEMENTS INDICATED AND MODIFICATION OPTIONS	22

List of Figures

Figure 1: Local Context	1
Figure 2: Site Plan	2
Figure 3: Area Transit Network.....	3
Figure 4: Existing Peak Hour Traffic Volumes.....	4
Figure 5: Riverside South CDP – Land Use Plan	6
Figure 6: Riverside South CDP – Road Hierarchy.....	7
Figure 7: Claridge Phase 2	8
Figure 8: RSDC Phase 15	9
Figure 9: Cardel Ironwood.....	9
Figure 10: Richcraft PUD 240 Poplin Street.....	10
Figure 11: Claridge 76 Nutting Crescent	10
Figure 12: Shoppers Drug Mart 671 River Road.....	11
Figure 13: Site Trip Generated Trip Volumes	14
Figure 14: Projected Background 2020 Traffic Volumes	15
Figure 15: Projected Background 2025 Traffic Volumes	16
Figure 16: Claridge Homes Riverside South Phase 2 Traffic Volumes (2021).....	17
Figure 17: Riverside South Development Corporation Riverside South Phase 15 Traffic Volumes (2025).....	17
Figure 18: Projected Total 2020 Traffic Volumes	20
Figure 19: Projected Total 2025 Traffic Volumes	21

List of Tables

Table 1: Exemptions Review Summary	12
--	----

Table 2: Additional Recommended Exemptions Summary.....	12
Table 3: 2009 TRANS Trip Generation Rate.....	12
Table 4: TRANS Vehicle Trip Generation.....	13
Table 5: Total Site Trip Generation.....	13
Table 6: Projected Background 2020 Performance at Study Area Intersection	15
Table 7: Projected Background 2025 Performance at Study Area Intersection	16
Table 8: MMLOS Targets for Boundary Streets.....	18
Table 9: Minimum Required Elements for MMLOS Analysis	18
Table 10: Projected Total 2020 Performance at Study Area Intersection.....	20
Table 11: Projected Total 2025 Performance at Study Area Intersection.....	21

LIST OF APPENDICES

APPENDIX A – Screening Form and City Response
APPENDIX B – Traffic Data
APPENDIX C – Collision Data
APPENDIX D – Background 2020 SYNCHRO Analysis
APPENDIX E – Projected 2020 and 2025 SYNCHRO Analysis
APPENDIX F – TDM Checklist

TIA Forecasting and Strategy Report

1. SCREENING FORM

The screening form was provided to the City during the pre-consultation meeting on December 20th, 2017 and identified the need for a Transportation Impact Assessment (TIA). The Trip Generation trigger was met based on the unit count of 112 mixed units of single-family homes and townhomes. The unit count has been updated to 117 townhome units to reflect site plan.

The Screening and Scoping Report was submitted on January 24, 2018 to the City of Ottawa Transportation Project Manager (TPM). The report concluded with recommending the exemptions include Module 4.1 Development Design – Element 4.1.3 Circulation and Access, Module 4.2 Parking, Module 4.4 Access Intersections, Module 4.6 Neighbourhood Traffic Management – Element 4.6.1 Adjacent Neighbourhoods, Module 4.7 Transit – Element 4.7.2 Transit Priority, Module 4.8, and Module 4.9 Intersection Design. No response has been received from the TPM at the time of the submission of this report.

The Screening Form and correspondence is provided in Appendix A.

2. DESCRIPTION OF PROPOSED DEVELOPMENT

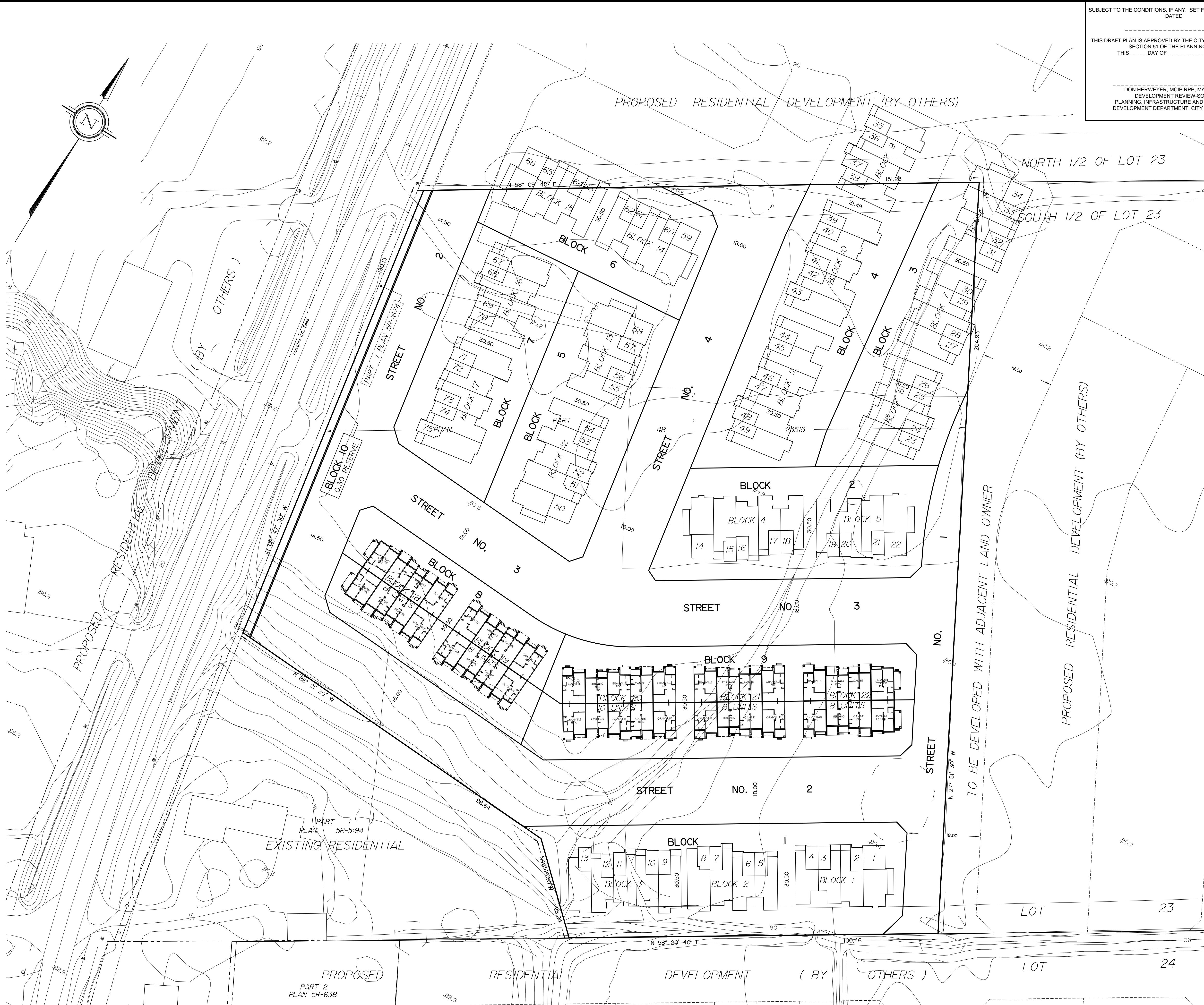
2.1. PROPOSED DEVELOPMENT

The proposed development at 879 River Road is a greenfield development, forming part of the Riverside South Community. The site's local context is illustrated in Figure 1.

The development will include approximately 117 residential units. The development will ultimately be accessed through the future surrounding development, but potentially can be access by a temporary access on River Road. The site plan is illustrated in Figure 2. The estimated date of occupancy is 2019 with one phase of development.

Figure 1: Local Context

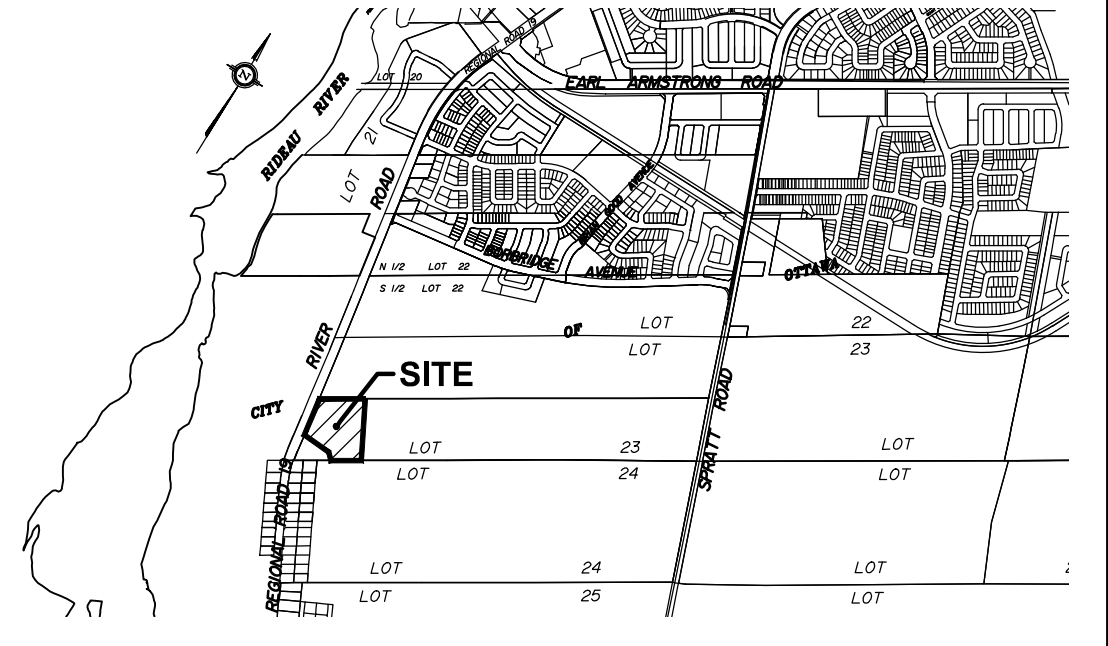




SUBJECT TO THE CONDITIONS, IF ANY, SET FORTH IN OUR LETTER DATED _____

THIS DRAFT PLAN IS APPROVED BY THE CITY OF OTTAWA UNDER SECTION 51 OF THE PLANNING ACT.
THIS _____ DAY OF _____, 20____

DON HERVEYER, MCIP RPP, MANAGER
DEVELOPMENT REVIEW-SOUTH
PLANNING, INFRASTRUCTURE AND ECONOMIC
DEVELOPMENT DEPARTMENT, CITY OF OTTAWA



KEY MAP
NOT TO SCALE

OPTION C
DRAFT PLAN OF SUBDIVISION OF
PART OF LOT 23
BROKEN FRONT
CONCESSION (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis , O'Sullivan , Vollebekk Ltd.
January 15, 2018

Metric
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND
CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

SURVEYOR'S CERTIFICATE

I CERTIFY THAT :
The boundaries of the lands to be subdivided and their relationship
to adjoining lands have been accurately and correctly shown.

Date _____ Edward M. Lancaster
ONTARIO LAND SURVEYOR

OWNER'S CERTIFICATE

This is to certify that I am the owner of the lands to be subdivided and that this plan
was prepared in accordance with my instructions.

Date _____ Steve Grandmont
Authorized Signing Officer
Richcraft Homes Ltd.
I have the authority to bind the corporation

Number of Units

Towns 75

Singles 0

Back-to-Backs 42

Total Number of Units = 117

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51-17 OF THE PLANNING ACT

- (a) see plan
- (b) see plan
- (c) see plan
- (d) single/multi-family residential housing, park land, open space and institutional
- (e) see plan
- (f) see plan
- (g) see plan
- (h) City of Ottawa
- (i) see soils report
- (j) see plan
- (k) sanitary, storm sewers, municipal water, bell, hydro, cable and gas to be available
- (l) see plan



ANNIS, O'SULLIVAN, VOLLEBEKK LTD.

14 Concourse Gate, Suite 500

Nepaan, Ont. K2E 7S6

Phone: (613) 727-0850 / Fax: (613) 727-1079

Email: Nepaan@asvold.com

Job No. 18577-17 Richcraft PIL123 C BF GL DPS D2

S

3. EXISTING CONDITIONS

3.1. AREA ROAD NETWORK

River Road is a north-south arterial, which extends from Boundary Road in the south (where it continues as Rideau River Road) to Riverside Drive in the north. Within the study area, River Road has a two-lane undivided rural cross section with auxiliary turn lanes provided at major intersections. The posted speed limit within the study area is 70 km/h, transitioning to 80 km/h north of the proposed site and to 60 km/h at Earl Armstrong Road.

Earl Armstrong Road is an east-west arterial, which extends from River Road in the east to High Road in the west. Within the study area, Riverside Drive has a four-lane divided cross section with auxiliary turn lanes provided at major intersections. The posted speed limit within the study area is 70 km/h.

3.2. PEDESTRIAN/CYCLING NETWORK

Sidewalk facilities are provided along both sides of Earl Armstrong Road and River Road has paved/gravel shoulders. Bicycle facilities are currently provided in the form of bike lanes on Earl Armstrong Road along both sides of the road.

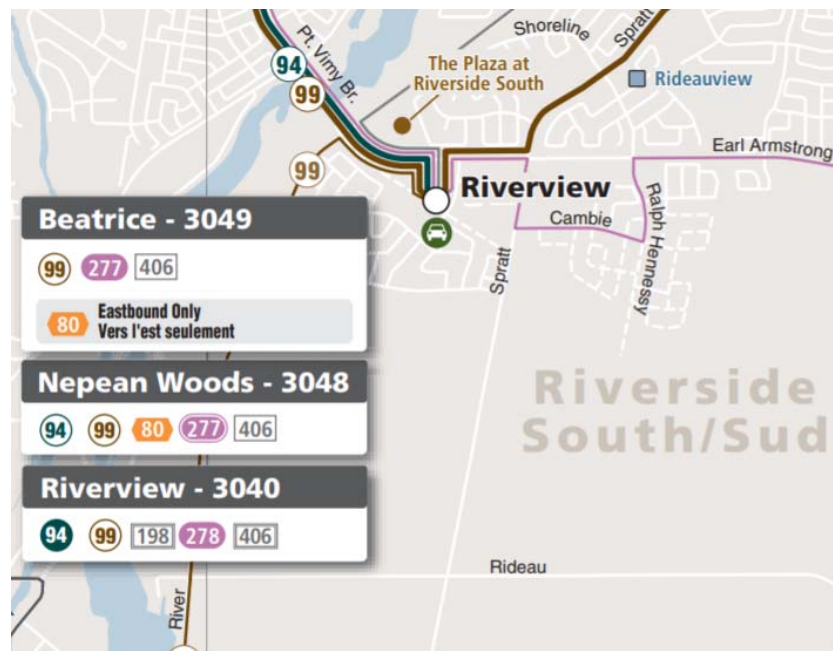
Per the City's Cycling Plan, River Road and Earl Armstrong Road are all classified as "Spine Routes".

3.3. TRANSIT NETWORK

Transit service within the vicinity of the site is currently provided by OC Transpo Peak Route #99 which provides peak hour service in the morning and afternoon. Bus stops for Route #99 are located along River Road at the River Road/Nicolls Island Road and River Road/Rideau Road intersections, approximately 190m south of the proposed development.

Rapid transit service (in the form of BRT) is also provided via Riverview Station, located approximately 1.5 kilometres north of the proposed development, which provides access to multiple routes along the Transitway.

Figure 3: Area Transit Network



3.4. EXISTING STUDY AREA INTERSECTION

River Road and Earl Armstrong Road

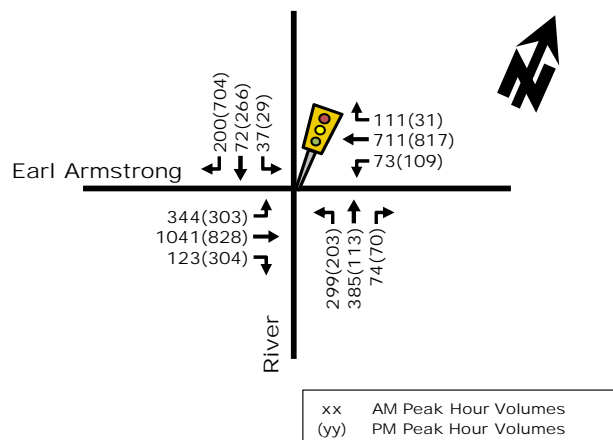
River Road at Earl Armstrong Road is a signalized intersection. The cross-section of River Road consists of dual left turn lanes, two through lanes and a right turn lane on all approaches, including transit lanes in the east-west directions.



3.5. EXISTING INTERSECTION OPERATIONS

The existing peak hour traffic volumes (illustrated in Figure 4 below) were collected from City of Ottawa turning movement counts, which were completed in July 2016. The resulting peak hour and full traffic volume counts are included as Appendix B.

Figure 4: Existing Peak Hour Traffic Volumes



3.6. EXISTING ROAD SAFETY CONDITIONS

Collision history for study area roads (2014 to 2016, inclusive) was obtained from the City of Ottawa, and the majority (90%) of collisions involved property damage, and the remaining (10%) collisions involved non-fatal injuries indicating low impact speeds.

Over the three-year period, the types of collisions cited by police include: single vehicle (other) (40% or 4 collisions), rear end and approaching (20% of 2 collisions each), and angle and other (10% or 1 collision each)

A standard unit of measure for assessing collisions at an intersection is based on the number collisions per million entering vehicles (MEV). At intersection and road segment within the study area, reported collisions per MEV is as follows:

- 0.19 collisions/MEV at the River Road and Earl Armstrong Road intersection;
- 0.17 collisions/MEV on River Road between Earl Armstrong Road and Nicolls Island Road; and
- 0.09 collisions/MEV at the River Road and Nicolls Road intersection.

With respect to the subject site, there does not appear to be any prevailing safety issues along the River Road. The source collision data as provided by the City of Ottawa and related analysis is included as Appendix C.

4. PLANNED CONDITIONS

4.1. PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES

Identified on the 'Affordable Network' map within the TMP is the widening of Earl Armstrong Road from 2-lanes to 4-lanes between Limebank Road and Bowesville Road and on the 'Network Concept', extending Earl Armstrong Road as a 2-lane road between Albion Road to Hawthorne Road. Additionally, on the 'Network Concept' map, Limebank Road is to be widened from 2-lanes to 4-lanes between Mitch Owens Road and Earl Armstrong Road.

Rapid transit measures within the study area include at-grade bus rapid transit (BRT) between Southwest Transitway and Riverside South Town Center on the 'Transit Network Concept' map along Earl Armstrong Road and the extension of existing O-train to Bowesville/Riverside South Station identified on the 'Transit Affordable Network' map.

Although not identified in the TMP, Spratt Road is planned to be extended south of Earl Armstrong Road to Boundary Road. It will be expanded to a 4-lane cross section with sidewalks and stop controls where warranted.

4.2. OTHER AREA DEVELOPMENTS

4.2.1. RIVERSIDE SOUTH CDP

In 2005, Council approved the Riverside South CDP to direct the long-term development of the community and provide guidelines for City staff for decision-making regarding land use planning that would be consistent with the community's priorities for the future. The Plan was amended in 2010, and again in June 2016.

The most recent Land Use Plan for Riverside South is provided as Figure 5, and the development forecast at full build-out is as follows:

- Population 54,788 people (compared to 13,779 existing)
- Dwelling units 20,469 homes
- Employment 17,703 jobs within the designated employment areas, plus 9,960 more jobs within the Combined mixed-use, commercial, institutional areas.

According to the CDP, the road network for the Riverside South Community is based on a grid of east-west and north-south collector roads, while two arterial roads, namely Earl Armstrong Road and Limebank Road, serve as the axis for the network. The road hierarchy is shown as Figure 6. The following modifications to the road network are suggested:

- *Riverside Drive will be widened to six lanes from Limebank Road north to Hunt Club Road in the medium term, and in conjunction with River Road, which will remain a two-lane scenic road, will act as a north-south corridor that will connect Riverside South to the Vimy Memorial Bridge.*
- *Earl Armstrong Road has been upgraded to accommodate four lanes of traffic, and will be extended east to Bank Street. It is connected to Strandherd Drive, west of the Rideau River, via the Vimy Memorial Bridge.*

- Limebank Road has been widened in part to four lanes from south of Earl Armstrong Road to its intersection with Riverside Drive/River Road north of the community and is to become the main north-south arterial linking Riverside South to the greater Ottawa area.
- Spratt Road acts as a community collector linking the existing neighbourhoods in the northwest quadrant to the future development areas to the south and east.
- Other future major and minor collectors within the new community will extend into other neighbourhoods to provide links to the arterial system.

Figure 5: Riverside South CDP – Land Use Plan

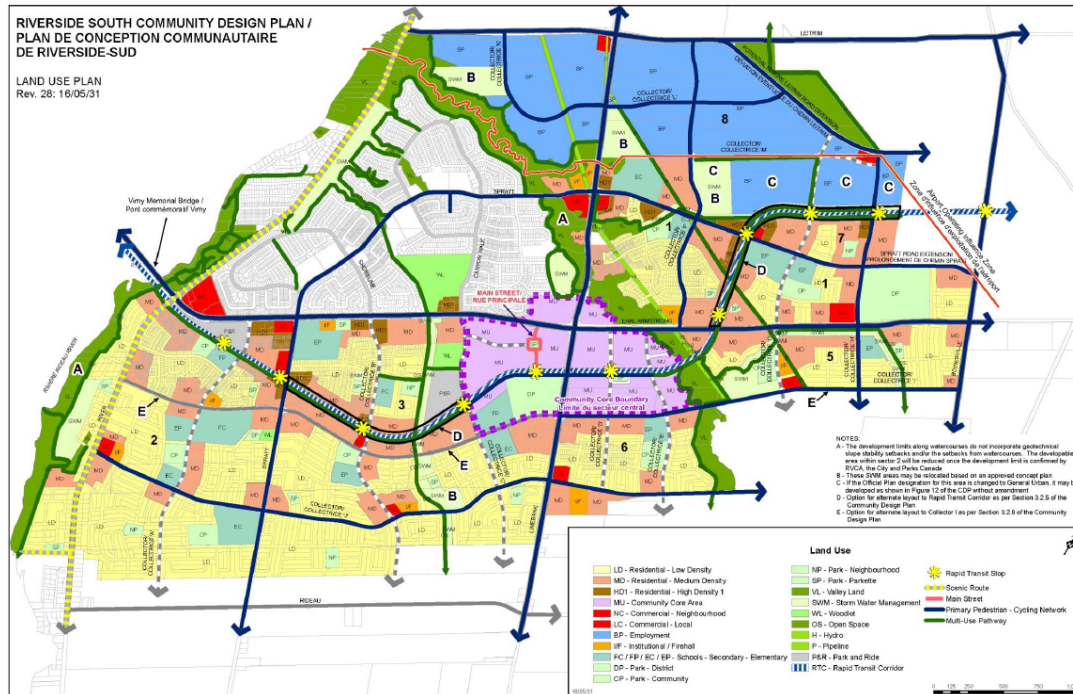
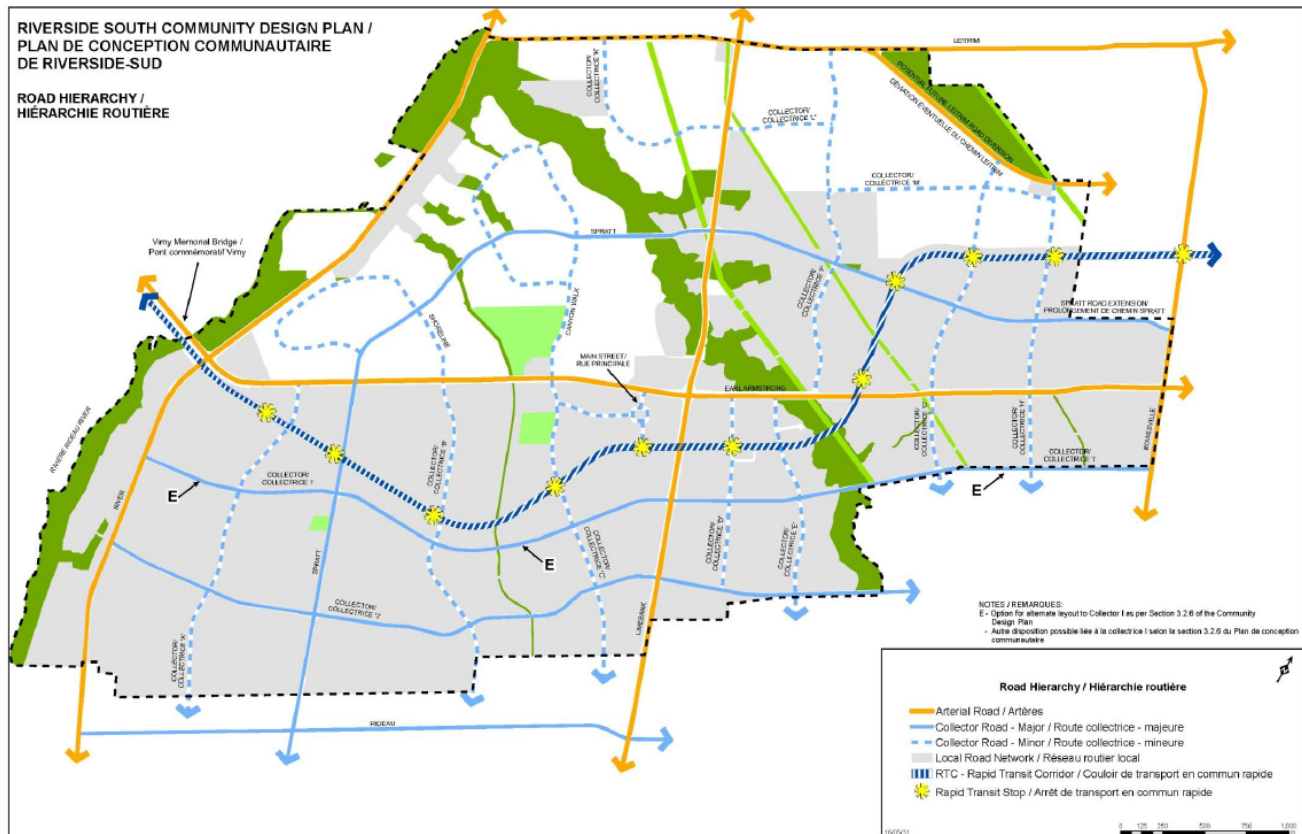


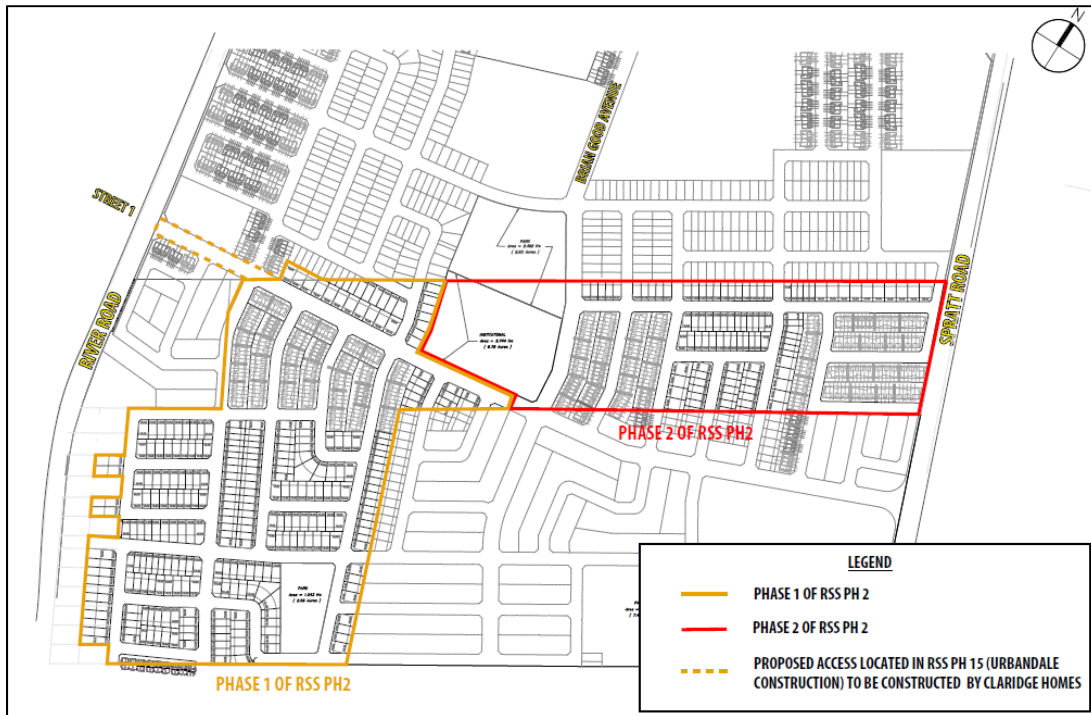
Figure 6: Riverside South CDP – Road Hierarchy



4.2.2. CLARIDGE HOMES RIVERSIDE SOUTH PHASE 2

Claridge Phase 2 is located 4720 Spratt Road and 807 River Road, and is proposed to include a total of 755 residential units consisting of 505 single family homes and 250 townhomes. The proposed development borders the proposed 879 River Road lands on the east and south sides, sharing two internal roadways for access. It is estimated that west phase of the development will be completed by 2021 and east phase will be completed by 2026. Figure 7 illustrates the proposed development.

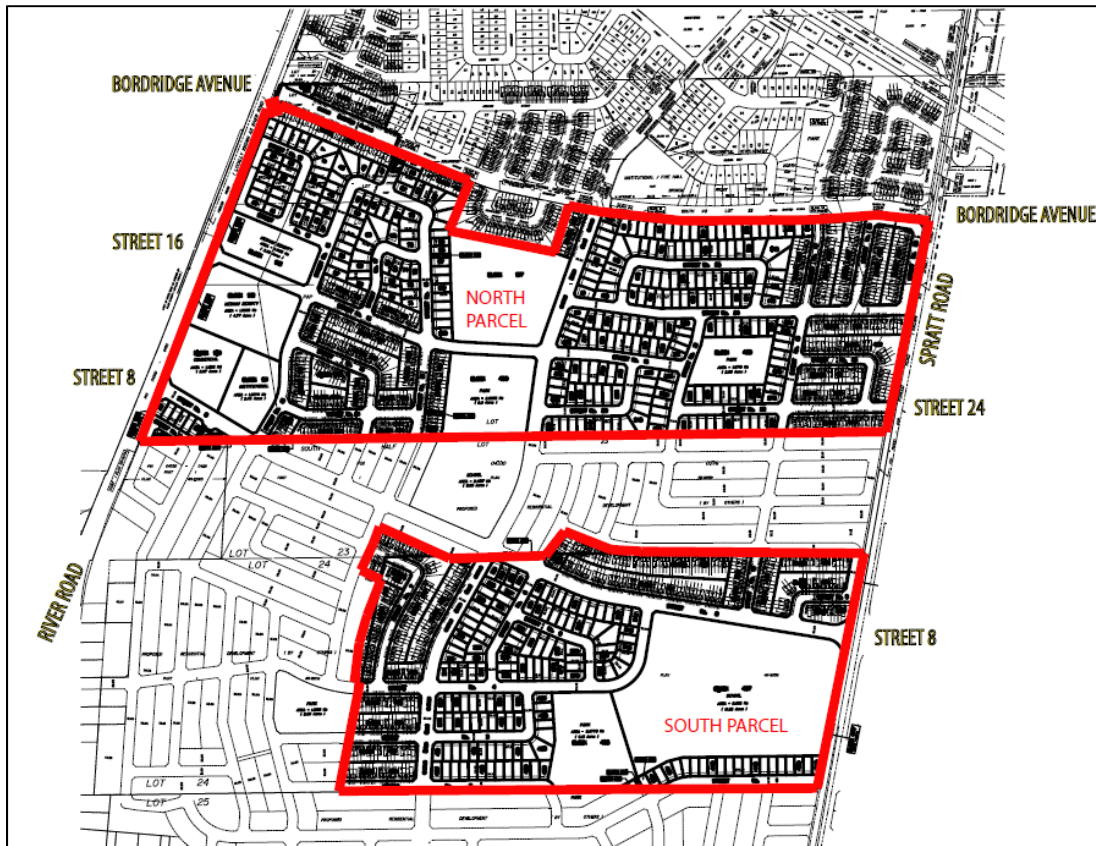
Figure 7: Claridge Phase 2



4.2.3. RIVERSIDE SOUTH DEVELOPMENT CORPORATION RIVERSIDE SOUTH PHASE 15

The Phase 15 lands are divided into two parcels at 4650 and 4800 Spratt Road. The north parcel is directly north of the proposed 879 River Road lands, and the south parcel is located to the southeast. The proposed development will include approximately 1,446 residential units, comprised of 647 single family homes, 639 townhomes and 160 apartment units. Estimated to be complete by 2018, the development has not been initiated. Figure 8 illustrates the Phase 15 lands.

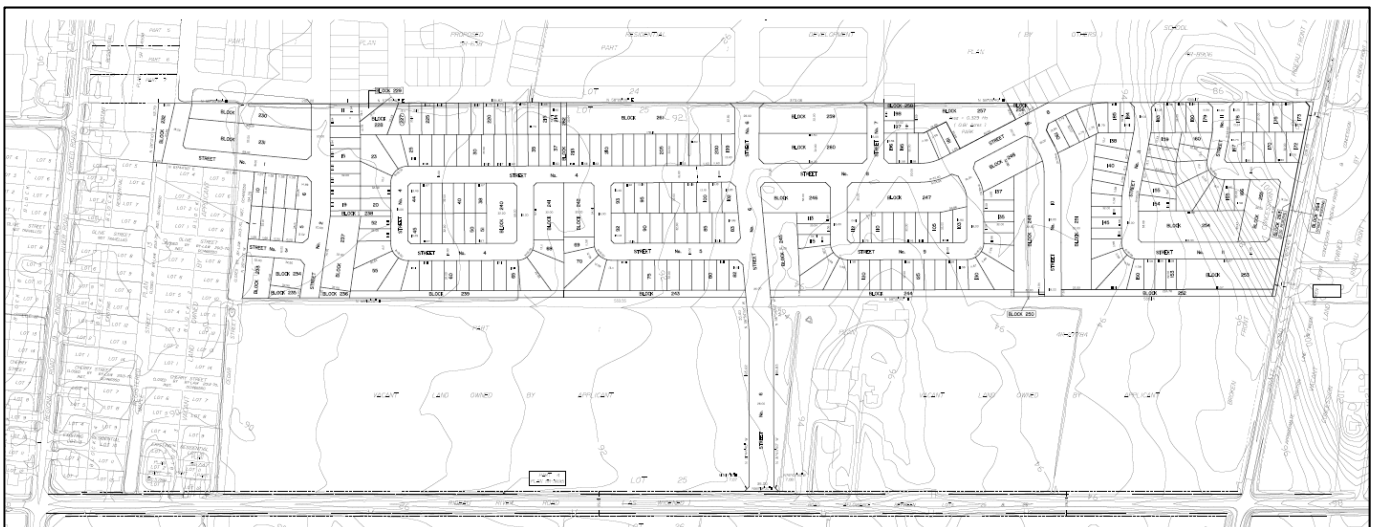
Figure 8: RSDC Phase 15



4.2.4. CARDEL IRONWOOD (673 RIDEAU ROAD)

The Ironwood development is located at 673 Rideau Road, 200m north of Rideau Road between Spratt Road and the existing homes along River Road. The development is planned for 494 residential units, consisting of 234 single family homes and 260 townhomes. It is estimated that the development will begin in 2019 and slowly build out until 2029. Figure 9

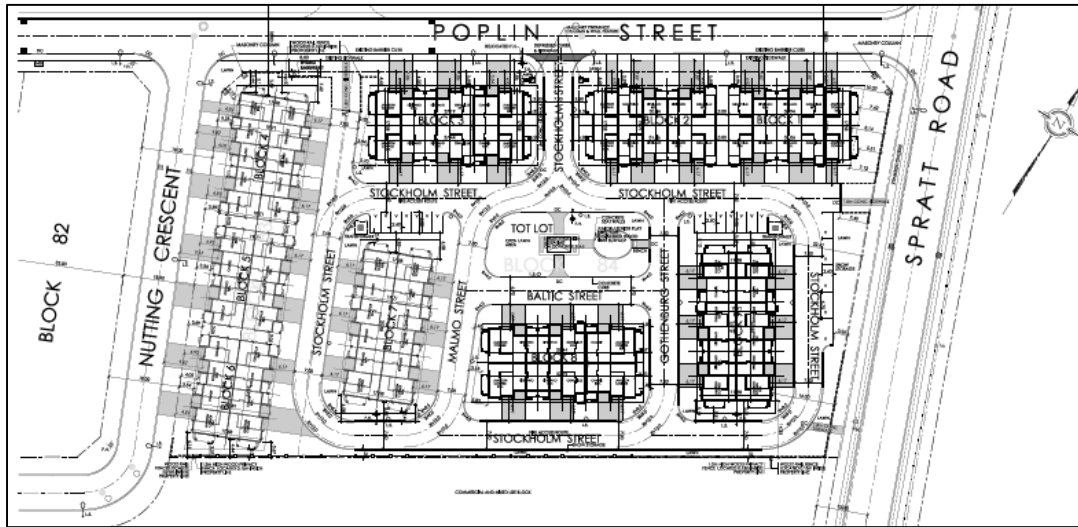
Figure 9: Cardel Ironwood



4.2.5. RICHCRAFT PUD (240 POPLIN STREET)

Richcraft's planned unit development (PUD) is located on the south side of Poplin Street, west of Spratt Road. The development will include 94 residential condominium units. The development is currently being constructed and is illustrated in Figure 10.

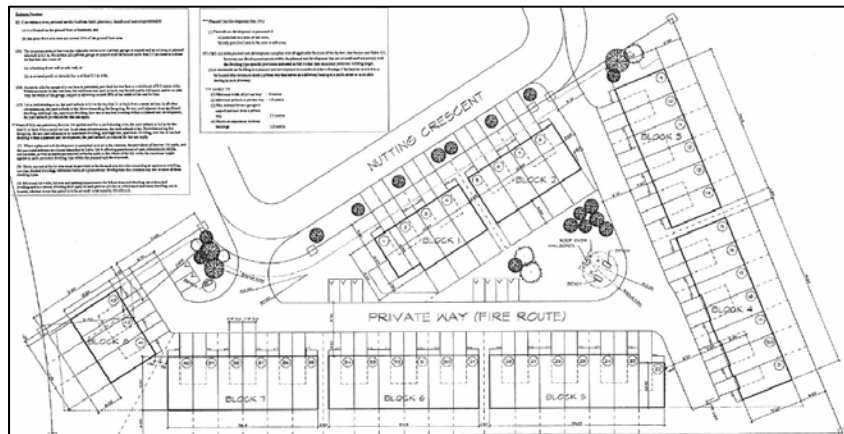
Figure 10: Richcraft PUD 240 Poplin Street



4.2.6. CLARIDGE HOMES (76 NUTTING CRESCENT)

The proposed development will include 43 townhomes with an empty parcel between Brian Good Avenue and Spratt Road. Figure 11 illustrates the site plan. Prepared in 2014, the development has not been initiated.

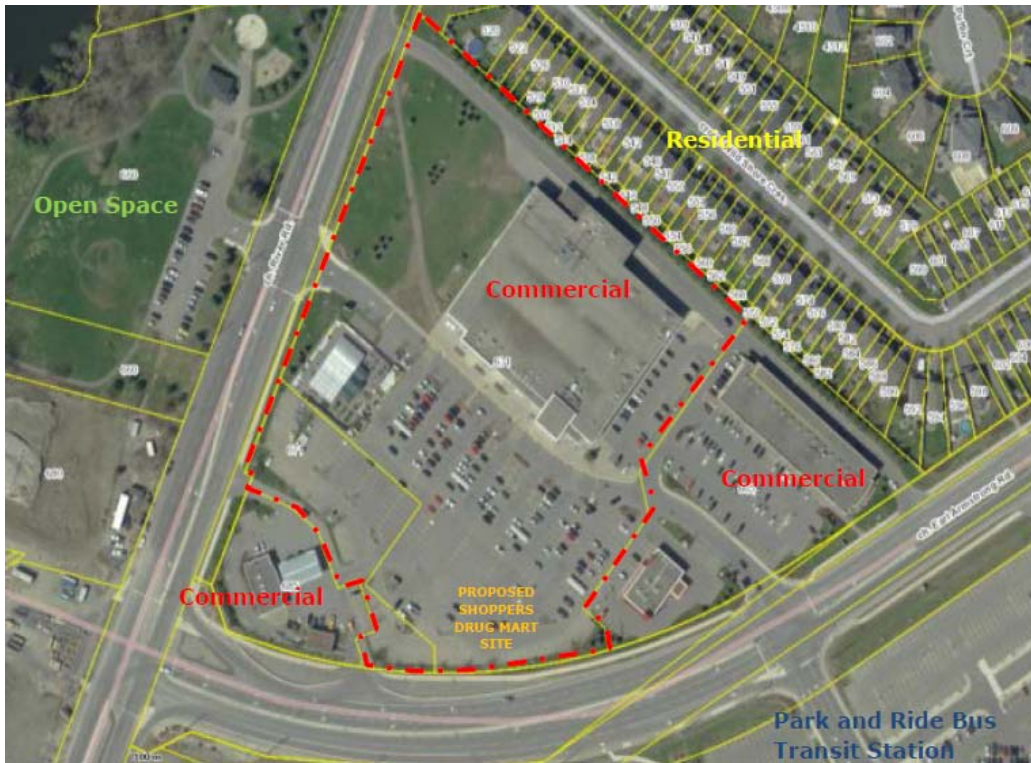
Figure 11: Claridge 76 Nutting Crescent



4.2.7. SHOPPERS DRUG MART (671 RIVER ROAD)

A Shoppers Drug Mart is proposed on the northeast quadrant of the River Road and Earl Armstrong Road intersection, and would include approximately 1,448 m² of GFA. No traffic study has been prepared for the development. Figure 12 illustrates the location of the new building within the existing development.

Figure 12: Shoppers Drug Mart 671 River Road



5. STUDY AREA

5.1. TRANSIT

As mentioned previously, transit is served within the area with bus stops for Route #99 located approximately 190m from the site.

5.2. NETWORK CONCEPT

The Rideau River screenline, SL-42, is in close proximity to the proposed development, capturing east-west traffic on Earl Armstrong Road and Bridge Street. It is not anticipated that this development will have significant impacts on this screenline.

5.3. INTERSECTION DESIGN

The proposed site will access the adjacent road network through the surrounding developments. A temporary access may be required until the surrounding development proceeds. The Strategy Report will review and document the access requirements if it is required.

6. TIME PERIODS

The weekday morning and afternoon peak hours are considered the appropriate time periods for operational analysis for this residential and retail development.

7. HORIZON YEARS

For the purposes of the operational analysis it is assumed that the subject development will be fully built and occupied by 2020. This will necessitate the analysis of 2020 and 2025 horizons.

8. EXEMPTIONS REVIEW

Based on the foregoing analysis and review of the existing conditions in Step 2, the Scoping Report, it is recommended that, if required, any future work within the context of this TIA excludes the following modules and elements summarized in Table 1.

Table 1: Exemptions Review Summary

Module	Element	Exemption Consideration
4.1 Development Design	4.1.3 Circulation and Access	Not required for plans of subdivision
4.2 Parking	All Elements	Not required for plans of subdivision
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Will utilize adjacent developments for access to River Road. Not anticipated to exceed ATM thresholds.
4.8 Review of Network Concept	-	Will not generate 200 persons trips

In addition to the above recommendations of the Exemptions Review, the following exemptions are also proposed and summarized in Table 2.

Table 2: Additional Recommended Exemptions Summary

Module	Element	Exemption Consideration
4.4 Access Intersections	All Elements	Extension of surrounding planned community and no specific access intersection is proposed as part of the development.
4.7 Transit	4.7.2 Transit Priority	No development driveways included within proposed lands, and will access transit services from adjacent development collector roads and River Road.
4.9 Intersection Design	-	No specific access intersection is proposed as part of the development.

9. DEVELOPMENT GENERATED TRAVEL DEMAND

9.1. TRIP GENERATION

9.1.1. TRIP GENERATION

Appropriate trip generation rate for the proposed development consisting of 124 townhome units was obtained from the City's 2009 TRANS Trip Generation – Residential Trip Rates. These rates are summarized in Table 3.

Table 3: 2009 TRANS Trip Generation Rate

Land Use	Trip Rates	
	AM Peak	PM Peak
Townhomes	T = 0.50(du)	T = 0.51(du)
Notes: T = Average Vehicle Trip Ends du = Dwelling units		

Using the TRANS Trip Generation rate, the total amount of vehicle trips generated by the proposed townhome units were projected and the results are summarized in Table 4.

Table 4: TRANS Vehicle Trip Generation

Land Use	Data Source	Units	AM Peak (veh/h)			PM Peak (veh/h)		
			In	Out	Total	In	Out	Total
			22%	78%		62%	38%	
Townhomes	TRANS	124 du	13	49	62	39	24	63
Total			13	49	62	39	24	63

As shown in Table 4, a total of 62 and 63 veh/h are projected to travel to/from the proposed development during the weekday morning and afternoon peak hours.

9.1.2. MODE SHARES

Using the TRANS Auto Trips projected in Table 4 and the modal share percentages from the 2011 NCR Household Origin – Destination Survey and Table 3.13 of the TRANS Trip Generation Study, the modal share for the proposed development are summarized in Table 5.

Table 5: Total Site Trip Generation

Travel Mode	AM Mode Share	AM Peak (persons/h)			PM Mode Share	PM Peak (persons/h)		
		In	Out	Total		In	Out	Total
Auto Driver	60%	13	49	62	65%	39	24	63
Auto Passenger	15%	4	11	15	15%	10	5	15
Transit	10%	2	8	10	10%	6	4	10
Non-motorized	15%	3	12	15	10%	6	4	10
Total People Trips	100%	22	80	103	100%	61	37	97
Total 'New' Auto Trips		13	49	62		39	24	63

As shown in Table 5, based on the TRANS Trip Generation method, the proposed site is projected to generate approximately 97 to 103 two-way person-trips per hour during the weekday peak hours. The increase in two-way transit trips is estimated to be 10 persons per hour, and the increase in bike/walk trips is approximately 10 to 15 persons per hour.

9.2. TRIP DISTRIBUTION

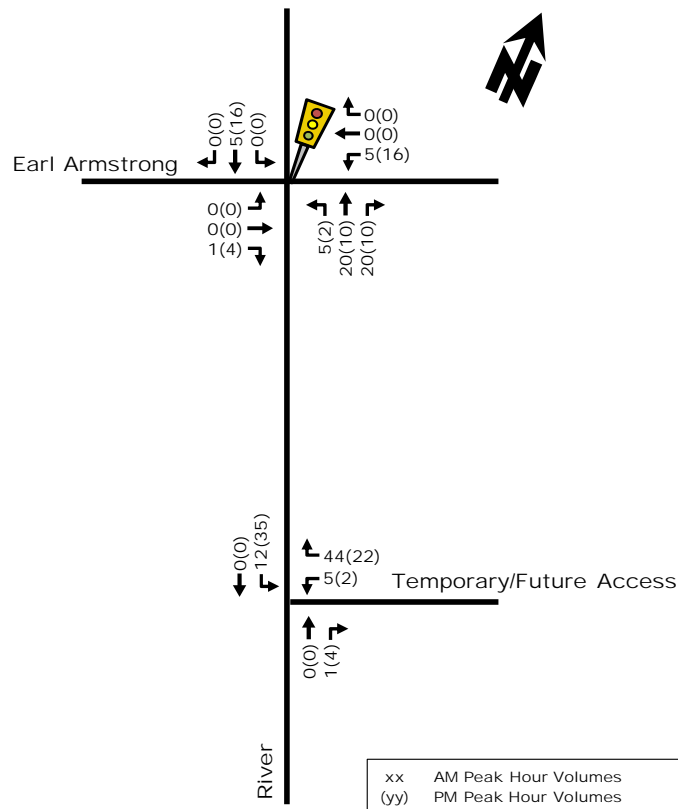
Traffic distribution was based on the 2011 NCR Household Origin – Destination Survey, existing volume splits at study area intersections and our knowledge of the surrounding area. The resultant distribution is outlined as follows.

- 40% to/from the north via River Road
 - 40% to/from the east via River Road and Earl Armstrong
 - 10% to/from the west via River Road and Earl Armstrong
 - 10% to/from the south via River Road
- 100%

9.3. TRIP ASSIGNMENT

New site generated trips were assigned to the Study Area intersections using the above distribution. Figure 13 shows the resulting volume assignment of the new site generated trip used in this analysis.

Figure 13: Site Trip Generated Trip Volumes



10. BACKGROUND NETWORK TRAVEL DEMANDS

10.1. TRANSPORTATION NETWORK PLANS

The transportation network changes have been discussed within Section 4.1 and none are anticipated to impact the transportation analysis for this development.

10.2. BACKGROUND GROWTH

The background traffic along River Road and Earl Armstrong Road is expected to increase at a constant rate. The anticipated development of the Riverside South community will be captured by subsequent transportation impact assessments to determine when various improvements are triggered. Given the spike in vehicle demand along Earl Armstrong Road due to the opening of the Vimy Memorial Bridge, a 1% traffic growth rate per annum was assumed for the 2020 and 2025 horizon years. River Road was assumed to have 0% growth at the urban boundary and any future traffic growth along the road corridor will be generated by the development of the adjacent community.

Figure 14 and Figure 15 illustrate the future background traffic volumes for the 2020 and 2025 future background traffic volumes, respectively. Table 6 and Table 7 summarize the future background operations for the 2020 and 2025 future background traffic volumes, respectively.

10.2.1. PROJECTED BACKGROUND 2020 OPERATIONS

The projected background 2020 traffic volumes were derived by superimposing the other study area developments and the background growth rate on the existing traffic volumes. The resulting projected background 2020 traffic volumes are illustrated in Figure 14. Table 6 provides a summary of the projected background 2020 operations at the study area intersections. The SYNCHRO model output of projected background 2020 conditions is provided within Appendix D.

Figure 14: Projected Background 2020 Traffic Volumes

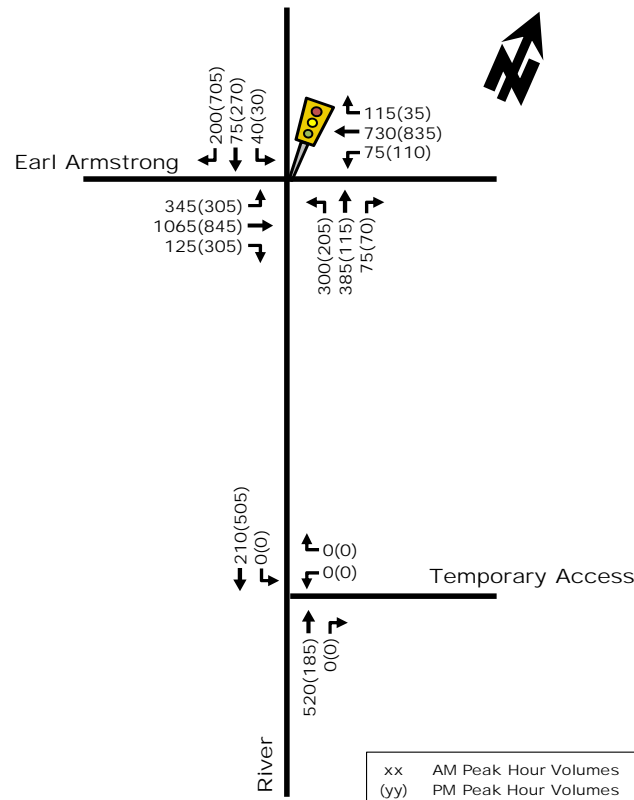


Table 6: Projected Background 2020 Performance at Study Area Intersection

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Signalized						
River/Earl Armstrong	F(F)	1.26(1.12)	EBL(EBL)	44.4(55.5)	B(D)	0.64(0.90)
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 6, the River/Earl Armstrong intersection, 'as a whole', is projected to operate at acceptable levels of service LoS 'D' or better during both peak hours. The critical movement during both peak hours is the eastbound left-turn and will have a LoS 'F'.

No improvements are required to support the development during the 2020 horizon.

10.2.2. PROJECTED BACKGROUND 2025 OPERATIONS

The projected background 2025 traffic volumes were derived by superimposing the other study area developments and the background growth rate on the existing traffic volumes. The resulting projected background 2025 traffic volumes are illustrated in Figure 15. Table 7 provides a summary of the projected background 2025 operations at the study area intersections. The SYNCHRO model output of projected background 2025 conditions is provided within Appendix D.

Figure 15: Projected Background 2025 Traffic Volumes

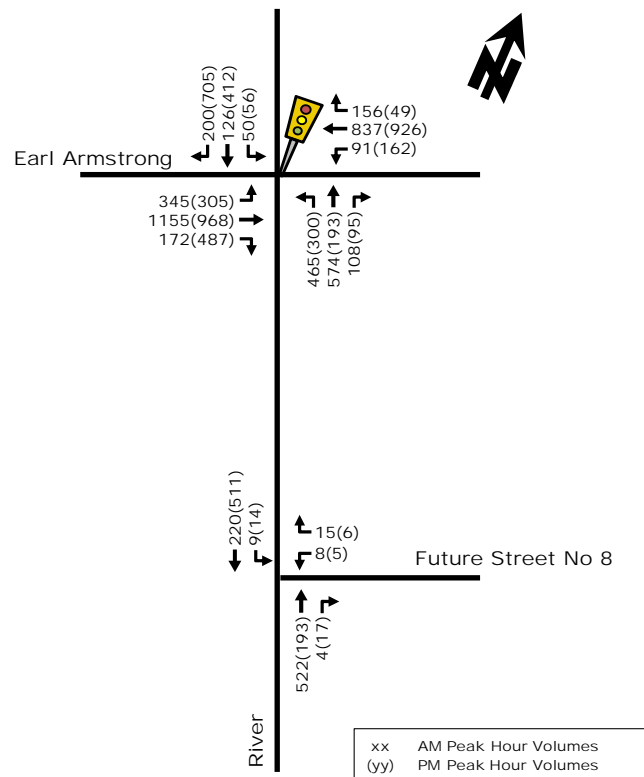


Table 7: Projected Background 2025 Performance at Study Area Intersection

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Signalized						
River/Earl Armstrong	F(F)	1.26(1.16)	EBL(SBR)	56.5(57.8)	C(E)	0.78(0.94)
Stop-Controlled						
River/Street No. 8	B(B)	13.0(10.4)	WB(WB)	0.5(0.4)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 7, the River/Earl Armstrong intersection, 'as a whole', is projected to operate at acceptable levels of service LoS 'E' or better during both peak hours. The critical movement during both peak hours is the eastbound left-turn and will have a LoS 'F'.

The River/Street No. 8 intersection, 'as-a-whole', is projected to operate at acceptable levels of service LoS 'A' during both peak hours. The critical movement during both peaks is noted as the westbound approach and is projected to operate at a LoS 'B'.

No improvements are required to support the development during the 2020 horizon.

10.3. OTHER DEVELOPMENTS

The City of Ottawa's Development Applications webtool has been used to determine if there are proposed developments within the area of influence of the proposed development. These developments have been discussed in greater detail in Section 4.2 and only 3 will have an impact on the study area intersections. Figure 16 and Figure 17 document the traffic impact of the developments on the study area intersections. These have been included in the above background analysis.

Figure 16: Claridge Homes Riverside South Phase 2 Traffic Volumes (2021)

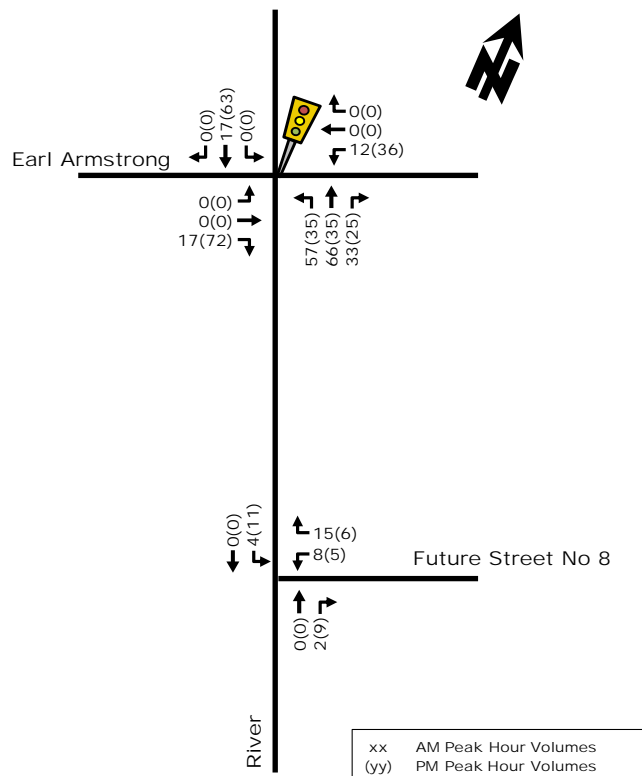
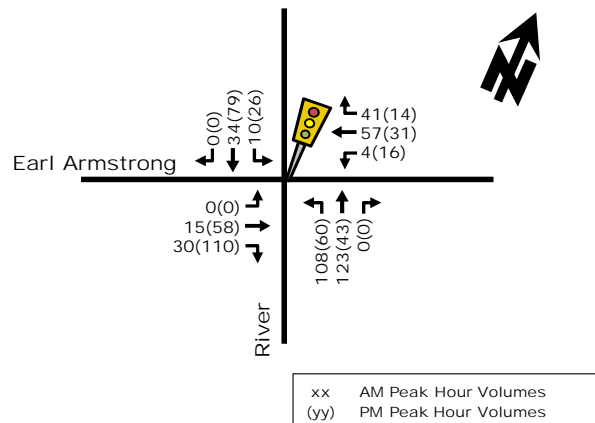


Figure 17: Riverside South Development Corporation Riverside South Phase 15 Traffic Volumes (2025)



11. DEMAND RATIONALIZATION

The forecasted background volumes do not identify any lane constraints due to capacity and no changes to the trip generation or distribution analysis is required.

12. DEVELOPMENT DESIGN

12.1. DESIGN FOR SUSTAINABLE MODES

Within the proposed site, the 18.0m right-of-ways (local roads) will require sidewalks along a single side of the roadway, and the 14.5m right-of-way window street will require a sidewalk on one side, either within the 14.5m right-of-way or on the adjacent section of River Road. If the pedestrian facility is provided along River Road, connections into the development will be required.

The local road network within the proposed site does not require specific cycling facilities and cyclists are anticipated to operate within the shared vehicle lanes.

No transit stops are located along the frontage of River Street, and existing paved shoulders will serve as connections from the proposed site to nearby transit stops.

12.2. NEW STREET NETWORKS

The street network within the proposed site consists of local roadways. The block lengths are short and traffic calming measures will not likely be required. The potential for narrowed intersections/bulb-outs to located at pedestrian crossings would be a recommended feature to reduce crossing distances.

13. BOUNDARY STREET DESIGN

Given the existing facilities and designations of River Road, the Multi-Modal Level of Service (MMLOS) targets are provided below in Table 8 and the minimum requirements to reach ear target are identified in Table 9.

Table 8: MMLOS Targets for Boundary Streets

OP Designation / Policy Area	Road Class	Pedestrian LOS	Bicycle LOS	Transit LOS	Truck LOS	Auto LOS
General Rural Area	River Road (Arterial)	No Target	D	N/A	C	D

Table 9: Minimum Required Elements for MMLOS Analysis

Mode	Required Elements
Bicycle	<p>BLOS "C" – segment evaluation</p> <ul style="list-style-type: none"> Bike lane/shoulder not adjacent to parking: <ul style="list-style-type: none"> More than 2 travel lanes in each direction without a separating median; ≥1.2 m to <1.5 m wide bike lane/shoulder (includes marked buffer and paved gutter width); and <70 km/h operating speed.
Truck	<p>TkLOS "C" – segment evaluation</p> <ul style="list-style-type: none"> With two-lane cross section: curb lane width ≤ 3.3 m

Mode	Required Elements
Auto	LOS "D" – intersection evaluation <ul style="list-style-type: none">v/c = 0.81 to 0.90

The existing conditions satisfy all MMLOS requirements with the exception of the operating speed for the BLOS; the posted speed limit is 70 km/h and transitions to 80km/h north of the proposed site. It is recommended that the City review the posted speed limit from Rideau Road to Earl Armstrong Road to exploring options to meet the BLOS for River Road.

14.ACCESS INTERSECTION DESIGN

14.1. LOCATION AND DESIGN OF ACCESS

The proposed site will ultimately access River Road via Street No. 8 within the RSDC Phase 15 lands, which was proposed to be signalized in the IBI's 2015 Transportation Impact Study. If the development proceeds prior to the RSDC lands, a temporary access will be required for the site. It is recommended that the access be located along Street No. 3 within the proposed site plan, at the existing field access and across from driveway to the 782 River Road residence.

14.2. INTERSECTION CONTROL

The ultimate intersection at Street No. 8 (RSDC Phase 15 lands) and River Road has previously been proposed as a minor side street stop-controlled intersection. Similarly, the temporary access for the subject site, as discussed above, is recommended to be a minor side street stop-control.

14.3. INTERSECTION DESIGN

14.3.1. PROJECTED TOTAL 2020 CONDITIONS

The projected total 2020 traffic volumes were derived by superimposing the 2020 site-generated traffic volumes on background 2020 traffic volumes. The resulting total projected 2020 traffic volumes are illustrated in Figure 18. Table 10 provides a summary of the total projected 2020 operations at the study area intersections. The SYNCHRO model output of total projected 2020 conditions is provided within Appendix E.

Figure 18: Projected Total 2020 Traffic Volumes

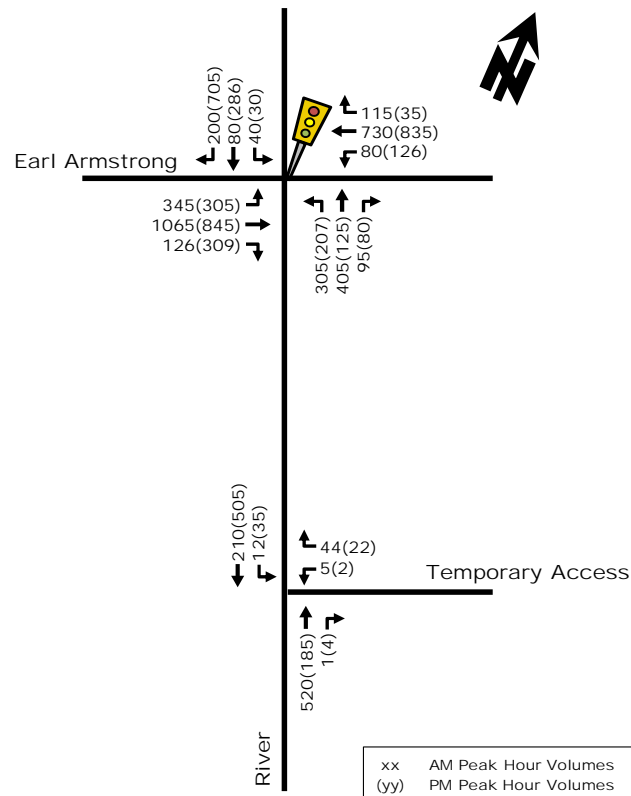


Table 10: Projected Total 2020 Performance at Study Area Intersection

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Signalized						
River/Earl Armstrong	F(F)	1.26(1.12)	EBL(EBL)	44.5(55.4)	B(D)	0.65(0.90)
Stop-Controlled						
River/Temporary Access	B (A)	12.5 (9.7)	WB (WB)	0.9 (0.7)	A (A)	-
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 10, the River/Earl Armstrong intersection, 'as a whole', is projected to operate at acceptable levels of service LoS 'D' or better during both peak hours. The critical movement during both peak hours is the eastbound left-turn and will have a LoS 'F' similar to the forecasted background 2020 conditions.

The River/Temporary Access intersection, 'as-a-whole', is projected to operate at acceptable levels of service LoS 'A' during both peak hours. The westbound approach is the critical movement during both peak hours, and is projected to operate at a LoS 'B' or better.

No improvements are required to support the development during the 2020 horizon.

14.3.2. PROJECTED TOTAL 2025 CONDITIONS

The projected total 2025 traffic volumes were derived by superimposing the 2020 site-generated traffic volumes on background 2025 traffic volumes. The resulting total projected 2025 traffic volumes are illustrated in Figure 19. Table 11 provides a summary of the total projected 2025 operations at the study area intersections. The SYNCHRO model output of total projected 2025 conditions is provided within Appendix E.

Figure 19: Projected Total 2025 Traffic Volumes

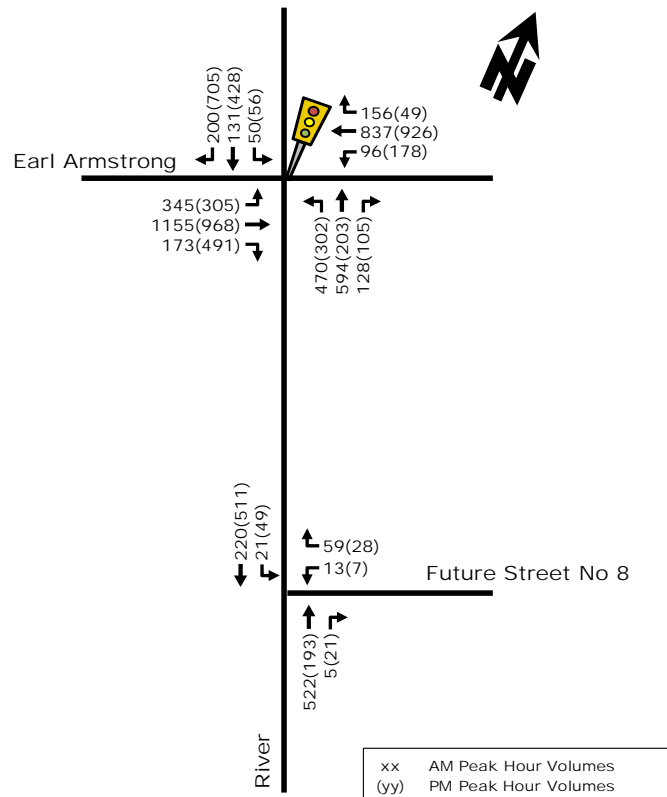


Table 11: Projected Total 2025 Performance at Study Area Intersection

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Signalized						
River/Earl Armstrong	F(F)	1.26(1.16)	EBL(SBR)	57.1(57.9)	C(E)	0.79(0.94)
Stop-Controlled						
River/Street No. 8	B(B)	13.4(10.9)	WB(WB)	1.3(1.0)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 11, the River/Earl Armstrong intersection, 'as a whole', is projected to operate at acceptable levels of service LoS 'E' or better during both peak hours. During the AM peak hour, the critical movement is noted as the eastbound left-turn and during the PM peak hour, the critical movement is the southbound right-turn. These movements are projected to operate at a LoS 'F', similar to the 2025 projected background operations.

The River/Street No. 8 intersection, 'as-a-whole', is projected to operate at acceptable levels of service LoS 'A' during both peak hours. The critical movement during both peak hours is noted as the westbound approach and are projected to operate at a LoS 'B'.

No improvements are required to support the development during the 2025 horizon.

15. TRANSPORTATION DEMAND MANAGEMENT

15.1. CONTEXT FOR TDM

As the proposed site is anticipated to access the adjacent road network through future development, notwithstanding a temporary access to River Road during the interim, TDM measures are required to be explored. The notable impact of auto trips from this site are along the internal road network of future development and at the proposed access for Street No. 8 at River Road. Additionally, the low transit modal share in the Riverside South community is an avenue worth exploring to reduce the development demand, and maximize the use of the existing and future transit infrastructure.

15.2. NEED AND OPPORTUNITY

The auto trip focus of the current Riverside South community provides an opportunity for a modal shift towards transit, given the Riverview Park & Ride and the extension of the BRT through the community and to the north. The TDM planning can focus on this modal shift within the proposed community, with incentives to take transit.

It is noted that while the proposed site is located near the urban boundary and would typically generate auto trips to the nearest park & ride, the proximity of Route #99 to the site on River Road provides the opportunity to shift the auto trips to transit trips without the auto trip in-between.

15.3. TDM PROGRAM

The TDM program for the subject site is limited to PRESTO passes and a transit information package to initial residents, subject to developer sales initiatives and programs. The TDM form has been provided in Appendix F.

16. TRANSIT

16.1. ROUTE CAPACITY

Total "new" two-way transit trips are approximately 10 (2 in, 8 out) and 10 (6 in, 4 out) persons/h in the AM and PM peaks, respectively. During the AM peak, the outbound transit trips represent approximately 15% of a single bus (55 passengers), approximately 8% of an articulated bus (75 passengers), and approximately 7% of a double decker bus (90 passengers).

17. SUMMARY OF IMPROVEMENTS INDICATED AND MODIFICATION OPTIONS

Based on the results summarized herein the following conclusions are offered:

Proposed Site

- The proposed development is located at 879 River Road and is a greenfield development, forming part of the Riverside South Community;
- In total, the development will include 117 residential units. The development will ultimately be accessed through the future surrounding development; and

- A temporary access may be provided during the interim along River Road if the development proceeds prior to the development to the north.

Background Conditions

- Overall, the intersection of River/Earl Armstrong will operate acceptable during the projected horizons of 2020 and 2025;
- The critical movement during the background 2020 horizon is the eastbound left-turn and will be over capacity with a LoS 'F'; and
- The critical movements during the background 2025 horizon is the eastbound left-turn during the AM peak and the southbound right-turn during the PM peak. Both movements will be over capacity with a LoS 'F'.

Projected Conditions

- The intersection of River/Earl Armstrong will continue to operate similar to the background conditions during the 2020 and 2025 horizons;
- The interim River/Temporary Access intersection in the 2020 horizon, is projected to operate well as a minor street stop-controlled intersection during both peak periods with a LoS 'A';
- The River/Future Street No. 8 intersection is expected to operate well as a minor street stop-controlled intersection in the 2025 horizon, with a LoS 'A' during both peak periods; and
- No improvements are required to support the development during either the 2020 or 2025 horizons.

Site Plan

- The internal site road network is compromised of local streets. A sidewalk is recommended on one side of the roadway and cycling facilities will be accommodated in shared lanes.

Boundary Streets

- It is recommended that the City review the posted speed limit from Rideau Road to Earl Armstrong Road to exploring options to meet the BLOS for River Road.

Based on the foregoing conclusions, the proposed development is recommended to proceed from a transportation perspective.

Appendix A

Screening Form

City of Ottawa 2017 TIA Guidelines

Date

1/15/2018

TIA Screening Form

Project

Richcraft - 879 River Rd

Project Number

-

Results of Screening	Yes/No
Development Satisfies the Trip Generation Trigger	Yes
Development Satisfies the Location Trigger	No
Development Satisfies the Safety Trigger	No

Module 1.1 - Description of Proposed Development

Municipal Address	879 River Road
Description of location	BF CON PT LOT 23 RP 5R-1674;PT PART 2
Land Use	Residential
Development Size	117 units
Number of Accesses and Locations	Use of adjacent subdivisions
Development Phasing	Single Phase
Buildout Year	2019
Sketch Plan / Site Plan	See attached

Module 1.2 - Trip Generation Trigger

Land Use Type	Townhomes or Apartments	
Development Size	117	Units
Trip Generation Trigger Met?	Yes	

Module 1.3 - Location Triggers

Development Proposes a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit, or Spine Bicycle Networks (See Sheet 3)	No
Development is in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone. (See Sheet 3)	No
Location Trigger Met?	No

Module 1.4 - Safety Triggers

Posted Speed Limit on any boundary road	<80	km/h
Horizontal / Vertical Curvature on a boundary street limits sight lines at a proposed driveway	No	
A proposed driveway is within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions) or within auxiliary lanes of an intersection;	No	
A proposed driveway makes use of an existing median break that serves an existing site	No	
There is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development	No	
The development includes a drive-thru facility	No	
Safety Trigger Met?	No	

Appendix B

Traffic Count Data

5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

Full Length (7AM-7PM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA

Leg Direction	North Southbound							East Westbound							South Northbound							West Eastbound							
Time	R	T	L	U	App	Ped*		R	T	L	U	App	Ped*		R	T	L	U	App	Ped*		R	T	L	U	App	Ped*		Int
2016-06-07																													
7:00AM	171	57	39	0	267	3		90	653	71	0	814	1		64	399	311	0	774	0		117	1048	333	1	1499	2		3354
8:00AM	211	86	32	1	330	2		81	669	86	1	837	6		102	302	248	0	652	2		126	769	387	0	1282	0		3101
9:00AM	205	67	8	0	280	0		40	441	84	2	567	0		66	173	176	0	415	3		107	424	261	1	793	0		2055
10:00AM	130	84	28	0	242	4		29	347	70	0	446	4		70	129	129	0	328	4		103	306	199	1	609	3		1625
11:00AM	151	98	25	0	274	2		25	342	66	0	433	2		70	94	140	0	304	4		117	369	153	0	639	0		1650
12:00PM	223	131	0	1	355	6		32	370	80	4	486	0		69	142	106	2	319	2		139	405	177	1	722	0		1882
1:00PM	184	102	40	0	326	0		26	325	85	0	436	1		71	133	122	0	326	0		152	358	167	2	679	2		1767
2:00PM	258	142	39	0	439	0		34	436	68	1	539	1		77	89	118	1	285	0		153	424	197	0	774	0		2037
3:00PM	543	225	27	0	795	5		34	716	107	1	858	0		87	107	104	1	299	2		216	673	259	0	1148	0		3100
4:00PM	631	258	29	0	918	3		31	785	104	1	921	0		78	133	206	1	418	1		323	867	262	0	1452	3		3709
5:00PM	734	239	34	0	1007	0		33	851	106	0	990	0		61	127	205	0	393	1		286	724	335	0	1345	0		3735
6:00PM	507	201	27	0	735	0		25	676	122	0	823	1		77	106	163	0	346	3		204	524	205	1	934	0		2838
Total	3948	1690	328	2	5968	25		480	6611	1049	10	8150	16		892	1934	2028	5	4859	22		2043	6891	2935	7	11876	10		30853
% Approach	66.2%	28.3%	5.5%	0%	-	-		5.9%	81.1%	12.9%	0.1%	-	-		18.4%	39.8%	41.7%	0.1%	-	-		17.2%	58.0%	24.7%	0.1%	-	-		-
% Total	12.8%	5.5%	1.1%	0%	19.3%	-		1.6%	21.4%	3.4%	0%	26.4%	-		2.9%	6.3%	6.6%	0%	15.7%	-		6.6%	22.3%	9.5%	0%	38.5%	-		-
Lights	3948	1690	328	2	5968	-		480	6605	1049	10	8144	-		892	1933	2028	5	4858	-		2043	6864	2933	7	11847	-		30817
% Lights	100%	100%	100%	100%	100%	-		100%	99.9%	100%	100%	99.9%	-		100%	99.9%	100%	100%	100.0%	-		100%	99.6%	99.9%	100%	99.8%	-		99.9%
Bicycles on Road	0	0	0	0	0	-		0	6	0	0	6	-		0	1	0	0	1	-		0	27	2	0	29	-		36
% Bicycles on Road	0%	0%	0%	0%	0%	-		0%	0.1%	0%	0%	0.1%	-		0%	0.1%	0%	0%	0%	-		0%	0.4%	0.1%	0%	0.2%	-		0.1%
Pedestrians	-	-	-	-	-	25		-	-	-	-	16			-	-	-	-	22			-	-	-	-	-	10		
% Pedestrians	-	-	-	-	-	100%		-	-	-	-	100%			-	-	-	-	100%			-	-	-	-	-	100%		

* Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

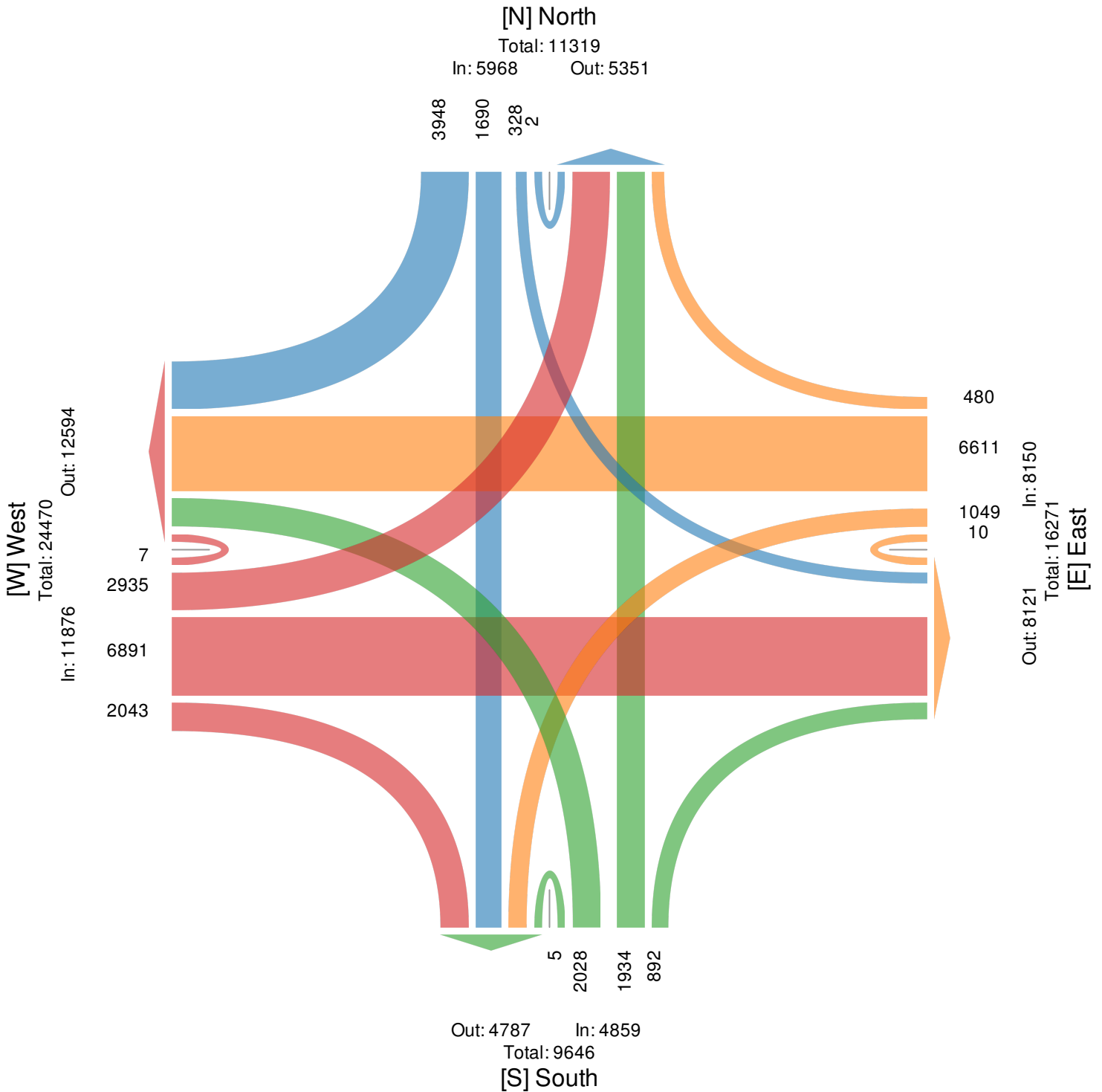
Full Length (7AM-7PM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA



5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

AM Peak (7:15AM - 8:15AM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA

Leg Direction	North Southbound						East Westbound						South Northbound						West Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2016-06-07 7:15AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00AM	211	86	32	1	330	2	81	669	86	1	837	6	102	302	248	0	652	2	126	769	387	0	1282	0	3101
Total	200	72	37	1	310	3	111	711	73	0	895	2	74	385	299	0	758	1	123	1041	344	1	1509	2	3472
% Approach	64.5%	23.2%	11.9%	0.3%	-	-	12.4%	79.4%	8.2%	0%	-	-	9.8%	50.8%	39.4%	0%	-	-	8.2%	69.0%	22.8%	0.1%	-	-	-
% Total	5.8%	2.1%	1.1%	0%	8.9%	-	3.2%	20.5%	2.1%	0%	25.8%	-	2.1%	11.1%	8.6%	0%	21.8%	-	3.5%	30.0%	9.9%	0%	43.5%	-	-
PHF	0.735	0.720	0.771	0.250	0.752	-	0.867	0.936	0.760	-	0.944	-	0.881	0.859	0.813	-	0.857	-	0.809	0.870	0.896	0.250	0.925	-	0.995
Lights	200	72	37	1	310	-	111	710	73	0	894	-	74	385	299	0	758	-	123	1037	344	1	1505	-	3467
% Lights	100%	100%	100%	100%	100%	-	100%	99.9%	100%	0%	99.9%	-	100%	100%	100%	0%	100%	-	100%	99.6%	100%	100%	99.7%	-	99.9%
Bicycles on Road	0	0	0	0	0	-	0	1	0	0	1	-	0	0	0	0	0	-	0	4	0	0	4	-	5
% Bicycles on Road	0%	0%	0%	0%	0%	-	0%	0.1%	0%	0%	0.1%	-	0%	0%	0%	0%	0%	-	0%	0.4%	0%	0%	0.3%	-	0.1%
Pedestrians	-	-	-	-	-	3	-	-	-	-	2		-	-	-	-	1		-	-	-	-	-	2	
% Pedestrians	-	-	-	-	-	100%	-	-	-	-	100%		-	-	-	-	100%		-	-	-	-	-	100%	

* Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

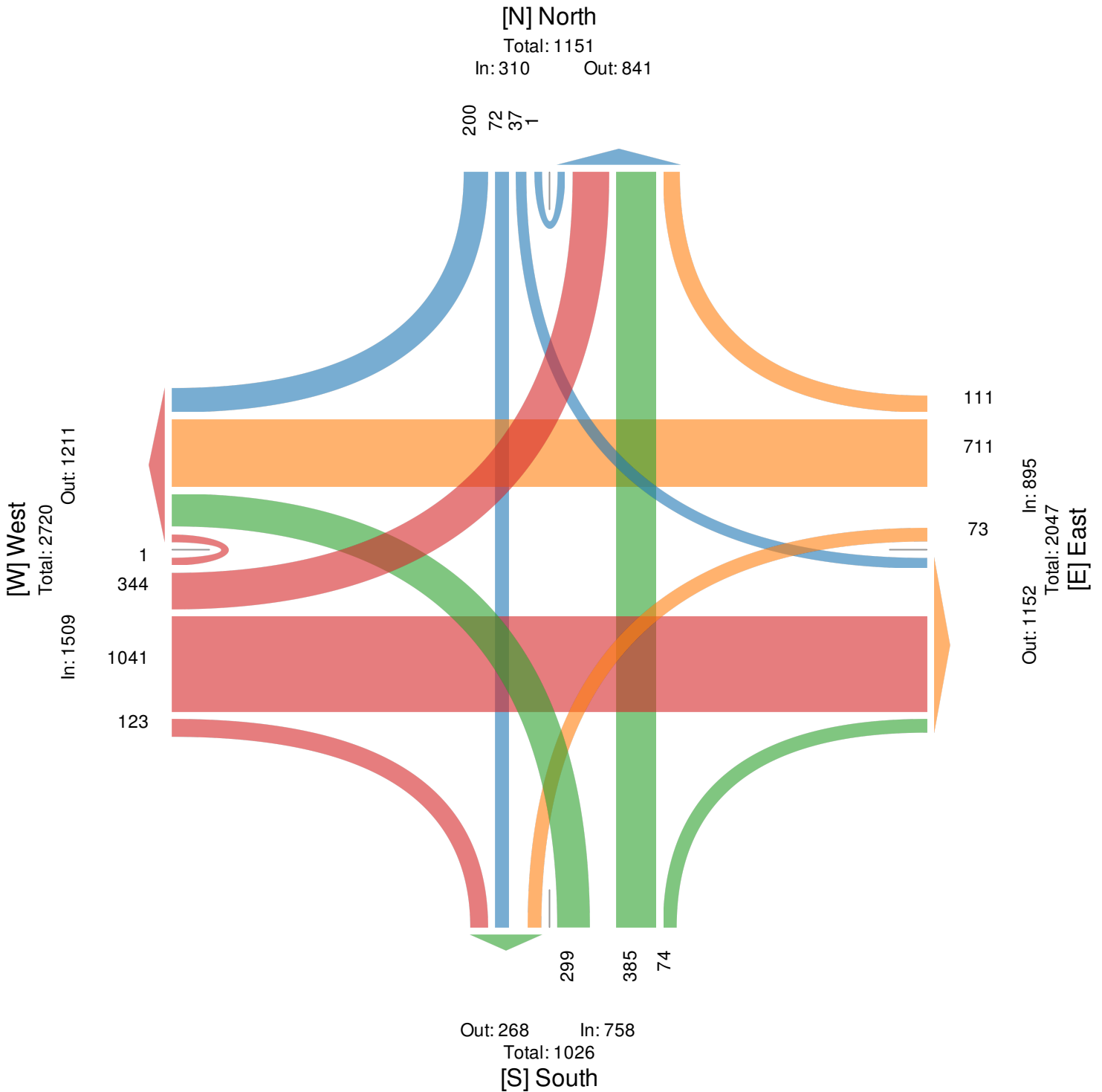
AM Peak (7:15AM - 8:15AM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA



5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

Midday Peak (1:45PM - 2:45PM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA

Leg Direction	North Southbound						East Westbound						South Northbound						West Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2016-06-07 1:45PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:00PM	258	142	39	0	439	0	34	436	68	1	539	1	77	89	118	1	285	0	153	424	197	0	774	0	2037
2:15PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2:30PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	209	146	32	0	387	0	31	372	77	0	480	1	67	103	116	1	287	0	155	404	191	1	751	0	1905
% Approach	54.0%	37.7%	8.3%	0%	-	-	6.5%	77.5%	16.0%	0%	-	-	23.3%	35.9%	40.4%	0.3%	-	-	20.6%	53.8%	25.4%	0.1%	-	-	-
% Total	11.0%	7.7%	1.7%	0%	20.3%	-	1.6%	19.5%	4.0%	0%	25.2%	-	3.5%	5.4%	6.1%	0.1%	15.1%	-	8.1%	21.2%	10.0%	0.1%	39.4%	-	-
PHF	0.886	0.793	0.727	-	0.930	-	0.705	0.894	0.740	-	0.923	-	0.761	0.757	0.879	0.250	0.920	-	0.791	0.886	0.936	0.250	0.920	-	0.932
Lights	209	146	32	0	387	-	31	372	77	0	480	-	67	103	116	1	287	-	155	401	190	1	747	-	1901
% Lights	100%	100%	100%	0%	100%	-	100%	100%	100%	0%	100%	-	100%	100%	100%	100%	100%	-	100%	99.3%	99.5%	100%	99.5%	-	99.8%
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	3	1	0	4	-	4
% Bicycles on Road	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0.7%	0.5%	0%	0.5%	-	0.2%
Pedestrians	-	-	-	-	0		-	-	-	-	1		-	-	-	-	0		-	-	-	-	0		
% Pedestrians	-	-	-	-	-		-	-	-	-	100%		-	-	-	-	-		-	-	-	-	-		

* Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

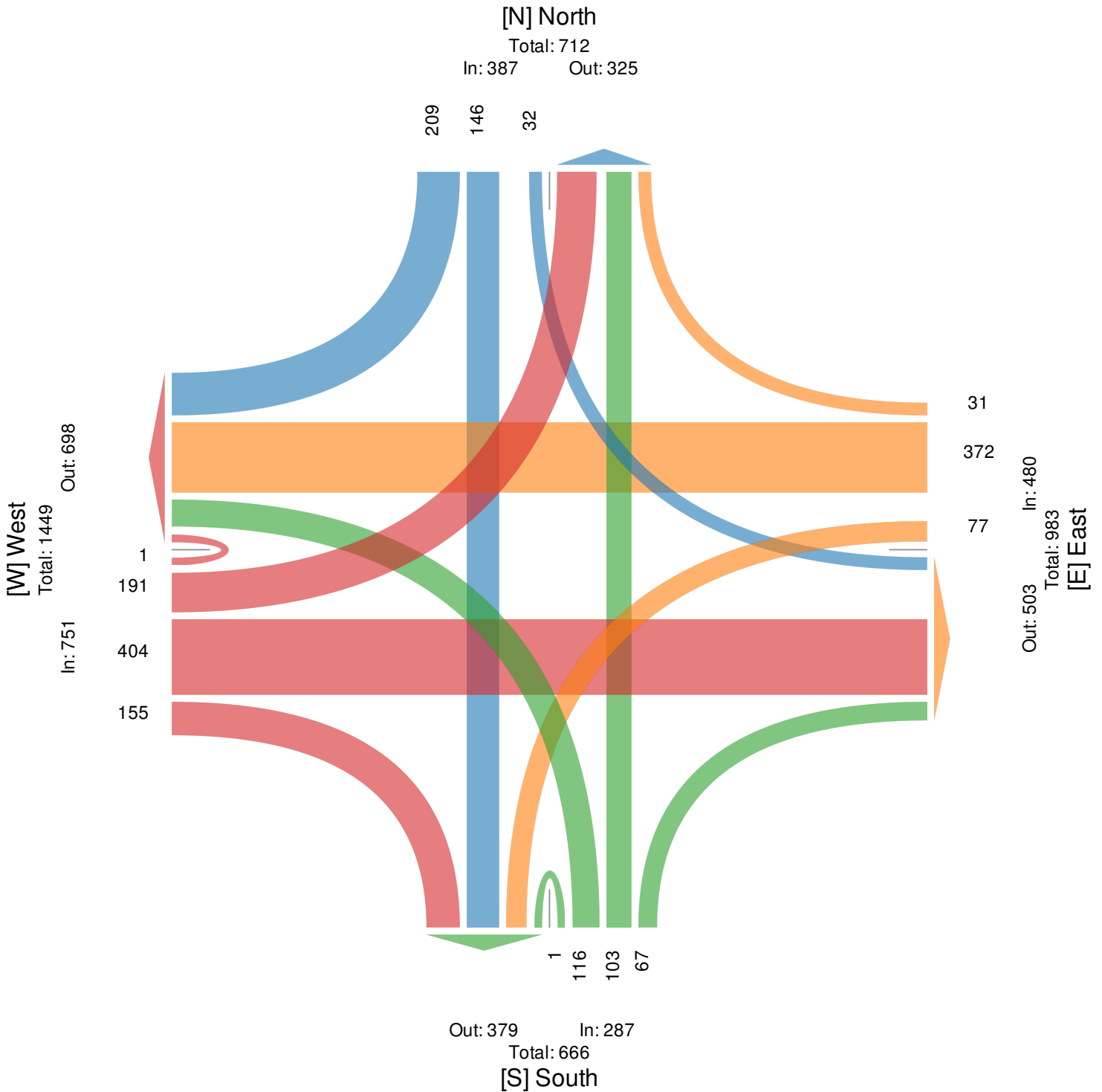
Midday Peak (1:45PM - 2:45PM)

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA



5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

PM Peak (4:30PM - 5:30PM) - Overall Peak Hour

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA

Leg Direction	North Southbound						East Westbound						South Northbound						West Eastbound						
Time	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	R	T	L	U	App	Ped*	Int
2016-06-07																									
4:30PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00PM	734	239	34	0	1007	0	33	851	106	0	990	0	61	127	205	0	393	1	286	724	335	0	1345	0	3735
5:15PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	704	266	29	0	999	3	31	817	109	0	957	0	70	113	203	1	387	0	304	828	303	0	1435	3	3778
% Approach	70.5%	26.6%	2.9%	0%	-	-	3.2%	85.4%	11.4%	0%	-	-	18.1%	29.2%	52.5%	0.3%	-	-	21.2%	57.7%	21.1%	0%	-	-	-
% Total	18.6%	7.0%	0.8%	0%	26.4%	-	0.8%	21.6%	2.9%	0%	25.3%	-	1.9%	3.0%	5.4%	0%	10.2%	-	8.0%	21.9%	8.0%	0%	38.0%	-	-
PHF	0.951	0.821	0.806	-	0.942	-	0.861	0.877	0.826	-	0.889	-	0.761	0.657	0.940	0.250	0.888	-	0.864	0.900	0.947	-	0.986	-	0.979
Lights	704	266	29	0	999	-	31	817	109	0	957	-	70	113	203	1	387	-	304	826	303	0	1433	-	3776
% Lights	100%	100%	100%	0%	100%	-	100%	100%	100%	0%	100%	-	100%	100%	100%	100%	100%	-	100%	99.8%	100%	0%	99.9%	-	99.9%
Bicycles on Road	0	0	0	0	0	-	0	0	0	0	0	-	0	0	0	0	0	-	0	2	0	0	2	-	2
% Bicycles on Road	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0%	0%	0%	0%	-	0%	0.2%	0%	0%	0.1%	-	0.1%
Pedestrians	-	-	-	-		3	-	-	-	-		0	-	-	-	-		0	-	-	-	-		3	
% Pedestrians	-	-	-	-		100%	-	-	-	-		-	-	-	-	-		-	-	-	-	-		100%	

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

5253495 - Earl Armstrong and River - June - 7th - TMC

Tue Jun 7, 2016

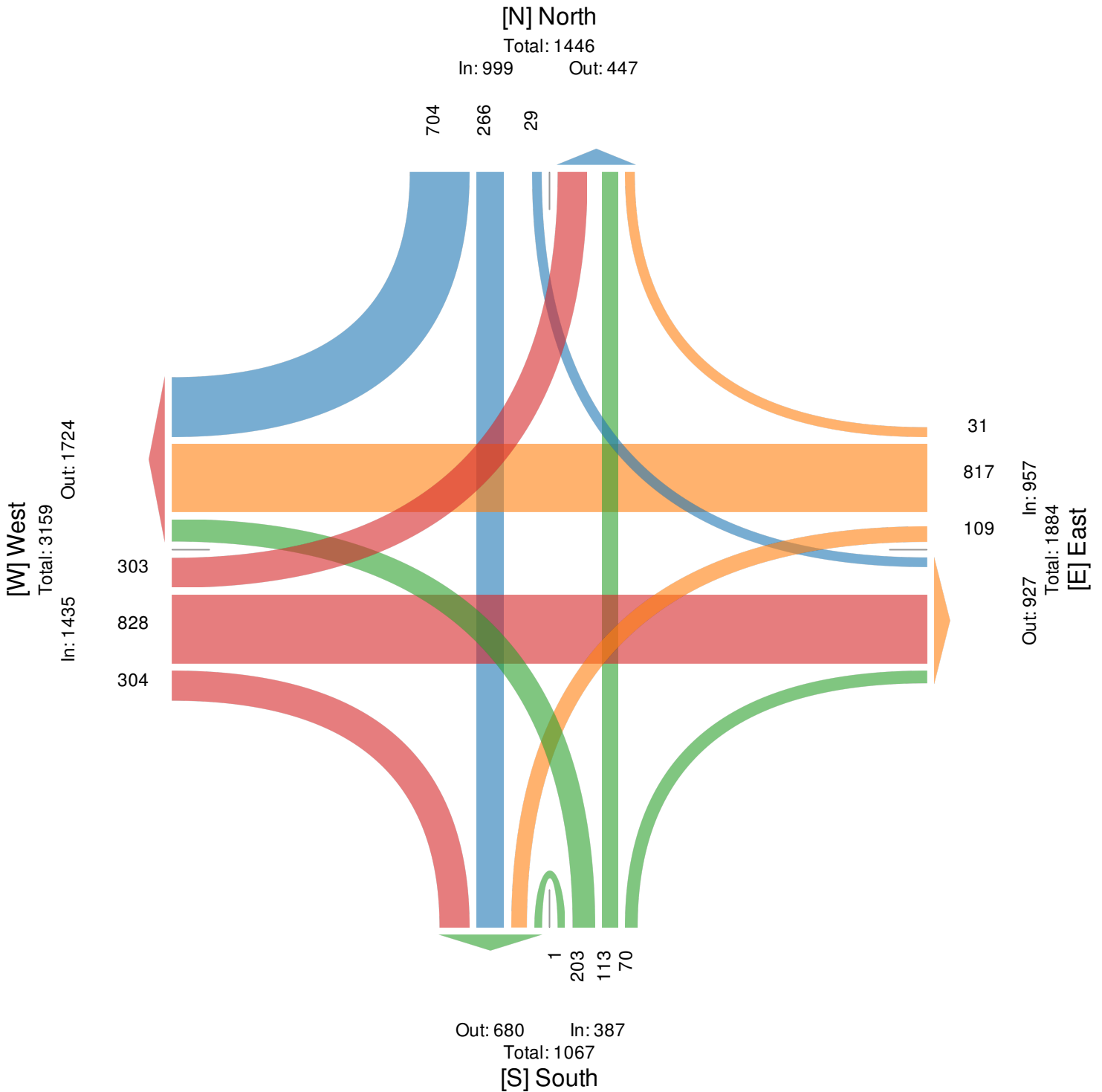
PM Peak (4:30PM - 5:30PM) - Overall Peak Hour

All Classes (Pedestrians, Bicycles on Road, Lights)

All Movements

ID: 323532, Location: 45.2693, -75.699949, Site Code: 35945103

Provided by: City of Ottawa
110 Laurier Ave West, Ottawa, ON, K1P 1J1, CA



Appendix C

Collision Data and Analysis

Total Area

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total
P.D. only	2	0	0	1	1	4	0	1	9
Non-fatal injury	0	0	0	0	1	0	0	0	1
Non reportable	0	0	0	0	0	0	0	0	0
Total	2	0	0	1	2	4	0	1	10
	#2 or 20%	#6 or 0%	#6 or 0%	#4 or 10%	#2 or 20%	#1 or 40%	#6 or 0%	#4 or 10%	

90%
10%
0%
100%

River, Earl Armstrong to Nicolls Island

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2014-2016	7	33,870	1095	0.19

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total
P.D. only	1	0	0	0	1	3	0	1	6
Non-fatal injury	0	0	0	0	1	0	0	0	1
Non reportable	0	0	0	0	0	0	0	0	0
Total	1	0	0	0	2	3	0	1	7
	14%	0%	0%	0%	29%	43%	0%	14%	

86%
14%
0%
100%

River/Nicolls Island

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2014-2016	2	10,660	1095	0.17

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total
P.D. only	1	0	0	1	0	0	0	0	2
Non-fatal injury	0	0	0	0	0	0	0	0	0
Non reportable	0	0	0	0	0	0	0	0	0
Total	1	0	0	1	0	0	0	0	2
	50%	0%	0%	50%	0%	0%	0%	0%	

100%
0%
0%
100%

River, Nicolls Island to Rideau

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2014-2016	1	10,660	1095	0.09

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total
P.D. only	0	0	0	0	0	1	0	0	1
Non-fatal injury	0	0	0	0	0	0	0	0	0
Non reportable	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	1	0	0	1
	0%	0%	0%	0%	0%	100%	0%	0%	

100%
0%
0%
100%

























Appendix D

SYNCHRO Background Traffic Analysis

2020 Projected Background - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	345	1065	125	75	730	115	300	385	75	40	75	200
Future Volume (vph)	345	1065	125	75	730	115	300	385	75	40	75	200
Lane Group Flow (vph)	345	1065	125	75	730	115	300	385	75	40	75	200
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	13.7	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	59.9	59.9	9.6	56.5	56.5	13.9	22.6	22.6	7.4	13.4	13.4
Actuated g/C Ratio	0.08	0.50	0.50	0.08	0.47	0.47	0.12	0.19	0.19	0.06	0.11	0.11
v/c Ratio	1.26	0.45	0.15	0.29	0.33	0.15	0.81	0.62	0.19	0.20	0.20	0.58
Control Delay	188.9	21.7	2.4	54.8	20.9	1.9	68.8	49.8	1.0	55.7	48.3	13.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	188.9	21.7	2.4	54.8	20.9	1.9	68.8	49.8	1.0	55.7	48.3	13.6
LOS	F	C	A	D	C	A	E	D	A	E	D	B
Approach Delay		57.7			21.3			52.5			27.2	
Approach LOS		E			C			D			C	
Queue Length 50th (m)	~52.6	59.9	0.0	8.6	37.6	0.0	35.8	45.8	0.0	4.7	8.6	0.0
Queue Length 95th (m)	#81.9	81.2	7.4	16.2	53.0	5.7	#55.1	58.8	0.0	10.2	15.1	20.3
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	2378	815	273	2243	777	383	1022	564	383	1022	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.45	0.15	0.27	0.33	0.15	0.78	0.38	0.13	0.10	0.07	0.34

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 80 (67%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.26

Intersection Signal Delay: 44.4

Intersection LOS: D

Intersection Capacity Utilization 61.7%

ICU Level of Service B

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2020 Projected Background - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

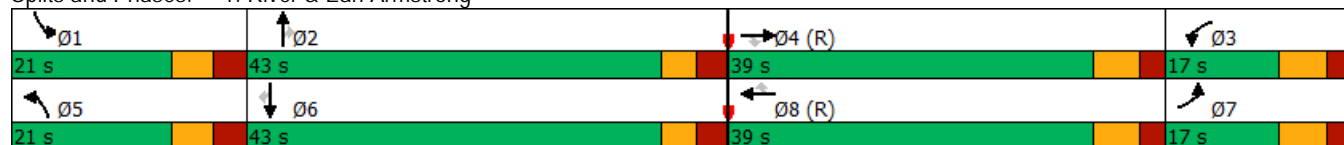
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

























Splits and Phases: 1: River & Earl Armstrong



2020 Projected Background - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	745	305	110	835	35	205	115	70	30	270	705
Future Volume (vph)	305	745	305	110	835	35	205	115	70	30	270	705
Lane Group Flow (vph)	305	745	305	110	835	35	205	115	70	30	270	705
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	17.0	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	32.5	32.5	10.2	32.5	32.5	12.4	49.6	49.6	7.2	38.9	38.9
Actuated g/C Ratio	0.08	0.27	0.27	0.08	0.27	0.27	0.10	0.41	0.41	0.06	0.32	0.32
v/c Ratio	1.12	0.58	0.49	0.40	0.65	0.07	0.62	0.08	0.10	0.16	0.25	1.11
Control Delay	139.4	39.9	6.7	56.8	41.5	0.3	59.6	23.5	0.3	55.3	31.1	94.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	139.4	39.9	6.7	56.8	41.5	0.3	59.6	23.5	0.3	55.3	31.1	94.8
LOS	F	D	A	E	D	A	E	C	A	E	C	F
Approach Delay		54.8			41.7			38.3			76.5	
Approach LOS		D			D			D			E	
Queue Length 50th (m)	~42.5	55.6	0.0	12.8	63.7	0.0	24.0	9.2	0.0	3.5	24.6	~150.8
Queue Length 95th (m)	#70.5	69.1	21.3	22.0	78.3	0.0	36.0	15.8	0.0	8.4	36.3	#226.1
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1290	624	273	1290	511	383	1370	703	383	1074	638
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.12	0.58	0.49	0.40	0.65	0.07	0.54	0.08	0.10	0.08	0.25	1.11

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 80 (67%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 120

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.12

Intersection Signal Delay: 55.5

Intersection LOS: E

Intersection Capacity Utilization 85.3%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2020 Projected Background - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

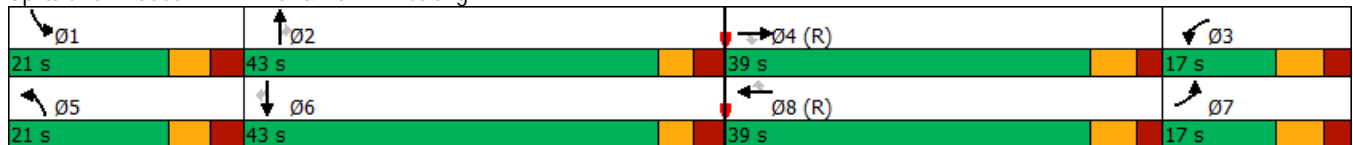
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

























Splits and Phases: 1: River & Earl Armstrong



2025 Projected Background - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	345	1155	172	91	837	156	465	574	108	50	126	200
Future Volume (vph)	345	1155	172	91	837	156	465	574	108	50	126	200
Lane Group Flow (vph)	345	1155	172	91	837	156	465	574	108	50	126	200
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	33.5	33.5	13.8	33.5	33.5	13.7	34.0	34.0	13.7	34.0	34.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	49.5	49.5	10.2	49.5	49.5	14.3	29.4	29.4	7.7	20.0	20.0
Actuated g/C Ratio	0.08	0.41	0.41	0.08	0.41	0.41	0.12	0.24	0.24	0.06	0.17	0.17
v/c Ratio	1.26	0.59	0.24	0.33	0.43	0.22	1.21	0.71	0.23	0.24	0.23	0.48
Control Delay	188.9	30.0	4.9	55.3	27.1	5.0	162.7	46.6	2.6	56.1	42.3	9.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	188.9	30.0	4.9	55.3	27.1	5.0	162.7	46.6	2.6	56.1	42.3	9.3
LOS	F	C	A	E	C	A	F	D	A	E	D	A
Approach Delay		60.2			26.3			89.5			26.6	
Approach LOS		E			C			F			C	
Queue Length 50th (m)	~52.6	76.0	0.0	10.5	50.6	0.0	~69.0	67.1	0.0	5.8	13.6	0.0
Queue Length 95th (m)	#81.9	103.2	14.7	18.9	70.8	14.2	#101.3	80.3	4.6	12.1	20.5	18.0
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1964	712	273	1964	703	383	1022	564	383	1022	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.59	0.24	0.33	0.43	0.22	1.21	0.56	0.19	0.13	0.12	0.34

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 52 (43%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 105

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.26

Intersection Signal Delay: 56.5

Intersection LOS: E

Intersection Capacity Utilization 73.6%

ICU Level of Service D

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2025 Projected Background - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

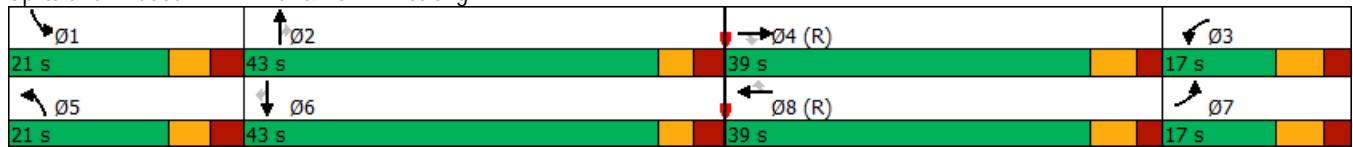
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2025 Projected Background - AM Peak - HCM 2010 TWSC
2: River & Street No 8

























03/12/2018

Intersection						
Int Delay, s/veh	0.5					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W	W	T	T	T	T
Traffic Vol, veh/h	8	15	522	4	9	220
Future Vol, veh/h	8	15	522	4	9	220
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	15	522	4	9	220
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	762	524	0	0	526	0
Stage 1	524	-	-	-	-	-
Stage 2	238	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	373	553	-	-	1041	-
Stage 1	594	-	-	-	-	-
Stage 2	802	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	369	553	-	-	1041	-
Mov Cap-2 Maneuver	369	-	-	-	-	-
Stage 1	588	-	-	-	-	-
Stage 2	802	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	13	0	0.3			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	471	1041	-	
HCM Lane V/C Ratio	-	-	0.049	0.009	-	
HCM Control Delay (s)	-	-	13	8.5	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.2	0	-	

2025 Projected Background - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	968	487	162	926	49	300	193	95	56	412	705
Future Volume (vph)	305	968	487	162	926	49	300	193	95	56	412	705
Lane Group Flow (vph)	305	968	487	162	926	49	300	193	95	56	412	705
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	39.0	39.0	13.8	39.0	39.0	17.0	43.0	43.0	17.0	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	32.5	32.5	10.2	32.5	32.5	13.9	46.2	46.2	7.8	37.4	37.4
Actuated g/C Ratio	0.08	0.27	0.27	0.08	0.27	0.27	0.12	0.38	0.38	0.06	0.31	0.31
v/c Ratio	1.12	0.75	0.72	0.59	0.72	0.10	0.81	0.15	0.14	0.27	0.40	1.16
Control Delay	139.4	44.4	15.5	62.5	43.3	0.4	68.8	25.8	0.9	56.3	34.0	117.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	139.4	44.4	15.5	62.5	43.3	0.4	68.8	25.8	0.9	56.3	34.0	117.8
LOS	F	D	B	E	D	A	E	C	A	E	C	F
Approach Delay		52.9			44.2			43.7			85.5	
Approach LOS		D			D			D			F	
Queue Length 50th (m)	~42.5	76.6	19.8	19.2	72.4	0.0	35.8	16.0	0.0	6.5	40.2	~161.9
Queue Length 95th (m)	#70.5	92.6	61.1	30.5	88.0	0.0	#55.1	25.0	1.5	13.0	54.7	#234.2
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1290	680	273	1290	511	383	1276	666	383	1033	606
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.12	0.75	0.72	0.59	0.72	0.10	0.78	0.15	0.14	0.15	0.40	1.16

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 31 (26%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.16

Intersection Signal Delay: 57.8

Intersection LOS: E

Intersection Capacity Utilization 89.4%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2025 Projected Background - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

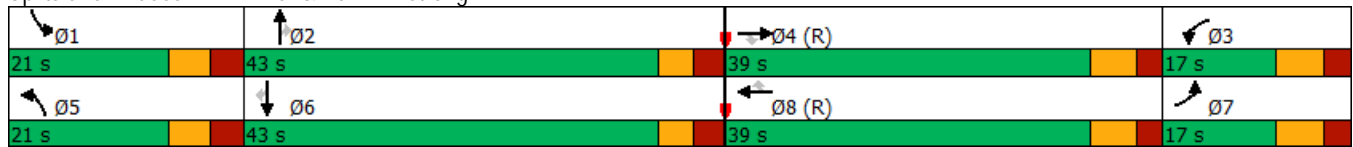
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2025 Projected Background - PM Peak - HCM 2010 TWSC
2: River & Street No 8

03/12/2018

Intersection						
Int Delay, s/veh	0.4					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	5	6	19	17	14	511
Future Vol, veh/h	5	6	19	17	14	511
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	6	19	17	14	511
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	567	28	0	0	36	0
Stage 1	28	-	-	-	-	-
Stage 2	539	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	485	1047	-	-	1575	-
Stage 1	995	-	-	-	-	-
Stage 2	585	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	479	1047	-	-	1575	-
Mov Cap-2 Maneuver	479	-	-	-	-	-
Stage 1	983	-	-	-	-	-
Stage 2	585	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	10.4	0		0.2		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	680		1575	-	
HCM Lane V/C Ratio	-	0.016		0.009	-	
HCM Control Delay (s)	-	10.4		7.3	0	
HCM Lane LOS	-	B		A	A	
HCM 95th %tile Q(veh)	-	0		0	-	

























Appendix E

SYNCHRO Total Traffic Analysis

2020 Projected Total - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	345	1065	126	80	730	115	305	405	95	40	80	200
Future Volume (vph)	345	1065	126	80	730	115	305	405	95	40	80	200
Lane Group Flow (vph)	345	1065	126	80	730	115	305	405	95	40	80	200
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	13.7	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	59.2	59.2	9.6	55.8	55.8	13.9	23.3	23.3	7.4	14.0	14.0
Actuated g/C Ratio	0.08	0.49	0.49	0.08	0.46	0.46	0.12	0.19	0.19	0.06	0.12	0.12
v/c Ratio	1.26	0.45	0.16	0.31	0.33	0.15	0.82	0.63	0.23	0.20	0.21	0.57
Control Delay	188.9	22.2	2.6	55.2	21.5	1.9	69.7	49.5	1.9	55.7	47.6	13.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	188.9	22.2	2.6	55.2	21.5	1.9	69.7	49.5	1.9	55.7	47.6	13.0
LOS	F	C	A	E	C	A	E	D	A	E	D	B
Approach Delay		58.1			22.0			51.5			27.0	
Approach LOS		E			C			D			C	
Queue Length 50th (m)	~52.6	60.8	0.0	9.2	38.2	0.0	36.5	48.1	0.0	4.7	9.2	0.0
Queue Length 95th (m)	#81.9	83.2	7.8	17.1	54.4	5.8	#56.6	60.7	1.9	10.2	15.6	19.9
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	2351	807	273	2216	769	383	1022	564	383	1022	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.45	0.16	0.29	0.33	0.15	0.80	0.40	0.17	0.10	0.08	0.34

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 80 (67%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.26

Intersection Signal Delay: 44.5

Intersection LOS: D

Intersection Capacity Utilization 61.7%

ICU Level of Service B

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2020 Projected Total - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

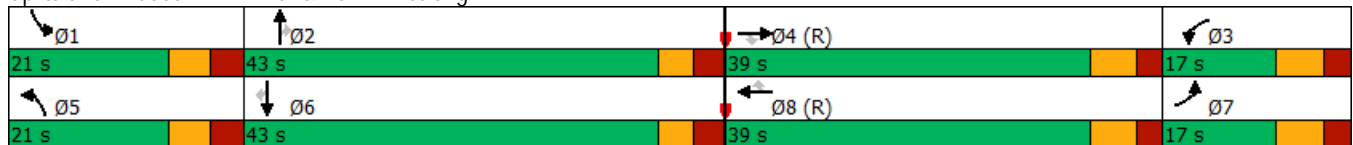
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2020 Projected Total - AM Peak - HCM 2010 TWSC
2: River & Temporary Access

























03/12/2018

Intersection						
Int Delay, s/veh	0.9					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	5	44	520	1	12	210
Future Vol, veh/h	5	44	520	1	12	210
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	44	520	1	12	210
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	755	521	0	0	521	0
Stage 1	521	-	-	-	-	-
Stage 2	234	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	376	555	-	-	1045	-
Stage 1	596	-	-	-	-	-
Stage 2	805	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	371	555	-	-	1045	-
Mov Cap-2 Maneuver	371	-	-	-	-	-
Stage 1	588	-	-	-	-	-
Stage 2	805	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	12.5	0		0.5		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	- 528		1045	-	
HCM Lane V/C Ratio	-	- 0.093		0.011	-	
HCM Control Delay (s)	-	- 12.5		8.5	0	
HCM Lane LOS	-	- B		A	A	
HCM 95th %tile Q(veh)	-	- 0.3		0	-	

2020 Projected Total - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	845	309	126	835	35	207	125	80	30	286	705
Future Volume (vph)	305	845	309	126	835	35	207	125	80	30	286	705
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Storage Lanes	2		1	2		1	2		1	2		1
Taper Length (m)	30.0			30.0			30.0			30.0		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		456.5			442.4			269.7			261.2	
Travel Time (s)		32.9			31.9			19.4			18.8	
Lane Group Flow (vph)	305	845	309	126	835	35	207	125	80	30	286	705
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	13.7	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	32.5	32.5	10.2	32.5	32.5	12.5	49.6	49.6	7.2	38.8	38.8
Actuated g/C Ratio	0.08	0.27	0.27	0.08	0.27	0.27	0.10	0.41	0.41	0.06	0.32	0.32
v/c Ratio	1.12	0.66	0.49	0.46	0.65	0.07	0.62	0.09	0.11	0.16	0.27	1.11
Control Delay	139.4	41.6	6.7	58.2	41.5	0.3	59.6	23.5	0.3	55.3	31.3	95.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	139.4	41.6	6.7	58.2	41.5	0.3	59.6	23.5	0.3	55.3	31.3	95.8
LOS	F	D	A	E	D	A	E	C	A	E	C	F
Approach Delay		54.7			42.1			37.2			76.6	
Approach LOS		D			D			D			E	
Queue Length 50th (m)	~42.5	64.7	0.0	14.7	63.7	0.0	24.3	10.0	0.0	3.5	26.3	~151.4
Queue Length 95th (m)	#70.5	79.3	21.2	24.5	78.3	0.0	36.2	16.9	0.0	8.4	38.2	#226.5
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1290	626	273	1290	511	383	1370	703	383	1072	636
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.12	0.66	0.49	0.46	0.65	0.07	0.54	0.09	0.11	0.08	0.27	1.11
Intersection Summary												
Area Type:	Other											
Cycle Length: 120												

2020 Projected Total - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

Actuated Cycle Length: 120

Offset: 31 (26%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.12

Intersection Signal Delay: 55.4

Intersection LOS: E

Intersection Capacity Utilization 85.3%

ICU Level of Service E

Analysis Period (min) 15

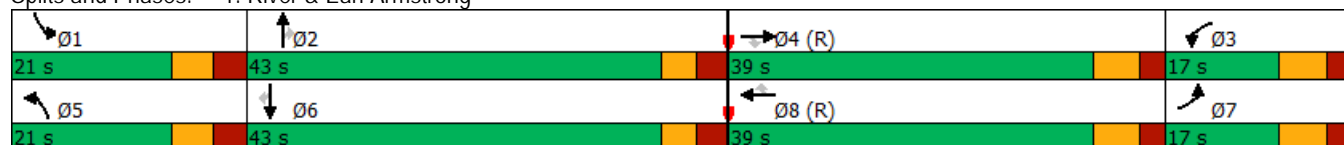
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2020 Projected Total - PM Peak - HCM 2010 TWSC

2: River & Temporary Access

























03/12/2018

Intersection						
Int Delay, s/veh	0.7					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔↔		↔		↔	
Traffic Vol, veh/h	2	22	168	4	35	505
Future Vol, veh/h	2	22	168	4	35	505
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	22	168	4	35	505
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	745	170	0	0	172	0
Stage 1	170	-	-	-	-	-
Stage 2	575	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	382	874	-	-	1405	-
Stage 1	860	-	-	-	-	-
Stage 2	563	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	369	874	-	-	1405	-
Mov Cap-2 Maneuver	369	-	-	-	-	-
Stage 1	830	-	-	-	-	-
Stage 2	563	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	9.7	0		0.5		
HCM LOS	A					
Minor Lane/Major Mvmt		NBT	NBRWBLn1	SBL	SBT	
Capacity (veh/h)		-	-	785	1405	-
HCM Lane V/C Ratio		-	-	0.031	0.025	-
HCM Control Delay (s)		-	-	9.7	7.6	0
HCM Lane LOS		-	-	A	A	A
HCM 95th %tile Q(veh)		-	-	0.1	0.1	-

2025 Total Projected - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	345	1155	173	96	837	156	470	594	128	50	131	200
Future Volume (vph)	345	1155	173	96	837	156	470	594	128	50	131	200
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Storage Lanes	2		1	2		1	2		1	2		1
Taper Length (m)	30.0			30.0			30.0			30.0		
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (k/h)		70			70			60			60	
Link Distance (m)		456.5			442.4			269.7			261.2	
Travel Time (s)		23.5			22.8			16.2			15.7	
Lane Group Flow (vph)	345	1155	173	96	837	156	470	594	128	50	131	200
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	13.7	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	48.7	48.7	10.2	48.7	48.7	14.3	30.1	30.1	7.7	20.8	20.8
Actuated g/C Ratio	0.08	0.41	0.41	0.08	0.41	0.41	0.12	0.25	0.25	0.06	0.17	0.17
v/c Ratio	1.26	0.60	0.25	0.35	0.43	0.22	1.23	0.71	0.26	0.24	0.23	0.48
Control Delay	188.9	30.7	5.0	55.7	27.7	5.1	167.4	46.2	4.2	56.1	41.7	9.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	188.9	30.7	5.0	55.7	27.7	5.1	167.4	46.2	4.2	56.1	41.7	9.0
LOS	F	C	A	E	C	A	F	D	A	E	D	A
Approach Delay		60.7			26.9			89.5			26.4	
Approach LOS		E			C			F			C	
Queue Length 50th (m)	~52.6	77.8	0.0	11.1	51.8	0.0	~70.3	68.7	0.0	5.8	14.0	0.0
Queue Length 95th (m)	#81.9	104.3	15.0	19.7	71.6	14.3	#102.8	82.6	9.0	12.1	21.1	17.8
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1935	705	273	1935	694	383	1022	564	383	1022	595
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.26	0.60	0.25	0.35	0.43	0.22	1.23	0.58	0.23	0.13	0.13	0.34
Intersection Summary												
Area Type:	Other											
Cycle Length: 120												

2025 Total Projected - AM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

Actuated Cycle Length: 120

Offset: 80 (67%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.26

Intersection Signal Delay: 57.1

Intersection LOS: E

Intersection Capacity Utilization 74.2%

ICU Level of Service D

Analysis Period (min) 15

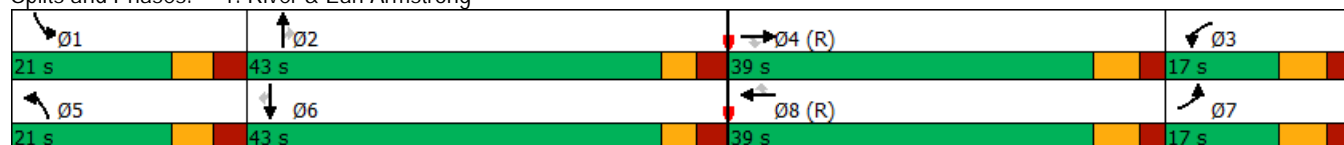
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2025 Total Projected - AM Peak - HCM 2010 TWSC

2: Street No. 8

























03/12/2018

Intersection						
Int Delay, s/veh	1.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	13	59	522	5	21	220
Future Vol, veh/h	13	59	522	5	21	220
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	13	59	522	5	21	220
Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	787	525	0	0	527	0
Stage 1	525	-	-	-	-	-
Stage 2	262	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	360	552	-	-	1040	-
Stage 1	593	-	-	-	-	-
Stage 2	782	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	352	552	-	-	1040	-
Mov Cap-2 Maneuver	352	-	-	-	-	-
Stage 1	579	-	-	-	-	-
Stage 2	782	-	-	-	-	-
Approach	WB	NB	SB			
HCM Control Delay, s	13.4	0	0.7			
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	501	1040	-	
HCM Lane V/C Ratio	-	-	0.144	0.02	-	
HCM Control Delay (s)	-	-	13.4	8.5	0	
HCM Lane LOS	-	-	B	A	A	
HCM 95th %tile Q(veh)	-	-	0.5	0.1	-	

2025 Total Projected - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

03/12/2018

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	305	968	491	178	926	49	302	203	105	56	428	705
Future Volume (vph)	305	968	491	178	926	49	302	203	105	56	428	705
Lane Group Flow (vph)	305	968	491	178	926	49	302	203	105	56	428	705
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	13.8	34.5	34.5	13.8	34.5	34.5	13.7	43.0	43.0	13.7	43.0	43.0
Total Split (s)	17.0	39.0	39.0	17.0	39.0	39.0	21.0	43.0	43.0	21.0	43.0	43.0
Total Split (%)	14.2%	32.5%	32.5%	14.2%	32.5%	32.5%	17.5%	35.8%	35.8%	17.5%	35.8%	35.8%
Yellow Time (s)	4.2	4.2	4.2	4.2	4.2	4.2	3.7	3.1	3.1	3.7	3.1	3.1
All-Red Time (s)	2.6	2.3	2.3	2.6	2.3	2.3	3.0	2.9	2.9	3.0	2.9	2.9
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.8	6.5	6.5	6.8	6.5	6.5	6.7	6.0	6.0	6.7	6.0	6.0
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lead	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	32.5	32.5	10.2	32.5	32.5	13.9	46.2	46.2	7.8	37.4	37.4
Actuated g/C Ratio	0.08	0.27	0.27	0.08	0.27	0.27	0.12	0.38	0.38	0.06	0.31	0.31
v/c Ratio	1.12	0.75	0.73	0.65	0.72	0.10	0.81	0.16	0.16	0.27	0.41	1.16
Control Delay	139.4	44.4	17.0	65.1	43.3	0.4	69.1	25.8	1.6	56.3	34.3	118.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	139.4	44.4	17.0	65.1	43.3	0.4	69.1	25.8	1.6	56.3	34.3	118.0
LOS	F	D	B	E	D	A	E	C	A	E	C	F
Approach Delay		53.2			44.9			43.1			85.0	
Approach LOS		D			D			D			F	
Queue Length 50th (m)	~42.5	76.6	23.9	21.2	72.4	0.0	36.1	16.8	0.0	6.5	42.0	~161.9
Queue Length 95th (m)	#70.5	92.6	66.4	33.0	88.0	0.0	#55.9	26.2	3.4	13.0	56.7	#234.2
Internal Link Dist (m)		432.5			418.4			245.7			237.2	
Turn Bay Length (m)	195.0		75.0	105.0		145.0	135.0		15.0	70.0		100.0
Base Capacity (vph)	273	1290	672	273	1290	511	383	1276	666	383	1032	606
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.12	0.75	0.73	0.65	0.72	0.10	0.79	0.16	0.16	0.15	0.41	1.16

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 108 (90%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 115

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 1.16

Intersection Signal Delay: 57.9

Intersection LOS: E

Intersection Capacity Utilization 89.5%

ICU Level of Service E

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

2025 Total Projected - PM Peak - Lanes, Volumes, Timings

1: River & Earl Armstrong

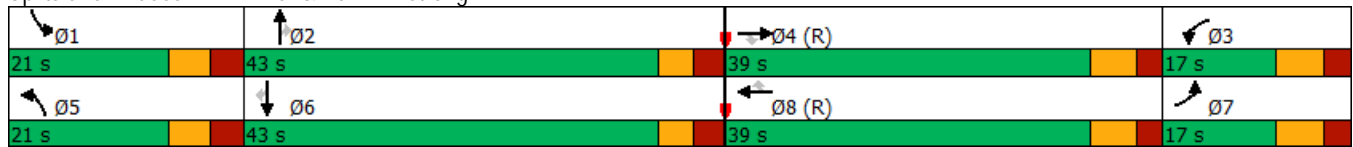
03/12/2018

Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: River & Earl Armstrong



2025 Total Projected - PM Peak - HCM 2010 TWSC

2: Street No. 8

03/12/2018

Intersection

Int Delay, s/veh 1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	W		T			T
Traffic Vol, veh/h	7	28	193	21	49	511
Future Vol, veh/h	7	28	193	21	49	511
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	28	193	21	49	511

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	813	204	0
Stage 1	204	-	-
Stage 2	609	-	-
Critical Hdwy	6.42	6.22	-
Critical Hdwy Stg 1	5.42	-	-
Critical Hdwy Stg 2	5.42	-	-
Follow-up Hdwy	3.518	3.318	-
Pot Cap-1 Maneuver	348	837	-
Stage 1	830	-	-
Stage 2	543	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	331	837	-
Mov Cap-2 Maneuver	331	-	-
Stage 1	789	-	-
Stage 2	543	-	-

Approach	WB	NB	SB
HCM Control Delay, s	10.9	0	0.7
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	641	1356
HCM Lane V/C Ratio	-	-	0.055	0.036
HCM Control Delay (s)	-	-	10.9	7.8
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.2	0.1

Appendix F

TDM Checklist

TDM Measures Checklist:
Residential Developments (multi-family, condominium or subdivision)

Legend	
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance
★	The measure is one of the most dependably effective tools to encourage the use of sustainable modes

TDM measures: <i>Residential developments</i>		Check if proposed & add descriptions
1. TDM PROGRAM MANAGEMENT		
1.1 Program coordinator		
BASIC ★	1.1.1 Designate an internal coordinator, or contract with an external coordinator	<input type="checkbox"/> N/A
1.2 Travel surveys		
BETTER	1.2.1 Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	<input type="checkbox"/>
2. WALKING AND CYCLING		
2.1 Information on walking/cycling routes & destinations		
BASIC	2.1.1 Display local area maps with walking/cycling access routes and key destinations at major entrances (<i>multi-family, condominium</i>)	<input type="checkbox"/> N/A
2.2 Bicycle skills training		
BETTER	2.2.1 Offer on-site cycling courses for residents, or subsidize off-site courses	<input type="checkbox"/> N/A

TDM measures: <i>Residential developments</i>		Check if proposed & add descriptions
3. TRANSIT		
3.1 Transit information		
BASIC	3.1.1 Display relevant transit schedules and route maps at entrances (<i>multi-family, condominium</i>)	<input type="checkbox"/> N/A
BETTER	3.1.2 Provide real-time arrival information display at entrances (<i>multi-family, condominium</i>)	<input type="checkbox"/> N/A
3.2 Transit fare incentives		
BASIC ★	3.2.1 Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	<input checked="" type="checkbox"/> Recommended for new purchasers. Subject to developer programs and sales strategy.
BETTER	3.2.2 Offer at least one year of free monthly transit passes on residence purchase/move-in	<input type="checkbox"/>
3.3 Enhanced public transit service		
BETTER ★	3.3.1 Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels (<i>subdivision</i>)	<input type="checkbox"/>
3.4 Private transit service		
BETTER	3.4.1 Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	<input type="checkbox"/>
4. CARSHARING & BIKESHARING		
4.1 Bikeshare stations & memberships		
BETTER	4.1.1 Contract with provider to install on-site bikeshare station (<i>multi-family</i>)	<input type="checkbox"/> N/A
BETTER	4.1.2 Provide residents with bikeshare memberships, either free or subsidized (<i>multi-family</i>)	<input type="checkbox"/> N/A
4.2 Carshare vehicles & memberships		
BETTER	4.2.1 Contract with provider to install on-site carshare vehicles and promote their use by residents	<input type="checkbox"/>
BETTER	4.2.2 Provide residents with carshare memberships, either free or subsidized	<input type="checkbox"/>
5. PARKING		
5.1 Priced parking		
BASIC ★	5.1.1 Unbundle parking cost from purchase price (<i>condominium</i>)	<input type="checkbox"/> N/A
BASIC ★	5.1.2 Unbundle parking cost from monthly rent (<i>multi-family</i>)	<input type="checkbox"/> N/A

TDM measures: <i>Residential developments</i>		Check if proposed & add descriptions
6. TDM MARKETING & COMMUNICATIONS		
6.1 Multimodal travel information		
BASIC ★	6.1.1 Provide a multimodal travel option information package to new residents	<input checked="" type="checkbox"/> Information package/links to City of Ottawa pathway and cycling networks.
6.2 Personalized trip planning		
BETTER ★	6.2.1 Offer personalized trip planning to new residents	<input type="checkbox"/>