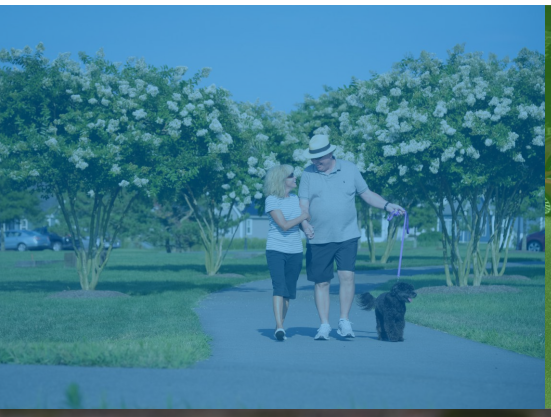
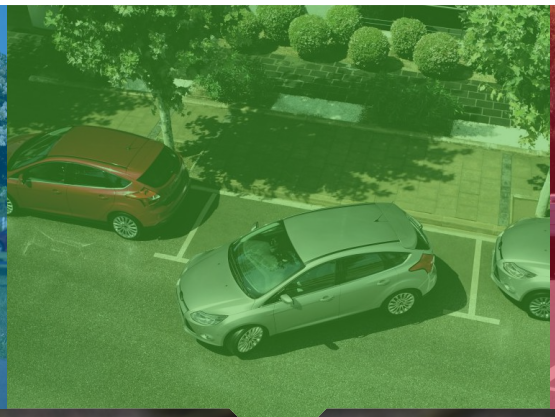
CARDEL

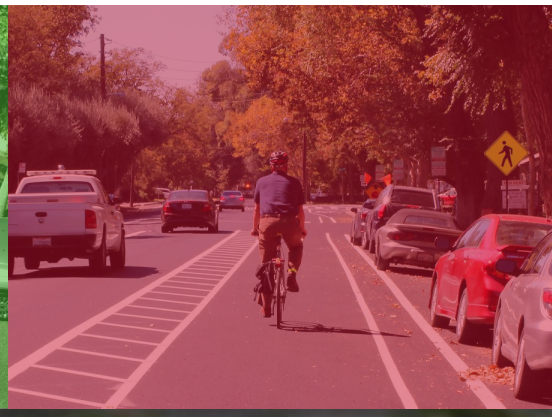
October 2017

Ironwood - 673 River Road

Community Transportation Study / Transportation Impact Study







PARSONS

Ironwood – 673 River Road

Community Transportation Study/ Transportation Impact Study

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Community Transportation Study/Transportation Impact Study

1. INTRODUCTION

Cardel Homes is planning the Ironwood residential subdivision in the Riverside South community within in the City of Ottawa at 673 River Road. The property is divided by the Urban Boundary and only the portion within the Boundary is proposed to be developed. To support the development, a Community Transportation Study/Transportation Impact Study is required to satisfy the site plan application. The residential development will consist of 234 single family homes and 260 townhomes, for a total of 494 units. The proposed site is located north of Rideau Road, between River Road and Spratt Road.

Figure 1 illustrates the local context and Figure 2 illustrates the proposed Site Plan for Ironwood.

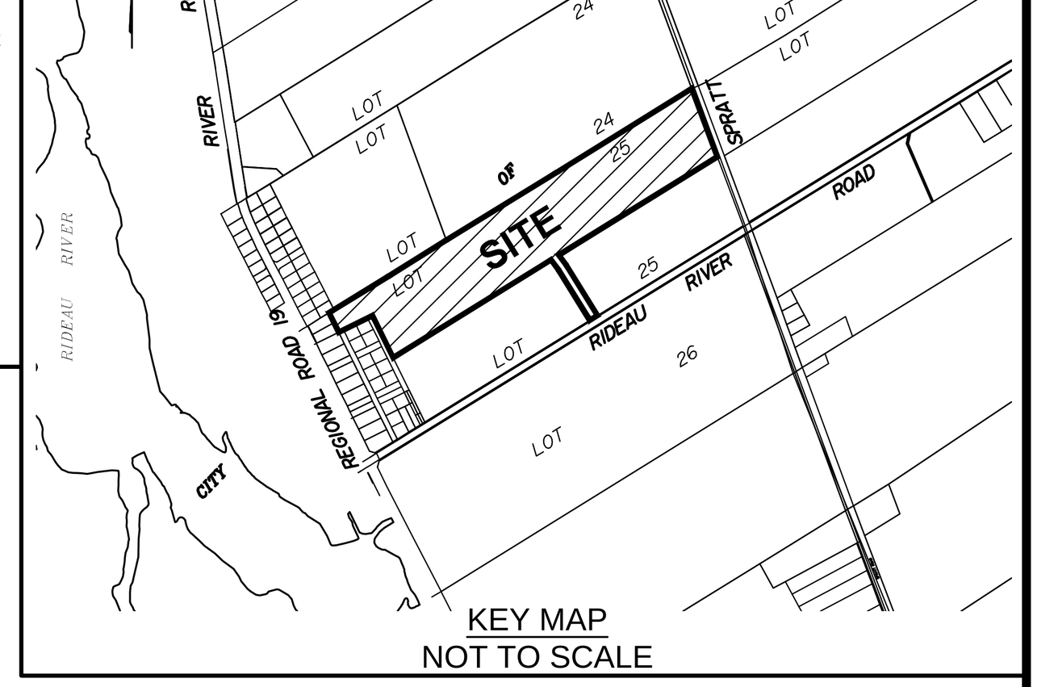
Figure 1: Local Context

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



KEY MAP
NOT TO SCALE

DRAFT PLAN OF SUBDIVISION OF

PART OF LOT 25
BROKEN FRONT
CONCESSION (RIDEAU FRONT)
Geographic Township of Gloucester
CITY OF OTTAWA
Prepared by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1250
50 37.5 25 12.5 0 25 50 Metres

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 / agent of the lands to be subdivided and that this plan was prepared in accordance with my instructions.

______________ Date

____
Greg Graham
2356349 Ontario, Inc (Cardel Homes)
I have the authority to bind the corporation

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, open space, parkland
(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

Ontario Land Surveyors
ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com

Job No. 16891-17 Cardel Pt Lt 25 BF RF GL DPS F | N

2. EXISTING CONDITIONS

2.1. AREA ROAD NETWORK

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.

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 80 km/h.

Spratt Road is a north-south major collector roadway with a two-lane rural cross-section, transitioning into a four-lane urban cross-section south of Earl Armstrong Road. Sidewalks are provided along the urban section along both sides of the roadway. The posted speed limit is 80 km/h through the rural section and 60 km/h at the urban section.

Rideau Road is an east-west local roadway with a rural two-lane cross-section. Gravel run along both sides of the roadway, and exponential stop bars are located at the Spratt intersection. The posted speed limit within the study area is 80 km/h.

2.2. PEDESTRIAN/CYCLING NETWORK

Sidewalk facilities are provided along both sides of Earl Armstrong Road and the 4-lane section of Spratt Road. Both River Road and Rideau Road have gravel shoulders and Spratt Road has paved shoulders along the 2-lane section. Bicycle facilities are currently provided in the form of bike lanes on Earl Armstrong Road along both sides of the road.

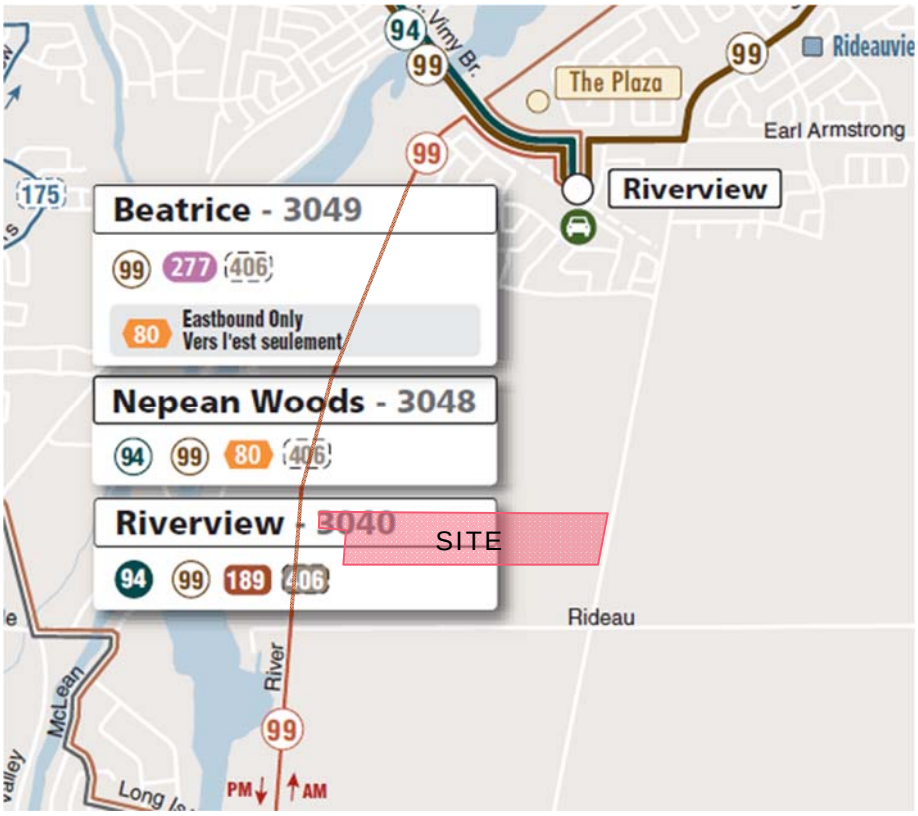
Per the City's Cycling Plan, River Road and Earl Armstrong Road are all classified as "Spine Routes" and Spratt Road and Rideau Road are classified as a "Local Route".

2.3. 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 100 to 400 m from 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.

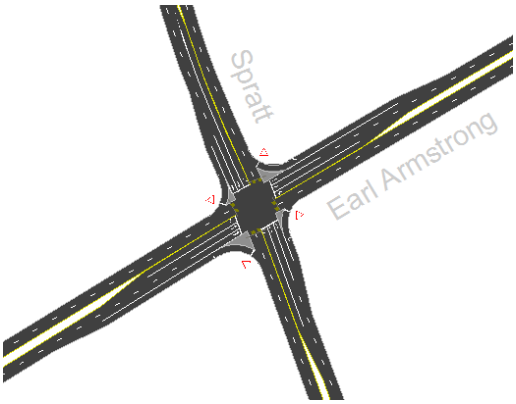
Figure 3: Area Transit Network



2.4. EXISTING STUDY AREA INTERSECTIONS

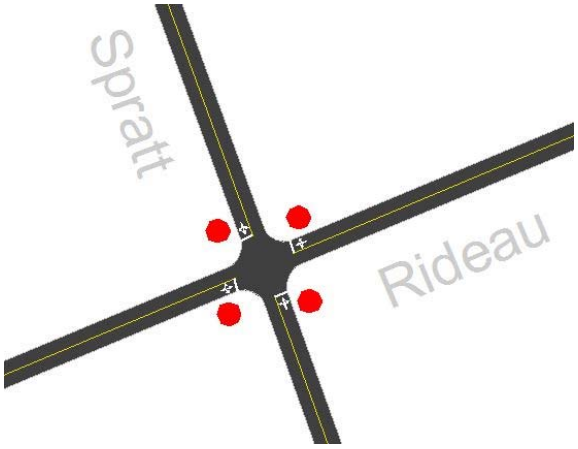
Spratt Road/Earl Armstrong Road

The Spratt Road/Earl Armstrong Road intersection is a signalized four-legged intersection. Each leg consists of a dedicated left-turn lane, two through lanes and a channelized right-turn lane. Bike lanes are provided in the east-west direction along Earl Armstrong Road.



Spratt Road/Rideau Road

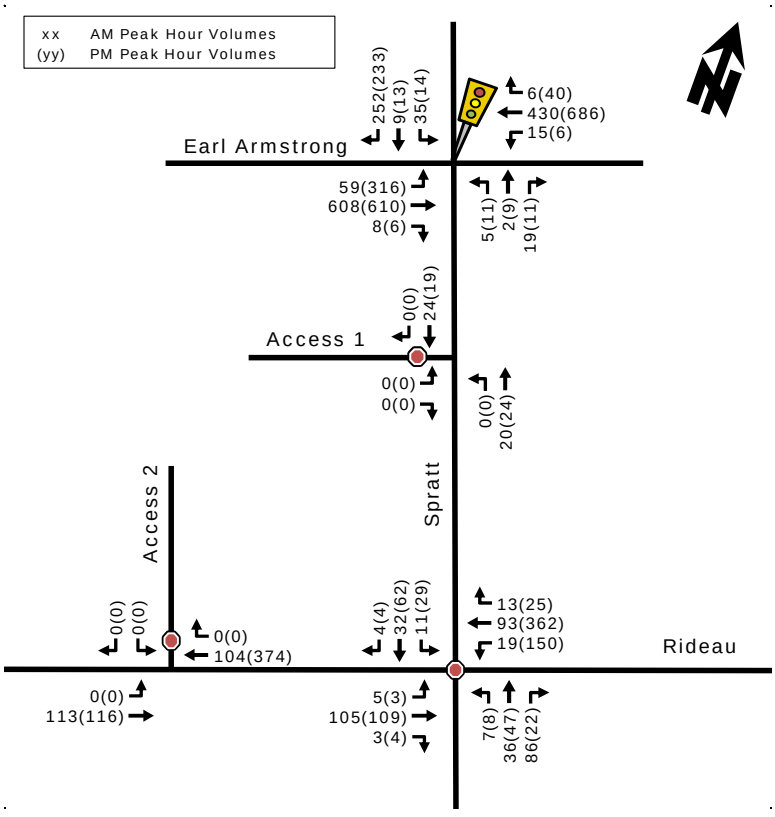
The Spratt Road/Rideau Road intersection is a stop-controlled four-legged intersection. A single lane approach is provided for each leg of this intersection with all movements permitted.



2.5. EXISTING INTERSECTION OPERATIONS

Illustrated as Figure 4, are the most recent weekday morning and afternoon peak hour traffic volumes obtained from the City of Ottawa for the Earl Armstrong Road/River Road intersection. Peak hour traffic volumes are included as Appendix A.

Figure 4: Existing Peak Hour Traffic Volumes



The following Table 1 provides a summary of existing traffic operations at study area intersections based on the SYNCHRO (V9) traffic analysis software. The subject intersection was assessed in terms of the volume-to-capacity (v/c) ratio and the corresponding Level of Service (LoS) for the critical movement(s). The subject intersections 'as a whole' were assessed based on a weighted v/c ratio. The SYNCHRO model output of existing conditions is provided within Appendix B.

Table 1: Existing Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Spratt/Earl Armstrong	B(B)	0.66(0.69)	SBR(SBR)	8.5(10.4)	A(A)	0.36(0.46)
Spratt/Rideau (unsignalized)	A(C)	0.16(0.73)	NBT(WBT)	8.2(16.0)	-	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 1, the signalized Earl Armstrong Road/Spratt Road study area intersection 'as a whole' is currently operating at a LoS 'A' during both peak hours. With regard to 'critical movements' at study area intersections, the northbound through movement at the Earl Armstrong Road/Spratt Road intersection is currently operating at a LoS 'B' during peak hours.

The Spratt Road/Rideau Road 'critical movements' are identified as the northbound through during the AM peak (LoS 'A') and the westbound through during the PM peak (Los 'C')

2.6. EXISTING ROAD SAFETY CONDITIONS

Collision history for study area roads (2013 to 2015, inclusive) was obtained from the City of Ottawa and most collisions (72%) involved only property damage, indicating low impact speeds, and 28% involved personal injuries.

The primary causes of collisions cited by police include; turning movement (39%), single vehicle (28%), rear end (17%), and angle (17%) type collisions.

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 have historically take place at a rate of:

- 0.66/MEV at the Spratt Road/Earl Armstrong Road intersection; and
- 3.24/MEV on Spratt Road between Earl Armstrong Road and Rideau Road intersections.

Based on the available data, there does not appear to be any prevailing safety issues at the Spratt Road and Earl Armstrong Road intersection. The high MEV for the Spratt Road segment is driven by low volumes and three (3) total collisions within the review period. All three collisions were single vehicle incidents, with an animal strike, a daytime drive into the ditch, and a snowy condition nighttime drive into the ditch. No pattern is noted for these three incidents and as the adjacent properties are developed, the nature of the road and single vehicle incidents is anticipated to decrease.

The source collision data as provided by the City of Ottawa and related analysis is provided as Appendix C.

2.7. SCREENLINE OPERATIONS

The TRANS Screenline System does not provide an existing east-west screenline that adequately capture north-south travel demand within the study area to help inform the study of the potential need to provide additional road capacity. As such, a *Study Screenline* has been created along Earl Armstrong Road that captures north-south travel demand on the subject section of Spratt Road and the arterial roads both immediately east and west. The screenline includes River Road, Spratt Road and Limebank Road.

As shown in Figure 5, the nearby existing standard screenlines within the TRANS model environment include:

- SL 42 – Rideau River South/Manotick with one station at Bridge Street (west of study area);
- SL 50 – Mitch Owens with stations at River Road, Dozios Road, Manotick Station Road, Stagecoach Road, Old Prescott Road and Bank Street (south of study area); and
- SL 08 – Leitrim with stations at River Road, Albion Road, Bank Street and Hawthorne Road

Vehicle trips crossing the *Study Screenline* were estimated using two sources, namely observed ground counts from the peak hour intersection turning movement counts (see Figure 4) and simulated values from the TRANS regional model (AM peak only). The results are summarized in Table 2. Both data sources reveal that the approximately one half of the existing road capacity of the *Study Screenline* is being used, suggesting that there is considerable spare capacity available. Note that some individual road links may be operating closer to capacity, and others well below.

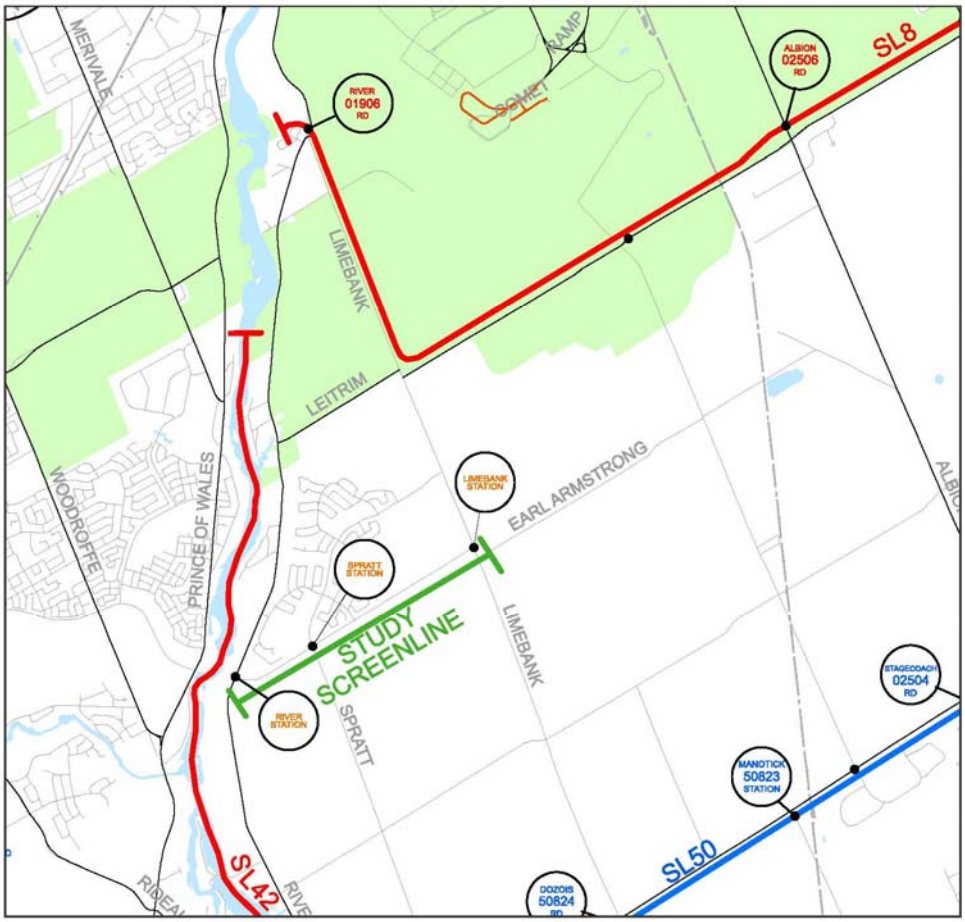
As shown in Table 2, the *Study Screenline* is currently operating below capacity (v/c = 1.00). It can be seen that there is available spare capacity across the screenline for future growth. The screenline analysis is provided in Appendix D.

Table 2: Existing *Study Screenline* Performance

Screenline	Peak Directional Demand[1] (PCU)[2]		Directional Capacity[3] (PCU)	v/c	
	AM Peak	PM Peak		AM Peak	PM Peak
Study Screenline	1,374	1,428	5,780	0.24	0.25

1. Existing volumes obtained from the City of Ottawa
2. PCU (Passenger Car Units) were assumed to be the sum of autos and 2 x heavy vehicles
3. Directional capacities were obtained from the City's 2008 Transportation Master Plan – Road Infrastructure Needs Study

Figure 5: Study Area Screenlines



3. DEMAND FORECASTING

3.1. 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.

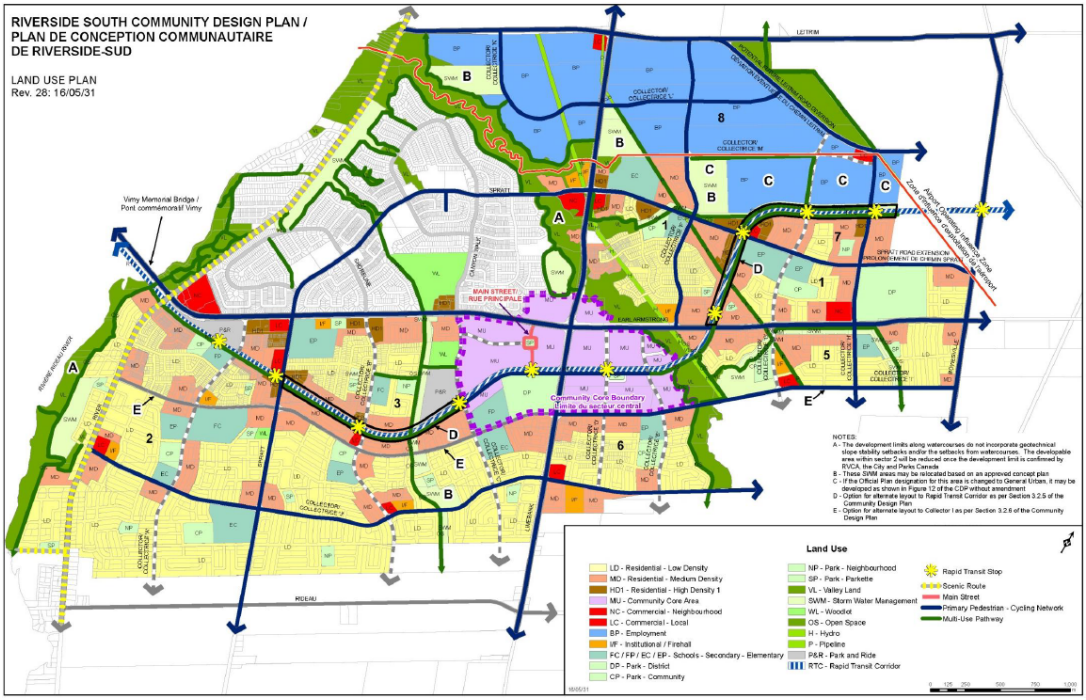
3.2. OTHER AREA DEVELOPMENT

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 6, 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.

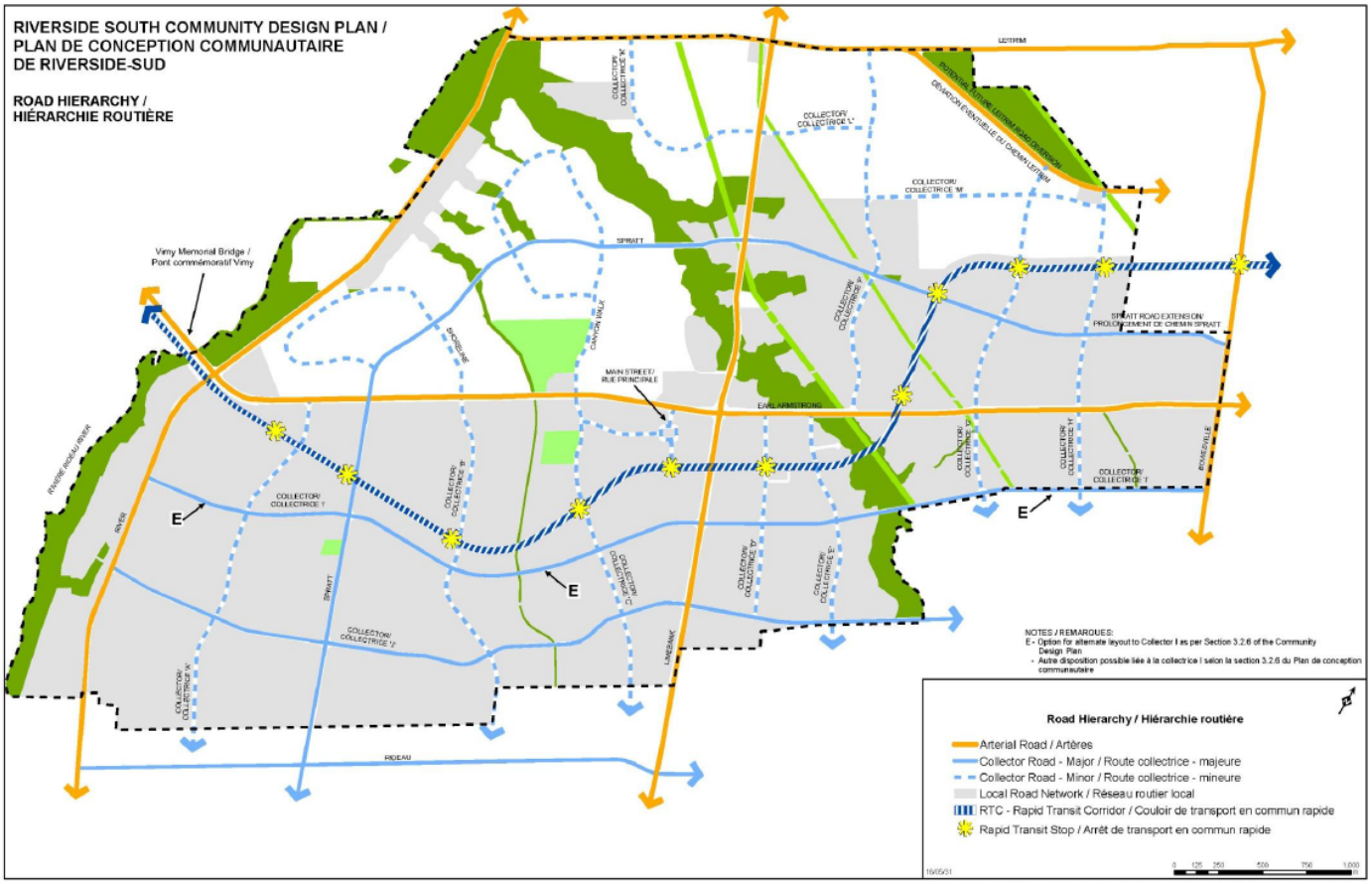
Figure 6: Riverside South CDP – Land Use Plan



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 7. 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.*

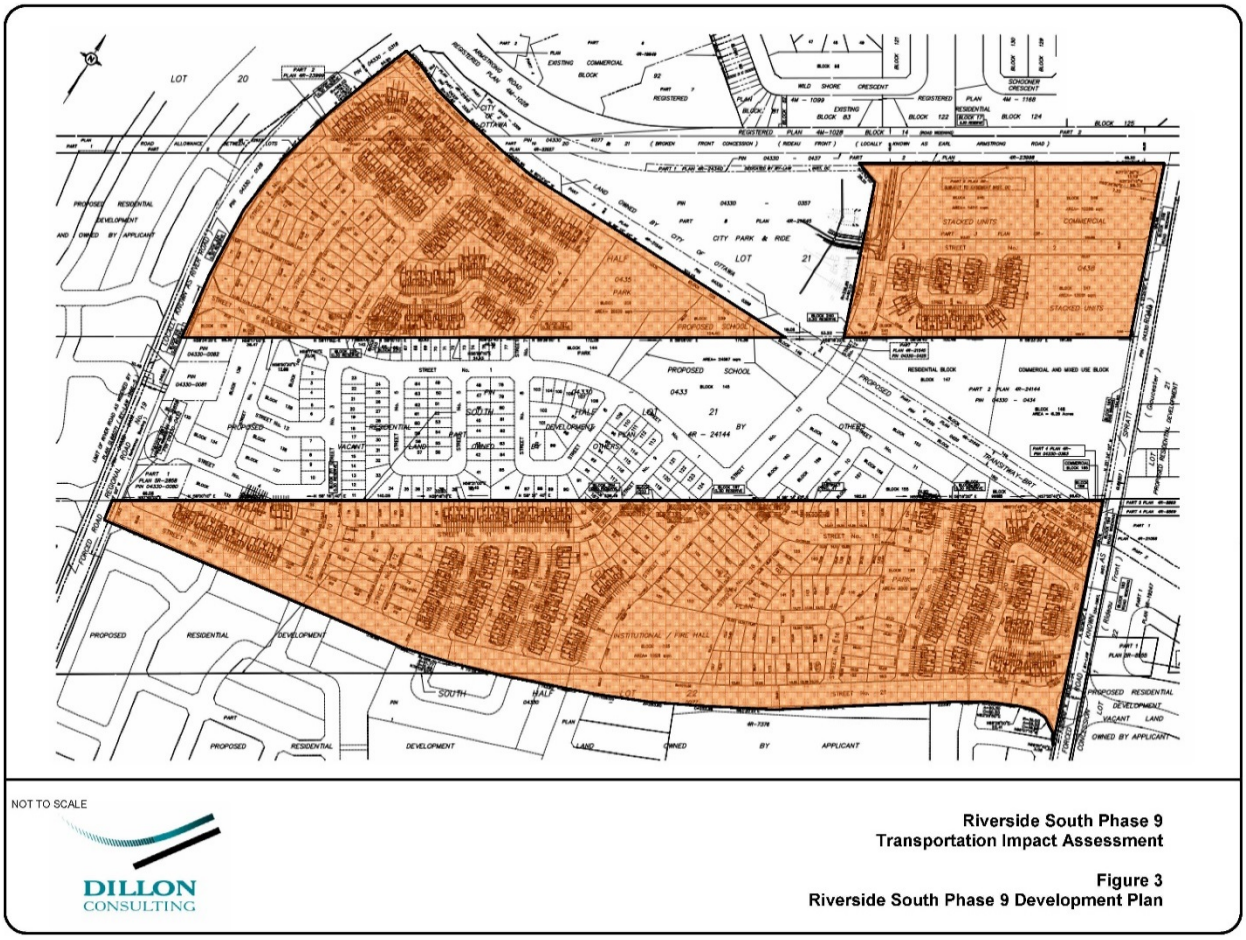
Figure 7: Riverside South CDP – Road Hierarchy



3.3. RIVERSIDE SOUTH PHASE 9

In 2010, Dillion Consulting completed the Riverside South Phase 9 Transportation Impact Study. This development is located immediately south of Earl Armstrong Road between River Road and Spratt Road (Figure 8). The development will consist of 244 single family homes, 751 townhomes, for a total of 995 units and approximately 191,000 sqft of institutional and commercial land.

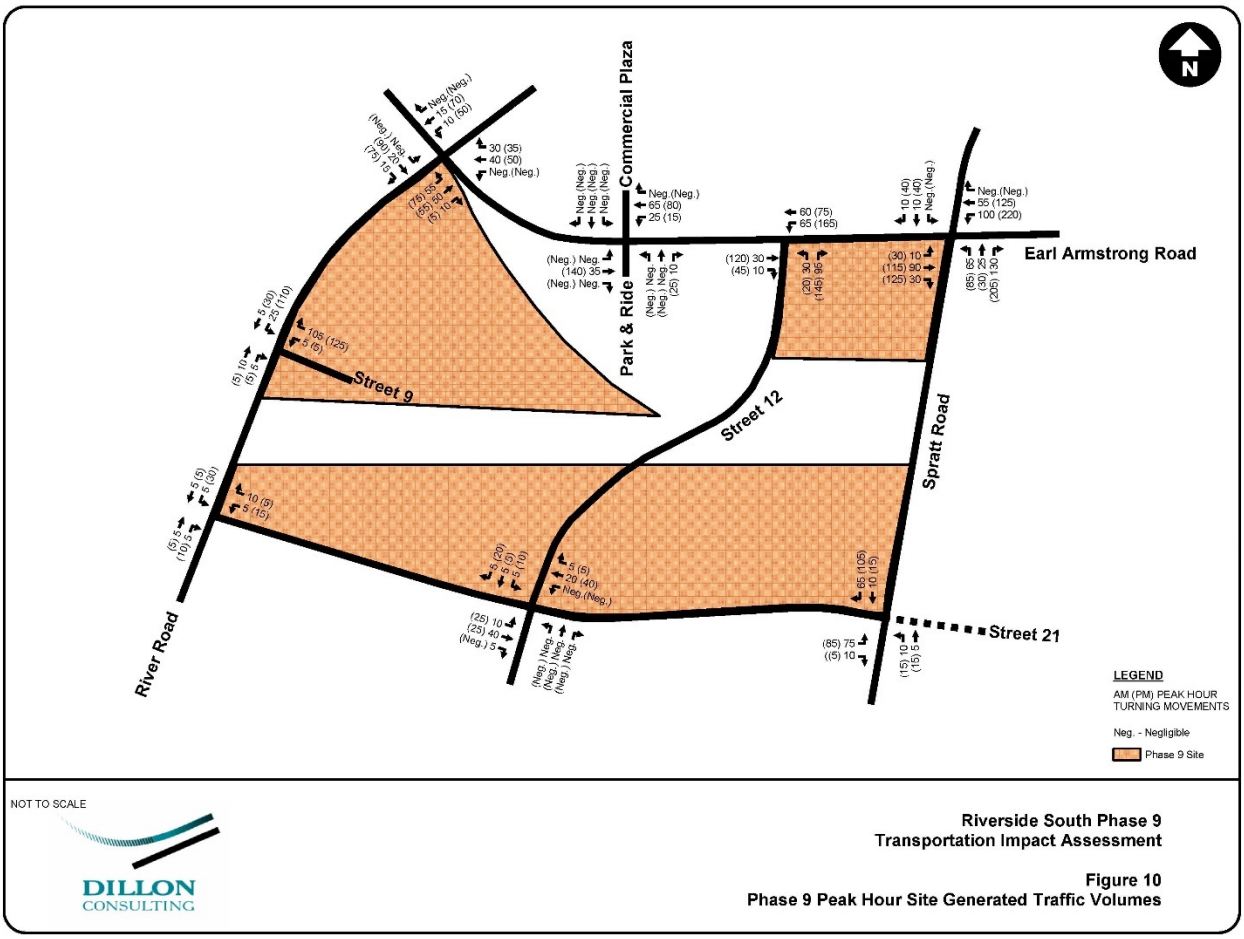
Figure 8: Riverside South Phase 9 Development



Full build-out and occupancy was forecasted for 2018 however, as of today, approximately 50% of the development has been built, the remaining being the southern-most portion of the subdivision. Because of this, only the trips generated onto Spratt Road from the new development will be taken into account.

Figure 9 shows the site generated trips to the Spratt Road and Earl Armstrong Road intersection.

Figure 9: Phase 9 Site Forecasted Volumes



3.4. BACKGROUND TRAFFIC GROWTH

The background traffic along River Road, Limebank 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 2029 and 2034 Horizon years. Spratt Road and Rideau 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.

The projected background traffic volumes for the horizon years is illustrated as Figure 10 for 2029 and Figure 11 for 2034.

Figure 10: Projected 2029 Baseline Traffic Volumes

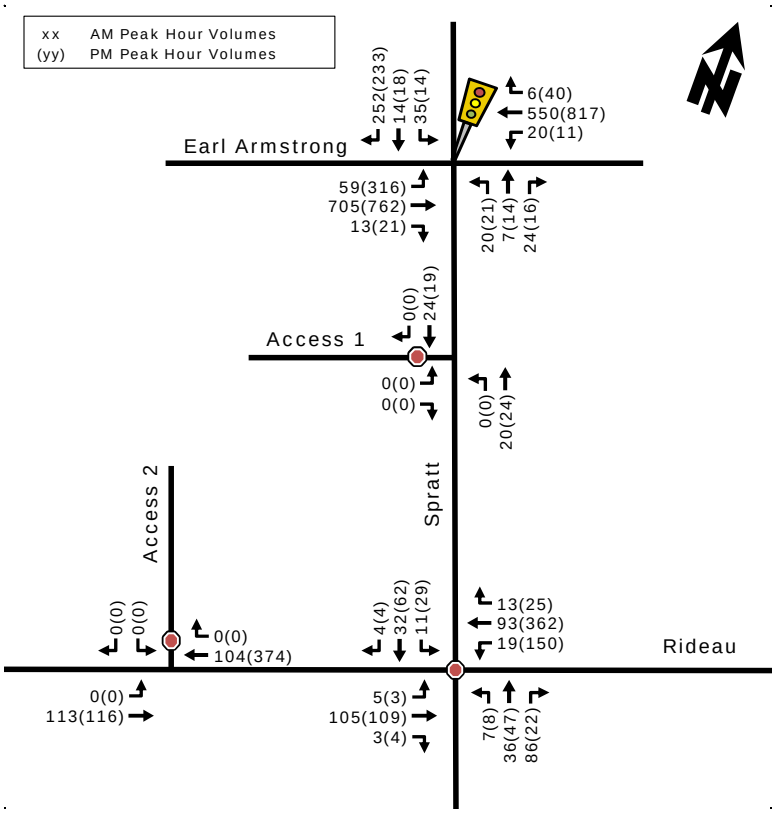
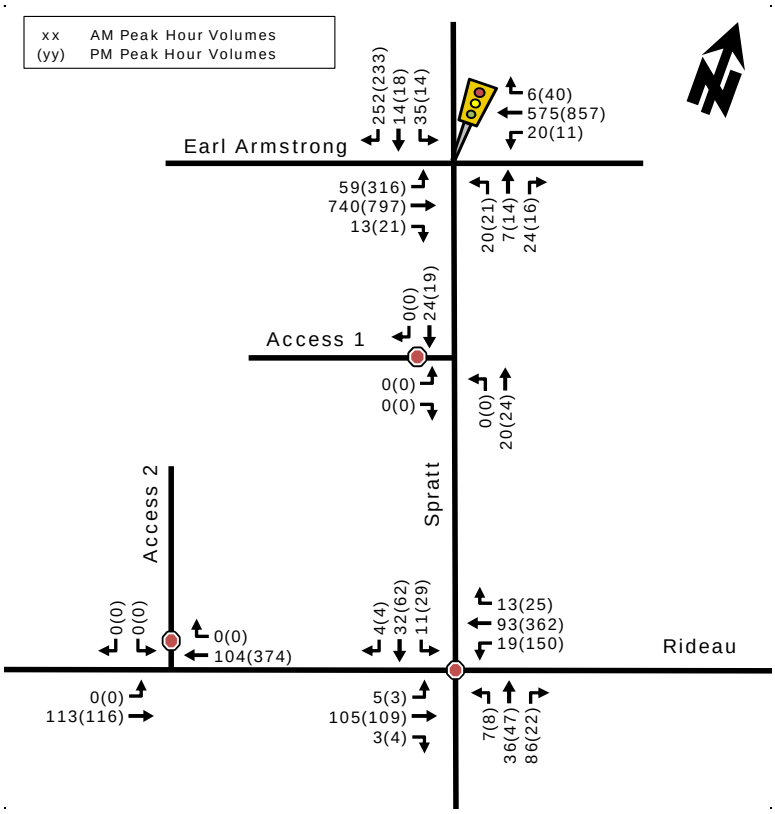


Figure 11: Projected 2034 Baseline Traffic Volumes



3.5. SITE TRIP GENERATION

Appropriate trip generation rates for the proposed development of approximately 234 single family homes and 260 residential townhome units were obtained from the 9th Edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual, which are summarized in Table 3.

As ITE trip generation surveys only record vehicle trips and typically reflect highly suburban locations (with little to no access by travel modes other than private automobiles), adjustment factors appropriate to the more connected suburban study area context were applied to attain estimates of person trips for the proposed development. This approach is considered appropriate within the industry for more urban developments.

Table 3: ITE Trip Generation Rates

Land Use	Data Source	Trip Rates	
		AM Peak	PM Peak
Single Family Homes	ITE 210	T = 0.70(x) + 9.74	Ln(T) = 0.90(x) + 0.51
Townhomes	ITE 230	Ln(T) = 0.80(x) + 0.26	Ln(T) = 0.82(x) + 0.32

Notes: T = Average Vehicle Trip Ends
X = 1000 ft² Gross Floor Area

To convert ITE vehicle trip rates to person trips, an auto occupancy factor and a non-auto trip factor were applied to the ITE vehicle trip rates. Our review of available literature suggests that a combined factor of approximately 1.3 is considered reasonable to account for typical North American auto occupancy values of approximately 1.15 and combined transit and non-motorized modal shares of less than 10%. As such, the person trip generation for the proposed site is summarized in Table 4.

Table 4: Modified Person Trip Generation

Land Use	Units	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total
Single Family Homes	234	56	170	226	185	109	294
Townhomes	260	24	120	144	114	57	171
Total Person Trips		**80**	**290**	**370**	**299**	**166**	**465**

Note: 1.3 factor to account for typical North American auto occupancy values of approximately 1.15 and combined transit and non-motorized modal shares of less than 10%

The person trips shown in Table 4 for the proposed site were then reduced by modal share values, with the total site-generated vehicle traffic summarized in Table 5.

Table 5: Total Site Vehicle Trip Generation

Land Use	Mode Share	AM Peak (veh/h)			PM Peak (veh/h)		
		In	Out	Total	In	Out	Total
Auto Driver	65%	52	189	241	195	108	303
Auto Passenger	20%	16	58	74	60	34	94
Transit	10%	8	29	37	30	16	46
Non-motorized	5%	4	14	18	14	8	22
Total 'New' Auto Trips		**52**	**189**	**241**	**195**	**108**	**303**

As shown in Table 5, the resulting number of potential 'new' two-way vehicle trips for the proposed development is approximately 241 and 303 veh/h during the weekday morning and afternoon peak hours, respectively.

3.6. VEHICLES DISTRIBUTION AND ASSIGNMENT

Traffic distribution was based on the different types of land uses, existing volume splits at study area intersections and our knowledge of the surrounding area. The resultant distribution is outlined as follows.

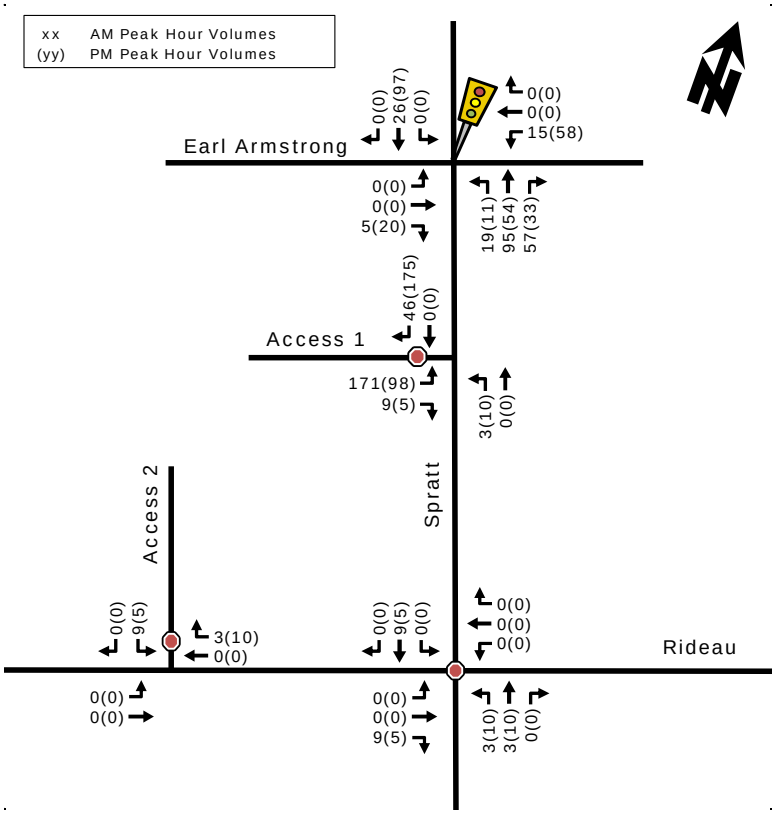
Residential

- 10% to/from the north via River Road and Earl Armstrong Road
- 50% to/from the north via Spratt Road and Limebank Road
- 30% to/from the north via Earl Armstrong Road and Limebank Road
- 5% to/from the south via Spratt Road
- 5% to/from the south via Rideau Road and Spratt Road

100%

Based on these distributions, 'new' site-generated trips were assigned to study area intersections, which are illustrated as Figure 12.

Figure 12: 'New' Site Generation Traffic Volumes

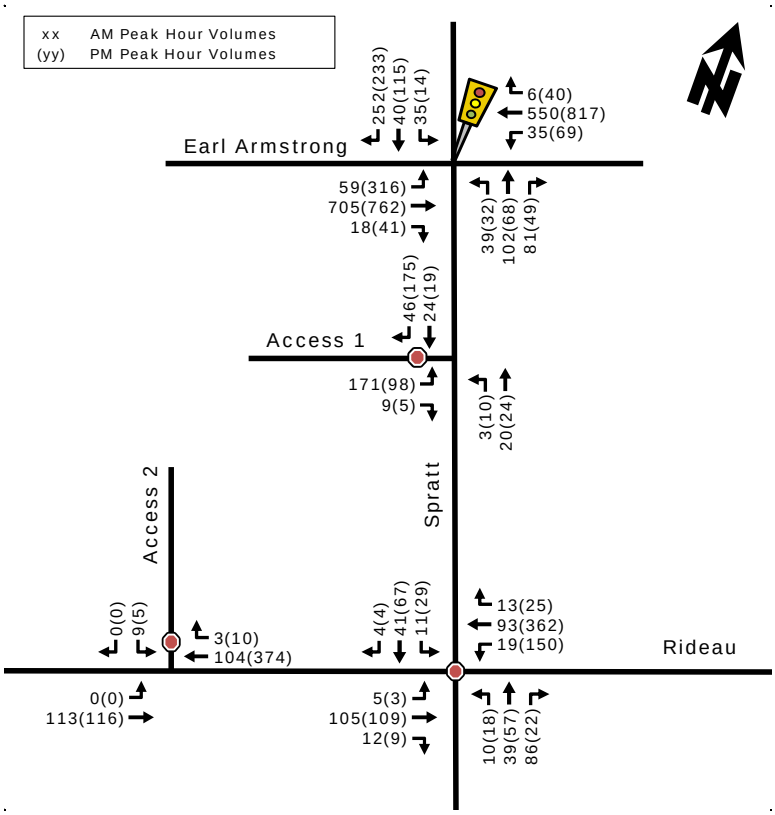


4. FUTURE TRAFFIC OPERATIONS

4.1. PROJECTED 2029 CONDITIONS AT FULL SITE DEVELOPMENT

The total projected 2029 volumes associated with the proposed development were derived by superimposing 'new' site-generated traffic volumes (Figure 12) onto projected 2029 background traffic volumes (Figure 10). The resulting total projected 2029 volumes are illustrated as Figure 13

Figure 13: Total Projected 2029 Peak Hour Traffic Volumes



The following Table 6 provides a projected performance summary for study area intersections, based on total projected 2029 traffic volumes. The detailed SYNCHRO model output of projected 2029 conditions is provided within Appendix E.

Table 6: Projected 2029 Performance of Study Area Intersections

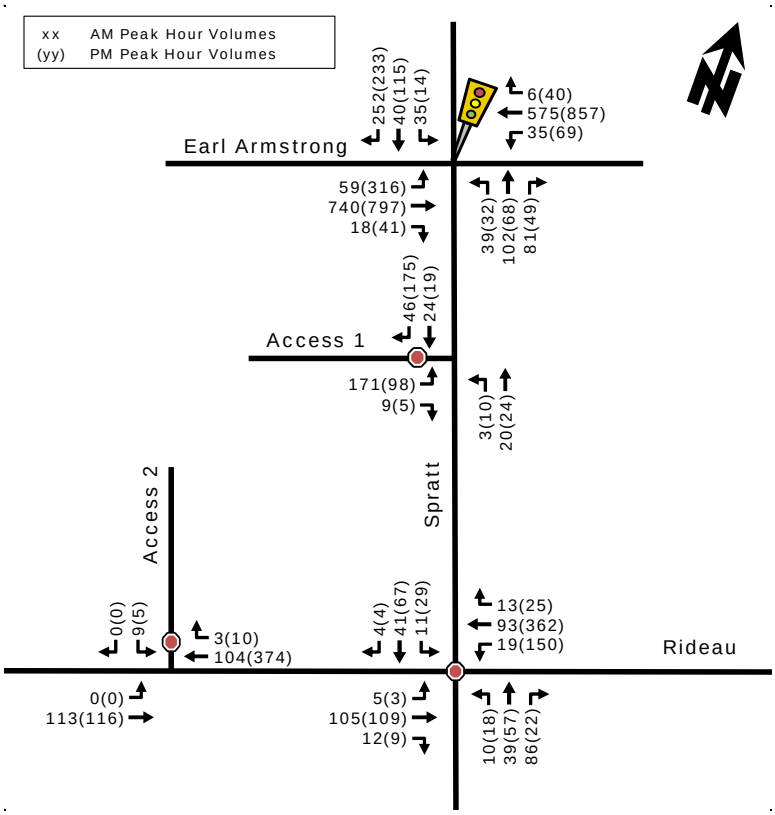
Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a Whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Spratt/Earl Armstrong	B(B)	0.65(0.65)	SBR(SBR)	12.3(12.3)	A(A)	0.38(0.48)
Spratt/Site Access 1 (unsignalized)	A(A)	9.9(10.0)	EBL(EBL)	6.6(3.3)	-	-
Rideau/Site Access 2 (unsignalized)	A(B)	9.8(12.1)	SBL(SBL)	0.4(0.1)	-	-
Spratt/Rideau (unsignalized)	A(C)	8.4(20.7)	EBT(WBT)	8.3(16.6)	-	-
Notes: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 6, all study area intersections 'as a whole' are projected to operate at an acceptable LoS 'C' or better during peak hours. With regard to the 'critical movements' at study area intersections, the critical movements are projected to operate at an acceptable LoS 'C' or better during the morning and afternoon peak hours with respect to the City of Ottawa operating standards of LoS 'D' or better ($v/c \leq 0.90$).

4.2. PROJECTED 2034 CONDITIONS AT FIVE YEARS BEYOND FULL SITE DEVELOPMENT

The total projected 2024 volumes associated with the proposed development were derived by superimposing 'new' site-generated volumes (Figure 12) onto projected 2024 baseline traffic volumes (Figure 11). The resulting total projected 2024 volumes are illustrated as Figure 14.

Figure 14: Total Projected 2034 Peak Hour Traffic Volumes



The following Table 7 provides a projected performance summary for study area intersections, based on total projected 2024 traffic volumes (5-years beyond full site build-out). The detailed SYNCHRO model output of projected 2034 conditions is provided within Appendix G.

Table 7: Projected 2034 Performance of Study Area Intersections

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
Spratt/Earl Armstrong	B(B)	0.65(0.65)	SBR(SBR)	12.2(12.4)	A(A)	0.39(0.50)
Spratt/Site Access 1 (unsignalized)	A(B)	9.9(10.0)	EBL(EBL)	6.1(3.3)	-	-
Rideau/Site Access 2 (unsignalized)	A(B)	9.8(12.1)	SBL(SBL)	0.4(0.1)	-	-
Spratt/Rideau (unsignalized)	A(C)	8.4(20.7)	EBT(WBT)	8.3(16.6)	-	-
Notes: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 7, with the continued 1% traffic growth along Earl Armstrong Road, Limebank Road and River Road, all study area intersections 'as a whole' are projected to operate at an acceptable LoS 'C' or better during peak hours. With regard to the 'critical movements' at study area intersections, the critical movements are projected to operate at an acceptable LoS 'C' or better during the morning and afternoon peak hours with respect to the City of Ottawa operating standards of LoS 'D' or better ($v/c \leq 0.90$).

4.3. NEIGHBOURHOOD IMPACTS

Based on the Riverside South CDP, the proposed development is in accordance with the forecasted Land Use Plan outlined in the CDP. Ironwood is a predominantly residential development north of Rideau Road between Spratt Road and River Road which does not conflict with the Community Design Plan Map located in the CDP. This development has been forecasted for and as such will not have any unexpected impacts on the traffic network that have not already been accounted for in the planned community.

4.4. PROJECTED SCREENLINE OPERATIONS

The projected screenline capacity for the 2029 and 2034 horizon are summarized below in Table 8. Similar to the existing conditions, the *Study Screenline* capacity is anticipated to be approximately 26% through to 2034, with spare capacity for future growth.

Table 8: Projected *Study Screenline* Performance

Screenline	Peak Directional Demand[1] (PCU)[2]		Directional Capacity[3] (PCU)	v/c	
	AM Peak	PM Peak		AM Peak	PM Peak
2029 Study Screenline	1,710	1,783	5,780	0.30	0.31
2034 Study Screenline	1,750	1,819	5,780	0.30	0.31

1. 2029 and 2034 volumes obtained from Study Projections
2. PCU (Passenger Car Units) were assumed to be the sum of autos and 2 x heavy vehicles
3. Directional capacities were obtained from the City's 2008 Transportation Master Plan – Road Infrastructure Needs Study

5. TRANSPORTATION DEMAND MANAGEMENT

Depending on the nature of a development, Transportation Demand Management (TDM) strategies have the potential to be an integral part of a planned development to address and support the City's policies with regard to TDM. Several other TDM measures could also be considered, including:

- Improving the quality and safety of pedestrian facilities, such as enhanced sidewalks/lighting;
- Promote transit passes and park & ride options within the Riverside South and to the Riverview Station; and
- Promote appropriate car sharing programs/facilities to reduce auto ownership and attract residents who do not own a vehicle.

TDM strategies are important in encouraging active modes of transportation to/from the site, further lessening the reliance on the private automobile.

6. SITE PLAN REVIEW

SITE ACCESS

Based on the projected volumes, the Street No. 8 intersection with Spratt Road and the Street No. 6 intersection with Rideau Road will both operate well as a minor street stop-control. No left-turn auxiliary lanes are required for these roads.

Typically, if the right-turning volume exceeds 60 vehicles per hours, or represents a volume greater than 10-20% of the approaching volume, a right-turn lane should be considered. At the Street No. 8 and Spratt Road intersection, the turning volumes (175 vehicles) and the percentage approaching volume (90%) exceed both of these conditions, and the discussion should occur if a right-turn lane is required. Breaking down the southbound volumes by movement, the will be approximately three right-turning vehicles every minute and one through vehicle every three minutes. Given the low volume of southbound through vehicles, the single lane on Spratt Road will operate predominantly as a right-turn lane and have very little impact on the through volumes to the south. Once Spratt Road is widened to two-lanes, this issue

may be revisited within the context of an urban collector. It is noted that this recommendation would be consistent with the recommendation in the Riverside South Phase 9 TIS, dated November 2010 by Dillon, for Spratt Road and Street 21 (CDP Collector 'I'). This intersection is illustrated as a two-lane roadway on Spratt Road with minor stop-control on the east-west Street 21.

Emergency Access

As the development of the site is anticipated to occur before the lands to the north are initiated, a secondary emergency access/egress will be required once the development reaches a total of 200 units. It is anticipated that Street No. 6 and 8 will provide dual access points for the subject site.

Internal Roadways

The internal road network is comprised of 14.5m window lanes, 18.0m local roads, 20.0m internal collector roads and a 26.0m minor community collector, as per the CDP. Short block lengths and the offset internal road grid provide a high level of connectivity with minimal loading on the internal intersections.

It is noted that the western limits of the site plan require the development of the lands to the north (or south) for road connectivity and would require a temporary access if they are to proceed prior to the northern connection being established.

Sidewalks

Within the community, sidewalks can be provided on both sides of the north-south minor collector (26.0m right-of-way), and sidewalks along a single side will be provided for the 20.0m and 18.0m right-of-ways. The window lanes cannot support a sidewalk, although a connection to the adjacent street sidewalks should be provided for connectivity.

This conforms with the current City of Ottawa review of the typical cross-sections (only 16.5m and 18.0m approved to date) that have identified that a four-party trench is required to support a single sidewalk and have assumed that a 22.0m right-of-way is required for two sidewalks along a roadway.

Cycling

Cycling facilities are to be provided along the north-south collector (26.0m right-of-way), as identified within the CDP. The remainder of the cycling network will accommodate through shared on-road facilities.

Traffic Calming

The implementation of passive traffic calming measures are currently being incorporated into new subdivisions with the goal of reducing potential reconstruction costs soon after a new development roads are completed. The nature of these calming measures should primarily be limited to horizontal features. Within the subject lands, curb narrowings should be provided at the local road intersections with Street No. 6 and 8 to reduce the entrance and exit speeds onto local roads and reduce the crossing distance for pedestrians travelling along the corridors. In addition, a full intersection narrowing should be considered at the Street No. 6 and 8 intersection as it is the major intersection for both north-south and east-west travel within the development.

7. FINDINGS AND RECOMMENDATIONS

Ironwood, located north of Rideau Road, between River Road and Spratt Road, is a residential development that will consist of 234 single family homes and 260 townhomes, for a total of 494 units. It was determined that the proposed development will generate 241 new vehicle trips in the morning peak hour and 303 vehicle trips in the afternoon peak hour.

Based on the foregoing analysis of the proposed development, the following transportation-related conclusions are offered:

EXISTING CONDITIONS

- The study area intersection north of the site are currently operating 'as a whole' with an overall LoS 'C' or better during the weekday morning and afternoon peak hours.
- With regard to 'critical movements' at the study area intersection, they are noted as operating at an acceptable LoS 'C' or better during the peak hours.
- Based on the available data, there does not appear to be any safety issues at the signalized study area intersections adjacent to the proposed site.
- The Project Screenline, south of Earl Armstrong Road, is operating below 30% capacity during the weekday peak hours.

PROJECTED CONDITIONS

- Given the increase if vehicular volumes along Earl Armstrong Road, a 1% traffic growth rate per annum was assumed for the 2029 and 2034 horizon years. No background growth was assumed for Spratt Road.
- The proposed development is projected to generate 'new' two-way vehicle volumes of approximately 241 and 303 veh/h during the weekday morning and afternoon peak hours, respectively.
- At full occupancy (year 2029), study area intersections 'as a whole' are projected to operate at an acceptable LoS 'C' or better and the 'critical movements' are projected to operate at acceptable levels of service during both peak hours.
- At 5-years beyond site build-out, study area intersections 'as a whole' are projected to operate at an acceptable LoS 'C' or better;

SITE PLAN

- A single road connection support up to 200 units within the subdivision and a secondary access will be required for emergency access beyond this threshold. Street No. 6 and 8 will fulfill this purpose and no other connections will be required for the subject site.
- Local roads and internal collector roads can support sidewalks along a single side of the roadway and the minor collector roads within the development are sufficiently wide enough to permit the construction of sidewalks along both sides of the road.
- Intersection narrowings are recommended on the local road approaches to the internal collectors (Street No. 6 and 8) and at the intersection of Street No. 6 and 8, as it is central within the community for both north-south and east-west travel.

Based on the foregoing, the proposed development fits well into the context of the surrounding area, and its location and design serves to promote use of walking, cycling, and transit modes, thus supporting City of Ottawa policies, goals and objectives with respect to redevelopment, intensification and modal share.

Therefore, the proposed Cardel Homes' Ironwood development is recommended from a transportation perspective.

Prepared By:

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Reviewed By:

LICENSED PROFESSIONAL ENGINEER
A. J. HARTE
100149314
Oct 2, 2017
PROVINCE OF ONTARIO

Andrew Harte, P.Eng.
Transportation Engineer

Appendix A – Current Peak Hour Traffic Volumes

5252499 - Earl Armstrong and Limebank - June - 7th - TMC
Tue Jun 7, 2016
AM Peak (7:15AM - 8:15AM) - Overall Peak Hour
All Classes (Pedestrians, Bicycles on Road, Lights)
All Movements
ID: 323544, Location: 45.2806, -75.667103, Site Code: 35948103

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	156	88	6	0	**250**	0	22	108	2	0	**132**	2	3	236	160	0	**399**	0	114	293	385	0	**792**	1	**1573**
Total	202	96	13	0	**311**	0	53	120	3	0	**176**	1	1	288	171	0	**460**	0	134	373	585	0	**1092**	1	**2039**
% Approach	65.0%	30.9%	4.2%	0%	-	-	30.1%	68.2%	1.7%	0%	-	-	0.2%	62.6%	37.2%	0%	-	-	12.3%	34.2%	53.6%	0%	-	-	-
% Total	9.9%	4.7%	0.6%	0%	**15.3%**	-	2.6%	5.9%	0.1%	0%	**8.6%**	-	0%	14.1%	8.4%	0%	**22.6%**	-	6.6%	18.3%	28.7%	0%	**53.6%**	-	-
PHF	0.743	0.774	0.813	-	**0.755**	-	0.602	0.833	0.750	-	**0.759**	-	0.250	0.800	0.929	-	**0.846**	-	0.798	0.871	0.813	-	**0.898**	-	0.929
Lights	201	94	13	0	**308**	-	53	120	3	0	**176**	-	1	287	171	0	**459**	-	132	371	585	0	**1088**	-	2031
% Lights	99.5%	97.9%	100%	0%	**99.0%**	-	100%	100%	100%	0%	**100%**	-	100%	99.7%	100%	0%	**99.8%**	-	98.5%	99.5%	100%	0%	**99.6%**	-	99.6%
Bicycles on Road	1	2	0	0	**3**	-	0	0	0	0	**0**	-	0	1	0	0	**1**	-	2	2	0	0	**4**	-	8
% Bicycles on Road	0.5%	2.1%	0%	0%	**1.0%**	-	0%	0%	0%	0%	**0%**	-	0%	0.3%	0%	0%	**0.2%**	-	1.5%	0.5%	0%	0%	**0.4%**	-	0.4%
Pedestrians	-	-	-	-		0	-	-	-	-		1	-	-	-	-		0	-	-	-	-		1	
% Pedestrians	-	-	-	-		-	-	-	-	-		100%	-	-	-	-		-	-	-	-	-		100%	

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

5252499 - Earl Armstrong and Limebank - June - 7th - TMC
Tue Jun 7, 2016
PM Peak (4PM - 5PM)
All Classes (Pedestrians, Bicycles on Road, Lights)
All Movements
ID: 323544, Location: 45.2806, -75.667103, Site Code: 35948103

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 4:00PM	469	259	13	0	**025**	0	22	277	2	0	**135**	0	2	114	103	0	**957**	0	218	191	194	0	**T31**	0	**5oT2**
4:15PM	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	**3**
4:30PM	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	**3**
4:45PM	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	0	0	0	0	**3**	0	**3**
a l t64	469	259	13	0	**025**	0	22	277	2	0	**135**	0	2	114	103	0	**957**	0	218	191	194	0	**T31**	0	**5oT2**
% Apprl 6ch	63.3%	35.0%	1.8%	0%	-	-	7.3%	92.0%	0.7%	0%	-	-	0.9%	52.1%	47.0%	0%	-	-	36.2%	31.7%	32.2%	0%	-	-	-
% a l t64	25.2%	13.9%	0.7%	0%	**17.o%**	-	1.2%	14.9%	0.1%	0%	**5T.5%**	-	0.1%	6.1%	5.5%	0%	**55.0%**	-	11.7%	10.2%	10.4%	0%	**19.1%**	-	-
8 PH	0.946	0.938	0.650	-	**3.703**	-	0.688	0.975	0.250	-	**3.700**	-	0.500	0.864	0.715	-	**3.oFF**	-	0.924	0.918	0.836	-	**3.73o**	-	0.969
Lights	468	258	13	0	**017**	-	22	277	2	0	**135**	-	2	114	103	0	**957**	-	218	191	193	0	**T39**	-	1861
% Lights	99.8%	99.6%	100%	0%	**77.0%**	-	100%	100%	100%	0%	**533%**	-	100%	100%	100%	0%	**533%**	-	100%	100%	99.5%	0%	**77.o%**	-	99.8%
Bicyc4es In Rl 6d	1	1	0	0	**9**	-	0	0	0	0	**3**	-	0	0	0	0	**3**	-	0	0	1	0	**5**	-	3
% Bicyc4es In Rl 6d	0.2%	0.4%	0%	0%	**3.1%**	-	0%	0%	0%	0%	**3%**	-	0%	0%	0%	0%	**3%**	-	0%	0%	0.5%	0%	**3.9%**	-	0.2%
Pedestrians	-	-	-	-		0	-	-	-	-		0	-	-	-	-		0	-	-	-	-		0	
% Pedestrians	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	

*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 aek(47-15 PM) A-15 PM l

P CCs Cddded 4aet edri Bnd, c Boyv Ed Rn L Rkt , gBvrdl

P CCM Rme I enrd

D -323532, gRykrnBn-. 582 6S3,)756 SSS. S, 9Be s Rte-35S. 5103

aiRnBet bo-s Bo Rf Orrkwk

110 gkuiBi Pme Wedr, Orrkwk, ON, K1a 1J1, s P

geh : Be yrBn	NRirv 9 RurvbRunt					Ekdr WedrbRunt					9 Rurv NRirvbRunt					Wedr EkdrbRunt					
TBle	L	T	g	U	App aet*	L	T	g	U	App aet*	L	T	g	U	App aet*	L	T	g	U	App aet*	Int
2016)06)07 7-15 PM	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**
7-30 PM	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-. 5 PM	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**
A-00 PM	211	A6	32	1	**220** 2	A1	66S	A6	1	**521** 6	102	302	2. A	0	**397** 2	126	76S	3A7	0	**T757** 0	**2T0T**
o atl 6	200	72	37	1	**2T0** 3	111	711	73	0	**549** 2	7.	3A5	2SS	0	**195** 1	123	10. 1	3. .	1	**T904** 2	**2%47**
rAppcal h-	6. 6%	238%	118%	08%	**.**)	128 %	758. %	A8%	0%	**.**)	58%	50%	358 %	0%	**.**)	A8%	6S0%	228%	08%	**.**)	)
ro atl 6	58%	28%	18%	0%	**584**)	382%	208%	28%	0%	**7985**)	28%	118%	A6%	0%	**7185**)	36%	30%	S6%	0%	**%289**)	)
PHF	08735	08720	08771	08250	**08197**)	08A67	08536	08760	)	**08%%**)	08AA1	08A5S	08A13	)	**08591**)	08A0S	08A70	08AS6	08250	**08479**)	08SS5
Lig- ts	200	72	37	1	**2T0**)	111	710	73	0	**54%**)	7.	3A5	2SS	0	**195**)	123	1037	3. .	1	**T909**)	3. 67
rLig- ts	100%	100%	100%	100%	**T00**)	100%	SS8%	100%	0%	**4484**)	100%	100%	100%	0%	**T00**)	100%	SS6%	100%	100%	**4481**)	SS8%
Bihyh%s an Ral d	0	0	0	0	**0**)	0	1	0	0	**T**)	0	0	0	0	**0**)	0	.	0	0	**%**)	5
rBihyh%s and Ral d	0%	0%	0%	0%	**0**)	0%	081%	0%	0%	**08T**)	0%	0%	0%	0%	**0**)	0%	08 %	0%	0%	**082**)	08%
aet edri Bnd	)	)	)	)	3	)	)	)	)	2	)	)	)	)	1	)	)	)	)	2	
% aet edri Bnd	)	)	)	)	100%	)	)	)	)	100%	)	)	)	)	100%	)	)	)	)	100%	

*aet edri Bnd knt c Boyv Ed Rn s iRddwkC8g-gefr, L-LBivr, T-Tviu, U-U)Tuin

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

Tue Jun 7, 2016

AM AePa k(:50 AM - 8:50 AM) - OverPll AePa Hour

Cll s lPdded kAet edir Bnd, c BRyled on Lo Pt , gBnmid)

Cll Move I enid

D: 525852, goyPBn: (826. 5, -784 6. . . (. , SBe s ote: 58. (8105

AroviBet 9Rs BRobOiiPf P

110 gPurBr Cve w edi, OiiPf P, OW, N1A 1J1, s C

geh 3 Be yiBn	Worim Souim9ount					KPdi w edi9ount					Souim Worim9ount					w e di KPdi9ount					
TBle	L	T	g	E	App Aet U	L	T	g	E	App Aet U	L	T	g	E	App Aet U	L	T	g	E	App Aet U	Int
2016-06-07 (:50 AM	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 AM	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**
8:00 AM	75(	25.	5(	0	**2005** 0	55	*81	106	0	**110** 0	61	127	208	0	**313** 1	2*6	72(	558	0	**2397** 0	**3537**
8:18 AM	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	70(	266	2.	0	**111** 5	51	*17	10.	0	**175** 0	70	115	205	1	**365** 0	50(	*2*	505	0	**2937** 5	**3556**
4 %App oarc	704	8%	264	6%	24 % 0% **h** -	54	2%	*84	(%	114 (% 0% **h** -	1*4	1%	2. 42	0%	824 8% 045% **h** -	214	2%	874	7%	214 0% 0% **h** -	-
4 %Total	1*4	6%	74	0%	04 *% 0% **-. 194** -	04	*%	214	6%	24. % 0% **-784** -	14 %		540	0%	84 (% 0% **208-4** -	*4	0%	214 %		*4 0% 0% **3614 04** -	-
PHF	04. 81		04* 21	04* 06	**- 0819-** -	04*	61	04*	77	04* 26 **- 0866 1** -	047	61	046	87	04 (0 04280 **0866 6** -	04*	6(	04 00		04 (7 **- 0816.** -	04 7.
Lig cts	70(	266	2.	0	**111** -	51	*17	10.	0	**175** -	70	115	205	1	**365** -	50(	*26	505	0	**2933** -	5776
4 %Lig cts	100%	100%	100%	0%	**2004** -	100%	100%	100%	0%	**2004** -	100%	100%	100%	100%	**2004** -	100%	. . 4*	%	100%	0% **1184** -	. . 4 %
Bir yr les %s n Road	0	0	0	0	**0** -	0	0	0	0	**0** -	0	0	0	0	**0** -	0	2	0	0	**-** -	2
4 %Bir yr les on %Road	0%	0%	0%	0%	**04** -	0%	0%	0%	0%	**04** -	0%	0%	0%	0%	**04** -	0%	042	%	0%	0% **0824** -	04 %
Aet edri Bnd	-	-	-	-	5	-	-	-	-	0	-	-	-	-	0	-	-	-	-	5	
% Aet edri Bnd	-	-	-	-	100%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	

UAet edri Bnd Pnt c BRyled on s roddf Pla4g: gebi, L: LBimi, T: Tmru, E: E-Turn

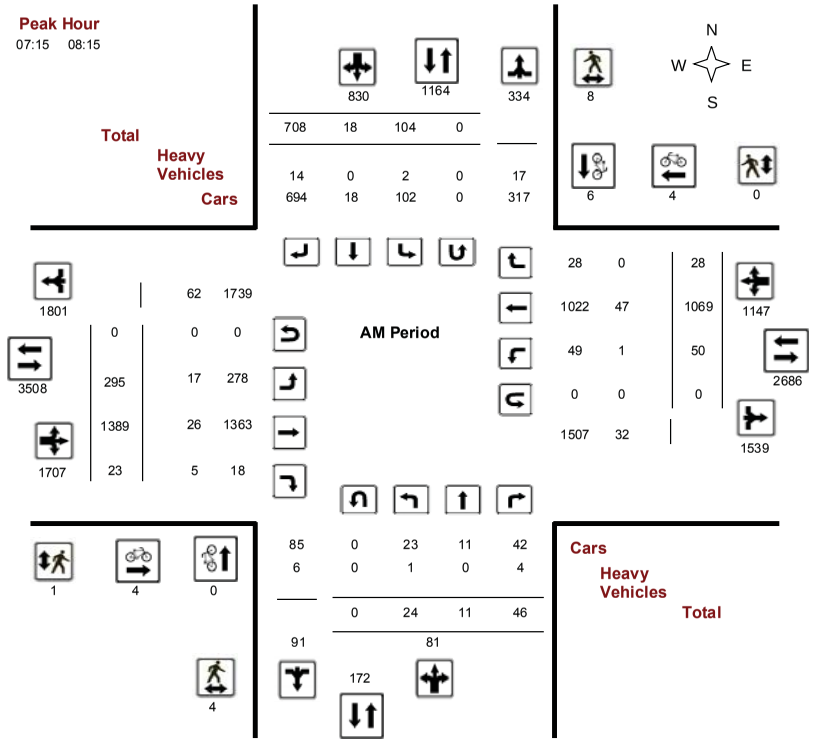
Transportation Services - Traffic Services

Turning Movement Count - AM Period Diagram

EARL ARMSTRONG RD @ SPRATT RD

Survey Date: Monday, August 17, 2015
Start Time: 07:00

WO#: 35250
Device: Jamar Technologies, Inc



Comments :

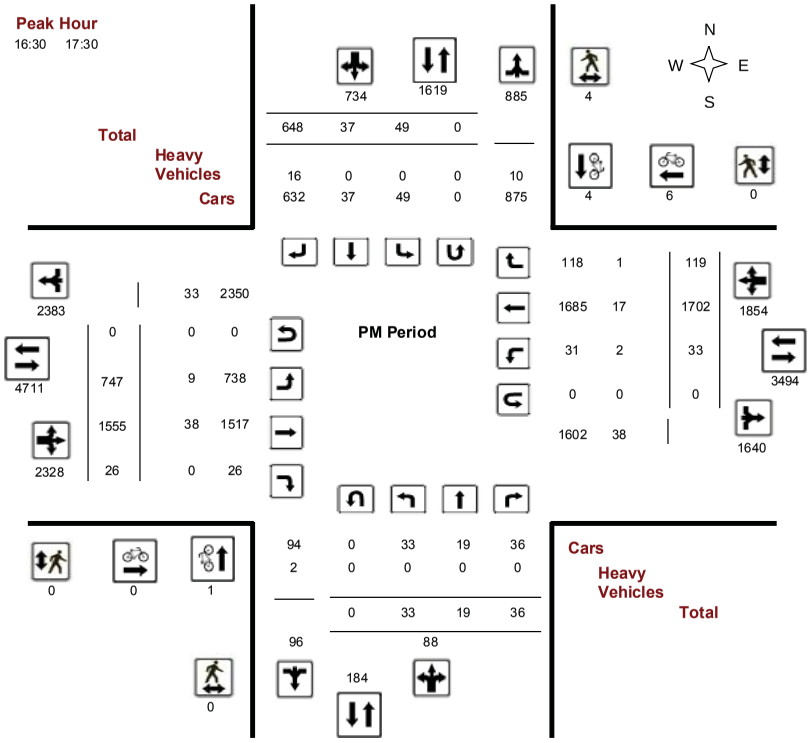
Transportation Services - Traffic Services

Turning Movement Count - PM Period Diagram

EARL ARMSTRONG RD @ SPRATT RD

Survey Date: Monday, August 17, 2015
Start Time: 07:00

WO#: 35250
Device: Jamar Technologies, Inc



Comments :

Intersection: Spratt / Rideau

Date: Tuesday, May 30, 2017

Time: 7:00AM to 8:30AM

Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	15-Minute Total
7:00AM - 7:15AM	0	1	19	0	2	0	1	8	0	2	15	2	50
7:15AM - 7:30AM	2	7	14	3	4	1	0	23	0	0	9	2	65
7:30AM - 7:45AM	1	6	16	2	5	0	1	23	1	3	22	1	81
7:45AM - 8:00AM	2	7	18	1	5	0	0	21	0	9	17	5	85
8:00AM - 8:15AM	1	7	14	4	10	1	2	13	0	2	16	3	73
8:15AM - 8:30AM	1	8	5	1	6	2	1	17	2	3	14	0	60
1.5 Hour Total	7	36	86	11	32	4	5	105	3	19	93	13	407

Intersection: Spratt / Rideau

Date: Tuesday, May 30, 2017

Time: 4:00PM to 5:30PM

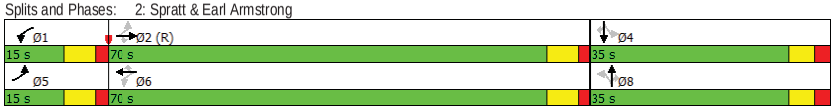
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR	15-Minute Total
4:00PM - 4:15PM	0	7	4	3	12	1	1	19	0	17	42	0	106
4:15PM - 4:30PM	0	6	4	5	5	0	0	13	0	21	46	0	100
4:30PM - 4:45PM	1	9	3	5	6	1	1	10	1	22	54	1	114
4:45PM - 5:00PM	3	6	3	5	9	1	0	15	0	19	55	3	119
5:00PM - 5:15PM	3	6	3	5	6	0	1	14	1	20	50	3	112
5:15PM - 5:30PM	1	4	3	2	7	0	0	16	1	25	52	1	112
1.5 Hour Total	8	38	20	25	45	3	3	87	3	124	299	8	655

Appendix B – SYNCHRO Capacity Analysis: Existing Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	608	8	15	430	6	5	2	19	35	9	252
Future Volume (vph)	59	608	8	15	430	6	5	2	19	35	9	252
Lane Group Flow (vph)	62	640	8	16	453	6	5	2	20	37	9	265
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	15.0	70.0	70.0	15.0	70.0	70.0	35.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	12.5%	58.3%	58.3%	12.5%	58.3%	58.3%	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	97.4	93.5	93.5	94.6	88.0	88.0	13.5	13.5	13.5	13.5	13.5	13.5
Actuated g/C Ratio	0.81	0.78	0.78	0.79	0.73	0.73	0.11	0.11	0.11	0.11	0.11	0.11
v/c Ratio	0.09	0.25	0.01	0.03	0.19	0.01	0.03	0.01	0.08	0.25	0.02	0.66
Control Delay	3.4	5.6	0.0	3.5	6.6	0.0	42.2	41.0	0.7	49.5	42.3	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	3.4	5.6	0.0	3.5	6.6	0.0	42.2	41.0	0.7	49.5	42.3	13.6
LOS	A	A	A	A	A	A	D	D	A	D	D	B
Approach Delay		5.3			6.4			11.4			18.7	
Approach LOS		A			A			B			B	
Queue Length 50th (m)	1.8	11.4	0.0	0.4	14.8	0.0	1.1	0.2	0.0	8.3	1.0	0.0
Queue Length 95th (m)	8.0	47.6	0.0	3.0	34.1	0.0	4.3	1.3	0.0	16.2	3.1	21.6
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	739	2582	1151	661	2431	1083	338	856	441	340	856	574
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.25	0.01	0.02	0.19	0.01	0.01	0.00	0.05	0.11	0.01	0.46

Intersection Summary			
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 93 (78%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.66			
Intersection Signal Delay: 8.5		Intersection LOS: A	
Intersection Capacity Utilization 44.3%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 2: Spratt & Earl Armstrong



Existing AM
6: Spratt & Rideau 06/08/2017

Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	105	93	36	32
Future Volume (vph)	105	93	36	32
Lane Group Flow (vph)	119	132	136	50
Sign Control	Stop	Stop	Stop	Stop

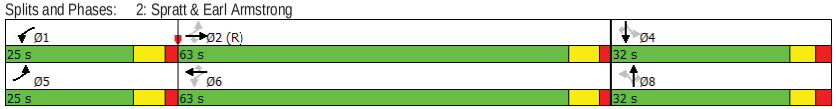
Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 28.9%		ICU Level of Service A
Analysis Period (min) 15		

Existing PM
2: Spratt & Earl Armstrong 06/08/2017

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	316	610	6	6	686	40	11	9	11	14	13	233
Future Volume (vph)	316	610	6	6	686	40	11	9	11	14	13	233
Lane Group Flow (vph)	333	642	6	6	722	42	12	9	12	15	14	245
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	25.0	63.0	63.0	25.0	63.0	63.0	32.0	32.0	32.0	32.0	32.0	32.0
Total Split (%)	20.8%	52.5%	52.5%	20.8%	52.5%	52.5%	26.7%	26.7%	26.7%	26.7%	26.7%	26.7%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	101.0	98.6	98.6	91.9	84.0	84.0	11.0	11.0	11.0	11.0	11.0	11.0
Actuated g/C Ratio	0.84	0.82	0.82	0.77	0.70	0.70	0.09	0.09	0.09	0.09	0.09	0.09
v/c Ratio	0.55	0.24	0.00	0.01	0.31	0.04	0.10	0.03	0.06	0.12	0.05	0.69
Control Delay	5.8	3.5	0.0	3.0	8.2	0.1	49.0	46.6	0.5	49.8	47.2	16.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	5.8	3.5	0.0	3.0	8.2	0.1	49.0	46.6	0.5	49.8	47.2	16.5
LOS	A	A	A	A	A	A	D	D	A	D	D	B
Approach Delay		4.2			7.7			30.7			19.9	
Approach LOS		A			A			C			B	
Queue Length 50th (m)	9.7	9.7	0.0	0.2	27.7	0.0	2.7	1.0	0.0	3.4	1.6	0.0
Queue Length 95th (m)	26.3	37.1	0.0	1.1	55.3	0.3	8.1	3.4	0.0	9.4	4.6	23.0
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	680	2723	1233	763	2320	1042	304	773	408	305	773	529
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.24	0.00	0.01	0.31	0.04	0.04	0.01	0.03	0.05	0.02	0.46

Intersection Summary		
Cycle Length: 120		
Actuated Cycle Length: 120		
Offset: 15 (13%), Referenced to phase 2:EBTL, Start of Green		
Natural Cycle: 80		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.69		
Intersection Signal Delay: 8.0	Intersection LOS: A	
Intersection Capacity Utilization 56.0%	ICU Level of Service B	
Analysis Period (min) 15		

Splits and Phases: 2: Spratt & Earl Armstrong



Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	109	362	47	62
Future Volume (vph)	109	362	47	62
Lane Group Flow (vph)	122	565	80	100
Sign Control	Stop	Stop	Stop	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 55.5%		ICU Level of Service B
Analysis Period (min) 15		

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	3	3	0	2	0	5	0	0	13	72%
Non-fatal injury	0	4	0	1	0	0	0	0	5	28%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**3**	**7**	**0**	**3**	**0**	**5**	**0**	**0**	**18**	100%
	#3 or 17%	#1 or 39%	#5 or 0%	#3 or 17%	#5 or 0%	#2 or 28%	#5 or 0%	#5 or 0%		

EARL ARMSTRONG RD/SPRATT RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2013-2015	14	19,340	1095	**0.66**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	3	3	0	1	0	2	0	0	9	64%
Non-fatal injury	0	4	0	1	0	0	0	0	5	36%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**3**	**7**	**0**	**2**	**0**	**2**	**0**	**0**	**14**	100%
	21%	50%	0%	14%	0%	14%	0%	0%		

SPRATT RD, EARL ARMSTRONG RD to RIDEAU RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2013-2015	3	845	1095	**3.24**

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	3	0	0	3	100%
Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**	**3**	100%
	0%	0%	0%	0%	0%	100%	0%	0%		

RIDEAU RD/SPRATT RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2013-2015	1	n/a	1095	**n/a**

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	1	0	0	0	0	1	100%
Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	100%
	0%	0%	0%	100%	0%	0%	0%	0%		

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** December 31, 2015

Location: EARL ARMSTRONG RD @ SPRATT RD

Traffic Control: Traffic signal **Total Collisions:** 10

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Apr-04, Fri,10:30	Clear	SMV other	P.D. only	Dry	East	Turning left	Pick-up truck	Ran off road	
2014-Oct-30, Thu,18:39	Clear	Rear end	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle	
					South	Turning right	Pick-up truck	Other motor vehicle	
2014-Jan-03, Fri,11:15	Snow	Turning movement	P.D. only	Ice	East	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Pick-up truck	Other motor vehicle	
2014-May-27, Tue,09:20	Clear	Rear end	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle	
					South	Turning right	Passenger van	Other motor vehicle	
2015-Feb-12, Thu,20:30	Clear	Angle	P.D. only	Loose snow	South	Turning right	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Dec-16, Tue,08:54	Clear	Turning movement	Non-fatal injury	Dry	East	Turning left	Pick-up truck	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	

2014-Jul-04, Fri,18:09	Clear	Turning movement	Non-fatal injury	Dry	East	Turning left	Pick-up truck	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2015-May-19, Tue,16:21	Clear	Turning movement	Non-fatal injury	Dry	West	Going ahead	Pick-up truck	Other motor vehicle
					East	Turning left	Passenger van	Other motor vehicle
2015-May-28, Thu,08:30	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2015-Sep-17, Thu,14:25	Clear	Rear end	P.D. only	Dry	East	Slowing or stopping	Pick-up truck	Other motor vehicle
					East	Stopped	Passenger van	Other motor vehicle

Location: SPRATT RD btwn EARL ARMSTRONG RD & RIDEAU RD

Traffic Control: No control **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Sep-03, Wed,19:30	Clear	SMV other	P.D. only	Dry	North	Going ahead	Pick-up truck	Animal - wild	
2015-Jul-25, Sat,06:40	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Ditch	

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2013-01-01 TO: 2014-01-01

EARL ARMSTRONG RD & SPRATT RD

Former Municipality: **Gloucester** Traffic Control: **Traffic signal** Number of Collisions: **4**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2013-02-28	Thu	08:02	Snow	Daylight	Angle	Non-fatal	V1 W	Packed snow	Going ahead	Automobile, station	Other motor vehicle	0
								V2 N	Packed snow	Turning left	Pick-up truck	Other motor vehicle	
2	2013-11-01	Fri	01:30	Clear	Dark	Single vehicle	P.D. only	V1 E	Wet	Turning left	Automobile, station	Curb	0
3	2013-11-14	Thu	18:03	Clear	Dark	Turning	P.D. only	V1 N	Dry	Turning left	Pick-up truck	Other motor vehicle	0
								V2 S	Dry	Going ahead	Automobile, station	Other motor vehicle	
4	2013-11-17	Sun	13:27	Clear	Daylight	Turning	P.D. only	V1 E	Dry	Turning left	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Going ahead	Automobile, station	Other motor vehicle	

RIDEAU RD & SPRATT RD

Former Municipality: **Gloucester** Traffic Control: **Stop sign** Number of Collisions: **1**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
5	2013-07-30	Tue	08:58	Clear	Daylight	Angle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Turning left	Passenger van	Other motor vehicle	

SPRATT RD, EARL ARMSTRONG RD to RIDEAU RD

Former Municipality: **Gloucester** Traffic Control: **No control** Number of Collisions: **1**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
6	2013-02-14	Thu	20:16	Snow	Dark	Single vehicle	P.D. only	V1 N	Wet	Going ahead	Automobile, station	Ran off road	0

(Note: Time of Day = "00:00" represents unknown collision time

Appendix D – Screenline Traffic Volumes

Screenline Earl Armstrong 2017 (Inbound - NB, Outbound - SB)			Direction	Peak	Passenger Veh	Taxis	Light Trucks	Heavy Trucks	Buses	Other	Total Vehicles	PCUs	v/c
Station	**# lanes**	**Assumed Capacity***											
River	2	2,000	Inbound	AM	524			131			655	786	0.39
				PM	309			78			387	465	0.23
			Outbound	AM	239			60			299	359	0.18
				PM	545			137			**682**	**819**	**0.41**
Spratt	2	1,680	Inbound	AM	20			6			26	32	0.02
				PM	24			7			31	38	0.02
			Outbound	AM	28			8			**36**	**44**	**0.03**
				PM	20			5			25	30	0.02
Limebank	2	2,100	Inbound	AM	370			93			463	556	0.26
				PM	176			44			220	264	0.13
			Outbound	AM	187			47			234	281	0.13
				PM	385			97			**482**	**579**	**0.28**
TOTAL	**6**	**5,780**	Inbound	AM	914	0	0	230	0	0	1144	1374	0.24
				PM	509	0	0	129	0	0	638	767	0.13
			Outbound	AM	454	0	0	115	0	0	569	684	0.12
				PM	950	0	0	239	0	0	**1189**	**1428**	**0.25**

** Assumed capacity based on similar suburban roads obtained from the 2008 Road Infrastructure Needs Study*

Screenline Earl Armstrong 2029 (Inbound - NB, Outbound - SB)			Direction	Peak	Passenger Veh	Taxis	Light Trucks	Heavy Trucks	Buses	Other	Total Vehicles	PCUs	v/c
Station	**# lanes**	**Assumed Capacity***											
River	2	2,000	Inbound	AM	562			141			703	844	0.42
				PM	326			81			407	488	0.24
			Outbound	AM	253			63			316	379	0.19
				PM	597			149			**746**	**895**	**0.45**
Spratt	2	1,680	Inbound	AM	178			44			222	266	0.16
				PM	119			30			149	179	0.11
			Outbound	AM	74			19			93	112	0.07
				PM	180			45			**225**	**270**	**0.16**
Limebank	2	2,100	Inbound	AM	400			100			500	600	0.29
				PM	188			47			235	282	0.13
			Outbound	AM	197			49			246	295	0.14
				PM	412			103			**515**	**618**	**0.29**
TOTAL	**6**	**5,780**	Inbound	AM	1140	0	0	285	0	0	1425	1710	0.30
				PM	633	0	0	158	0	0	791	949	0.16
			Outbound	AM	524	0	0	131	0	0	655	786	0.14
				PM	1189	0	0	297	0	0	**1486**	**1783**	**0.31**

** Assumed capacity based on similar suburban roads obtained from the 2008 Road Infrastructure Needs Study*

Screenline Earl Armstrong 2034 (Inbound - NB, Outbound - SB)			Direction	Peak	Passenger Veh	Taxis	Light Trucks	Heavy Trucks	Buses	Other	Total Vehicles	PCUs	v/c
Station	**# lanes**	**Assumed Capacity***											
River	2	2,000	Inbound	AM	577			144			721	865	0.43
				PM	330			83			413	496	0.25
			Outbound	AM	257			64			321	385	0.19
				PM	609			152			**761**	**913**	**0.46**
Spratt	2	1,680	Inbound	AM	178			44			222	266	0.16
				PM	119			30			149	179	0.11
			Outbound	AM	74			19			93	112	0.07
				PM	180			45			**225**	**270**	**0.16**
Limebank	2	2,100	Inbound	AM	413			103			516	619	0.29
				PM	193			48			241	289	0.14
			Outbound	AM	202			50			252	302	0.14
				PM	424			106			**530**	**636**	**0.30**
TOTAL	**6**	**5,780**	Inbound	AM	1168	0	0	291	0	0	1459	1750	0.30
				PM	642	0	0	161	0	0	803	964	0.17
			Outbound	AM	533	0	0	133	0	0	666	799	0.14
				PM	1213	0	0	303	0	0	**1516**	**1819**	**0.31**

** Assumed capacity based on similar suburban roads obtained from the 2008 Road Infrastructure Needs Study*

Appendix E – SYNCHRO Capacity Analysis: Projected 2029 Conditions

Projected 2029 AM
1: Spratt/Spatt & Site Access 06/19/2017

Lane Group	EBL	NBT	SBT
Lane Configurations			
Traffic Volume (vph)	171	20	24
Future Volume (vph)	171	20	24
Lane Group Flow (vph)	189	24	73
Sign Control	Stop	Free	Free

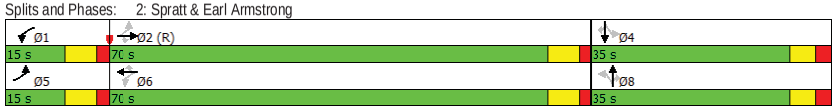
Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 21.6%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2029 AM
2: Spratt & Earl Armstrong 06/19/2017

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	705	18	35	550	6	39	102	81	35	40	252
Future Volume (vph)	59	705	18	35	550	6	39	102	81	35	40	252
Lane Group Flow (vph)	62	742	19	37	579	6	41	107	85	37	42	265
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	15.0	70.0	70.0	15.0	70.0	70.0	35.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	12.5%	58.3%	58.3%	12.5%	58.3%	58.3%	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	95.7	90.1	90.1	94.2	87.3	87.3	14.2	14.2	14.2	14.2	14.2	14.2
Actuated g/C Ratio	0.80	0.75	0.75	0.78	0.73	0.73	0.12	0.12	0.12	0.12	0.12	0.12
v/c Ratio	0.10	0.30	0.02	0.07	0.24	0.01	0.27	0.27	0.34	0.26	0.11	0.65
Control Delay	3.5	6.8	0.1	3.6	7.1	0.0	49.9	48.0	11.9	49.8	44.7	13.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.5	6.8	0.1	3.6	7.1	0.0	49.9	48.0	11.9	49.8	44.7	13.1
LOS	A	A	A	A	A	A	D	D	B	D	D	B
Approach Delay		6.4			6.8			35.2			20.9	
Approach LOS		A			A			D			C	
Queue Length 50th (m)	1.8	27.4	0.0	1.1	20.3	0.0	9.2	12.5	0.0	8.3	4.8	0.0
Queue Length 95th (m)	8.0	57.6	0.0	5.4	44.3	0.0	17.5	18.3	12.1	16.4	8.8	21.6
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	663	2489	1113	590	2412	1075	327	856	441	308	856	574
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.30	0.02	0.06	0.24	0.01	0.13	0.13	0.19	0.12	0.05	0.46

Intersection Summary		
Cycle Length: 120		
Actuated Cycle Length: 120		
Offset: 93 (78%), Referenced to phase 2:EBTL, Start of Green		
Natural Cycle: 75		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.65		
Intersection Signal Delay: 12.3	Intersection LOS: B	
Intersection Capacity Utilization 47.0%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 2: Spratt & Earl Armstrong



Lane Group	EBT	WBT	SBL
Lane Configurations			
Traffic Volume (vph)	113	104	9
Future Volume (vph)	113	104	9
Lane Group Flow (vph)	119	112	9
Sign Control	Free	Free	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 16.3%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2029 AM
6: Spratt & Rideau 06/19/2017

Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	105	93	39	41
Future Volume (vph)	105	93	39	41
Lane Group Flow (vph)	129	132	143	59
Sign Control	Stop	Stop	Stop	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 29.6%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2029 PM
1: Spratt/Spatt & Site Access 06/19/2017

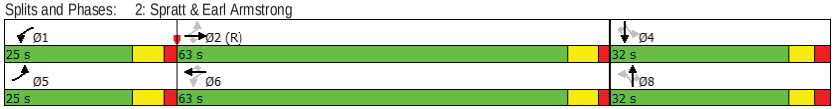
Lane Group	EBL	NBT	SBT
Lane Configurations			
Traffic Volume (vph)	98	24	19
Future Volume (vph)	98	24	19
Lane Group Flow (vph)	108	36	204
Sign Control	Stop	Free	Free

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 25.2%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	316	762	41	69	817	40	32	68	49	14	115	233
Future Volume (vph)	316	762	41	69	817	40	32	68	49	14	115	233
Lane Group Flow (vph)	333	802	43	73	860	42	34	72	52	15	121	245
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	25.0	63.0	63.0	25.0	63.0	63.0	32.0	32.0	32.0	32.0	32.0	32.0
Total Split (%)	20.8%	52.5%	52.5%	20.8%	52.5%	52.5%	26.7%	26.7%	26.7%	26.7%	26.7%	26.7%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	99.0	88.6	88.6	90.0	81.1	81.1	12.8	12.8	12.8	12.8	12.8	12.8
Actuated g/C Ratio	0.82	0.74	0.74	0.75	0.68	0.68	0.11	0.11	0.11	0.11	0.11	0.11
v/c Ratio	0.62	0.33	0.04	0.14	0.38	0.04	0.27	0.20	0.22	0.11	0.34	0.65
Control Delay	7.9	6.7	0.1	3.5	10.1	0.1	53.2	48.9	4.7	48.2	51.3	14.6
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	7.9	6.7	0.1	3.5	10.1	0.1	53.2	48.9	4.7	48.2	51.3	14.6
LOS	A	A	A	A	B	A	D	D	A	D	D	B
Approach Delay		6.8			9.2			35.3			27.6	
Approach LOS		A			A			D			C	
Queue Length 50th (m)	12.3	31.4	0.0	2.3	39.6	0.0	7.6	8.3	0.0	3.3	14.2	0.0
Queue Length 95th (m)	27.4	52.4	0.4	6.6	74.9	0.3	16.7	14.6	3.5	9.4	22.2	22.8
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	606	2449	1118	682	2241	1010	274	773	408	288	773	529
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.33	0.04	0.11	0.38	0.04	0.12	0.09	0.13	0.05	0.16	0.46

Intersection Summary			
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 15 (13%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.65			
Intersection Signal Delay: 12.3		Intersection LOS: B	
Intersection Capacity Utilization 60.9%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Spratt & Earl Armstrong



Lane Group	EBT	WBT	SBL
Lane Configurations			
Traffic Volume (vph)	116	374	5
Future Volume (vph)	116	374	5
Lane Group Flow (vph)	122	405	5
Sign Control	Free	Free	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization	31.4%	ICU Level of Service A
Analysis Period (min)	15	

Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	109	362	57	67
Future Volume (vph)	109	362	57	67
Lane Group Flow (vph)	127	565	102	106
Sign Control	Stop	Stop	Stop	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization	52.9%	ICU Level of Service A
Analysis Period (min)	15	

Appendix F – SYNCHRO Capacity Analysis: Projected 2034 Conditions

Projected 2034 AM
1: Spratt/Spatt & Site Access 06/19/2017

Lane Group	EBL	NBT	SBT
Lane Configurations			
Traffic Volume (vph)	171	20	24
Future Volume (vph)	171	20	24
Lane Group Flow (vph)	189	24	73
Sign Control	Stop	Free	Free

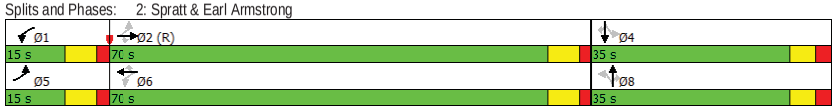
Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 21.6%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2034 AM
2: Spratt & Earl Armstrong 06/19/2017

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	59	740	18	35	575	6	39	102	81	35	40	252
Future Volume (vph)	59	740	18	35	575	6	39	102	81	35	40	252
Lane Group Flow (vph)	62	779	19	37	605	6	41	107	85	37	42	265
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	15.0	70.0	70.0	15.0	70.0	70.0	35.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	12.5%	58.3%	58.3%	12.5%	58.3%	58.3%	29.2%	29.2%	29.2%	29.2%	29.2%	29.2%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	95.7	90.1	90.1	94.2	87.3	87.3	14.2	14.2	14.2	14.2	14.2	14.2
Actuated g/C Ratio	0.80	0.75	0.75	0.78	0.73	0.73	0.12	0.12	0.12	0.12	0.12	0.12
v/c Ratio	0.10	0.31	0.02	0.07	0.25	0.01	0.27	0.27	0.34	0.26	0.11	0.65
Control Delay	3.5	6.9	0.1	3.6	7.1	0.0	49.9	48.0	11.9	49.8	44.7	13.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.5	6.9	0.1	3.6	7.1	0.0	49.9	48.0	11.9	49.8	44.7	13.1
LOS	A	A	A	A	A	A	D	D	B	D	D	B
Approach Delay		6.5			6.9			35.2			20.9	
Approach LOS		A			A			D			C	
Queue Length 50th (m)	1.8	29.2	0.0	1.1	21.4	0.0	9.2	12.5	0.0	8.3	4.8	0.0
Queue Length 95th (m)	8.0	61.2	0.0	5.4	46.5	0.0	17.5	18.3	12.1	16.4	8.8	21.6
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	648	2489	1113	571	2412	1075	327	856	441	308	856	574
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.10	0.31	0.02	0.06	0.25	0.01	0.13	0.13	0.19	0.12	0.05	0.46

Intersection Summary		
Cycle Length: 120		
Actuated Cycle Length: 120		
Offset: 93 (78%), Referenced to phase 2:EBTL, Start of Green		
Natural Cycle: 75		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.65		
Intersection Signal Delay: 12.2	Intersection LOS: B	
Intersection Capacity Utilization 47.6%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 2: Spratt & Earl Armstrong



Lane Group	EBT	WBT	SBL
Lane Configurations			
Traffic Volume (vph)	113	104	9
Future Volume (vph)	113	104	9
Lane Group Flow (vph)	119	112	9
Sign Control	Free	Free	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 16.3%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2034 AM
6: Rideau 06/19/2017

Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	105	93	39	41
Future Volume (vph)	105	93	39	41
Lane Group Flow (vph)	129	132	143	59
Sign Control	Stop	Stop	Stop	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 29.6%		ICU Level of Service A
Analysis Period (min) 15		

Projected 2034 PM
1: Spratt/Spatt & Site Access 06/19/2017

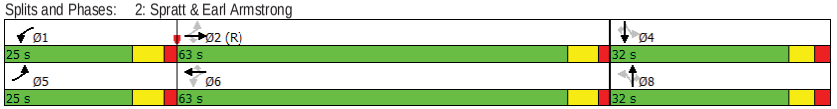
Lane Group	EBL	NBT	SBT
Lane Configurations			
Traffic Volume (vph)	98	24	19
Future Volume (vph)	98	24	19
Lane Group Flow (vph)	108	36	204
Sign Control	Stop	Free	Free

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization 25.2%		ICU Level of Service A
Analysis Period (min) 15		

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	316	797	41	69	857	40	32	68	49	14	115	233
Future Volume (vph)	316	797	41	69	857	40	32	68	49	14	115	233
Lane Group Flow (vph)	333	839	43	73	902	42	34	72	52	15	121	245
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Detector Phase	5	2	2	1	6	6	8	8	8	4	4	4
Switch Phase												
Minimum Initial (s)	5.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	11.4	30.3	30.3	11.4	30.3	30.3	31.2	31.2	31.2	31.2	31.2	31.2
Total Split (s)	25.0	63.0	63.0	25.0	63.0	63.0	32.0	32.0	32.0	32.0	32.0	32.0
Total Split (%)	20.8%	52.5%	52.5%	20.8%	52.5%	52.5%	26.7%	26.7%	26.7%	26.7%	26.7%	26.7%
Yellow Time (s)	4.6	4.6	4.6	4.6	4.6	4.6	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	1.8	1.7	1.7	1.8	1.7	1.7	2.5	2.5	2.5	2.5	2.5	2.5
Lost Time Adjust (s)	-2.4	-2.3	-2.3	-2.4	-2.3	-2.3	-2.2	-2.2	-2.2	-2.2	-2.2	-2.2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes						
Recall Mode	None	C-Max	C-Max	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	99.0	88.6	88.6	89.7	80.8	80.8	12.8	12.8	12.8	12.8	12.8	12.8
Actuated g/C Ratio	0.82	0.74	0.74	0.75	0.67	0.67	0.11	0.11	0.11	0.11	0.11	0.11
v/c Ratio	0.64	0.34	0.04	0.14	0.40	0.04	0.27	0.20	0.22	0.11	0.34	0.65
Control Delay	8.5	6.8	0.1	3.7	10.6	0.1	53.2	48.9	4.7	48.2	51.3	14.6
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	8.5	6.8	0.1	3.7	10.6	0.1	53.2	48.9	4.7	48.2	51.3	14.6
LOS	A	A	A	A	B	A	D	D	A	D	D	B
Approach Delay		7.0			9.7			35.3			27.6	
Approach LOS		A			A			D			C	
Queue Length 50th (m)	12.3	33.3	0.0	2.3	42.4	0.0	7.6	8.3	0.0	3.3	14.2	0.0
Queue Length 95th (m)	27.4	55.6	0.4	6.6	82.6	0.3	16.7	14.6	3.5	9.4	22.2	22.8
Internal Link Dist (m)		597.2			504.8			103.7			577.6	
Turn Bay Length (m)	55.0		88.0	52.0		80.0	55.0		20.0	90.0		25.0
Base Capacity (vph)	593	2449	1118	666	2231	1006	274	773	408	288	773	529
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.34	0.04	0.11	0.40	0.04	0.12	0.09	0.13	0.05	0.16	0.46

Intersection Summary			
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 15 (13%), Referenced to phase 2:EBTL, Start of Green			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.65			
Intersection Signal Delay: 12.4		Intersection LOS: B	
Intersection Capacity Utilization 62.0%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 2: Spratt & Earl Armstrong



Lane Group	EBT	WBT	SBL
Lane Configurations			
Traffic Volume (vph)	116	374	5
Future Volume (vph)	116	374	5
Lane Group Flow (vph)	122	405	5
Sign Control	Free	Free	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization	31.4%	ICU Level of Service A
Analysis Period (min)	15	

Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	109	362	57	67
Future Volume (vph)	109	362	57	67
Lane Group Flow (vph)	127	565	102	106
Sign Control	Stop	Stop	Stop	Stop

Intersection Summary		
Control Type: Unsignalized		
Intersection Capacity Utilization	52.9%	ICU Level of Service A
Analysis Period (min)	15	