AZURE URBAN

929 Richmond

TRANSPORTATION IMPACT STUDY

December
2017

PARSONS

TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check ✓ appropriate field(s)] is either transportation engineering ☑ or transportation planning ☐.

[1,2] **License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.**

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Dated at Ottawa this 12 day of December, 20 17 .
(City)

Name: Ronald Jack
(Please Print)

Professional Title: Senior Transportation Engineer

Signature of Individual certifier that s/he meets the above four criteria

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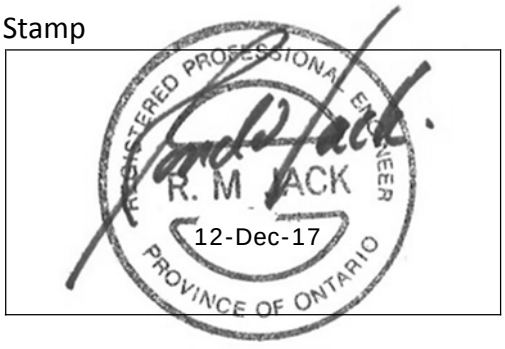
Stamp



929 Richmond

Transportation Impact Assessment

prepared for:
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929 Richmond Road
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Suite 100
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December 12, 2017

476519-01000

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Transportation Impact Assessment

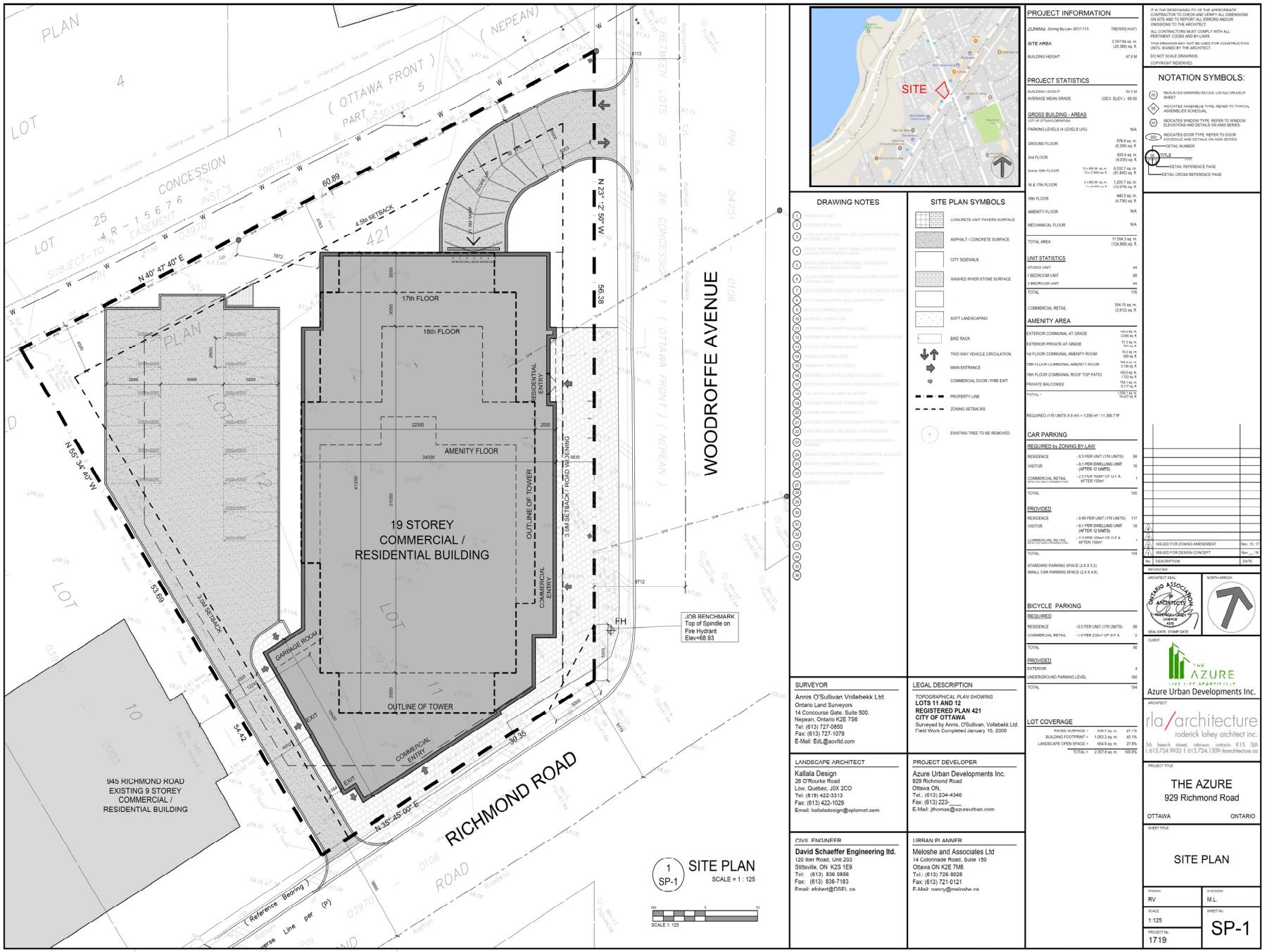
1. INTRODUCTION

Azure Developments is proposing the construction of an 19-storey residential building consisting of approximately 176 residential units and 3,812 ft² (355 m²) of ground floor retail, located at 929 Richmond Road. The site is located in the northwest quadrant of the Woodroffe/Richmond intersection. A development application was previously submitted for the same site, proposing 14-storey residential with approximately 85 units, however, due to market demand, the plan has been revised and is being resubmitted.

Vehicle assess is proposes via two full-movement driveways, one to Woodroffe Avenue and one to Richmond Road. The Woodroffe Avenue driveway connection provides access to the proposed underground parking garage, consisting of 126 parking spaces. The Richmond Road driveway connection provides access to a smaller surface parking lot, consisting of 14 proposed parking spaces, and this driveway will also be used for loading (i.e. garbage pickup). The development is expected to be constructed by 2019 and as such the horizon years 2019 and 2024 are assessed herein to represent build-out year and 5-years beyond build-out. No phasing for the development is planned. The local context of the site is provided as Figure 1 and the proposed Site Plan is provided as Figure 2.

Figure 1: Local Context

As part of the Site Plan Approval process, the City of Ottawa requires a submission of a formal Transportation Impact Assessment (TIA) consistent with their updated 2017 guidelines. With respect to these guidelines, the Screening, Scoping, Forecasting and Strategy Reports have been submitted and discussed with the City's Development Review Team. The discussion/review correspondence is provided as Appendix A for reference. The Transportation Impact Assessment provided herein incorporates the four previously submitted reports and the corresponding City review into one TIA final report.



DRAWING NOTES

SITE PLAN SYMBOLS

- CONCRETE UNIT PAVERS SURFACE
- ASPHALT / CONCRETE SURFACE
- CITY SIDEWALK
- WASHED RIVER STONE SURFACE
- SOFT LANDSCAPING
- BIKE RACK
- TWO WAY VEHICLE CIRCULATION
- MAIN ENTRANCE
- COMMERCIAL DOOR / FIRE EXIT
- PROPERTY LINE
- ZONING SETBACKS
- EXISTING TREE TO BE REMOVED

PROJECT INFORMATION

ZONING: Zoning By-Law 2017-113 — TM[1920] H(47)

SITE AREA	2,357.84 sq. m. (25,380) sq. ft.
BUILDING HEIGHT	47.0 M

PROJECT STATISTICS

BUILDING HEIGHT	59.5 M
AVERAGE MEAN GRADE	(GEO. ELEV.) 68.00

GROSS BUILDING - AREAS

CITY OF OTTAWA'S DEFINITION

PARKING LEVELS (4 LEVELS U/G)	N/A
GROUND FLOOR	576.6 sq. m. (6,206) sq. ft.
2nd FLOOR	839.4 sq. m. (9,035) sq. ft.
3rd to 16th FLOOR	13 x 616.36 sq. m. 13 x (7,955) sq. ft. — 8,532.7 sq. m. (91,845) sq. ft.
16 & 17th FLOOR	2 x 602.85 sq. m. 1 x (6,489) sq. ft. — 1,205.7 sq. m. (12,979) sq. ft.
18th FLOOR	440.0 sq. m. (4,736) sq. ft.
AMENITY FLOOR	N/A
MECHANICAL FLOOR	N/A
TOTAL AREA	11,594.3 sq. m. (124,800) sq. ft.

UNIT STATISTICS

STUDIO UNIT	44
1 BEDROOM UNIT	68
2 BEDROOM UNIT	64
TOTAL	176
COMMERCIAL RETAIL	354.15 sq. m. (3,812) sq. ft.

AMENITY AREA

EXTERIOR COMMUNAL AT GRADE	1910.95 sq. m. 2,045 sq. ft.
EXTERIOR PRIVATE AT GRADE	51.3 sq. m. 551 sq. ft.
1st FLOOR COMMUNAL AMENITY ROOM	74.3 sq. m. 800 sq. ft.
18th FLOOR COMMUNAL AMENITY ROOM	164.4 sq. m. 3,190 sq. ft.
18th FLOOR COMMUNAL ROOF TOP PATIO	160.5 sq. m. 1,722 sq. ft.
PRIVATE BALCONIES	764.1 sq. m. 8,177 sq. ft.
TOTAL =	1,026.1 sq. m. 10,427 sq. ft.

REQUIRED (176 UNITS X 6 m²) = 1,056 m² / 11,366.7 ft²

CAR PARKING

REQUIRED by ZONING BY-LAW

RESIDENCE	- 0.5 PER UNIT (176 UNITS)	88
VISITOR	- 0.1 PER DWELLING UNIT (AFTER 12 UNITS)	16
COMMERCIAL RETAIL (AFTER FIRST 2000 m² GFA)	- 2.0 PER 100m² GF U.F.A. AFTER 150m²	1
TOTAL		105

PROVIDED

RESIDENCE	- 0.66 PER UNIT (176 UNITS)	117
VISITOR	- 0.1 PER DWELLING UNIT (AFTER 12 UNITS)	16
COMMERCIAL RETAIL (AFTER FIRST 2000 m² GFA)	- 2.0 PER 100m² GF U.F.A. AFTER 150m²	1
TOTAL		134

STANDARD PARKING SPACE (2.6 X 5.2)
SMALL CAR PARKING SPACE (2.4 X 4.6)

BICYCLE PARKING

REQUIRED

RESIDENCE	- 0.5 PER UNIT (176 UNITS)	88
COMMERCIAL RETAIL	- 1.0 PER 2080m² GF U.F.A.	2
TOTAL		90

PROVIDED

EXTERIOR	4
UNDERGROUND PARKING LEVEL	190
TOTAL	194

LOT COVERAGE

PAVED SURFACE =	639.7 sq. m.	27.1%
BUILDING FOOTPRINT =	1,063.2 sq. m.	45.1%
LANDSCAPE OPEN SPACE =	654.9 sq. m.	27.8%
TOTAL =	2,357.8 sq. m.	100.0%

IT IS THE RESPONSIBILITY OF THE APPROPRIATE CONTRACTOR TO CHECK AND VERIFY ALL DIMENSIONS ON SITE AND TO REPORT ALL ERRORS AND/OR OMISSIONS TO THE ARCHITECT.

ALL CONTRACTORS MUST COMPLY WITH ALL PERTINENT CODES AND BY-LAWS.

THIS DRAWING MAY NOT BE USED FOR CONSTRUCTION UNTIL SIGNED BY THE ARCHITECT

DO NOT SCALE DRAWINGS.

NOTATION SYMBOLS:

- (N) INDICATES DRAWING NOTES, LISTED ON EACH SHEET.
- INDICATES ASSEMBLIES TYPE, REFER TO TYPICAL ASSEMBLIES SCHEDULE.
- INDICATES WINDOW TYPE, REFER TO WINDOW ELEVATIONS AND DETAILS ON A600 SERIES.
- INDICATES DOOR TYPE, REFER TO DOOR SCHEDULE AND DETAILS ON A500 SERIES.
- DETAIL NUMBER
- TITLE
- SHEET
- DETAIL REFERENCE PAGE
- DETAIL CROSS REFERENCE PAGE

No.	DESCRIPTION	DATE
4		
3		
2	ISSUED FOR ZONING AMENDMENT	Nov. 15, 17
1	ISSUED FOR DESIGN CONCEPT	Nov __, 16

REVISIONS:

ARCHITECT SEAL: ONTARIO ASSOCIATION OF ARCHITECTS — LICENCE 4274 — SEAL DATE STAMP DATE

NORTH ARROW

CLIENT: THE AZURE — LIVE | IVY | APARTMENTS
Azure Urban Developments Inc.

ARCHITECT: rla/architecture — roderick lahey architect inc.
56 beech street, ottawa, ontario K1S 3J6
t.613.724.9932 f.613.724.1209 rlaarchitecture.ca

PROJECT TITLE
THE AZURE
929 Richmond Road
OTTAWA ONTARIO

SHEET TITLE
SITE PLAN

DRAWN: RV	CHECKED: M.L.
SCALE: 1:125	SHEET No. SP-1
PROJECT No. 1719	

PARSONS

Figure 2: Proposed Site Plan

2. EXISTING CONDITIONS

2.1. AREA ROAD NETWORK

Richmond Road is an east-west arterial, which extends from Baseline Road in the west to Island Park Drive in the east, where it continues as Wellington Street. Richmond Road in the vicinity of the site has a four-lane cross section with auxiliary turn lanes at the Woodroffe/Richmond intersection. It narrows to a two-lane cross section approximately 100 m east and west of the intersection. On-street parking is not permitted within the study area and stopping is not permitted along Richmond Road during the peak hours. Within the vicinity of the site, the unposted speed limit is understood to be 50 km/h.

Woodroffe Avenue is a north-south arterial, which extends from Sir John A. Macdonald Parkway in the north to the Jock River in the south. Within the study area, Woodroffe Avenue has a two-lane vehicle cross-section with auxiliary lanes provided at the Richmond/Woodroffe intersection. The speed limit is posted at 50 km/h and on-street parking is not permitted.

2.2. PEDESTRIAN/CYCLING NETWORK

Sidewalk facilities within the vicinity of the site are provided along both sides Woodroffe Avenue and along the north side of Richmond Road. A multi-use path (MUP) is provided along the south side of Richmond Road. With respect to cycling, a MUP is provided along the south side of Richmond Road and Byron Avenue is a 'suggested route'. The City's Cycling Plan identifies Richmond Road and Woodroffe Avenue as Spine Routes and Byron Avenue (just south of Richmond) as a Local Road.

With regard to pedestrian volumes, according to the most recent traffic count data, approximately 30 to 35 pedestrians per hour were observed crossing Richmond Road and approximately 35 to 40 pedestrians per hour were observed crossing Woodroffe Avenue at the Woodroffe/Richmond intersection during the morning and afternoon peak hours. With regard to cycling volumes, very few cyclists were observed at this intersection during the 8-hour count (in December). An older count conducted in May 2011 observed 15 cyclists per day along Woodroffe Avenue and 35 cyclists per day along Richmond Road.

2.3. TRANSIT NETWORK

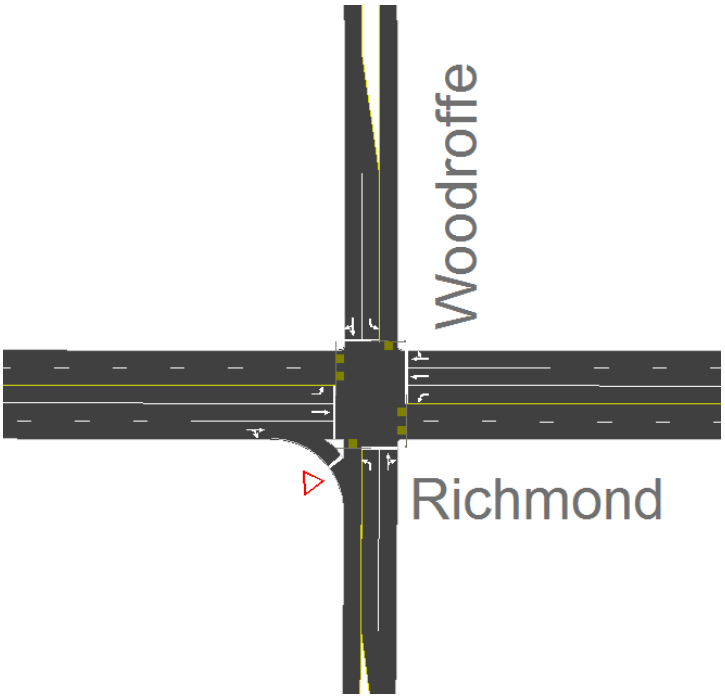
Transit service within the vicinity of the site is currently provided by OC Transpo Routes #11, 87, and 153. Bus stops for Route #87 are located along Woodroffe Avenue adjacent to the site. The westbound bus stop for Routes #11 and 153 are located along Richmond Road approximately 50 m west of the site. The eastbound bus stop for Route #11 is located along Richmond Road at the Woodroffe/Richmond intersection. Regular Routes #87 and 153 provide frequent all-day service and Peak Hour Route #11 provides weekday peak hour service only. The Lincoln Fields Transit Station is located approximately 2 km from the proposed development, which provides access to the Transitway. Phase 2 of the City's Light Rail Transit (LRT) Confederation Line is planned to be in operation by 2023, with a station at Lincoln Fields and two new stations within close proximity of the development.

Figure 3: Area Transit Network

2.4. EXISTING STUDY AREA INTERSECTION

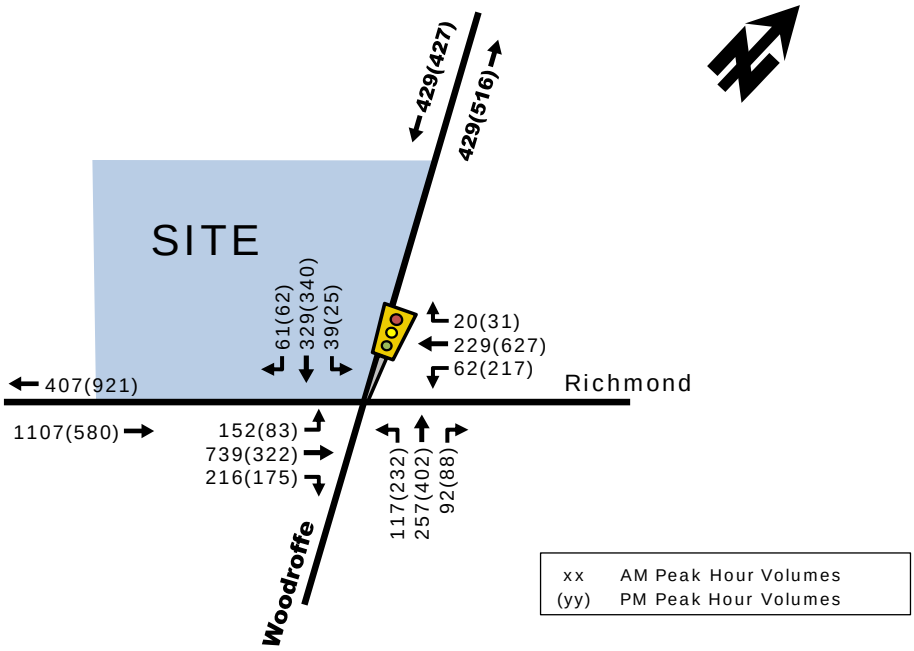
Woodroffe/Richmond

The Woodroffe/Richmond intersection is a signalized four-legged intersection. The westbound approach consists of a single left-turn lane, a through lane and a shared through/right-turn lane. The eastbound approach consists of a left-turn lane, a through lane and a shared through/channelized right-turn lane. The northbound and southbound approaches consist of a single left-turn lane and a shared through/right-turn lane. All movements are permitted at this location.



Illustrated as Figure 4, are the most recent weekday morning and afternoon peak hour traffic volumes obtained from the City of Ottawa at the Richmond/Woodroffe intersection. These peak hour traffic volumes are included as Appendix B.

Figure 4: Existing Peak Hour Traffic Volumes



2.4.1. VEHICLE OPERATION

The following Table 1 provides a summary of the existing traffic operations at the study area intersection based on the SYNCHRO (V9) traffic analysis software and the existing traffic volumes. The subject signalized 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 signalized intersection 'as a whole' was assessed based on weighted v/c ratio. The SYNCHRO model output of existing conditions is provided within Appendix C.

Table 1: Existing 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
Woodroffe/Richmond	D(E)	0.86(0.95)	SBT(NBL)	26.5(39.0)	B(C)	0.68(0.76)
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 Richmond/Woodroffe intersection 'as a whole' is currently operating at an acceptable LoS 'C' or better during peak hours. With regard to the 'critical movements', the northbound left-turn movement is operating at capacity (LoS 'E') during the afternoon peak hour. Given the site's proximity to the future LRT station, the City's future targets for vehicle level of service is LoS 'E' in this area. The southbound average and 95th percentile queues range between 75 m to 140 m during the peak hours, which spills back past the site's proposed driveway to Woodroffe Avenue. Similarly, the eastbound average and 95th percentile queues range between 50 m to 90 m during peak hours, which spills back past the site's proposed driveway connection to Richmond Road.

2.4.2. MULTI-MODAL LEVEL OF SERVICE

The following Table 2 summarizes the MMLoS analysis at the study area intersection and the road segments adjacent to the site for the existing condition. The detailed analysis is provided as Appendix C.

Table 2: MMLOS Analysis – Existing Conditions

Intersection	Level of Service									
	Pedestrian		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)		Vehicle (LoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target	LoS	Target
Richmond/Woodroffe	F	B	F	C	F	No target	E	D	E	D
Richmond Road Segment	F		E		D		A		n/a	n/a
Woodroffe Road Segment	F		E		D		B		n/a	

As shown in Table 2, none of the target levels of service are currently met. As discussed further on in this report, there are planned changed to the Woodroffe/Richmond intersection given the implementation of Stage 2 LRT within close proximately to this site. Given the proposed changes to this intersection and the adjacent roadways with the construction of Stage 2 LRT, some of these levels of service are expected to improve.

2.5. EXISTING ROAD SAFETY CONDITIONS

Collision history for the study area intersection and roadways (2012 to 2016, inclusive) was obtained from the City of Ottawa and most collisions (73%) involved only property damage, indicating low impact speeds, and 27% involved personal injuries. The primary causes of collisions cited by police include; rear end (31%), angle (23%), turning movement (21%), and single vehicle/other (15%) 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 the Richmond/Woodroffe intersection, reported collisions have historically take place at a rate of 0.63collisions/MEV.

It is noteworthy that within the 5-years of recorded collision data there were six (6) collisions involving pedestrians and no collisions involving cyclists. The collisions involving pedestrians resulted in non-fatal injuries and three (3) occurred at the Richmond/Woodroffe intersection, two (2) occurred mid-block along Richmond Avenue (between New Orchard and Woodroffe) and one (1) occurred mid-block along Woodroffe Avenue (between Richmond and Deschenes). The source collision data as provided by the City of Ottawa and related analysis is provided as Appendix D.

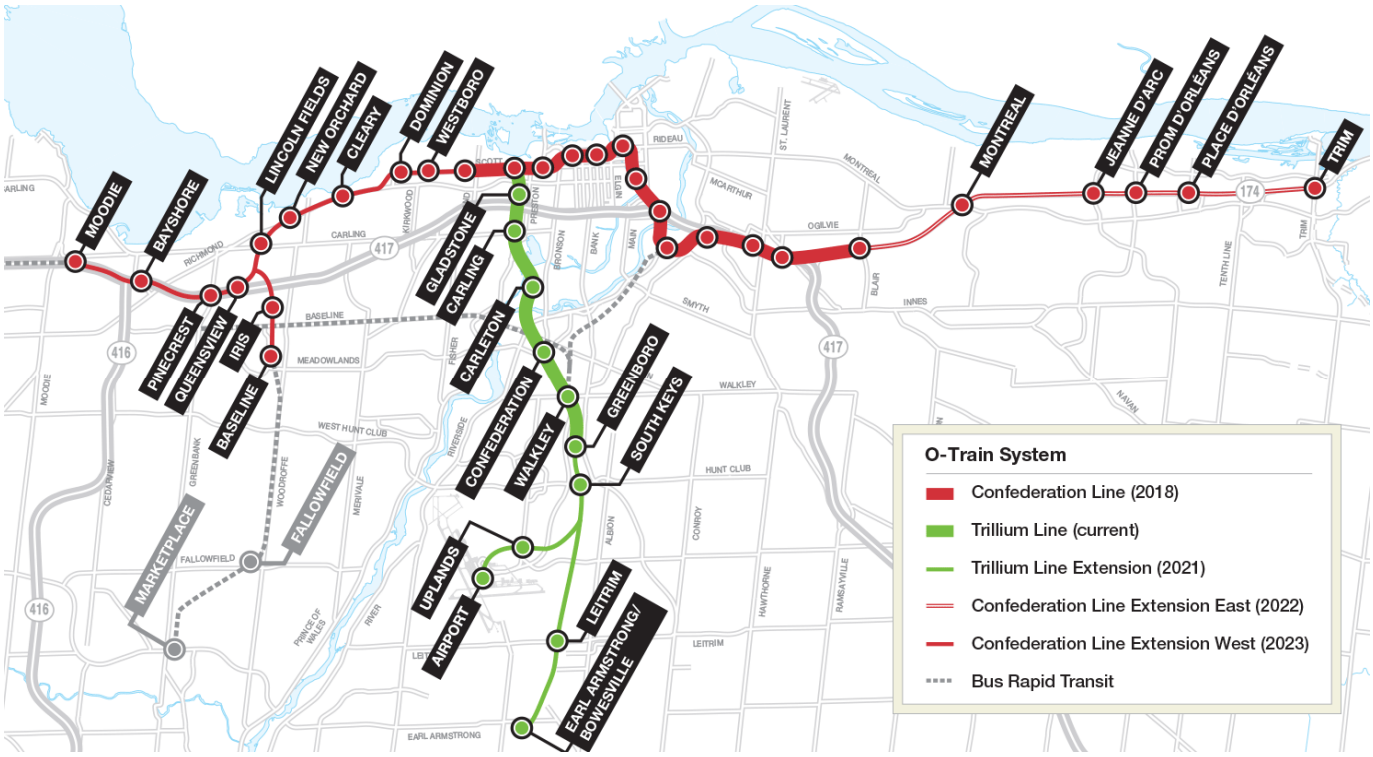
3. PLANNED CONDITIONS AND BACKGROUND NETWORK TRAVEL DEMAND

3.1. PLANNED STUDY AREA TRANSPORTATION NETWORK CHANGES

Transit

A notable transportation network change is the Stage 2 construction of the east-west LRT, which is the conversion of the City's existing BRT corridor to LRT. Stage 2 LRT is planned to extend west to the Moodie, with two new stations located within the vicinity of the site, to be completed by 2023. The following Figure 5 illustrates the planned Stages 1 and 2 of the future Confederation/Trillium Lines. The planned New Orchard and Cleary LRT Stations are located close to the proposed development, with the New Orchard Station being less than 600 m from the proposed development.

Figure 5: Planned LRT Phase II



In addition to the two planned LRT stations located within close proximity to the proposed development, a Transit Priority Corridor (isolated measures) is planned along Woodroffe Avenue, north of Carling Avenue. This Transit Priority Corridor is identified on the 2031 Network Concept, however, it is not identified on the 2031 Affordable Network.

Road Network

As part of the Stage 2 LRT implementation, a Richmond Road complete street concept is being undertaken by the City of Ottawa as well as a Byron Linear Park renewal between Redwood Avenue and Richardson Avenue. The following Figure 6 is the City's depiction of the proposed protected Richmond/Woodroffe intersection, which includes the following features:

- Closure of Byron Street at Woodroffe – convert space into Byron Linear Park space with multi-use pathways;
- Cycle tracks along both sides of Richmond Road;
- Cross-rides and textured cross-walks at intersections;
- Removal of acceleration lanes/bus bays and channelized right-turn lanes;
- Fully-protected intersections; and
- Single east-west through lanes for vehicle traffic at the Richmond/Woodroffe intersection.

Figure 6: Planned Protected Richmond/Woodroffe Intersection

3.2. OTHER AREA DEVELOPMENT

According to the City's development application search tool, the following development are planned within the vicinity of the subject site.

809 Richmond Road
OCEF is proposing the construction of two 16-storey towers with approximately 11,000 ft^2 of retail and 252 residential units at the above-noted address, which is located approximately 500 m east of the subject development. The Transportation Impact Study (prepared by Parsons) projects an increase in vehicle traffic of approximately 47 and 71 veh/h during the commuter peak hours for the horizon year 2018 and 24 and 36 veh/h for the horizon year 2023.

851 Richmond Road
Homestead Land Holding Ltd. is proposing the construction of one 11-storey tower with approximately 132 residential units at the above-noted address, which is located approximately 300 m east of the subject development. The Transportation Brief (prepared by Parsons) projects an increase in vehicle traffic of approximately 22 and 30 veh/h during the commuter peak hours.

3.3. HISTORIC TRAFFIC GROWTH

The following background traffic growth through the immediate study area (summarized in Table 3) was calculated based on historical traffic count data (years 2007, 2010, 2011 and 2016) provided by the City of Ottawa at the Richmond/Woodroffe intersection. Detailed background traffic growth analysis is included as Appendix E.

Table 3: Rideau/Cobourg Historical Background Growth (2007 – 2016)

Time Period	Percent Annual Change				
	North Leg	South Leg	East Leg	West Leg	Overall
8 hrs	0.90%	1.45%	0.06%	-0.15%	**0.52%**
AM Peak	0.12%	0.51%	-0.13%	-0.32%	**0.01%**
PM Peak	0.49%	1.85%	1.07%	-0.34%	**0.76%**

As shown in Table 3, the Woodroffe/Richmond intersection has experienced approximately 0% to 0.75% annual growth within recent years (calculated as a weighted average). To account for the historic and future increases in traffic volumes and to account for the traffic generated by the previously identified area developments, a 0.5% per annum growth factor was applied to existing traffic volumes along Woodroffe Avenue and Richmond Road to obtain background traffic volumes for the 2019 built-out horizon year and 2024 (5-years beyond site build-out). The resultant 2019 and 2024 background traffic volumes are depicted as Figures 7 and 8, respectively.

Figure 7: 2019 Background Traffic Volumes

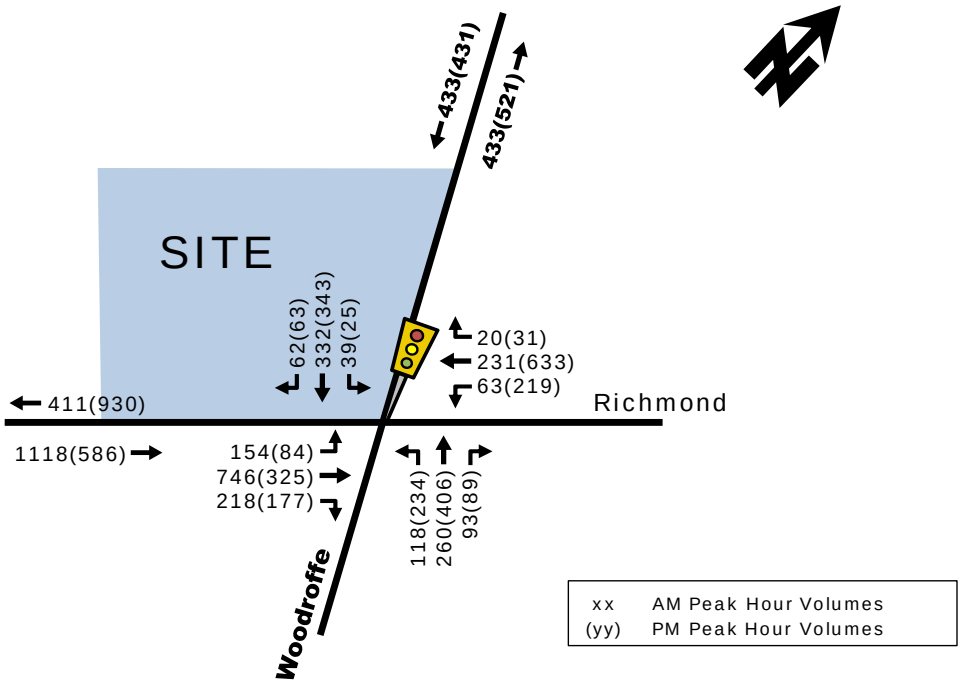
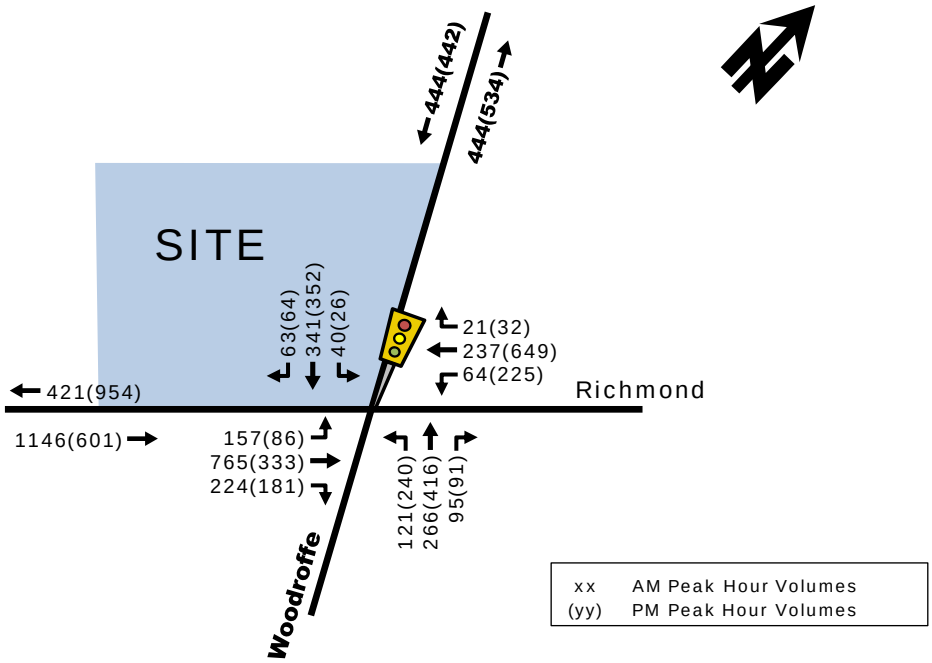


Figure 8: 2024 Background Traffic Volumes



4. DEVELOPMENT-GENERATED TRAFFIC

4.1. TRIP GENERATION

Appropriate trip generation rates for the proposed development consisting of approximately 176 high-rise condominiums and approximately 6,000 ft² of ground floor retail were obtained from the City's 2009 TRANS Trip Generation – Residential Trip Rates and the ITE Trip Generation Manual (9th Edition). These rates are summarized in Table 4.

Table 4: 2009 TRANS and ITE Trip Generation Rates

Land Use	ITE Land Use Code	Trip Rates – TRANS and ITE	
		AM Peak	PM Peak
High-Rise Apartments	ITE 222	T = 0.24(du)	T = 0.27(du)
Specialty Retail	ITE 826	T = 1.36(X) T = 1.20(X) + 10.74	T = 2.71(X) T = 2.40(X) + 21.48

Notes: T = Average Vehicle Trip Ends
du = Dwelling units
X = 1000 ft² Gross Floor Area
Specialty Retail AM Peak is assumed to be 50% of the PM Peak

4.1.1. RESIDENTIAL TRIPS

Using the TRANS Trip Generation rates for the residential component of the site, the total amount of vehicle trips generated by the proposed 176 residential units was calculated. The results are summarized in Table 5.

Table 5: Projected Vehicle Trip Generation – TRANS Model

Land Use	Area	AM Peak (Veh/h)			PM Peak (Veh/h)		
		In	Out	Total	In	Out	Total
High-Rise Apartments	176 units	10	32	42	29	19	48

As shown in Table 5, a total of 42 and 48 veh/h are projected to travel to/from the proposed development during the weekday morning and afternoon commuter peak hours. Using the TRANS Auto Trips projected in Table 5 and the mode share percentages outline the 2011 OD-Survey for Ottawa West, the modal share for the residential land use within the proposed development are summarized in Table 6.

Table 6: Site Trip Generation – Residential Use

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total
Auto Driver	50%	10	32	42	29	19	48
Auto Passenger	15%	2	10	12	9	5	14
Transit	20%	4	13	17	12	8	20
Non-motorized	15%	3	10	13	8	6	14
Total Person Trips	**100%**	**19**	**65**	**84**	**58**	**38**	**96**

As shown in Table 6, based on the TRANS Trip Generation method, the proposed site is projected to generate approximately 85 to 95 person trips per hour during the weekday commuter peak hours. The increase in two-way transit trips is estimated to be approximately 20 persons per hour, and the increase in bike/walk trips is approximately 15 persons per hour.

4.1.2. RETAIL TRIPS

The retail trip generation is based on the ITE trip generation rates, outlined in Table 4. 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 urban study area context were applied to attain estimates of person trips for the proposed development.

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. Based on the TIA Guidelines and our review of available literature, a combined factor of approximately 1.28 is considered reasonable to account for typical North American auto occupancy values of approximately 1.15 and combined transit/non-motorized modal shares of 10%. As such, the person trip generation for the proposed retail development is summarized in Table 7.

Table 7: Modified Person Trip Generation - Retail

Land Use	Area	AM Peak (Person Trip/h)			PM Peak (Person Trip/h)		
		In	Out	Total	In	Out	Total
Specialty Retail	3,812 ft^2	11	9	20	17	23	40

The person trips shown in Table 7 for the proposed retail development were then reduced by modal share values based on the site's location and proximity to adjacent communities, employment, shopping uses and transit availability. Modal share values for the retail component of the proposed development are summarized in Table 8.

Table 8: Retail Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total
Auto Driver	50%	6	5	11	9	12	21
Auto Passenger	15%	2	2	4	3	4	7
Transit	25%	2	1	3	3	4	7
Non-motorized	10%	1	1	2	2	3	5
Total Person Trips	**100%**	**11**	**9**	**20**	**17**	**23**	**40**
Less Retail Pass-by (30%)		-2	-2	-4	-3	-3	-6
Total 'New' Auto Trips		**4**	**3**	**7**	**6**	**9**	**15**

The following Table 9 summarizes the foregoing people trip generations for the residential and retail components of the proposed development.

Table 9: Total Projected 2019 Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total
Auto Driver	50%	16	37	53	38	31	69
Auto Passenger	15%	4	12	16	12	9	21
Transit	20%	6	14	20	15	12	27
Non-motorized	15%	4	11	15	10	9	19
Total Person Trips	**100%**	**30**	**74**	**104**	**75**	**61**	**136**
Less Retail Pass-by (30%)		-2	-2	-4	-3	-3	-6
Total 'New' Auto Trips		**14**	**35**	**49**	**35**	**28**	**63**

As shown in Table 9, the total number of person trips projected to be generated by this development is approximately 105 and 135 persons/h during the weekday commuter peak hours. The total amount of 'new' vehicle traffic to the study area is projected to be 50 to 63 veh/h during the peak hours. This amount of traffic equates to approximately 1 new vehicle every minute during peak hours.

4.1.3. MODE SHARES

The existing mode shared outlined in Table 10 above were derived from the 2011 OD Survey for the Ottawa West area, which are shown below.

Table 10: OD Survey Trips by Primary Travel Mode – Ottawa West

Time Period	24 Hours			AM Peak Hour			PM Peak Hour			Average	Selected Split
Mode	From District	To District	Within District	From District	To District	Within District	From District	To District	Within District		
Driver	56%	56%	38%	46%	51%	33%	55%	53%	32%	47%	50%
Passenger	15%	15%	11%	11%	15%	15%	16%	14%	10%	14%	15%
Transit	20%	20%	5%	31%	23%	4%	21%	24%	4%	17%	20%
Bike/Walk	6%	6%	42%	10%	6%	39%	6%	9%	52%	20%	15%
Other	2%	3%	3%	2%	5%	8%	2%	1%	2%	3%	-

These existing modal shares are used to calculate the projected traffic to/from the proposed development for the build-out year 2019. For the horizon year 2024, which represents five-years beyond full-build out, the following future mode share are forecasted. These mode shares reflect the addition of two new LRT Transit Stations within close proximity of the development, including the New Orchard LRT Station, which is located within 600 m of the proposed development.

Table 11: Future Mode Share Targets for the Development

Travel Mode	Mode Share Target	Rationale
Transit	65%	Development is located within 600 m of a future LRT station, making it a Transit-Oriented Development (TOD) which have transit targets of 65%.
Walking	10%	This is consistent with the City's Transportation Master Plan (TMP), TOD areas and the existing OD-survey.
Biking	5%	This is consistent with the City's TMP, TOD areas and the existing OD-survey.
Auto Passenger	15%	This is consistent with TOD targets.
Auto Driver	5%	This is consistent with TOD targets.

Based on the future mode share targets for this development, the projected 2024 site-generated person trips are outlined in Table 12.

Table 12: Future Projected 2024 Site-Generated Person Trips

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total
Auto Driver	15%	5	12	17	11	10	21
Auto Passenger	5%	2	4	6	3	4	7
Transit	65%	19	47	66	50	38	88
Non-motorized	15%	4	11	15	11	9	20
Total Person Trips	**100%**	**30**	**74**	**104**	**75**	**61**	**136**
Less Retail Pass-by (30%)		-2	-2	-4	-3	-3	-6
Total 'New' Auto Trips		**3**	**10**	**13**	**8**	**7**	**15**

Given the low forecasted number of vehicle trips for the horizon year 2024, no further vehicle analysis is included for this horizon year with respect to the site-generated traffic volumes, however, background and network changes to the study area are assessed in Section 5.1 for horizon year 2024.

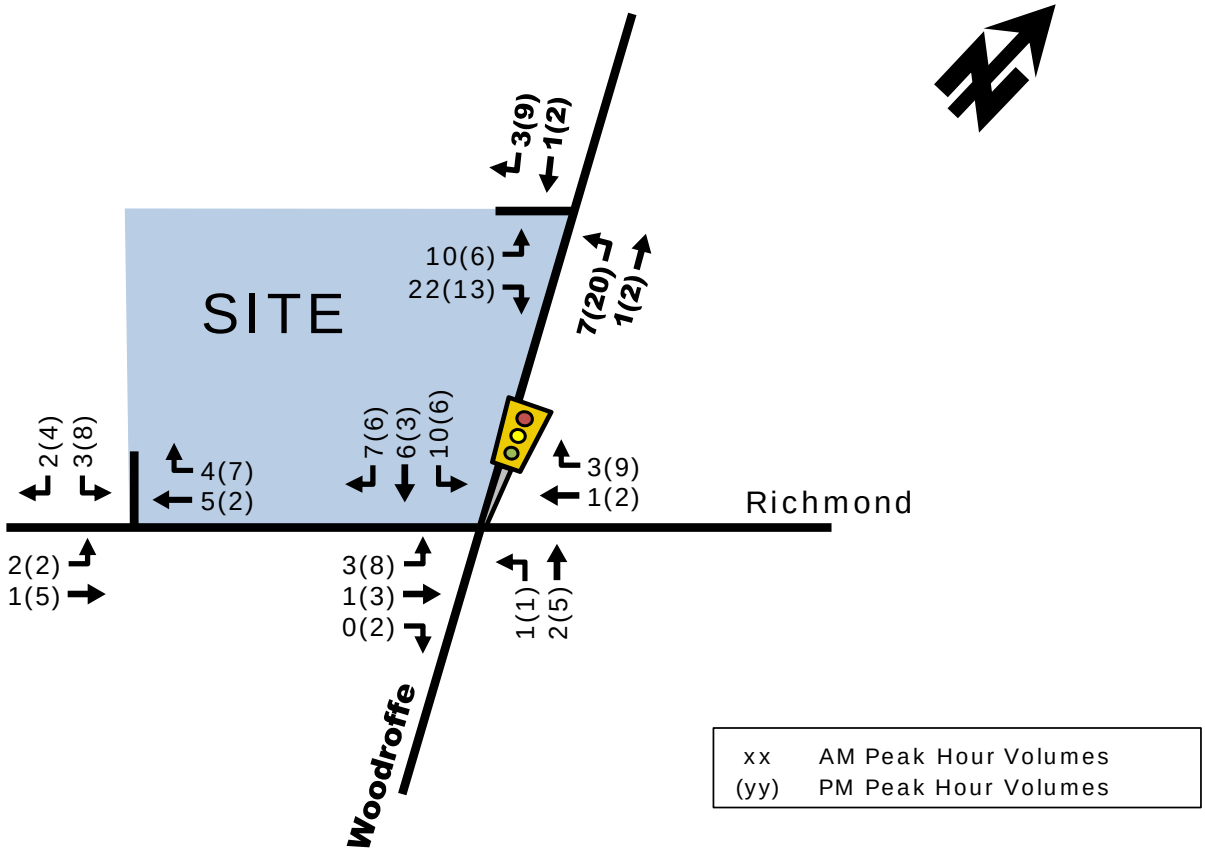
4.2. TRIP DISTRIBUTION AND ASSIGNMENT

The site-generated vehicle traffic distribution was based on existing traffic volume splits and the existing road network of the surrounding area. The resultant distribution is outlined as follows:

- 30% to/from the east via Richmond Road;
- 30% to/from the north via Woodroffe Avenue (destined to Sir John A. Macdonald Parkway);
- 20% to/from the west via Richmond Road; and
- 20% to/from the south via Woodroffe Avenue.

Based on the foregoing distributions, 'new' and 'pass-by' 2019 projected site-generated trips (Table 9) were assigned to the study area, which are illustrated as Figure 9.

Figure 9: 'New' and 'Pass-by' Projected 2019 Site-Generated Traffic Volumes



5. DEMAND FORECASTING – INTERSECTION DESIGN

5.1. BACKGROUND 2024 CONDITIONS

The horizon year 2024 background traffic volumes, illustrated previously as Figure 8, are assessed in terms of vehicle capacity and MMLOS. These volumes represent a 0.5% per annum traffic growth. In addition, the geometry of the study area intersection is planned to be redesigned to better accommodate person trips travelling to/from the planned LRT stations. The planned modifications to the Richmond/Woodroffe intersection, which are described in Section 3.1, are applied to the background 2024 analysis.

5.1.1. VEHICLE OPERATION

The following Table 13 provides a summary of the background traffic operations at the study area intersection based on the SYNCHRO (V9) traffic analysis software and the 2024 horizon year traffic volumes. The planned redesign of the Richmond/Woodroffe intersection includes a reduction in vehicle travel lanes in the eastbound and westbound directions and the removal of the eastbound channelized right-turn lane. The ensuing analysis reflects these changes. The SYNCHRO model output of background 2024 conditions is provided within Appendix F.

Table 13: Background 2024 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
Woodroffe/Richmond	F(F)	1.29(1.37)	EBT(WBL)	91.8(120.5)	F(F)	1.14(1.10)
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 13, the Richmond/Woodroffe intersection 'as a whole' is projected to operate above capacity (LoS 'F') during both peak hours, with failing critical movements. Optimizing the signal timing plan improves the v/c ratios (volume/capacity), however the resulting projected levels of service remain LoS 'F' during both peak hours.

These projected conditions reflect the removal of an eastbound and westbound vehicle travel lane, which are proposed to be removed as part of the planned roadway adjacent to the future LRT. With this removal of vehicle capacity at the intersection, drivers can expect long delays and queues for the future condition. However, the City's transit target for areas within close proximity of an LRT station is 65%. If this transit target is achieved, it is expected that traffic volumes within close proximity to LRT transit stations will decrease. As such, the vehicle level of service at this intersection may improve if traffic volumes in the area decrease.

Similar to existing conditions, vehicle queues are projected to spill back past the proposed site driveway accesses, however, drivers can provide gaps in the queues to allow vehicle movement to proceed to/from the proposed development.

In addition, it is noteworthy that this proposed intersection is relatively wide. The approximate distance between stop bars in the east-west direction is 58 m. MTO guidelines state that the distance between the stop bar and the signal head should not be more than 55 m. The wide intersection increases all-red signal timing, which increases delays and queues for vehicles. Given the alignment of Woodroffe Avenue at Richmond Road and the requirements for cross-rides and crosswalks, providing a more narrow intersection design would be challenging.

5.1.2. MULTI-MODAL LEVEL OF SERVICE

The following Table 14 summarizes the MMLoS analysis at the study area intersection and the road segments adjacent to the site, for the Background 2024 condition. The detailed analysis is provided as Appendix F. This analysis assumes the

proposed redesign of the Richmond/Woodroffe intersection planned as part of the Stage 2 LRT construction. It is noteworthy that the MMLoS targets are revised to reflect an area within 600 m of a rapid transit station, as the New Orchard LRT Station will be constructed by 2024.

Table 14: MMLOS Analysis – Background 2024 Conditions

Intersection	Level of Service									
	Pedestrian		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)		Vehicle (LoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target	LoS	Target
Richmond/Woodroffe	E*	A	A	C	F/A**	No target/A	E	D	F	D
Richmond Road Segment	C		A		D/A**		D		n/a	n/a
Woodroffe Road Segment	B		A		D/A**		C		n/a	

*PLOS 'E' is the worst-case level of service that governs the intersection PLOS. The majority of PLOS scores are in the PLOS 'C' to 'D' range.
** TLOS 'F' for transit along Woodroffe Avenue and Richmond Road is in the range of TLOS D to F. The LRT would result in TLOS 'A'.

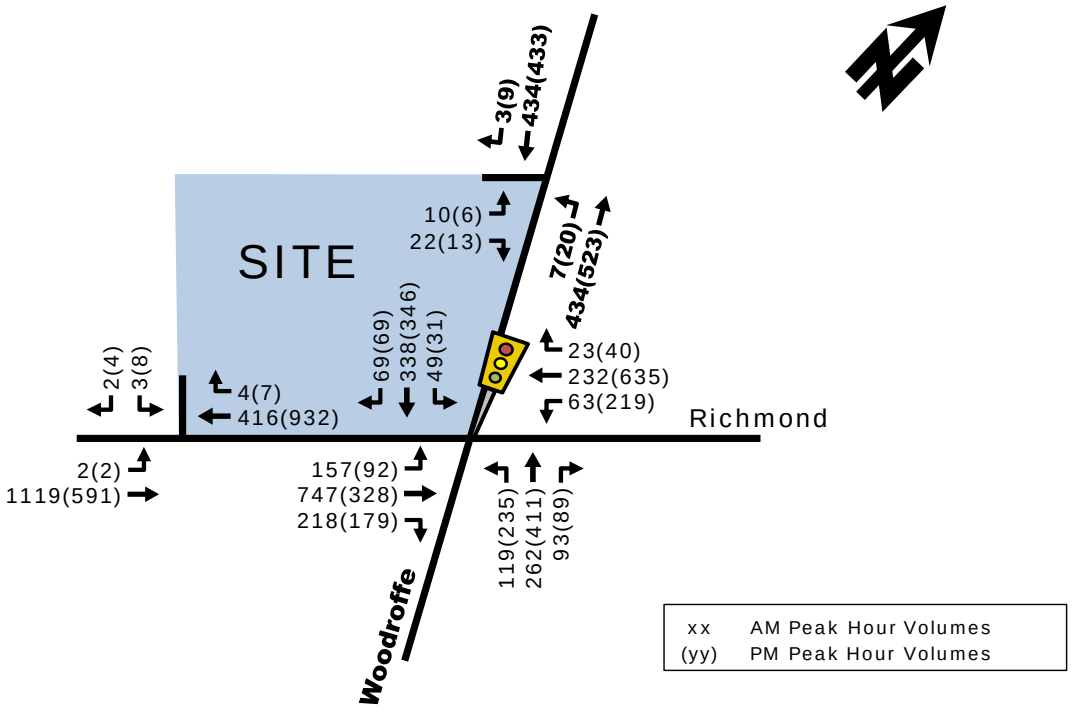
As shown in Table 14, the bicycle level of service targets are met in the future 2024 condition. This is because of the provided two-stage bicycle crossing, proposed cross-rides and cycle tracks. The following discussion is provided for all other modes:

- Pedestrians – PLoS 'A' is impossible to achieve at any intersection because of the delay score calculation. At this intersection, the Pedestrian Exposure to Traffic at Signalized Intersection (PETSI) score has improved significantly from the existing 'F' score to a 'C' score on each leg of the intersection. The delay score is 'C' to 'D' for each leg, except the west leg, which is 'E'. As the worst level of service score governs the intersection score, the overall score is PLoS 'E', however, it is significantly improved from the existing on all other legs.
- Transit – Given the proposed reductions in vehicle capacity, bus routes along Woodroffe Avenue and Richmond Road will be impacted by long queues and delays similar to all vehicles. As there are no transit priority measures identified on Richmond Road or Woodroffe Avenue in the TMP Affordable Network, there is no target for transit at this intersection or the roadways. The LRT is proposed adjacent to Richmond Road, which will result in TLoS 'A'.
- Trucks – Richmond Road forms part of the truck route and as such has a target level of service TkLOS 'D', however Woodroffe Avenue north of Richmond Road does not form part of the truck route and as such, has a target of TkLoS 'E'.
- Vehicles – Vehicle level of service is LoS 'F' for the intersection based on the proposed reduction in vehicle capacity at the Richmond/Woodroffe intersection. With the implementation of the LRT, a shift from vehicle drivers to transit ridership is expected. This will likely lessen the demand on this intersection and may improve vehicle level of service at this location.

5.2. TOTAL PROJECTED 2019 CONDITIONS

The total projected 2019 traffic volumes were derived by superimposing the 2019 site-generated traffic volumes onto background 2019 traffic volumes. The resulting total projected 2019 traffic volumes are illustrated in Figure 10.

Figure 10: Total Projected 2019 Traffic Volumes



5.2.1. VEHICLE OPERATION

The following Table 15 provides a summary of the total projected 2019 operations at the study area intersection based on the SYNCHRO (V9) traffic analysis software. The planned redesign of the Richmond/Woodroffe intersection is not expected to be completed by 2019, and as such the existing intersection geometry is assessed. The SYNCHRO model output of total projected 2019 conditions is provided within Appendix G.

Table 15: Total Projected 2019 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
Woodroffe/Richmond	D(E)	0.88(0.97)	SBT(NBL)	28.0(41.1)	B(C)	0.70(0.78)
Woodroffe/Site	B(C)	14.3(15.8)	EBL(EBL)	0.6(0.6)	-	-
Richmond/Site	C(C)	16.1(19.6)	SBL(SBL)	0.1(0.2)	-	-
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 15, the Richmond/Woodroffe intersection 'as a whole' is projected to operate at acceptable levels of service LoS 'C' or better during both peak hours. Similar to the existing conditions, the critical movements are projected to operate at an acceptable LoS 'D' or better with the exception of the northbound left-turn movement, which is projected to operate at capacity (LoS 'E'). A slight signal timing adjustment will improve this movement's operation to LoS 'D'.

With regard to the site driveway connections to Woodroffe Avenue and Richmond Road, they are projected to operate acceptably with delays on-site of 15 to 20 seconds (for vehicles turning left). Delays for vehicles entering the site are projected to be low with minimal queues and delays. As queues associated with the Richmond/Woodroffe intersection are projected to spill back past the location of both site driveways, as they do today, drivers are expected, as occurs across the City, to leave gaps in the queues to allow vehicle movement into and out of the site.

5.2.2. MULTI-MODAL LEVEL OF SERVICE

Given there are no proposed changes to the roadways geometry, and minimal increases in vehicle volumes, the MMLOS analysis for Total Projected 2019 is the same as the existing MMLOS outlined in Section 2.4.2.

5.3. TOTAL PROJECTED 2024 CONDITIONS

As mentioned in the Section 4, the site is expected to achieve high transit mode splits once the Stage 2 LRT is in place by 2023. As such, the number of projected site-generated vehicle trips is low, in the 15 veh/h range, which represents a negligible increase in traffic volumes. As such, the total projected 2024 conditions are the same as background 2024 conditions summarized in Section 5.1.

6. DEVELOPMENT DESIGN REVIEW

6.1. DESIGN FOR SUSTAINABLE MODES

Vehicle Parking

A total of 126 vehicle parking spaces are proposed to serve the subject development on three floors of underground parking with an additional 14 spaces proposed in a small surface parking lot. This amount of parking meets the City's By-Law requirements 0.5 per residential unit, 0.1 visitor parking spaces per unit (after the first 12 units) and 2.5 per 100 m^2 (after 150 m^2) of commercial area. The majority of parking space dimensions are noted to be 5.2 m in length and 2.6 m in width. There are ten (10) proposed small car spaces that are noted to be 2.4 m in width and 4.6 m in length. This amount of small car spaces is acceptable with respect to the City's By-Law and the small spots should be signed for 'small cars only'.

Given the site is in close proximity to a future LRT station, there is a maximum number of parking spaces permitted by the City's By-Law of 1.5 per residential unit. The development is not proposing to exceed this maximum number of parking spaces.

Bicycle Parking

With respect to bicycle parking, a total of 194 bicycle parking spaces are planned to be provided. Four (4) are proposed for retail use, and 190 are proposed underground for residential use. This number of bicycle parking spaces meets the City's By-Law requirements. It is noteworthy that the number of interior bicycle storage spaces exceeds the number of residential units, which helps promote the use of cyclists for residents of this development.

Transit

Transit service within the vicinity of the site is currently provided by OC Transpo Routes #11, 87, and 153. Bus stops for Route #87 are located along Woodroffe Avenue adjacent to the site. The westbound bus stop for Routes #11 and 153 are located along Richmond Road approximately 50 m west of the site. The eastbound bus stop for Route #11 is located along Richmond Road at the Woodroffe/Richmond intersection. Regular Routes #87 and 153 provide frequent all-day service and Peak Hour Route #11 provides weekday peak hour service only. The Lincoln Fields Transit Station is located approximately 2 km from the proposed development, which provides access to the Transitway. Phase 2 of the City's LRT Confederation Line is planned to be in operation by 2023, with a station at Lincoln Fields and two new stations within close proximity of the development. The planned New Orchard LRT station will be located within 600 m of the proposed development.

Based on the above-noted transit stop locations, it is estimated that 100% of the residential units are within 400 m walking distance to a transit stop.

6.2. CIRCULATION AND ACCESS

The proposed development has two planned driveway connections. The residential underground parking garage access is a full-movement 6.0 m wide driveway connection to Woodroffe Avenue located at the northern limit of the building/site. A small surface parking lot (14 spaces) is proposed via a full-movement driveway connection to Richmond Road. This Richmond Road driveway at only 3.0 m wide, is proposed to accommodate loading vehicles. This ensures that loading is done on-site and will not block traffic on the two adjacent arterial roadways. The truck turning templates are attached as Appendix H.

In review of these two driveway connections, Parsons raised the following concerns:

- For the Woodroffe connection, the width of the curved portion of the garage ramp is not sufficient to simultaneously accommodate both an inbound and outbound vehicle. In response, the project architect advised that they would be widening and/or increasing the radius of the garage ramp to better accommodate two-way traffic flow; and
- For the Richmond Road connections, being only 3 m wide and 20 m long, has the following issues:
    - Due to the close proximity of the proposed building, westbound HSU (heavy single unit) trucks waiting to turn right into the site cannot do so without jumping the curb. The project architect has advised that the driveway entrance will be modified to accommodate this truck movement;
    - Due to the proposed driveway width, two-way traffic cannot be accommodated at the same time. An implication of this is that if an inbound vehicle is trying to turn into this driveway while an outbound vehicle is exiting, the inbound vehicle would block traffic flow on Richmond Road in very close proximity to the signalized Woodroffe/Richmond intersection. As this would be unsafe/hazardous, options are:
        - Widen the driveway to two lanes;
        - Have the lengthy (20 m long) and narrow (3 m wide) driveway signalized at both ends, with the signal being “green” for entry at all times, except for when a vehicle wants to exit; or
        - Don’t allow any parking at this location and use the area as a truck court only, thereby reducing its use and removing potential conflict.
        - The project architect has advised that he is reviewing these options with the owner.

6.3. BOUNDARY STREET DESIGN

The City has recently prepared a complete street plan for Richmond Road within the vicinity of the site. This plan is part of the Stage 2 LRT construction to accommodate active modes travelling to/from the future LRT stations. The plan includes the following features:

- Closure of Byron Street at Woodroffe – convert space into Byron Linear Park space with multi-use pathways;
- Cycle tracks along both sides of Richmond Road;
- Cross-rides and textured cross-walks at intersections;
- Removal of acceleration lanes/bus bays and channelized right-turn lanes;
- Fully-protected intersections; and
- Single east-west through lanes for vehicle traffic at the Richmond/Woodroffe intersection.

The proposed Woodroffe/Richmond intersection design is provided as Figure 12. Review of the City’s design and the proposed Site Plan indicates that no changes to the City design are required. At the two site driveways, depressed sidewalks and cycle tracks will be required.

Figure 11: Propose Woodroffe/Richmond Intersection

Source: Richmond Road Complete Street Byron Linear Park Renewal – Open House Boards (Jan. 31, 2017)

6.4. ACCESS INTERSECTION DESIGN

6.4.1. LOCATION AND DESIGN OF ACCESS

Woodroffe Avenue Access

The primary vehicle access is proposed via Woodroffe Avenue. This full-movement driveway connection provides access to the underground parking levels (3). The driveway is located at the northern end of the site to offset the space between the signalized Woodroffe/Richmond intersection and the site driveway as much as possible. The distance between the site driveway and the intersection is approximately 45 m, which meet's the City's Private Approach By-Law requirements.

The driveway width is noted to be 6 m wide, which satisfies the Private Approach By-Law. The driveway turn radius should be reduced and/or the width of the driveway should be increased to improve operations for vehicles along this driveway. The grade of the ramp accessing the lower level parking garage is 12% to 21.5%. The ramp grade starts approximately 5 m from the property line and approximately 7.5 m from the sidewalk edge. The Private Approach By-Law states that the ramp grade should be 2% or less for 9 m from the property line. However, the 7.5 m provides sufficient amount of space for a vehicle exiting the ramp to be level with the roadway before the sidewalk, which provides the driver proper sight lines for approaching pedestrians, cyclists or vehicles as he/she exits the site. In addition, the site's proposed building is offset from the roadway edge by approximately 7 m, as such drivers have good sight lines to/from the south. To the north, the adjacent house is setback approximately 12 m from the roadway, providing good visibility in both directions.

Richmond Road Access

A small 14 space parking lot is proposed with full-movement access to Richmond Road. The driveway is located approximately 25 m from the Richmond/Woodroffe intersection, which satisfies the Private Approach By-Law. This parking

lot is expected to provide parking for residential visitors and retail patrons/staff. As such, traffic volumes travelling to/from this driveway are projected to be low during the peak hours, as shown in the Forecasting Report (approximately 5 to 10 two-way veh/h). This driveway is also provided for delivery vehicles and garbage vehicles to provide a loading area for these services away from the main arterial roadways (Woodroffe Avenue and Richmond Road). This driveway is necessary to accommodate loading/garbage services.

With regard to service vehicles, and garbage trucks in particular, the truck turning template is attached as Appendix H and shows conflicts for the garbage truck-sized vehicle entering and exiting the site. Revisions to the driveway entrance should be made to allow safe movement for this vehicle size.

With regard to passenger vehicle traffic to/from this same surface parking lot, although it is recognized that the vehicle volumes will be low, the 3 m width of the driveway is a concern. Two-way traffic cannot be safely accommodated within this narrow width and long throat length, which will result in vehicle conflicts on Richmond Road. Possible mitigation measures include; elimination of the parking supply thereby allowing service/garbage vehicles only, or signals to allow one-way traffic to operate safely.

6.4.2. INTERSECTION CONTROL AND DESIGN

Based on the projected vehicle volumes at the site driveway, STOP control on the minor approach (site) only is recommended. As the access intersections are unsignalized, no MMLoS analysis is provided.

7. TRANSPORTATION DEMAND MANAGEMENT

7.1. CONTEXT OF TDM

The mode shares developed for this proposed residential building reflect the modes splits for the Ottawa West area as outlined in Section 4.1.3 and in the following Table 16.

Table 16: OD Survey Trips by Primary Travel Mode – Ottawa West

Time Period	24 Hours			AM Peak Hour			PM Peak Hour			Average	Selected Split
Mode	From District	To District	Within District	From District	To District	Within District	From District	To District	Within District		
Driver	56%	56%	38%	46%	51%	33%	55%	53%	32%	47%	50%
Passenger	15%	15%	11%	11%	15%	15%	16%	14%	10%	14%	15%
Transit	20%	20%	5%	31%	23%	4%	21%	24%	4%	17%	20%
Bike/Walk	6%	6%	42%	10%	6%	39%	6%	9%	52%	20%	15%
Other	2%	3%	3%	2%	5%	8%	2%	1%	2%	3%	-

As shown, approximately half of the residents are expected to drive during peak hours, presumably to/from work, 20% are expected to take transit and 15% are expected to walk/bike.

With the implementation of the LRT Stage 2, and the New Orchard LRT Station within 600 m of the proposed development, the transit mode is expected to shift in the future. The future modes, as outlined in Section 4.1.3 are projected to be 65% transit, 15% driver, and 15% bike/walk. These are the City's mode share targets for developments located within walking distance of a rapid transit station.

It is unlikely the traffic volumes from the proposed development will be higher than projected for built-out year 2019, as these are based on current data within the area. If traffic volumes are higher than projected, congestions along Richmond Road may increase, affecting the Byron Linear Park located adjacent to Richmond Road.

7.1.1. DEVELOPMENT LOCATION AND INVOLVED PARTIES

The site is located within a Design Priority Area (DPA) and is a Transit-Oriented Development (TOD), that is owned by AZURE Urban Developments Inc.

7.2. NEED AND OPPORTUNITY

Failure to achieve the future high transit mode target may result in more congestion on Richmond Road and more turning movements at the site's driveways. The site has good pedestrian connections to the adjacent streets, which also provide quality pedestrian facilities including sidewalks on both sides of the roadways and the MUP along Richmond Road through the Byron Linear Park. Cycle tracks are proposed directly adjacent to the site and the development plans to provide more bicycle parking than residential units. The bicycle parking is also planned to be indoors and secure. As the site is located between two future LRT Stations, residents will be attracted to using transit.

7.3. TDM PROGRAM

The TDM checklist is attached as Appendix I. Some of the TDM measures that the proponent is providing/considering are as follows:

- Underground bicycle storage;
- More bicycle parking than residential units – proposing 190 spaces for 176 units;
- Potential car-sharing parking spaces; and
- Good pedestrian connectivity to the surrounding streets.

Given the site's location within 600 m of a future LRT transit station, residents of the development will be attracted to transit and active modes. This is reflected in the future mode splits outlined in the Forecasting Report.

8. TRANSIT

The number of transit trips projected to travel to/from the proposed residential development are 20 to 30 person trips two-way total during the morning and afternoon peak hours respectively. There are two local bus routes and one peak hour bus route with bus stops located within close proximity of the site. The bus frequency at the stops near the site are listed below:

- Route #87
  - Morning peak hour – 8 times an hour (two-way);
  - Afternoon peak hour – 7 times an hour (two-way);
- Route #11
  - Morning peak hour – 8 times an hour (two-way);
  - Afternoon peak hour – 8 times an hour (two-way);
- Route #153
  - Morning peak hour – 1 time an hour (eastbound);
  - Afternoon peak hour – 1 time an hour (eastbound).

Based on the 2019 trip generation projections, there are 20 two-way person transit trips projected during the morning peak hour and 30 during the afternoon peak hour (two-way total). Given there are approximately 17 two-way buses stopping close to the site during the morning and afternoon peak hours, these 20 to 30 trips will be distributed to these routes, averaging an additional 1 to 2 person trips per bus, which is considered negligible.

Based on the 2024 trip generation projections, there are 65 to 85 projected new two-way person transit trips generated by the proposed development. These projections are based on the City's targets for developments within 400 to 800 m of

a LRT Station. Since the development is within 600 to 800 m of two future LRT stations, these projected transit trips can be accommodated by the future Stage 2 LRT.

9. FINDINGS, RECOMMENDATIONS AND CONCLUSIONS

Based on the foregoing analysis and information, the following transportation-related conclusions and recommendations are provided:

- The existing conditions within the study area do not meet the level of service targets as identified in the City's MMLoS guidelines for pedestrian, cycling, transit, truck or vehicle facilities. The vehicle level of service at the Woodroffe/Richmond intersection is operating overall at acceptable levels of service, however, the northbound left-turn movement is operating at capacity (LoS 'E'). There are sidewalks within the study area and a MUP along the south side of Richmond Road;
- A notable transportation network change is the implementation of Stage 2 LRT within the vicinity of the proposed development. Two new LRT Stations are planned close to the site, including the New Orchard LRT Station, which will be located less than 600 m from the site. Stage 2 LRT is expected to be completed by 2023;
- With the implementation of Stage 2 LRT, a redesign of Richmond Road and Byron Linear Park are planned as City Projects. The subject Woodroffe/Richmond intersection is planned as a protected intersection with textured crosswalks and cross-rides. In terms of vehicle capacity, a vehicle travel lane is proposed to be removed in both the east and west directions at the Richmond/Woodroffe intersection;
- Based on historic traffic counts at the Woodroffe/Richmond intersection, an overall 0.5% growth rate per annum has been observed at study area intersections within recent years and was applied to study area intersections for the horizon years 2019 and 2024;
- The vehicle demand generated by the proposed development for the built-out year 2019 is approximately 50 to 63 veh/h during the morning and afternoon peak hours, respectively;
- The increase in transit ridership is projected to be approximately 20 to 30 persons/h during the peak hours for horizon year 2019. The increase in bike/walk traffic is projected to be approximately 15 to 20 persons/h during the peak hours for horizon year 2019;
- For the horizon year 2024, which represents 5-years beyond full build-out, the site-generated vehicle projections are estimated to reduce to approximately 15 veh/h during the peak hours and the transit ridership is expected to increase to approximately 65 to 85 persons/h during the peaks. Given the future implementation of Stage 2 LRT and the planned New Orchard Transit Station, located within 600 m of the proposed development, this increase in transit ridership is expected to be easily accommodated;
- Based on the forecasted vehicle demand for horizon year 2019, which included the site-generated vehicle traffic and background traffic growth, the study area intersection is projected to operate similar to existing, with an overall LoS 'C' during peak hours. The northbound left-turn movement is projected to operate at capacity (LoS 'E'), similar to existing. The MMLoS analysis results for horizon year 2019 are the same as the existing conditions as no roadway modifications are planned by 2019 and increases in vehicle volumes are minimal;
- Based on the horizon year 2024 background growth projections and the proposed modifications at the Woodroffe/Richmond intersection, the MMLoS results show bicycle levels of service are met within the study area. Pedestrian levels of service are significantly improved from the existing condition and the transit level of service is TLoS 'A' based on the implementation of the future LRT. The vehicle level of service is projected to significantly decrease during peak hours based on the projected volumes and the proposed removal of one east and west vehicle travel lane at the Richmond/Woodroffe intersection;

- Given the implementation of Stage 2 LRT within the study area and the planned improvements to the cycling and pedestrian network, the traffic volumes within the area may decrease as vehicle modes shift to transit. The vehicle level of service within the study area may improve as the demand on private automobiles decreases;
- A total of 126 parking spaces on three underground parking levels and an additional 14 spaces are in a small surface parking lot are proposed to serve the subject development. This amount of parking meets the City's minimum and maximum parking requirements;
- Bicycle parking is proposed underground and surface to meet the City's By-Law requirements;
- Two vehicle accesses are proposed, the main access to the underground parking is proposed to Woodroffe Avenue and the loading driveway/small parking lot driveway is proposed to Richmond Road. Both driveways are located as far from the signalized Richmond/Woodroffe intersection as possible given the site's location/dimensions and both distances meet the Private Approach By-Law requirements;
- With regard to the ramp providing access to the lower level parking garage, the turn radius should be increased and/or driveway width should be increased to facilitate the safe movement of simultaneous two-way vehicles. We are advised that the project architect will be doing this;
- With regard to passenger vehicle traffic to/from the surface parking lot, the combined 3 m width and 20 m length of the driveway are of concern. Two-way traffic cannot be accommodated within this narrow width and long throat length, which will result in unsafe vehicle conflicts on Richmond Road. Possible mitigation measures include; elimination of the parking supply thereby allowing service/garbage vehicles only; or signals to allow one-way traffic to operate safely. We are advised that the architect is reviewing these options with the property owner; and
- Proposed TDM measures include high rates of underground bicycle parking, good pedestrian connections and possible car-sharing parking spaces.

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, assuming the aforementioned site driveway design/operation issues are addressed, the proposed 929 Richmond Road residential development is recommended from a transportation perspective.

Prepared By:

André Sponder, B.A.Sc.
Transportation Analyst

Reviewed By:

Ronald Jack, P.Eng.
Senior Transportation Engineer

Appendix A

City Transportation Project Manager Correspondence

Sponder, Andre

From: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Sent: Thursday, November 30, 2017 12:38 PM
To: Sponder, Andre
Cc: McCreight, Laurel
Subject: RE: Strategy Report - 929 Richmond Road
Attachments: TIA Strategy Report_929 Richmond.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Andre,

Please see my comments below for the 929 Richmond Rd Strategy Report:

1) Section 2.2 – Provide the truck turning templates.
2) Section 4 - Assess the potential impact of the subject development on the design; are there any impact on the City's design? Are there any required design changes to the City's design?
3) Section 5.1
    a. Paragraph 1 and 3 – This only refers to the private access by-law compliance however this does not comply with TAC Standards (see Figure 8.8.2). Discussion and possible solutions may be required to ensure that this shorter distances do not create problems; ie back-up is traffic, accidents. Also, there may be visibility issues with the Richmond Access due to the location of the bus stop. Section 8.2 even makes this statement "Similar to existing conditions, vehicle queues are projected to spill back past the proposed site driveway accesses, however, drivers can provide gaps in the queues to allow vehicle movement to proceed to/from the proposed development."
    b. Paragraph 2 – As per the Part 4 – Parking, Queuing and Loading Provisions of the Zoning By-law "the grade of any part of a private approach to a building may be greater than 6% but shall not exceed 12% provided that a subsurface melting device sufficient to keep the private approach free of ice at all times is installed and properly maintained by the owner". This paragraph states that the grade will reach upwards of 21.5%.
    c. Paragraph 2 – It will need to be shown that the distance of 7.5m oppose to the 9m do not create any drainage issues or hazardous conditions.
4) Section 5.2 - Elements 4.5.1 and 4.5.2 from module 4.5 needs to be addressed.
5) Module 4.7 needs to be addressed.
6) Section 8.1 – when is the traffic volumes from?
7) Provide an electronic version of the Synchro analysis with final report.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Sponder, Andre [mailto:Andre.Sponder@parsons.com]
Sent: Monday, November 27, 2017 5:18 PM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Strategy Report - 929 Richmond Road

Hi Rosanna,

Please see the final Step 4 – Analysis attached for the 929 Richmond Road TIA project.

Please call if you would like to discuss.

Thanks,

André

From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Monday, November 20, 2017 9:58 AM
To: Sponder, Andre <Andre.Sponder@parsons.com>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Forecasting Report - 929 Richmond Road

Hi Andre,

The contents of Step 3 – Forecasting has been reviewed.

Please proceed to Step 4 – Forecasting.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Sponder, Andre [mailto:Andre.Sponder@parsons.com]
Sent: Friday, November 17, 2017 10:40 AM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Forecasting Report - 929 Richmond Road

Hi Rosanna,

Attached is the Forecasting Report for 929 Richmond Road.

I was wondering if you or Laurel might be able to provide me the CAD drawings for the future road alignments within this area related to the Stage 2 LRT plans.

Feel free to call to discuss.
Thanks,

André

André Sponder, B.A.Sc.
Transportation Analyst
1223 Michael St., Suite 100, Ottawa, ON K1J 7T2
andre.sponder@parsons.com - P: +1 613.691.1576

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From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Wednesday, November 15, 2017 11:20 AM
To: Sponder, Andre <Andre.Sponder@parsons.com>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Screening Form - 929 Richmond Road

Yup that works. Perhaps just adding a note refering back to it.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Sponder, Andre [mailto:Andre.Sponder@parsons.com]
Sent: Wednesday, November 15, 2017 9:59 AM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Screening Form - 929 Richmond Road

Hi Rosanna,

Thanks for the comments. For the intersection design at Woodroffe/Richmond, I had included a drawing as Figure 6 in Section 3.1. Is this what you had in mind for your second comment?

I will proceed to Step 3 and update the TIA regarding the comments for the final submission.

Thanks,

André

From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Wednesday, November 15, 2017 9:53 AM
To: Sponder, Andre <Andre.Sponder@parsons.com>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Screening Form - 929 Richmond Road

Hi Andre,

Please see my comments as follows:

- Section 2.2 – Are there counts from a different time of year that would give a better indication to cycling volumes?
- Section 4 – If it possible to obtain a copy of a visual representation of what is proposed plan for the intersection? Possibly include it as a figure.
- Recommendation – when using acronyms (ie BRT and LRT) spell them out in full the first time they are used. Do not assume that all readers of this document understand what they mean.

The above noted items (if able to be provided) do not require resubmission as a separate item, they can be included in the final submission.

Please proceed with Step 3 – Forecasting.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Sponder, Andre [mailto:Andre.Sponder@parsons.com]
Sent: Monday, November 13, 2017 11:31 AM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Screening Form - 929 Richmond Road

Hi Rosanna,

Please see the attached Scoping report for 929 Richmond Road.

Regards,

André

André Sponder, B.A.Sc.
Transportation Analyst
1223 Michael St., Suite 100, Ottawa, ON K1J 7T2
andre.sponder@parsons.com - P: +1 613.691.1576

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From: Baggs, Rosanna [mailto:Rosanna.Baggs@ottawa.ca]
Sent: Tuesday, October 31, 2017 12:48 PM
To: Sponder, Andre <Andre.Sponder@parsons.com>
Cc: McCreight, Laurel <Laurel.McCreight@ottawa.ca>
Subject: RE: Screening Form - 929 Richmond Road

Thank you Andre,

Since the screening form indicates that triggers have been met, please proceed with Step 1 – Screening.

Please call me to discuss if necessary.

Regards,

Rosanna Baggs, C.E.T.
Project Manager, Infrastructure Approvals | GPRJ Approbation demandes infrastructure
Development Review West Branch | Dir Services d'exam des dem d'amgt
Tel |Tél. : 613-580- 2424 ext. | poste 26388

From: Sponder, Andre [mailto:Andre.Sponder@parsons.com]
Sent: Tuesday, October 31, 2017 11:44 AM
To: Baggs, Rosanna <Rosanna.Baggs@ottawa.ca>
Subject: Screening Form - 929 Richmond Road

Hi Rosanna,

Please see attached Screening Form and Site Plan for the proposed 18-storey apartment building located at the corner of Richmond and Woodroffe.

If you have any questions or would like to discuss any concerns, please call.

Thanks,

André

André Sponder, B.A.Sc.
Transportation Analyst
1223 Michael St., Suite 100, Ottawa, ON K1J 7T2
andre.sponder@parsons.com - P: +1 613.691.1576

Appendix B

Existing Intersection Count Data

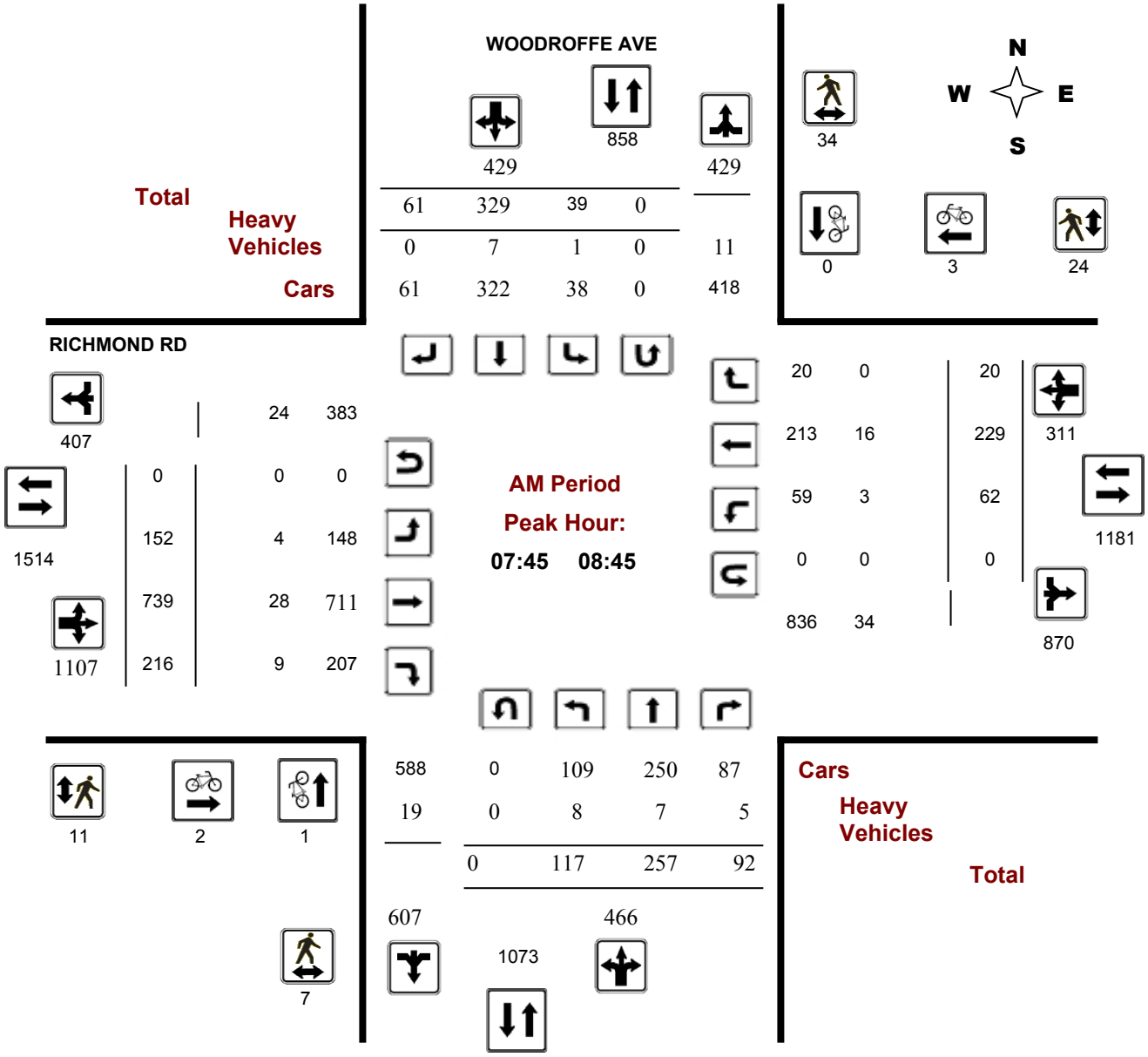
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

RICHMOND RD @ WOODROFFE AVE

Survey Date: Thursday, December 01, 2016
Start Time: 07:00

WO No: 36566
Device: Miovision



Comments

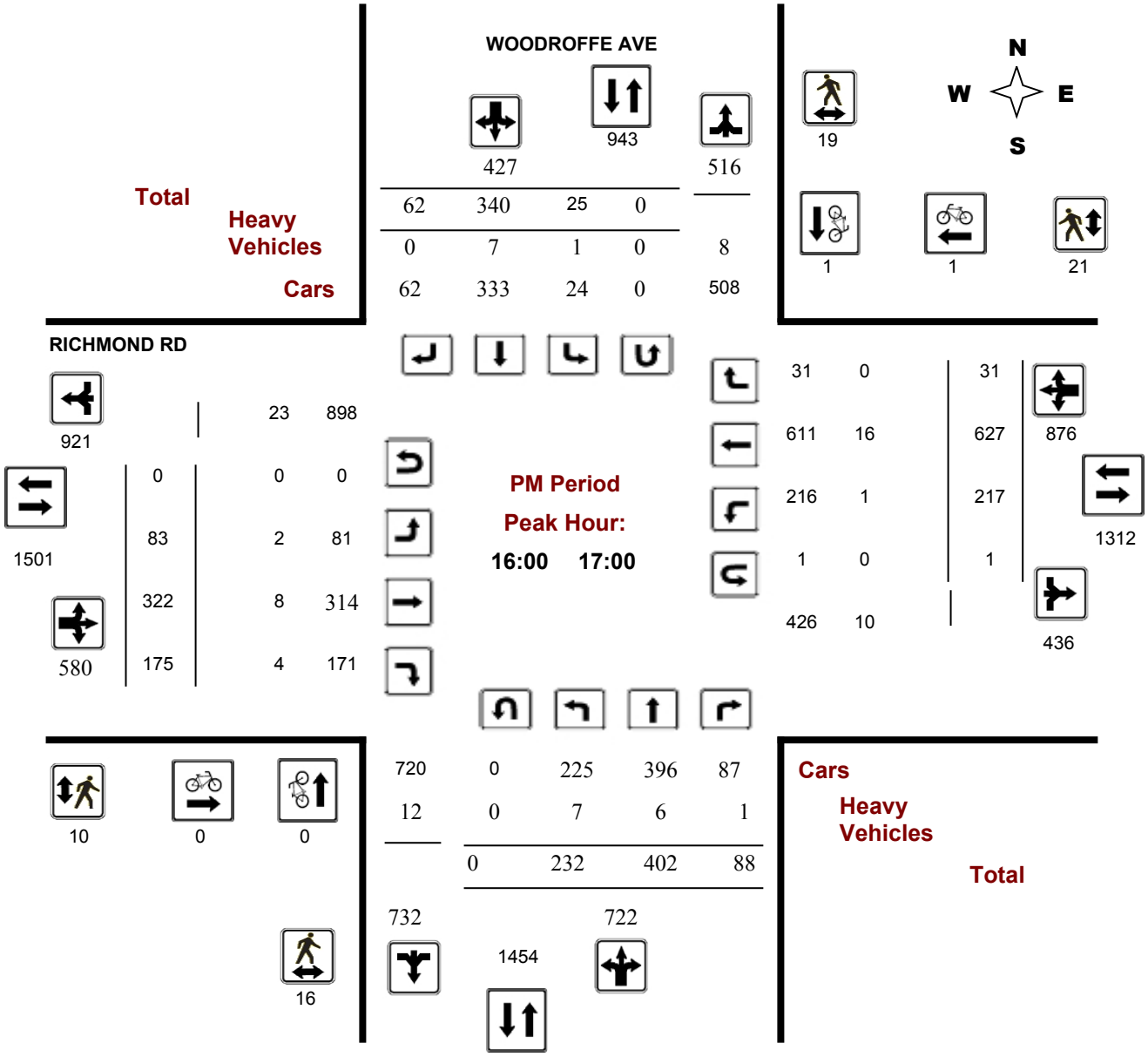
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

RICHMOND RD @ WOODROFFE AVE

Survey Date: Thursday, December 01, 2016 **WO No:** 36566

Start Time: 07:00 **Device:** Miovision



Comments

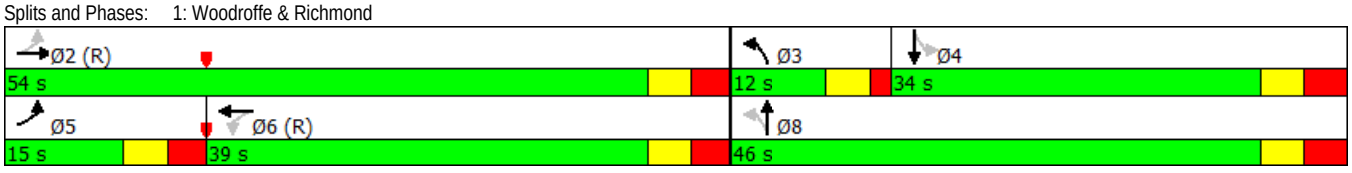
Appendix C

SYNCHRO Capacity and MMLOS Analysis: Existing Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	152	739	62	229	117	257	39	329
Future Volume (vph)	152	739	62	229	117	257	39	329
Lane Group Flow (vph)	169	1061	69	276	130	388	43	434
Turn Type	pm+pt	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2		6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	11.2	24.2	24.2	24.2	9.9	33.6	33.6	33.6
Total Split (s)	15.0	54.0	39.0	39.0	12.0	46.0	34.0	34.0
Total Split (%)	15.0%	54.0%	39.0%	39.0%	12.0%	46.0%	34.0%	34.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.9	2.9	2.9	2.9	1.6	3.3	3.3	3.3
Lost Time Adjust (s)	-2.2	-2.2	-2.2	-2.2	-0.9	-2.6	-2.6	-2.6
Total Lost Time (s)	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	C-Max	None	None	None	None
Act Effct Green (s)	51.3	51.3	36.5	36.5	40.7	40.7	28.7	28.7
Actuated g/C Ratio	0.51	0.51	0.36	0.36	0.41	0.41	0.29	0.29
v/c Ratio	0.33	0.63	0.43	0.23	0.61	0.55	0.16	0.86
Control Delay	15.5	18.8	35.5	22.3	31.3	24.5	27.8	51.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.5	18.8	35.5	22.3	31.3	24.5	27.8	51.0
LOS	B	B	D	C	C	C	C	D
Approach Delay		18.4		24.9		26.2		48.9
Approach LOS		B		C		C		D
Queue Length 50th (m)	17.4	72.6	10.2	18.9	15.5	51.7	6.1	76.3
Queue Length 95th (m)	29.5	93.8	24.5	28.6	#27.9	79.3	14.6	#125.6
Internal Link Dist (m)		206.7		191.0		115.7		120.6
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	518	1692	160	1218	214	725	277	527
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.63	0.43	0.23	0.61	0.54	0.16	0.82

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 35 (35%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 26.5	Intersection LOS: C
Intersection Capacity Utilization 80.7%	ICU Level of Service D
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

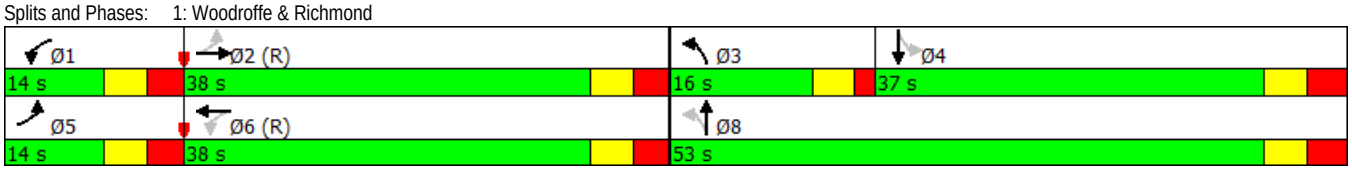
Splits and Phases: 1: Woodroffe & Richmond



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	83	322	217	627	232	402	25	340
Future Volume (vph)	83	322	217	627	232	402	25	340
Lane Group Flow (vph)	92	552	241	731	258	545	28	447
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	5.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	11.2	24.2	11.2	24.2	9.9	33.6	33.6	33.6
Total Split (s)	14.0	38.0	14.0	38.0	16.0	53.0	37.0	37.0
Total Split (%)	13.3%	36.2%	13.3%	36.2%	15.2%	50.5%	35.2%	35.2%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.9	2.9	2.9	2.9	1.6	3.3	3.3	3.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	4.9	6.6	6.6	6.6
Lead/Lag	Lead	Lag	Lead	Lag	Lead		Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
Act Effct Green (s)	39.9	32.5	42.4	36.0	46.7	45.0	29.0	29.0
Actuated g/C Ratio	0.38	0.31	0.40	0.34	0.44	0.43	0.28	0.28
v/c Ratio	0.37	0.53	0.76	0.63	0.95	0.73	0.14	0.92
Control Delay	22.1	26.7	39.9	33.2	65.7	30.9	30.0	61.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.1	26.7	39.9	33.2	65.7	30.9	30.0	61.8
LOS	C	C	D	C	E	C	C	E
Approach Delay		26.1		34.9		42.1		59.9
Approach LOS		C		C		D		E
Queue Length 50th (m)	10.9	40.3	31.6	69.2	32.7	86.1	4.2	85.4
Queue Length 95th (m)	20.7	57.0	#64.5	90.2	#79.2	126.0	11.4	#140.6
Internal Link Dist (m)		206.7		191.0		115.7		120.6
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	257	1038	317	1154	272	769	207	509
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.53	0.76	0.63	0.95	0.71	0.14	0.88

Intersection Summary		
Cycle Length: 105		
Actuated Cycle Length: 105		
Offset: 35 (33%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green		
Natural Cycle: 90		
Control Type: Actuated-Coordinated		
Maximum v/c Ratio: 0.95		
Intersection Signal Delay: 39.0	Intersection LOS: D	
Intersection Capacity Utilization 86.6%	ICU Level of Service E	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 1: Woodroffe & Richmond



Multi-Modal Level of Service - Intersections Form

Consultant	Parsons	Project	929 Richmond
Scenario	Existing	Date	Nov-17
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Richmond/Woodroffe				Intersection B				Intersection C			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	3	4	6	6								
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m								
	Conflicting Left Turns	Protected/ Permissive	Protected/ Permissive	Permissive	Protected/ Permissive								
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control								
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed								
	Ped Signal Leading Interval?	No	No	No	No								
	Right Turn Channel	No Channel	Conv'tl without Receiving Lane	No Channel	Conv'tl without Receiving Lane								
	Corner Radius	5-10m	10-15m	5-10m	5-10m								
	Crosswalk Type	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings								
	PETSI Score	**74**	**60**	**24**	**28**								
	Ped. Exposure to Traffic LoS	**C**	**C**	**F**	**F**	-	-	-	-	-	-	-	-
	Cycle Length	105	105	105	105								
	Effective Walk Time	21	21	26	10								
	Average Pedestrian Delay	**34**	**34**	**30**	**43**								
	Pedestrian Delay LoS	**D**	**D**	**D**	**E**	-	-	-	-	-	-	-	-
	Level of Service	**D**	**D**	**F**	**F**	-	-	-	-	-	-	-	-
		F				**-**				**-**			
	Approach From	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**	**NORTH**	**SOUTH**	**EAST**	**WEST**
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic								
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	≤ 50 m	≤ 50 m								
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h								
	Cyclist relative to RT motorists	**D**	**D**	**D**	**D**	-	-	-	-	-	-	-	-
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	-	-	-	-	-	-	-	-
	Left Turn Approach	One lane crossed	One lane crossed	≥ 2 lanes crossed	≥ 2 lanes crossed								
	Operating Speed	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h								
	Left Turning Cyclist	**E**	**E**	**F**	**F**	-	-	-	-	-	-	-	-
	Level of Service	**E**	**E**	**F**	**F**	-	-	-	-	-	-	-	-
		F				**-**				**-**			
Transit	Average Signal Delay	> 40 sec	≤ 30 sec	≤ 30 sec	≤ 20 sec								
	Level of Service	**F**	**D**	**D**	**C**	-	-	-	-	-	-	-	-
		F				**-**				**-**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m								
	Number of Receiving Lanes on Departure from Intersection	≥ 2	≥ 2	1	1								
	Level of Service	**B**	**B**	**E**	**E**	-	-	-	-	-	-	-	-
		E				**-**				**-**			
Auto	Volume to Capacity Ratio	0.91 - 1.00											
	Level of Service	**E**				**-**				**-**			

Multi-Modal Level of Service - Segments Form

Consultant	**Parsons**	**Project**	**929 Richmond**
Scenario	**Existing**	**Date**	**Nov-17**
Comments			

SEGMENTS		Richmond	Section 1	Woodroffe	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	F	< 1.5 m n/a	F	< 1.5 m n/a							
	Avg Daily Curb Lane Traffic Volume		> 3000		> 3000							
	Operating Speed On-Street Parking		> 50 to 60 km/h no		> 50 to 60 km/h no							
	Exposure to Traffic PLoS		F		F	-	-	-	-	-	-	-
	Effective Sidewalk Width		1.5 m		1.5 m							
	Pedestrian Volume		250 ped/hr		250 ped/hr							
	Crowding PLoS		B		B	-	-	-	-	-	-	-
	Level of Service		F		F	-	-	-	-	-	-	-
Bicycle	Type of Cycling Facility	-	Mixed Traffic	-	Mixed Traffic							
	Number of Travel Lanes		4-5 lanes total		2-3 lanes total							
	Operating Speed		≥ 50 to 60 km/h		≥ 50 to 60 km/h							
	# of Lanes & Operating Speed LoS		E		E	-	-	-	-	-	-	-
	Bike Lane (+ Parking Lane) Width											
	Bike Lane Width LoS		-		-	-	-	-	-	-	-	-
	Bike Lane Blockages											
	Blockage LoS		-		-	-	-	-	-	-	-	-
	Median Refuge Width (no median = < 1.8 m)											
	No. of Lanes at Unsignalized Crossing											
	Sidestreet Operating Speed											
	Unsignalized Crossing - Lowest LoS		-		-	-	-	-	-	-	-	-
	Level of Service		-		-	-	-	-	-	-	-	-
Transit	Facility Type	D	Mixed Traffic	D	Mixed Traffic							
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8		Vt/Vp ≥ 0.8							
	Level of Service		D		D	-	-	-	-	-	-	-
Truck	Truck Lane Width	A	> 3.7 m	B	> 3.7 m							
	Travel Lanes per Direction		> 1		1							
	Level of Service		A		B	-	-	-	-	-	-	-

Appendix D

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	13	8	3	8	0	2	0	1	35	73%
Non-fatal injury	2	2	1	3	0	5	0	0	13	27%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**15**	**10**	**4**	**11**	**0**	**7**	**0**	**1**	**48**	100%
	#1 or 31%	#3 or 21%	#5 or 8%	#2 or 23%	#7 or 0%	#4 or 15%	#7 or 0%	#6 or 2%		

Richmond Rd / Wodroffe Ave

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2012-2016	36	31,360	1825	**0.63**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	12	5	3	6	0	2	0	1	29	81%
Non-fatal injury	0	2	1	1	0	3	0	0	7	19%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**12**	**7**	**4**	**7**	**0**	**5**	**0**	**1**	**36**	100%
	33%	19%	11%	19%	0%	14%	0%	3%		

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2014 **To:** January 1, 2017

Location: RICHMOND RD @ WOODROFFE AVE

Traffic Control: Traffic signal **Total Collisions:** 26

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Feb-18, Tue,09:00	Snow	Rear end	P.D. only	Loose snow	South	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					South	Stopped	Automobile, station wagon	Other motor vehicle	
2014-May-07, Wed,15:00	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2014-Feb-14, Fri,07:38	Snow	Angle	P.D. only	Loose snow	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Sep-07, Sun,16:23	Clear	Angle	P.D. only	Dry	East	Going ahead	Unknown	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2014-Sep-13, Sat,14:56	Rain	Rear end	P.D. only	Wet	North	Slowing or stopping	Passenger van	Other motor vehicle	
					North	Stopped	Automobile, station wagon	Other motor vehicle	
2015-Jun-17, Wed,11:47	Clear	SMV other	Non-fatal injury	Dry	East	Turning right	Pick-up truck	Pedestrian	1

2015-Feb-11, Wed,11:00	Clear	Rear end	P.D. only	Dry	South	Turning right	Passenger van	Other motor vehicle
					South	Turning right	Automobile, station wagon	Other motor vehicle
2014-Dec-21, Sun,17:41	Clear	Rear end	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					South	Stopped	Automobile, station wagon	Other motor vehicle
2015-Mar-30, Mon,11:13	Rain	Angle	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle
2015-Jun-10, Wed,16:36	Clear	Angle	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2016-Aug-03, Wed,18:18	Rain	Sideswipe	Non-fatal injury	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Apr-01, Fri,13:03	Clear	Rear end	P.D. only	Dry	North	Slowing or stopping	Automobile, station wagon	Other motor vehicle
					North	Unknown	Automobile, station wagon	Other motor vehicle
					North	Stopped	Automobile, station wagon	Other motor vehicle
2016-Aug-27, Sat,10:52	Clear	Turning movement	P.D. only	Dry	East	Turning right	Delivery van	Other motor vehicle

					East	Going ahead	Pick-up truck	Other motor vehicle
2016-Oct-26, Wed,18:23	Clear	Turning movement	Non-fatal injury	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Oct-05, Mon,14:56	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Stopped	Pick-up truck	Other motor vehicle
2015-Nov-09, Mon,13:32	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Sep-30, Wed,11:49	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Municipal transit bus	Other motor vehicle
2015-Oct-28, Wed,15:12	Rain	Rear end	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Stopped	Automobile, station wagon	Other motor vehicle
2016-Jan-03, Sun,12:28	Clear	Rear end	P.D. only	Wet	North	Turning left	Automobile, station wagon	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle
2016-Feb-09, Tue,18:56	Snow	SMV other	P.D. only	Loose snow	East	Merging	Automobile, station wagon	Skidding/sliding

2016-Mar-24, Thu,08:02	Snow	SMV other	Non-fatal injury	Wet	South	Turning right	Automobile, station wagon	Pedestrian	1
2016-Apr-04, Mon,18:05	Clear	Turning movement	P.D. only	Dry	West	Turning left	Pick-up truck	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Apr-23, Sat,21:03	Clear	Angle	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-May-30, Mon,14:52	Clear	SMV other	P.D. only	Dry	East	Turning right	Automobile, station wagon	Pole (sign, parking meter)	
2016-Nov-10, Thu,06:27	Clear	Rear end	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Stopped	Pick-up truck	Other motor vehicle	
2016-Nov-16, Wed,14:50	Clear	Turning movement	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Pick-up truck	Other motor vehicle	

Location: RICHMOND RD btwn NEW ORCHARD AVE & WOODROFFE AVE

Traffic Control: No control

Total Collisions: 6

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jan-30, Thu,13:16	Clear	Angle	Non-fatal injury	Wet	South	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Pick-up truck	Other motor vehicle	

2014-Mar-04, Tue,10:45	Clear	Turning movement	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Making "U" turn	Pick-up truck	Other motor vehicle	
2014-Jun-25, Wed,17:11	Clear	Rear end	Non-fatal injury	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Pick-up truck	Other motor vehicle	
					West	Slowing or stopping	Pick-up truck	Other motor vehicle	
2016-Aug-31, Wed,08:46	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	1
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Dec-30, Wed,09:00	Clear	Turning movement	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Sep-30, Fri,16:50	Clear	SMV other	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Pedestrian	1

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2012-01-01 TO: 2014-01-01

RICHMOND RD, NEW ORCHARD AVE to WOODROFFE AVE

Former Municipality: **Ottawa** Traffic Control: **No control** Number of Collisions: **5**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2012-02-17	Fri	13:29	Clear	Daylight	Angle	P.D. only	V1 S	Dry	Turning left	Passenger van	Other motor vehicle	0
								V2 W	Dry	Going ahead	Automobile, station	Other motor vehicle	
2	2012-03-26	Mo	09:32	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	
3	2012-08-14	Tue	09:30	Clear	Daylight	Angle	P.D. only	V1 S	Dry	Turning left	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Going ahead	Automobile, station	Other motor vehicle	
4	2012-09-14	Fri	17:30	Rain	Daylight	Rear end	P.D. only	V1 W	Wet	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Wet	Stopped	Automobile, station	Other motor vehicle	
5	2012-10-15	Mo	18:48	Clear	Dusk	Rear end	Non-fatal	V1 E	Dry	Going ahead	Pick-up truck	Other motor vehicle	0
								V2 E	Dry	Turning left	Automobile, station	Other motor vehicle	

RICHMOND RD & WOODROFFE AVE

Former Municipality: **Ottawa** Traffic Control: **Traffic signal** Number of Collisions: **10**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
6	2012-02-20	Mo	18:44	Clear	Dark	Other	P.D. only	V1 S	Dry	Reversing	Automobile, station	Other motor vehicle	0
								V2 N	Dry	Stopped	Automobile, station	Other motor vehicle	
7	2012-02-26	Sun	01:14	Clear	Dark	Angle	Non-fatal	V1 S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Going ahead	Passenger van	Other motor vehicle	
8	2012-03-07	We	15:30	Clear	Daylight	Sideswipe	P.D. only	V1 W	Dry	Changing lanes	Pick-up truck	Other motor vehicle	0
								V2 W	Dry	Changing lanes	Pick-up truck	Other motor vehicle	
9	2012-04-09	Mo	11:30	Clear	Daylight	Rear end	P.D. only	V1 W	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Stopped	Automobile, station	Other motor vehicle	
10	2012-05-11	Fri	21:23	Clear	Dark	Rear end	P.D. only	V1 E	Dry	Slowing or	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Stopped	Pick-up truck	Other motor vehicle	
11	2012-06-13	We	22:15	Clear	Dark	Angle	P.D. only	V1 E	Dry	Turning right	Automobile, station	Other motor vehicle	0
								V2 S	Dry	Going ahead	Automobile, station	Other motor vehicle	

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

12	2012-07-26	Thu	16:01	Rain	Daylight	Rear end	P.D. only	V1	N	Wet	Slowing or	Unknown	Other motor vehicle	0
								V2	N	Wet	Stopped	Pick-up truck	Other motor vehicle	
13	2012-08-24	Fri	17:45	Clear	Daylight	Sideswipe	P.D. only	V1	W	Dry	Changing lanes	Automobile, station	Other motor vehicle	0
								V2	W	Dry	Turning left	Automobile, station	Other motor vehicle	
14	2012-08-27	Mo	12:55	Clear	Daylight	Single vehicle	Non-fatal	V1	N	Dry	Turning left	Pick-up truck	Pedestrian	1
15	2012-09-17	Mo	17:35	Clear	Daylight	Turning	Non-fatal	V1	W	Dry	Turning left	Automobile, station	Other motor vehicle	0
								V2	E	Dry	Going ahead	Pick-up truck	Other motor vehicle	

WOODROFFE AVE, DESCHENES ST to RICHMOND RD

Former Municipality: **Ottawa** 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
16	2012-11-08	Thu	11:18	Clear	Daylight	Single vehicle	Non-fatal	V1	S	Dry	Reversing	Passenger van	Pedestrian	1

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

Appendix E

Traffic Growth Analysis

Richmond / Woodroffe
8 hrs

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2007	Wednesday June 20	2714	2938	3977	4183	4368	4165	5432	5205	32982
2010	Friday July 16	2896	3146	4583	4349	4169	3464	5049	5738	33394
2011	Monday May 16	2690	2587	3672	4057	3817	4142	5427	4820	31212
2016	Thursday Decemeber 1	2987	3181	4418	4937	4173	4218	5644	4886	34444

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	2938	2714	5652	32982				
2010	3146	2896	6042	33394	7.1%	6.7%	6.9%	1.2%
2011	2587	2690	5277	31212	-17.8%	-7.1%	-12.7%	-6.5%
2016	3181	2987	6168	34444	23.0%	11.0%	16.9%	10.4%

Regression Estimate	2007	2867	2709	5576
Regression Estimate	2016	3083	2963	6045
Average Annual Change		**0.81%**	**1.00%**	**0.90%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	5432	5205	10637	32982				
2010	5049	5738	10787	33394	-7.1%	10.2%	1.4%	1.2%
2011	5427	4820	10247	31212	7.5%	-16.0%	-5.0%	-6.5%
2016	5644	4886	10530	34444	4.0%	1.4%	2.8%	10.4%

Regression Estimate	2007	5251	5365	10615
Regression Estimate	2016	5560	4909	10469
Average Annual Change		**0.64%**	**-0.98%**	**-0.15%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	4165	4368	8533	32982				
2010	3464	4169	7633	33394	-16.8%	-4.6%	-10.5%	1.2%
2011	4142	3817	7959	31212	19.6%	-8.4%	4.3%	-6.5%
2016	4218	4173	8391	34444	1.8%	9.3%	5.4%	10.4%

Regression Estimate	2007	3905	4206	8111
Regression Estimate	2016	4112	4039	8152
Average Annual Change		**0.58%**	**-0.45%**	**0.06%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	3977	4183	8160	32982				
2010	4583	4349	8932	33394	15.2%	4.0%	9.5%	1.2%
2011	3672	4057	7729	31212	-19.9%	-6.7%	-13.5%	-6.5%
2016	4418	4937	9355	34444	20.3%	21.7%	21.0%	10.4%

Regression Estimate	2007	4010	4038	8048
Regression Estimate	2016	4353	4811	9163
Average Annual Change		**0.92%**	**1.96%**	**1.45%**

Richmond / Woodroffe
AM Peak

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2007	Wednesday June 20	377	521	534	506	366	917	1158	491	4870
2010	Friday July 16	298	360	492	495	310	523	722	444	3644
2011	Monday May 16	335	446	483	479	296	813	1004	380	4236
2016	Thursday Decemeber 1	429	429	466	607	311	870	1107	407	4626

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	521	377	898	4870				
2010	360	298	658	3644	-30.9%	-21.0%	-26.7%	-25.2%
2011	446	335	781	4236	23.9%	12.4%	18.7%	16.2%
2016	429	429	858	4626	-3.8%	28.1%	9.9%	9.2%

Regression Estimate	2007	467	327	795
Regression Estimate	2016	403	400	804
Average Annual Change		**-1.62%**	**2.25%**	**0.12%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	1158	491	1649	4870				
2010	722	444	1166	3644	-37.7%	-9.6%	-29.3%	-25.2%
2011	1004	380	1384	4236	39.1%	-14.4%	18.7%	16.2%
2016	1107	407	1514	4626	10.3%	7.1%	9.4%	9.2%

Regression Estimate	2007	981	466	1447
Regression Estimate	2016	1019	386	1405
Average Annual Change		**0.43%**	**-2.07%**	**-0.32%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	917	366	1283	4870				
2010	523	310	833	3644	-43.0%	-15.3%	-35.1%	-25.2%
2011	813	296	1109	4236	55.4%	-4.5%	33.1%	16.2%
2016	870	311	1181	4626	7.0%	5.1%	6.5%	9.2%

Regression Estimate	2007	766	342	1107
Regression Estimate	2016	800	295	1094
Average Annual Change		**0.48%**	**-1.63%**	**-0.13%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	534	506	1040	4870				
2010	492	495	987	3644	-7.9%	-2.2%	-5.1%	-25.2%
2011	483	479	962	4236	-1.8%	-3.2%	-2.5%	16.2%
2016	466	607	1073	4626	-3.5%	26.7%	11.5%	9.2%

Regression Estimate	2007	522	473	995
Regression Estimate	2016	458	583	1041
Average Annual Change		**-1.44%**	**2.36%**	**0.51%**

Richmond / Woodroffe
PM Peak

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2007	Wednesday June 20	456	422	601	622	775	405	553	936	4770
2010	Friday July 16	486	525	718	637	823	431	672	1106	5398
2011	Monday May 16	488	393	526	719	1006	451	614	1071	5268
2016	Thursday Decemeber 1	427	516	722	732	876	436	580	921	5210

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	422	456	878	4770				
2010	525	486	1011	5398	24.4%	6.6%	15.1%	13.2%
2011	393	488	881	5268	-25.1%	0.4%	-12.9%	-2.4%
2016	516	427	943	5210	31.3%	-12.5%	7.0%	-1.1%

Regression Estimate	2007	429	481	910
Regression Estimate	2016	508	443	951
Average Annual Change		**1.89%**	**-0.90%**	**0.49%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	553	936	1489	4770				
2010	672	1106	1778	5398	21.5%	18.2%	19.4%	13.2%
2011	614	1071	1685	5268	-8.6%	-3.2%	-5.2%	-2.4%
2016	580	921	1501	5210	-5.5%	-14.0%	-10.9%	-1.1%

Regression Estimate	2007	603	1032	1635
Regression Estimate	2016	607	979	1586
Average Annual Change		**0.06%**	**-0.58%**	**-0.34%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2007	405	775	1180	4770				
2010	431	823	1254	5398	6.4%	6.2%	6.3%	13.2%
2011	451	1006	1457	5268	4.6%	22.2%	16.2%	-2.4%
2016	436	876	1312	5210	-3.3%	-12.9%	-10.0%	-1.1%

Regression Estimate	2007	418	826	1245
Regression Estimate	2016	446	924	1371
Average Annual Change		**0.71%**	**1.25%**	**1.07%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2007	601	622	1223	4770				
2010	718	637	1355	5398	19.5%	2.4%	10.8%	13.2%
2011	526	719	1245	5268	-26.7%	12.9%	-8.1%	-2.4%
2016	722	732	1454	5210	37.3%	1.8%	16.8%	-1.1%

Regression Estimate	2007	595	627	1222
Regression Estimate	2016	700	741	1441
Average Annual Change		**1.81%**	**1.88%**	**1.85%**

Appendix F

SYNCHRO Capacity and MMLOS Analysis – 2024 Background Conditions

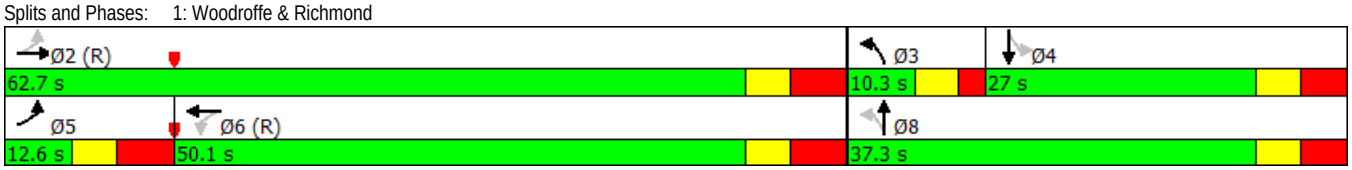
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	157	765	64	237	121	266	40	341
Future Volume (vph)	157	765	64	237	121	266	40	341
Lane Group Flow (vph)	174	1099	71	286	134	402	44	449
Turn Type	pm+pt	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2		6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	12.6	26.6	26.6	26.6	10.3	23.9	23.9	23.9
Total Split (s)	12.6	62.7	50.1	50.1	10.3	37.3	27.0	27.0
Total Split (%)	12.6%	62.7%	50.1%	50.1%	10.3%	37.3%	27.0%	27.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	4.3	4.3	4.3	4.3	2.0	3.6	3.6	3.6
Lost Time Adjust (s)	-3.6	-3.6	-3.6	-3.6	0.5	-2.9	-2.9	-2.9
Total Lost Time (s)	4.0	4.0	4.0	4.0	5.8	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	C-Max	None	None	None	None
Act Effct Green (s)	58.7	58.7	46.1	46.1	31.5	33.3	23.0	23.0
Actuated g/C Ratio	0.59	0.59	0.46	0.46	0.32	0.33	0.23	0.23
v/c Ratio	0.33	1.08	1.00	0.35	0.90	0.71	0.27	1.11
Control Delay	11.3	76.2	141.2	18.5	82.5	35.6	36.9	115.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.3	76.2	141.2	18.5	82.5	35.6	36.9	115.1
LOS	B	E	F	B	F	D	D	F
Approach Delay		67.3		42.9		47.4		108.1
Approach LOS		E		D		D		F
Queue Length 50th (m)	14.5	~238.7	13.3	33.8	19.2	64.3	7.0	~99.0
Queue Length 95th (m)	24.4	#314.8	#41.9	52.9	#50.1	98.3	17.0	#158.2
Internal Link Dist (m)		206.7		191.0		115.7		120.6
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	529	1013	71	808	149	569	163	404
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	1.08	1.00	0.35	0.90	0.71	0.27	1.11

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 110	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.11	
Intersection Signal Delay: 67.6	Intersection LOS: E
Intersection Capacity Utilization 110.4%	ICU Level of Service H
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: Woodroffe & Richmond

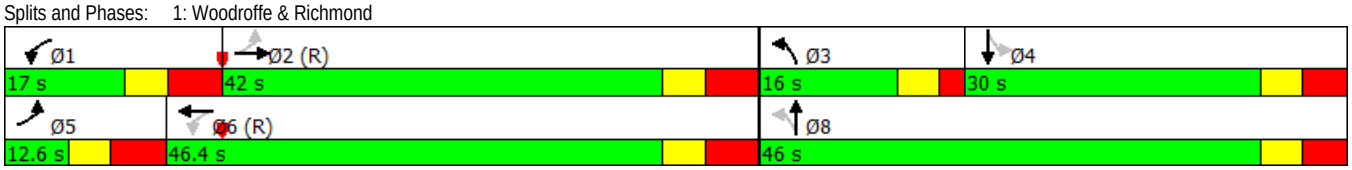


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	86	333	225	649	240	416	26	352
Future Volume (vph)	86	333	225	649	240	416	26	352
Lane Group Flow (vph)	96	571	250	757	267	563	29	462
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	5.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	12.6	26.6	12.6	26.6	11.9	27.9	27.9	27.9
Total Split (s)	12.6	42.0	17.0	46.4	16.0	46.0	30.0	30.0
Total Split (%)	12.0%	40.0%	16.2%	44.2%	15.2%	43.8%	28.6%	28.6%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	4.3	4.3	4.3	4.3	2.0	3.6	3.6	3.6
Lost Time Adjust (s)	-1.4	-1.4	-1.4	-1.4	-0.4	-0.3	-0.3	-0.3
Total Lost Time (s)	6.2	6.2	6.2	6.2	4.9	6.6	6.6	6.6
Lead/Lag	Lead	Lag	Lead	Lag	Lead		Lag	Lag
Lead-Lag Optimize?		Yes	Yes					
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
Act Effct Green (s)	42.2	35.8	51.4	42.7	41.1	39.4	23.4	23.4
Actuated g/C Ratio	0.40	0.34	0.49	0.41	0.39	0.38	0.22	0.22
v/c Ratio	0.57	0.98	1.01	1.05	1.07	0.87	0.24	1.18
Control Delay	30.9	67.1	86.6	80.6	104.6	45.4	39.6	141.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.9	67.1	86.6	80.6	104.6	45.4	39.6	141.8
LOS	C	E	F	F	F	D	D	F
Approach Delay		61.9		82.1		64.5		135.7
Approach LOS		E		F		E		F
Queue Length 50th (m)	9.9	110.3	~36.3	~178.6	~45.4	103.2	4.9	~112.8
Queue Length 95th (m)	#21.8	#180.6	#86.4	#249.5	#95.4	#164.6	13.5	#173.7
Internal Link Dist (m)		206.7		191.0		115.7		120.6
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	167	581	248	719	249	649	121	391
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.98	1.01	1.05	1.07	0.87	0.24	1.18

Intersection Summary	
Cycle Length: 105	
Actuated Cycle Length: 105	
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 120	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.18	
Intersection Signal Delay: 81.5	Intersection LOS: F
Intersection Capacity Utilization 102.8%	ICU Level of Service G
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: Woodroffe & Richmond



Multi-Modal Level of Service - Intersections Form

Consultant	**Parsons**	**Project**	**929 Richmond**
Scenario	**Background 2024**	**Date**	**Nov-17**
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Richmond/Woodroffe				Intersection B				Intersection C			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	3	3	3	3								
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m								
	Conflicting Left Turns	Protected/ Permissive	Protected/ Permissive	Permissive	Protected/ Permissive								
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control								
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed								
	Ped Signal Leading Interval?	No	No	No	No								
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel								
	Corner Radius	5-10m	5-10m	15-25m	5-10m								
	Crosswalk Type	Textured/coloured pavement	Textured/coloured pavement	Textured/coloured pavement	Textured/coloured pavement								
	PETSI Score	**74**	**74**	**71**	**74**								
	Ped. Exposure to Traffic LoS	**C**	**C**	**C**	**C**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Cycle Length	105	105	105	105								
	Effective Walk Time	22	22	29	13								
	Average Pedestrian Delay	**33**	**33**	**28**	**40**								
	Pedestrian Delay LoS	**D**	**D**	**C**	**E**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Level of Service	**D**	**D**	**C**	**E**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		E				**-**				**-**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP								
	Right Turn Lane Configuration	Not Applicable	Not Applicable	Not Applicable	Not Applicable								
	Right Turning Speed	Not Applicable	Not Applicable	Not Applicable	Not Applicable								
	Cyclist relative to RT motorists	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Separated or Mixed Traffic	**Separated**	**Separated**	**Separated**	**Separated**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Left Turn Approach	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box								
	Operating Speed	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h								
	Left Turning Cyclist	**A**	**A**	**A**	**A**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Level of Service	**A**	**A**	**A**	**A**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		A				**-**				**-**			
Transit	Average Signal Delay	> 40 sec	> 40 sec	> 40 sec	> 40 sec								
	Level of Service	**F**	**F**	**F**	**F**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		F				**-**				**-**			
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m								
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1								
	Level of Service	**E**	**E**	**E**	**E**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
		E				**-**				**-**			
Auto	Volume to Capacity Ratio	> 1.00											
	Level of Service	**F**				**-**				**-**			

Multi-Modal Level of Service - Segments Form

Consultant	**Parsons**	**Project**	**929 Richmond**
Scenario	**Background 2024**	**Date**	**27-Nov**
Comments			

SEGMENTS		Richmond	Section 1	Woodroffe	Section 2	Section 3	Section 4	Section 5	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	C	≥ 2 m 0.5 - 2 m	B	≥ 2 m > 2 m							
	Avg Daily Curb Lane Traffic Volume		> 3000		> 3000							
	Operating Speed On-Street Parking		> 50 to 60 km/h no		> 50 to 60 km/h no							
	Exposure to Traffic PLoS		**C**		**B**	-	-	-	-	-	-	-
	Effective Sidewalk Width		2.0 m		1.5 m							
	Pedestrian Volume		250 ped/hr		250 ped/hr							
	Crowding PLoS		**B**		**B**	-	-	-	-	-	-	-
	Level of Service		**C**		**B**	-	-	-	-	-	-	-
Bicycle	Type of Cycling Facility	A	Physically Separated	A	Physically Separated							
	Number of Travel Lanes											
	Operating Speed											
	# of Lanes & Operating Speed LoS		-		-	-	-	-	-	-	-	-
	Bike Lane (+ Parking Lane) Width											
	Bike Lane Width LoS		-		-	-	-	-	-	-	-	-
	Bike Lane Blockages											
	Blockage LoS		-		-	-	-	-	-	-	-	-
	Median Refuge Width (no median = < 1.8 m)											
	No. of Lanes at Unsignalized Crossing											
	Sidestreet Operating Speed											
	Unsignalized Crossing - Lowest LoS		~~A~~		~~A~~	-	-	-	-	-	-	-
	Level of Service		**A**		**A**	-	-	-	-	-	-	-
Transit	Facility Type	D	Mixed Traffic	D	Mixed Traffic							
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8		Vt/Vp ≥ 0.8							
	Level of Service		**D**		**D**	-	-	-	-	-	-	-
Truck	Truck Lane Width	D	≤ 3.3 m	C	≤ 3.5 m							
	Travel Lanes per Direction		1		1							
	Level of Service		**D**		**C**	-	-	-	-	-	-	-

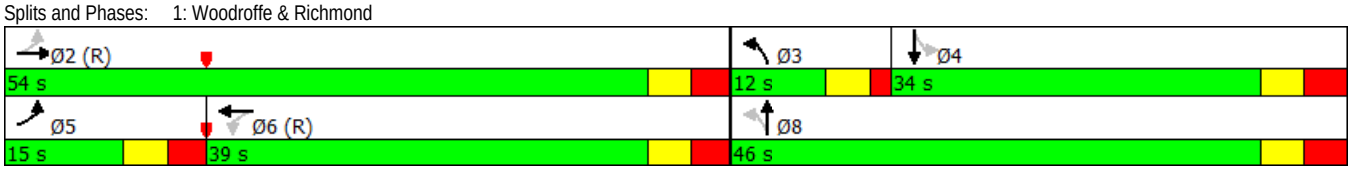
Appendix G

SYNCHRO Capacity Analysis – 2019 Total Projected Conditions

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	157	747	63	232	119	262	49	338
Future Volume (vph)	157	747	63	232	119	262	49	338
Lane Group Flow (vph)	174	1072	70	284	132	394	54	453
Turn Type	pm+pt	NA	Perm	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2		6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	6	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	10.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	11.2	24.2	24.2	24.2	9.9	33.6	33.6	33.6
Total Split (s)	15.0	54.0	39.0	39.0	12.0	46.0	34.0	34.0
Total Split (%)	15.0%	54.0%	39.0%	39.0%	12.0%	46.0%	34.0%	34.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.9	2.9	2.9	2.9	1.6	3.3	3.3	3.3
Lost Time Adjust (s)	-2.2	-2.2	-2.2	-2.2	0.9	-2.6	-2.6	-2.6
Total Lost Time (s)	4.0	4.0	4.0	4.0	5.8	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	C-Max	None	None	None	None
Act Effct Green (s)	50.9	50.9	36.2	36.2	39.3	41.1	29.1	29.1
Actuated g/C Ratio	0.51	0.51	0.36	0.36	0.39	0.41	0.29	0.29
v/c Ratio	0.34	0.64	0.46	0.24	0.74	0.55	0.20	0.88
Control Delay	15.9	19.2	37.2	22.4	46.1	24.5	28.6	53.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.9	19.2	37.2	22.4	46.1	24.5	28.6	53.5
LOS	B	B	D	C	D	C	C	D
Approach Delay		18.8		25.3		29.9		50.9
Approach LOS		B		C		C		D
Queue Length 50th (m)	18.0	73.8	10.4	19.4	16.3	52.8	7.8	80.7
Queue Length 95th (m)	30.4	95.3	25.5	29.3	#36.6	81.0	17.6	#134.1
Internal Link Dist (m)		19.2		191.0		115.7		15.1
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	508	1678	153	1203	179	725	274	527
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.64	0.46	0.24	0.74	0.54	0.20	0.86

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 35 (35%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 28.0	Intersection LOS: C
Intersection Capacity Utilization 82.8%	ICU Level of Service E
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 1: Woodroffe & Richmond

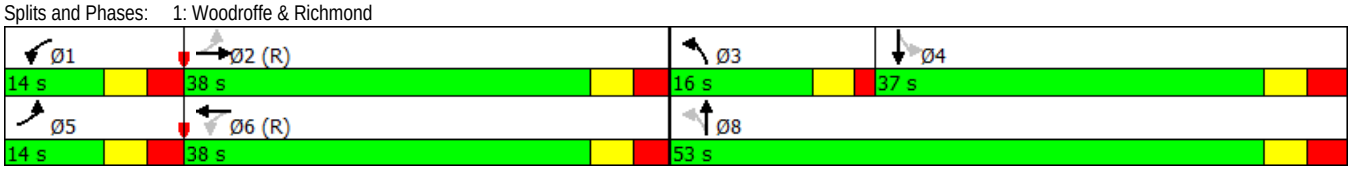


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	92	328	219	635	235	411	31	346
Future Volume (vph)	92	328	219	635	235	411	31	346
Lane Group Flow (vph)	102	563	243	750	261	556	34	461
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm	NA
Protected Phases	5	2	1	6	3	8		4
Permitted Phases	2		6		8		4	
Detector Phase	5	2	1	6	3	8	4	4
Switch Phase								
Minimum Initial (s)	5.0	10.0	5.0	10.0	5.0	10.0	10.0	10.0
Minimum Split (s)	11.2	24.2	11.2	24.2	9.9	33.6	33.6	33.6
Total Split (s)	14.0	38.0	14.0	38.0	16.0	53.0	37.0	37.0
Total Split (%)	13.3%	36.2%	13.3%	36.2%	15.2%	50.5%	35.2%	35.2%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
All-Red Time (s)	2.9	2.9	2.9	2.9	1.6	3.3	3.3	3.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2	6.2	6.2	4.9	6.6	6.6	6.6
Lead/Lag	Lead	Lag	Lead	Lag	Lead		Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Recall Mode	None	C-Max	None	C-Max	None	None	None	None
Act Effct Green (s)	39.6	32.1	41.5	33.1	47.1	45.4	29.4	29.4
Actuated g/C Ratio	0.38	0.31	0.40	0.32	0.45	0.43	0.28	0.28
v/c Ratio	0.44	0.55	0.78	0.71	0.98	0.74	0.18	0.94
Control Delay	24.1	27.0	41.4	36.3	74.0	31.1	30.8	64.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.1	27.0	41.4	36.3	74.0	31.1	30.8	64.4
LOS	C	C	D	D	E	C	C	E
Approach Delay		26.6		37.5		44.8		62.1
Approach LOS		C		D		D		E
Queue Length 50th (m)	12.2	41.2	31.9	71.5	33.6	88.8	5.2	88.8
Queue Length 95th (m)	22.5	58.3	#64.9	93.1	#83.4	129.7	13.3	#147.1
Internal Link Dist (m)		20.2		191.0		115.7		20.8
Turn Bay Length (m)	80.0		80.0		38.0		35.0	
Base Capacity (vph)	238	1030	313	1058	267	769	200	508
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.55	0.78	0.71	0.98	0.72	0.17	0.91

Intersection Summary

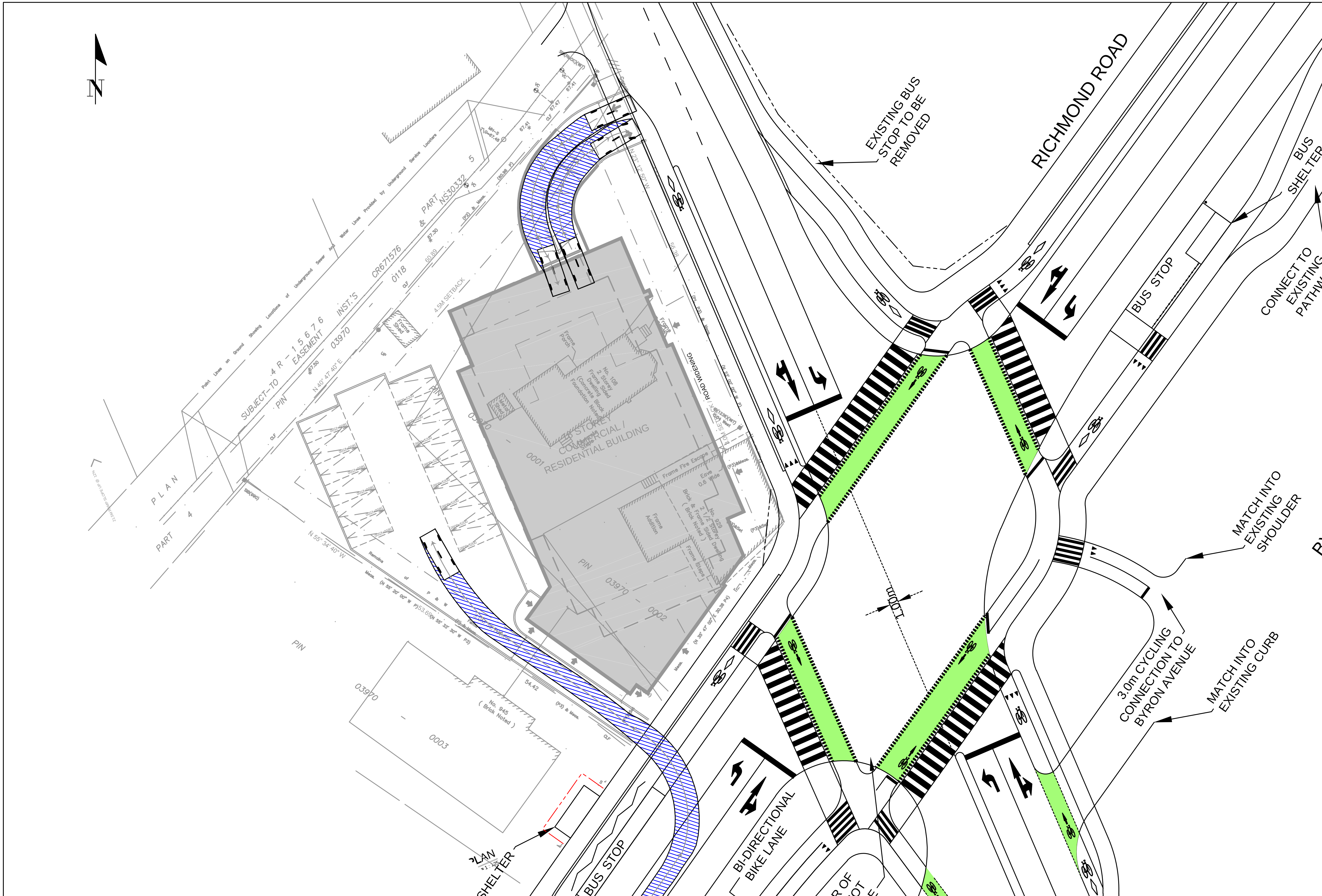
Cycle Length: 105
Actuated Cycle Length: 105
Offset: 35 (33%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 41.2 — Intersection LOS: D
Intersection Capacity Utilization 87.6% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

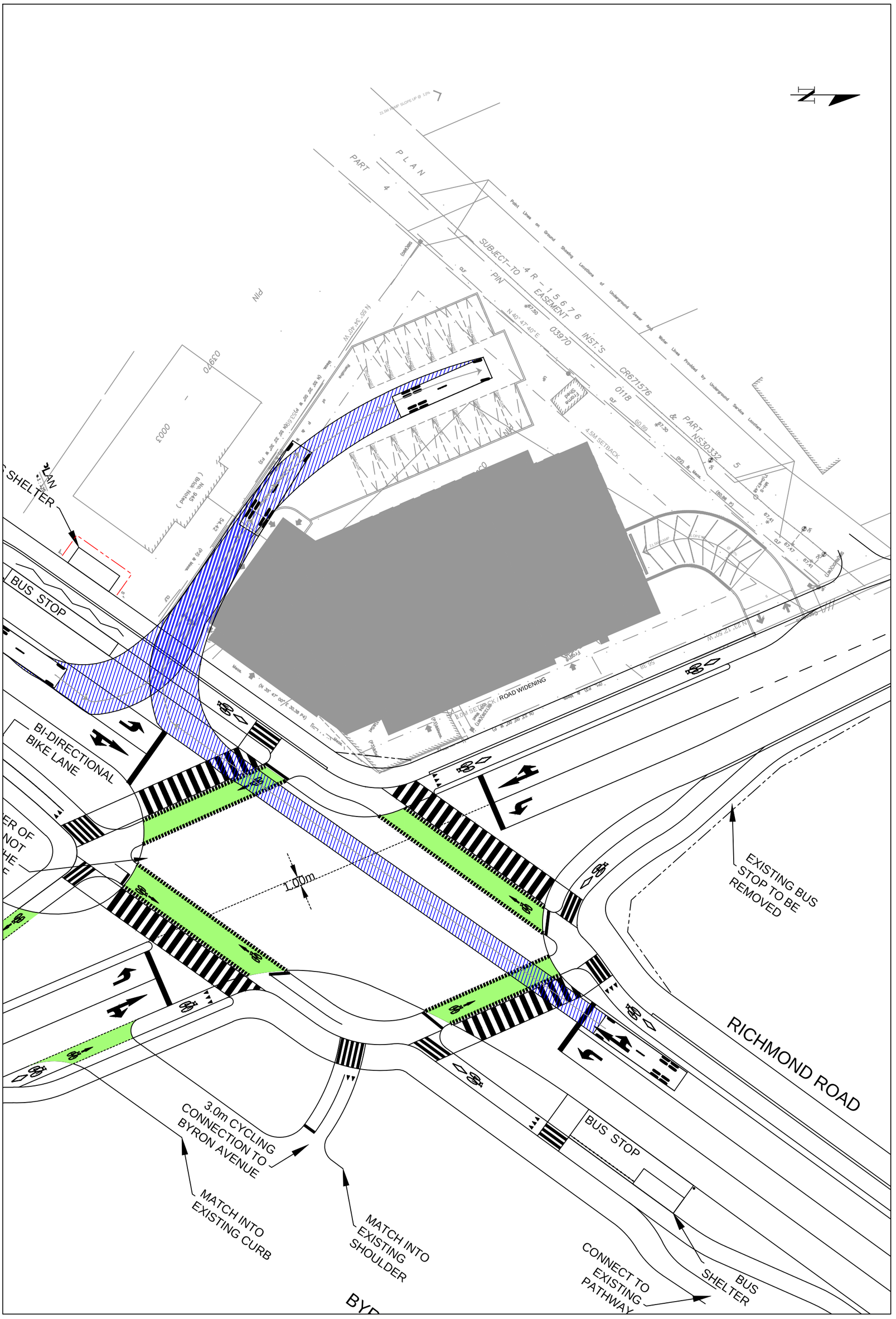
Splits and Phases: 1: Woodroffe & Richmond



Appendix H

Truck Turning Templates


N
RICHMOND ROAD
EXISTING BUS STOP TO BE REMOVED
BUS SHELTER
CONNECT TO EXISTING PATHWAY
BUS STOP
MATCH INTO EXISTING SHOULDER
3.0m CYCLING CONNECTION TO BYRON AVENUE
MATCH INTO EXISTING CURB
BI-DIRECTIONAL BIKE LANE
BUS STOP
4.5M SETBACK
ROAD WIDENING
1.00m


BUS STOP
BI-DIRECTIONAL BIKE LANE
4.5M SETBACK / ROAD WIDENING
7.00m
EXISTING BUS STOP TO BE REMOVED
RICHMOND ROAD
3.0m CYCLING CONNECTION TO BYRON AVENUE
MATCH INTO EXISTING CURB
MATCH INTO EXISTING SHOULDER
BUS STOP
CONNECT TO EXISTING PATHWAY
BUS SHELTER

Appendix I

Transportation Demand Management Checklist

TDM-Supportive Development Design and Infrastructure Checklist:
Residential Developments (multi-family or condominium)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
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

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☑
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☑
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☑
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☑
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☑

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☐ Unknown
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☑
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☑
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☑
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☐ N/A
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐ N/A
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☑
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐ N/A

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☑ Underground bike parking for residents
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☑
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☑
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	☑
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☑
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☑
	2.3	**Bicycle repair station**	
BETTER	2.3.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐ N/A
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐ To be discussed with Staff
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses *(see Zoning By-law Section 94)*	☐ To be considered
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☐
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☑
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐ N/A
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐ Residential use, shower/change facilities not required.
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	☑ Surface and underground parking