1299 Richmond Road

TIA Final Report

Final

September 2024

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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1299 Richmond Road

TIA Final Report

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FINAL REPORT

Parsons has been retained by Brigil Construction Inc. to prepare a TIA in support of a Zoning By-Law Amendment (ZBLA) and Site Plan Application (SPA) for a two-tower residential development. This document follows the TIA process as outlined in the City Transportation Impact Assessment (TIA) Guidelines (2017). The following report represents Step 5 – Final Report. The Screening Form and response to comments has been provided in **Appendix A**.

1.0 SCREENING FORM

The Screening Form confirmed the need for a TIA Report based on the trip generation and location triggers. The trip generation trigger was met as the development is anticipated to generate more than 60 person trips during peak hours. The location trigger was met given the development's location in the Richmond Arterial Mainstreet Design Priority Area (DPA) as well as within 600m of Lincoln Fields Station.

2.0 SCOPING REPORT

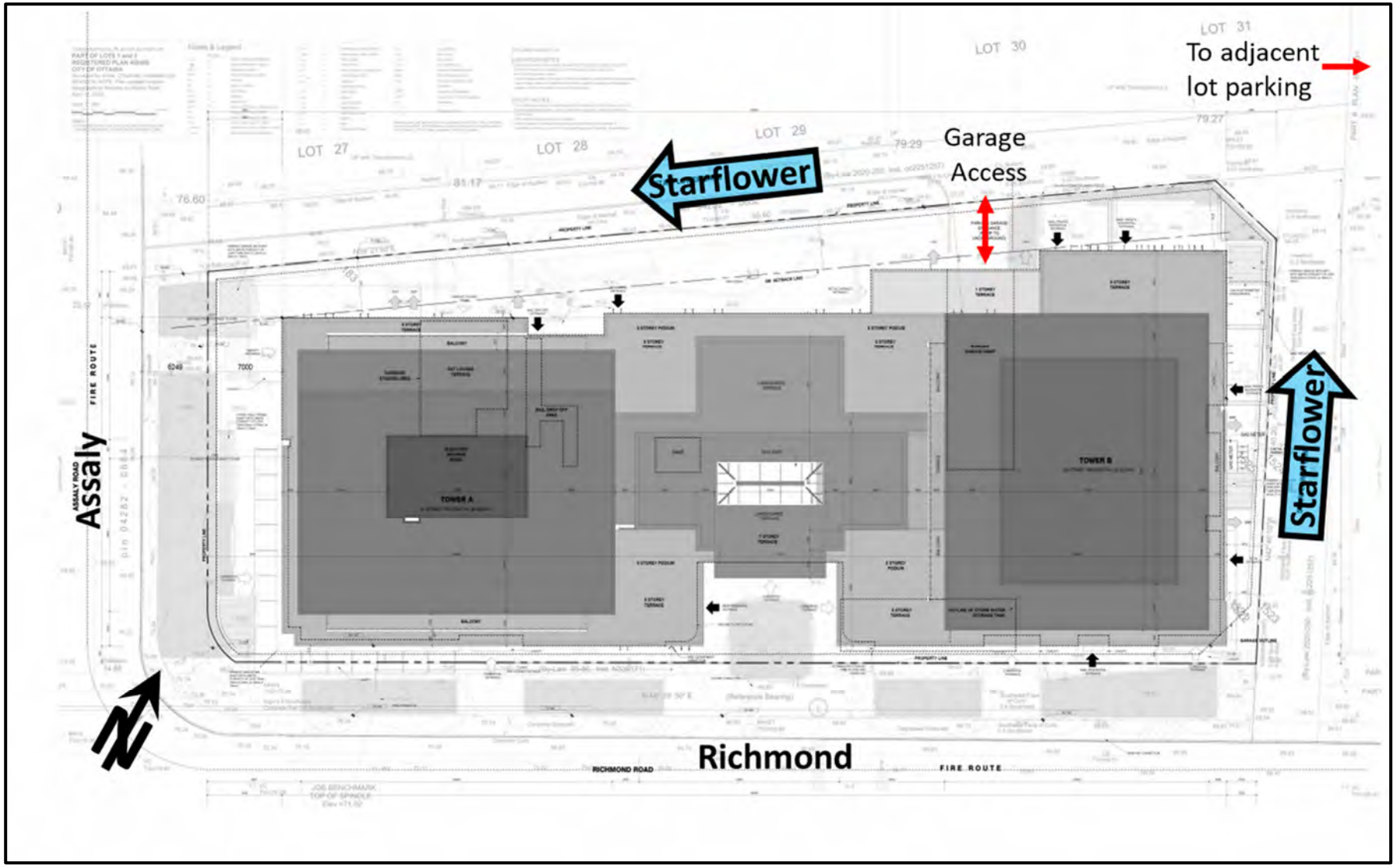
2.1. Existing and Planned Conditions

2.1.1. Proposed Development

The proposed development will be located at the municipal address of 1299 Richmond Rd and will be replacing the existing commercial building and surface parking lot. The site is bounded by municipal roads including, Richmond Rd to the south, Assaly Rd to the west, and Starflower Ln to the north and east. The proposed development will consist of a 28- and a 30-storey residential tower with a shared 5-storey podium. The buildings will house approximately 590 apartment units with 809 m^2 (8,707 ft^2) ground floor retail space. Access to a three-level underground parking garage is located along Starflower Ave on the north side of the building, with a total of 267 vehicle parking spaces. The buildout date of the development is assumed to be 2025. The site is currently zoned as Arterial Mainstreet (AM10). The local context of the site is illustrated in **Figure 1** and the concept plan is provided in the following pages as **Figure 2** (high quality plan in **Appendix A**).

Figure 1: Local Context

Figure 2: Proposed Site Plan



2.1.2. Existing Conditions

Area Road Network

The following roads were included in the TIA. Description for each road within the study area has been provided below.

Richmond Rd is an east-west municipal arterial road that extends from Baseline Rd in the west (where it continues west as Robertson Rd) to Island Park Dr in the east (where it continues east as Wellington St W). Within the study area, the roadway consists of a two-lane cross-section, with sidewalks on both sides of the road. From historical imaging, it appears that the north side of the road fronting the site has on-street parking with a width of approximately 2.3m, although no signage explicitly saying parking is or isn't allowed could be found. Bike lanes are provided on the north side of the road, with a cycle track on the south side. The posted speed limit is 50 km/h. Richmond Rd provides access to the site in existing conditions.

Assaly Rd is a short north-south municipal local road that extends from Regina St in the north to Richmond Rd in the south. The roadway consists of a two-lane cross-section with sidewalks on both sides of the road and an unposted assumed speed limit of 50km/h.

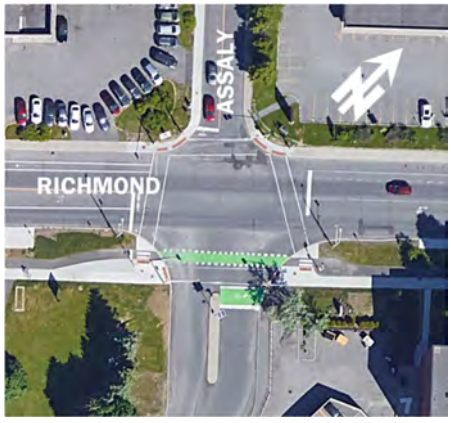
Starflower Ln is a municipal local one-way road that extends from Richmond Rd along the site frontage, turns west and continues in this direction beyond the property limits to Croydon Ave. The roadway consists of a one-lane cross-section with 6m right of way and pavement width, with a posted speed limit of 20km/h. Starflower Ln currently provides access to a variety of uses including residential homes and apartments as well as commercial retail uses.

Croydon Ave is a north-south municipal local road that extends from Regina St in the north to Carling Ave in the south. Within the study area, the roadway consists of a two-lane cross-section with sidewalks on both sides north of Richmond Rd and mostly on the west side south of thereof. The speed limit is assumed to be 50km/h.

Existing Study Area Intersections

Richmond/Assaly

The Richmond/Assaly intersection is a four-legged signalized intersection. The eastbound and westbound approaches consist of a shared through/right-turn lane and an auxiliary left-turn lane. The northbound approach consists of a shared through/left-turn lane and an auxiliary right-turn lane. The southbound approach consists of an all-movement lane. Crosswalks are provided on all legs of the intersection, with an eastbound through bike signal and crossing. The northbound right-turn on red is not permitted.

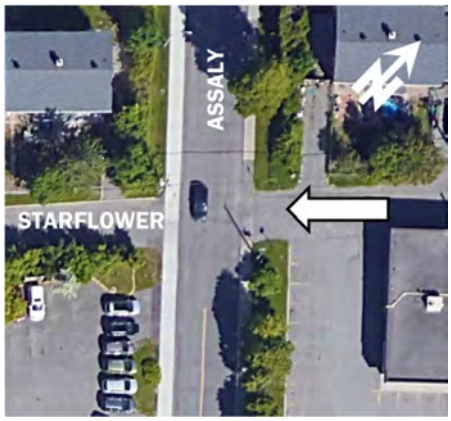


Richmond/Starflower

The Richmond/Starflower is an unsignalized three-legged intersection. The eastbound approach consists of a through lane and an auxiliary left-turn lane that extends from a downstream residential building access on Richmond Rd. The westbound approach consists of a shared through/right-turn lane. The north leg consists of a one-way northbound only lane. There is a continuous depressed sidewalk across Starflower Ln. Starflower Ln is one-way northbound at this location, thus southbound movements from Starflower Ln are not permitted.

Assaly/Starflower

The Assaly/Starflower intersection is an unsignalized four-legged intersection. There are no turning movements on any approach. The westbound approach on Starflower Ln is stop controlled. There is a continuous depressed sidewalk across Starflower Ln on both sides of Assaly Rd. Starflower Ln is one-way westbound across Assaly, thus movements in the eastbound direction are prohibited.



Richmond/Croydon

The Richmond/Croydon intersection is a four-legged signalized intersection. The eastbound, westbound, and northbound approaches consist of a shared through/right-turn lane and an auxiliary left-turn lane. The southbound approach consists of an all-movement lane. Crosswalks are provided on all legs of the intersection, with an eastbound through bike signal and crossing. The northbound right-turn on red is not permitted.

Existing Driveways to Adjacent Developments

There are 5 driveways providing access to residential uses along Starflower Ln as shown in **Figure 3**. Four driveways are located on the north side of Starflower Ln, all of which provide access to single family homes. The last driveway is located at the northeast corner of Starflower Ln and provides access to the surface parking lot of the existing residential building at 1285 Richmond Rd.

Figure 3: Adjacent Driveways within 200m of Site Access

Existing Area Traffic Management Measures

Existing area traffic management measures within the study area include bike signals at the intersections of Richmond/Assaly and Richmond/Croydon, as well as one-way operations with reduced speed of 20km/h along Starflower Ln.

Existing Pedestrian/Cycling Network

Sidewalk facilities are provided throughout the study area, including both sides of Richmond Rd, Assaly Rd and Croydon Ave.

Richmond Rd possesses a westbound on-street bike lane that extends through the study area, and an eastbound cycle track is provided on Richmond Rd which transitions to an on-street bike lane east of Starflower Ln. Multi-use Pathways (MUP) are provided on both sides of Kichi Zibi Mikan (former Sir John A. Macdonald Pkwy) called the Pinecrest Creek Pathway, with connections to Richmond Rd. The Pinecrest Creek Pathway provides connectivity to other major cycling facilities such as the major east-west Ottawa River Pathway which connects to the downtown and destinations west of the site. Pinecrest Creek Pathway also extends to the south, providing high quality cycling facilities to Algonquin College, the Experimental Farm Pathway and beyond. Richmond Rd is part of the Crosstown Bikeway Network according to the March 1, 2023 Transportation Master Plan (TMP) update, as shown in **Figure 4.**

Figure 4: 2023 TMP Crosstown Bikeway Network

Transit Network

The following description of OC Transpo routes within the study area reflect the current bus operations:

- **Route #11 (Parliament <-> Bayshore):** identified by OC Transpo as a "Frequent Route", this route operates all day, 7 days a week and at an average rate of every 15 minutes during weekday peak hours. The nearest bus stop to the site is at the intersection of Richmond/Starflower.
- **Route #153 (Tunney's Pasture <-> Lincoln Fields):** identified by OC Transpo as a "Local Route", this route operates with a custom routing to local destinations. The nearest bus stop to the site is at the intersection of Richmond/Assaly.
- **Lincoln Fields Station** is an existing station along the transitway, located within 350m radius of the site along Carling Ave and Sir John A. Macdonald Pkwy. Lincoln Fields Station provides access to many bus routes, including #11, #50, #51, #57, #58, #61, #62, #63, #64, #66, #67, #73, #74, #75, #82, #85, #153, #154, #186, #252, #256, #257, #258, #261, #262, #263, #264, #265, #267, #268, #282, #283, #301, #303 and #305.

The transit network for the study area is illustrated in **Figure 5** and the transit route maps are provided in **Appendix B**. **Figure 6** illustrates the bus stop locations.

Figure 5: Area Transit Network

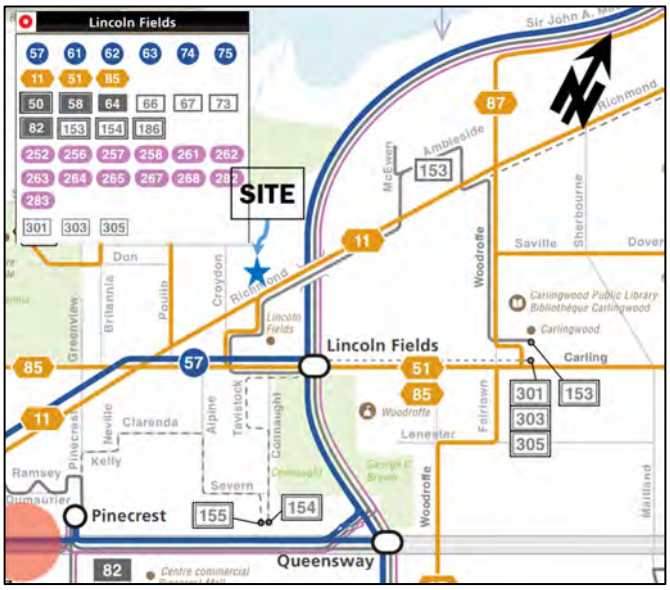
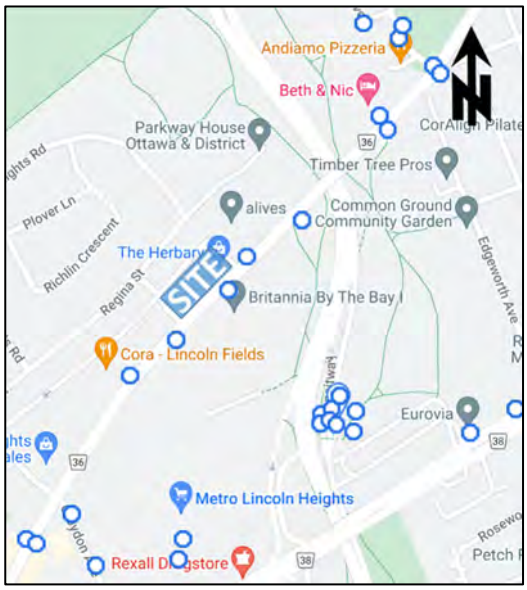


Figure 6: Bus Stop Locations



Peak Hour Travel Demands

Traffic count data was obtained from the City of Ottawa at the intersections of Assaly/Richmond and Croydon/Richmond in both 2016 and 2022. The City's 2022 counts were significantly lower compared to 2016 counts, as they were conducted when Covid-19 restrictions were still in place. However, the 2016 counts were also not expected to be fully representative of existing traffic volumes due to the various changes in the transportation network since that time, including the city's adoption of various new policies and design standards that prioritize sustainable modes of travel, the completion of Stage 1 LRT in September 2019, new road network projects, expanded policies supporting sustainable modes (such as improved TDM measures), and changes in travel behaviour triggered by Covid-19 (such as greater work-from-home opportunities).

To account for a worst-case scenario, the 2016 volumes that are expected to be overly conservative will be used as the baseline for existing volume within the study area

Additional study area intersection volumes were captured during a June 14, 2022 count performed by Parsons for the site access and Starflower Ln intersections with Richmond Rd and Assaly Rd. Within these counts, it was noted that a small number of vehicles (up to 7) was observed violating the one-way only restriction along Starflower Ln, by turning left on the southbound approach from Assaly Rd and travelling in the opposite direction to enter the existing strip mall at 1299 Richmond Rd.

The traffic volumes at study area intersections are illustrated in **Figure 7**, with raw traffic count data provided in **Appendix C**. Existing active transportations (pedestrian and cyclist) volumes at the intersection of Richmond/Assaly has been provided in **Figure 8**.

Figure 7: Existing Peak Hour Traffic Volumes

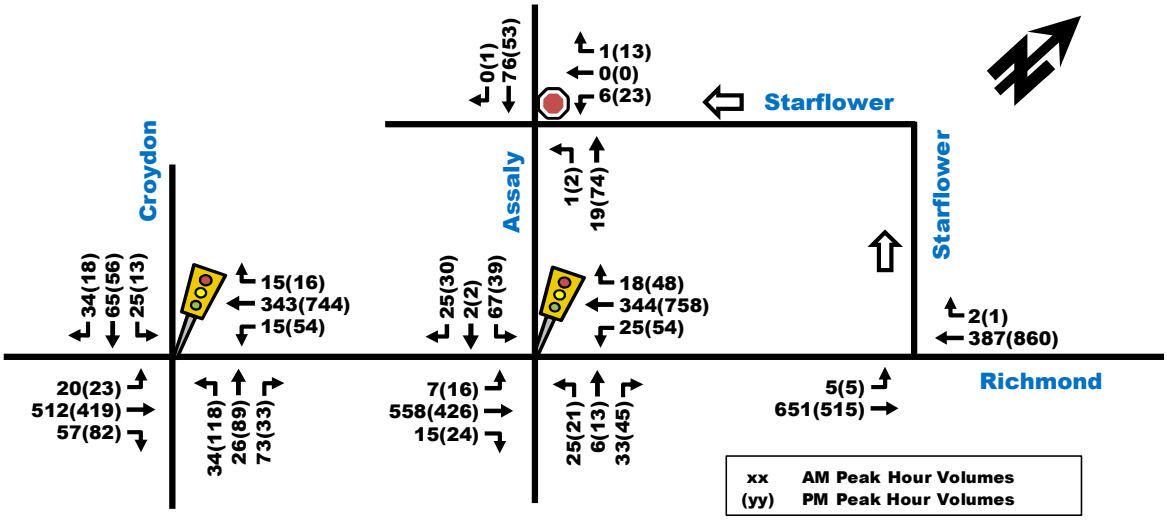
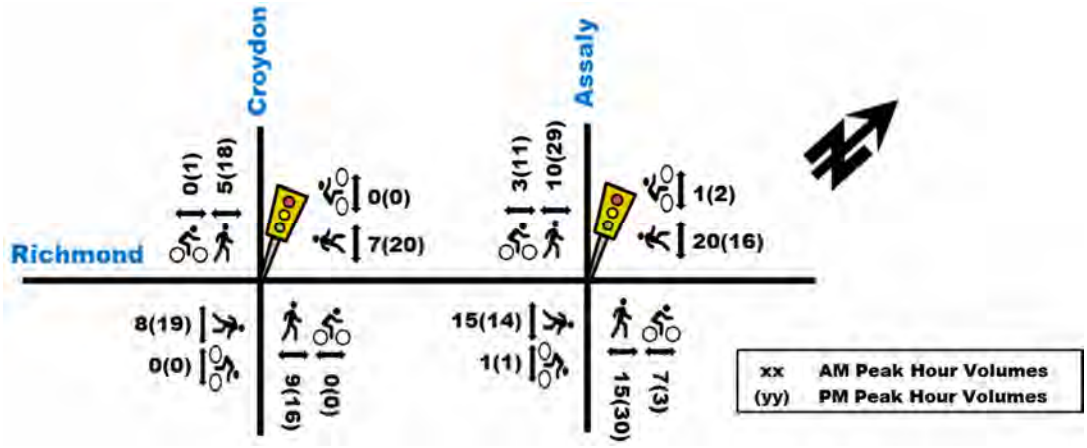


Figure 8: Existing Pedestrian and Cyclists Peak Hour Volumes



Existing Road Safety Conditions

A five-year collision history data (2017-2021, inclusive) was obtained from the City of Ottawa's Open Ottawa webpage for all intersections and road segments within the study area. It was determined that a total of 40 collisions have occurred. Of the 40 collisions, 11 (28%) resulted from rear ends, 10 (25%) from angled collisions, 10 (25%) from single vehicle (other), 5 (13%) from turning movements, 2 (5%) from sideswipes and 2 (5%) from single vehicle (unattended). Of the collisions, 29 (73%) collisions representing the majority of collisions, resulted in property damage only, while 11 (27%) resulted in non-fatal injuries. There were no fatal injuries recorded.

Within the study area, the quantity of collisions and/or distance of mid-block at each location has occurred at a rate of:

- Assaly/Richmond: 6
- Croydon/Richmond: 22
- Mid-block Assaly, Regina to Richmond: 1 (80m)
- Mid-block Richmond, Transitway to Assaly: 4 (270m)
- Mid-block Richmond, Assaly to Croydon: 7 (285m)
- Collisions with Pedestrians: 7 (18%)
- Collisions with Cyclists: 1 (3%)

The Croydon/Richmond intersection exhibited a total of 22 collisions, with 4 (18%) involving pedestrians and 1 (5%) involving cyclists. The collisions with vulnerable users has caused a non-fatal injury rate of 32% or 7 of the 22 collisions. The high rate of collisions with vulnerable users here may be attributed to active travellers heading to and from the Lincoln Heights Shopping Center to the community just north of Richmond Rd or linked to the intersection skew. Although space and pavement painting has been provided for cyclists and pedestrians, further measures from the Protected Intersection Design Manual (PIDG) such as leading pedestrian and cyclist intervals and no-right-on-red allowed for all movements could reduce the frequency of this type of collision.

The mid-block section on Richmond Rd between Assaly Rd and the Transitway exhibited 2 collisions with pedestrians out of 4 collisions total. Although not many collisions were recorded here, it could be possible that some pedestrians are crossing mid-block at an uncontrolled location to shorten the walking distance to/from Lincoln Fields Station to the community north of Richmond Rd. If this trend continues in future years, then the City may consider adding a PXO mid-block if warrants satisfy the need.

No other intersections or mid-block segments showed any notable or concerning trends. Collision data has been provided in **Appendix D.**

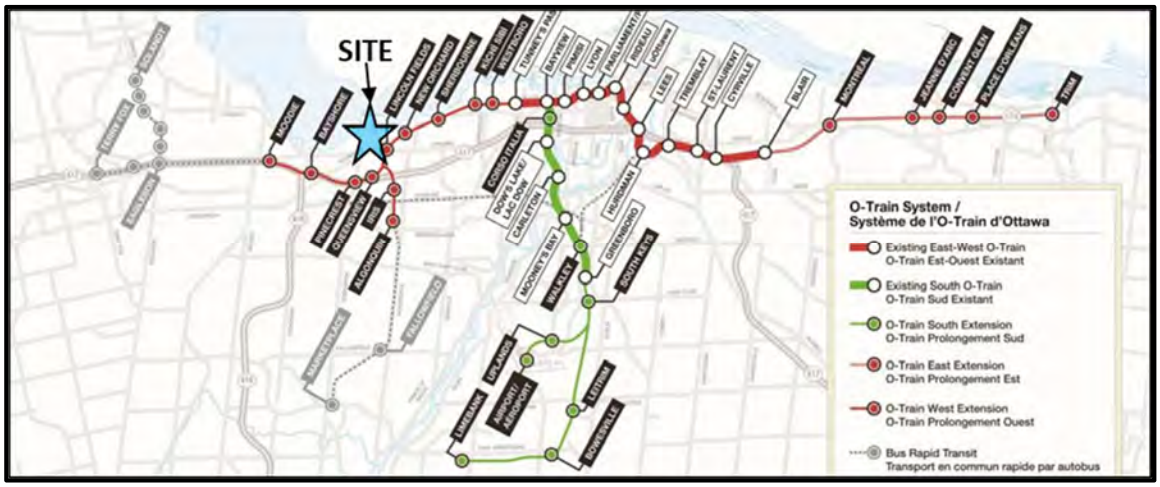
2.1.3. Planned Conditions

Future Transportation Network Changes

Stage 2 LRT

The Light Rail Transit (LRT) system in the City of Ottawa has entered Stage 2 of its implementation, which will include the extension of the LRT corridor in the west, east and south directions. The west extension will include a new LRT station at the existing Lincoln Fields bus station, located within 350m distance of the development site. The west extension to Moodie station is expected to be complete by 2027[1]. **Figure 9** illustrates the full expansion of the LRT Stage 2 system.

Figure 9: LRT Stage 2 Expansions Map



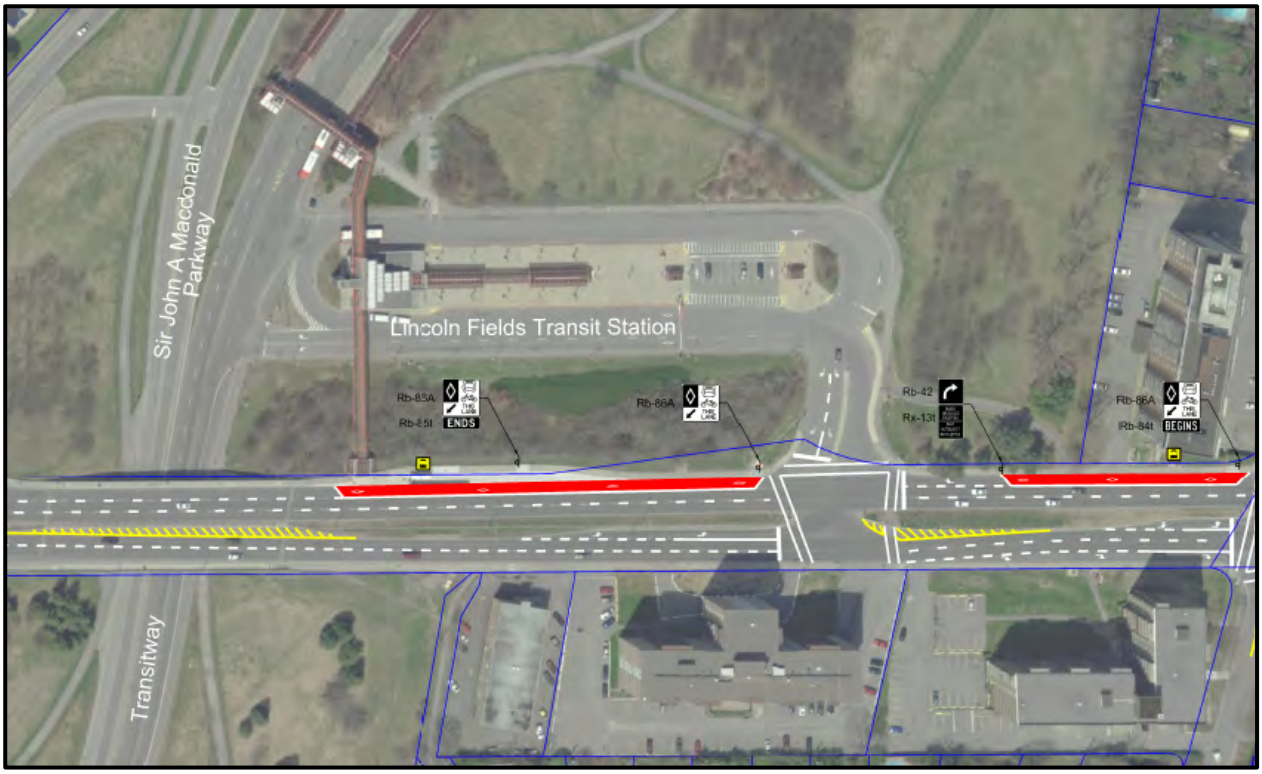
[1] https://ottawacitizen.com/news/ottawa-lrt-west-extension-could-be-ready-for-passengers-by-2027-city-says

Carling Avenue Transit Priority

The City of Ottawa is undergoing a detailed design for the Carling Ave Transit Priority corridor between Lincoln Fields Station and Bronson Ave, where a Bus Rapid Transit (BRT) is being implemented by converting a curbside lane in each direction across different sections of Carling Ave to a dedicated bus lane. **Figure 10** illustrates the proposed bus lane at the frontage of Lincoln Fields Station, as provided in the Carling Ave Transit Priority Measures Study (WSP 2017). Between Lincoln Fields Station and Sherwood Dr, some interim measures have been implemented since 2022.

In addition, the Carling Ave Transit Priority Corridor EA Study proposes new uni-directional cycle tracks along Carling Ave from Lincoln Fields to Dow's Lake Station near Preston St which are anticipated by 2028. The EA study coupled with the Lincoln Fields Secondary Plan, aim at improving cyclist connectivity and accessibility with plans to improve cyclist crossing treatments at Carling Ave intersections, including uni-directional and bi-directional crossrides.

Figure 10: Carling Ave Proposed Bus Lane



Lincoln Fields Secondary Plan

As part of the LRT Stage 2, the existing Lincoln Fields BRT station will be converted to an LRT station by 2027. The Lincoln Fields Station Secondary Plan was launched in December 2019 and paused in early 2020. Since then, the Secondary Plan has resumed in November 2021 and is currently underway[2]. The study area includes areas around Lincoln Fields Station, Carling Ave and Richmond Rd, which includes the proposed development site located within 350m of the LRT Station. The purpose of the study is to identify opportunities to improve connectivity and walkability to the station and engage the community to identify appropriate measures for Carling Ave, Richmond Rd, and Lincoln Fields Station. Within Schedule A, the site is designated as a mainstreet corridor and Schedule B denotes building heights up to 30-storeys for this site. **Section 4.1** will share details from Schedule C which illustrates possible future active transportation connections to the LRT Station.

[2] https://ottawa.ca/en/city-hall/public-engagement/projects/lincoln-fields-station-secondary-plan#section-005e87eb-f256-475a-84d9-205699df2c8c

Provided in **Appendix E** is a preliminary plan illustrating the potential future connectivity through MUP connections and a pedestrian bridge crossing. Connectivity to Richmond Rd is anticipated to be maintained in the future.

Lastly, within the Stage 2 LRT Station Connectivity Enhancement Study[3], the City has proposed additions to cycling and walking facilities near Lincoln Fields Station as illustrated in **Figure 11** and described below:

A. Replace the Woodroffe pedestrian bridge across alignment, south of station, to accommodate the LRT.
B. Multi-use pathway along east and west side of alignment, from Richmond Road to new Woodroffe pedestrian bridge south of Carling Avenue (noted as Item A), including reconstruction of pathway to Rosewood Avenue.
C. Station plaza with 9 passenger pick-up and drop-off spaces and bike parking for 60 bikes with space allocated to double in future when required.
D. Cycle tracks on Carling, in front of station entrance.
E. Signalized crossing including crossrides at Carling Avenue at station entrance, and west of station at a point mid-block between the station entrance and the ramps connecting Carling Avenue to Sir John A. Macdonald Parkway.
F. Add lighting to NCC pathway, from the pedestrian crossing at the Kichi Zibi Mikan to Richmond Road.
G. Provide more space in front of station plaza for pedestrians and cyclists by removing a lane of traffic in the westbound direction.

Figure 11: Stage 2 LRT Station Connectivity Enhancement Study – Lincoln Fields Station

[3] https://ottawa.ca/en/city-hall/public-engagement/projects/stage-2-lrt-station-connectivity-enhancement-study

Ultimate Cycling Network Plan

As shown previously in Figure 4, Richmond Rd is part of the Crosstown Bikeway network under the 2023 TMP update, and various adjacent pathways are identified near the site. Within the previous TMP cycling plan, Carling Ave was identified as a future spine route. The gaps in cycling facilities on Richmond Rd between Carling Ave and Holly Acres Rd was proposed a future spine route. Various local streets have a proposed future local route classification. The future cycling network based on the previous TMP is illustrated in **Figure 12**.

Figure 12: Ultimate Cycling Network Map (2013 TMP)

Other Area Developments

The following section outlines proposed future adjacent developments within the study area. Based on the City of Ottawa's Development Applications search tool, there are two development applications initiated in the area.

1047 Richmond Road

A Zoning By-Law Amendment (ZBLA) and Official Plan Amendment (OPA) applications have been submitted for a residential buildings' development located at 1047 Richmond Rd. The development will consist of 1,343 residential units with first floor retail, with an anticipated full buildout by 2026. Based on the TIA prepared by Parsons, the development is anticipated to generate approximately 85 vehicle trips and a total of 565 person trips during peak hours.

2475 Regina Street

A Zoning By-Law Amendment (ZBLA) application has been submitted for a residential buildings' development located at 2475 Regina St. The development will consist of 510 residential units with an anticipated full buildout by 2026. Based on the TIA prepared by EXP Services Inc., the development is anticipated to generate approximately 60 vehicle trips and a total of 215 person trips during peak hours.

365 Forest Street

A Zoning By-Law Amendment (ZBLA) application has been submitted for a residential buildings' development located at 365 Forest St. The development will consist of 391 residential units with an anticipated full buildout

by 2024. Based on the TIA prepared by CGH Transportation, the development is anticipated to generate up to approximately 45 vehicle trips and a total of 265 person trips during peak hours.

2.2. Study Area and Time Periods

For the purposes of this report, the proposed development is assumed to be fully constructed by 2025. As such, horizon years 2025 and 2030 (i.e. five-years after development buildout) will be analyzed using the weekday morning and afternoon peak hour time period traffic volumes. Proposed study area intersections are listed below and illustrated in **Figure 13**.

- Assaly/Richmond
- Starflower/Richmond
- Croydon/Richmond
- Assaly/Starflower
- Starflower/Residential Building Access

Figure 13: Study Area

2.3. Exemption Review

The following modules/elements of the TIA process provided in **Table 1** are recommended to be exempt in the subsequent steps of the TIA process, based on the City's TIA guidelines and the subject site:

Table 1: Exemptions Review Summary

Module	Element	Exemption Consideration
4.1 Development Design	4.1.3 New Street Network	Only required for plans of subdivision
4.8 Network Concept	All	To be confirmed. This section is typically only required when proposed development generates more than 200 person-trips peak hour in excess of the equivalent volumes permitted by established zoning.

3.0 FORECASTING REPORT

3.1. Development Generated Travel Demand

3.1.1. Trip Generation and mode shares

Trip Generation Rates

The proposed development will consist of approximately 590 apartment units and approximately 809 m^2 (8,707 ft^2) of retail space. The retail space will likely provide ancillary use for the high-density residential units and is expected to be intended for local residents, community and potentially some pass-by traffic. As such, it is not expected to be a regional attraction and is not anticipated to generate new trips.

The appropriate trip generation rates for high-rise apartment units were obtained from the 2020 TRANS Trip Generation Manual. The Manual provides person-trip rates during the peak AM and PM periods (i.e. 7am-9:30am and 3:30pm-6pm). The trip rates are summarized in **Table 2** below.

Table 2: Proposed Development Trip Rates

Land Use	ITE/TRANS Designation	Data Source	Trip Rates	
			AM Peak	PM Peak
Residential	"High-Rise Apartments"	TRANS	T = 0.8(du);	T = 0.9(du);
Note: T = Average Vehicle Trip Ends; du = Dwelling unit				

Using the respective residential trip rates in **Table 2**, the total number of person trips per hour generated by the proposed residential land use of the development are calculated for the morning and afternoon peak periods, as shown in **Table 3**.

Table 3: Residential Units Peak Period Person Trip Generation

Land Use	Dwelling Units	AM Peak Period Person Trips	PM Peak Period Person Trips
High-Rise Apartments	590	472	531

The proposed development's residential land use is anticipated to generate a total of approximately 472 and 531 person trips during the morning and afternoon peak periods, respectively. The total peak period person trips in **Table 3** are then divided into different travel modes using mode share percentages obtained from the 2020 TRANS Manual for the "Bayshore/Cedarview" district. **Table 4** provides the travel mode breakdown for the proposed high-rise apartments.

Table 4: High-Rise Apartments Peak Period Trips Mode Shares Breakdown

Travel Mode	Mode Share	AM Peak Period Person Trip	Mode Share	PM Peak Period Person Trips
Auto Driver	40%	187	40%	212
Auto Passenger	12%	58	15%	79
Transit	38%	181	33%	173
Cycling	2%	7	1%	6
Walking	8%	38	11%	61
Total Person Trips	**100%**	**472**	**100%**	**531**

Standard traffic analysis is usually conducted using the morning and afternoon peak hour trips as they represent a worst-case scenario. In the 2020 TRANS Manual, Table 4 provides conversions rates from peak period to peak hours for different mode shares. The conversion rates are provided in **Table 5** below.

Table 5: Peak Period to Peak Hour Conversion Factors (2020 TRANS Manual)

Travel Mode	Peak Period to Peak Hour Conversion Factors	
	AM	PM
Auto Driver and Passenger	0.48	0.44
Transit	0.55	0.47
Bike	0.58	0.48
Walk	0.58	0.52

Using the conversion rates in **Table 5** and the peak period person trips for different travel modes in **Table 4**, the peak hour trips for different travel modes can be calculated as shown in **Table 6**.

Table 6: High-Rise Apartments Peak Hour Trips Mode Share Breakdown

Travel Mode	AM Peak Hour Trips	PM Peak Hour Trips
Auto Driver	90	93
Auto Passenger	28	35
Transit	100	81
Cycling	4	3
Walking	22	31
Total Person Trips	**244**	**244**

As shown above, the residential land use of the proposed development is anticipated to generate a total of up to 244 total person trips, 93 total vehicle trips, 100 total transit trips and 34 total active transport (walking and cycling) trips during peak hours.

The location of the Lincoln Fields LRT Station is within a 350m radius (roughly 750m walking distance via public infrastructure or approximately 550m walking distance via informal routes). Therefore, it is reasonable to expect there would be higher transit usage from this development than the average for the TRANS district. Additionally, there are notable biking destinations accessible via high quality pathways and MUPs, including Tunney's Pasture (approximately 7kms bike ride, 20 mins), Downtown Ottawa (10kms, 30 mins), Bayshore Shopping Center (4kms, 15 mins), National Defense Headquarters (8kms, 25 mins), Algonquin College (4kms, 15mins) to name a few. An increase in cycling mode share is also forecasted.

Table 7 summarizes the TRANS 2020 suggested residential modal shares, the City's Transit Oriented Development (TOD) mode shares and future projected residential modal shares.

Table 7: Future Mode Share Targets for Residential Trips

Travel Mode	TRANS Residential Mode Shares		City's TOD Mode Shares	Future Target Mode Share (AM & PM)	Residential Modal Share Target Rationale
	AM	PM			
Auto Driver	40%	40%	15%	25%	A reduction in driver mode share from TRANS is justifiable given the close proximity to future LRT station and high-quality cycling facilities nearby. Reduced parking rate of approximately 0.35 residential parking spaces per unit further dissuade driving and promotes alternate modes of transportation.
Auto Passenger	12%	15%	5%	10%	
Transit	38%	33%	65%	55%	Development is located within 600m of a future LRT/existing BRT station, making it a Transit-Oriented Development (TOD).
Cycling	2%	1%	5%	5%	There are high quality cycling facilities with major city pathways nearby, making cycling an attractive option.
Walking	8%	11%	10%	5%	A lower walking mode share is expected as the site is located far from major employment nodes.

The peak hour mode share trips have been adjusted with the proposed target mode shares as shown in **Table 8**. Note that the same mode share percentages are applied to both the AM and PM peak hours.

Table 8: High-Rise Apartments Peak Hour Trips TOD Mode Share Breakdown

Travel Mode	Mode Share	AM Peak Hour Trips	PM Peak Hour Trips
Auto Driver	25%	61	61
Auto Passenger	10%	24	24
Transit	55%	134	134
Cycling	5%	12	12
Walking	5%	12	12
Total Person Trips	**100%**	**244**	**244**

Using the modified mode shares above, the breakdown of inbound and outbound trips for the high-rise apartments are provided in **Table 9**. The inbound and outbound percentages were obtained from the 2020 TRANS Manual.

Table 9: High-Rise Apartments Mode Shares Breakdown

Travel Mode	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
	In (31%)	Out (69%)	Total	In (58%)	Out (42%)	Total
Auto Driver	19	42	61	35	26	61
Auto Passenger	7	17	24	14	10	24
Transit	42	92	134	78	56	134
Cycling	4	8	12	7	5	12
Walking	4	8	12	7	5	12
Total Person Trips	**76**	**168**	**244**	**142**	**102**	**244**

As shown in **Table 9**, the total number of vehicle trips anticipated to be generated by the residential land use is 61 vehicles per hour during the morning and afternoon peak hours.

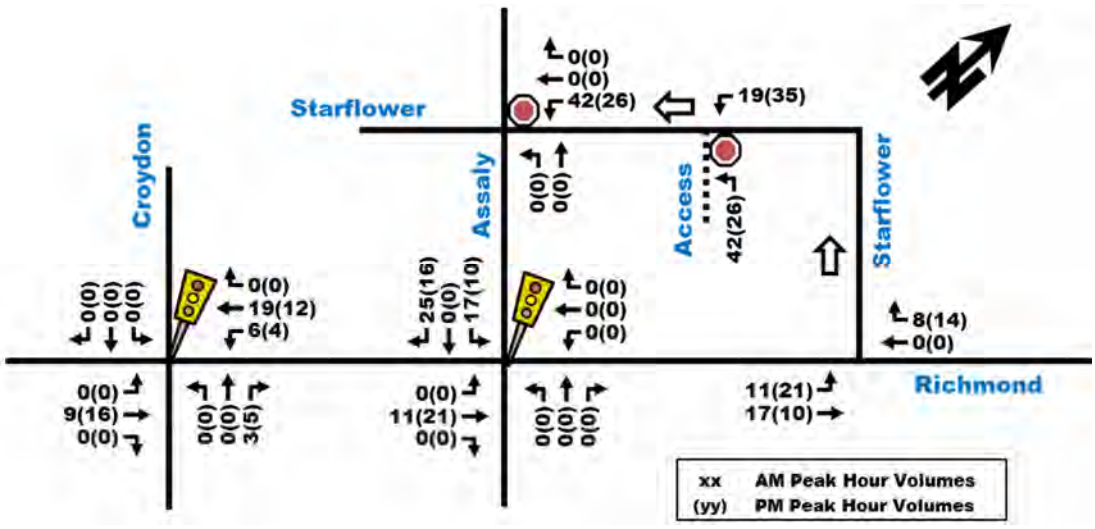
3.1.2. Trip Distribution and Assignment

Based on the 2011 OD Survey (Bayshore/Cedarview district) and the location of adjacent arterial roadways and neighbourhoods, the distribution of site-generated traffic volumes was estimated as follows:

- 40% to/from the east via Richmond Rd;
- 60% to/from the west via Richmond Rd;

The anticipated 'new' auto trips for the proposed development from **Table 9** were then assigned to the road network as shown in **Figure 14** for the total site-generated traffic.

Figure 14: Site-Generated Traffic



3.2. Background Network Traffic

3.2.1. Transportation network plans

Refer to Section 2.1.3: Planned Conditions.

3.2.2. Background Growth

The City of Ottawa is currently in the process of completing Stage 2 LRT which will bring a new rapid transit LRT Station within 350m radius of the development with connectivity as far west as Moodie and Baseline Stations, via downtown and as far east as Trim Station, which should further reduce auto usage and replace it with transit and active transportation. As mentioned in existing conditions, Section 2.1.2, the 2016 volumes which were used as existing baseline conditions are considered a worst-case scenario as the existing volumes are assumed lower due to already constructed Stage 1 LRT and effects of Covid-19 change in work culture and greater work-from-home opportunities.

However, to partially coordinate with other future adjacent developments, a conservative growth rate of 0.5% annually was applied to the through movements along Richmond Rd at applicable the study area intersections.

3.2.3. Other Developments

Refer to Section 2.1.3 for a description of the adjacent future developments. Given the anticipated full buildout years of the adjacent development, the adjacent 365 Forest St development will be added at the future background 2025 volumes, while the adjacent 2475 Regina St development will be added to the future background 2030 volumes. The total future background 2025 and 2030 traffic volumes are provided in Figure 15 and Figure 16, respectively.

Figure 15: Future Background 2025 Traffic Volumes

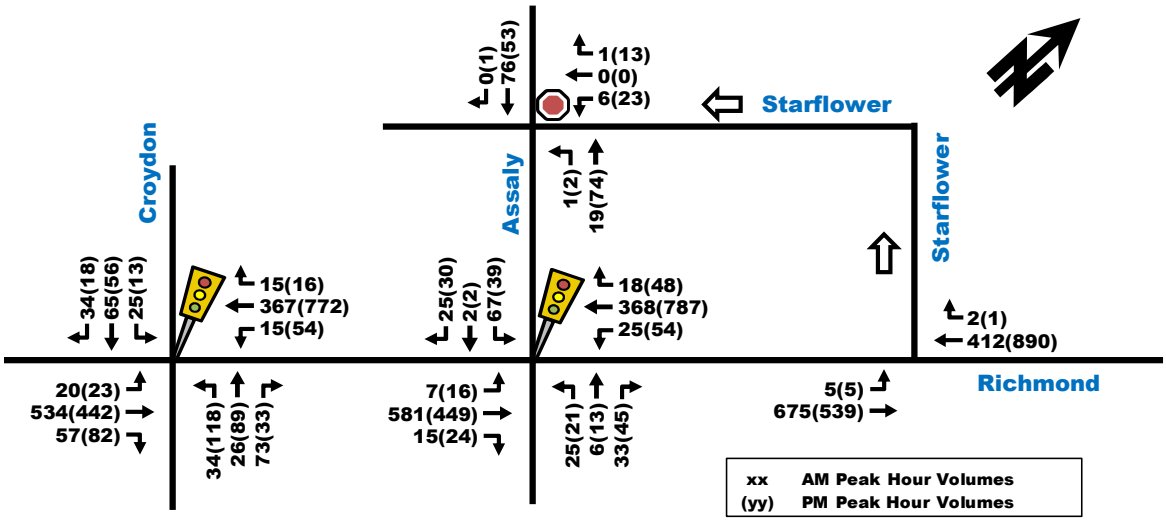
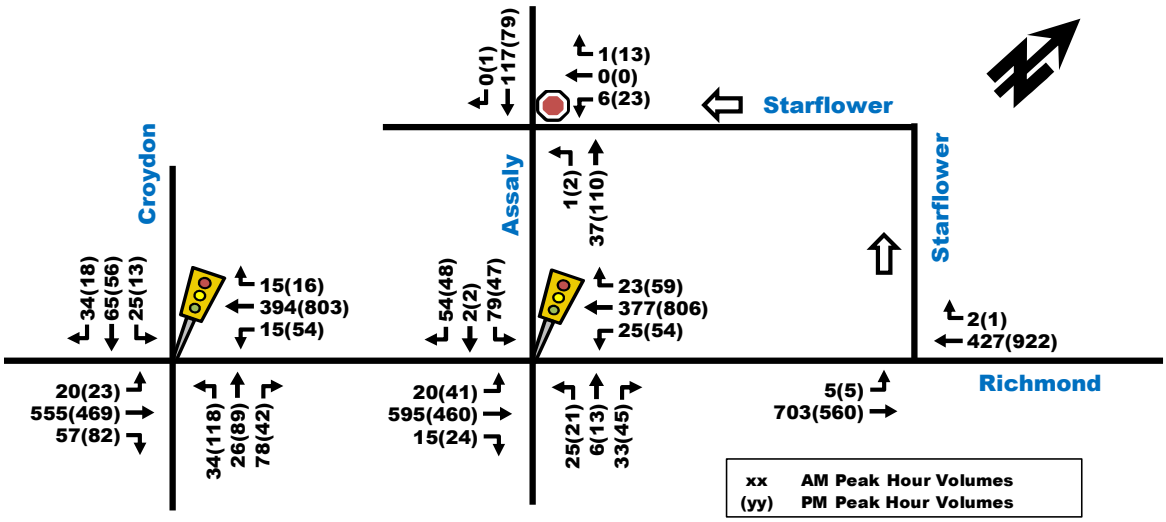


Figure 16: Future Background 2030 Traffic Volumes



3.3. Demand Rationalization

The following section indicates factors that may be used to rationalize the future travel demands in the study area and determine if there are potential capacity limitations and how they may be addressed.

The total projected 2025 and 2030 traffic volumes can be calculated by superimposing the site-generated traffic in **Figure 14**, onto the background traffic in **Figure 15** and **Figure 16**. The total projected 2025 and 2030 traffic volumes are illustrated in **Figure 18** and **Figure 19**, respectively. The approach for this study was to proceed without applying any reductions to the study area traffic volumes, as a worst-case scenario. The impact of the proposed development's site-generated traffic volumes on the study area intersections and roadways will be determined in the subsequent sections of the TIA report.

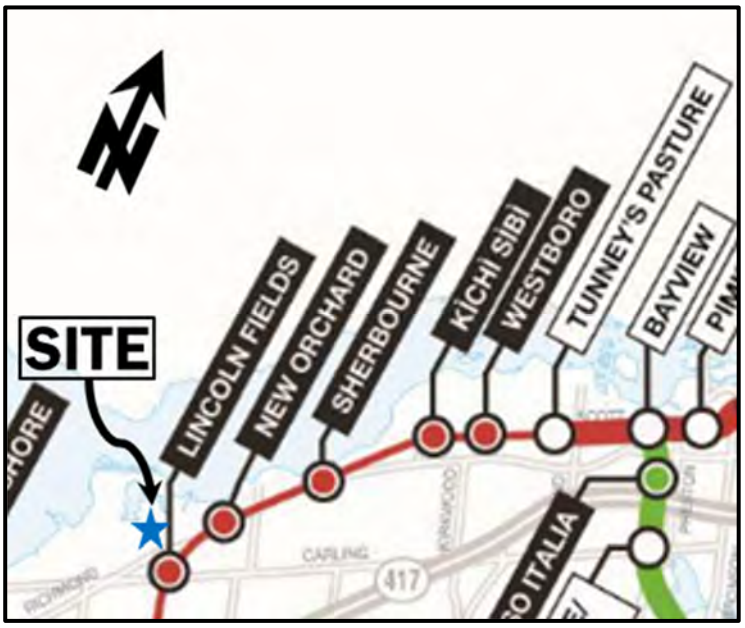
Nonetheless, based on plans in the broader transportation network, the effect of the following two transit-related upgrades may influence vehicle travel patterns in the road network and result in an overall reduction in background traffic volumes.

LRT Stage 2

As discussed in **Section 2.1.3.1** of this TIA, the Stage 2 construction of the LRT is underway, which will involve reconstructing the existing Lincoln Fields Station (located within 350m radius) and expanding the LRT corridor in different directions. The west expansion is expected to be completed by 2027.

As shown in the **Figure 17** below, between Lincoln Fields Station and the existing Tunney's Pasture LRT Station, two new stations, New Orchard and Sherbourne, will also be constructed along Richmond Rd, while Kichi Sibi and Westboro Stations will be constructed along the transitway slightly north of Richmond Rd.

Figure 17: LRT Stations Along Richmond Rd



These new stations are expected to result in a significantly higher transit usage from background traffic and surrounding developments along Richmond Rd, which will result in a decrease in vehicles travelling along the Richmond Rd corridor. The influence of the LRT will likely be experienced at the frontage of the proposed development as well. Once the LRT is constructed, travel patterns will begin to adjust as trips shift from vehicle trips to transit trips.

Carling Ave Transit Priority

Carling Ave is located within a 450m radius of the proposed development site, which is outside the study area limits of this TIA Report. However, the Transit Priority Study indicated that the BRT is expected to result in a 20% reduction in peak direction background traffic and up to 15% reduction in the off-peak direction along Carling Ave. Although this BRT is located outside of the study area, it is forecasted that some residual effects of a reduction in vehicle travel within the Carling Ave corridor will affect the study area intersections by reducing their volumes too.

Figure 18: Total Projected 2025 Traffic Volumes

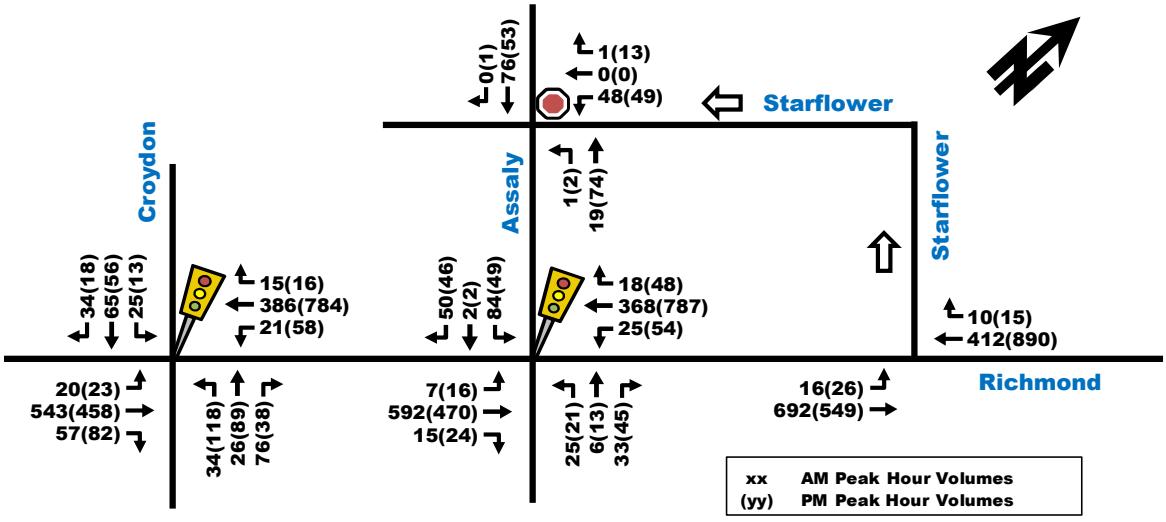
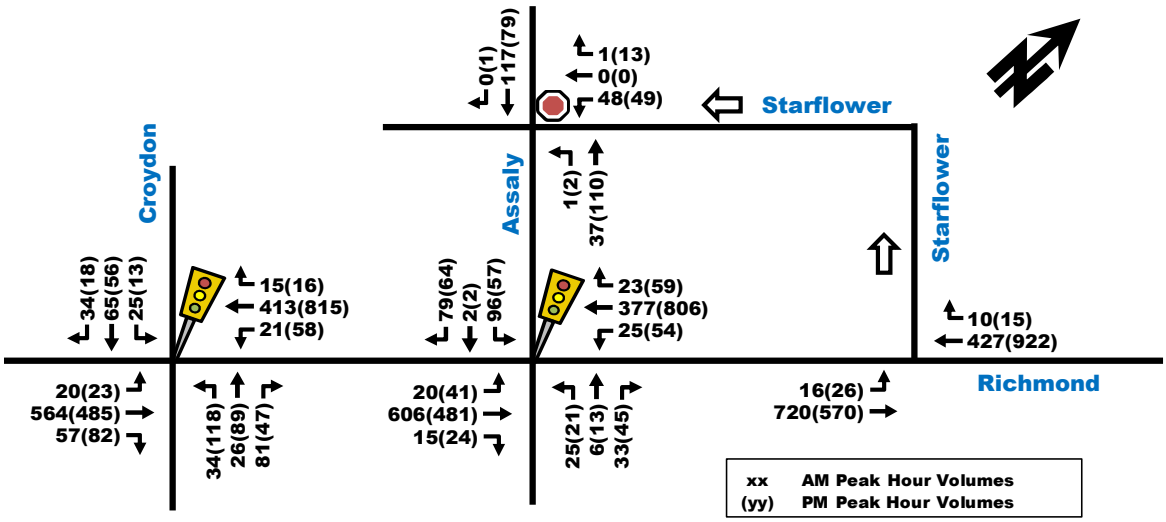


Figure 19: Total Projected 2030 Traffic Volumes



4.0 STRATEGY REPORT

4.1. Development Design

4.1.1. Design for Sustainable Modes

Location of Transit Facilities

The subject development is located within 350m radius of major transit station at Lincoln Fields. Lincoln Fields is currently under construction, being upgraded from a bus rapid transit (BRT) to a light rail transit (LRT) as part of Stage 2 Confederation Line West expansion. Lincoln Fields will also be part of a major connection point for bus routes off Carling Avenue. The LRT station is anticipated to be operational by 2027.

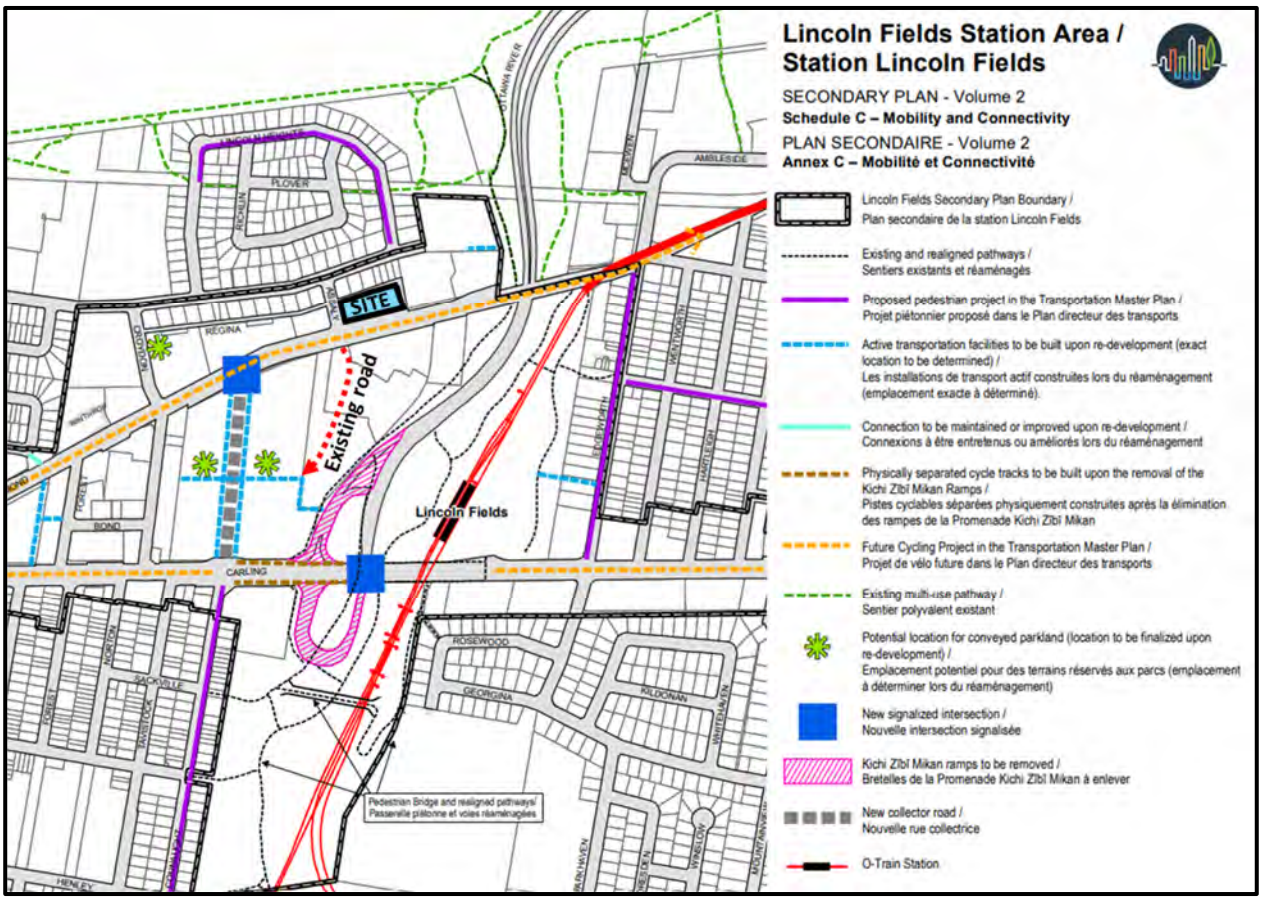
From the site, the most direct route to Lincoln Fields Station using municipal facilities uses the signalized intersection of Assaly/Richmond, sidewalk on the south side of Richmond Rd to the Pinecrest Pathway, as shown in **Figure 20**. It is acknowledged there are also informal routes used by the public that traverse adjacent properties to reduce their travel time to Lincoln Station, which do not appear to be enforced. The City could explore formalizing these connections via joint use agreements or alternate arrangements; however this is not a responsibility for the developer. Within the Lincoln Fields Station Secondary Plan, Schedule C, a future active transportation connection is proposed through the residential developments directly south, as shown in **Figure 21**.

That said, in the event these informal routes via private property are closed in the future or not rebuilt once the areas become redeveloped, the existing formal connection previously described do provide adequate connectivity to the station. **Appendix E** illustrates the proposed pedestrian enhancements within the Lincoln Fields Station, which includes new pedestrian bridge crossings and MUP connections.

In addition to rapid transit at Lincoln Fields, there are bus stops located adjacent to the site for frequent route #11 and local route #153. Frequent route #11 provides connectivity between Bayshore Shopping Center and Downtown via Richmond / Wellington / Somerset St. Local route #153 provides connectivity to Lincoln Fields Station for those who have mobility challenges and may find it difficult to walk the 600m to Lincoln Fields Station.

Figure 20: Walking Routes to Transit Facilities

Figure 21: Lincoln Fields Station Secondary Plan – Schedule C: Mobility and Connectivity



Pedestrian/Cycling Routes and Facilities

Walking facilities to transit stations have been described in the module above. Building entrances will provide direct connectivity to existing sidewalk facilities on Richmond Rd and Assaly Rd. Courtyards with outdoor patio are proposed and wide pedestrian areas. The client proposes to include bollards to provide a physical barrier to separate active transportation users from vehicles in the rear of the building. Within this area, a flush treatment between the vehicle area and pedestrian area is proposed, for convenient and permeable treatment for active users. Within the perimeter of the bollard area, textured pavers are proposed to alert visually impaired pedestrians that they are entering a mixed-use space. A layby is proposed intended for passenger pick-up, loading operations and garbage pick-up.

The site currently has good connectivity to cycling infrastructure. On-street cycling facilities fronting the site such as partial uni-directional cycling facilities on the south side of Richmond Rd or bike lane adjacent to curbside parking on the north side of Richmond Rd provide direct access from the site to Pinecrest Creek Pathway. The Pinecrest Creek Pathway provides grade separated cycling and pedestrian facilities at most major crossings and connects to the major east-west Ottawa River Pathway that leads to the downtown and along the Ottawa River; as well as major destinations to the south such as Algonquin College, the Experimental Farm Pathway and beyond. The existing cycling and pedestrian infrastructures will link to future facilities such as those proposed on Carling Ave via the Carling Ave Transit Priority project. It is noteworthy that not all pathways are winter maintained, and some are actually groomed for winter activities such as cross-country skiing.

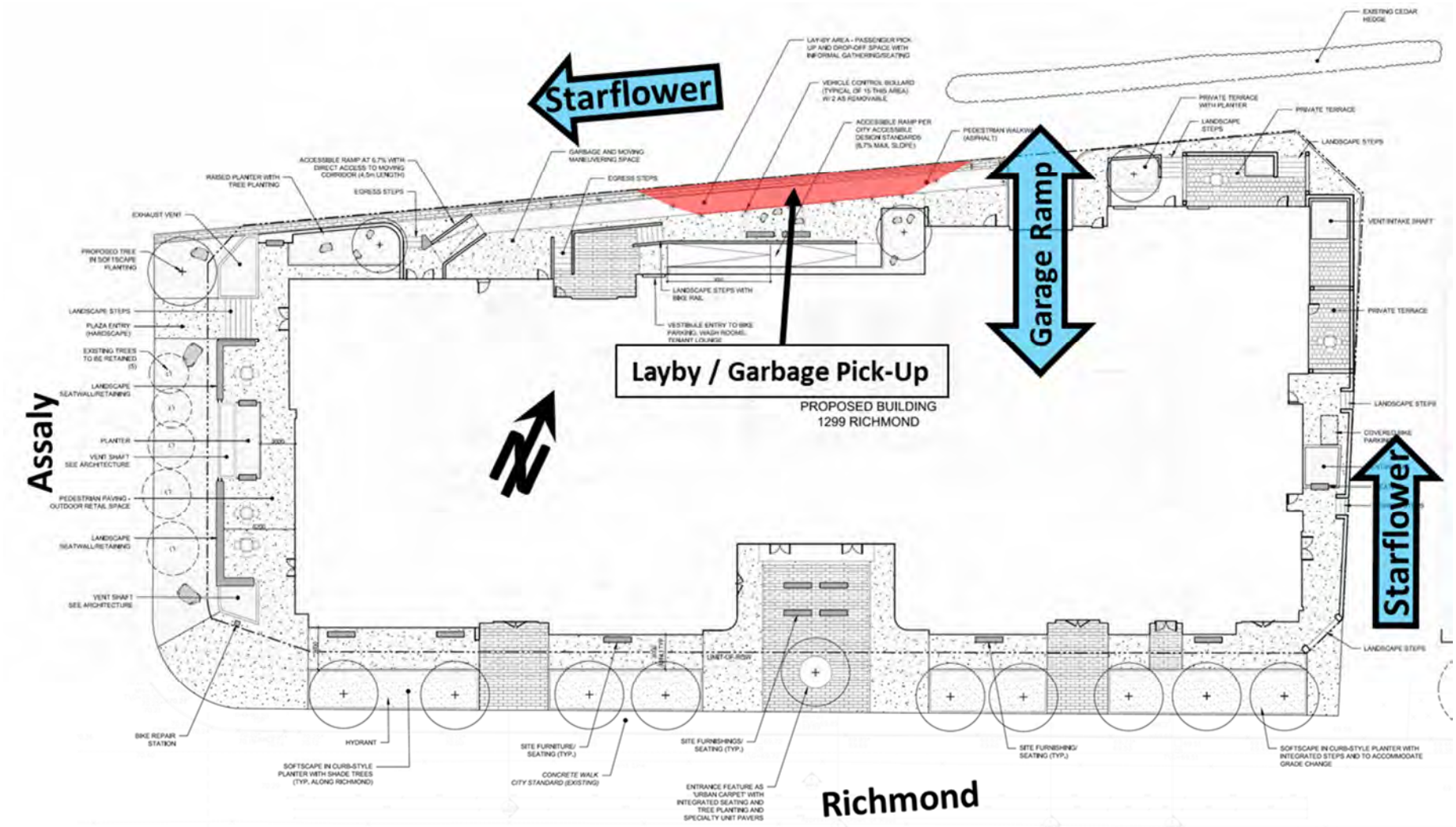
Bicycle Parking

A combined total of 583 bicycle parking is currently proposed which is very close to 1:1 ratio of bike parking to units. The largest bike parking storage is proposed on ground floor in a secure room, with 222 spaces for residents and 5 spaces for retail. An additional 145 spaces are proposed in P1, 105 in P2 and 106 in P3 parking lots. Bike parking spaces within the parking garage will be located close to elevators which provide access to the ground floor.

4.1.2. Circulation and Access

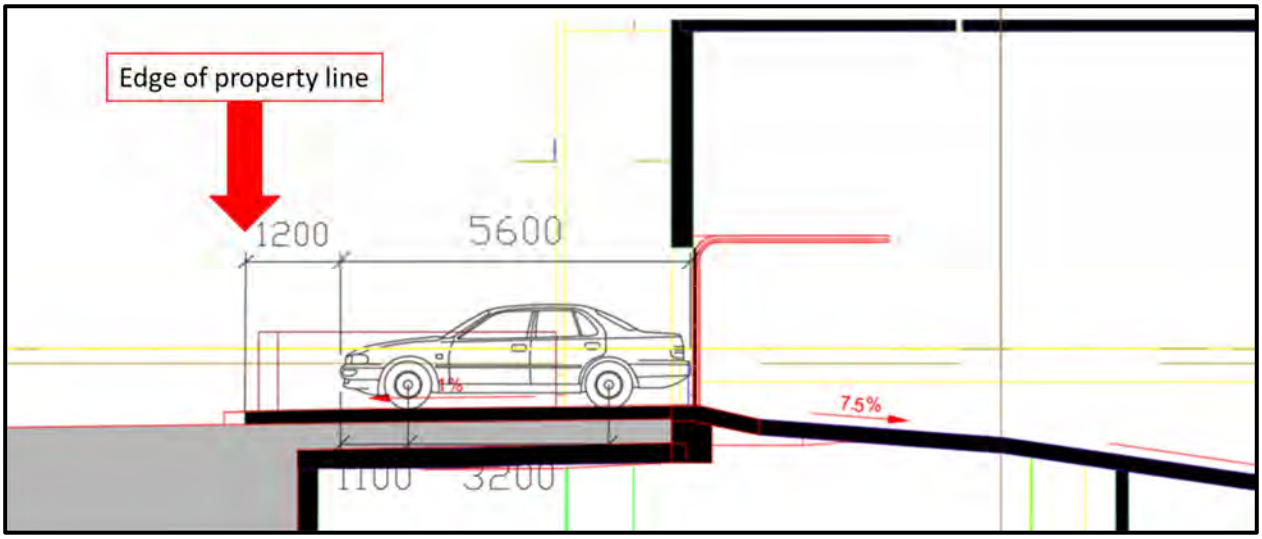
The existing site currently provides two access points off Richmond Rd. The proposed development will see the removal of the existing access closer to Assaly Rd (to be reinstated to boulevard design as per City standards), and will rely on Starflower Ln to provide access/egress for the subject site as shown in **Figure 22**. Starflower Ln will continue to operate as a one-way road, with full movement entry via Richmond Rd and full movement exit at Assaly Rd. There will be an underground garage ramp located on the backside of the building, accessible via Starflower Ln. All surface parking will be removed, and the site will only offer underground parking for residents and visitors.

Figure 22: Site Access and Circulation



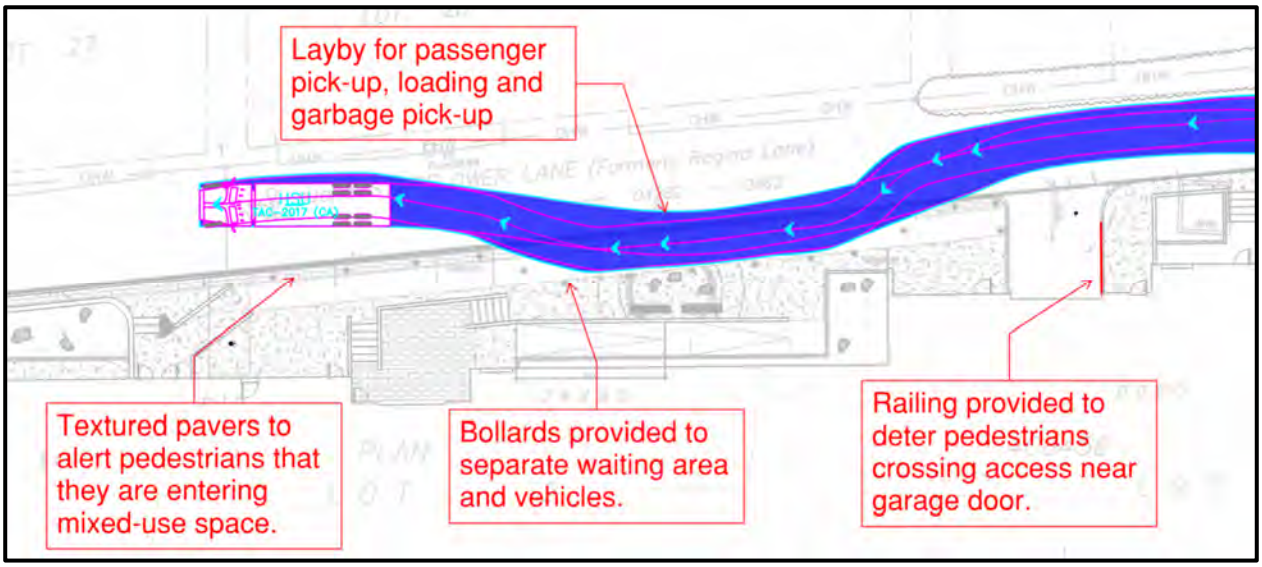
The parking garage for Towers A and B will be housed within a shared three-level structure. The parking garage will include a single 6.3m wide ramp access to permit two-way travel, located approximately 25m west from the internal T-intersection on Starflower Ln. As per the Private Approach (By-Law No. 2003-447), Section 25, 1u, *"no person shall construct a private approach serving a parking area with more than 50 parking spaces, with a grade exceeding 2% within the private property for a distance of 9 metres from the highway line or future highway line".* Given the constrained site, the developer is proposing a reduction in distance to approximately 6.8m with a 1% grade as shown in **Figure 23**. The vehicle shown in the figure is 5.6m long, providing approximately 1.2m of space to allow unlikely and infrequent pedestrians crossings along the garage access within an almost flat surface. It is noteworthy that in North America, an average vehicle is 4.5m long, and the shown graphic would be more representative of a larger vehicle such as a Ford F-150 extended cab.

Figure 23: Ramp Access Vertical Profile with P-Car



To dissuade pedestrians crossing near to the garage door, the client proposes adding a railing on the east side of the garage driveway as shown in **Figure 24**. The railing would be built in a way to ensure driver sightlines (see through) but providing an obstacle for pedestrians to cross.

Figure 24: Layby Area and Garage Driveway Treatments



The buildings will be set back from the laneway, providing adequate sight lines. Starflower Ln has a posted speed limit of 20km/h, which can be maintained based on the frequency of driveway accesses and proposed design of the development frontage that promotes slower driving speeds. Given the measures proposed, the site access is considered adequate.

The majority of internal ramp grades within the parking garage vary between 4% to 5%, with the first ramp transitioning from 7.5% to 14.7% when indoors, which is considered acceptable.

The site plan has been designed to ensure both MSU/HSU size trucks can be accommodated on Starflower Ln. Garbage operations for all towers will be completed within a layby parallel to Starflower Ln, where the required bins will be placed outside for pickup. Loading will also occur from the layby, which has been designed to limit encroachment onto Starflower Ln while maintaining a separate space protected by bollards for pedestrians waiting. The truck turning templates have been provided in **Appendix F.**

4.1.3. New Streets Network

Exempt. See **Table 1**.

4.2. Parking

4.2.1. Parking Supply

According to Part 4 – Parking, Queueing and Loading Provisions for the City of Ottawa By-Laws, the site is located in Area Z based on Schedule 1A and is within Rapid Transit Stations within Schedule 2A. **Table 10** summarizes the vehicle parking minimum allowed within the parking by-law and the quantities proposed.

Table 10: Proposed Vehicle Parking Space Supply

Rate per Unit/Size[1]	Land Use	Required Vehicle Spaces			Proposed Spaces		
		Residents	Res Visitor	Retail	Residents	Visitor / Retail	Total
0.0 base residential per unit; 0.1 visitor parking per unit; 0.0 spaces per 100 m² of commercial	588 units, 809 m² Retail	0	58	0	207	60	267
1. Within the area shown as Area Z, no off-street motor vehicle parking is required to be provided under this section, (By-law 2016-249) for residential and retail. Within Areas X, Y and Z, no more than thirty visitor parking spaces are required per building and the first 12 units are exempt.							

Table 11 summarizes the bicycle parking requirements as per City of Ottawa Zoning By-Law-Part 4, sections 100-114.

Table 11: Bicycle Parking Requirements

Land Use		Rate per Unit/Size	Required Bicycle Spaces	Proposed Spaces
Residential	588 units	0.5 per unit	294	583
Retail	809 m²	1 per 250 m²	3	
		Totals	297	Meets mins.

The Parking By-law requires 58 residential visitor spaces and a minimum of 0 residential occupant and retail parking spaces given its close proximity to Lincoln Fields major LRT station (Area Z within Schedule 1A in Parking By-law). The development proposes 207 residential parking spaces, 57 shared visitor and retail parking spaces and 3 car-share spaces meant for all users meeting the minimum requirements. Within Area Z, a maximum of 1.75 combined vehicle spaces per unit is allowed, which would equate to 1,029 spaces. The development proposes a parking rate that is above the minimum requirements and below the maximum allowed parking limits.

The Parking By-law also requires a minimum of 297 bike parking spaces. The proposed development proposes a total of 583 bike parking spaces, almost doubling the required minimum standard, with the majority of bike parking located indoors in a well-lit secured area, within the ground floor (227 spaces) and the underground parking lot (356 spaces).

4.2.2. Spillover Parking

This section is no longer required since the June 14th, 2023 TIA Guidelines update.

4.3. Boundary Street Design

4.3.1. Existing and Future Conditions

The boundary streets for the development are Richmond Rd and Assaly Rd. The existing roadway geometries consist of the following features:

- *Richmond Rd:*
  - 1 vehicle travel lane in each direction;
  - 2m sidewalk on both sides of road with greater than 2m boulevard separation (note: bike lane functions as buffer);
  - More than 3,000 vehicles per day;
  - Posted speed limit is 50km/h;
  - Classified as an arterial mainstreet roadway but not identified as a trucking route; and,
  - Identified as a spine route and cross-town bike route with bike lane adjacent to curbside parking on the north side and cycle track on the south side.
- *Assaly Rd:*
  - 1 vehicle travel lane in each direction;
  - 1.5m sidewalk on east side and 2m sidewalks on west side, both without boulevard separation. The future site frontage sidewalk on Assaly Rd is proposed as greater than 2m wide with no boulevard separation;
  - Less than 3,000 vehicles per day;
  - Assumed unposted speed limit is 50km/h;
  - Not part of a cycling, transit or trucking route; and,
  - Located within 300m of Regina Street Alternative School.

Multi-modal Level of Service (MMLOS) analysis for the subject road segments adjacent to the site is summarized in **Table 12** with detail analysis provided in **Appendix G**.

Table 12: MMLOS – Boundary Street Segment Existing

Road Segment	Multi-Modal Level of Service							
	Pedestrian		Bicycle		Transit		Truck	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target
Existing								
Richmond Rd – north side between Assaly & Starflower	B	A	D	A	D	D	B	E
Richmond Rd – south side between Assaly & Starflower	C	A	A	A	D	D	B	E
Assaly Rd – east side between Regina & Richmond	F	A	D	D	-	n/a	-	n/a
Assaly Rd – west side between Regina & Richmond	C	A	D	D	-	n/a	-	n/a
Future								
Assaly Rd – east side between Regina & Richmond	C	A	D	D	-	n/a	-	n/a

Pedestrian

- None of the road segments meet the target PLoS 'A' triggered by the proximity to a school and within 600m of rapid transit station. It is noteworthy that the developer is proposing wide sidewalks and paved courtyards within the site frontage, providing an improvement to existing pedestrian facilities. Due to vehicular volumes on Richmond Rd, only Assaly Rd could meet future targets if greater than 2m sidewalks with greater than 2m boulevards were provided.

Bicycle

- The cyclist BLoS targets were met on all road segments except for the north side of Richmond Rd. To meet the BLoS target, a physically separated cycling facility or if a speed survey demonstrates the 85th percentile speed is 50km/h or less, then it would meet the BLoS target for this location.

Transit

- Only Richmond Rd has active transit services. The transit TLoS targets were met.

Truck

- None of the boundary streets are truck routes. The trucking TkLoS targets were met at Richmond Rd.

4.4. Access Intersection Design

4.4.1. Location and Design of Access

As described in Section 4.1.2, the site will be removing one of the two existing accesses to the subject site, maintaining Starflower Ln. Starflower Ln is a public city road which begins at Richmond Rd permitting only inbound traffic and is located approximately 100m east of signalized Assaly/Richmond intersection. Since Starflower Ln is a public local road and the garage ramp is located off Starflower, then as per TAC Chapter 8.9.10, no clear throat lengths are required (only required for collectors and arterial roads). Nonetheless, the first conflict point on Starflower Ln measured from Richmond Rd which is an arterial road occurs at the T-intersection approximately 50m north of Richmond Rd where it transitions into a private access to an existing residential complex to the east and continues as Starflower Ln to the west. Should Starflower Ln be considered a private approach in the future, the recommended clear throat length of 40m for a development with more than 200 units accessed by an arterial road would be satisfied.

Starflower Ln provides access to the underground parking garage ramp approximately 25m west of the T-intersection. The distance between the ramp and Assaly Rd to the west is approximately 85m. The Starflower/Assaly intersection operates as a STOP-control on Starflower and free-flow on Assaly. Starflower Ln varies in width from approximately 5m to 7m wide and has been designed to accommodate HSU vehicles.

4.4.2. Intersection Control

Due to the low forecasted traffic volumes at study area intersections, it is not anticipated that traffic signals or all-way-stop-control (AWSC) will be required in the future. The internal T-intersection for Starflower Ln and adjacent surface parking lot for 1285 Richmond Rd is currently unsignalized. A yield or STOP-control could be added here based on the judgement of City Staff and could be confirmed during detailed design. The volumes at this internal T-intersection are forecasted to be very low and poses very low risk leaving as is. Section 4.9.2 will assess if the Richmond Rd access or Starflower/Assaly intersection are in need of alternate intersection controls.

4.4.3. Intersection Design

Given that Starflower Ln is a local street, there is no minimum throat distance requirement in the TAC manual. Nonetheless, if Starflower Ln was considered as a driveway rather than a local street, there are no conflict points until at least 50m from Richmond Rd, which is beyond the 40m suggested clear throat distance from an

arterial road. Storage lanes at accesses on Starflower Ln are not expected due to low turning volumes. Section 4.9.2 will confirm if sub-par operations are present and if storage lanes are recommended.

4.5. Transportation Demand Management

4.5.1. Context for TDM

Based on the type of development, it is assumed that most trips generated by the proposed site will be residents leaving the site in the AM peak to go to work and returning from work to the proposed site in the PM peak. Sections 3.1.1 and 3.1.2 describe how many trips are anticipated per travel mode. The site is located within 600m of rapid transit.

4.5.2. Need and Opportunity

Since the development is located in a transit priority area within 600m radius of future Lincoln Fields LRT Station, measures to provide sustainable active mode shares are encouraged. Such measures are described in more detail in Section 4.5.3 below, but include reduced parking ratios (proposed 0.35/unit for residents), more aggressive Multi-Modal Levels of Service (MMLOS) such as providing wider sidewalks as described in Section 4.3 and 4.9 and safe and efficient connectivity to public transit as described in Section 4.1 and 4.7, to name a few.

4.5.3. TDM Program

The TDM infrastructure checklist and TDM Measures are attached as Appendix H.

Regarding the TDM Supportive Development Design and Infrastructure Checklist:

- Ten (10) out of the ten (10) “required” measures have been satisfied.
- At least twelve (12) of fourteen (14) “basic” measures related to walking, cycling, transit and parking have been satisfied or are not applicable
- Three (3) of the of the seven (7) candidate “better” measures are also proposed or are non-applicable, including:
  - Separate long-term and short-term parking areas
  - Provide on-site carshare space (3 spaces proposed)
  - Provide a permanent bike repair station

Regarding the TDM Measures Checklist:

- Six (6) out of seven (7) “basic” measures related to walking, cycling, transit, parking and TDM marketing have been satisfied. Four (4) of those, which have been designated by an asterisk (*), are considered by the TDM Measures to be some of the most dependably effective tools to encourage sustainable travel modes. This includes:
  - Display walking and cycling information at major entrances.
  - Display transit information at major entrances.
  - *Designate an internal coordinator
  - *Offer preloaded PRESTO card to residents with one monthly transit pass.
  - * Unbundle parking costs from monthly rent.
  - * Provide multi-modal travel information package to new residents.
- Three (3) out of eleven (11) “better” measures related to walking, cycling, transit, parking and TDM marketing have been satisfied. One (1) of those, which has been designated by an asterisk (*), is considered by the TDM Measures to be some of the most dependably effective tools to encourage sustainable travel modes. This includes:
  - Offer on-site cycling courses for residents or subsidize off-site courses.

- Provide on-site carshare space (3 spaces proposed)
- *Offer personalized trip planning to new residents.

4.6. Neighborhood Traffic Management

4.6.1. Adjacent Neighborhoods

The development proposes maintaining the one-way Starflower Ln local street, with the inbound access at Richmond Rd and outbound access at Assly Rd. Traffic volumes along this segment is anticipated to be less than 50 veh/h during the peak hours, conforming to local roads classification.

The street is approximately 155m in length, with an internal T-intersection. The segment is short and not conducive to speeding. This street is expected to be low risk for infiltration and is not expected to operate outside of its designated local road classification.

4.7. Transit

4.7.1. Route Capacity

The future development is expected to generate approximately 135 'new' two-way transit trips. It is forecasted that the majority of transit trips will use the nearby high quality LRT network via Lincoln Fields Station. The future line will have separate tracks for each direction, allowing high frequency service to meet required transit demands.

Bus route 11 which operates adjacent to the site has average headways of 15 minutes during the day, and occasionally less than 15 minutes during peak hours. OC Transpo has buses such as the New Flyer D60L with a total capacity of 110 passengers or Alexander Dennis Enviro 500 with approximately 100 passengers, so it is expected to have sufficient capacity to support the remainder 'new' two-way transit passenger trips not using the future LRT Line.

4.7.2. Transit Priority

Richmond Rd does not have transit priority within the study area intersections. The future Confederation Line West Extension is planned completion by 2027. This corridor will continue to operate as grade separated rapid transit, with the subject development not affecting LRT times.

4.8. Review of Network Concept

The site is currently zoned as AM10 which allows general mixed-use. Under clause (f), the maximum building height is governed by the adjacent property line zoning. In this case, the site located just north of the proposed development is zones as R3A. Subclause (i) indicated that "in any area up to and including 20 meters from a property line abutting a R1, R2 or R3 residential zone (By-law 2011-124)", then the maximum allowable height is 11m.

The developer is proposing a 28-storey and 30-storey towers, which would be higher than 11m. On average, it can be assumed that each storey equates to approximately 3m in height including ceiling and building materials. Under this assumption, an 11m building would likely consist of 3 to 4 storeys high.

For the purpose of this assessment, it will be assumed that the first floor is occupied by a lobby and commercial uses only, with no units on the first floor. Additionally, it will be assumed that each floor has the same number of units, disregarding setbacks which would probably have a smaller GFA and fewer units on higher floors for a more conservative analysis. Using the above assumptions, a base calculation for how many projected units above existing zoning can be derived as seen in **Table 13**.

Table 13: Projected Number of Units Above Existing Zoning

Tower	Storeys Allowed	Storeys Proposed	Floors Above Existing Zoning	Units Proposed Above 4 Storeys[1]
Tower A	4	30	26	259
Tower B	4	28	24	239
			Totals	498

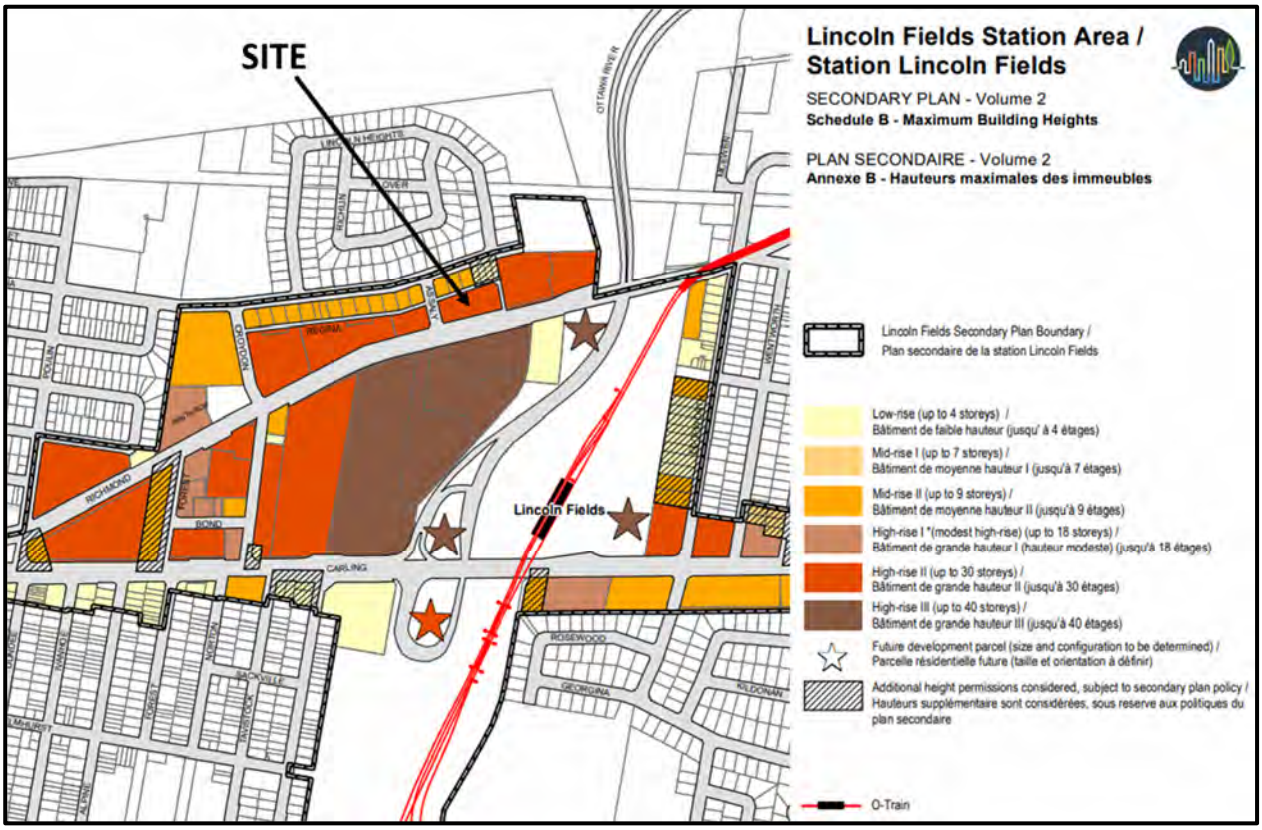
1. Units proposed include 240 for Tower A and 220 for Tower B plus the difference split from the podium units on the 5th floor only.

Based on **Table 13**, approximately 498 units will be located above allowable zoning which would create approximate 206 more peak hour person trips than the equivalent volume permitted by established zoning (refer to **Appendix I** for calculations).

According to the TIA guidelines, 200 peak hour person trips or more above the equivalent volume permitted by established zoning is the trigger for additional analysis. In this case, the threshold is met by only 6 person trips.

However, this increase of peak hour trips is not anticipated to change the TMP concept for auto or transit network. Within the New Official Plan, increasing density near rapid transit corridors is a priority. This development, located within 600m of a major LRT Station will increase the local density by providing more than 200 new peak hour trips compared to the existing permitted zoning. The majority of these new trips are anticipated to make use of the LRT station currently under construction at Lincoln Fields. A higher rate of cyclists from this development are forecasted given then proximity to high quality bike lanes. Lastly, within the Lincoln Fields Station Secondary Plan, Schedule B, the maximum height suggested for this site is 30-storeys, consistent with what has been proposed, as shown in

Figure 25: Lincoln Fields Station Secondary Plan – Schedule B: Maximum Building Heights



To help promote alternate modes of transportation from this development, a low vehicle parking rate is proposed and strong TDM measures are proposed. In the event that higher vehicle use occurs, the adjacent

network has ample capacity to accommodate the development. Overall, the development's increase in density near high quality transit and cycling facilities aligns with the City's future planning vision.

4.9. Intersection Design

4.9.1. Intersection Control

The site generated vehicle traffic is quite minimal and the existing intersection controls are anticipated to be kept as they are today.

4.9.2. Intersection Design

Multi-Modal Level of Service

As stated in the MMLOS Guidelines, only signalized intersections are considered for the intersection Level of Service measures. The MMLOS analysis is summarized in **Table 14**, with detailed analyses provided in **Appendix J**.

Table 14: MMLOS – Existing and Future Adjacent Signalized Intersections

Road Segment	Multi-Modal Level of Service							
	Pedestrian		Bicycle		Transit		Truck	
	PLoS	Target[1]	BLoS	Target	TLoS	Target	TkLoS	Target
Assaly/Richmond	F	A	D	A	A	D	F	E
Croydon/Richmond	F	A	D	A	B	D	F	E

Pedestrian

- For all intersections, pedestrians must cross the equivalent of at least 6 lanes of traffic due to the cross-section of the south approach. There are no options that can help improve the PLoS significantly enough to come anywhere near achieving the target PLoS 'A'.

Bicycle

- The bicycle BLoS target was not met at any intersection due to the lack of 2-stage left-turn boxes for the east approach and lack of cycling facilities on north-sotuh approaches.

Transit

- The Transit TLoS target was met at both intersections.

Truck

- Truck target level of service was not met at either intersection, however neither of them are truck routes.

Existing Conditions

Both Assaly and Croydon intersections with Richmond Rd have a uni-directional cross-ride on the south side of the intersections. Currently, right-turn-on-red is not permitted for the northbound movement. Given that both existing and future projected volumes have less than 150 right-turns for the eastbound movement, then no further measures were deemed necessary at this time.

The existing traffic volumes at study area intersections were assessed based on vehicle capacity v/c and delays (s) to determine their level of service. Synchro 11 software was used with summarized results in **Table 15** and details results in **Appendix K.**

Table 15: Existing Intersection Performance

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Assaly/Richmond	A(B)	0.52(0.68)	EBT(WBT)	9.6(11.1)	A(B)	0.47(0.62)
Croydon/Richmond	A(B)	0.52(0.70)	EBT(WBT)	14.2(18.6)	A(B)	0.49(0.64)
Starflower/Richmond (U)	A(B)	8(10)	EB(EB)	0(0)	A(A)	-
Starflower/Assaly (U)	A(A)	9(9)	WB(WB)	1(2)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 0.9 and a saturation flow rate of 1800 veh/h/lane. U = Unsignalized.						

As shown in **Table 15**, all study area intersections operate overall very well, with LoS 'B' or better and critical movements of 'B' or better.

Background Conditions 2030

The future background 2030 conditions represent the impact of additional background developments along with forecasted east-west growth in background volumes of 0.5% annually. Since 2030 background has the same intersection layouts as 2025 and is the more critical of the two scenarios as it has been grown for a longer time, then only 2030 will be analyzed. The future projected 2030 background volumes are illustrated in **Figure 16** with projected operation outputs in **Table 16**. The detailed Synchro results can be found in **Appendix L**.

Table 16: 2030 Background Intersection Performance

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Assaly/Richmond	A(B)	0.50(0.66)	EBT(WBT)	9.4(10.7)	A(A)	0.46(0.60)
Croydon/Richmond	A(B)	0.50(0.68)	EBT(WBT)	13.5(17.8)	A(B)	0.46(0.62)
Starflower/Richmond (U)	A(B)	8(10)	EB(EB)	0(0)	A(A)	-
Starflower/Assaly (U)	B(B)	10(10)	WB(WB)	0(2)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane. U = Unsignalized.						

As seen in **Table 16**, the study area intersection are anticipated to perform very similarly to existing conditions, which performs very well.

Future Conditions 2030 – Full Buildout

Given how well the existing and background 2030 conditions performed, only the most critical future scenario 2030 will be analyzed, as it has the same road geometries and signal timing, but an additional 5 years of annual growth rate on Richmond Rd. The future full build-out 2030 volumes were derived by superimposing background 2030 volumes which include other area developments and background growth, with future site-generated volumes. The future projected 2030 volumes are illustrated in **Figure 19** with projected operation outputs in **Table 17**. The detailed Synchro results can be found in **Appendix M**.

Table 17: 2030 Full Build-out Intersection Performance

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Assaly/Richmond	A(B)	0.57(0.66)	EBT(WBT)	11.2(10.9)	A(A)	0.53(0.60)
Croydon/Richmond	A(B)	0.51(0.69)	EBT(WBT)	13.6(18.0)	A(B)	0.47(0.62)
Starflower/Richmond (U)	A(B)	8(10)	EB(EB)	0(0)	A(A)	-
Starflower/Assaly (U)	B(B)	10(10)	WB(WB)	2(2)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 1.0 and a saturation flow rate of 1800 veh/h/lane. U = Unsignalized.						

As seen in **Table 17**, all study area intersections are expected to operate similarly to existing conditions and future background 2030 conditions, with very minor delays and ample capacity left. Given the ample intersection capacity, the City Safety department could see if additional PIDG measures could be implemented at Croydon/Richmond intersection to reduce collisions with vulnerable active users, however this intersection is far removed from the site and the site is not anticipated to negatively impact existing operations.

Queuing Assessment

Overall, the Synchro software shows modest queues for an arterial mainstreet, with the westbound movement in the PM peak experiencing the longest queues at approximately 200m for the 95th percentile at Assaly Rd and Croydon Rd intersections with Richmond Rd. These queues could block vehicles entering the site momentarily until the green phase is given at the signals. The average or 50th percentile queue during the PM peak is 59m at Assaly/Richmond, which would not be long enough to block the entrance to Starflower Ln. The future projected 2030 queues are similar to the existing queues.

Overall, the queues are acceptable and relatively minor, which is anticipated given that all intersections operate overall very well and with good critical movements in terms of intersection performance.

5.0 FINDINGS AND RECOMMENDATIONS

Based on the results summarized herein the following findings and recommendations are provided:

Existing Conditions

- The site is currently occupied by commercial uses and is zoned as AM10.
- The site is located in a transit-oriented development zone, being located approximately 350m from Lincoln Fields major BRT station and future LRT Station by year 2027.
- Overall, there were 40 collisions recorded in five years within the study area. The Croydon/Richmond intersection experienced a higher-than-average rate of collision with pedestrians and cyclists. Further intersection modifications from the PIDG guide could reduce the frequency of these collisions. Although limited data, it is possible that a POX may be recommended in future years if pedestrians continue to cross Richmond Rd at unsignalized locations.
- The site is currently accessed by two entrances and two exits: one a full movement access to Richmond Rd, the second a one-way in laneway at Starflower Ln with an egress at Assaly Rd.
- Existing intersections operate at very good overall and critical movements LoS ‘B’ or better during the weekday peak hours.

Proposed Development

- The site proposes approximately 590 residential units and 8,707 ft² of retail space in a 28 and 30-storey buildings connected by a 5-storey podium.
- The site will make use of the existing Starflower Ln, which is a one-way road from Richmond Rd to Assaly Rd, in order to access the underground parking garage ramp. The second existing full movement Richmond Rd access located closer to Assaly Rd will be eliminated and reinstated according to City design standards.
- The proposed development is projected to generate approximately 135 'new' transit trips during the AM and PM peak hour periods, which can be accommodated by rapid transit Lincoln Fields LRT Station (expected completion by 2027) which is located approximately 600m walking distance. Additional capacity is available from the existing frequent bus route 11.
- The proposed development is projected to generate 'new' vehicle volumes of approximately 60 veh/h two-way total during the weekday morning and afternoon peak hours.
- The developer proposes 583 bike parking spaces which almost doubles the minimum by-law requirements. All of the bike parking will be located indoors in a well-lit secured area near elevators in the parking garage or at ground floor.
- A total of 207 residential spaces, 57 visitor/retail spaces and 3 carshare spaces are proposed for the site which meets the minimum and is below the maximum allowed parking rates based on the Parking By-laws.
- A strong TDM plan is proposed for this development to encourage the use of alternate modes of transportation and reduce the need for vehicular reliance. Refer to **Section 4.5** for further details.

Future Conditions

- Other nearby developments and a 0.5% growth rate were applied to existing volumes (based on more conservative 2016 baseline volumes) to estimate background conditions. The 2030 background intersection performance of all study area intersections was similar to existing conditions.
- The MMLOS road segment analysis shows that pedestrian targets were not met at any location given the high PLoS targets given the proximity to major rapid transit facilities (LRT). The PLoS target on Assaly Rd could be met if a 2m wide sidewalk with 2m wide boulevards was built. The bicycle BLoS targets were met at all locations except for Richmond Rd north side given that fully segregated cycling facilities are not present. All other targets were met at all locations.
- The MMLOS intersection analysis shows that only transit targets were met for signalized intersections. Truck targets were not met, but none of the study area intersections had designated truck routes. The pedestrian PLoS targets weren't met given the higher-operating speeds and number of travel lanes required to cross. The bicycle target goals were also not met given the lack of cycling facilities on all approaches, the quantity of lanes required to be crossed and the higher operating speeds.
- The 2030 full buildout conditions continued to operate at overall very good LoS 'B' or better with some critical movements at LoS 'B'. No major queueing implications were noted within the network.
- The site is proposing upgraded pedestrian facilities along the site frontage on Richmond Rd and Assaly Rd, with more than 2m wide sidewalks.
- The on-going Stage 2 LRT Expansion will provide enhanced pedestrian and cyclist facilities near Lincoln Fields Station. Additional improvements to cycling facilities and intersection corssing treatments are anticipated as part of the Carling Transit Priority Corridor works. The site will provide direct connectivity to existing and future pedestrian and cycling network infrastructure.

Based on the foregoing findings, the proposed development located at 1299 Richmond Rd is recommended from a transportation perspective.

Prepared By:

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Transportation Engineer

Reviewed By:

Austin Shih, P.Eng.
Senior Transportation Engineer

Appendix A:

Screening Form and Site Plan

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1223 Michael Street, Suite 100|Ottawa, ON K1J 7T2

City of Ottawa 2017 TIA Guidelines

TIA Screening Form

Date	22-Jun-22
Project	1299 Richmond TIA
Project Number	478250-01000

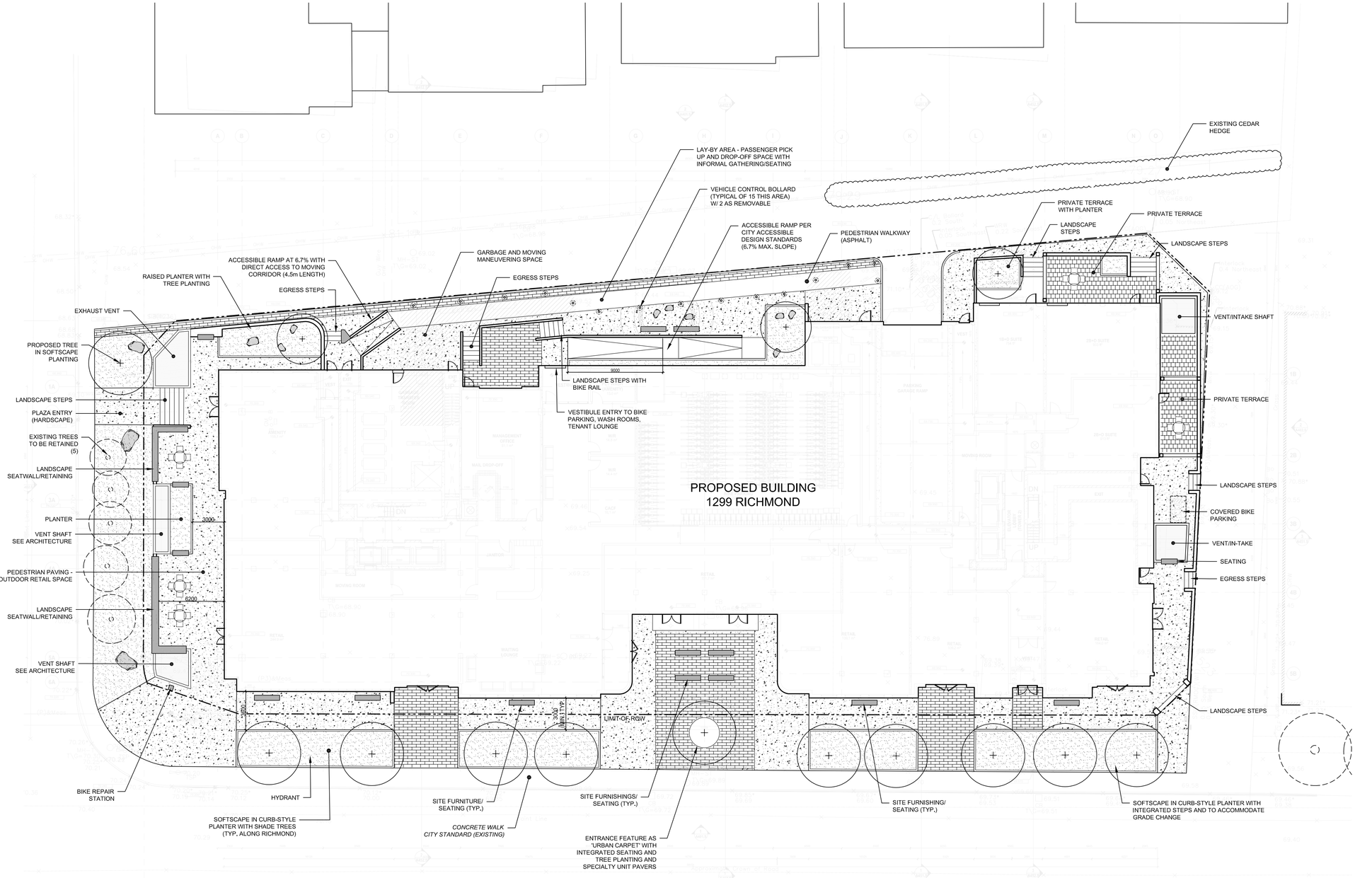
Results of Screening	Yes/No
Development Satisfies the Trip Generation Trigger	Yes
Development Satisfies the Location Trigger	Yes
Development Satisfies the Safety Trigger	No

Module 1.1 - Description of Proposed Development	
Municipal Address	1299 Richmond Rd, Ottawa, ON K2B 8L2, Canada
Description of location	At northwest corner of Richmond/Assaly intersection
Land Use	Two residential apartment buildings
Development Size	28 and 30-storey buildings with shared podium
Number of Accesses and Locations	One access assumed on the north along Starflower Ln
Development Phasing	Single Phase
Buildout Year	Assumed 2024
Sketch Plan / Site Plan	See attached

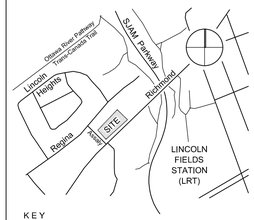
Module 1.2 - Trip Generation Trigger		
Land Use Type	Townhomes or Apartments	
Development Size	588	Units
Trip Generation Trigger Met?	Yes	

Module 1.3 - Location Triggers	
Development Proposes a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit, or Spine Bicycle Networks (See Sheet 3)	No
Development is in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone. (See Sheet 3)	Yes
Location Trigger Met?	Yes

Module 1.4 - Safety Triggers		
Posted Speed Limit on any boundary road	<80	km/h
Horizontal / Vertical Curvature on a boundary street limits sight lines at a proposed driveway	No	
A proposed driveway is within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions) or within auxiliary lanes of an intersection;	No	
A proposed driveway makes use of an existing median break that serves an existing site	No	
There is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development	No	
The development includes a drive-thru facility	No	
Safety Trigger Met?	No	



brigil



KEY

LANDSCAPE

siteform

Siteform Inc. Landscape Architecture
Ottawa, ON K1S 3G8
613.796.4537 www.siteform.ca

LEGEND

- CONIFEROUS TREE
- DECIDUOUS TREE (SHADE)
- LANDSCAPE BOULDER
- MOVABLE OUTDOOR FURNITURE
- SOFTSCAPE
- HARDSCAPE
- SPECIALTY UNIT PAVING TYPE 1
- SPECIALTY UNIT PAVING TYPE 2

RECORD OF DRAWING

ISSUED FOR SITE PLAN COORDINATION AUGUST 30, 2024

1299 Richmond Road, Ottawa
for
BRIGIL

23002	EK/JL	JL
PROJECT	DRAWN	REVIEWED

Landscape Plan

LP1

Appendix B:

Transit Route Maps

11

Fréquent

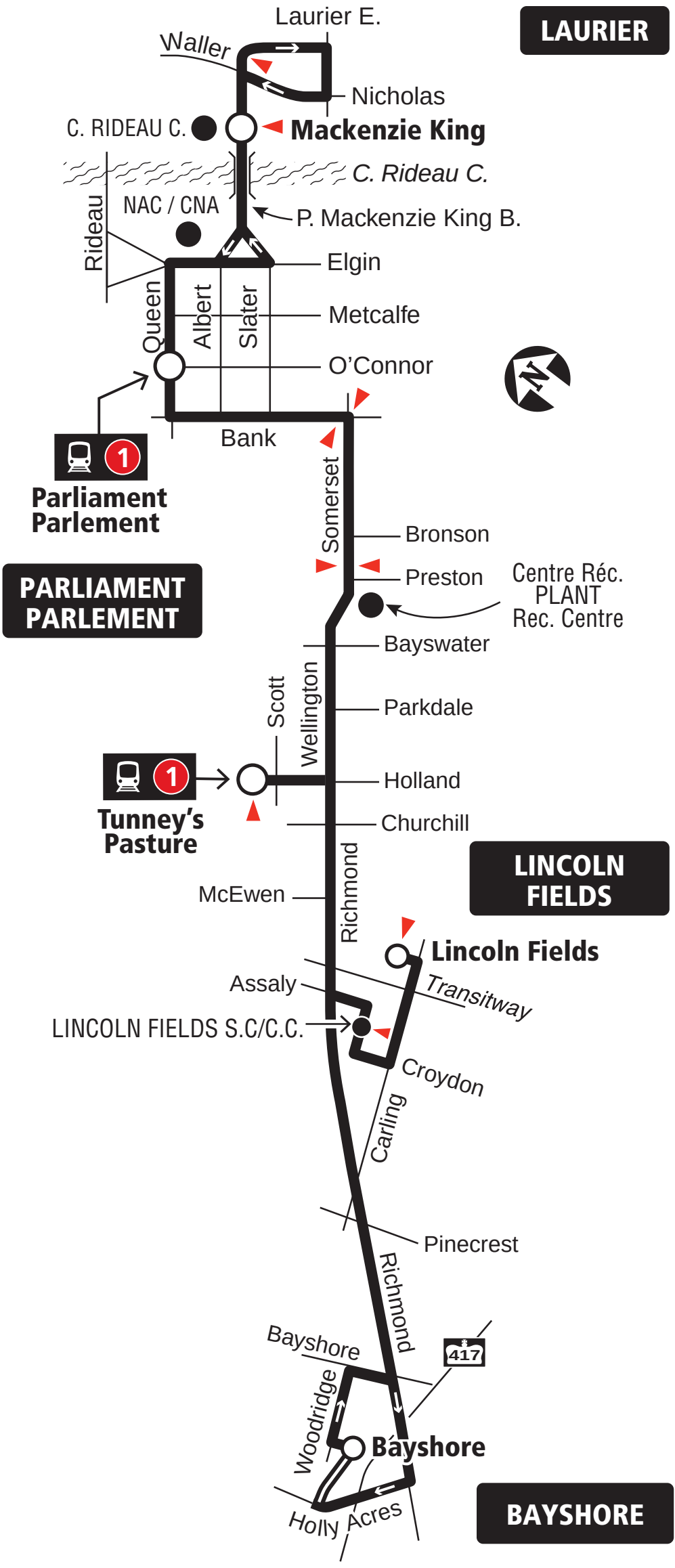
LINCOLN FIELDS BAYSHORE

LAURIER

7 days a week / 7 jours par semaine

All day service

Service toute la journée



Transitway & Station

Timepoint / Heures de passage

2021.09

Schedule / Horaire 613-560-1000

Text / Texto* 560560

plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

*Standard message rates may apply / Les tarifs réguliers de messagerie texte peuvent s'appliquer

Customer Service
Service à la clientèle **613-560-5000**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective September 5, 2021

En vigueur 5 septembre 2021

OC Transpo

INFO 613-560-5000
octranspo.com

153

LINCOLN FIELDS
TUNNEY'S PASTURE
CARLINGWOOD

Local

7 days a week / 7 jours par semaine

Selected time periods only
Périodes sélectionnées seulement

2022.06

○	Station
▮▮▮▮▮▮▮▮▮▮	Some trips / Quelques trajets
▲	Timepoint / Heures de passage

2022.06

Schedule / Horaire 613-560-1000
Text / Texto* 560560
plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres
*Standard message rates may apply / Les tarifs réguliers de messagerie texte peuvent s'appliquer

Customer Service
Service à la clientèle **613-560-5000**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité **613-741-2478**

Effective June 26, 2022
En vigueur 26 juin 2022

OC Transpo

INFO 613-560-5000
octranspo.com

Appendix C:

Traffic Data

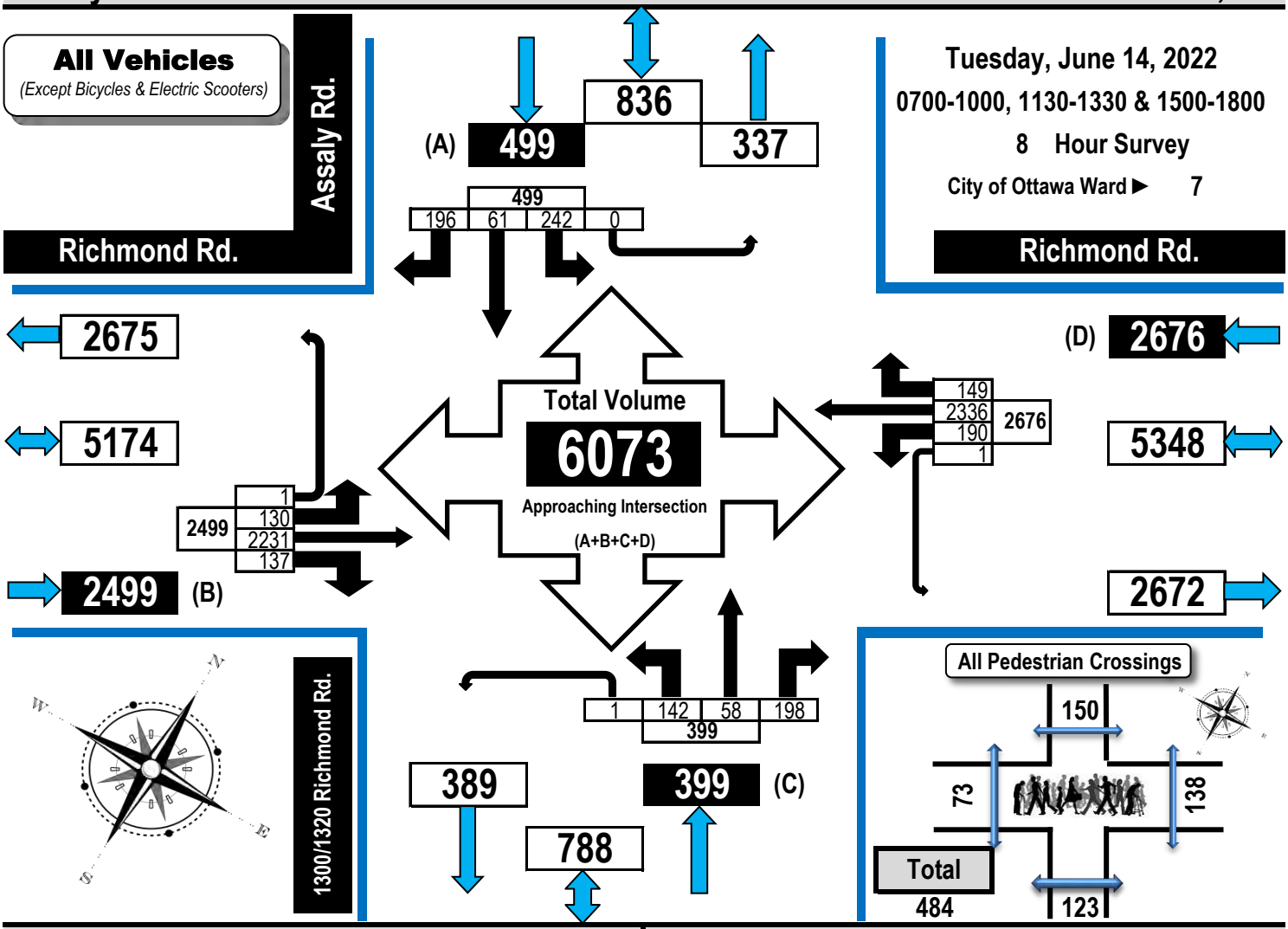
ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

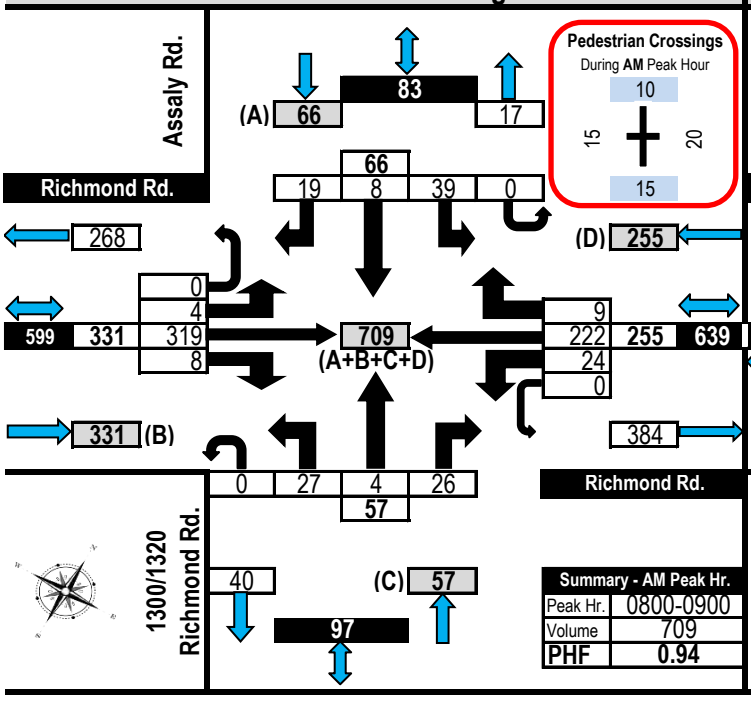
Assaly Road & Richmond Road — Ottawa, ON

All Vehicles
(Except Bicycles & Electric Scooters)

Tuesday, June 14, 2022
0700-1000, 1130-1330 & 1500-1800
8 Hour Survey
City of Ottawa Ward ► 7

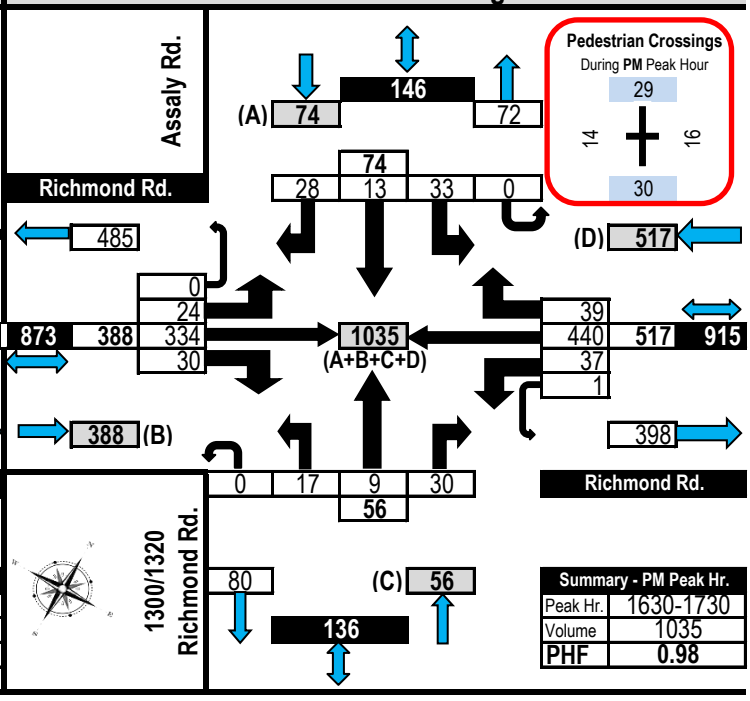


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0800-0900
Volume	709
PHF	0.94

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1630-1730
Volume	1035
PHF	0.98

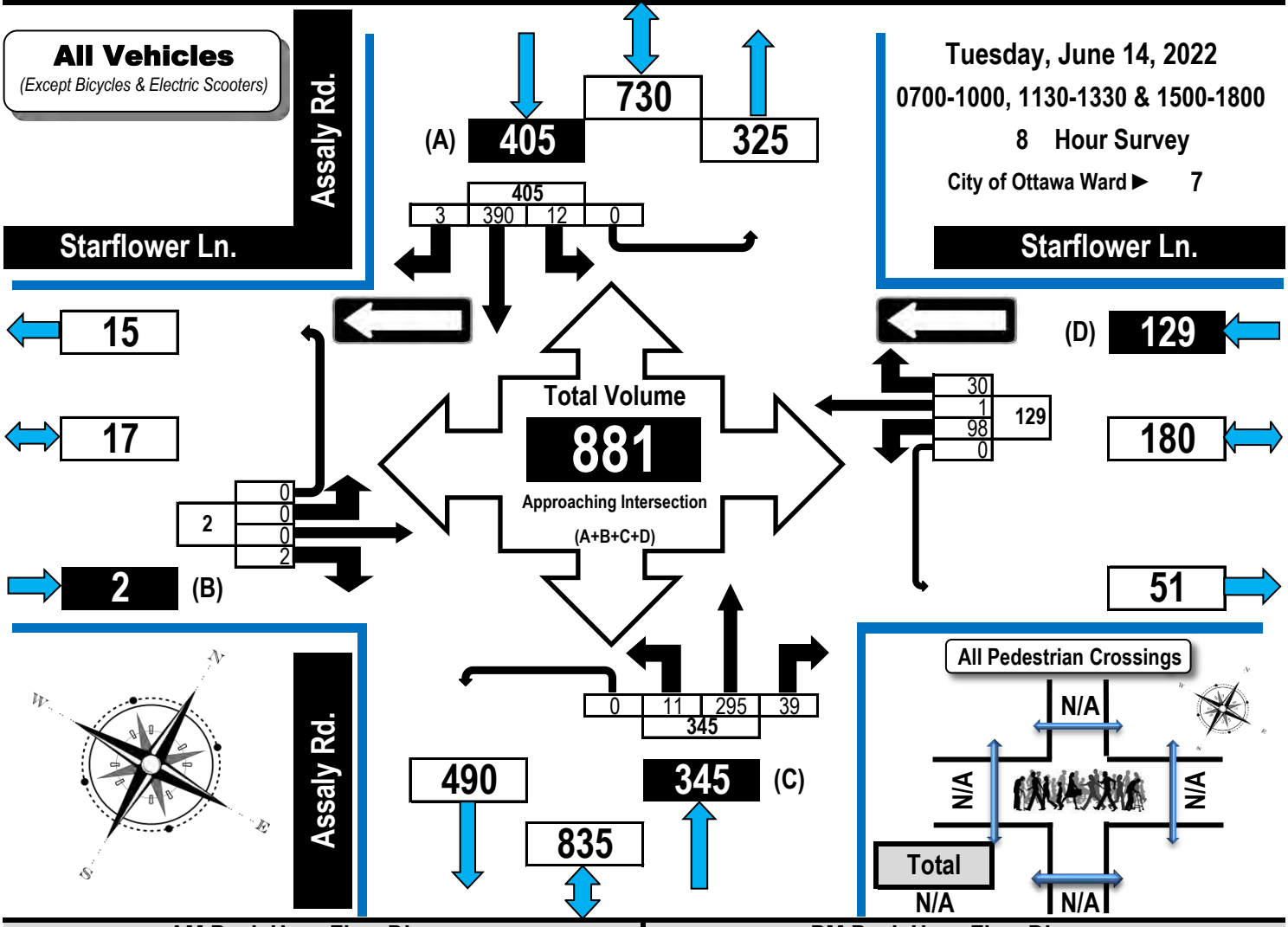
ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

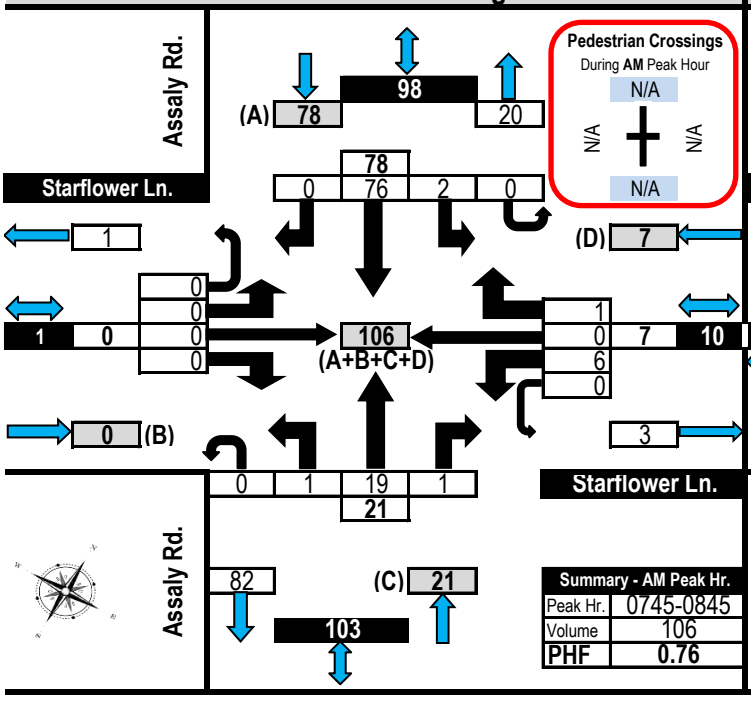
Assaly Road & Starflower Lane — Ottawa, ON

All Vehicles
(Except Bicycles & Electric Scooters)

Tuesday, June 14, 2022
0700-1000, 1130-1330 & 1500-1800
8 Hour Survey
City of Ottawa Ward ► 7

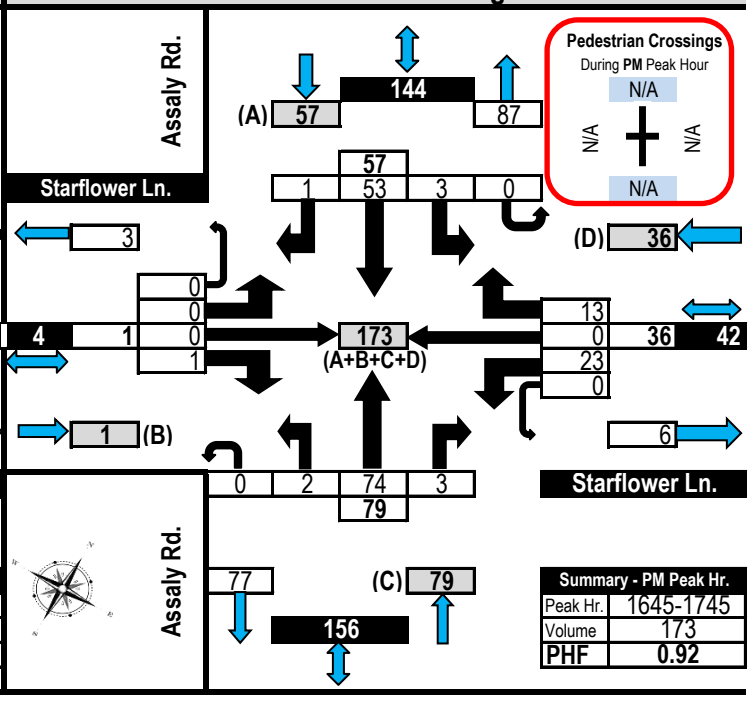


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0745-0845
Volume	106
PHF	0.76

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1645-1745
Volume	173
PHF	0.92

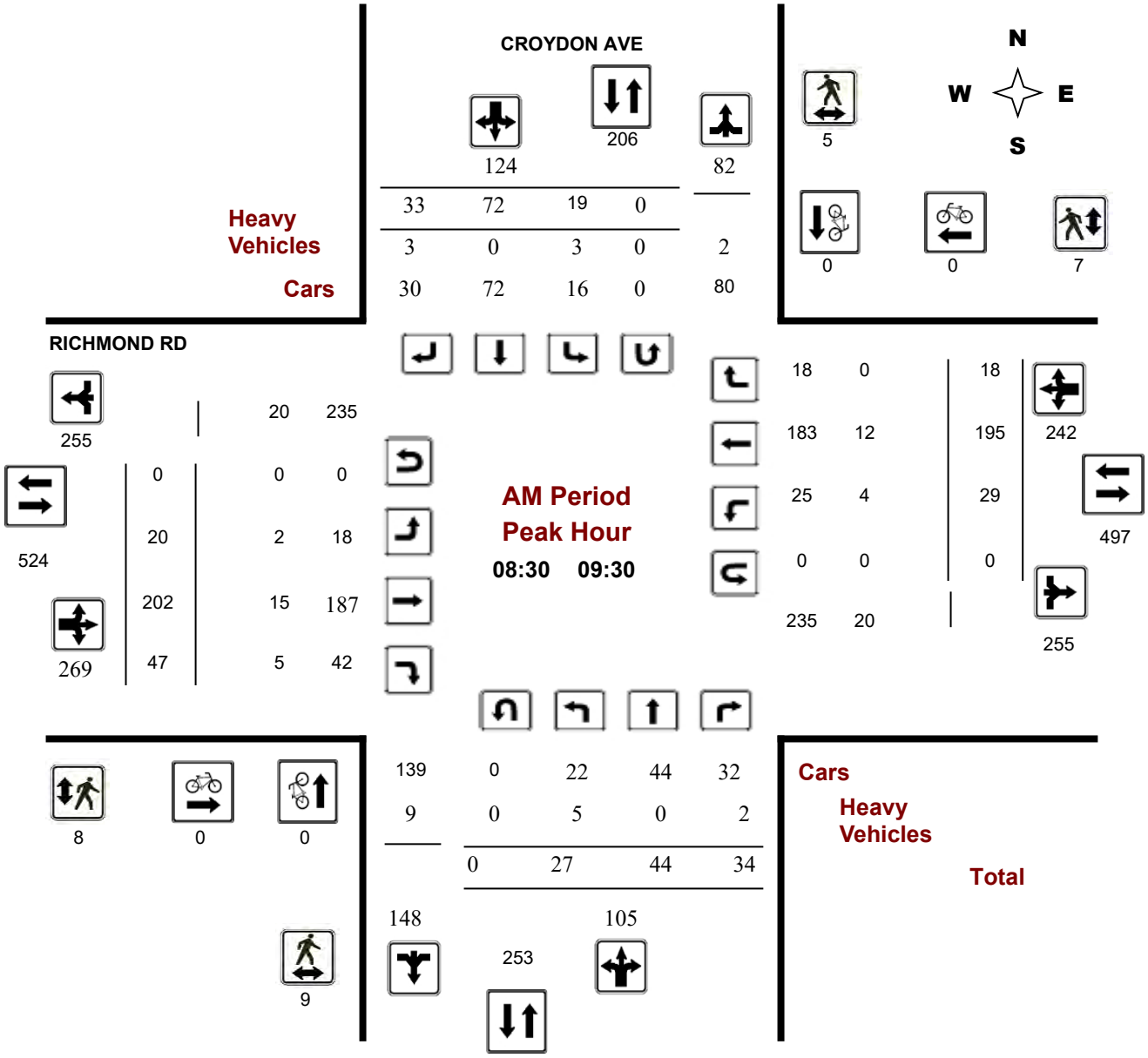
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CROYDON AVE @ RICHMOND RD

Survey Date: Thursday, February 17, 2022 **WO No:** 40154

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



Comments

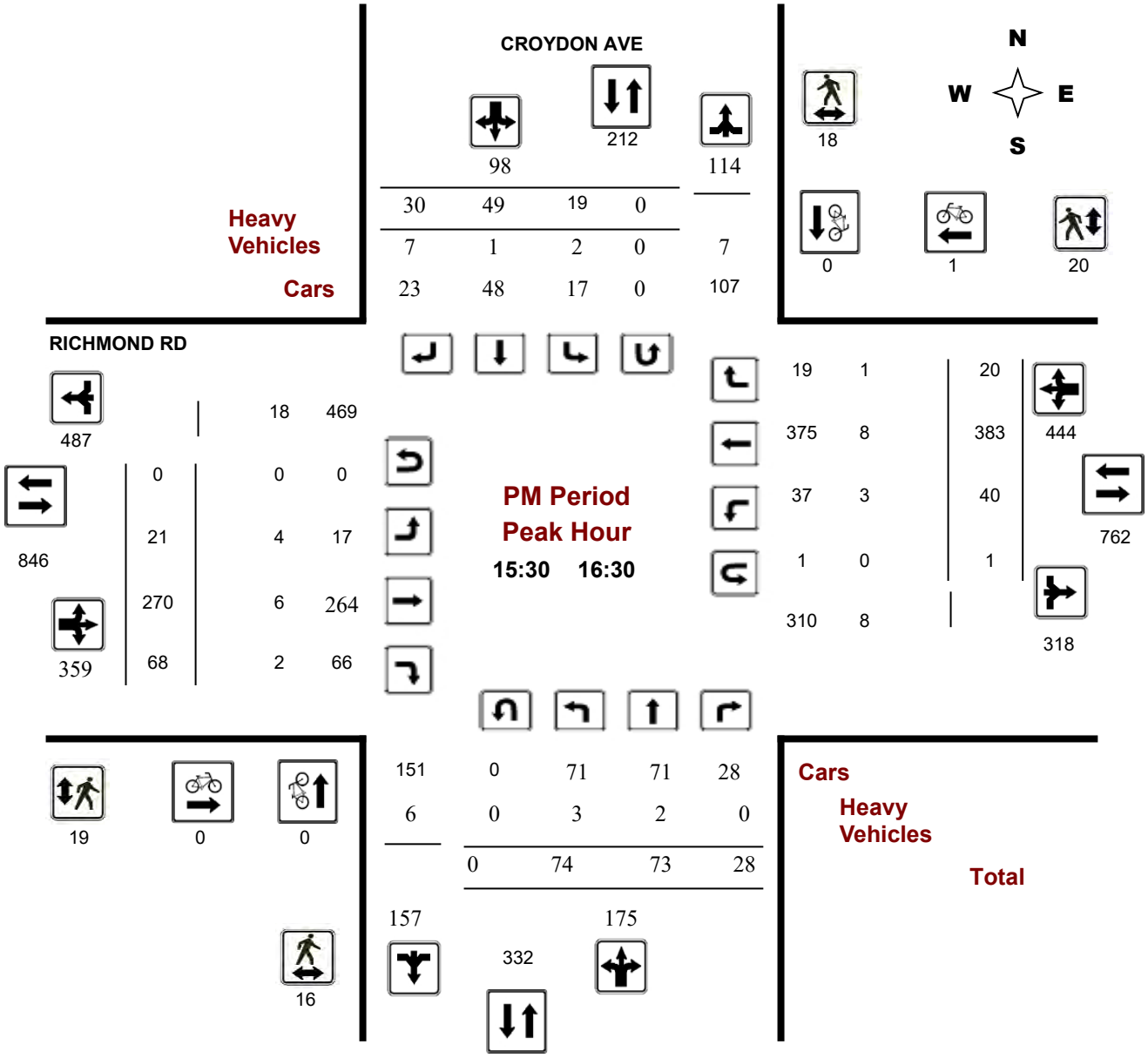
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

CROYDON AVE @ RICHMOND RD

Survey Date: Thursday, February 17, 2022 **WO No:** 40154

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



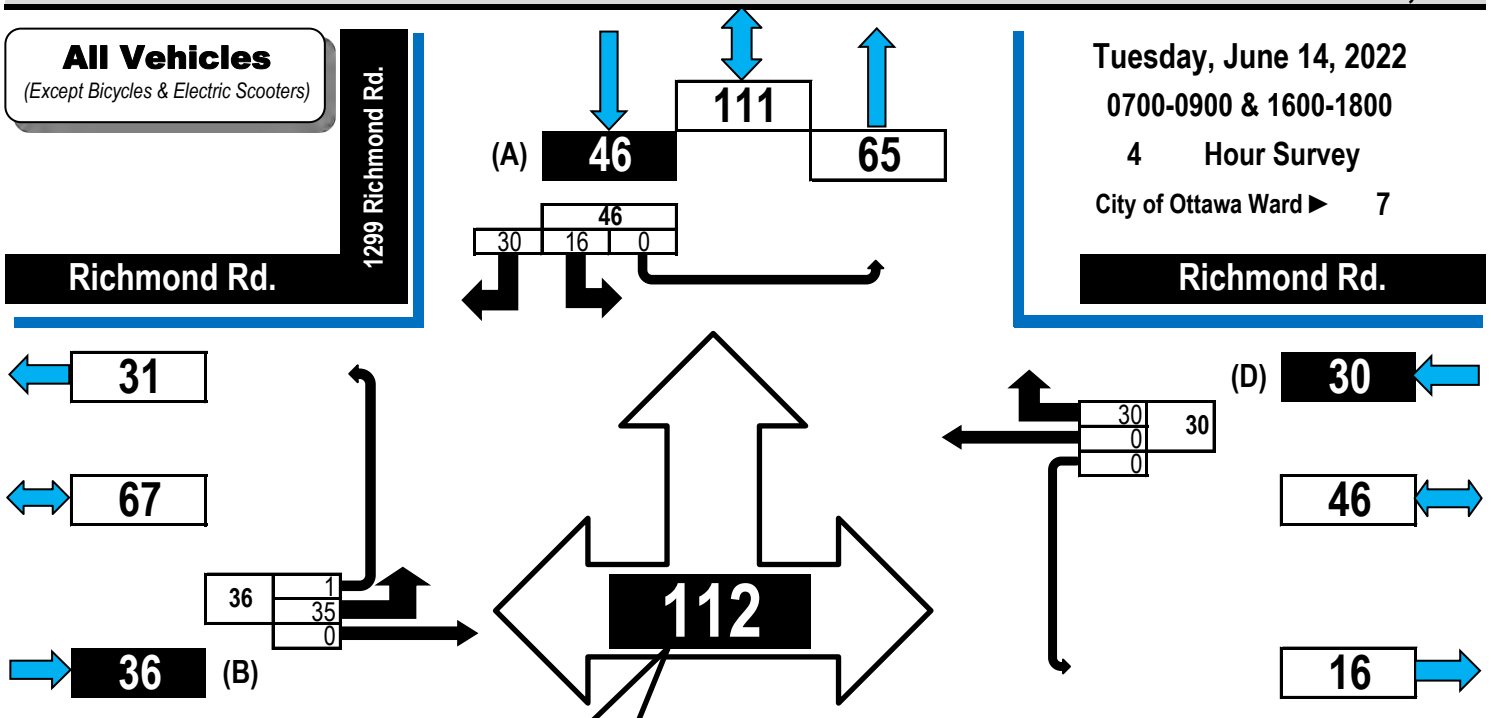
Comments

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

Richmond Road & 1299 Richmond Road — Ottawa, ON

All Vehicles
(Except Bicycles & Electric Scooters)

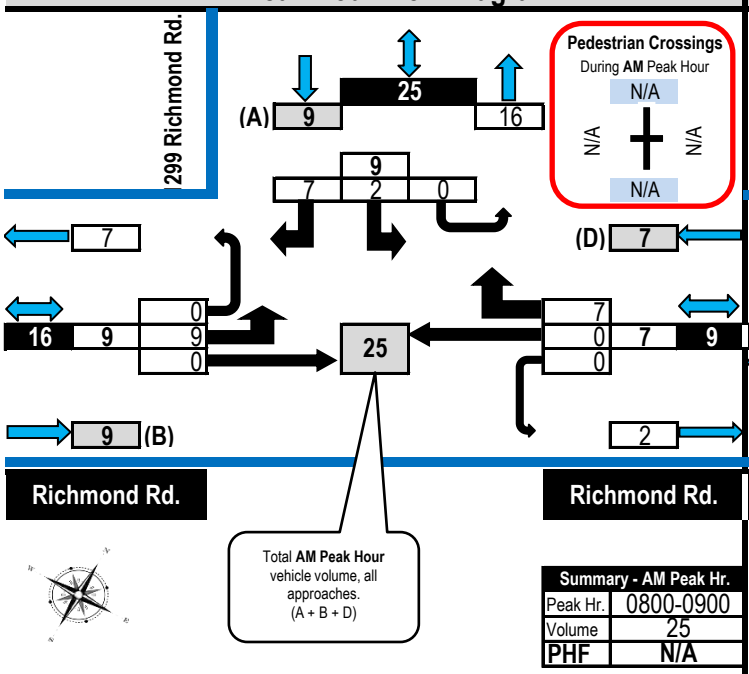
Tuesday, June 14, 2022
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 7



Total vehicle volume, all approaches. (A + B + D)

All Pedestrian Crossings
N/A
N/A N/A
Total
N/A

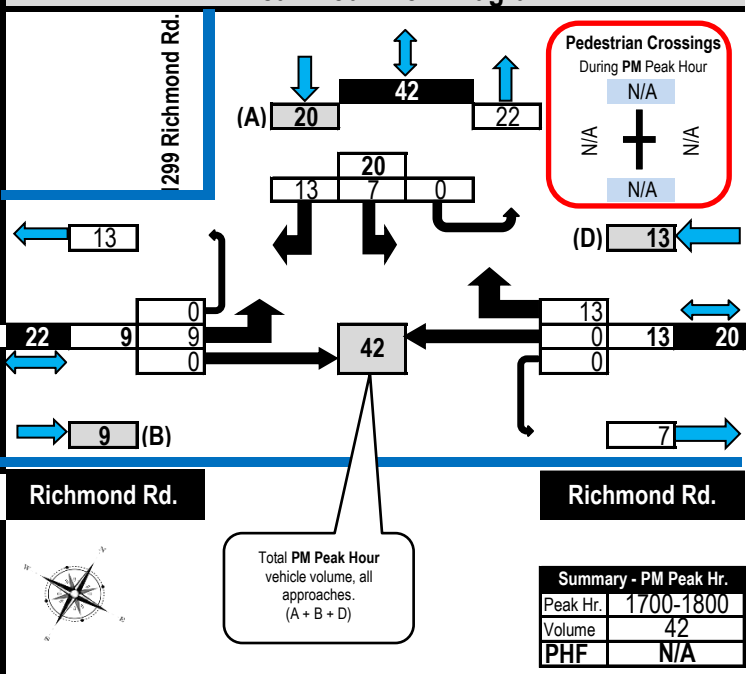
AM Peak Hour Flow Diagram



Total **AM Peak Hour** vehicle volume, all approaches. (A + B + D)

Summary - AM Peak Hr.	
Peak Hr.	0800-0900
Volume	25
PHF	N/A

PM Peak Hour Flow Diagram



Total **PM Peak Hour** vehicle volume, all approaches. (A + B + D)

Summary - PM Peak Hr.	
Peak Hr.	1700-1800
Volume	42
PHF	N/A

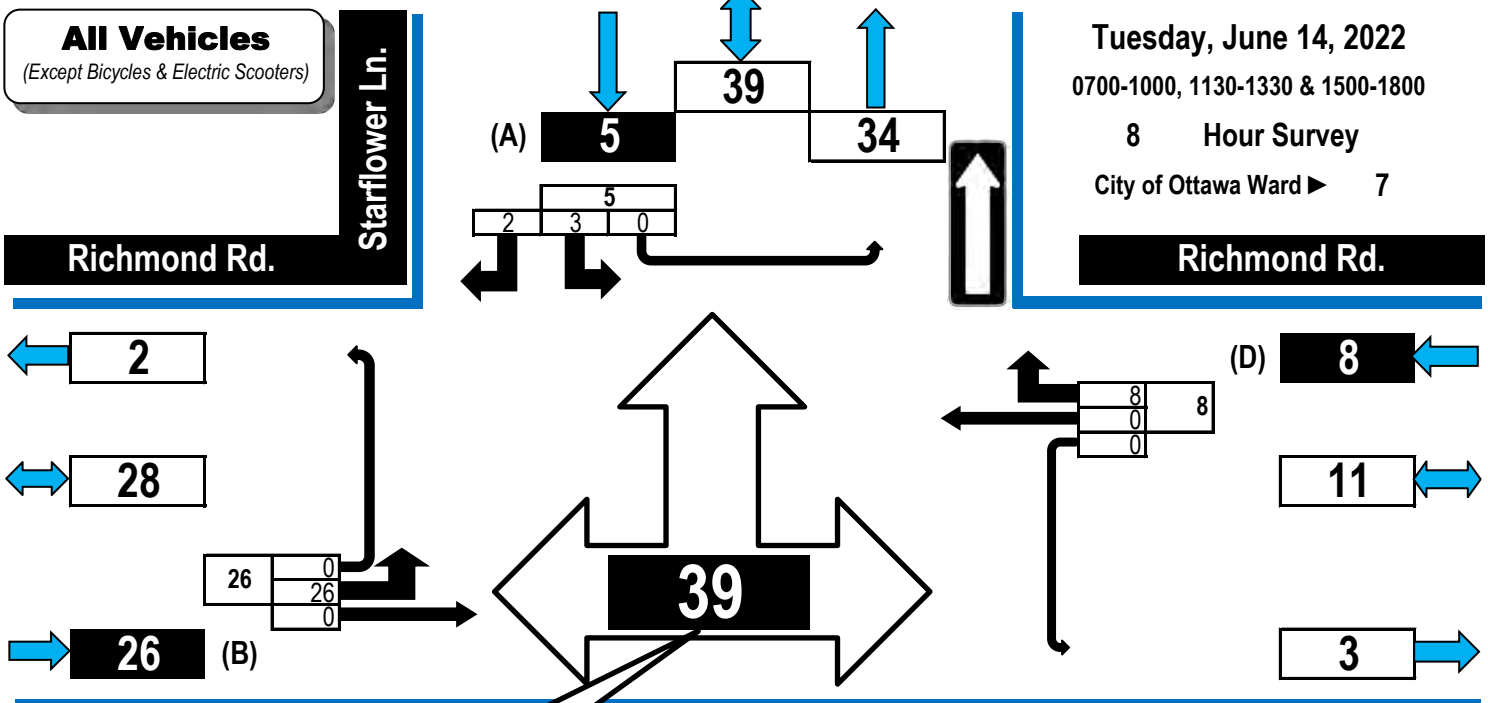
ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

Richmond Road & Starflower Lane — Ottawa, ON

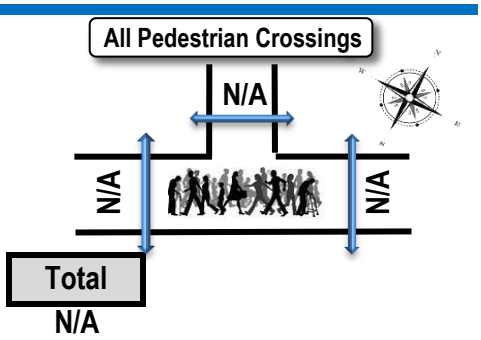
All Vehicles
(Except Bicycles & Electric Scooters)

Tuesday, June 14, 2022
0700-1000, 1130-1330 & 1500-1800
8 Hour Survey
City of Ottawa Ward ▶ 7

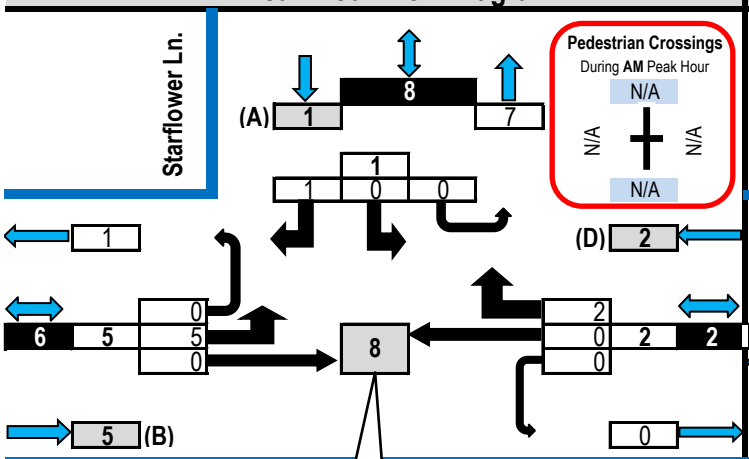


Total vehicle volume, all approaches. (A + B + D)

Please refer to the traffic count at Assaly & Richmond Roads for vehicle volumes on Richmond Road at this intersection.



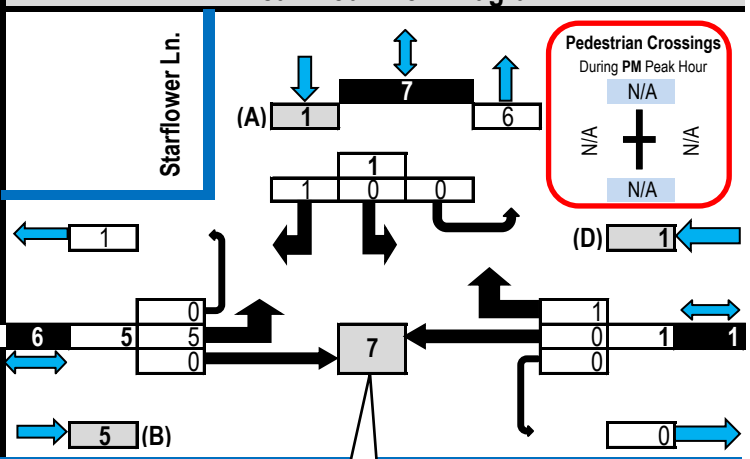
AM Peak Hour Flow Diagram



Total **AM Peak Hour** vehicle volume, all approaches. (A + B + D)

Summary - AM Peak Hr.	
Peak Hr.	0715-0815
Volume	8
PHF	N/A

PM Peak Hour Flow Diagram



Total **PM Peak Hour** vehicle volume, all approaches. (A + B + D)

Summary - PM Peak Hr.	
Peak Hr.	1630-1730
Volume	7
PHF	N/A

ACCURATE TRUSTED TRAFFIC DATA

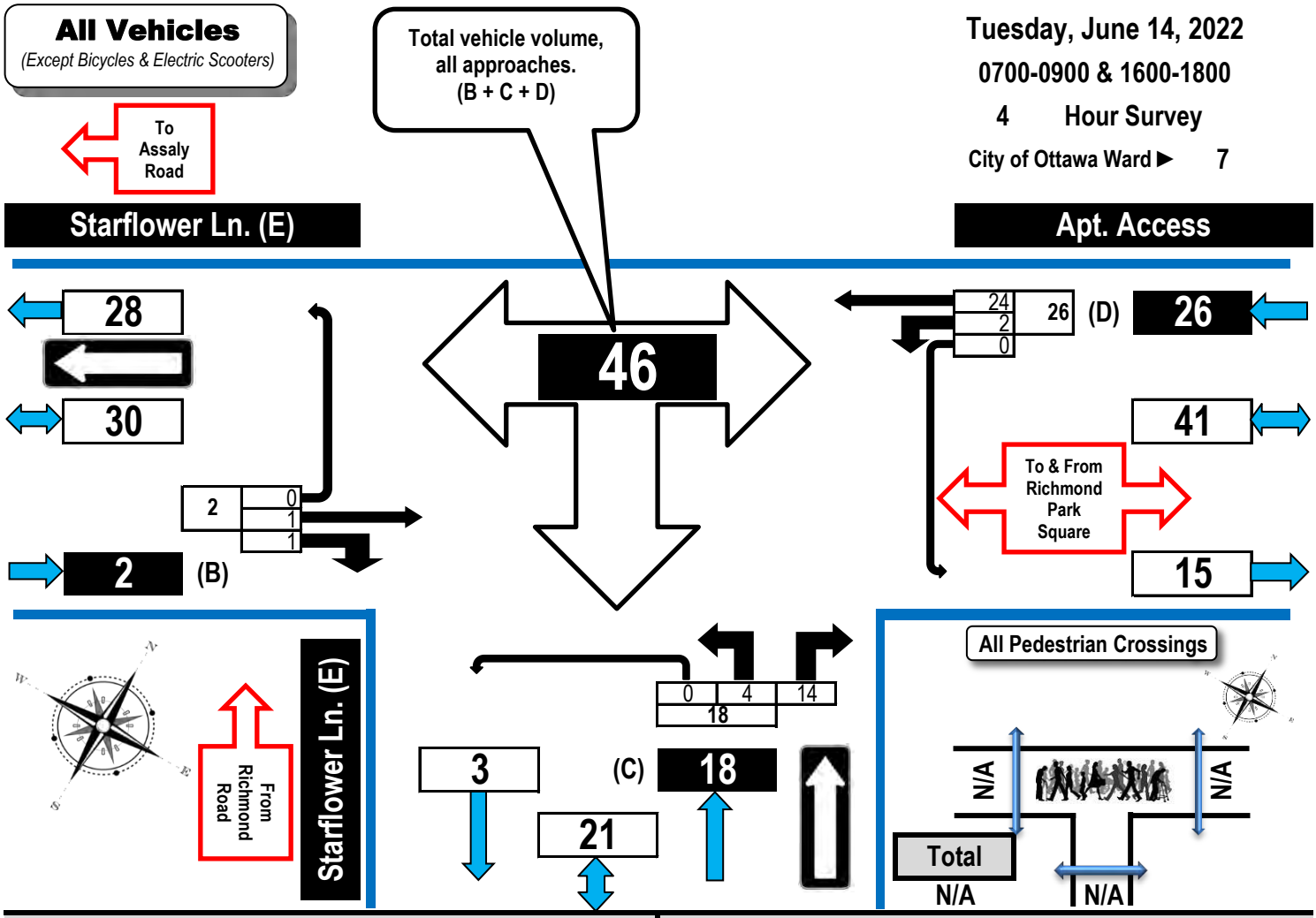
Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

Starflower Lane East & Apartment Access — Ottawa, ON

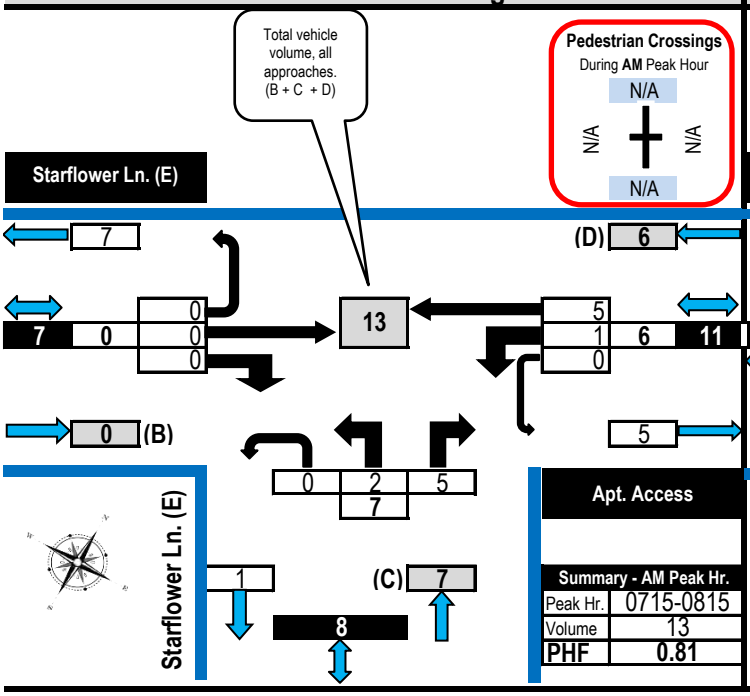
All Vehicles
(Except Bicycles & Electric Scooters)

Total vehicle volume, all approaches. (B + C + D)

Tuesday, June 14, 2022
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 7

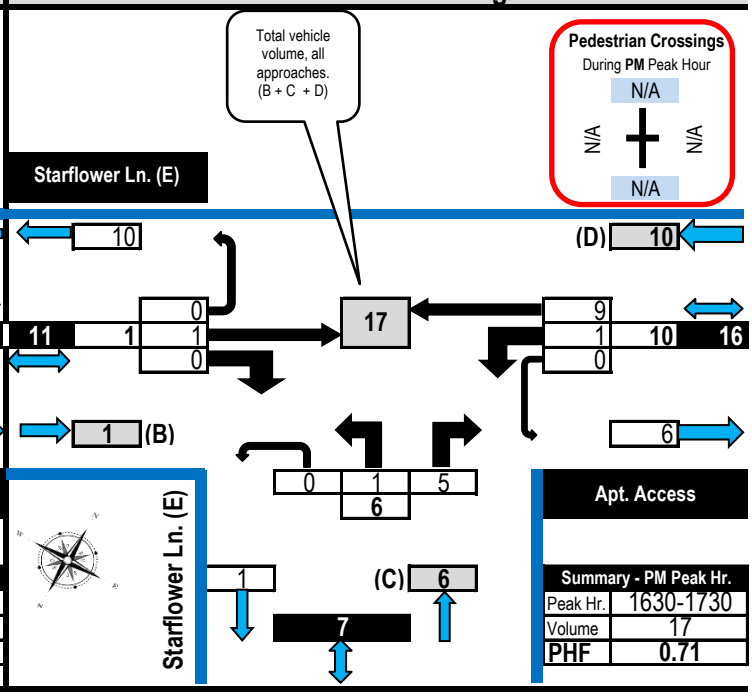


AM Peak Hour Flow Diagram



Apt. Access	
Summary - AM Peak Hr.	
Peak Hr.	0715-0815
Volume	13
PHF	0.81

PM Peak Hour Flow Diagram



Apt. Access	
Summary - PM Peak Hr.	
Peak Hr.	1630-1730
Volume	17
PHF	0.71

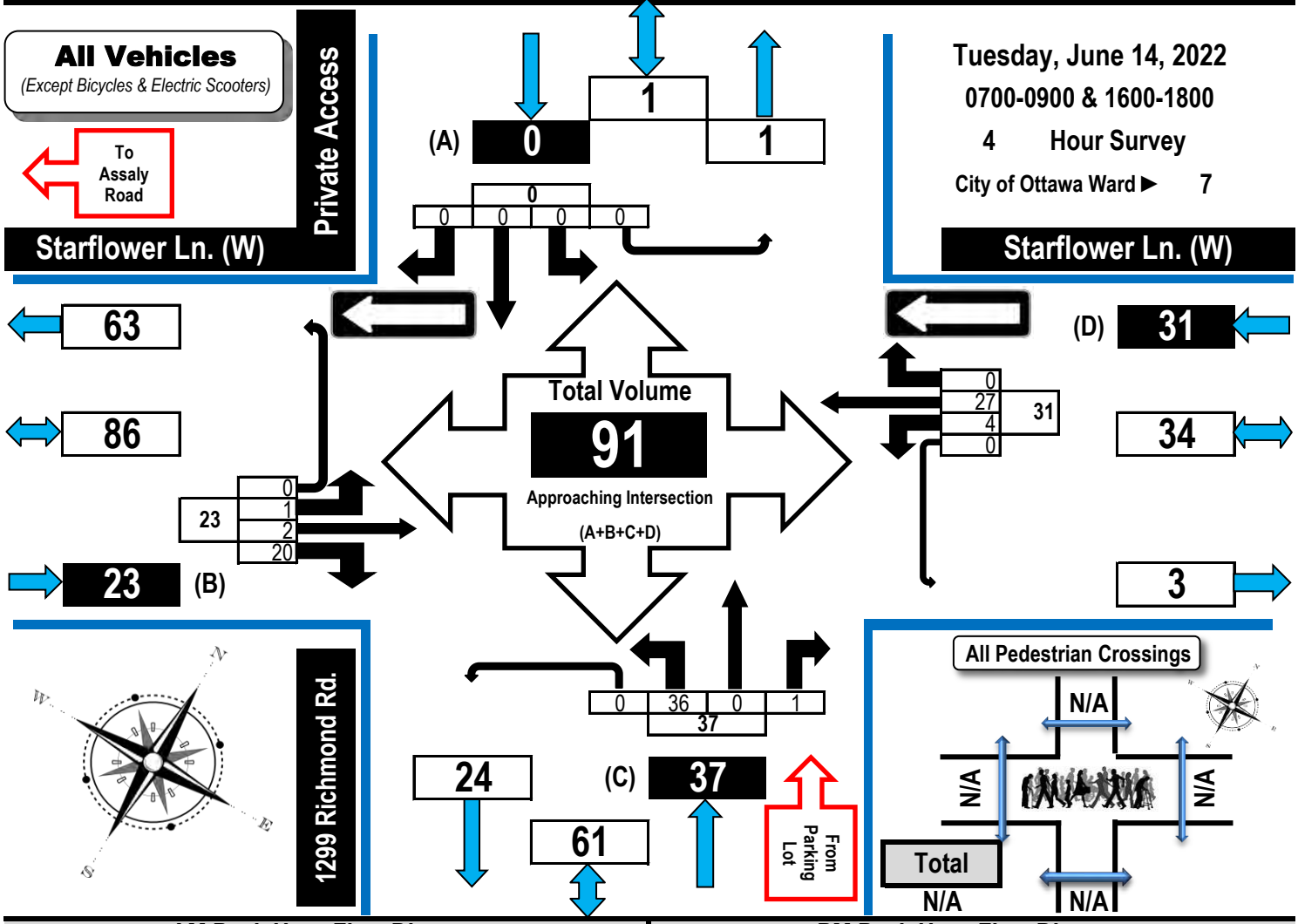
ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams
All Vehicles Except Bicycles

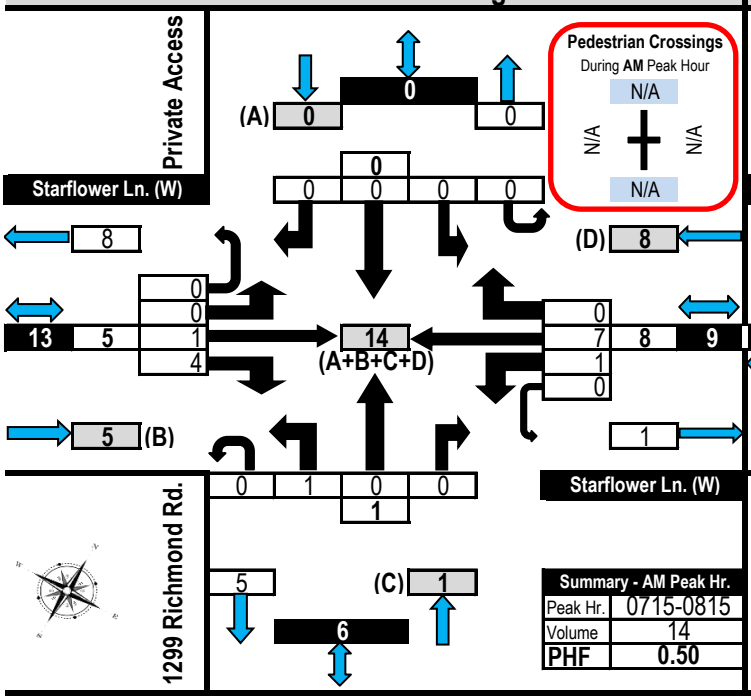
Starflower Lane West & 1299 Richmond Road — Ottawa, ON

All Vehicles
(Except Bicycles & Electric Scooters)

Tuesday, June 14, 2022
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 7

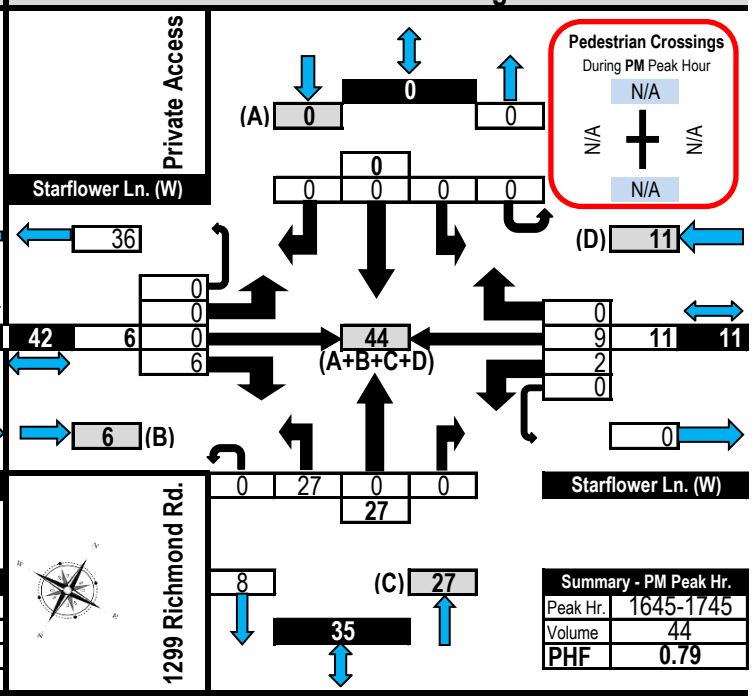


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0715-0815
Volume	14
PHF	0.50

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1645-1745
Volume	44
PHF	0.79

Appendix D:

Collision Data

Total Area

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	9	4	2	9	0	3	2	0	29	73%
Non-fatal injury	2	1	0	1	0	7	0	0	11	28%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**11**	**5**	**2**	**10**	**0**	**10**	**2**	**0**	**40**	100%
	#1 or 28%	#4 or 13%	#5 or 5%	#2 or 25%	#7 or 0%	#2 or 25%	#5 or 5%	#7 or 0%		

ASSALY RD/RICHMOND RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2021	6	15,264	1825	**0.22**

Peds	Cyclists
1	**0**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	3	0	0	1	0	0	1	0	5	83%
Non-fatal injury	0	0	0	0	0	1	0	0	1	17%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**3**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**6**	100%
	50%	0%	0%	17%	0%	17%	17%	0%		

CROYDON AVE/RICHMOND RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2021	22	17,166	1825	**0.70**

Peds	Cyclists
4	**1**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	4	3	1	6	0	1	0	0	15	68%
Non-fatal injury	2	1	0	0	0	4	0	0	7	32%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**6**	**4**	**1**	**6**	**0**	**5**	**0**	**0**	**22**	100%
	27%	18%	5%	27%	0%	23%	0%	0%		

Road Segments

RICHMOND RD, ASSALY RD to REGINA LANE

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2021	4	n/a	366.0922917	**n/a**

Peds	Cyclists
2	**0**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	0	1	0	0	0	1	0	0	2	50%
Non-fatal injury	0	0	0	0	0	2	0	0	2	50%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**4**	100%
	0%	25%	0%	0%	0%	75%	0%	0%		

RICHMOND RD, ASSALY RD to CROYDON AVE

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2021	7	n/a	366.0922917	**n/a**

Peds	Cyclists
0	**0**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	2	0	1	2	0	1	0	0	6	86%
Non-fatal injury	0	0	0	1	0	0	0	0	1	14%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**2**	**0**	**1**	**3**	**0**	**1**	**0**	**0**	**7**	100%
	29%	0%	14%	43%	0%	14%	0%	0%		

ASSALY RD, REGINA LANE to RICHMOND RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2017-2021	1	n/a	366.0922917	**n/a**

Peds	Cyclists
0	**0**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	SMV other	SMV unattended vehicle	Other	Total	
P.D. only	0	0	0	0	0	0	1	0	1	100%
Non-fatal injury	0	0	0	0	0	0	0	0	0	0%
Non-reportable	0	0	0	0	0	0	0	0	0	0%
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	100%
	0%	0%	0%	0%	0%	0%	100%	0%		

Appendix E:

Lincoln Fields Station Future Connectivity Plan

TITLEBLOCK: 863.6mm x 558.8mm

STAGE 2 ETAPE 2 — Confederation Line EAST / Confederation Line WEST

Ottawa

DRAWING NAME: LINCOLN FIELDS STATION CONNECTIVITY	CONTRACT No.
	DESIGNED: — / CHECKED: D. BERLIN
	DRAWN: H. ELJAJI / SEALED:
DRAWING NUMBER	PRIMARY SEAL
ENGINEERING JV	SECONDARY SEAL
SCALE — HORIZONTAL 1:1,000 22"x34" 1:2,000 11"x17" — 0m 75m	ASSET No. / ASSET GROUP

REV	DESCRIPTION	BY	DATE
A	ISSUED FOR INFORMATION	HE	2021-04-08

KEY MAP - WEST N.T.S.

KEY MAP - EAST N.T.S.

LAYOUT INFORMATION BASED ON 3 DEGREE MTM ZONE 9 NAD 83 ORIGINAL COORDINATE SYSTEM. COMBINED SCALE FACTOR 0.9999

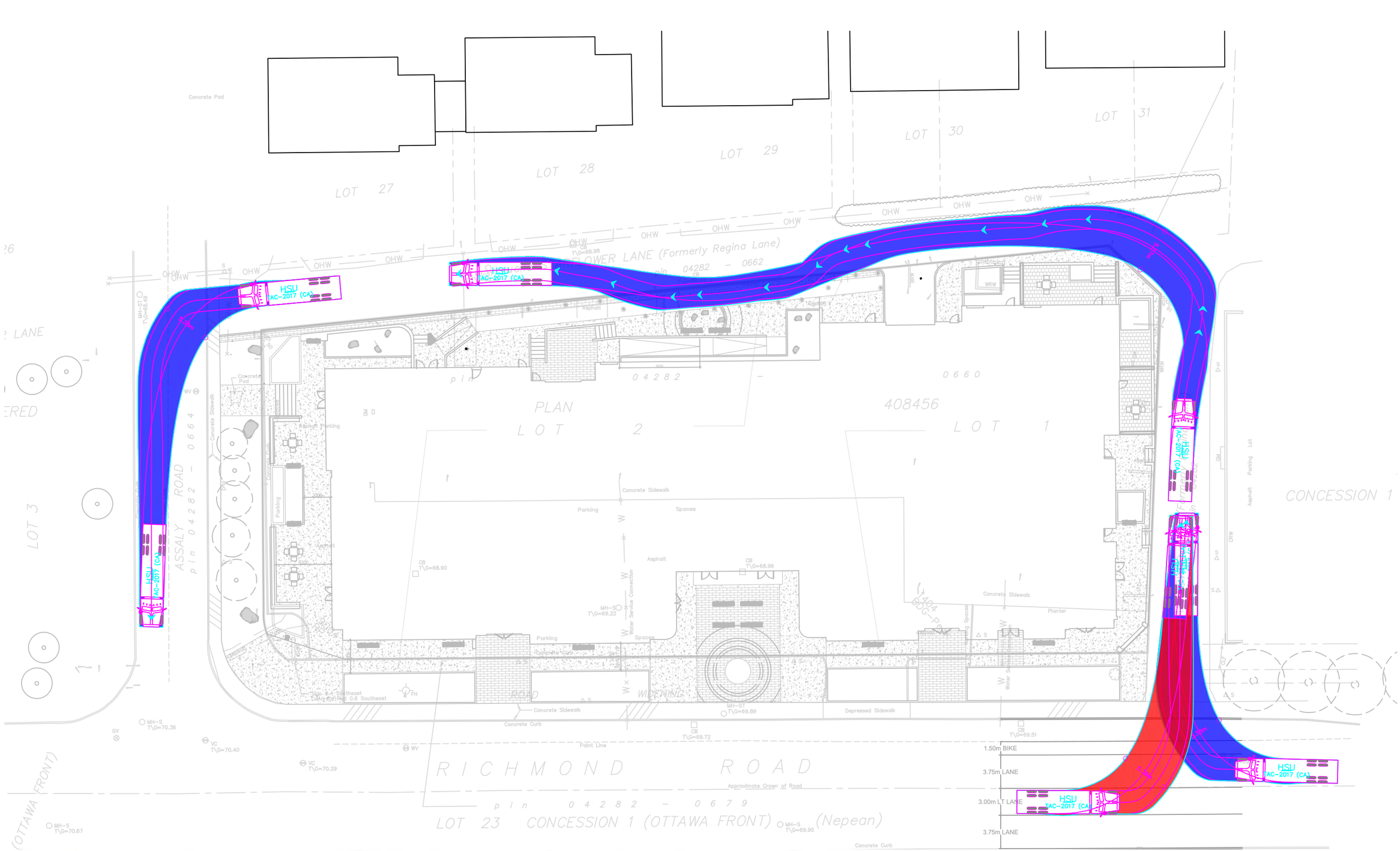
PRELIMINARY
NOT FOR CONSTRUCTION
2021-04-08

CARLING AVENUE
SIR JOHN A MACDONALD PARKWAY
RICHMOND ROAD
MUP CONNECTION UNDERNEATH CARLING AVENUE TO EXISTING NCC PATHWAY
PEDESTRIAN BRIDGE CROSSING
LINCOLN FIELDS STATION
FARE GATES
FARE GATES / FARE PAID ZONE
BUS LOOP
PPUDO
PASSENGER DROP OFF ZONE
MUP CONNECTION - SIGNALIZED CROSSING AT CARLING AVENUE
EMERGENCY ACCESS
MUP CONNECTION OVER PARKWAY TUNNEL
MUP CONNECTION
STA BACK = 44+200
STA AHEAD = 44+300
43+800
84+100
63+800
63+900
84+400
70+100
70+114
84+100
84+468
44+200
64+200
44+300
64+500
44+400
64+400
WOODPARK
WHITEHAVEN
ROSEWOOD AVENUE
GEORGINA DRIVE
EDGEWORTH AVENUE
CARLING AVENUE
WENTWORTH AVENUE
HARTLEIGH AVENUE
LAWN AVENUE
MIDWAY AVENUE
44+500
64+600

O:\GIS\2021\Lincoln Fields+Woodpark\Lincoln Fields Connectivity.dgn Plotted 2021-04-08 at 9:13:50 AM

Appendix F:

Truck Turning Templates

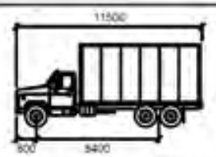


PARSONS

Note: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall provide the location of utilities and shall be responsible for adequate protection from damage.

N

Legend



HSU

	mm
Width	2600
Track	2600
Lock to Lock Time	6.0
Steering Angle	40.0

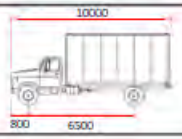
Not to Scale

Drawing Description	HSU Turning Movements	
Client Brigil	**Date** Sept 5, 2024	**Figure Number** 1
Project Number 478250	**Project Description**	

PARSONS

N

Legend



MSU

	mm
Width	2600
Track	2600
Lock to Lock Time	6.0
Steering Angle	40.2

Not to Scale

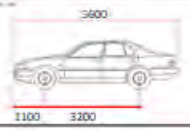
Drawing Description		
Client	Date	Figure Number
Project Number	Project Description	

PARSONS

Note: The location of utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned. The contractor shall provide the location of utilities and shall be responsible for adequate protection from damage.

N

Legend



P-Car

	mm
Width	2000
Track	2000
Lock to Lock Time	6.0
Steering Angle	35.9

Not to Scale

Drawing Description	P-Car and MSU Turning Movements	
Client Brigil	Date Sept 5, 2024	Figure Number 2
Project Number 478250	Project Description	

Appendix G:

MMLOS: Road Segments

Multi-Modal Level of Service - Segments Form

Consultant	**Parsons**	**Project**	**478250**
Scenario	**1299 Richmond**	**Date**	**1-Jun-23**
Comments			

SEGMENTS		**Street A**	Richmond North	Richmond South	Assaly East	Assaly West	Assaly Future	Section 6	Section 7	Section 8	Section 9
Pedestrian	Sidewalk Width Boulevard Width	**-**	≥ 2 m < 0.5	≥ 2 m > 2 m	1.5 m < 0.5 m	≥ 2 m < 0.5	≥ 2 m < 0.5				
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000	≤ 3000	≤ 3000	≤ 3000				
	Operating Speed On-Street Parking		> 50 to 60 km/h no	> 50 to 60 km/h no	> 50 to 60 km/h no	> 50 to 60 km/h no	> 50 to 60 km/h no				
	Exposure to Traffic PLoS		**E**	**C**	**F**	**C**	**C**	**-**	**-**	**-**	**-**
	Effective Sidewalk Width										
	Pedestrian Volume										
	Crowding PLoS		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Level of Service		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Bicycle	Type of Cycling Facility	**D**	Curbside Bike Lane	Physically Separated	Mixed Traffic	Mixed Traffic	Mixed Traffic		Curbside Bike Lane		
	Number of Travel Lanes		≤ 1 each direction		≤ 2 (no centreline)	≤ 2 (no centreline)	≤ 2 (no centreline)		≤ 1 each direction		
	Operating Speed		>50 to 70 km/h		≥ 50 to 60 km/h	≥ 50 to 60 km/h	≥ 50 to 60 km/h		≤ 50 km/h		
	# of Lanes & Operating Speed LoS		**C**	**-**	**D**	**D**	**D**	**-**	**A**	**-**	**-**
	Bike Lane (+ Parking Lane) Width		≥1.5 to <1.8 m								
	Bike Lane Width LoS		**B**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Bike Lane Blockages		Rare								
	Blockage LoS		**A**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge		< 1.8 m refuge	< 1.8 m refuge	< 1.8 m refuge				
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes		≤ 3 lanes	≤ 3 lanes	≤ 3 lanes				
	Sidestreet Operating Speed		>40 to 50 km/h		>40 to 50 km/h	>40 to 50 km/h	>40 to 50 km/h				
	Unsignalized Crossing - Lowest LoS		**B**	**A**	**B**	**B**	**B**	**-**	**-**	**-**	**-**
	Level of Service		**C**	**A**	**D**	**D**	**D**	**-**	**-**	**-**	**-**
Transit	Facility Type	**D**	Mixed Traffic	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	**B**	> 3.7 m	> 3.7 m							
	Travel Lanes per Direction		1	1							
	Level of Service		**B**	**B**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix H:

TDM Checklists

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	☑ no parking between front door and street
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☑ buildings near sidewalk
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☑ modern design building
	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)*	☑ sidewalks connect to existing infrastructure. Paved facilities from front door to Lincoln Fields Station
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)*	☑ sidewalks connect building entrance to existing facilities connecting to transit

		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)*	☑ sidewalks built to city standards.
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)*	☑ sidewalks built to city standards.
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)*	☑ sidewalks connect building entrance to existing facilities connecting to transit
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☑ refer to comment above
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☑ existing street lighting and bus shelter
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	☑ Starflower posted <30km/h, Richmond has separated faciltiies
	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	☑ refer to landscape plan
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)	☑ signage will be added

		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)*	☑ mostly located indoors in sheltered secure area
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)*	☑ exceeds minimum
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)*	☑ meets bylaw
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	☑ almost 1:1 ratio units to bike parking
	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)*	☑ meets bylaw
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☐ Very close, site proposes 583 bike parking for 588 units
	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)	☑ Client plans to add a bike repair station
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐ shelter and lighting already exist on Richmond Road
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	☐
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	☑ layby north side of building
	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)*	☑ 3 carshare spaces proposed.
	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	☑ meets bylaw
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	☑ visitor and resident parking separated
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)*	☑ shared parking provisions proposed
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)*	☐
	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)	☑ visitor and resident parking separated

TDM-Supportive Development Design and Infrastructure Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

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: *Non-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: *Non-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)*	☑
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	☑
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	☑ Starflower posted <30km/h. Richmond has separated cycling facilities
	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)	☑

		TDM-supportive design & infrastructure measures: *Non-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)*	☑
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 commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	☐
BETTER	2.1.5	Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single office 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 the expected number of commuter cyclists (assuming the cycling mode share target is met)	☑
	2.3	**Shower & change facilities**	
BASIC	2.3.1	Provide shower and change facilities for the use of active commuters	☐
BETTER	2.3.2	In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	☐
	2.4	**Bicycle repair station**	
BETTER	2.4.1	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)	☑

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☑
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	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐
	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	☑
	4.2	**Carpool parking**	
BASIC	4.2.1	Provide signed parking spaces for carpools in a priority location close to a major building entrance, sufficient in number to accommodate the mode share target for carpools	☐
BETTER	4.2.2	At large developments, provide spaces for carpools in a separate, access-controlled parking area to simplify enforcement	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide carshare parking spaces in permitted non-residential zones, occupying either required or provided parking spaces *(see Zoning By-law Section 94)*	☑
	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	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	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)*	☑
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)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	☐
	7.	**OTHER**	
	7.1	**On-site amenities to minimize off-site trips**	
BETTER	7.1.1	Provide on-site amenities to minimize mid-day or mid-commute errands	☐

TDM Measures Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☑
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances	☑
	2.2	**Bicycle skills training**	
		Commuter travel	
BETTER ★	2.2.1	Offer on-site cycling courses for commuters, or subsidize off-site courses	☑
	2.3	**Valet bike parking**	
		Visitor travel	
BETTER	2.3.1	Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances	☑
BASIC		3.1.2	Provide online links to OC Transpo and STO information	☑
BETTER		3.1.3	Provide real-time arrival information display at entrances	☐
		3.2	**Transit fare incentives**	
			Commuter travel	
BETTER		3.2.1	Offer preloaded PRESTO cards to encourage commuters to use transit	☑
BETTER	★	3.2.2	Subsidize or reimburse monthly transit pass purchases by employees	☐
			Visitor travel	
BETTER		3.2.3	Arrange inclusion of same-day transit fare in price of tickets (e.g. for festivals, concerts, games)	☐
		3.3	**Enhanced public transit service**	
			Commuter travel	
BETTER		3.3.1	Contract with OC Transpo to provide enhanced transit services (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.3.2	Contract with OC Transpo to provide enhanced transit services (e.g. for festivals, concerts, games)	☐
		3.4	**Private transit service**	
			Commuter travel	
BETTER		3.4.1	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.4.2	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for festivals, concerts, games)	☐

			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		4.	**RIDESHARING**	
		4.1	**Ridematching service**	
			Commuter travel	
BASIC	★	4.1.1	Provide a dedicated ridematching portal at OttawaRideMatch.com	☐
		4.2	**Carpool parking price incentives**	
			Commuter travel	
BETTER		4.2.1	Provide discounts on parking costs for registered carpools	☐
		4.3	**Vanpool service**	
			Commuter travel	
BETTER		4.3.1	Provide a vanpooling service for long-distance commuters	☐
		5.	**CARSHARING & BIKESHARING**	
		5.1	**Bikeshare stations & memberships**	
BETTER		5.1.1	Contract with provider to install on-site bikeshare station for use by commuters and visitors	☐
			Commuter travel	
BETTER		5.1.2	Provide employees with bikeshare memberships for local business travel	☐
		5.2	**Carshare vehicles & memberships**	
			Commuter travel	
BETTER		5.2.1	Contract with provider to install on-site carshare vehicles and promote their use by tenants	☑
BETTER		5.2.2	Provide employees with carshare memberships for local business travel	☐
		6.	**PARKING**	
		6.1	**Priced parking**	
			Commuter travel	
BASIC	★	6.1.1	Charge for long-term parking (daily, weekly, monthly)	☐
BASIC		6.1.2	Unbundle parking cost from lease rates at multi-tenant sites	☑
			Visitor travel	
BETTER		6.1.3	Charge for short-term parking (hourly)	☐

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		7. TDM MARKETING & COMMUNICATIONS	
		7.1 Multimodal travel information	
		Commuter travel	
BASIC	★	7.1.1 Provide a multimodal travel option information package to new/relocating employees and students	☑
		Visitor travel	
BETTER	★	7.1.2 Include multimodal travel option information in invitations or advertising that attract visitors or customers (e.g. for festivals, concerts, games)	☐
		7.2 Personalized trip planning	
		Commuter travel	
BETTER	★	7.2.1 Offer personalized trip planning to new/relocating employees	☑
		7.3 Promotions	
		Commuter travel	
BETTER		7.3.1 Deliver promotions and incentives to maintain awareness, build understanding, and encourage trial of sustainable modes	☐
		8. OTHER INCENTIVES & AMENITIES	
		8.1 Emergency ride home	
		Commuter travel	
BETTER	★	8.1.1 Provide emergency ride home service to non-driving commuters	☐
		8.2 Alternative work arrangements	
		Commuter travel	
BASIC	★	8.2.1 Encourage flexible work hours	☐
BETTER		8.2.2 Encourage compressed workweeks	☐
BETTER	★	8.2.3 Encourage telework	☐
		8.3 Local business travel options	
		Commuter travel	
BASIC	★	8.3.1 Provide local business travel options that minimize the need for employees to bring a personal car to work	☐
		8.4 Commuter incentives	
		Commuter travel	
BETTER		8.4.1 Offer employees a taxable, mode-neutral commuting allowance	☐
		8.5 On-site amenities	
		Commuter travel	
BETTER		8.5.1 Provide on-site amenities/services to minimize mid-day or mid-commute errands	☐

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

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

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

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

TDM measures: *Residential developments*				Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☑
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☑

Appendix I:

Above Zoning Peak Person Trip Calculations

Time	Number of Units	Type of Unit	District
Peak Hour	498	High-Rise	Bayshore/Cedarview

	AM peak			PM peak			AM peak	PM peak
	In	Out	Total	In	Out	Total	Mode Share	Mode Share
Auto Driver	24	52	76	46	33	79	40%	40%
Auto Passenger	7	16	24	17	12	29	12%	15%
Transit	26	58	84	40	29	68	38%	33%
Cycling	1	2	4	1	1	2	2%	1%
Pedestrian	6	13	19	15	11	27	8%	11%
Total	64	142	206	119	86	206	100%	100%

Appendix J:

MMLOS: Intersections

Multi-Modal Level of Service - Intersections Form

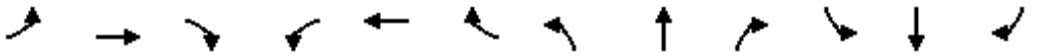
Consultant	**Parsons**	**Project**	**478250**
Scenario	**1299 Richmond**	**Date**	**1-Jun-23**
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Assaly/Richmond				Croydon/Richmond				Intersection C			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	4	6	5	5	3	6	4	6				
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	Median > 2.4 m	No Median - 2.4 m				
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive				
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control				
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR prohibited	RTOR allowed	RTOR allowed	RTOR allowed	RTOR prohibited	RTOR allowed	RTOR allowed				
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No				
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel				
	Corner Radius	5-10m	15-25m	5-10m	10-15m	5-10m	10-15m	5-10m	10-15m				
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings				
	PETSI Score	**54**	**21**	**38**	**37**	**71**	**23**	**56**	**20**				
	Ped. Exposure to Traffic LoS	**D**	**F**	**E**	**E**	**C**	**F**	**D**	**F**	**-**	**-**	**-**	**-**
	Cycle Length												
	Effective Walk Time												
	Average Pedestrian Delay												
	Pedestrian Delay LoS	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
	Level of Service	**D**	**F**	**E**	**E**	**C**	**F**	**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	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP				
	Right Turn Lane Configuration	≤ 50 m	≤ 50 m	Not Applicable	Not Applicable	≤ 50 m	≤ 50 m	Not Applicable	Not Applicable				
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	Not Applicable	Not Applicable	≤ 25 km/h	≤ 25 km/h	Not Applicable	Not Applicable				
	Cyclist relative to RT motorists	**D**	**D**	**Not Applicable**	**Not Applicable**	**D**	**D**	**Not Applicable**	**Not Applicable**	**-**	**-**	**-**	**-**
	Separated or Mixed Traffic	**Mixed Traffic**	**Mixed Traffic**	**Separated**	**Separated**	**Mixed Traffic**	**Mixed Traffic**	**Separated**	**Separated**	**-**	**-**	**-**	**-**
	Left Turn Approach	No lane crossed	No lane crossed	1 lane crossed	2-stage, LT box	No lane crossed	No lane crossed	1 lane crossed	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	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h				
	Left Turning Cyclist	**C**	**C**	**D**	**A**	**C**	**C**	**D**	**A**	**-**	**-**	**-**	**-**
	Level of Service	**D**	**D**	**D**	**A**	**D**	**D**	**D**	**A**	**-**	**-**	**-**	**-**
		D				**D**				**-**			
Transit	Average Signal Delay			0 sec	0 sec			≤ 10 sec	0 sec				
	Level of Service	**-**	**-**	**A**	**A**	**-**	**-**	**B**	**A**	**-**	**-**	**-**	**-**
		A				**B**				**-**			
Truck	Effective Corner Radius	< 10 m	> 15 m	< 10 m	10 - 15 m	< 10 m	10 - 15 m	< 10 m	10 - 15 m				
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1	1				
	Level of Service	**F**	**C**	**F**	**E**	**F**	**E**	**F**	**E**	**-**	**-**	**-**	**-**
		F				**F**				**-**			
Auto	Volume to Capacity Ratio												
	Level of Service	**-**				**-**				**-**			

Appendix K:

Synchro Analysis: Existing Intersection Performance



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	558	15	25	344	18	25	6	33	67	2	25
Future Volume (vph)	7	558	15	25	344	18	25	6	33	67	2	25
Satd. Flow (prot)	1695	1775	0	1695	1769	0	0	1717	1517	0	1644	0
Flt Permitted	0.518			0.359				0.760			0.767	
Satd. Flow (perm)	917	1775	0	637	1769	0	0	1338	1446	0	1282	0
Satd. Flow (RTOR)		3			5						28	
Lane Group Flow (vph)	8	637	0	28	402	0	0	35	37	0	104	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	37.0	37.0		37.0	37.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	52.9%	52.9%		52.9%	52.9%		47.1%	47.1%	47.1%	47.1%	47.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	48.3	48.3		48.3	48.3			13.6	13.6		13.6	
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.19	0.19		0.19	
v/c Ratio	0.01	0.52		0.06	0.33			0.13	0.13		0.38	
Control Delay	3.7	7.3		8.4	8.4			21.6	21.5		20.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	3.7	7.3		8.4	8.4			21.6	21.5		20.9	
LOS	A	A		A	A			C	C		C	
Approach Delay		7.3			8.4			21.6			20.9	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.2	15.6		1.0	18.0			4.1	4.3		9.2	
Queue Length 95th (m)	m0.5	#121.0		6.5	59.4			8.1	8.3		15.9	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	632	1225		439	1221			510	551		506	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.52		0.06	0.33			0.07	0.07		0.21	

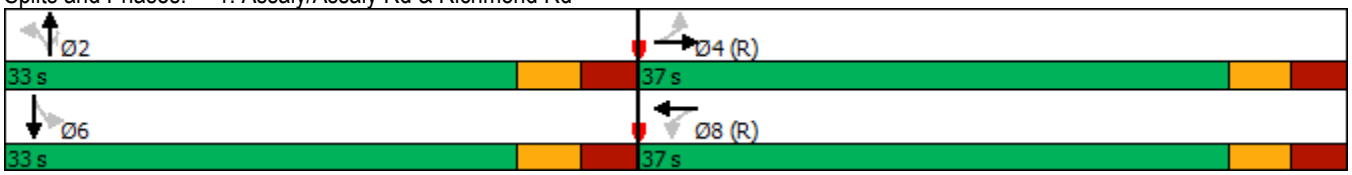
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 64 (91%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

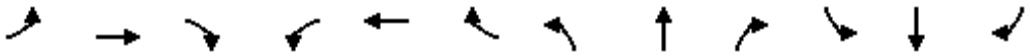
Maximum v/c Ratio: 0.52

Intersection Signal Delay: 9.6	Intersection LOS: A
Intersection Capacity Utilization 76.9%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	512	57	15	343	15	34	26	73	25	65	34
Future Volume (vph)	20	512	57	15	343	15	34	26	73	25	65	34
Satd. Flow (prot)	1695	1751	0	1695	1771	0	1695	1553	0	0	1687	0
Flt Permitted	0.524			0.366			0.697				0.901	
Satd. Flow (perm)	931	1751	0	650	1771	0	1232	1553	0	0	1532	0
Satd. Flow (RTOR)		11			4						30	
Lane Group Flow (vph)	22	632	0	17	398	0	38	110	0	0	138	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	39.0	39.0		39.0	39.0		31.0	31.0		31.0	31.0	
Total Split (%)	55.7%	55.7%		55.7%	55.7%		44.3%	44.3%		44.3%	44.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	48.8	48.8		48.8	48.8		12.4	12.4			12.3	
Actuated g/C Ratio	0.70	0.70		0.70	0.70		0.18	0.18			0.18	
v/c Ratio	0.03	0.52		0.04	0.32		0.17	0.40			0.47	
Control Delay	7.5	10.7		11.2	12.4		22.9	27.6			23.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.5	10.7		11.2	12.4		22.9	27.6			23.4	
LOS	A	B		B	B		C	C			C	
Approach Delay		10.6			12.3			26.4			23.4	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	0.8	34.4		1.0	27.8		4.4	13.5			13.2	
Queue Length 95th (m)	4.9	#108.7		m6.0	75.4		9.0	20.2			21.1	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	649	1224		453	1235		438	552			564	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.03	0.52		0.04	0.32		0.09	0.20			0.24	

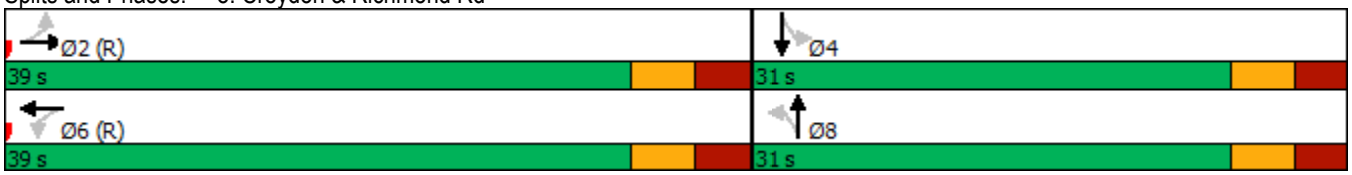
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 40 (57%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.52

Intersection Signal Delay: 14.2	Intersection LOS: B
Intersection Capacity Utilization 58.3%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd



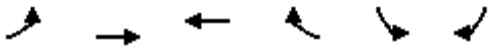
Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	6	0	1	1	19	0	0	76	0
Future Vol, veh/h	0	0	0	6	0	1	1	19	0	0	76	0
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	7	0	1	1	21	0	0	84	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	107	122	21	99	0	-	-	-	0
Stage 1	23	23	-	-	-	-	-	-	-
Stage 2	84	99	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	891	768	1056	1494	-	0	0	-	-
Stage 1	1000	876	-	-	-	0	0	-	-
Stage 2	939	813	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	890	0	1056	1494	-	-	-	-	-
Mov Cap-2 Maneuver	890	0	-	-	-	-	-	-	-
Stage 1	999	0	-	-	-	-	-	-	-
Stage 2	939	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0.4	0
HCM LOS	A		

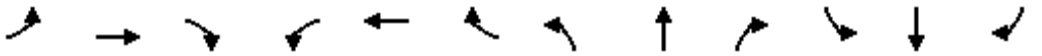
Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1494	-	910	-	-
HCM Lane V/C Ratio	0.001	-	0.009	-	-
HCM Control Delay (s)	7.4	0	9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	651	387	2	0	0
Future Volume (Veh/h)	5	651	387	2	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	723	430	2	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.80	
vC, conflicting volume	447				1181	446
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	447				1102	446
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	1113				187	612

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	6	723	432
Volume Left	6	0	0
Volume Right	0	0	2
cSH	1113	1700	1700
Volume to Capacity	0.01	0.43	0.25
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	8.3	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.1		0.0
Approach LOS			

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		39.5%	ICU Level of Service
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	426	24	54	758	48	21	13	45	39	2	30
Future Volume (vph)	16	426	24	54	758	48	21	13	45	39	2	30
Satd. Flow (prot)	1695	1763	0	1695	1760	0	0	1731	1517	0	1608	0
Flt Permitted	0.238			0.457				0.806			0.808	
Satd. Flow (perm)	425	1763	0	798	1760	0	0	1420	1445	0	1317	0
Satd. Flow (RTOR)		5			6						33	
Lane Group Flow (vph)	18	500	0	60	895	0	0	37	50	0	78	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	52.0	52.0		52.0	52.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	61.2%	61.2%		61.2%	61.2%		38.8%	38.8%	38.8%	38.8%	38.8%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	63.6	63.6		63.6	63.6			13.3	13.3		13.3	
Actuated g/C Ratio	0.75	0.75		0.75	0.75			0.16	0.16		0.16	
v/c Ratio	0.06	0.38		0.10	0.68			0.17	0.22		0.33	
Control Delay	2.6	2.9		6.7	13.3			30.1	31.3		22.5	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	2.6	2.9		6.7	13.3			30.1	31.3		22.5	
LOS	A	A		A	B			C	C		C	
Approach Delay		2.9			12.9			30.8			22.5	
Approach LOS		A			B			C			C	
Queue Length 50th (m)	0.3	9.4		2.3	63.5			5.6	7.6		6.8	
Queue Length 95th (m)	m0.8	13.2		10.8	#212.7			10.9	13.6		15.0	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	318	1320		596	1318			446	453		436	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.06	0.38		0.10	0.68			0.08	0.11		0.18	

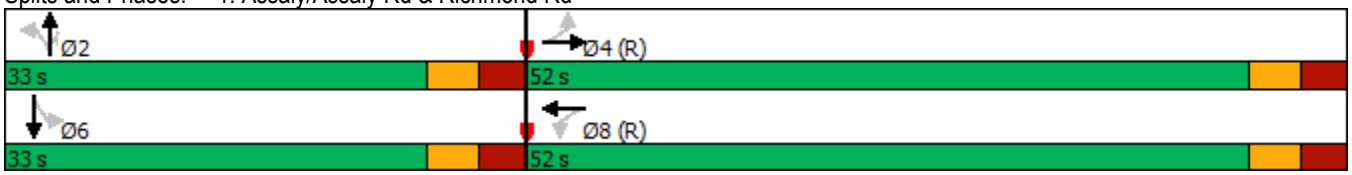
Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 64 (75%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

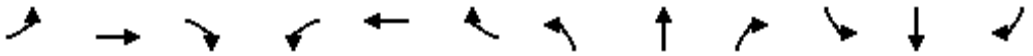
Maximum v/c Ratio: 0.68

Intersection Signal Delay: 11.1	Intersection LOS: B
Intersection Capacity Utilization 73.5%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	419	82	54	744	16	118	89	33	13	56	18
Future Volume (vph)	23	419	82	54	744	16	118	89	33	13	56	18
Satd. Flow (prot)	1695	1725	0	1695	1777	0	1695	1686	0	0	1704	0
Flt Permitted	0.242			0.410			0.760				0.940	
Satd. Flow (perm)	432	1725	0	723	1777	0	1318	1686	0	0	1606	0
Satd. Flow (RTOR)		19			2						16	
Lane Group Flow (vph)	26	557	0	60	845	0	131	136	0	0	96	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		6			2			8			4	
Permitted Phases	6			2			8			4		
Detector Phase	6	6		2	2		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	54.0	54.0		54.0	54.0		31.0	31.0		31.0	31.0	
Total Split (%)	63.5%	63.5%		63.5%	63.5%		36.5%	36.5%		36.5%	36.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	57.8	57.8		57.8	57.8		14.7	14.7			14.7	
Actuated g/C Ratio	0.68	0.68		0.68	0.68		0.17	0.17			0.17	
v/c Ratio	0.09	0.47		0.12	0.70		0.57	0.47			0.33	
Control Delay	7.7	9.1		12.4	18.8		40.7	35.1			26.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.7	9.1		12.4	18.8		40.7	35.1			26.5	
LOS	A	A		B	B		D	D			C	
Approach Delay		9.0			18.3			37.8			26.5	
Approach LOS		A			B			D			C	
Queue Length 50th (m)	1.2	33.6		3.3	79.3		20.1	20.4			11.6	
Queue Length 95th (m)	5.8	81.2		m13.5	#190.7		31.7	31.2			21.0	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	293	1178		491	1208		386	493			481	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.09	0.47		0.12	0.70		0.34	0.28			0.20	

Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 40 (47%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 18.6	Intersection LOS: B
Intersection Capacity Utilization 76.4%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd

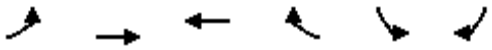
Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	23	0	13	2	74	0	0	53	1
Future Vol, veh/h	0	0	0	23	0	13	2	74	0	0	53	1
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	26	0	14	2	82	0	0	59	1

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	146	161	82	75	0	-	-	-	0
Stage 1	86	86	-	-	-	-	-	-	-
Stage 2	60	75	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	846	731	978	1524	-	0	0	-	-
Stage 1	937	824	-	-	-	0	0	-	-
Stage 2	963	833	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	845	0	978	1524	-	-	-	-	-
Mov Cap-2 Maneuver	845	0	-	-	-	-	-	-	-
Stage 1	936	0	-	-	-	-	-	-	-
Stage 2	963	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1524	-	889	-	-
HCM Lane V/C Ratio	0.001	-	0.045	-	-
HCM Control Delay (s)	7.4	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-



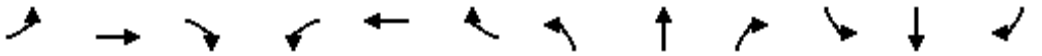
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	515	860	1	0	0
Future Volume (Veh/h)	5	515	860	1	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	572	956	1	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.89	
vC, conflicting volume	972				1556	972
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	972				1562	972
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	709				109	307

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	6	572	957
Volume Left	6	0	0
Volume Right	0	0	1
cSH	709	1700	1700
Volume to Capacity	0.01	0.34	0.56
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	10.1	0.0	0.0
Lane LOS	B		
Approach Delay (s)	0.1		0.0
Approach LOS			

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		51.2%	ICU Level of Service
Analysis Period (min)		15	

Appendix L:

Synchro Analysis: Background Intersection Performance



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	595	15	25	377	23	25	6	33	79	2	54
Future Volume (vph)	20	595	15	25	377	23	25	6	33	79	2	54
Satd. Flow (prot)	1695	1775	0	1695	1765	0	0	1715	1517	0	1614	0
Flt Permitted	0.519			0.375				0.753			0.802	
Satd. Flow (perm)	919	1775	0	665	1765	0	0	1326	1446	0	1313	0
Satd. Flow (RTOR)		2			6						54	
Lane Group Flow (vph)	20	610	0	25	400	0	0	31	33	0	135	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	37.0	37.0		37.0	37.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	52.9%	52.9%		52.9%	52.9%		47.1%	47.1%	47.1%	47.1%	47.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	48.2	48.2		48.2	48.2			13.8	13.8		13.8	
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.20	0.20		0.20	
v/c Ratio	0.03	0.50		0.05	0.33			0.12	0.12		0.45	
Control Delay	3.7	6.8		8.4	8.5			21.2	21.1		18.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	3.7	6.8		8.4	8.5			21.2	21.1		18.8	
LOS	A	A		A	A			C	C		B	
Approach Delay		6.7			8.5			21.1			18.8	
Approach LOS		A			A			C			B	
Queue Length 50th (m)	0.5	14.5		0.9	17.8			3.6	3.9		9.8	
Queue Length 95th (m)	m1.1	#63.7		6.0	58.7			7.3	7.7		17.6	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	632	1221		457	1216			505	551		534	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.03	0.50		0.05	0.33			0.06	0.06		0.25	

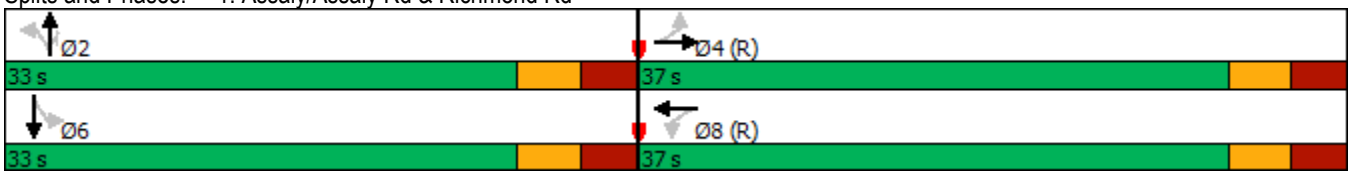
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 64 (91%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

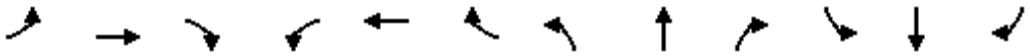
Maximum v/c Ratio: 0.50

Intersection Signal Delay: 9.4	Intersection LOS: A
Intersection Capacity Utilization 79.2%	ICU Level of Service D
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	555	57	15	394	15	34	26	78	25	65	34
Future Volume (vph)	20	555	57	15	394	15	34	26	78	25	65	34
Satd. Flow (prot)	1695	1754	0	1695	1772	0	1695	1548	0	0	1687	0
Flt Permitted	0.516			0.380			0.738				0.905	
Satd. Flow (perm)	917	1754	0	675	1772	0	1304	1548	0	0	1539	0
Satd. Flow (RTOR)		10			4						30	
Lane Group Flow (vph)	20	612	0	15	409	0	34	104	0	0	124	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	39.0	39.0		39.0	39.0		31.0	31.0		31.0	31.0	
Total Split (%)	55.7%	55.7%		55.7%	55.7%		44.3%	44.3%		44.3%	44.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	49.0	49.0		49.0	49.0		12.2	12.2			12.1	
Actuated g/C Ratio	0.70	0.70		0.70	0.70		0.17	0.17			0.17	
v/c Ratio	0.03	0.50		0.03	0.33		0.15	0.39			0.43	
Control Delay	7.5	10.1		10.7	12.0		22.6	27.5			22.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.5	10.1		10.7	12.0		22.6	27.5			22.2	
LOS	A	B		B	B		C	C			C	
Approach Delay		10.0			12.0			26.3			22.2	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	0.7	32.0		0.8	27.4		4.0	12.7			11.4	
Queue Length 95th (m)	4.7	99.3		m5.2	74.1		8.3	19.2			19.0	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	642	1231		472	1242		463	550			566	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.03	0.50		0.03	0.33		0.07	0.19			0.22	

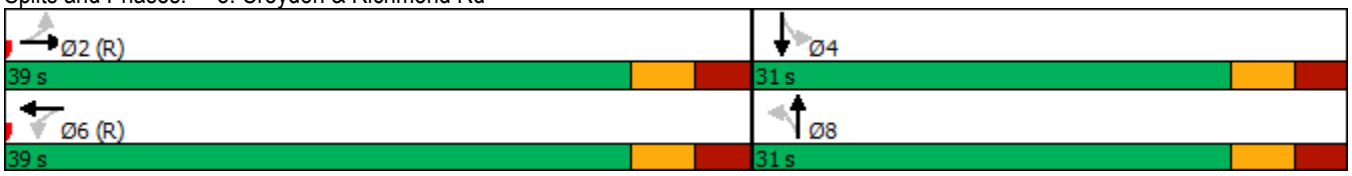
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 40 (57%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 13.5	Intersection LOS: B
Intersection Capacity Utilization 60.7%	ICU Level of Service B
Analysis Period (min) 15	

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd



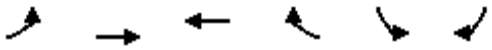
Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	6	0	1	1	37	0	0	117	0
Future Vol, veh/h	0	0	0	6	0	1	1	37	0	0	117	0
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	6	0	1	1	37	0	0	117	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	156	171	37	132	0	-	-	-	0
Stage 1	39	39	-	-	-	-	-	-	-
Stage 2	117	132	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	835	722	1035	1453	-	0	0	-	-
Stage 1	983	862	-	-	-	0	0	-	-
Stage 2	908	787	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	834	0	1035	1453	-	-	-	-	-
Mov Cap-2 Maneuver	834	0	-	-	-	-	-	-	-
Stage 1	982	0	-	-	-	-	-	-	-
Stage 2	908	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.2	0.2	0
HCM LOS	A		

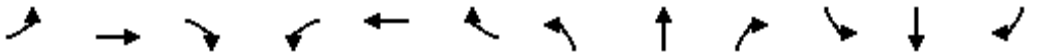
Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1453	-	858	-	-
HCM Lane V/C Ratio	0.001	-	0.008	-	-
HCM Control Delay (s)	7.5	0	9.2	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	703	427	2	0	0
Future Volume (Veh/h)	5	703	427	2	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	703	427	2	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.81	
vC, conflicting volume	444				1156	443
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	444				1077	443
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1116				196	615

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	5	703	429
Volume Left	5	0	0
Volume Right	0	0	2
cSH	1116	1700	1700
Volume to Capacity	0.00	0.41	0.25
Queue Length 95th (m)	0.1	0.0	0.0
Control Delay (s)	8.2	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.1		0.0
Approach LOS			

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		42.4%	ICU Level of Service
Analysis Period (min)		15	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	460	24	54	806	59	21	13	45	47	2	48
Future Volume (vph)	41	460	24	54	806	59	21	13	45	47	2	48
Satd. Flow (prot)	1695	1765	0	1695	1757	0	0	1731	1517	0	1590	0
Flt Permitted	0.252			0.467				0.813			0.829	
Satd. Flow (perm)	450	1765	0	815	1757	0	0	1433	1445	0	1335	0
Satd. Flow (RTOR)		5			7						48	
Lane Group Flow (vph)	41	484	0	54	865	0	0	34	45	0	97	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	52.0	52.0		52.0	52.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	61.2%	61.2%		61.2%	61.2%		38.8%	38.8%	38.8%	38.8%	38.8%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	63.5	63.5		63.5	63.5			13.5	13.5		13.5	
Actuated g/C Ratio	0.75	0.75		0.75	0.75			0.16	0.16		0.16	
v/c Ratio	0.12	0.37		0.09	0.66			0.15	0.20		0.39	
Control Delay	3.1	3.0		6.6	12.8			29.5	30.6		20.9	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	3.1	3.0		6.6	12.8			29.5	30.6		20.9	
LOS	A	A		A	B			C	C		C	
Approach Delay		3.0			12.4			30.1			20.9	
Approach LOS		A			B			C			C	
Queue Length 50th (m)	0.8	9.6		2.0	59.3			5.1	6.8		7.4	
Queue Length 95th (m)	m1.9	13.5		9.9	#201.6			10.1	12.5		16.5	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	336	1319		608	1313			450	453		452	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.12	0.37		0.09	0.66			0.08	0.10		0.21	

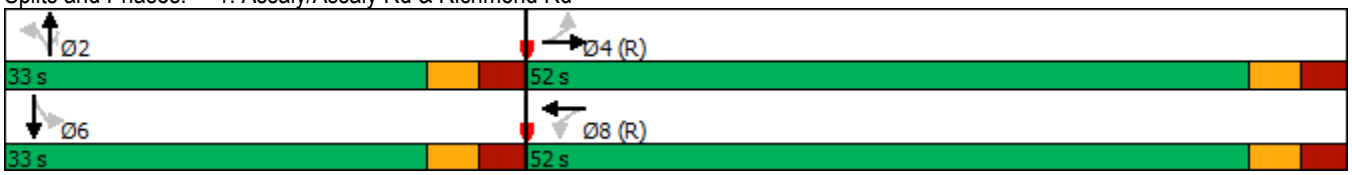
Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 64 (75%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

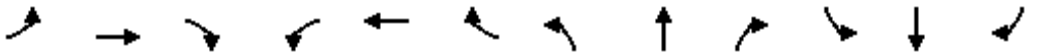
Maximum v/c Ratio: 0.66

Intersection Signal Delay: 10.7	Intersection LOS: B
Intersection Capacity Utilization 76.0%	ICU Level of Service D
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	469	82	54	803	16	118	89	42	13	56	18
Future Volume (vph)	23	469	82	54	803	16	118	89	42	13	56	18
Satd. Flow (prot)	1695	1731	0	1695	1777	0	1695	1670	0	0	1704	0
Flt Permitted	0.257			0.414			0.788				0.940	
Satd. Flow (perm)	459	1731	0	730	1777	0	1366	1670	0	0	1606	0
Satd. Flow (RTOR)		17			2						16	
Lane Group Flow (vph)	23	551	0	54	819	0	118	131	0	0	87	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		6			2			8			4	
Permitted Phases	6			2			8			4		
Detector Phase	6	6		2	2		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	54.0	54.0		54.0	54.0		31.0	31.0		31.0	31.0	
Total Split (%)	63.5%	63.5%		63.5%	63.5%		36.5%	36.5%		36.5%	36.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	57.9	57.9		57.9	57.9		14.6	14.6			14.6	
Actuated g/C Ratio	0.68	0.68		0.68	0.68		0.17	0.17			0.17	
v/c Ratio	0.07	0.46		0.11	0.68		0.51	0.46			0.30	
Control Delay	7.5	9.0		12.0	17.9		37.7	35.1			25.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.5	9.0		12.0	17.9		37.7	35.1			25.9	
LOS	A	A		B	B		D	D			C	
Approach Delay		8.9			17.5			36.3			25.9	
Approach LOS		A			B			D			C	
Queue Length 50th (m)	1.0	32.7		2.8	70.0		17.9	19.7			10.3	
Queue Length 95th (m)	5.2	79.8		m12.3	#181.7		28.5	30.4			19.2	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	313	1185		497	1212		400	489			481	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.07	0.46		0.11	0.68		0.29	0.27			0.18	

Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 40 (47%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 17.8	Intersection LOS: B
Intersection Capacity Utilization 76.4%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd

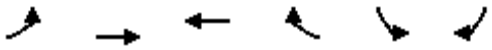
Intersection	
Int Delay, s/veh	1.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	23	0	13	2	110	0	0	79	1
Future Vol, veh/h	0	0	0	23	0	13	2	110	0	0	79	1
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	23	0	13	2	110	0	0	79	1

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	194	209	110	95	0	-	-	-	0
Stage 1	114	114	-	-	-	-	-	-	-
Stage 2	80	95	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	795	688	943	1499	-	0	0	-	-
Stage 1	911	801	-	-	-	0	0	-	-
Stage 2	943	816	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	794	0	943	1499	-	-	-	-	-
Mov Cap-2 Maneuver	794	0	-	-	-	-	-	-	-
Stage 1	910	0	-	-	-	-	-	-	-
Stage 2	943	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1499	-	842	-	-
HCM Lane V/C Ratio	0.001	-	0.043	-	-
HCM Control Delay (s)	7.4	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-



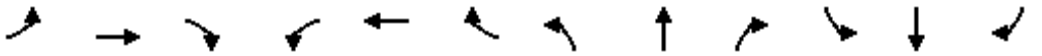
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	560	922	1	0	0
Future Volume (Veh/h)	5	560	922	1	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	5	560	922	1	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.90	
vC, conflicting volume	938				1508	938
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	938				1508	938
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	730				118	321

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	5	560	923
Volume Left	5	0	0
Volume Right	0	0	1
cSH	730	1700	1700
Volume to Capacity	0.01	0.33	0.54
Queue Length 95th (m)	0.2	0.0	0.0
Control Delay (s)	10.0	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.1		0.0
Approach LOS			

Intersection Summary			
Average Delay		0.0	
Intersection Capacity Utilization		54.6%	ICU Level of Service A
Analysis Period (min)		15	

Appendix M:

Synchro Analysis: Future Projected Intersection Performance



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	606	15	25	377	23	25	6	33	96	2	79
Future Volume (vph)	20	606	15	25	377	23	25	6	33	96	2	79
Satd. Flow (prot)	1695	1775	0	1695	1765	0	0	1715	1517	0	1604	0
Flt Permitted	0.509			0.350				0.757			0.814	
Satd. Flow (perm)	901	1775	0	620	1765	0	0	1335	1446	0	1323	0
Satd. Flow (RTOR)		2			6						67	
Lane Group Flow (vph)	20	621	0	25	400	0	0	31	33	0	177	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	37.0	37.0		37.0	37.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	52.9%	52.9%		52.9%	52.9%		47.1%	47.1%	47.1%	47.1%	47.1%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	42.9	42.9		42.9	42.9			14.5	14.5		14.5	
Actuated g/C Ratio	0.61	0.61		0.61	0.61			0.21	0.21		0.21	
v/c Ratio	0.04	0.57		0.07	0.37			0.11	0.11		0.54	
Control Delay	3.9	9.0		8.9	9.5			20.3	20.2		20.4	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	3.9	9.0		8.9	9.5			20.3	20.2		20.4	
LOS	A	A		A	A			C	C		C	
Approach Delay		8.9			9.5			20.3			20.4	
Approach LOS		A			A			C			C	
Queue Length 50th (m)	0.5	15.0		1.0	19.4			3.5	3.8		13.4	
Queue Length 95th (m)	m1.1	#116.3		6.1	58.7			7.3	7.7		22.8	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	553	1089		380	1085			509	551		546	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.04	0.57		0.07	0.37			0.06	0.06		0.32	

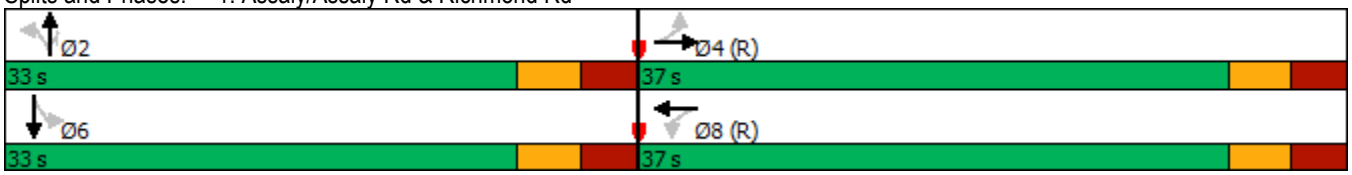
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 64 (91%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

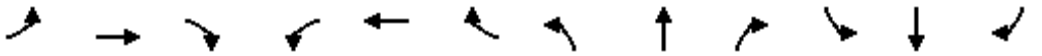
Maximum v/c Ratio: 0.57

Intersection Signal Delay: 11.2	Intersection LOS: B
Intersection Capacity Utilization 81.5%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	564	57	21	413	15	34	26	81	25	65	34
Future Volume (vph)	20	564	57	21	413	15	34	26	81	25	65	34
Satd. Flow (prot)	1695	1754	0	1695	1774	0	1695	1545	0	0	1687	0
Flt Permitted	0.502			0.374			0.738				0.905	
Satd. Flow (perm)	892	1754	0	664	1774	0	1304	1545	0	0	1539	0
Satd. Flow (RTOR)		10			3						30	
Lane Group Flow (vph)	20	621	0	21	428	0	34	107	0	0	124	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	39.0	39.0		39.0	39.0		31.0	31.0		31.0	31.0	
Total Split (%)	55.7%	55.7%		55.7%	55.7%		44.3%	44.3%		44.3%	44.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	48.9	48.9		48.9	48.9		12.3	12.3			12.2	
Actuated g/C Ratio	0.70	0.70		0.70	0.70		0.18	0.18			0.17	
v/c Ratio	0.03	0.51		0.05	0.35		0.15	0.39			0.42	
Control Delay	7.5	10.4		10.6	12.1		22.4	27.6			22.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.5	10.4		10.6	12.1		22.4	27.6			22.0	
LOS	A	B		B	B		C	C			C	
Approach Delay		10.3			12.0			26.3			22.0	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	0.7	33.3		1.3	33.3		4.0	13.1			11.4	
Queue Length 95th (m)	4.7	#102.2		m6.4	73.9		8.3	19.6			19.0	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	623	1229		464	1240		463	549			566	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.03	0.51		0.05	0.35		0.07	0.19			0.22	

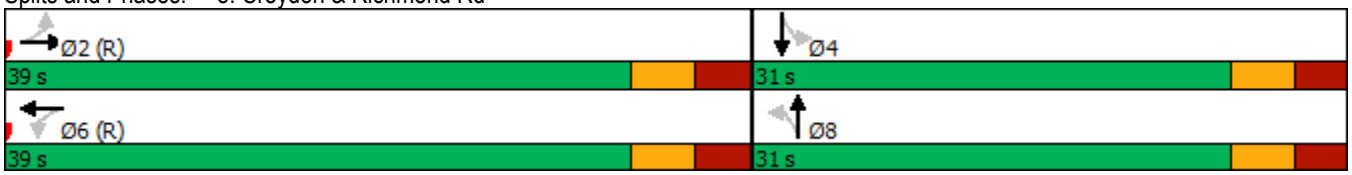
Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Offset: 40 (57%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.51

Intersection Signal Delay: 13.6	Intersection LOS: B
Intersection Capacity Utilization 61.2%	ICU Level of Service B
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd



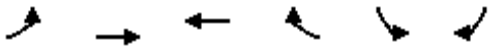
Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	48	0	1	1	37	0	0	117	0
Future Vol, veh/h	0	0	0	48	0	1	1	37	0	0	117	0
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	48	0	1	1	37	0	0	117	0

Major/Minor	Minor1			Major1			Major2		
Conflicting Flow All	156	171	37	132	0	-	-	-	0
Stage 1	39	39	-	-	-	-	-	-	-
Stage 2	117	132	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	835	722	1035	1453	-	0	0	-	-
Stage 1	983	862	-	-	-	0	0	-	-
Stage 2	908	787	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	834	0	1035	1453	-	-	-	-	-
Mov Cap-2 Maneuver	834	0	-	-	-	-	-	-	-
Stage 1	982	0	-	-	-	-	-	-	-
Stage 2	908	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.6	0.2	0
HCM LOS	A		

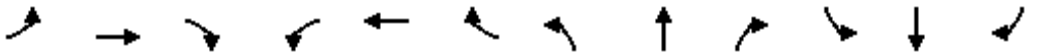
Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1453	-	837	-	-
HCM Lane V/C Ratio	0.001	-	0.059	-	-
HCM Control Delay (s)	7.5	0	9.6	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	720	427	10	0	0
Future Volume (Veh/h)	16	720	427	10	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	16	720	427	10	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.79	
vC, conflicting volume	452				1199	447
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	452				1118	447
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	100
cM capacity (veh/h)	1109				178	612

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	16	720	437
Volume Left	16	0	0
Volume Right	0	0	10
cSH	1109	1700	1700
Volume to Capacity	0.01	0.42	0.26
Queue Length 95th (m)	0.3	0.0	0.0
Control Delay (s)	8.3	0.0	0.0
Lane LOS	A		
Approach Delay (s)	0.2		0.0
Approach LOS			

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	41	481	24	54	806	59	21	13	45	57	2	64
Future Volume (vph)	41	481	24	54	806	59	21	13	45	57	2	64
Satd. Flow (prot)	1695	1766	0	1695	1757	0	0	1731	1517	0	1585	0
Flt Permitted	0.251			0.453				0.780			0.835	
Satd. Flow (perm)	448	1766	0	791	1757	0	0	1376	1445	0	1340	0
Satd. Flow (RTOR)		5			7						64	
Lane Group Flow (vph)	41	505	0	54	865	0	0	34	45	0	123	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2		2	6		
Detector Phase	4	4		8	8		2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	30.3	30.3		30.3	30.3		33.3	33.3	33.3	33.3	33.3	
Total Split (s)	52.0	52.0		52.0	52.0		33.0	33.0	33.0	33.0	33.0	
Total Split (%)	61.2%	61.2%		61.2%	61.2%		38.8%	38.8%	38.8%	38.8%	38.8%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3	3.3	3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Lost Time (s)	6.3	6.3		6.3	6.3			6.3	6.3		6.3	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None	None	None	None	
Act Effct Green (s)	63.3	63.3		63.3	63.3			13.7	13.7		13.7	
Actuated g/C Ratio	0.74	0.74		0.74	0.74			0.16	0.16		0.16	
v/c Ratio	0.12	0.38		0.09	0.66			0.15	0.19		0.46	
Control Delay	3.2	3.2		6.8	12.9			29.4	30.3		21.0	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	3.2	3.2		6.8	12.9			29.4	30.3		21.0	
LOS	A	A		A	B			C	C		C	
Approach Delay		3.2			12.6			29.9			21.0	
Approach LOS		A			B			C			C	
Queue Length 50th (m)	0.9	10.5		2.0	59.3			5.1	6.8		9.0	
Queue Length 95th (m)	m2.0	14.5		10.0	#201.6			10.1	12.5		19.4	
Internal Link Dist (m)		290.9			84.7			127.4			31.1	
Turn Bay Length (m)	210.0			50.0					15.0			
Base Capacity (vph)	333	1315		588	1309			432	453		464	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.12	0.38		0.09	0.66			0.08	0.10		0.27	

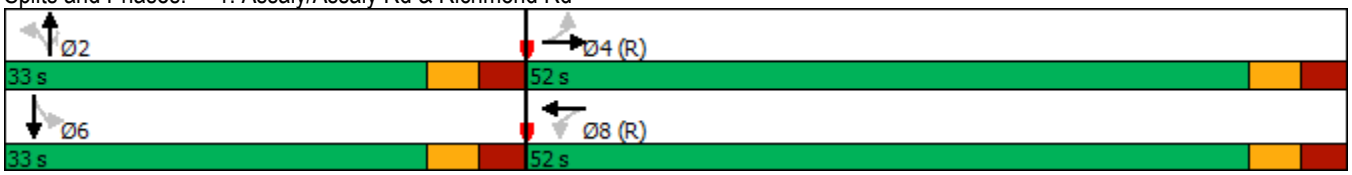
Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 64 (75%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

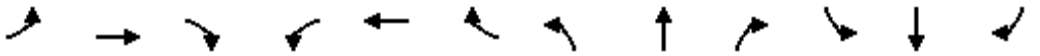
Maximum v/c Ratio: 0.66

Intersection Signal Delay: 10.9	Intersection LOS: B
Intersection Capacity Utilization 77.0%	ICU Level of Service D
Analysis Period (min) 15	

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Assaly/Assaly Rd & Richmond Rd





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	23	485	82	58	815	16	118	89	47	13	56	18
Future Volume (vph)	23	485	82	58	815	16	118	89	47	13	56	18
Satd. Flow (prot)	1695	1732	0	1695	1777	0	1695	1660	0	0	1704	0
Flt Permitted	0.250			0.404			0.788				0.939	
Satd. Flow (perm)	446	1732	0	713	1777	0	1366	1660	0	0	1604	0
Satd. Flow (RTOR)		16			2						16	
Lane Group Flow (vph)	23	567	0	58	831	0	118	136	0	0	87	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		6			2			8			4	
Permitted Phases	6			2			8			4		
Detector Phase	6	6		2	2		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	26.4	26.4		26.4	26.4		31.1	31.1		31.1	31.1	
Total Split (s)	54.0	54.0		54.0	54.0		31.0	31.0		31.0	31.0	
Total Split (%)	63.5%	63.5%		63.5%	63.5%		36.5%	36.5%		36.5%	36.5%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	3.1	3.1		3.1	3.1		2.8	2.8		2.8	2.8	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Lost Time (s)	6.4	6.4		6.4	6.4		6.1	6.1			6.1	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Act Effct Green (s)	57.9	57.9		57.9	57.9		14.6	14.6			14.6	
Actuated g/C Ratio	0.68	0.68		0.68	0.68		0.17	0.17			0.17	
v/c Ratio	0.08	0.48		0.12	0.69		0.50	0.48			0.30	
Control Delay	7.5	9.2		12.1	18.2		37.7	35.7			25.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay	7.5	9.2		12.1	18.2		37.7	35.7			25.9	
LOS	A	A		B	B		D	D			C	
Approach Delay		9.1			17.8			36.6			25.9	
Approach LOS		A			B			D			C	
Queue Length 50th (m)	1.0	34.3		3.0	71.1		17.9	20.5			10.3	
Queue Length 95th (m)	5.2	83.5		m13.2	#186.3		28.5	31.3			19.2	
Internal Link Dist (m)		287.8			290.9			143.4			166.2	
Turn Bay Length (m)	50.0			45.0			50.0					
Base Capacity (vph)	303	1185		485	1211		400	486			481	
Starvation Cap Reductn	0	0		0	0		0	0			0	
Spillback Cap Reductn	0	0		0	0		0	0			0	
Storage Cap Reductn	0	0		0	0		0	0			0	
Reduced v/c Ratio	0.08	0.48		0.12	0.69		0.29	0.28			0.18	

Intersection Summary
Cycle Length: 85
Actuated Cycle Length: 85
Offset: 40 (47%), Referenced to phase 2:WBTL and 6:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 18.0	Intersection LOS: B
Intersection Capacity Utilization 79.9%	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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Croydon & Richmond Rd

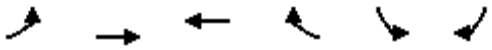
Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	0	0	49	0	13	2	110	0	0	79	1
Future Vol, veh/h	0	0	0	49	0	13	2	110	0	0	79	1
Conflicting Peds, #/hr	0	0	0	0	0	0	15	0	15	15	0	15
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	-	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	0	0	49	0	13	2	110	0	0	79	1

Major/Minor	Minor1		Major1		Major2				
Conflicting Flow All	194	209	110	95	0	-	-	-	0
Stage 1	114	114	-	-	-	-	-	-	-
Stage 2	80	95	-	-	-	-	-	-	-
Critical Hdwy	6.42	6.52	6.22	4.12	-	-	-	-	-
Critical Hdwy Stg 1	5.42	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	5.42	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	2.218	-	-	-	-	-
Pot Cap-1 Maneuver	795	688	943	1499	-	0	0	-	-
Stage 1	911	801	-	-	-	0	0	-	-
Stage 2	943	816	-	-	-	0	0	-	-
Platoon blocked, %					-			-	-
Mov Cap-1 Maneuver	794	0	943	1499	-	-	-	-	-
Mov Cap-2 Maneuver	794	0	-	-	-	-	-	-	-
Stage 1	910	0	-	-	-	-	-	-	-
Stage 2	943	0	-	-	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.7	0.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	WBLn1	SBT	SBR
Capacity (veh/h)	1499	-	821	-	-
HCM Lane V/C Ratio	0.001	-	0.076	-	-
HCM Control Delay (s)	7.4	0	9.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	26	570	922	15	0	0
Future Volume (Veh/h)	26	570	922	15	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	26	570	922	15	0	0
Pedestrians					15	
Lane Width (m)					0.0	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)		109				
pX, platoon unblocked					0.89	
vC, conflicting volume	952				1566	944
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	952				1574	944
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	96				100	100
cM capacity (veh/h)	722				104	318

Direction, Lane #	EB 1	EB 2	WB 1
Volume Total	26	570	937
Volume Left	26	0	0
Volume Right	0	0	15
cSH	722	1700	1700
Volume to Capacity	0.04	0.34	0.55
Queue Length 95th (m)	0.9	0.0	0.0
Control Delay (s)	10.2	0.0	0.0
Lane LOS	B		
Approach Delay (s)	0.4		0.0
Approach LOS			

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		55.5%	ICU Level of Service B
Analysis Period (min)		15	