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Byron Place Apartments 433-435 Churchill Avenue and 468-472 Byron Place Transportation Impact Assessment

Engineering excellence. Planning precision. Inspired landscapes.

**Byron Place Apartments
433-435 Churchill Avenue and
468-472 Byron Place**

Transportation Impact Assessment

Prepared By:

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April 2019
Revised May 2020

Novatech File: 118024
Ref: R-2018-028

May 5th, 2020

City of Ottawa
Planning and Growth Management Department
110 Laurier Ave. W., 4th Floor,
Ottawa, Ontario K1P 1J1

Attention: Mr. Wally Dubyk
Project Manager, Infrastructure Approvals

Dear Mr. Dubyk:

Reference: 433-435 Churchill Avenue and 468-472 Byron Place
Transportation Impact Assessment
Novatech File No. 117198

A Transportation Impact Assessment (TIA) was prepared in April 2019 in support of applications for rezoning and Site Plan Control for 433-435 Churchill Avenue and 468-472 Byron Place. This revision to the TIA has been prepared to address City comments and to reflect revisions to the site plan.

The structure and format of this report is in accordance with the City of Ottawa Transportation Impact Assessment Guidelines (June 2017).

If you have any questions or comments regarding this report, please feel free to contact the undersigned.

Yours truly,

NOVATECH



Brad Byvelds, P. Eng.
Project Coordinator | Transportation/Traffic



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 licensed¹ or registered² professional in good standing, whose field of expertise [check ☒ appropriate field(s)] is either transportation engineering ☒ or transportation planning ☐.

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

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Dated at Ottawa this 5th day of May, 2020 .
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Signature of Individual certifier that s/he meets the above four criteria

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EXECUTIVE SUMMARY

This Transportation Impact Assessment (TIA) has been prepared in support of applications for rezoning and Site Plan Control for 433-435 Churchill Avenue and 468-472 Byron Place. The subject site has an area of approximately 0.2 hectares and is currently occupied by an automobile sales development and three low-rise residential developments. The subject site is surrounded by the following:

- Byron Place/Byron Avenue to the north;
- Low-rise residential development and office/commercial development to the south;
- Highcroft Avenue and low-rise residential development to the east; and
- Churchill Avenue, Churchill Alternative School and Westboro Masonic Hall to the west.

The proposed development will include 72 apartment units and two retail units with a combined gross floor area (GFA) of approximately 3,660ft². The proposed development will include an underground parking garage containing 43 vehicle parking spaces and 60 bicycle parking spaces.

The City's 2017 TIA Guidelines identify three triggers for completing a TIA report, including trip generation, location, and safety. The criteria for each trigger are outlined in the City's TIA Screening Form. Based on the TIA Screening Form, the subject application satisfies the trip generation and safety triggers for completing a TIA.

The conclusions and recommendations of this TIA can be summarized as follows:

Development Design and Parking

- Byron Place will be partially closed to provide a public park area in the southeast corner of the Churchill Avenue/Byron Avenue intersection. As a fire access route must be provided to within 15m of the main building entrance, a portion of Byron Place will remain open to function as the fire route for the proposed development.
- The width of Byron Place will be reduced to 6.0m in order to provide a wider landscape buffer between the proposed building and sidewalk. The turnaround hammerhead within Byron Place will also facilitate short-term parking for drop-offs/pick-ups.
- On-site pedestrian facilities will be provided between the retail entrances and the sidewalks along Churchill Avenue. A sidewalk will be provided along the northern frontage of the site along Byron Place, providing pedestrian connectivity between the residential entrances and the existing sidewalk along Churchill Avenue.
- A garbage room will be provided within the building. Garbage bins will be wheeled down the pathway south of the building, and will be picked up curbside along Churchill Avenue.
- All required TDM-supportive design and infrastructure measures in the TDM checklist are met.
- The proposed vehicular and bicycle parking meets the minimum requirement of the ZBL.

Boundary Streets

- Churchill Avenue currently meets the target BLOS B, TkLOS D and Auto LOS E, however it does not meet the target PLOS A. Byron Avenue and Highcroft Avenue meet the target BLOS and Auto LOS, however they do not meet the target PLOS A.
- To achieve the target PLOS A along both Churchill Avenue and Byron Avenue, either a reduction in the daily curb traffic to less than 3000 vehicles per day or a reduction in the operational speed to 30km/hr is required.

- To achieve the target PLOS A along Highcroft Avenue either a 1.8m sidewalk with 2.0m boulevard or a 2.0m sidewalk with 0.5m boulevard is required. Consideration could be given by the City to improve the sidewalk on the east side of Highcroft Avenue.
- As a sidewalk is not currently provided on the west side of Highcroft Avenue, a new sidewalk along the frontage of the subject site would not provide pedestrian system connectivity to the south. As such, no new sidewalk is proposed along Highcroft Avenue.
- The City of Ottawa's Ultimate Cycling Network identifies a future separated major pathway on the north side of Byron Avenue. The separated pathway will ultimately result in a BLOS A along Byron Avenue

Access Design

- Site access to Highcroft Avenue will provide access to the full movement intersection at Byron Avenue. The existing curb extension restricting the southbound through movement along Highcroft Avenue south of Byron Place will be removed and a new island will be provided to south of the proposed access to the parking garage for the proposed development.
- The island will be offset 2.0m from the existing western curb-line to permit southbound cyclists along Highcroft Avenue, and will maintain a 4.25m northbound vehicle lane. The width of the northbound vehicle lane and southbound cycle lane are consistent with the recommended clearance widths required for snow removal identified in Table 5 of the City's Traffic Calming Design Guidelines.
- The width and length of the proposed island will eliminate any opportunity for vehicles leaving the site to turn right to travel southbound on Highcroft Avenue, as well as restrict westbound vehicles along Byron Avenue to cut through the residential community to avoid the traffic light at Churchill Avenue/Byron Avenue. The proposed island width (4.75m included curb offset) is an improvement on the existing curb extension which narrows the roadway by approximately 2.4m.
- The proposed driveway width and location adheres to the requirements of the City's ZBL and Private Approach By-law.
- The proposed driveway exceeds the minimum TAC corner clearance requirement to the Highcroft Avenue/Byron Place intersection.

Transportation Demand Management and Transit

- To encourage travel by sustainable modes, the proponent agrees to implement the following TDM measures from the checklist:
 - display local area maps with walking/cycling access routes and key destinations at major entrances;
 - display relevant transit schedules and route maps at entrances;
 - unbundle parking cost from monthly rent; and
 - provide multimodal travel option information package to new residents.

Intersection Design

- The Churchill Avenue/Byron Avenue and Churchill Avenue/Richmond Road intersections do not meet the target PLOS A, BLOS B, TkLOS D, however they do meet the target Auto LOS E.
- A reduction in the pedestrian crossing distance would have the greatest improvement to the PLOS at these intersections.
- To achieve the target BLOS, consideration could be given by the City to reducing the operational speed to 50km/hr and providing a two-stage left turn bike box on all legs of these intersections.

- To achieve the target TkLOS, an effective turn radius greater than 15m is required on all four corners of these intersections. Increasing the turn radius at these intersections could be considered by the City, however it should be noted that the increased radius will have a negative impact on the PLOS.
- Critical movements at all study area intersections are anticipated to operate with a LOS D or better under background traffic conditions.
- The addition of site generated traffic volumes are not anticipated to have a significant impact to the intersection operations within the study area.
- Based on anticipated trip distribution, one vehicle during the AM peak hour and three vehicles during the PM peak hour are anticipated to arrive from the south. If these trips were to use Kenwood Avenue/Highcroft Avenue to access the site during the PM peak hour, this would result in one new vehicle approximately every 20 minutes. This increase in traffic is not anticipated to be noticeable and will not have a significant impact on the existing operations along Highcroft Avenue.

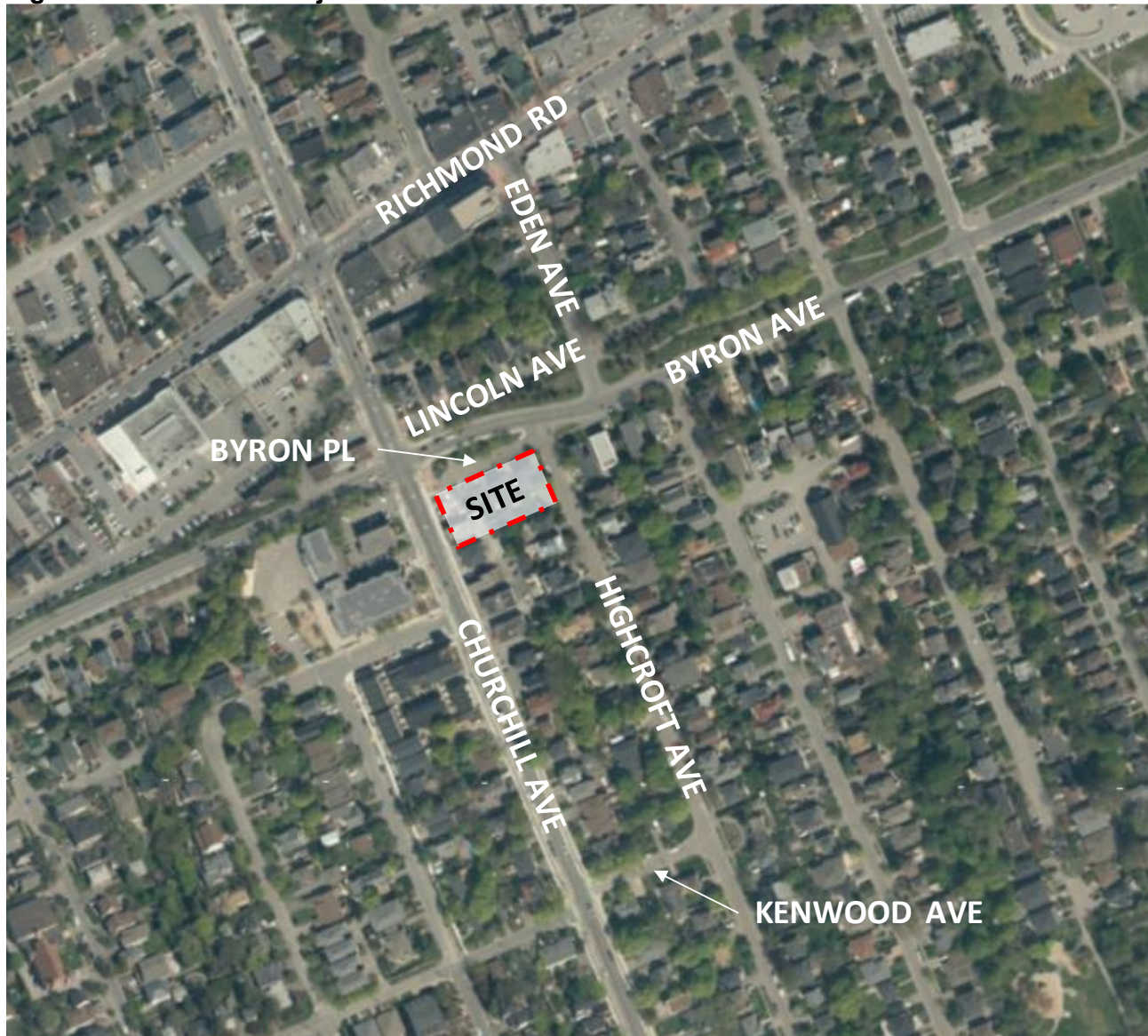
1.0 INTRODUCTION

This Transportation Impact Assessment (TIA) has been prepared in support of applications for rezoning and Site Plan Control for 433-435 Churchill Avenue and 468-472 Byron Place. The subject site has an area of approximately 0.2 hectares and is currently occupied by an automobile sales development and three low-rise residential developments. The subject site is surrounded by the following:

- Byron Place/Byron Avenue to the north;
- Low-rise residential development and office/commercial development to the south;
- Highcroft Avenue and low-rise residential development to the east; and
- Churchill Avenue, Churchill Alternative School and Westboro Masonic Hall to the west.

An aerial photo of the subject site is provided in **Figure 1**.

Figure 1: View of the Subject Lands



2.0 PROPOSED DEVELOPMENT

The proposed development will include 72 apartment units and two retail units with a combined gross floor area (GFA) of approximately 3,660ft². The proposed development will include an underground parking garage containing 43 vehicle parking spaces and 60 bicycle parking spaces.

A preliminary review of various access options was conducted, including access to Churchill Avenue, Byron Avenue, Byron Place and Highcroft Avenue. Access to Highcroft Avenue is recommended based on the following factors.

- Access along Byron Avenue and Churchill Avenue requires a minimum corner clearance of 55m from the Churchill Avenue/Byron Avenue intersection, and is unachievable.
- OC Transpo bus stop and school bus loading zone are located along the west side of Churchill Avenue and create additional conflict opposite the site.
- The northbound left turn lane and taper at the Churchill Avenue/Byron Avenue extend past the site.
- The raised northbound cycle track transitions to on-road shared travel lane across the Churchill Avenue frontage.
- Westbound and northbound queues at the Churchill Avenue/Byron Avenue intersection periodically extend to Highcroft Avenue and Ravenhill Avenue during weekday peak hours.
- The non-standard intersection configuration/traffic calming feature at Byron Place/Highcroft Avenue/Byron Avenue currently operates with low-volume on Byron Place.
- The City of Ottawa's Private Approach By-law requires the access to be located on the lower class of roadway where possible.

Site access to Highcroft Avenue will provide access to the full movement intersection at Byron Avenue. A 16 unit residential development was recently constructed at 450 Churchill Avenue. All movement access to this development is provided along Churchill Avenue south of Ravenhill Avenue. This driveway serves a smaller development compared to the proposed development, is not located in close proximity to a signalized intersection with turn lanes and tapers, and is not located across from a transit stop/school bus loading zone. The access provided for 450 Churchill Avenue development is not comparable to the proposed development.

The existing curb extension restricting the southbound through movement along Highcroft Avenue south of Byron Place will be moved to south of the proposed access to the parking garage for the proposed development. This will eliminate any opportunity for vehicles leaving the site to turn right to travel southbound on Highcroft Avenue.

The proposed development will be constructed in one phase, with an estimated completion date of 2021. The proposed Site Plan is included in **Appendix A**.

3.0 SCREENING AND SCOPING

3.1 Screening Form

The City's 2017 TIA Guidelines identify three triggers for completing a TIA report, including trip generation, location, and safety. The criteria for each trigger are outlined in the City's TIA Screening Form. A copy of the TIA Screening Form is included in **Appendix B**.

Based on the TIA Screening Form, the subject application satisfies the trip generation and safety triggers for completing a TIA.

3.2 Existing Conditions

3.2.1 Roadways

All roadways within the study area fall under the jurisdiction of the City of Ottawa.

Byron Avenue is a collector roadway that generally runs on an east-west alignment in the vicinity of the subject site. It has a two-lane undivided urban cross section with a regulatory speed limit of 50km/hr.

Richmond Road is an arterial roadway that generally runs on an east-west alignment in the vicinity of the subject site. It has a two-lane undivided urban cross section with a regulatory speed limit of 50km/h. Richmond Road is a full load truck route.

Churchill Avenue runs on a north-south alignment and is classified as a major collector roadway between Richmond Road and Carling Avenue, and an arterial roadway between Richmond Road and Scott Street. It has a two-lane undivided urban cross section with a posted speed limit of 50 km/hr. Churchill Avenue is a full load truck route.

Highcroft Avenue is local roadway that runs on a north-south alignment. It has a two-lane undivided urban cross section and a regulatory speed limit of 50 km/hr.

Byron Place is a local roadway that runs on an east-west alignment parallel to Byron Avenue, commencing at Highcroft avenue and terminating approximately 60m to the west. It has a two-lane undivided urban cross section with a sidewalk on the south side.

3.2.2 Intersections

A review of the existing lane configurations and traffic control at the study area intersections is provided below.

Churchill Avenue/Byron Avenue

- Signalized intersection
- Northbound/Southbound: one left turn lane and one shared through/right turn lane
- Eastbound/Westbound: one approach lane
- Ladder striped crosswalks are provided on all four legs
- A bike lane is provided on the west leg



Richmond Road/Churchill Avenue

- Signalized intersection
- Northbound/Southbound: one approach lane
- Eastbound/Westbound: one left turn lane and one shared through/right turn lane
- Ladder striped crosswalks are provided on all four legs

Byron Avenue/Highcroft Avenue/Byron Place

- Unsignalized intersection, stop control on Highcroft Avenue
- One approach lane on all legs
- Northbound right turn movement is channelized
- A concrete island and curb extension restrict the southbound through movement along Highcroft Avenue south of Byron Place



3.2.3 Driveways

In accordance with the City's 2017 TIA guidelines, a review of adjacent driveways along the boundary roads are provided as follows:

Highcroft Avenue, East Side:

- Residential driveways to 462 Byron Avenue, and 441 and 445 Highcroft Avenue

Churchill Avenue, East Side:

- Driveways to commercial developments at 439 and 445 Churchill Avenue

Highcroft Avenue, West Side:

- Residential driveways to 440 and 444 Highcroft Avenue

Churchill Avenue, West Side:

- Driveway to Westboro Masonic Hall
- Driveway to Churchill Alternative School

The subject lands (435 Churchill Avenue) share a driveway with the development to the south (439 Churchill Avenue). There is no easement registered between the properties. The property at 439 Churchill Avenue also shares a driveway with 445 Churchill Avenue. Access to 439 Churchill Avenue can be maintained adjacent to the proposed building.

3.2.4 Pedestrian and Bicycle Facilities

Sidewalks are provided on both sides of Churchill Avenue, Richmond Road and Byron Avenue between Churchill Avenue and Eden Avenue. Byron Avenue, east of Eden Avenue and west of Churchill Avenue has a sidewalk on the south side of the roadway.

Churchill Avenue and Richmond Road are classified as spine cycling routes, and Byron Avenue is classified as a local cycling route in the City's Ultimate Cycling Network. An eastbound bike lane and westbound sharrows are provided along Byron Avenue west of Eden Avenue. Eastbound and westbound bike lanes are provided along Byron Avenue east of Eden Avenue. Cycle tracks are provided along Churchill Avenue south of Byron Avenue.

3.2.5 Transit

The locations of all OC Transpo bus stops within a 400m walking distance, or approximately a 5 minute walk, of the subject site are described as follows:

- #7538 and #7539 are located along Churchill Avenue south of Byron Avenue;
- #4987 and #5616 are located along Churchill Avenue north of Richmond Road;
- #4864 and #4865 are located along Richmond Road between Eden Avenue and Edgewood Avenue; and
- #4876 is located along Richmond Avenue west of Churchill Avenue.

The location of the bus stops is shown in **Figure 2**.

Figure 2: OC Transpo Bus Stop Locations

The aforementioned bus stops serve OC Transpo Route 11, Route 50 and Route 151. Descriptions of the foregoing transit routes are provided in the following table. Route maps are included in **Appendix C**.

Table 1: OC Transpo Route Information

Route	Description	Schedule		
		Days	Service	Headways
11	Travels between Lincoln Fields Transit Station and Parliament Transit Station	7 Days/Week	All Day	<u>Weekday/Saturday</u> Morning/Afternoon: 15 min Night: 30 min
50	Travels between Lincoln Fields Transit Station and Tunney's Pasture Transit Station	Monday to Saturday	All Day	<u>Weekday</u> AM/PM Peak: 15 min Mid-Day/Night: 30 min <u>Saturday</u> Morning/Afternoon: 30 min Night: 60 min
151	Travels between Carlingwood Shopping Centre and Tunney's Pasture Transit Station	Monday to Friday	Selected Time Periods	Once in the morning and evening, twice in the afternoon

3.2.6 Existing Area Traffic Management Measures

A concrete island and curb extension restrict the southbound through movement along Highcroft Avenue south of Byron Place. Speed humps were recently constructed along Byron Avenue as part of the City's Byron Avenue Traffic Calming Project. There are currently no other area traffic management measures in place along any of the study area roadways.

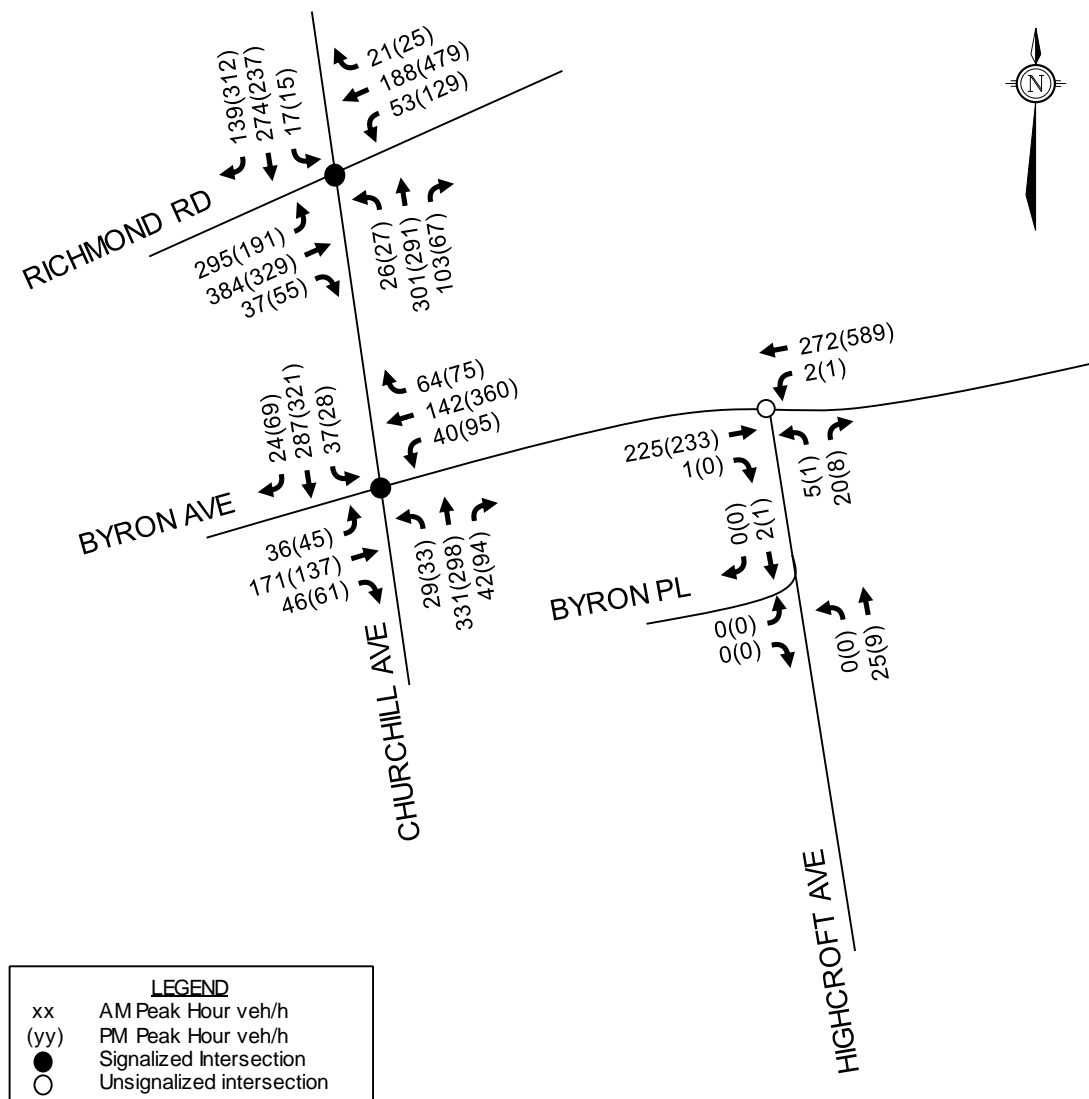
3.2.7 Existing Traffic Volumes

Weekday traffic counts were completed by the City of Ottawa and Novatech at the study area intersections on the following dates:

- Churchill Avenue/Richmond Road November 22nd, 2017 (City)
- Churchill Avenue/Byron Avenue August 25th, 2016 (City)
- Byron Avenue/Highcroft Avenue/Byron Place October 3rd, 2018 (Novatech)

Due to seasonal variation, the traffic volumes between the Churchill Avenue/Byron Avenue and Byron Avenue/Highcroft Avenue/Byron Place have been balanced to within 10%. The existing traffic volumes at these intersections during the weekday AM and PM peak hours are shown in **Figure 3**. Peak hour summary sheets of the aforementioned traffic count are included in **Appendix D**.

Figure 3: Existing Traffic Volumes



It is noteworthy that a total of nine illegal southbound through movements were recorded along Highcroft Avenue over the eight-hour period. As shown in Figure 3, two illegal southbound movements were recorded during the AM peak hour and one was recorded during the weekday PM peak hour.

3.2.8 Collision Records

Historical collision data from the last five years was obtained from the City's Public Works and Service Department for the study area intersections. Copies of the collision summary reports are included in **Appendix E**. The following table summarizes the reported collisions at each intersection within the last five years.

Table 2: Historical Collision Records

Intersection	Number of Collision					
	Single Vehicle	Rear-End	Angle	Turning Movement	Sideswipe	Total
Churchill Avenue/ Richmond Road	8	10	7	2	6	33
Churchill Avenue/ Byron Avenue	1	3	2	2	0	8
Byron Avenue/ Highcroft Avenue	1	0	0	0	0	1

Churchill Avenue/Richmond Road

A total of 33 collisions were reported at the Churchill Avenue/Richmond Road intersection over the last five years. Personal injuries were incurred from six of the 33 collisions.

Ten of the total collisions were rear-end impacts, of which five involved eastbound vehicles, three involved southbound vehicles and two involved westbound vehicles. Forty percent of the rear-end impacts occurred under wet or icy surface conditions, suggesting environmental factors played a role in the rear-end collision history at this intersection.

Seven of the total collisions were angle impacts, of which five involved a southbound and an eastbound vehicle, one involved a northbound and an eastbound vehicle and one involved a northbound and a westbound vehicle. The setback of the existing building in the northwest quadrant of the Churchill Avenue/Richmond Road intersection (337 Richmond Road) from the right-of-way (ROW) is minimal. This building limits the sight distance between the southbound and eastbound approaches, and is anticipated to be a contributing factor for the number of angle impacts between these approaches.

Eight of the total collisions were single vehicle impacts, four of which involved a turning vehicle and a pedestrian and four involved an unattended vehicle. Ladder striped crosswalks are currently provided on all legs of this intersection to enhance visibility of the crosswalk and increase drivers' awareness of potential conflicts. Three of the impacts involving an unattended vehicle occurred on the north and south approaches (the fourth was unknown).

Churchill Avenue/Byron Avenue

A total of eight collisions were reported at the Churchill Avenue/Byron Avenue intersection over the last five years. Personal injuries were not incurred from any of the reported collisions at this intersection. There was no pattern associated with the collision history at this intersection.

Byron Avenue/Highcroft Avenue

The only collision reported at the Byron Avenue/Highcroft Avenue intersection over the last five years was a single vehicle impact with a building/wall on the northbound approach.

3.3 Planned Conditions

The 2031 Rapid Transit and Transit Priority Network in the City of Ottawa's 2013 Transportation Master Plan (TMP) identifies the implementation of transit signal priority measures and queue jump lanes at select intersections along Richmond Road, Wellington Street West and Somerset Street

between Woodroffe Avenue and Bank Street. The City's 2013 TMP does not identify any roadway projects within the study area.

A Transportation Brief was submitted to the City of Ottawa dated May 2016, and updated in March and July 2017 in support of a Site Plan Control application for a 187 unit apartment building at 190 Richmond Road.

3.4 Study Area and Time Periods

This report will review the design elements along Churchill Avenue and Byron Avenue boundary streets. The proposed study area for this report includes all accesses to the proposed development and the following intersections:

- Churchill Avenue/Richmond Road
- Churchill Avenue/Byron Avenue
- Byron Avenue/Highcroft Avenue

The selected time periods for the analysis are the weekday AM and PM peak hours, which represent the 'worst case' combination of site generated traffic and adjacent street traffic. Analysis will be completed for the 2021 build-out year and the 2026 horizon year.

3.5 Exemptions Review

This module reviews possible exemptions from the final TIA, as outlined in the TIA Guidelines. The applicable exemptions for the subject lands are shown in **Table 3**.

Table 3: TIA Exemptions

Module	Element	Exemption Criteria	Exemption Applies
Design Review Component			
4.1 Development Design	4.1.2 Circulation and Access	• Only required for site plans	No
	4.1.3 New Street Networks	• Only required for plans of subdivision	Yes
4.2 Parking	4.2.1 Parking Supply	• Only required for site plans	No
	4.2.2 Spillover Parking	• Only required for site plans where parking supply is 15% below unconstrained demand	Yes
Network Impact Component			
4.5 Transportation Demand Management	<i>All elements</i>	• Not required for non-residential site plans expected to have fewer than 60 employees and/or students on location at any given time	No
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	• Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Yes

Module	Element	Exemption Criteria	Exemption Applies
4.8 Network Concept	<i>All elements</i>	<ul style="list-style-type: none"> Only required when proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by the established zoning 	Yes

Churchill Avenue is classified as a major collector roadway south of Richmond Road, and Byron Avenue is classified as a collector roadway. Based on the existing traffic volumes at the Churchill Avenue/Byron Avenue intersection, as presented in Figure 3, the following traffic volumes are currently using these roadways:

- Churchill Avenue south of Byron Avenue:
 - AM Peak: approximately 775 vehicles two-way (400 northbound, 375 southbound)
 - PM Peak: approximately 900 vehicles two-way (425 northbound, 475 southbound)
- Byron Avenue east of Churchill Avenue:
 - AM Peak: approximately 450 vehicles two-way (255 eastbound, 195 westbound)
 - PM Peak: approximately 705 vehicles two-way (245 eastbound, 460 westbound)

The lane capacity along Churchill Avenue and Byron Avenue are estimated at 600 vehicles per hour per lane (vphpl) based on the City's Long Range Transportation Model. Based on the foregoing the peak directional traffic along Churchill Avenue is operating with a volume to capacity ratio of 0.67 and 0.79 during the weekday AM and PM peak hours respectively. The peak directional traffic along Byron Avenue is operating with a volume to capacity ratio of 0.43 and 0.77 during the weekday AM and PM peak hours respectively. Total traffic, including the additional traffic generated by the proposed development, as presented in Figure 4 below, is not anticipated to increase above the peak directional capacity of 600vphpl. As such, the Neighbourhood Traffic Management module is exempt from the required analysis in the TIA.

4.0 FORECASTING

4.1 Development-Generated Traffic

4.1.1 Trip Generation

Trips generated by the proposed residential development were estimated using the TRANS Trip Generation Manual prepared in 2009. Trips generated by the residential development were calculated using the recommended trip generation rates for mid-rise apartments (3-10 floors) in the urban area (inside the greenbelt), as presented in Table 3.18 of the TRANS report. The directional splits are based on the blended splits presented in Table 3.17 of the report.

Trips generated by the proposed retail development have been developed based on the Shopping Centre (Land Use 820) in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition.

The following table presents the trip generation for the proposed development.

Table 4: TRANS/ITE Trip Generation

Land Use	Units / GFA	AM Peak			PM Peak		
		IN	OUT	TOT	IN	OUT	TOT
Mid-rise Apartment (3-10 Floors)	72	4	14	18	12	8	20
Shopping Centre	3,660 s.f.	2	1	3	7	7	14

The residential trip generation was converted to person trips using the Apartment modal shares presented in Table 3.13 of the TRANS report. Trips generated by the Shopping Centre land use were converted to person trips using a 1.28 ITE trip to person trip adjustment factor. The person trips generated by the proposed development are summarized in the following table.

Table 5: Person Trip Generation

Land Use	AM Peak			PM Peak		
	IN	OUT	TOT	IN	OUT	TOT
Mid-rise Apartment (3-10 Floors)	12	37	49	31	19	50
Shopping Centre	2	2	4	9	9	18

The modal shares for the proposed development are anticipated to be consistent with the modal shares outlined in the 2011 TRANS O-D Survey Report, specific to the Ottawa West Area. The modal shares applied to the residential development have been derived based on all observed trips within the Ottawa West Area, as well as trips departing during the AM peak and arriving during the PM peak. The modal shares applied to the commercial development have been derived based on all observed trips within the Ottawa West Area during the weekday AM and PM peak hours. A full breakdown of the projected person trips by modal share are shown in the below table.

Table 6: Person Trips by Modal Share

Travel Mode		Modal Share	AM Peak			PM Peak		
			IN	OUT	TOT	IN	OUT	TOT
Residential Person Trips			12	37	49	31	19	50
Auto Driver	45%		6	16	22	14	9	23
Auto Passenger	15%		1	6	7	4	3	7
Transit	20%		2	8	10	6	4	10
Non-Auto	20%		3	7	10	7	3	10
Commercial Person Trips			2	2	4	9	9	17
Auto Driver	35%		1	1	2	3	3	6
Auto Passenger	15%		0	0	0	1	2	3
Transit	5%		0	0	0	0	0	0
Non-Auto	45%		1	1	2	4	4	8
Auto Driver (Total)			7	17	24	17	12	29
Auto Passenger (Total)			1	6	7	5	5	10
Transit (Total)			2	8	10	6	4	10
Non-Auto (Total)			4	8	12	11	7	18

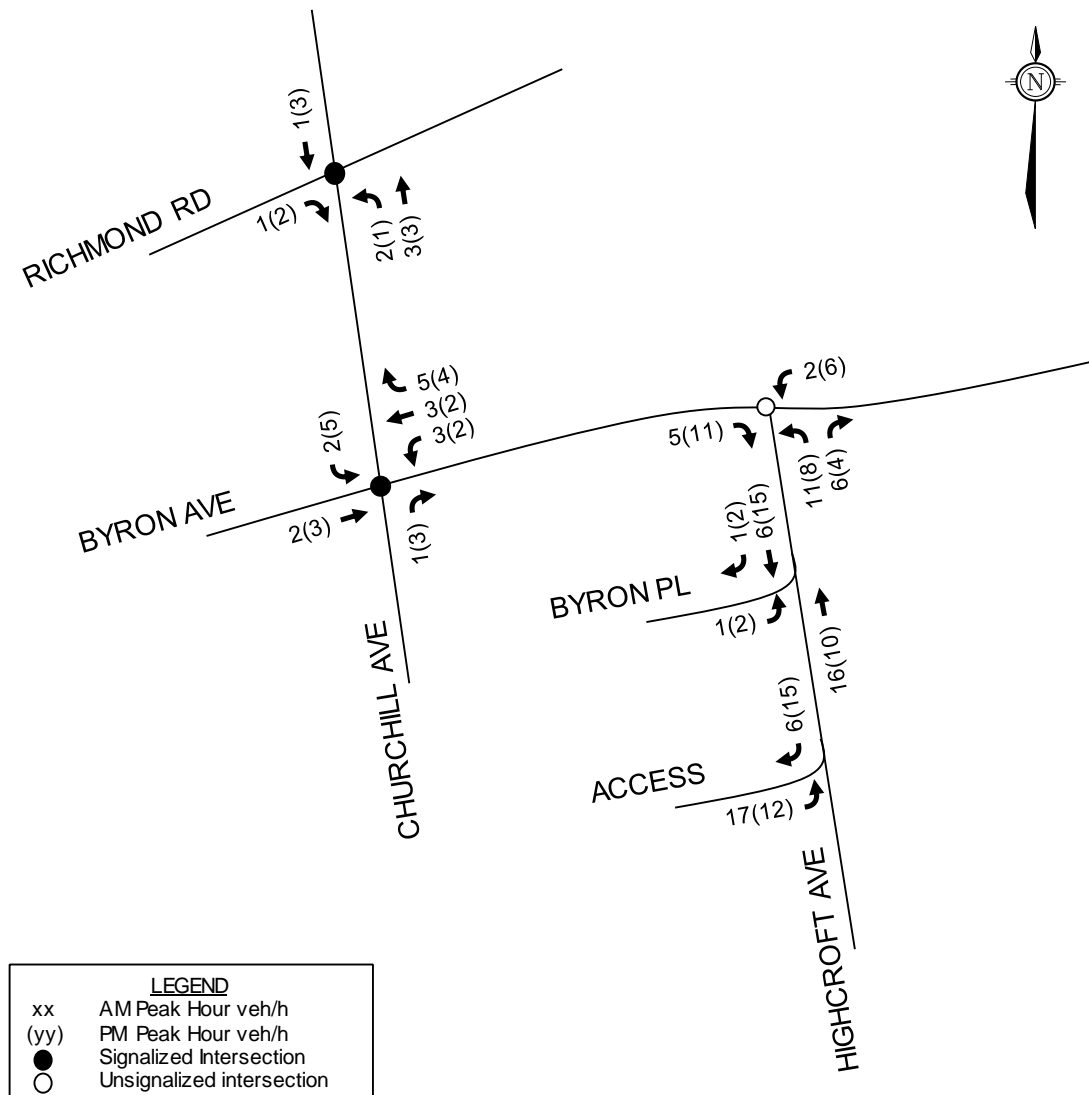
4.1.2 Trip Distribution

The assumed distribution of trips generated by the proposed development has been derived from existing traffic patterns on the roadways within the study area. As the proposed development is predominantly residential, the majority of peak hour trips are anticipated to be to/from work. It is appropriate for the assumed trip distribution to be based on the distribution of existing traffic volumes exiting the study area during the AM peak hour and arriving to the study area during the PM peak hour. The projected distribution of trips is summarized as follows:

- 35% to/from the east via either Byron Avenue or Richmond Road
- 30% to/from the west via either Byron Avenue or Richmond Road
- 20% to/from the north via Churchill Avenue
- 15% to/from the south via Churchill Avenue

Site generated traffic volumes are shown in **Figure 4**.

Figure 4: Site Generated Traffic



4.2 Background Traffic

4.2.1 General Background Growth Rate

A review of historic traffic counts, as well as snapshots from the City's Long Range Transportation Model were reviewed to determine an appropriate background growth rate along the study area roadways.

Based on the historic traffic counts (2012 and 2016 at Churchill Avenue/Byron Avenue, 2015 and 2017 at Churchill Avenue/Richmond Road), traffic volumes have generally decreased along the study area roadways. This is consistent with the 2031 and 2011 snapshots from the City's long range transportation model, which suggests no growth along the area roadways.

Based on the foregoing, no growth rate has been applied to the existing traffic volumes within the study area.

4.2.2 Other Area Development Traffic

As identified above, a Transportation Brief was submitted to the City of Ottawa dated May 2016, and updated in March and July 2017 in support of a Site Plan Control application for a 187 unit apartment building at 190 Richmond Road. Traffic generated by this development has been added to the through traffic volumes along Richmond Road in the future background traffic projections. Relevant excerpts from the 190 Richmond Road report are included in **Appendix F**.

As no annual growth rate has been applied to the existing traffic volumes, the 2021 and 2026 background traffic volumes are anticipated to be the same. The background traffic volumes along the study area roadways are shown in **Figure 5**. Total traffic volumes for the 2021 and 2026 build-out years are shown in **Figure 6**.

Figure 5: 2021 and 2026 Background Traffic

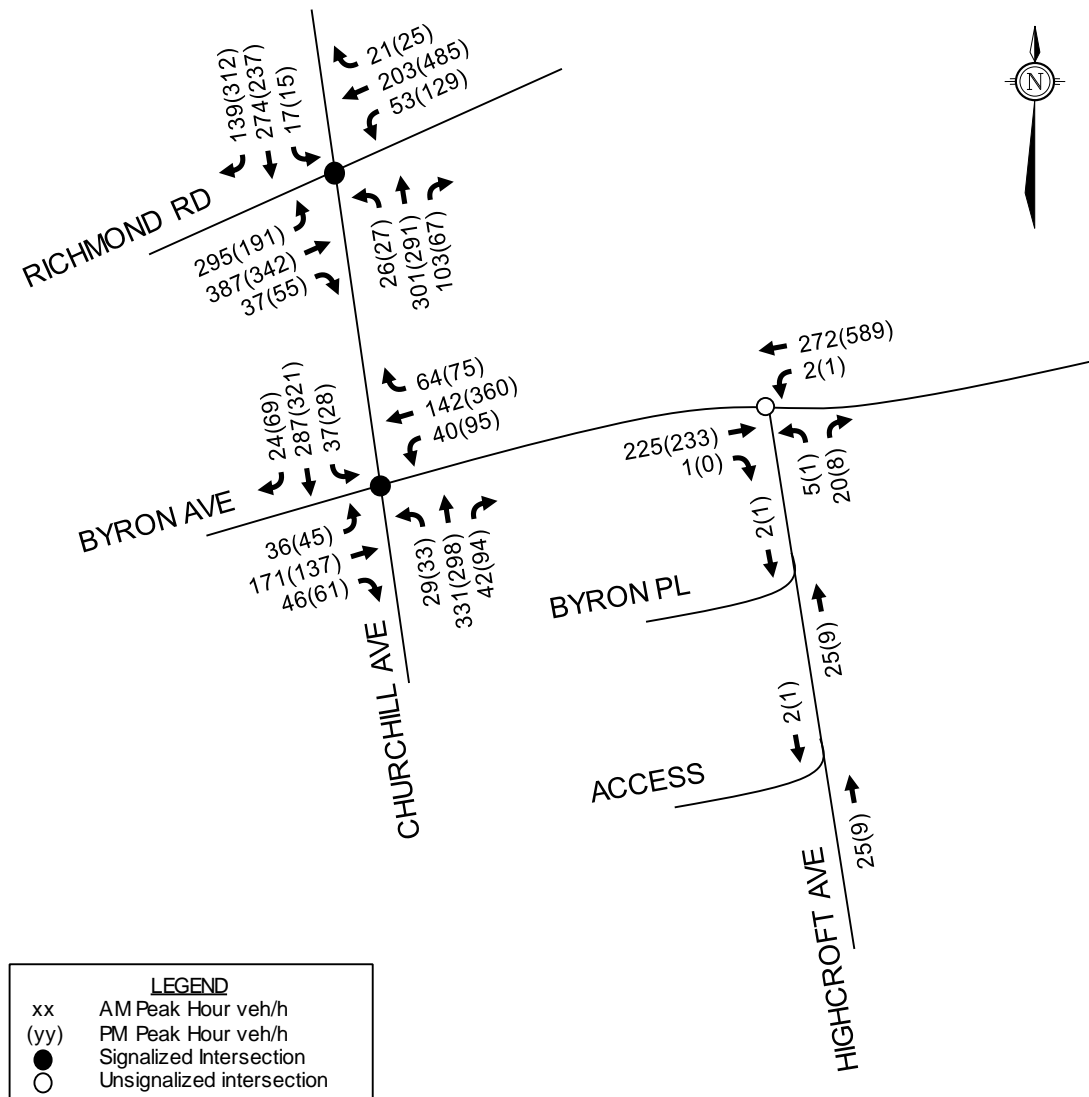
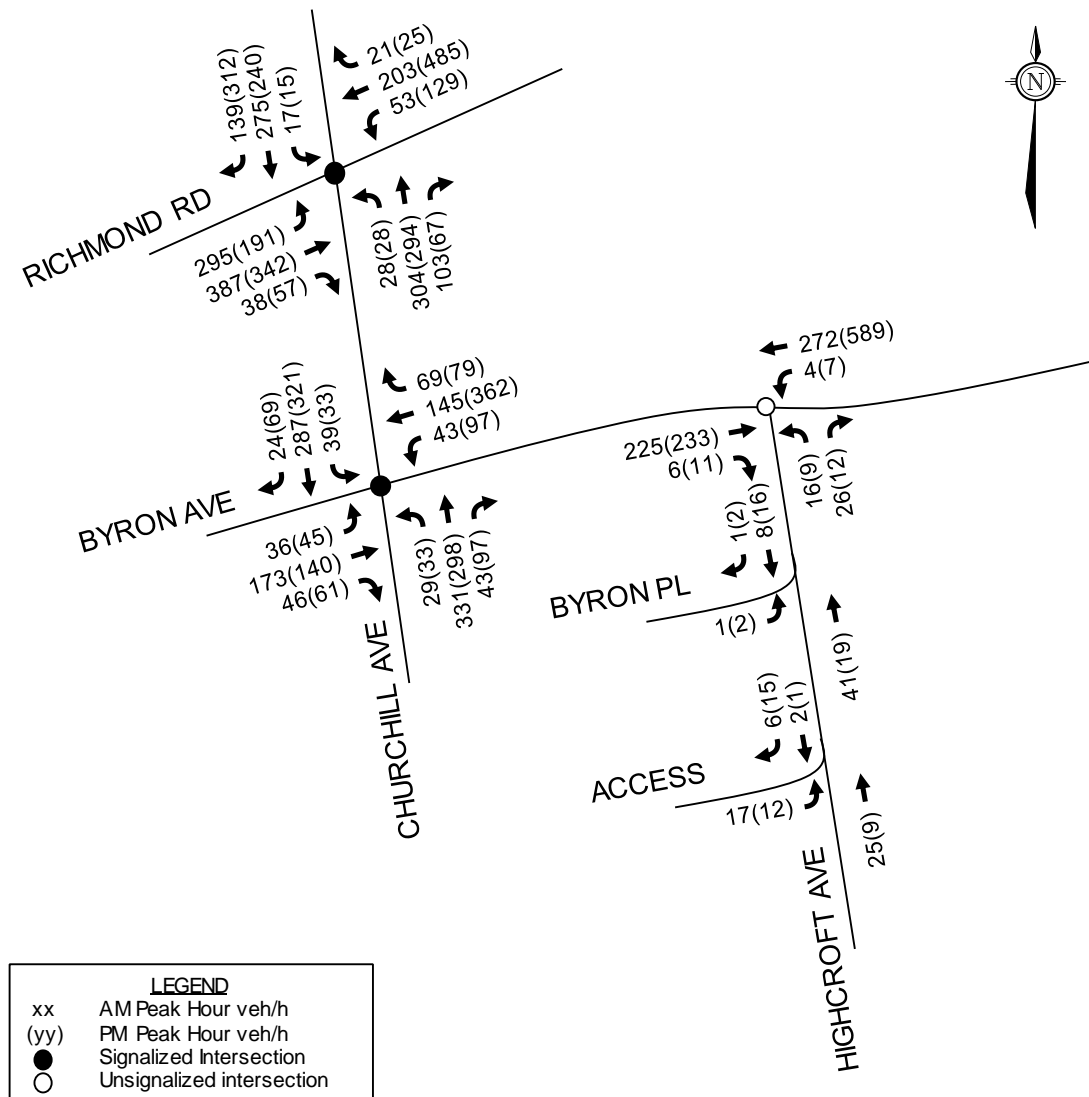


Figure 6: 2021 and 2026 Total Traffic



5.0 ANALYSIS

5.1 Development Design

Byron Place will be partially closed to provide a public park area in the southeast corner of the Churchill Avenue/Byron Avenue intersection. As a fire access route must be provided to within 15m of the main building entrance, a portion of Byron Place will remain open to function as the fire route for the proposed development. The width of Byron Place will be reduced to 6.0m in order to provide a wider landscape buffer between the proposed building and sidewalk. The turnaround hammerhead within Byron Place will also facilitate short-term parking for drop-offs/pick-ups.

A Road Modification Approval (RMA) application is required to alter the existing curbs along Highcroft Avenue and Byron Place. A functional design of the proposed Highcroft Avenue and Byron Place roadway modifications is provided in **Appendix G**. A RMA application will be submitted to the City of Ottawa under a separate cover.

On-site pedestrian facilities will be provided between the retail entrances and the sidewalks along Churchill Avenue. A sidewalk will be provided along the northern frontage of the site along Byron Place, providing pedestrian connectivity between the residential entrances and the existing sidewalk along Churchill Avenue.

Bicycle parking for the proposed development will be in accordance with the minimum requirements of the City's Zoning By-law (ZBL), as described in Section 5.2. Four bicycle parking spaces will be located at grade near the commercial units along Churchill Avenue. Thirteen bicycle parking spaces for residents will be provided in an at grade enclosure in the southeast corner of the building. All remaining bicycle parking spaces will be provided underground.

A garbage room will be provided within the building. Garbage bins will be wheeled down the pathway south of the building, and will be picked up curbside along Churchill Avenue.

A review of the Transportation Demand Management (TDM) – *Supportive Development Design and Infrastructure Checklist* has been conducted. A copy of the TDM checklist is included in **Appendix H**. All required TDM-supportive design and infrastructure measures in the TDM checklist are met.

5.2 Parking

The subject site is located in Area B on Schedule 1 and Area X on Schedule 1A of the City's Zoning By-law (ZBL). Minimum vehicular and bicycle parking rates for the proposed development are identified in the ZBL and are summarized in the following table.

Table 7: Parking Requirement

Land Use		Rate	Units/GFA	Required	Provided
Vehicle Parking					
Apartment	Tenant	0.5 per dwelling unit in excess of 12 units	72 Units	30	37
	Visitor	0.1 per dwelling unit in excess of 12 units		6	6
Commercial Unit One		None for commercial units with 200m ² GFA or less	158m ²	0	0
Commercial Unit Two			197m ²	0	0
Total				36	43
Bicycle Parking					
Apartment		0.5 per Dwelling Unit	72	36	56
Commercial Unit One		1 per 250m ² of GFA	161m ²	0	4
Commercial Unit Two			160m ²	0	
Total				36	60

Based on the foregoing table, the proposed vehicular and bicycle parking meets the minimum requirement of the ZBL.

5.3 Boundary Streets

This section provides a review of the boundary streets using complete streets principles. The Multi-Modal Level of Service (MMLOS) guidelines produced by IBI Group in 2015 were used to evaluate the Level of Service (LOS) of the boundary roadways for each mode of transportation. Schedule B of the City of Ottawa's Official Plan indicates Churchill Avenue and Byron Avenue are within the General Urban Area. The boundary streets are also located within 600m of the Dominion Transit Station and within 300m of the Churchill Alternative School. Photos of the boundary Streets (provided by Google Streetview) are provided below.

Figure 7: Churchill Avenue (Looking South)

Figure 8: Byron Avenue (Looking East)



Figure 9: Highcroft Avenue (Looking North)



Target Pedestrian LOS (PLOS), Bicycle LOS (BLOS), Transit LOS (TLOS), Truck LOS (TkLOS) and Auto LOS for the study area roadways are based on the targets within 300m of a school, as identified in Exhibit 22 of the MMLOS guidelines. The following table summarizes the findings of the MMLOS segment analysis. Detailed segment MMLOS calculations are included in **Appendix I**.

Table 8: Segment MMLOS Summary

Segment	PLOS	BLOS	TLOS	TkLOS	Auto LOS
Churchill Avenue	B	A	F	B	C
Target	A	B	-	D	E
Byron Avenue	C	B	D	B	D
Target	A	B	-	-	E

Segment	PLOS	BLOS	TLOS	TkLOS	Auto LOS
Highcroft Avenue	C	B	D	B	A
Target	A	D	-	-	E

Churchill Avenue currently meets the target BLOS B, TkLOS D and Auto LOS E, however it does not meet the target PLOS A. Byron Avenue and Highcroft Avenue meet the target BLOS and Auto LOS, however they do not meet the target PLOS A.

Based on an operating speed of 50km/hr and average daily curb lane traffic greater than 3000 vehicles per day, the target PLOS A is unachievable. To achieve the target PLOS A along both Churchill Avenue and Byron Avenue, either a reduction in the daily curb traffic to less than 3000 vehicles per day or a reduction in the operational speed to 30km/hr is required. To achieve the target PLOS A along Highcroft Avenue either a 1.8m sidewalk with 2.0m boulevard or a 2.0m sidewalk with 0.5m boulevard is required. Consideration could be given by the City to improve the sidewalk on the east side of Highcroft Avenue. As a sidewalk is not currently provided on the west side of Highcroft Avenue, a new sidewalk along the frontage of the subject site would not provide pedestrian system connectivity to the south. As such, no new sidewalk is proposed along Highcroft Avenue.

The City of Ottawa's Ultimate Cycling Network identifies a future separated major pathway on the north side of Byron Avenue. The separated pathway will ultimately result in a BLOS A along Byron Avenue.

5.4 Access Intersections Design

As described Section 2.0, a preliminary review of various access options was conducted, including access to Churchill Avenue, Byron Avenue, Byron Place and Highcroft Avenue. Access to Highcroft Avenue is recommended based on the following factors.

- Access along Byron Avenue and Churchill Avenue requires a minimum corner clearance of 55m from the Churchill Avenue/Byron Avenue intersection, and is unachievable.
- OC Transpo bus stop and school bus loading zone are located along the west side of Churchill Avenue and create additional conflict opposite the site.
- The northbound left turn lane and taper at the Churchill Avenue/Byron Avenue extend past the site.
- The raised northbound cycle track transitions to on-road shared travel lane across the Churchill Avenue frontage.
- Westbound and northbound queues at the Churchill Avenue/Byron Avenue intersection periodically extend to Highcroft Avenue and Ravenhill Avenue during weekday peak hours.
- The non-standard intersection configuration/traffic calming feature at Byron Place/Highcroft Avenue/Byron Avenue currently operates with low-volume on Byron Place.
- The City of Ottawa's Private Approach By-law requires the access to be located on the lower class of roadway where possible.

Site access to Highcroft Avenue will provide access to the full movement intersection at Byron Avenue. The existing curb extension restricting the southbound through movement along Highcroft Avenue south of Byron Place will be removed and a new island will be provided to south of the proposed access to the parking garage for the proposed development.

The proposed island will be 2.75m in width and 9.1m in length. The island will be offset 2.0m from the existing western curb-line to permit southbound cyclists along Highcroft Avenue, and will maintain a 4.25m northbound vehicle lane. The width of the northbound vehicle lane and southbound cycle lane are consistent with the recommended clearance widths required for snow removal identified in Table 5 of the City's Traffic Calming Design Guidelines.

The width and length of the proposed island will eliminate any opportunity for vehicles leaving the site to turn right to travel southbound on Highcroft Avenue, as well as restrict westbound vehicles along Byron Avenue to cut through the residential community to avoid the traffic light at Churchill Avenue/Byron Avenue. The proposed island width (4.75m included curb offset) is an improvement on the existing curb extension which narrows the roadway by approximately 2.4m.

A RMA application is required to alter the existing curbs along Highcroft Avenue and Byron Place. A functional design of the proposed Highcroft Avenue and Byron Place roadway modifications is provided in **Appendix G**. A RMA application will be submitted to the City of Ottawa under a separate cover.

The proposed access will be 6.2m in width and will be located approximately 6.7m from the southern property line, and approximately 19m from the Byron Place right-of-way limit. The City's ZBL identifies a minimum width of 6.0m for a driveway leading to a parking garage containing more than 20 parking spaces. The City's Private Approach By-law requires the access to be 3.0m from any adjacent property line. The Private Approach By-law also identifies where a property abuts or is within 46m of an arterial or major collector roadway, in the case of an apartment building containing 20 to 99 parking spaces, a minimum distance of 18m is required between the proposed access and the nearest intersecting street line. The proposed driveway width and location adheres to the requirements of the City's ZBL and Private Approach By-law.

Transportation Association of Canada (TAC) Geometric Design Guidelines identify a minimum corner clearance of 15m between a driveway on a local roadway and a stop-controlled intersection. The proposed driveway exceeds the minimum TAC corner clearance requirement to the Highcroft Avenue/Byron Place intersection.

A review of the intersection operations at the proposed access was conducted for the 2021 and 2026 total traffic conditions was conducted. Based on the analysis, the proposed access will operate with a LOS A under the 2021 and 2026 total traffic conditions. Detailed summary sheets of the Synchro analysis are provided in **Appendix J**.

5.5 Transportation Demand Management

A review of the Transportation Demand Management (TDM) Measures checklist was conducted and can be found in **Appendix H**. To encourage travel by sustainable modes, the proponent agrees to implement the following TDM measures from the checklist:

- display local area maps with walking/cycling access routes and key destinations at major entrances;
- display relevant transit schedules and route maps at entrances;
- unbundle parking cost from monthly rent; and
- provide multimodal travel option information package to new residents.

5.6 Transit

Relevant boarding/alighting information and bus occupancy information from the winter 2018 service period for OC Transpo bus stops #4876, #4987, #5616, #7538 and #7539 were received from OC Transpo. OC Transpo has also advised that both Route 11 and Route 50 operate with 40-foot buses during the weekday AM and PM peak periods. Information received from OC Transpo is included in **Appendix C**. The following table summarizes the transit information received from OC Transpo.

Table 9: Existing OC Transpo Utilization

OC Transpo Stop	OC Transpo Route	AM Period			PM Period		
		Total Boarding	Total Alighting	Average Load	Total Boarding	Total Alighting	Average Load
#4876	11	1	15	8	13	19	17
#4987	11	5	19	17	18	7	14
	50	1	4	15	3	1	10
#5616	50	0	0	9	5	3	12
#7538	50	6	5	15	1	1	10
#7539	50	0	2	9	2	5	11

Based on the trip generation presented in Section 4.1, the proposed development is anticipated to generate 10 transit trips (2 in, 8 out) during the AM peak hour and 10 transit trips (6 in, 4 out) during the PM peak hour. Based on the transit utilization data received from OC Transpo, the existing bus stops/routes in the vicinity of the subject site have capacity to accommodate the transit trips generated by the proposed development.

5.7 Intersection Design

5.7.1 Existing Intersection MMLOS Analysis

This section provides a review of the signalized study area intersections using complete streets principles. The MMLOS guidelines produced by IBI Group in October 2015 were used to evaluate the LOS of the signalized study area intersections for each mode of transportation. Schedule B of the City of Ottawa's Official Plan indicates the study area intersections are located in the General Urban Area. The study area intersections are also located within 600m of the Dominion Transit Station and within 300m of the Churchill Alternative School. Aerial photos of the study area intersections are provided in Section 3.2.2.

Target PLOS, BLOS, TLOS, TkLOS and Auto LOS for the study area intersections are based on the targets within 300m of a school, as identified in Exhibit 22 of the MMLOS guidelines. The following table summarizes the findings of the MMLOS intersection analysis.

A site visit was conducted to review the intersection operations. Although the north and south approaches to the Churchill Avenue/Richmond Road intersection are painted as one approach lane, the wide lane widths permit drivers to travel around a queued vehicle. For the purposes of the intersection capacity analysis, the north and south approaches to this intersection have been modeled as a through/left turn lane and a right turn lane.

Detailed intersection MMLOS calculations are included in **Appendix K**.

Table 10: Intersection MMLOS Summary

Intersection	PLOS	BLOS	TLOS	TkLOS	Auto LOS
Churchill Avenue/ Byron Avenue	D	D	C	F	E
Target	A	B	-	D	E
Churchill Avenue/ Richmond Road	D	D	F	F	E
Target	A	B	-	D	E

The Churchill Avenue/Byron Avenue and Churchill Avenue/Richmond Road intersections do not meet the target PLOS A, BLOS B, TkLOS D, however they do meet the target Auto LOS E.

A reduction in the pedestrian crossing distance would have the greatest improvement to the PLOS at these intersections. To achieve the target BLOS, consideration could be given by the City providing a two-stage left turn bike box on all legs of these intersections. To achieve the target TkLOS, an effective turn radius greater than 15m is required on all four corners of these intersections. Increasing the turn radius at these intersections could be considered by the City, however it should be noted that the increased radius will have a negative impact on the PLOS.

5.7.2 2021 and 2026 Background Intersection Operations

Intersection capacity analysis has been completed for the 2021 and 2026 background traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0).

The results of the intersection capacity analysis are summarized in the following table. Detailed summary sheets are provided in **Appendix J**.

Table 11: 2021 and 2026 Background Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
Churchill Avenue/ Byron Avenue	0.73	C	WBT	0.88	D	WBT
Churchill Avenue/ Richmond Road	0.86	D	EBL	0.83	D	WBT/R
Byron Avenue/ Highcroft Avenue	10 sec	B	NB	10 sec	B	NB

Based on the foregoing, critical movements at all study area intersections are anticipated to operate with a LOS D or better under background traffic conditions. Based on the previous table, the background traffic conditions appear to improve when compared to the existing traffic conditions. This can be attributed to differences in the Peak Hour Factor (set to 0.90 in existing conditions and 1.0 in future conditions, as per the 2017 TIA Guidelines).

5.7.3 2021 and 2026 Total Intersection Operations

Intersection capacity analysis has been completed for the 2021 and 2026 total traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0).

The results of the intersection capacity analysis are summarized in the following table. Detailed summary sheets are provided in **Appendix J**.

Table 12: 2021 and 2026 Total Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
Churchill Avenue/ Byron Avenue	0.76	C	WBT	0.89	D	WBT
Churchill Avenue/ Richmond Road	0.86	D	EBL	0.83	D	WBT/R
Byron Avenue/ Highcroft Avenue	11 sec	B	NB	13 sec	B	NB

Based on the foregoing, the addition of site generated traffic volumes are not anticipated to have a significant impact to the intersection operations within the study area.

For the purposes of this analysis, it has been assumed that all trips from the south will travel north on Churchill Avenue to Byron Avenue, and turn right from Byron Avenue onto Highcroft Avenue. However it is acknowledged that some of these drivers may choose to turn right from Churchill Avenue onto Kenwood Avenue, and travel northbound on Highcroft Avenue to access the site.

Based on anticipated trip distribution, one vehicle during the AM peak hour and three vehicles during the PM peak hour are anticipated to arrive from the south. If these trips were to use Kenwood Avenue/Highcroft Avenue to access the site during the PM peak hour, this would result in one new vehicle approximately every 20 minutes. This increase in traffic is not anticipated to be noticeable and will not have a significant impact on the existing operations along Highcroft Avenue.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing, the conclusions and recommendations of this TIA can be summarized as follows:

Development Design and Parking

- Byron Place will be partially closed to provide a public park area in the southeast corner of the Churchill Avenue/Byron Avenue intersection. As a fire access route must be provided to within 15m of the main building entrance, a portion of Byron Place will remain open to function as the fire route for the proposed development.
- The width of Byron Place will be reduced to 6.0m in order to provide a wider landscape buffer between the proposed building and sidewalk. The turnaround hammerhead within Byron Place will also facilitate short-term parking for drop-offs/pick-ups.
- On-site pedestrian facilities will be provided between the retail entrances and the sidewalks along Churchill Avenue. A sidewalk will be provided along the northern frontage of the site

along Byron Place, providing pedestrian connectivity between the residential entrances and the existing sidewalk along Churchill Avenue.

- A garbage room will be provided within the building. Garbage bins will be wheeled down the pathway south of the building, and will be picked up curbside along Churchill Avenue.
- All required TDM-supportive design and infrastructure measures in the TDM checklist are met.
- The proposed vehicular and bicycle parking meets the minimum requirement of the ZBL.

Boundary Streets

- Churchill Avenue currently meets the target BLOS B, TkLOS D and Auto LOS E, however it does not meet the target PLOS A. Byron Avenue and Highcroft Avenue meet the target BLOS and Auto LOS, however they do not meet the target PLOS A.
- To achieve the target PLOS A along both Churchill Avenue and Byron Avenue, either a reduction in the daily curb traffic to less than 3000 vehicles per day or a reduction in the operational speed to 30km/hr is required.
- To achieve the target PLOS A along Highcroft Avenue either a 1.8m sidewalk with 2.0m boulevard or a 2.0m sidewalk with 0.5m boulevard is required. Consideration could be given by the City to improve the sidewalk on the east side of Highcroft Avenue.
- As a sidewalk is not currently provided on the west side of Highcroft Avenue, a new sidewalk along the frontage of the subject site would not provide pedestrian system connectivity to the south. As such, no new sidewalk is proposed along Highcroft Avenue.
- The City of Ottawa's Ultimate Cycling Network identifies a future separated major pathway on the north side of Byron Avenue. The separated pathway will ultimately result in a BLOS A along Byron Avenue

Access Design

- Site access to Highcroft Avenue will provide access to the full movement intersection at Byron Avenue. The existing curb extension restricting the southbound through movement along Highcroft Avenue south of Byron Place will be removed and a new island will be provided to south of the proposed access to the parking garage for the proposed development.
- The island will be offset 2.0m from the existing western curb-line to permit southbound cyclists along Highcroft Avenue, and will maintain a 4.25m northbound vehicle lane. The width of the northbound vehicle lane and southbound cycle lane are consistent with the recommended clearance widths required for snow removal identified in Table 5 of the City's Traffic Calming Design Guidelines.
- The width and length of the proposed island will eliminate any opportunity for vehicles leaving the site to turn right to travel southbound on Highcroft Avenue, as well as restrict westbound vehicles along Byron Avenue to cut through the residential community to avoid the traffic light at Churchill Avenue/Byron Avenue. The proposed island width (4.75m included curb offset) is an improvement on the existing curb extension which narrows the roadway by approximately 2.4m.
- The proposed driveway width and location adheres to the requirements of the City's ZBL and Private Approach By-law.
- The proposed driveway exceeds the minimum TAC corner clearance requirement to the Highcroft Avenue/Byron Place intersection.

Transportation Demand Management and Transit

- To encourage travel by sustainable modes, the proponent agrees to implement the following TDM measures from the checklist:
 - display local area maps with walking/cycling access routes and key destinations at major entrances;
 - display relevant transit schedules and route maps at entrances;
 - unbundle parking cost from monthly rent; and
 - provide multimodal travel option information package to new residents.

Intersection Design

- The Churchill Avenue/Byron Avenue and Churchill Avenue/Richmond Road intersections do not meet the target PLOS A, BLOS B, TkLOS D, however they do meet the target Auto LOS E.
- A reduction in the pedestrian crossing distance would have the greatest improvement to the PLOS at these intersections.
- To achieve the target BLOS, consideration could be given by the City to reducing the operational speed to 50km/hr and providing a two-stage left turn bike box on all legs of these intersections.
- To achieve the target TkLOS, an effective turn radius greater than 15m is required on all four corners of these intersections. Increasing the turn radius at these intersections could be considered by the City, however it should be noted that the increased radius will have a negative impact on the PLOS.
- Critical movements at all study area intersections are anticipated to operate with a LOS D or better under background traffic conditions.
- The addition of site generated traffic volumes are not anticipated to have a significant impact to the intersection operations within the study area.
- Based on anticipated trip distribution, one vehicle during the AM peak hour and three vehicles during the PM peak hour are anticipated to arrive from the south. If these trips were to use Kenwood Avenue/Highcroft Avenue to access the site during the PM peak hour, this would result in one new vehicle approximately every 20 minutes. This increase in traffic is not anticipated to be noticeable and will not have a significant impact on the existing operations along Highcroft Avenue.

NOVATECH

Prepared by:



Brad Byvelds, P. Eng.
Project Coordinator | Transportation/Traffic

APPENDIX A

Proposed Site Plan

APPENDIX B

TIA Screening Form

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	433 and 435 Churchill Avenue North, 468 and 472 Byron Place
Description of Location	The 0.19 ha parcel is four existing properties bound by Churchill Avenue North to west, Highcroft Avenue to the east and Byron Place to the north
Land Use Classification	General Mixed Use
Development Size (units)	84 residential units
Development Size (m ²)	325m² retail
Number of Accesses and Locations	One proposed access on Highcroft Avenue
Phase of Development	N/A
Buildout Year	2019

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m ²
Industrial	5,000 m ²
Fast-food restaurant or coffee shop	100 m ²
Destination retail	1,000 m ²
Gas station or convenience market	75 m ²

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?		X
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*		X

*DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?		X
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		X
Is the proposed driveway 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)?	X	
Is the proposed driveway within auxiliary lanes of an intersection?		X
Does the proposed driveway make use of an existing median break that serves an existing site?		X
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		X
Does the development include a drive-thru facility?		X

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?	X	
Does the development satisfy the Location Trigger?		X
Does the development satisfy the Safety Trigger?	X	

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

APPENDIX C

OC Transpo System Information



★ SUBJECT SITE

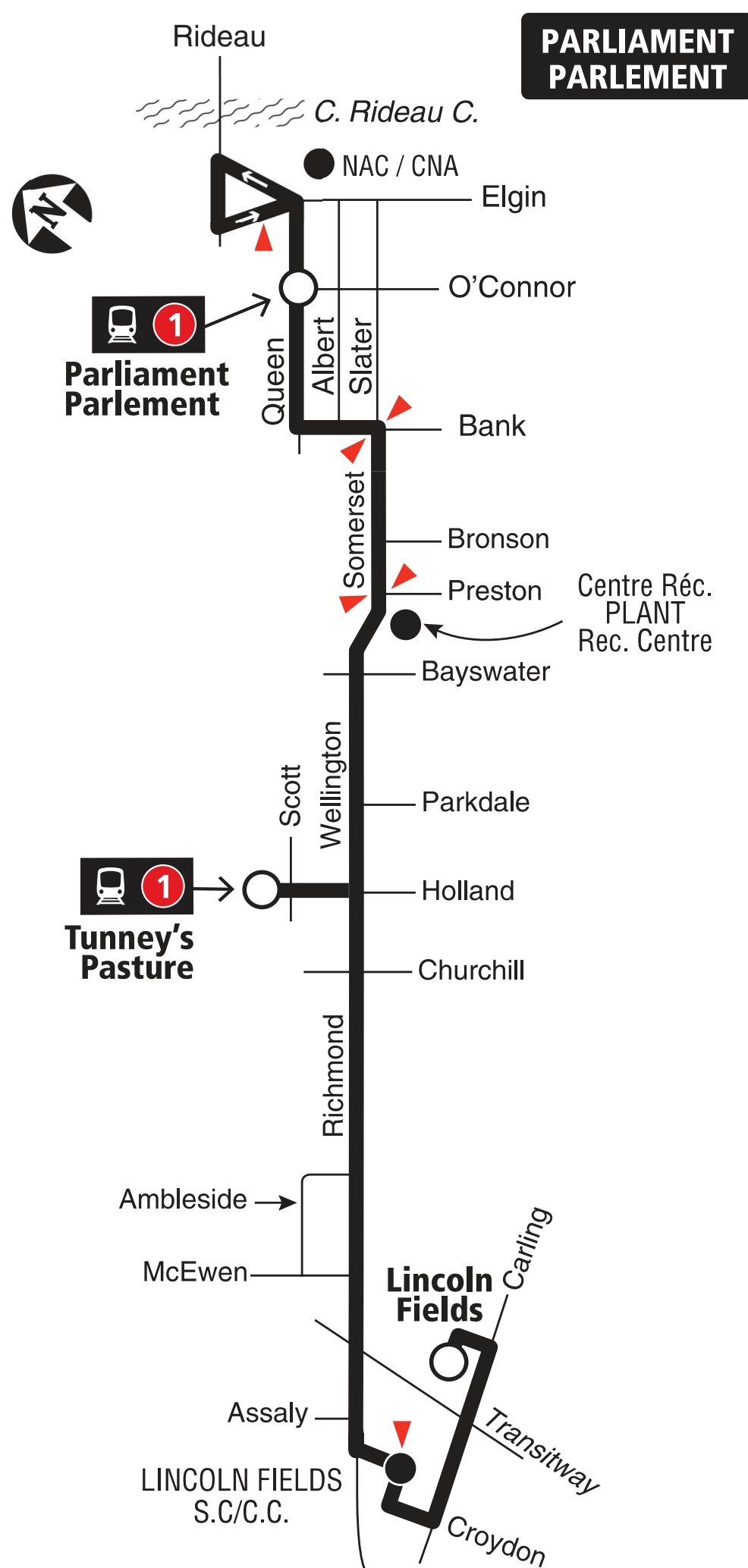
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Fréquent

7 days a week / 7 jours par semaine

All day service

Service toute la journée



LINCOLN FIELDS



Transitway & Station



Timepoint / Heures de passage

2018.09



Schedule / Horaire.....613-560-1000

Text / Texto560560

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

Customer Relations

Service à la clientèle **613-741-4390**

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

Security / Sécurité **613-741-2478**

Effective Septembre 2, 2018

En vigueur 2 septembre 2018



INFO 613-741-4390
octranspo.com

FORMER / ANCIEN 150

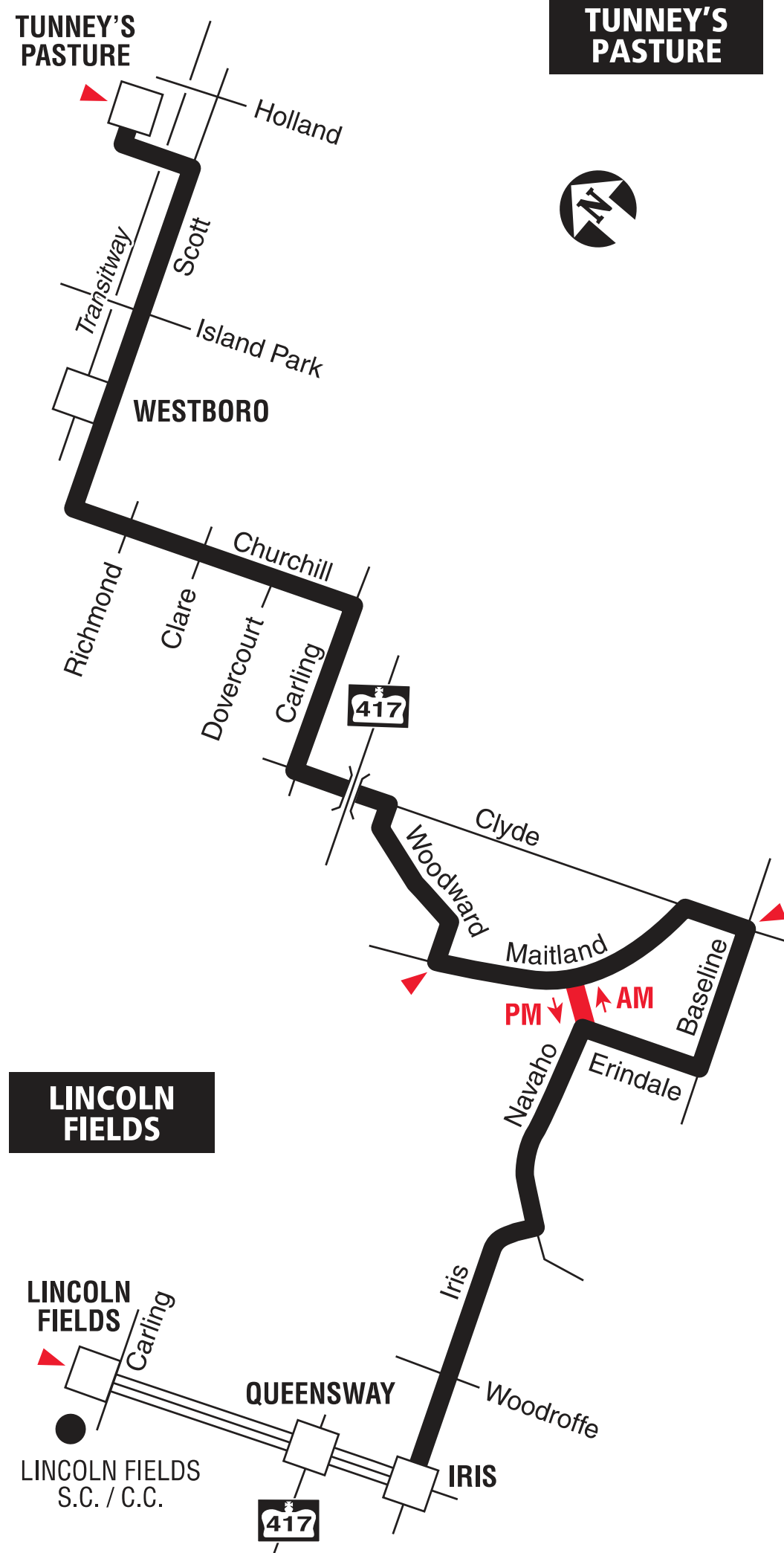
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TUNNEY'S PASTURE LINCOLN FIELDS

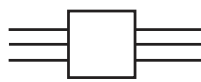
Local

Monday to Saturday / Lundi au samedi

No service Sat. eve. or all day Sunday / Aucun service le soir le sam. ou toute la journée dimanche



Legend • Légende



Transitway & Station



Peak Periods only /
Périodes de pointe seulement



Timepoint / Heures de passage

2017.04



Schedule / Horaire.....613-560-1000

Text / Texto560560

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

Customer Relations

Service à la clientèle **613-842-3600**

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

Security / Sécurité **613-741-2478**

Effective April 24, 2017

En vigueur 24 avril 2017



INFO 613-741-4390
octranspo.com

FORMER / ANCIEN 11X

151

TUNNEY'S
PASTURE

CARLINGWOOD

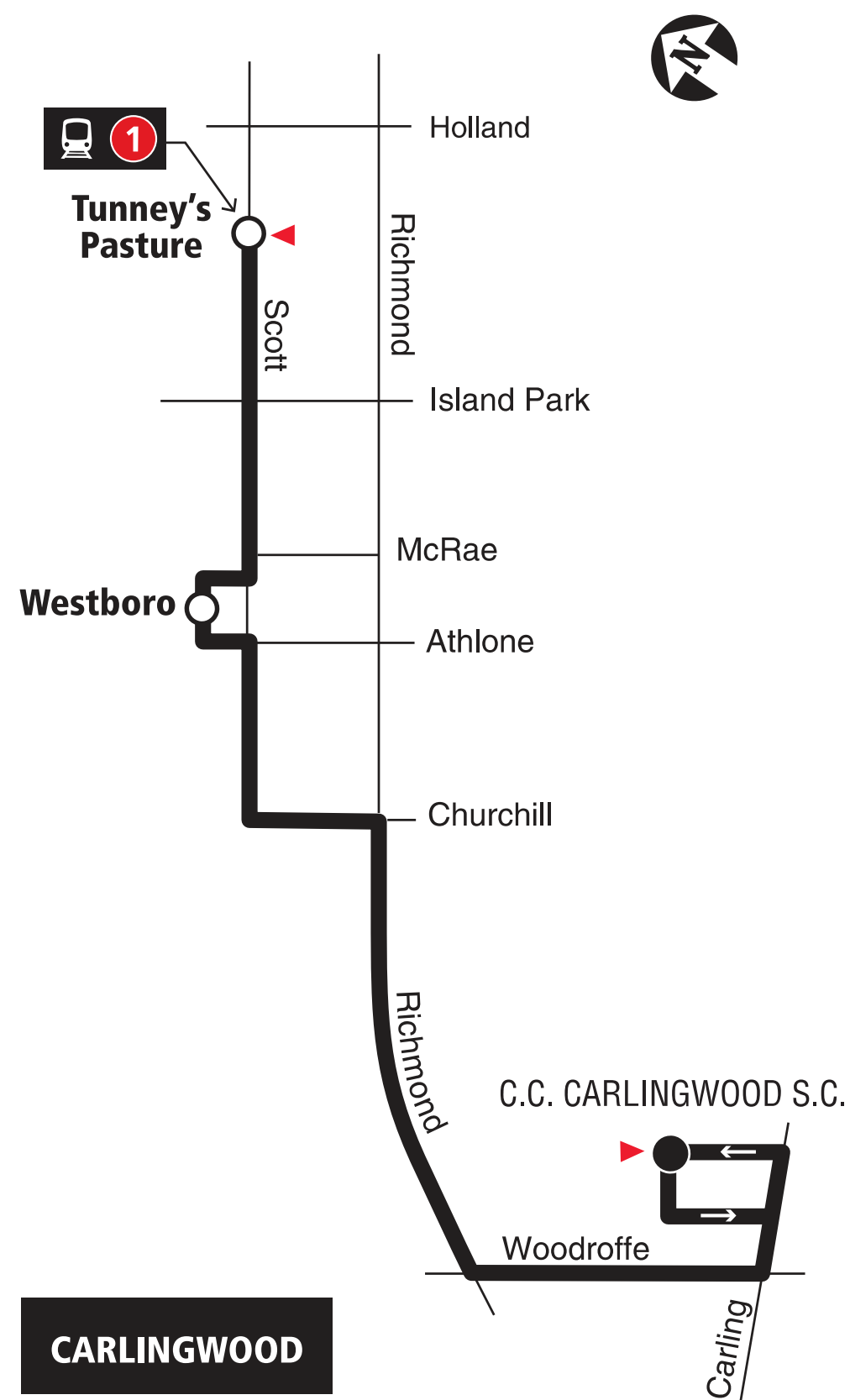
Local

Monday to Friday / Lundi au vendredi

Selected time periods only

Périodes sélectionnées seulement

TUNNEY'S
PASTURE



CARLINGWOOD



Station



Timepoint / Heures de passage

2018.06



Schedule / Horaire.....613-560-1000

Text / Texto560560

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

Customer Relations

Service à la clientèle **613-842-3600**

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

Security / Sécurité **613-741-2478**

Effective June 24, 2018

En vigueur 24 juin 2018



INFO 613-741-4390
octranspo.com

Hi Brad,

Please see the requested data below. All data is for an average weekday of the Winter 2018 booking period, during the AM and PM peak periods (6-9am and 3-6pm, respectively). Passenger counts for stops 4864 and 4865 are not available as Route 11 did not serve them during the Winter 2018 booking.

As shown below, some stops are served by Route 11 and others by Route 50. Both routes are planned to operate with 40-foot buses during the AM and PM peak periods.

Stop	Route	Direction	AM Peak Period			PM Peak Period		
			Total Boardings	Total Alightings	Average Load at Departure	Total Boardings	Total Alightings	Average Load at Departure
4876	11	Westbound	1	15	8	13	19	17
4987	11	Eastbound	5	19	17	18	7	14
	50	Eastbound	1	4	15	3	1	10
5616	50	Westbound	0	0	9	5	3	12
7538	50	Eastbound	6	5	15	1	1	10
7539	50	Westbound	0	2	9	2	5	11

If you have any questions, please don't hesitate to contact me.

Best regards,
Genya

APPENDIX D

Traffic Count Data

Turning Movement Count - Peak Hour Diagram

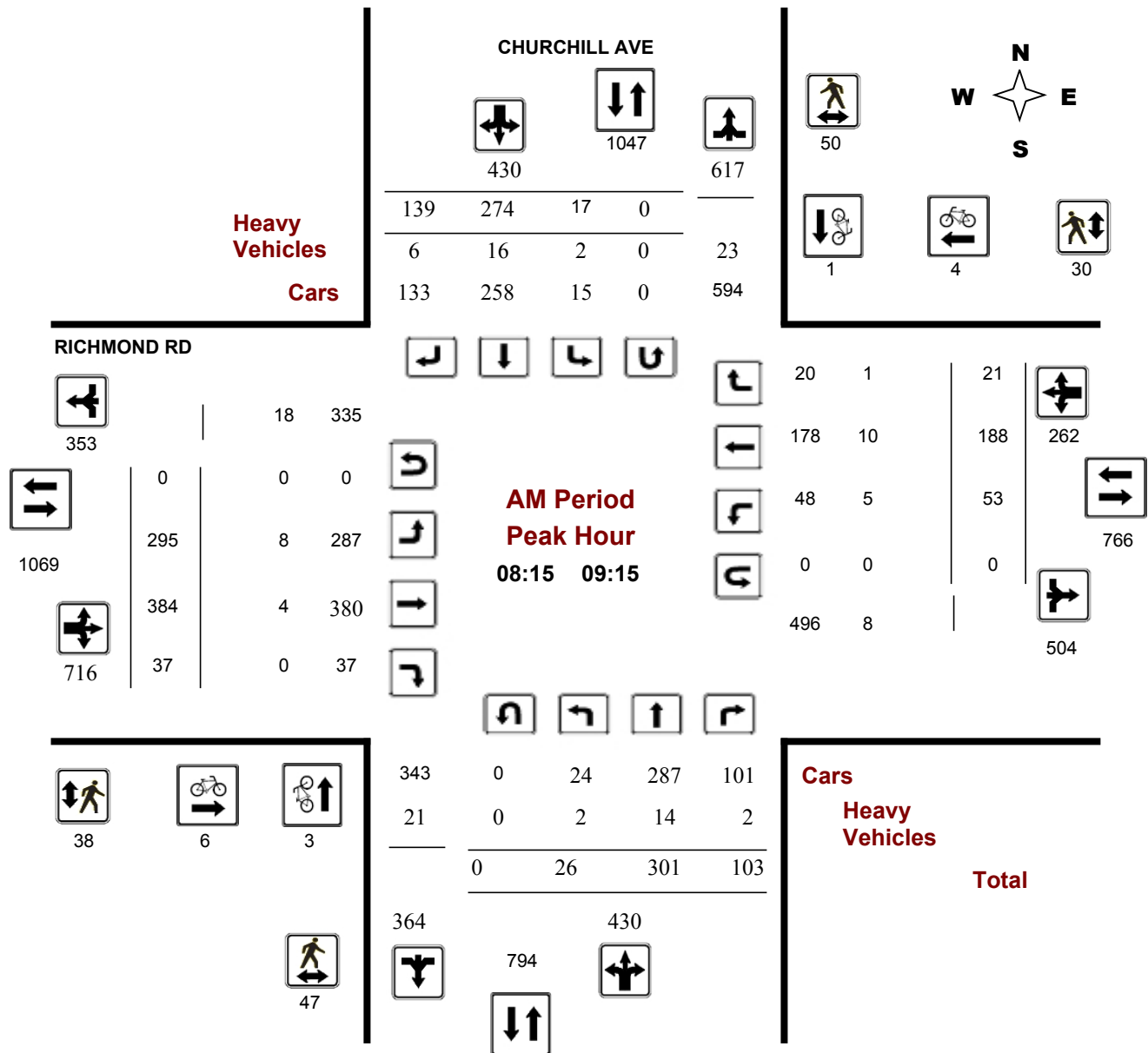
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Turning Movement Count - Peak Hour Diagram

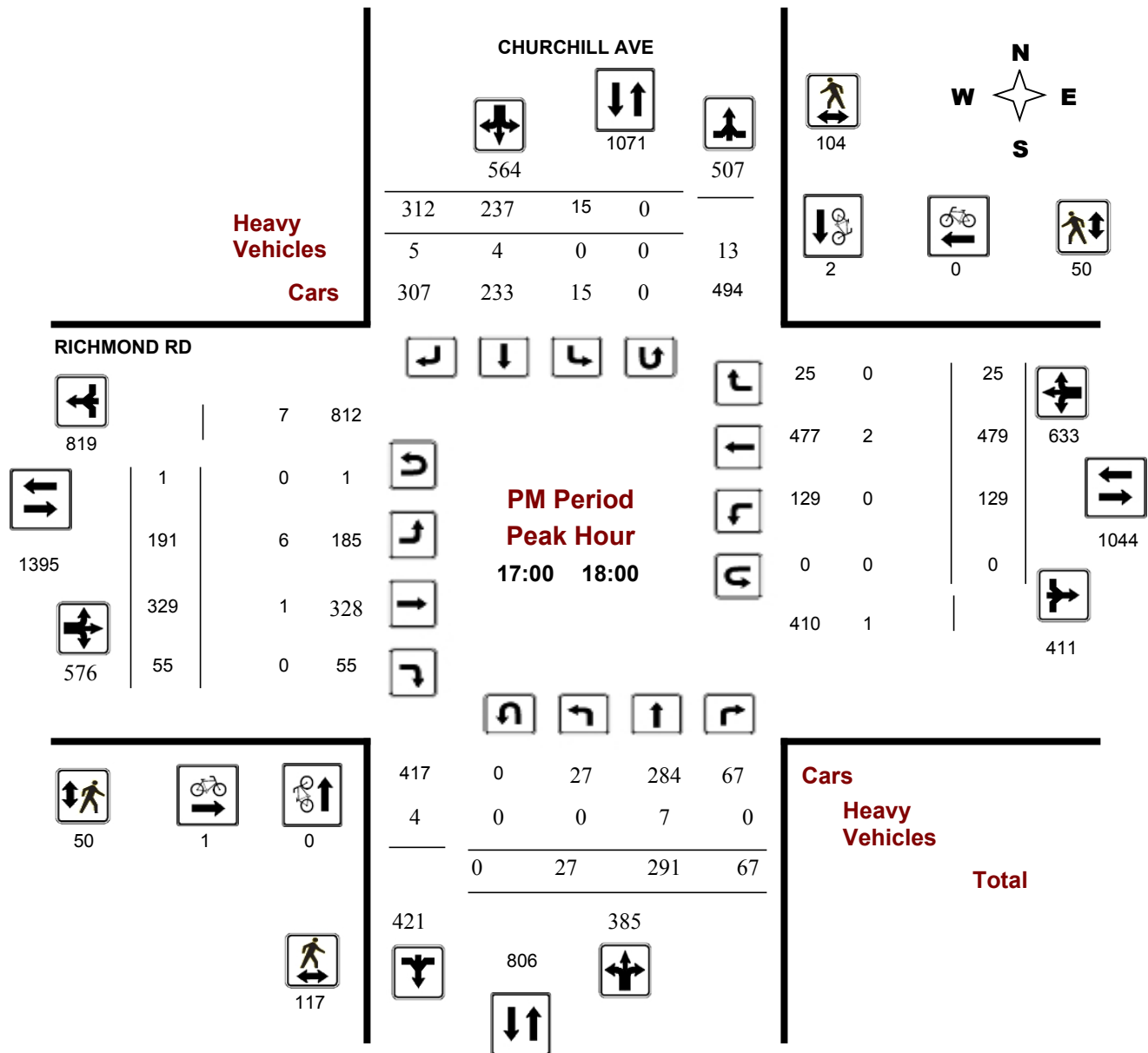
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Turning Movement Count - Peak Hour Diagram

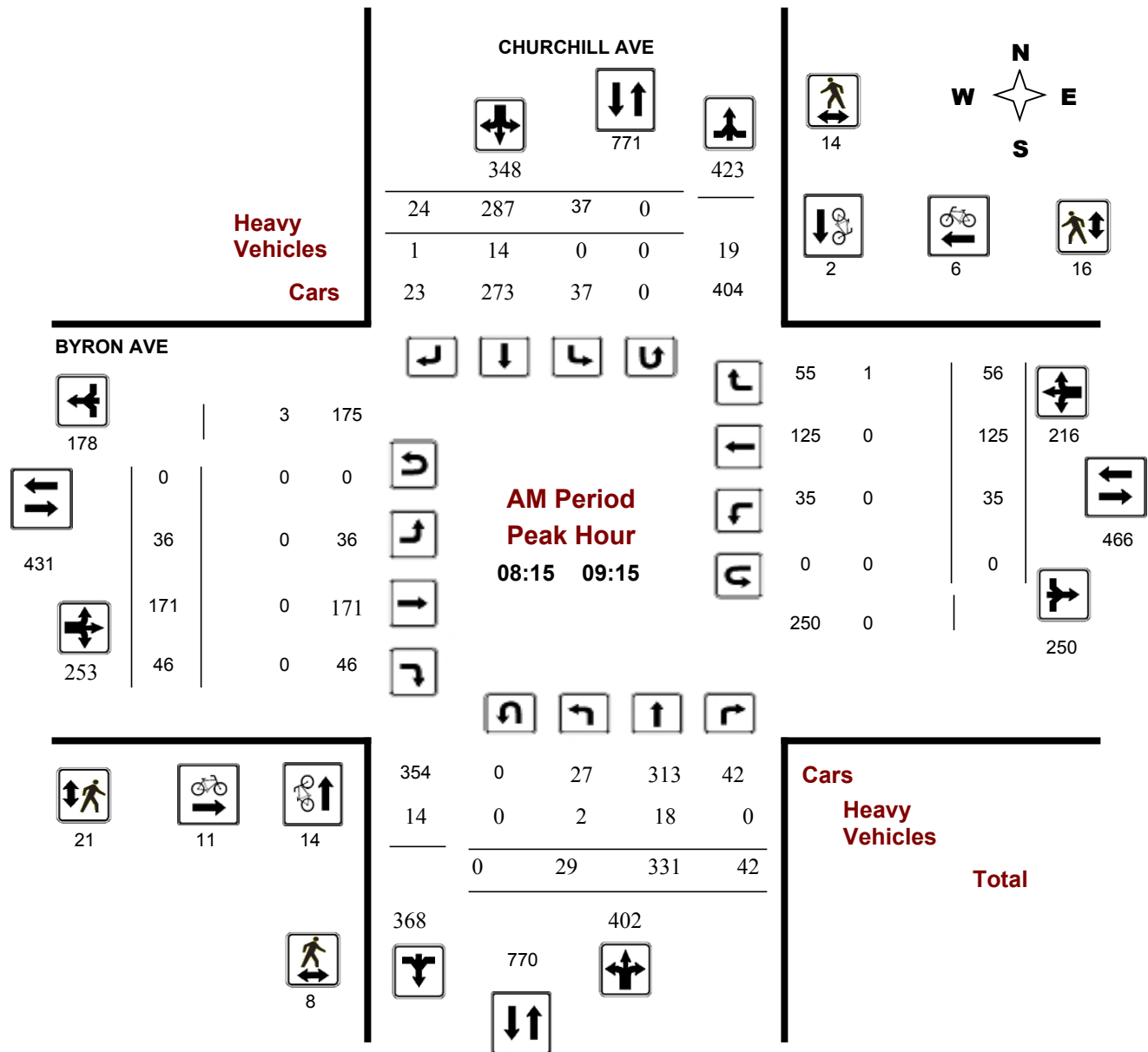
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Start Time: 07:00

WO No: 36253

Device: Miovision



Turning Movement Count - Peak Hour Diagram

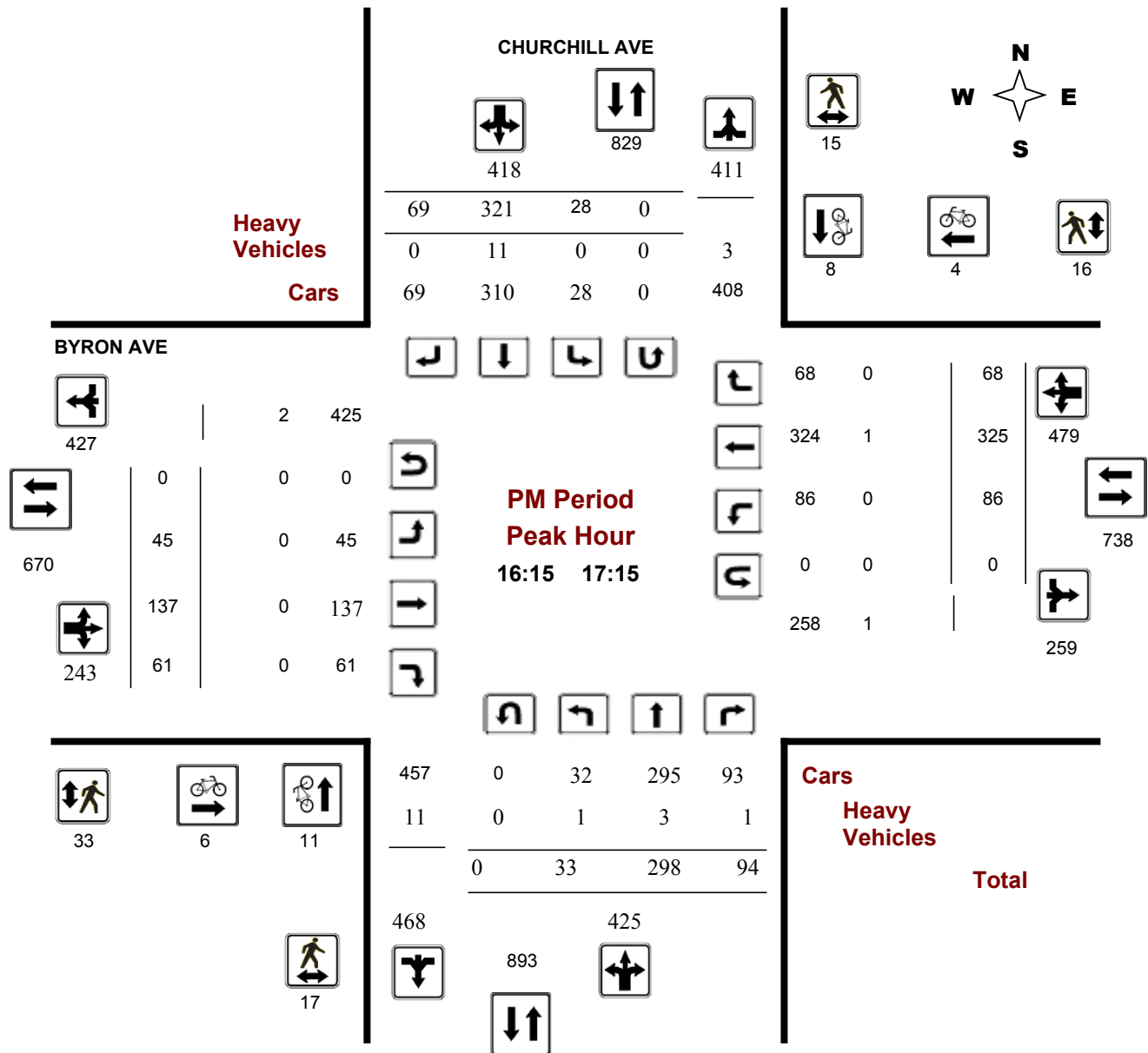
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

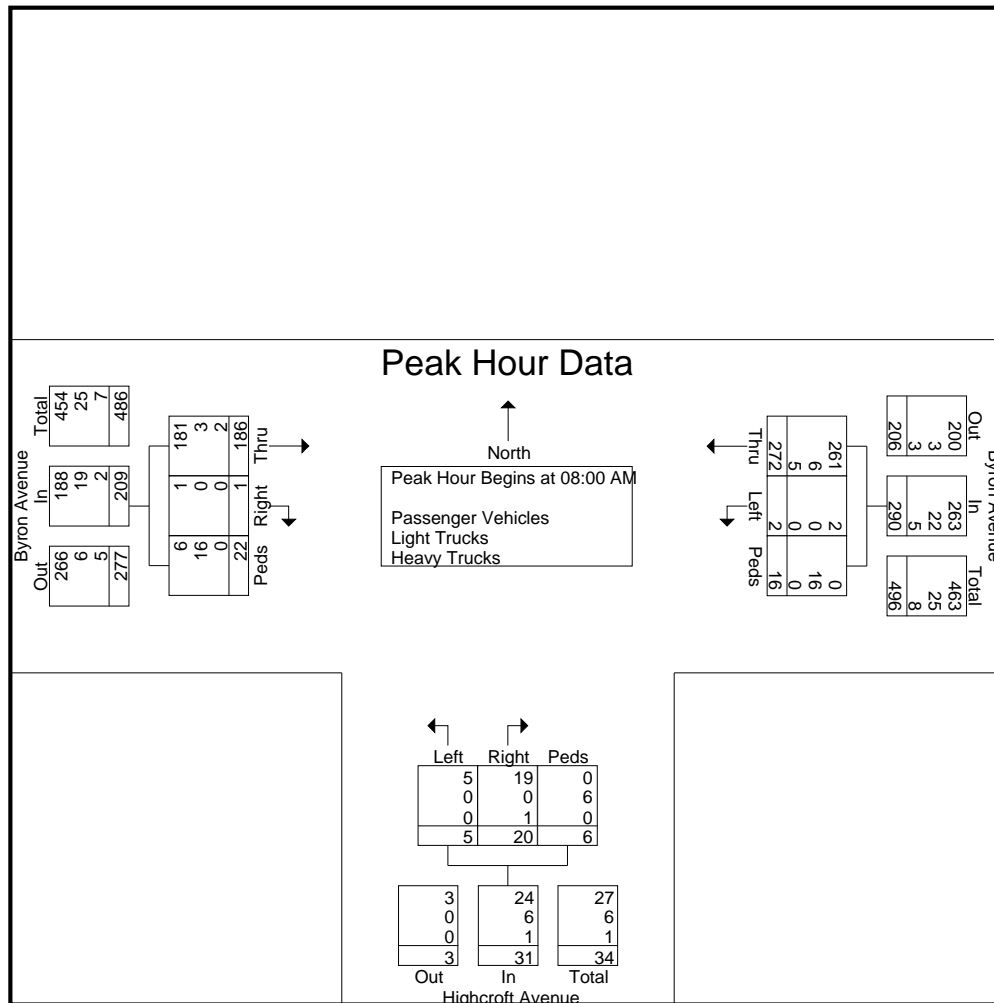
Start Time: 07:00

WO No: 36253

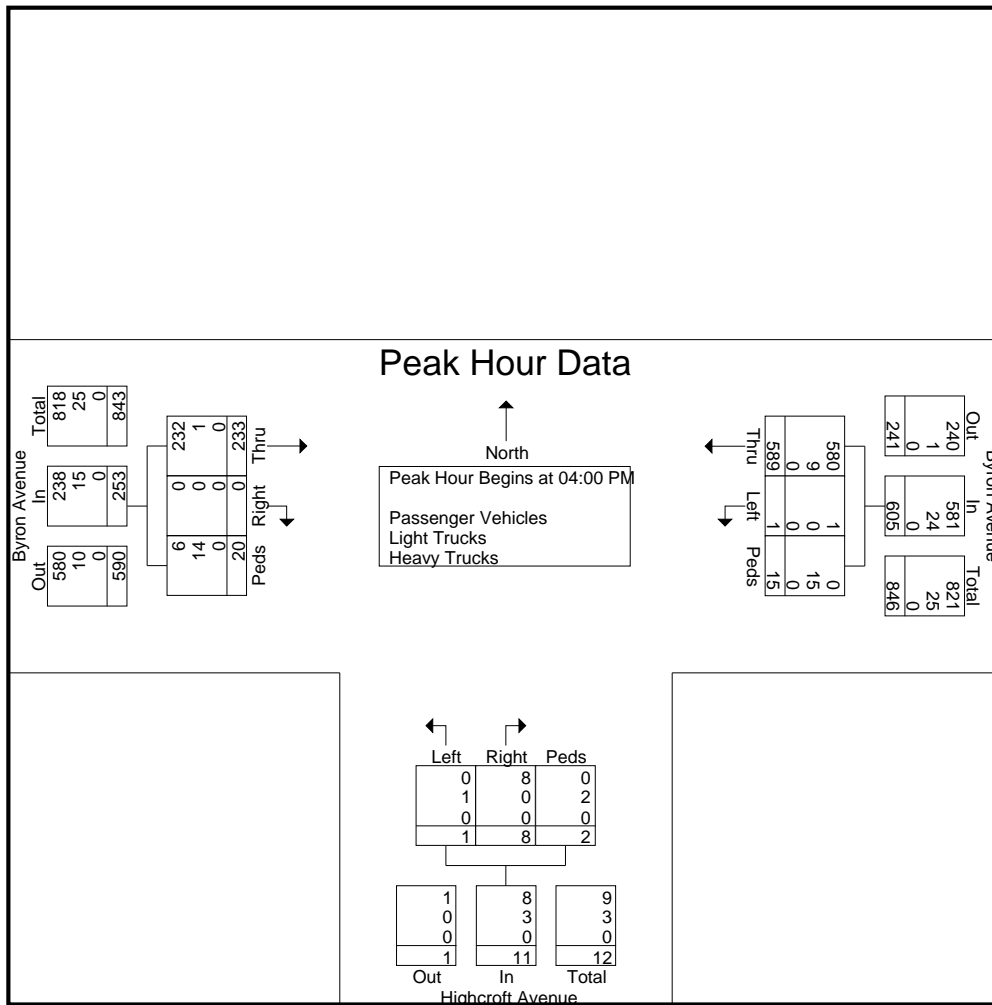
Device: Miovision



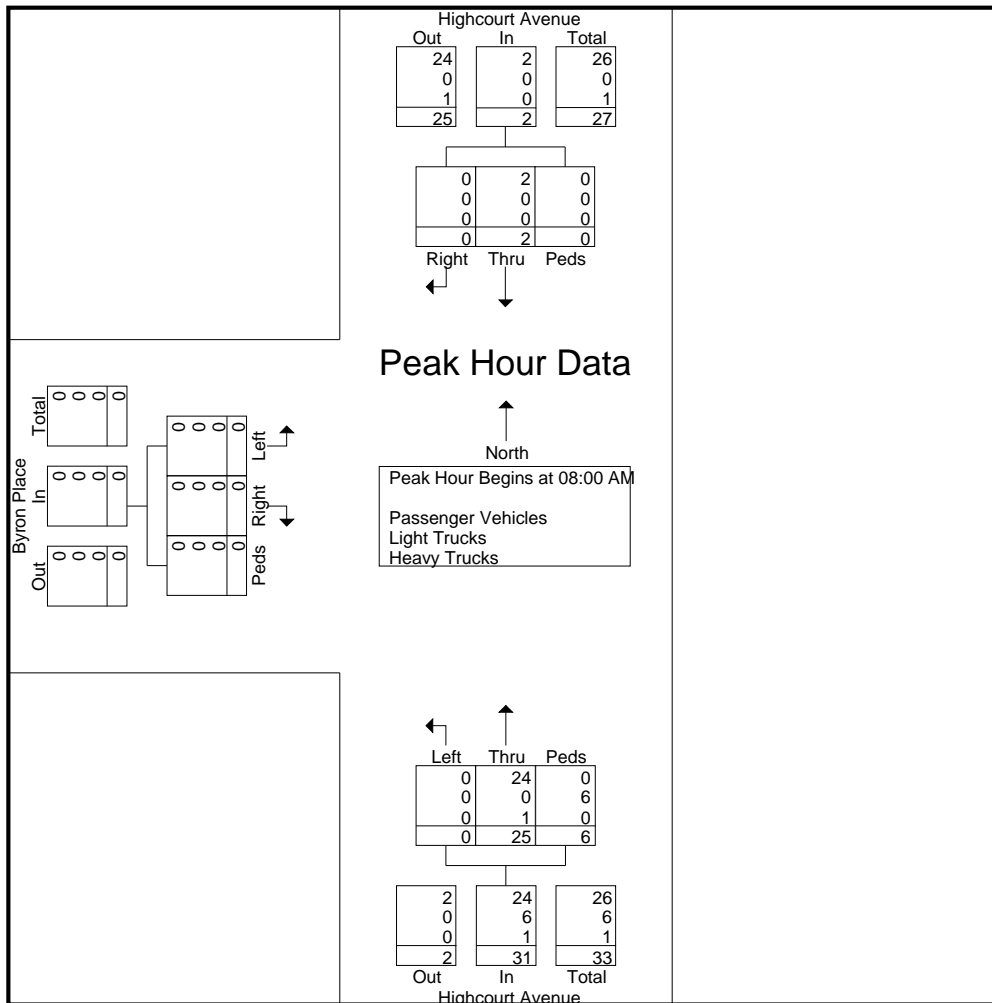
File Name : Byron_Highcroft
Site Code : 118024__
Start Date : 10/3/2018
Page No : 5



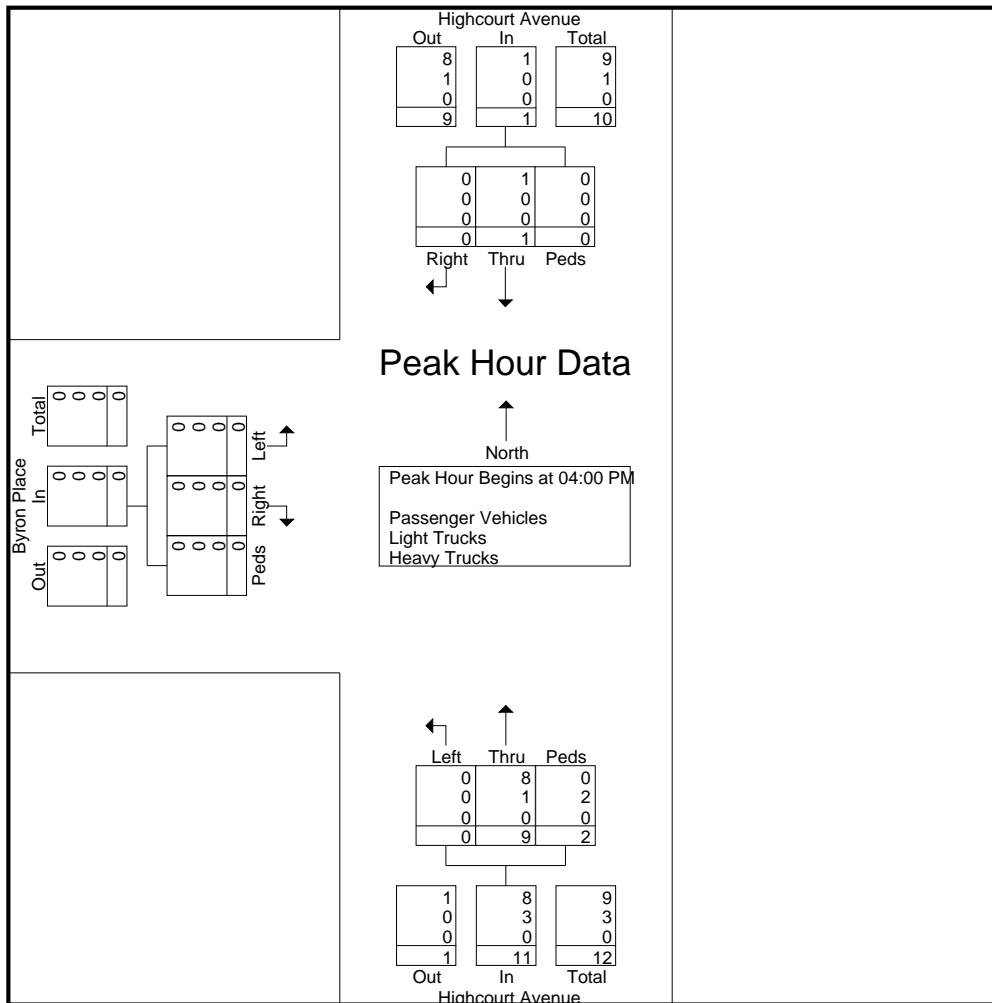
File Name : Byron_Highcroft
Site Code : 118024__
Start Date : 10/3/2018
Page No : 9



File Name : Highcroft_ByronPL
Site Code : 118024____
Start Date : 10/3/2018
Page No : 5



File Name : Highcroft_ByronPL
Site Code : 118024____
Start Date : 10/3/2018
Page No : 9



Traffic Signal Timing

City of Ottawa, Transportation Services Department

Traffic Signal Operations Unit

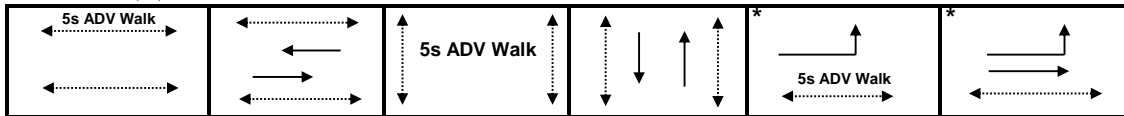
Intersection:	Main: Richmond	Side: Churchill N
Controller:	MS-3200	TSD: 5229
Author:	Yassine Bennani	Date: 24-Sep-2018

Existing Timing Plans[†]

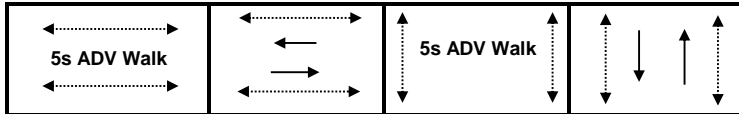
	Plan					Ped Minimum Time		
	AM Peak 1	Off Peak 2	PM Peak 3	Night 4	Weekend 5	Walk	DW	A+R
Cycle	80	75	90	65	75			
Offset	43	16	0	29	16			
EB Thru	45	43	60	33	43	16	9	3.3+2.8
WB Thru	31	31	45	33	31	16	9	3.3+2.8
NB Thru	35	32	30	32	32	7	9	3.6+2.6
SB Thru	35	32	30	32	32	7	9	3.6+2.6
EB Left	14	12	15	-	12	-	-	3.3+2.8

Phasing Sequence[‡]

Plan: 1, 2, 3 & 5



Plan: 4



Notes: 1) For the east-west direction, there is a straight thru green arrow displayed during the 5 second advanced walk interval. After this 5 seconds, the green arrow changes to a green ball.

Schedule

Weekday		Saturday		Sunday	
Time	Plan	Time	Plan	Time	Plan
0:15	4	0:15	4	0:15	4
6:30	1	6:30	2	6:30	2
9:30	2	9:00	5	9:00	5
15:00	3	18:30	2	18:00	2
18:30	2	22:30	4	22:30	4
22:30	4				

Notes

[†]: Time for each direction includes amber and all red intervals

[‡]: Start of first phase should be used as reference point for offset

Asterisk (*) Indicates actuated phase

(fp): Fully Protected Left Turn

◀.....▶ Pedestrian signal

Cost is \$56.50 (\$50 + HST)

Traffic Signal Timing

City of Ottawa, Transportation Services Department

Traffic Signal Operations Unit

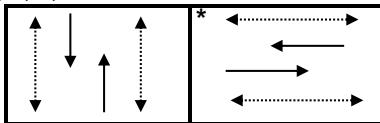
Intersection:	Main: Churchill	Side: Byron
Controller:	ATC-3	TSD: 5634
Author:	Yassine Bennani	Date: 24-Sep-2018

Existing Timing Plans†

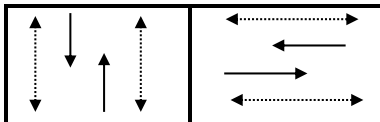
	Plan					Ped Minimum Time				
	AM Peak 1	Off Peak 2	PM Peak 3	Night 4	Weekend 5	AM School 11	PM School 12	Walk	DW	A+R
Cycle	80	75	90	60	75	80	75			
Offset	74	45	40	X	45	74	45			
NB Thru	42	40	45	32	40	42	40	10	9	3.3+2.1
SB Thru	42	40	45	32	40	42	40	10	9	3.3+2.1
EB Thru	38	35	45	28	35	38	35	10	15	3.3+2.3
WB Thru	38	35	45	28	35	38	35	10	15	3.3+2.3

Phasing Sequence‡

Plan: 1, 2, 3, 4, 5



Plan: 11, 12



Schedule

Weekday		Saturday		Sunday	
Time	Plan	Time	Plan	Time	Plan
0:15	4	0:15	4	0:15	4
6:30	1	6:30	2	6:30	2
7:45	11	9:00	5	9:00	5
8:15	1	18:30	2	18:00	2
9:30	2	22:30	4	22:30	4
14:15	12				
15:00	3				
18:30	2				
22:30	4				

Notes

†: Time for each direction includes amber and all red intervals
‡: Start of first phase should be used as reference point for offset
Asterisk (*) Indicates actuated phase
(fp): Fully Protected Left Turn
◄.....► Pedestrian signal

Cost is \$56.50 (\$50 + HST)

APPENDIX E

Collision Records



City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2013 **To:** December 31, 2017

Location: BYRON AVE @ CHURCHILL AVE

Traffic Control: Traffic signal

Total Collisions: 8

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jul-25, Fri,15:29	Clear	Other	P.D. only	Loose sand or gravel	North	Reversing	Construction equipment	Other motor vehicle	
					North	Stopped	Pick-up truck	Other motor vehicle	
2014-Oct-02, Thu,10:57	Clear	Rear end	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
2015-Jan-29, Thu,16:00	Clear	Angle	P.D. only	Ice	North	Turning right	Pick-up truck	Skidding/sliding	
					West	Stopped	Pick-up truck	Other motor vehicle	
2015-Jun-09, Tue,10:04	Rain	Rear end	P.D. only	Wet	North	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					North	Stopped	Automobile, station wagon	Other motor vehicle	
2016-Mar-26, Sat,12:30	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2016-Jun-11, Sat,09:49	Rain	Turning movement	P.D. only	Wet	East	Turning left	Automobile, station wagon	Other motor vehicle	

					West	Going ahead	Automobile, station wagon	Other motor vehicle
					South	Stopped	Pick-up truck	Other motor vehicle
2017-Sep-12, Tue,14:43	Clear	Turning movement	P.D. only	Dry	West	Turning right	Unknown	Cyclist
					West	Going ahead	Bicycle	Other motor vehicle
2013-Jun-11, Tue,13:50	Rain	Angle	P.D. only	Wet	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle

Location: BYRON AVE @ HIGHCROFT AVE

Traffic Control: Stop sign

Total Collisions: 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2013-Jun-27, Thu,04:16	Clear	SMV other	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Building or wall	

Location: CHURCHILL AVE @ RICHMOND RD

Traffic Control: Traffic signal

Total Collisions: 33

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Feb-26, Wed,14:52	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-May-01, Thu,19:54	Clear	SMV other	Non-fatal injury	Dry	East	Turning left	Pick-up truck	Pedestrian	1
2014-Jun-13, Fri,06:47	Rain	Angle	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	

2014-Oct-06, Mon,00:46	Clear	Angle	P.D. only	Dry	South	Going ahead	Unknown	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Oct-20, Mon,09:40	Clear	Sideswipe	P.D. only	Dry	North	Going ahead	Construction equipment	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Jan-16, Fri,10:39	Clear	Angle	P.D. only	Slush	West	Pulling away from shoulder or curb	Automobile, station wagon	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle
2015-Jun-18, Thu,09:14	Clear	Sideswipe	P.D. only	Dry	South	Turning right	Truck - tank	Other motor vehicle
					South	Turning right	Automobile, station wagon	Other motor vehicle
2015-Feb-26, Thu,17:03	Clear	Angle	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2015-Jan-31, Sat,20:21	Snow	Turning movement	P.D. only	Loose snow	East	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Apr-11, Sat,12:34	Clear	Sideswipe	P.D. only	Dry	West	Changing lanes	Automobile, station wagon	Other motor vehicle
					West	Turning left	Pick-up truck	Other motor vehicle

2015-Jul-24, Fri,14:25	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Stopped	Truck and trailer	Other motor vehicle
2015-Jan-25, Sun,14:02	Clear	Rear end	Non-fatal injury	Dry	East	Turning left	Pick-up truck	Other motor vehicle
					East	Turning left	Automobile, station wagon	Other motor vehicle
					East	Turning left	Automobile, station wagon	Other motor vehicle
2016-Jun-17, Fri,05:29	Clear	Angle	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2015-Nov-19, Thu,10:56	Clear	Rear end	P.D. only	Wet	West	Unknown	Unknown	Other motor vehicle
					West	Stopped	Pick-up truck	Other motor vehicle
2015-Oct-03, Sat,11:00	Clear	Rear end	P.D. only	Dry	West	Slowing or stopping	Pick-up truck	Other motor vehicle
					West	Stopped	Pick-up truck	Other motor vehicle
2016-Jan-04, Mon,12:08	Clear	Rear end	P.D. only	Wet	South	Changing lanes	Pick-up truck	Other motor vehicle
					South	Turning right	Automobile, station wagon	Other motor vehicle
2016-Aug-07, Sun,12:12	Clear	Rear end	P.D. only	Dry	South	Slowing or stopping	Automobile, station wagon	Other motor vehicle
					South	Stopped	Pick-up truck	Other motor vehicle

2016-Jun-02, Thu,14:22	Clear	SMV other	Non-fatal injury	Dry	South	Turning right	Automobile, station wagon	Pedestrian	1
2017-Sep-06, Wed,00:00	Clear	SMV unattended vehicle	P.D. only	Dry	Unknown	Unknown	Unknown	Unattended vehicle	
2017-Jan-28, Sat,15:02	Snow	Rear end	Non-fatal injury	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle	1
					East	Stopped	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	
2016-Dec-31, Sat,12:01	Snow	SMV other	Non-fatal injury	Loose snow	East	Turning left	Automobile, station wagon	Pedestrian	1
2016-Aug-13, Sat,00:00	Clear	SMV unattended vehicle	P.D. only	Dry	North	Unknown	Unknown	Unattended vehicle	
2016-Dec-09, Fri,08:40	Clear	Rear end	P.D. only	Ice	East	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Sep-26, Tue,19:08	Clear	Turning movement	P.D. only	Dry	North	Going ahead	Pick-up truck	Other motor vehicle	
					South	Turning left	Automobile, station wagon	Other motor vehicle	
2013-Jan-17, Thu,16:33	Clear	SMV unattended vehicle	P.D. only	Dry	South	Turning right	Municipal transit bus	Unattended vehicle	
2013-Feb-16, Sat,10:33	Clear	SMV other	Non-fatal injury	Dry	North	Turning right	Municipal transit bus	Pedestrian	1

2013-Apr-06, Sat,11:44	Clear	Rear end	P.D. only	Dry	East	Going ahead	Unknown	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Jun-13, Thu,13:00	Clear	Angle	P.D. only	Dry	South	Turning right	Automobile, station wagon	Other motor vehicle
					East	Turning left	Automobile, station wagon	Other motor vehicle
2013-Jun-17, Mon,18:52	Clear	Sideswipe	P.D. only	Dry	East	Merging	Automobile, station wagon	Other motor vehicle
					East	Turning left	Municipal transit bus	Other motor vehicle
2013-Jun-13, Thu,14:30	Clear	Rear end	P.D. only	Dry	South	Slowing or stopping	Pick-up truck	Other motor vehicle
					South	Stopped	Automobile, station wagon	Other motor vehicle
2013-Jul-28, Sun,12:50	Clear	SMV unattended vehicle	P.D. only	Dry	South	Turning right	Municipal transit bus	Unattended vehicle
2013-Aug-28, Wed,15:34	Clear	Sideswipe	P.D. only	Dry	South	Merging	Pick-up truck	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2013-Sep-24, Tue,11:51	Clear	Sideswipe	P.D. only	Dry	East	Pulling away from shoulder or curb	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle

APPENDIX F

Relevant Excerpts from Other Reports



Page | 6

APPENDIX G

Functional Design of Roadway Modifications

M:\2018\118024\CADD\Design\Traffic\118024-FD.dwg, 118024-FD, Apr 08, 2020 - 12:54pm, mhiller

LEGEND:

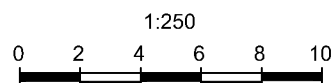
- ST — ST — EXISTING STORM SEWER
— S — S — EXISTING SANITARY SEWER
— W — W — EXISTING WATERMAIN
— OHW — OHW — EXISTING OVER HEAD HYDRO LINE
— G — G — EXISTING GAS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMANS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED, BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
3.	REVISED AS PER CITY COMMENTS	MAY 05/20	BJB
2.	ISSUED FOR PUBLIC OPEN HOUSE	JUN 4/19	BJB
1.	ISSUED FOR CITY REVIEW	APR 5/19	BJB

SCALE

1:250



DESIGN	RCH
CHECKED	BJB
DRAWN	RCH
CHECKED	BJB
APPROVED	JLL

FOR REVIEW ONLY

NOVATECH

Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY of OTTAWA
BYRON PLACE AT HIGHCROFT AVENUE

DRAWING NAME

FUNCTIONAL DESIGN

PROJECT No.
118024

REV
REV # 1

DRAWING No.
118024-FD

APPENDIX H

Transportation Demand Management 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: <i>Residential developments</i>		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	<input checked="" type="checkbox"/>
BASIC	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	<input checked="" type="checkbox"/>
BASIC	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	<input checked="" type="checkbox"/>
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 (<i>see Official Plan policy 4.3.3</i>)	<input checked="" type="checkbox"/>
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 (<i>see Official Plan policy 4.3.12</i>)	<input checked="" type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		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 (<i>see Official Plan policy 4.3.10</i>)	<input checked="" type="checkbox"/>
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 (<i>see Official Plan policy 4.3.10</i>)	<input checked="" type="checkbox"/>
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 (<i>see Official Plan policy 4.3.11</i>)	<input checked="" type="checkbox"/>
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	<input checked="" type="checkbox"/>
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	<input type="checkbox"/>
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	<input type="checkbox"/>
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	<input type="checkbox"/>
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)	<input type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		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 <i>Official Plan policy 4.3.6</i>)	<input checked="" type="checkbox"/>
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 <i>Zoning By-law Section 111</i>)	<input checked="" type="checkbox"/>
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 <i>Zoning By-law Section 111</i>)	<input checked="" type="checkbox"/>
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	<input type="checkbox"/>
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 <i>Zoning By-law Section 111</i>)	<input checked="" type="checkbox"/> Not Applicable (Less than 50 bicycle parking spaces required)
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	<input type="checkbox"/>
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)	<input type="checkbox"/>
3. TRANSIT		
3.1 Customer amenities		
BASIC	3.1.1 Provide shelters, lighting and benches at any on-site transit stops	<input type="checkbox"/>
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	<input type="checkbox"/>
BETTER	3.1.3 Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	<input type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		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	<input type="checkbox"/>
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 <i>Zoning By-law Section 94</i>)	<input type="checkbox"/>
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	<input type="checkbox"/>
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	<input checked="" type="checkbox"/>
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	<input type="checkbox"/>
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 <i>Zoning By-law Section 104</i>)	<input type="checkbox"/>
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 <i>Zoning By-law Section 111</i>)	<input type="checkbox"/>
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)	<input type="checkbox"/>

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

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

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

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

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

APPENDIX I

Segment MMLOS Analysis

Pedestrian Level of Service (PLOS)

Sidewalk Width	Boulevard Width	Avg. Daily Curb Lane Traffic Volume	Presence of On-Street Parking	Operating Speed	Segment PLOS
Churchill Avenue (East Side)					
2.0m	>2.0m	>3,000 vpd	No	50 km/hr	B
Churchill Avenue (West Side)					
2.0m	>2.0m	>3,000 vpd	Yes	50 km/hr	B
Byron Avenue (North Side)					
2.0m	None	>3,000 vpd	No	50 km/hr	C
Byron Avenue (South Side)					
1.8m	None	<3,000 vpd	No	50 km/hr	B
Highcroft Avenue (East Side)					
1.5m	>2.0m	<3,000 vpd	Yes	50 km/hr	C

Bicycle Level of Service (BLOS)

Road Class	Bike Route	Type of Bikeway	Travel Lanes	Centerline Markings	Operating Speed	Segment BLOS
Churchill Avenue						
Major Collector	Spine	Separated Facility	2	Yes	50 km/hr	A
Byron Avenue						
Collector	Local	Bike Lanes	2	Yes	50 km/hr	B
Highcroft Avenue						
Local	N/A	Mixed Traffic	2	No	50 km/hr	B

Transit Level of Service (TLOS)

Facility Type	Level/Exposure to Congestion Delay, Friction and Incidents			Segment TLOS
	Congestion	Friction	Incident Potential	
Churchill Avenue				
Mixed Traffic	Yes	High	High	F
Byron Avenue				
Mixed Traffic	Yes	Low	Medium	D
Highcroft Avenue				
Mixed Traffic	Yes	Low	Medium	D

Truck Level of Service (TkLOS)

Curb Lane Width	Number of Travel Lanes (Per Direction)	Segment TkLOS
Churchill Avenue		
>3.7m	1	B
Byron Avenue		
>3.7m	1	B
Highcroft Avenue		
>3.7m	1	B

Auto LOS

Direction	Directional Capacity ¹	Traffic Volumes		V/C Ratio and LOS				Auto LOS
		AM Peak	PM Peak	AM Peak		PM Peak		
				v/c	LOS	v/c	LOS	
Churchill Avenue								
NB	600vph	402	425	0.67	B	0.71	C	C
SB	600vph	373	477	0.62	B	0.80	C	
Byron Avenue								
EB	600vph	250	259	0.41	A	0.43	A	D
WB	600vph	246	530	0.41	A	0.88	D	
Highcroft Avenue								
NB	400vph	25	2	0.06	A	0.01	A	A
SB	400vph	9	1	0.02	A	0.01	A	

1. Typical lane capacity based on the City's guidelines for the TRANS long-range transportation model

Segment MMLOS Summary

Segment		Churchill Avenue East	Churchill Avenue West	Byron Avenue North	Byron Avenue South	Highcroft Avenue
Pedestrian	Sidewalk Width	2.0m	2.0m	2.0m	2.0m	None
	Boulevard Width	>2.0m	>2.0m	None	None	None
	Average Daily Curb Lane Traffic Volume	>3000vpd	>3000vpd	>3000vpd	<3000vpd	<3000vpd
	On-Street Parking	No	Yes	No	No	Yes
	Operating Speed	60 km/h	60 km/h	60 km/hr	60 km/hr	60 km/hr
	Level of Service	C	B	E	C	F
	Target	A				
Cyclist	Road Classification	Major Collector		Collector		Local
	Bike Route Classification	Spine		Local		N/A
	Type of Bikeway	Separated Facility		Mixed Traffic		Mixed Traffic
	Travel Lanes	2		2		2
	Centerline Markings	Yes		Yes		No
	Operating Speed	60 km/h		60 km/hr		60 km/hr
	Level of Service	A		F		F
Target	B					D
Transit	Facility Type	Mixed Traffic		Mixed Traffic		-
	Friction/Congestion/Incident Potential	Frequent		Limited		-
	Level of Service	F		D		-
	Target	-				
Truck	Lane Width	>3.7m		>3.7m		-
	Travel Lanes (per direction)	1		1		-
	Level of Service	B		B		-
	Target	D		-		-
Auto	Volume	477 vph		530 vph		25 vph
	Capacity	600 vph		600 vph		400 vph
	Volume to Capacity Ratio	0.80		0.88		0.06
	Level of Service	C		D		A
	Target	E				



















APPENDIX J

Synchro Analysis Reports

3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place













Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	171	46	40	142	64	29	331	42	37	287	24
Future Volume (vph)	36	171	46	40	142	64	29	331	42	37	287	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.98	0.99		0.98	0.99	
Frt		0.975			0.965			0.983			0.988	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1748	0	0	1712	0	1616	1701	0	1729	1705	0
Flt Permitted		0.881			0.850		0.535			0.484		
Satd. Flow (perm)	0	1548	0	0	1465	0	888	1701	0	868	1705	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			27			11			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	40	190	51	44	158	71	32	368	47	41	319	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	281	0	0	273	0	32	415	0	41	346	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	38.0	38.0		38.0	38.0		42.0	42.0		42.0	42.0	
Total Split (%)	47.5%	47.5%		47.5%	47.5%		52.5%	52.5%		52.5%	52.5%	
Maximum Green (s)	32.4	32.4		32.4	32.4		36.6	36.6		36.6	36.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place

Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		18.6			18.6		50.4	50.4		50.4	50.4	
Actuated g/C Ratio		0.23			0.23		0.63	0.63		0.63	0.63	
v/c Ratio		0.75			0.75		0.06	0.39		0.08	0.32	
Control Delay		39.0			38.3		7.9	9.5		8.0	8.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		39.0			38.3		7.9	9.5		8.0	8.9	
LOS		D			D		A	A		A	A	
Approach Delay		39.0			38.3			9.4			8.8	
Approach LOS		D			D			A			A	
Queue Length 50th (m)		37.4			34.9		1.7	26.6		2.2	21.2	
Queue Length 95th (m)		55.7			53.6		6.2	55.5		7.5	45.0	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		637			609		559	1074		546	1075	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.44			0.45		0.06	0.39		0.08	0.32	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 74 (93%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 20.9

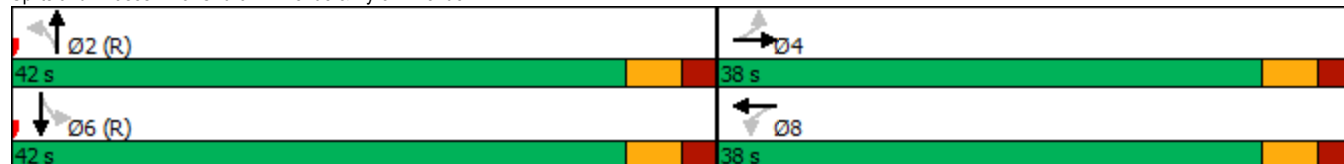
Intersection LOS: C

Intersection Capacity Utilization 62.2%

ICU Level of Service B

Analysis Period (min) 15





















Splits and Phases: 3: Churchill Avenue & Byron Avenue



6: Churchill Avenue & Richmond Rd
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place













Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	384	37	53	188	21	26	301	103	17	274	139
Future Volume (vph)	295	384	37	53	188	21	26	301	103	17	274	139
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.95	0.99		0.96	0.99			1.00	0.90		1.00	0.89
Frt		0.987			0.985				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1765	0	1586	1690	0	0	1722	1517	0	1706	1488
Flt Permitted	0.374			0.391				0.952			0.966	
Satd. Flow (perm)	629	1765	0	628	1690	0	0	1640	1369	0	1650	1317
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			7				180			180
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	328	427	41	59	209	23	29	334	114	19	304	154
Shared Lane Traffic (%)												
Lane Group Flow (vph)	328	468	0	59	232	0	0	363	114	0	323	154
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	14.0	40.1		31.1	31.1		30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	17.5%	50.1%		38.8%	38.8%		37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	7.9	34.0		25.0	25.0		23.8	23.8	23.8	23.8	23.8	23.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	31.6	26.6		17.6	17.6			29.2	29.2		29.2	29.2
Actuated g/C Ratio	0.39	0.33		0.22	0.22			0.36	0.36		0.36	0.36
v/c Ratio	0.93	0.79		0.43	0.62			0.61	0.19		0.54	0.26
Control Delay	55.1	33.8		34.7	33.6			28.0	1.6		25.8	3.7
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	55.1	33.8		34.7	33.6			28.0	1.6		25.8	3.7
LOS	E	C		C	C			C	A		C	A
Approach Delay		42.5			33.8			21.7			18.7	
Approach LOS		D			C			C			B	
Queue Length 50th (m)	36.7	63.0		7.8	31.1			44.6	0.0		38.4	0.0
Queue Length 95th (m)	#62.2	83.2		17.0	46.4			#87.6	3.2		69.6	9.3
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	351	753		196	532			598	613		602	594
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.93	0.62		0.30	0.44			0.61	0.19		0.54	0.26

Intersection Summary

Area Type: Other

Cycle Length: 80.1

Actuated Cycle Length: 80.1

Offset: 43 (54%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay: 30.8

Intersection LOS: C

Intersection Capacity Utilization 91.2%

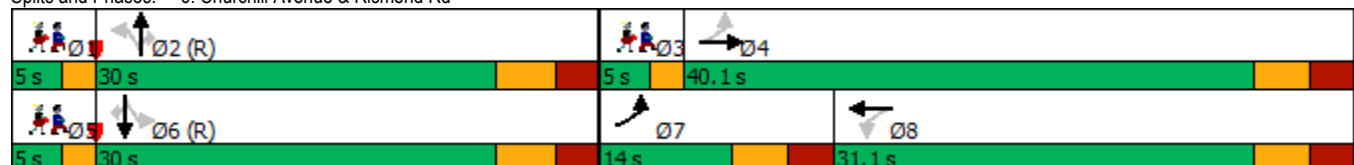
ICU Level of Service F

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.










Splits and Phases: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

9: Highcroft Avenue & Byron Avenue
AM Peak



















433-435 Churchill Avenue and 468-472 Byron Place
Existing Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	225	1	2	272	5	20
Future Volume (Veh/h)	225	1	2	272	5	20
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)	250	1	2	302	6	22
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	85					
pX, platoon unblocked			0.93		0.93	0.93
vC, conflicting volume			261		566	260
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			164		493	163
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		99	97
cM capacity (veh/h)			1310		494	814
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	251	304	28			
Volume Left	0	2	6			
Volume Right	1	0	22			
cSH	1700	1310	715			
Volume to Capacity	0.15	0.00	0.04			
Queue Length 95th (m)	0.0	0.0	0.9			
Control Delay (s)	0.0	0.1	10.2			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.2			
Approach LOS			B			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			26.8%	ICU Level of Service	A	
Analysis Period (min)			15			

3: Churchill Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place

Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	137	61	95	360	75	33	298	94	28	321	69
Future Volume (vph)	45	137	61	95	360	75	33	298	94	28	321	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.98	0.98		0.99	0.99	
Frt		0.966			0.981			0.964			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1723	0	0	1752	0	1616	1663	0	1729	1667	0
Flt Permitted		0.816			0.874		0.391			0.390		
Satd. Flow (perm)	0	1417	0	0	1543	0	652	1663	0	699	1667	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24			12			22			15	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	50	152	68	106	400	83	37	331	104	31	357	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	270	0	0	589	0	37	435	0	31	434	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	45.0	45.0		45.0	45.0		45.0	45.0		45.0	45.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	39.4	39.4		39.4	39.4		39.6	39.6		39.6	39.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
Existing Traffic

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		36.9			36.9		42.1	42.1		42.1	42.1	
Actuated g/C Ratio		0.41			0.41		0.47	0.47		0.47	0.47	
v/c Ratio		0.45			0.92		0.12	0.55		0.09	0.55	
Control Delay		19.6			46.3		16.3	20.3		16.0	21.7	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.6	
Total Delay		19.6			46.3		16.3	20.3		16.0	22.2	
LOS		B			D		B	C		B	C	
Approach Delay		19.6			46.3			20.0			21.8	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		28.3			87.7		3.7	52.1		3.5	47.7	
Queue Length 95th (m)		48.4			#150.4		9.8	81.5		m6.2	m63.1	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		633			682		304	790		327	788	
Starvation Cap Reductn		0			0		0	0		0	111	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.43			0.86		0.12	0.55		0.09	0.64	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 40 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.92

Intersection Signal Delay: 29.0

Intersection LOS: C

Intersection Capacity Utilization 78.6%

ICU Level of Service D

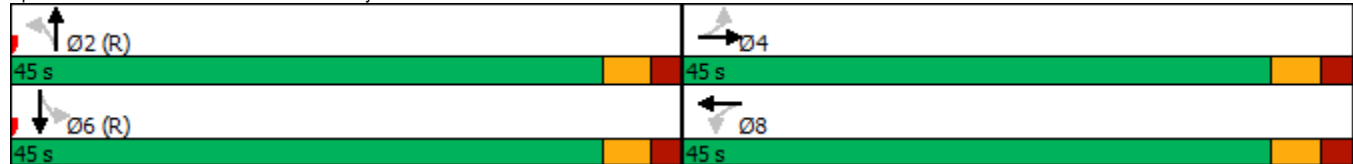
Analysis Period (min) 15

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: 3: Churchill Avenue & Byron Avenue



6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place

Existing Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	329	55	129	479	25	27	291	67	15	237	312
Future Volume (vph)	191	329	55	129	479	25	27	291	67	15	237	312
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.98	0.98		0.95	0.99			1.00	0.89		1.00	0.87
Frt		0.979			0.992				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1740	0	1586	1710	0	0	1722	1517	0	1706	1488
Flt Permitted	0.170			0.514				0.871			0.821	
Satd. Flow (perm)	294	1740	0	818	1710	0	0	1499	1354	0	1402	1300
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4				160			186
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	212	366	61	143	532	28	30	323	74	17	263	347
Shared Lane Traffic (%)												
Lane Group Flow (vph)	212	427	0	143	560	0	0	353	74	0	280	347
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	15.0	55.0		45.0	45.0		25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	16.7%	61.1%		50.0%	50.0%		27.8%	27.8%	27.8%	27.8%	27.8%	27.8%
Maximum Green (s)	8.9	48.9		38.9	38.9		18.8	18.8	18.8	18.8	18.8	18.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
Existing Traffic

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	49.2	44.2		34.2	34.2			22.0	22.0		22.0	22.0
Actuated g/C Ratio	0.55	0.49		0.38	0.38			0.24	0.24		0.24	0.24
v/c Ratio	0.71	0.50		0.46	0.86			0.96	0.16		0.82	0.76
Control Delay	24.9	16.3		25.1	39.1			72.2	4.7		55.2	27.9
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	24.9	16.3		25.1	39.1			72.2	4.7		55.2	27.9
LOS	C	B		C	D			E	A		E	C
Approach Delay		19.1			36.2			60.5			40.1	
Approach LOS		B			D			E			D	
Queue Length 50th (m)	16.9	43.5		17.5	83.6			~71.9	1.0		47.9	26.9
Queue Length 95th (m)	#28.6	62.2		32.4	119.2			m#119.2	m4.5		#95.4	#73.5
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	297	952		353	741			366	452		342	458
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.71	0.45		0.41	0.76			0.96	0.16		0.82	0.76

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.96

Intersection Signal Delay: 37.0

Intersection LOS: D

Intersection Capacity Utilization 91.9%

ICU Level of Service F

Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

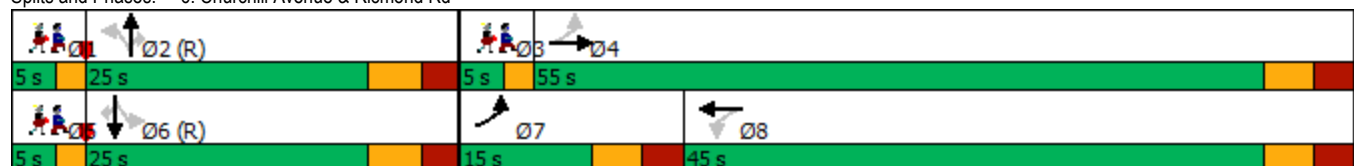
Queue shown is maximum after two cycles.

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

Queue shown is maximum after two cycles.

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










Splits and Phases: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			



















9: Highcroft Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
Existing Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	233	0	1	589	1	8
Future Volume (Veh/h)	233	0	1	589	1	8
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)	259	0	1	654	1	9
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	85					
pX, platoon unblocked						
vC, conflicting volume			269		925	269
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			269		925	269
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	99
cM capacity (veh/h)			1294		298	767
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	259	655	10			
Volume Left	0	1	1			
Volume Right	0	0	9			
cSH	1700	1294	663			
Volume to Capacity	0.15	0.00	0.02			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.0	10.5			
Approach LOS			B			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			43.6%	ICU Level of Service		A
Analysis Period (min)			15			













3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	171	46	40	142	64	29	331	42	37	287	24
Future Volume (vph)	36	171	46	40	142	64	29	331	42	37	287	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.97	0.99		0.98	0.99	
Frt		0.975			0.965			0.983			0.988	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1748	0	0	1712	0	1616	1701	0	1729	1705	0
Flt Permitted		0.889			0.857		0.566			0.519		
Satd. Flow (perm)	0	1562	0	0	1477	0	938	1701	0	929	1705	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			27			11			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	36	171	46	40	142	64	29	331	42	37	287	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	253	0	0	246	0	29	373	0	37	311	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	38.0	38.0		38.0	38.0		42.0	42.0		42.0	42.0	
Total Split (%)	47.5%	47.5%		47.5%	47.5%		52.5%	52.5%		52.5%	52.5%	
Maximum Green (s)	32.4	32.4		32.4	32.4		36.6	36.6		36.6	36.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.1			17.1		51.9	51.9		51.9	51.9	
Actuated g/C Ratio		0.21			0.21		0.65	0.65		0.65	0.65	
v/c Ratio		0.73			0.73		0.05	0.34		0.06	0.28	
Control Delay		38.9			38.1		7.0	8.2		7.1	7.7	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.9			38.1		7.0	8.2		7.1	7.7	
LOS		D			D		A	A		A	A	
Approach Delay		38.9			38.1			8.1			7.6	
Approach LOS		D			D			A			A	
Queue Length 50th (m)		33.5			31.1		1.4	21.5		1.8	17.4	
Queue Length 95th (m)		51.5			49.2		5.3	45.5		6.4	37.3	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		642			614		608	1106		602	1108	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.39			0.40		0.05	0.34		0.06	0.28	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 74 (93%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.73

Intersection Signal Delay: 20.1

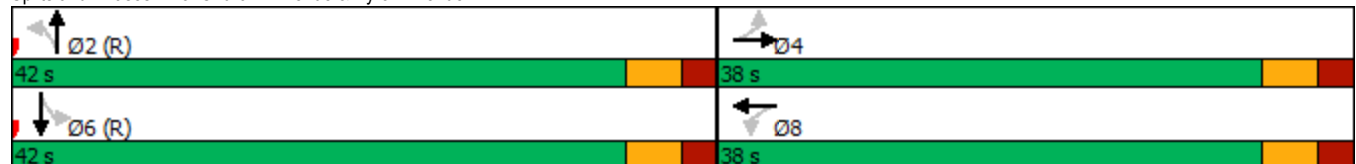
Intersection LOS: C

Intersection Capacity Utilization 62.2%

ICU Level of Service B





















Analysis Period (min) 15

Splits and Phases: 3: Churchill Avenue & Byron Avenue



6: Churchill Avenue & Richmond Rd
AM Peak













433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	387	37	53	203	21	26	301	103	17	274	139
Future Volume (vph)	295	387	37	53	203	21	26	301	103	17	274	139
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.95	0.99		0.96	0.99			1.00	0.90		1.00	0.89
Frt		0.987			0.986				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1765	0	1586	1693	0	0	1722	1517	0	1706	1488
Flt Permitted	0.373			0.462				0.957			0.970	
Satd. Flow (perm)	626	1765	0	739	1693	0	0	1648	1369	0	1656	1317
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			7				180			180
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	295	387	37	53	203	21	26	301	103	17	274	139
Shared Lane Traffic (%)												
Lane Group Flow (vph)	295	424	0	53	224	0	0	327	103	0	291	139
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	14.0	40.1		31.1	31.1		30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	17.5%	50.1%		38.8%	38.8%		37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	7.9	34.0		25.0	25.0		23.8	23.8	23.8	23.8	23.8	23.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	30.6	25.6		16.6	16.6			30.2	30.2		30.2	30.2
Actuated g/C Ratio	0.38	0.32		0.21	0.21			0.38	0.38		0.38	0.38
v/c Ratio	0.86	0.75		0.35	0.63			0.53	0.16		0.47	0.23
Control Delay	43.6	31.8		31.2	34.9			24.8	1.0		23.5	2.7
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	43.6	31.8		31.2	34.9			24.8	1.0		23.5	2.7
LOS	D	C		C	C			C	A		C	A
Approach Delay		36.6			34.2			19.1			16.8	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	33.7	57.2		7.0	30.8			37.4	0.0		32.4	0.0
Queue Length 95th (m)	#49.0	73.4		14.9	44.8			70.5	1.5		61.9	6.9
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	343	753		230	533			620	627		623	608
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.86	0.56		0.23	0.42			0.53	0.16		0.47	0.23

Intersection Summary

Area Type: Other

Cycle Length: 80.1

Actuated Cycle Length: 80.1

Offset: 43 (54%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.86

Intersection Signal Delay: 27.6

Intersection LOS: C

Intersection Capacity Utilization 91.4%

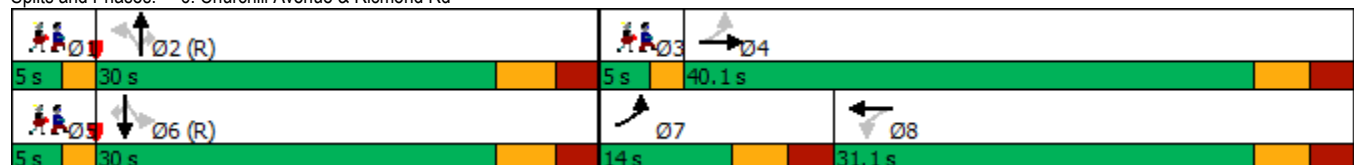
ICU Level of Service F

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.










Splits and Phases: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			



















9: Highcroft Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	225	1	2	272	5	20
Future Volume (Veh/h)	225	1	2	272	5	20
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)	225	1	2	272	5	20
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	85					
pX, platoon unblocked			0.94		0.94	0.94
vC, conflicting volume			236		512	236
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			157		449	156
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		99	98
cM capacity (veh/h)			1338		531	834
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	226	274	25			
Volume Left	0	2	5			
Volume Right	1	0	20			
cSH	1700	1338	749			
Volume to Capacity	0.13	0.00	0.03			
Queue Length 95th (m)	0.0	0.0	0.8			
Control Delay (s)	0.0	0.1	10.0			
Lane LOS		A	A			
Approach Delay (s)	0.0	0.1	10.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization			26.8%	ICU Level of Service	A	
Analysis Period (min)			15			

3: Churchill Avenue & Byron Avenue
PM Peak













433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	137	61	95	360	75	33	298	94	28	321	69
Future Volume (vph)	45	137	61	95	360	75	33	298	94	28	321	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.98	0.98		0.98	0.99	
Frt		0.966			0.981			0.964			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1723	0	0	1752	0	1616	1662	0	1729	1667	0
Flt Permitted		0.831			0.886		0.446			0.444		
Satd. Flow (perm)	0	1443	0	0	1564	0	742	1662	0	794	1667	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24			12			23			15	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	45	137	61	95	360	75	33	298	94	28	321	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	243	0	0	530	0	33	392	0	28	390	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	45.0	45.0		45.0	45.0		45.0	45.0		45.0	45.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	39.4	39.4		39.4	39.4		39.6	39.6		39.6	39.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place

2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		34.4			34.4		44.6	44.6		44.6	44.6	
Actuated g/C Ratio		0.38			0.38		0.50	0.50		0.50	0.50	
v/c Ratio		0.43			0.88		0.09	0.47		0.07	0.47	
Control Delay		19.9			41.5		15.1	17.6		15.6	20.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.4	
Total Delay		19.9			41.5		15.1	17.6		15.6	20.4	
LOS		B			D		B	B		B	C	
Approach Delay		19.9			41.5			17.4			20.0	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		26.2			78.9		3.0	41.7		3.1	41.6	
Queue Length 95th (m)		42.6			#115.5		8.9	70.9		m6.8	60.5	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		645			691		367	835		393	834	
Starvation Cap Reductn		0			0		0	0		0	134	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.38			0.77		0.09	0.47		0.07	0.56	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 40 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 26.4

Intersection LOS: C

Intersection Capacity Utilization 78.6%

ICU Level of Service D

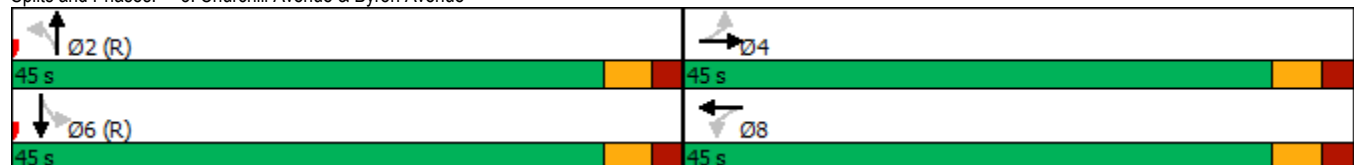
Analysis Period (min) 15

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: 3: Churchill Avenue & Byron Avenue



6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place













2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	342	55	129	485	25	27	291	67	15	237	312
Future Volume (vph)	191	342	55	129	485	25	27	291	67	15	237	312
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.97	0.99		0.95	0.99			0.99	0.89		1.00	0.87
Frt		0.979			0.993				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1740	0	1586	1712	0	0	1722	1517	0	1706	1488
Flt Permitted	0.193			0.528				0.953			0.967	
Satd. Flow (perm)	332	1740	0	839	1712	0	0	1639	1354	0	1651	1300
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14			4				160			186
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	191	342	55	129	485	25	27	291	67	15	237	312
Shared Lane Traffic (%)												
Lane Group Flow (vph)	191	397	0	129	510	0	0	318	67	0	252	312
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	15.0	55.0		45.0	45.0		25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	16.7%	61.1%		50.0%	50.0%		27.8%	27.8%	27.8%	27.8%	27.8%	27.8%
Maximum Green (s)	8.9	48.9		38.9	38.9		18.8	18.8	18.8	18.8	18.8	18.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	47.3	42.3		32.3	32.3			23.6	23.6		23.6	23.6
Actuated g/C Ratio	0.53	0.47		0.36	0.36			0.26	0.26		0.26	0.26
v/c Ratio	0.62	0.48		0.43	0.83			0.74	0.14		0.58	0.65
Control Delay	19.7	17.0		25.2	37.7			44.6	4.3		37.6	20.9
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	19.7	17.0		25.2	37.7			44.6	4.3		37.6	20.9
LOS	B	B		C	D			D	A		D	C
Approach Delay		17.9			35.2			37.6			28.4	
Approach LOS		B			D			D			C	
Queue Length 50th (m)	16.3	42.6		16.4	77.3			51.6	0.7		38.9	18.7
Queue Length 95th (m)	23.4	57.0		28.8	104.3			m#101.7	m4.9		#73.6	#58.2
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	307	951		362	742			429	472		432	477
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.62	0.42		0.36	0.69			0.74	0.14		0.58	0.65

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 29.2

Intersection LOS: C

Intersection Capacity Utilization 92.2%

ICU Level of Service F

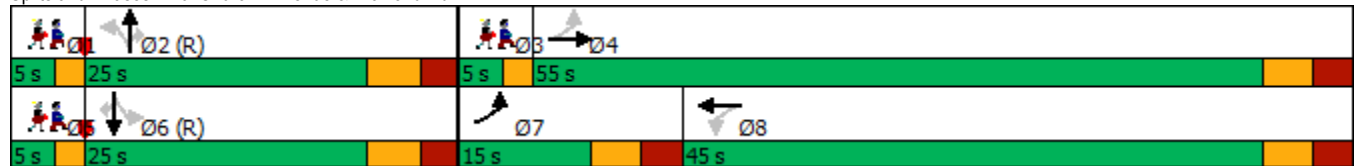
Analysis Period (min) 15

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: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

9: Highcroft Avenue & Byron Avenue
PM Peak



















433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Background Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	233	0	1	589	1	8
Future Volume (Veh/h)	233	0	1	589	1	8
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)	233	0	1	589	1	8
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)	85					
pX, platoon unblocked						
vC, conflicting volume			243		834	243
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			243		834	243
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	99
cM capacity (veh/h)			1323		337	793
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	233	590	9			
Volume Left	0	1	1			
Volume Right	0	0	8			
cSH	1700	1323	690			
Volume to Capacity	0.14	0.00	0.01			
Queue Length 95th (m)	0.0	0.0	0.3			
Control Delay (s)	0.0	0.0	10.3			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.0	10.3			
Approach LOS			B			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			43.6%	ICU Level of Service		A
Analysis Period (min)			15			

3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place













2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	173	46	43	145	69	29	331	43	39	287	24
Future Volume (vph)	36	173	46	43	145	69	29	331	43	39	287	24
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.97	0.99		0.98	0.99	
Frt		0.976			0.964			0.983			0.988	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1750	0	0	1709	0	1616	1701	0	1729	1705	0
Flt Permitted		0.886			0.850		0.565			0.518		
Satd. Flow (perm)	0	1559	0	0	1463	0	936	1701	0	927	1705	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			28			11			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	36	173	46	43	145	69	29	331	43	39	287	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	255	0	0	257	0	29	374	0	39	311	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	38.0	38.0		38.0	38.0		42.0	42.0		42.0	42.0	
Total Split (%)	47.5%	47.5%		47.5%	47.5%		52.5%	52.5%		52.5%	52.5%	
Maximum Green (s)	32.4	32.4		32.4	32.4		36.6	36.6		36.6	36.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place

2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		17.4			17.4		51.6	51.6		51.6	51.6	
Actuated g/C Ratio		0.22			0.22		0.64	0.64		0.64	0.64	
v/c Ratio		0.72			0.76		0.05	0.34		0.07	0.28	
Control Delay		38.4			39.6		7.2	8.3		7.3	7.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.4			39.6		7.2	8.3		7.3	7.9	
LOS		D			D		A	A		A	A	
Approach Delay		38.4			39.6			8.3			7.8	
Approach LOS		D			D			A			A	
Queue Length 50th (m)		33.7			32.7		1.4	21.8		1.9	17.5	
Queue Length 95th (m)		51.2			51.3		5.4	46.6		6.8	38.1	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		641			609		603	1101		597	1102	
Starvation Cap Reductn		0			0		0	0		0	0	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.40			0.42		0.05	0.34		0.07	0.28	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 74 (93%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 20.6

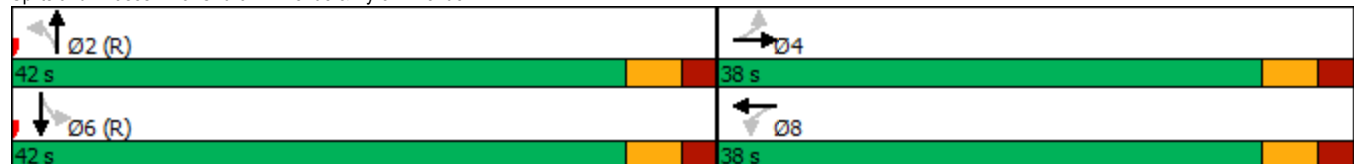
Intersection LOS: C

Intersection Capacity Utilization 64.9%

ICU Level of Service C

Analysis Period (min) 15





















Splits and Phases: 3: Churchill Avenue & Byron Avenue



6: Churchill Avenue & Richmond Rd
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place

2020 and 2025 Total Traffic













												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	295	387	38	53	203	21	28	304	103	17	275	139
Future Volume (vph)	295	387	38	53	203	21	28	304	103	17	275	139
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.95	0.99		0.96	0.99			1.00	0.90		1.00	0.89
Frt		0.987			0.986				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1764	0	1586	1693	0	0	1722	1517	0	1706	1488
Flt Permitted	0.374			0.462				0.954			0.970	
Satd. Flow (perm)	628	1764	0	739	1693	0	0	1642	1369	0	1656	1317
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			7				180			180
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	295	387	38	53	203	21	28	304	103	17	275	139
Shared Lane Traffic (%)												
Lane Group Flow (vph)	295	425	0	53	224	0	0	332	103	0	292	139
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	14.0	40.1		31.1	31.1		30.0	30.0	30.0	30.0	30.0	30.0
Total Split (%)	17.5%	50.1%		38.8%	38.8%		37.5%	37.5%	37.5%	37.5%	37.5%	37.5%
Maximum Green (s)	7.9	34.0		25.0	25.0		23.8	23.8	23.8	23.8	23.8	23.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place

2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	30.7	25.7		16.7	16.7			30.1	30.1		30.1	30.1
Actuated g/C Ratio	0.38	0.32		0.21	0.21			0.38	0.38		0.38	0.38
v/c Ratio	0.86	0.75		0.35	0.63			0.54	0.16		0.47	0.23
Control Delay	43.2	31.7		31.2	34.9			25.1	1.0		23.6	2.7
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	43.2	31.7		31.2	34.9			25.1	1.0		23.6	2.7
LOS	D	C		C	C			C	A		C	A
Approach Delay		36.4			34.2			19.4			16.9	
Approach LOS		D			C			B			B	
Queue Length 50th (m)	33.7	57.3		7.0	30.8			38.2	0.0		32.5	0.0
Queue Length 95th (m)	#48.9	73.4		14.9	44.8			72.0	1.5		62.1	6.9
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	344	753		230	533			617	627		623	607
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.86	0.56		0.23	0.42			0.54	0.16		0.47	0.23

Intersection Summary

Area Type: Other

Cycle Length: 80.1

Actuated Cycle Length: 80.1

Offset: 43 (54%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.86

Intersection Signal Delay: 27.6

Intersection LOS: C

Intersection Capacity Utilization 91.9%

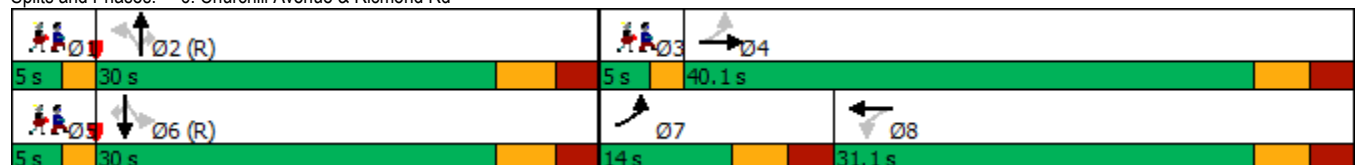
ICU Level of Service F

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.










Splits and Phases: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			










9: Highcroft Avenue & Byron Avenue
AM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Total Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	225	6	4	272	16	26
Future Volume (Veh/h)	225	6	4	272	16	26
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)	225	6	4	272	16	26
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	85					
pX, platoon unblocked			0.94		0.94	0.94
vC, conflicting volume			241		518	238
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			157		453	154
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		97	97
cM capacity (veh/h)			1333		527	833
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	231	276	42			
Volume Left	0	4	16			
Volume Right	6	0	26			
cSH	1700	1333	682			
Volume to Capacity	0.14	0.00	0.06			
Queue Length 95th (m)	0.0	0.1	1.5			
Control Delay (s)	0.0	0.1	10.6			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.1	10.6			
Approach LOS			B			
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			28.5%	ICU Level of Service		A
Analysis Period (min)			15			

11: Highcroft Avenue & Access
AM Peak



















433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Total Traffic

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	0	0	25	2	6
Future Volume (Veh/h)	17	0	0	25	2	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	17	0	0	25	2	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	30	5	8			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	30	5	8			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	100	100			
cM capacity (veh/h)	984	1078	1612			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	17	25	8			
Volume Left	17	0	0			
Volume Right	0	0	6			
cSH	984	1612	1700			
Volume to Capacity	0.02	0.00	0.00			
Queue Length 95th (m)	0.4	0.0	0.0			
Control Delay (s)	8.7	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	8.7	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			3.0			
Intersection Capacity Utilization		13.3%		ICU Level of Service		A
Analysis Period (min)			15			

3: Churchill Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place













2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	140	61	97	362	79	33	298	97	33	321	69
Future Volume (vph)	45	140	61	97	362	79	33	298	97	33	321	69
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	0.0		0.0	0.0		0.0	15.0		0.0	15.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	7.6			7.6			25.0			25.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.99			0.99		0.98	0.98		0.98	0.99	
Frt		0.967			0.980			0.963			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1725	0	0	1750	0	1616	1661	0	1729	1667	0
Flt Permitted		0.832			0.883		0.444			0.440		
Satd. Flow (perm)	0	1446	0	0	1556	0	738	1661	0	787	1667	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			12			23			15	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		207.2			85.0			153.8			123.1	
Travel Time (s)		14.9			6.1			11.1			8.9	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
Confl. Bikes (#/hr)			11			6			14			6
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	0%	0%	0%	0%	0%	2%	7%	5%	0%	0%	5%	4%
Adj. Flow (vph)	45	140	61	97	362	79	33	298	97	33	321	69
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	246	0	0	538	0	33	395	0	33	390	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		0.0			0.0			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5		6.1	30.5	
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8		6.1	1.8	
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		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	
Minimum Split (s)	30.6	30.6		30.6	30.6		25.5	25.5		25.5	25.5	
Total Split (s)	45.0	45.0		45.0	45.0		45.0	45.0		45.0	45.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	39.4	39.4		39.4	39.4		39.6	39.6		39.6	39.6	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	

3: Churchill Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place

2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.3	2.3		2.3	2.3		2.1	2.1		2.1	2.1	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.6			5.6		5.4	5.4		5.4	5.4	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		C-Max	C-Max		C-Max	C-Max	
Walk Time (s)	10.0	10.0		10.0	10.0		10.0	10.0		10.0	10.0	
Flash Dont Walk (s)	15.0	15.0		15.0	15.0		9.0	9.0		9.0	9.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		34.7			34.7		44.3	44.3		44.3	44.3	
Actuated g/C Ratio		0.39			0.39		0.49	0.49		0.49	0.49	
v/c Ratio		0.43			0.89		0.09	0.48		0.09	0.47	
Control Delay		19.9			42.3		15.2	17.9		16.1	20.2	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.4	
Total Delay		19.9			42.3		15.2	17.9		16.1	20.6	
LOS		B			D		B	B		B	C	
Approach Delay		19.9			42.3			17.7			20.2	
Approach LOS		B			D			B			C	
Queue Length 50th (m)		26.4			79.9		3.1	42.7		3.6	41.7	
Queue Length 95th (m)		43.2			#122.5		8.9	71.8		m7.8	60.6	
Internal Link Dist (m)		183.2			61.0			129.8			99.1	
Turn Bay Length (m)							15.0			15.0		
Base Capacity (vph)		645			687		362	828		387	827	
Starvation Cap Reductn		0			0		0	0		0	132	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.38			0.78		0.09	0.48		0.09	0.56	

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 40 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 26.8

Intersection LOS: C

Intersection Capacity Utilization 79.5%

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: 3: Churchill Avenue & Byron Avenue

 Ø2 (R)	 Ø4
45 s	45 s
 Ø6 (R)	 Ø8
45 s	45 s

6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place













2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	191	342	57	129	485	25	28	294	67	15	240	312
Future Volume (vph)	191	342	57	129	485	25	28	294	67	15	240	312
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	30.0		0.0	25.0		0.0	15.0		15.0	15.0		15.0
Storage Lanes	1		0	1		0	0		1	0		1
Taper Length (m)	45.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.97	0.98		0.95	0.99			0.99	0.89		1.00	0.87
Frt		0.979			0.993				0.850			0.850
Flt Protected	0.950			0.950				0.996			0.997	
Satd. Flow (prot)	1679	1740	0	1586	1712	0	0	1722	1517	0	1706	1488
Flt Permitted	0.193			0.527				0.951			0.967	
Satd. Flow (perm)	332	1740	0	837	1712	0	0	1635	1354	0	1651	1300
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4				160			184
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		135.1			164.7			123.1			131.3	
Travel Time (s)		9.7			11.9			8.9			9.5	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
Confl. Bikes (#/hr)			6			4			3			1
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Heavy Vehicles (%)	3%	1%	0%	9%	5%	5%	8%	5%	2%	12%	6%	4%
Adj. Flow (vph)	191	342	57	129	485	25	28	294	67	15	240	312
Shared Lane Traffic (%)												
Lane Group Flow (vph)	191	399	0	129	510	0	0	322	67	0	255	312
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(m)		3.7			3.7			3.7			3.7	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		4.9			4.9			4.9			4.9	
Two way Left Turn Lane												
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24		14	24		14	24		14	24		14
Number of Detectors	1	2		1	2		1	2	1	1	2	1
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	Right
Leading Detector (m)	6.1	30.5		6.1	30.5		6.1	30.5	6.1	6.1	30.5	6.1
Trailing Detector (m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8		6.1	1.8		6.1	1.8	6.1	6.1	1.8	6.1
Detector 1 Type	CI+Ex	CI+Ex		CI+Ex	CI+Ex		CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex	CI+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7			28.7			28.7			28.7	
Detector 2 Size(m)		1.8			1.8			1.8			1.8	
Detector 2 Type		CI+Ex			CI+Ex			CI+Ex			CI+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4			8			2		2	6		6
Detector Phase	7	4		8	8		2	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.1	31.1		31.1	31.1		24.2	24.2	24.2	24.2	24.2	24.2
Total Split (s)	15.0	55.0		45.0	45.0		25.0	25.0	25.0	25.0	25.0	25.0
Total Split (%)	16.7%	61.1%		50.0%	50.0%		27.8%	27.8%	27.8%	27.8%	27.8%	27.8%
Maximum Green (s)	8.9	48.9		38.9	38.9		18.8	18.8	18.8	18.8	18.8	18.8
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6	3.6	3.6	3.6	3.6

Lane Group	Ø1	Ø3	Ø5
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Ideal Flow (vphpl)			
Storage Length (m)			
Storage Lanes			
Taper Length (m)			
Lane Util. Factor			
Ped Bike Factor			
Frt			
Flt Protected			
Satd. Flow (prot)			
Flt Permitted			
Satd. Flow (perm)			
Right Turn on Red			
Satd. Flow (RTOR)			
Link Speed (k/h)			
Link Distance (m)			
Travel Time (s)			
Confl. Peds. (#/hr)			
Confl. Bikes (#/hr)			
Peak Hour Factor			
Heavy Vehicles (%)			
Adj. Flow (vph)			
Shared Lane Traffic (%)			
Lane Group Flow (vph)			
Enter Blocked Intersection			
Lane Alignment			
Median Width(m)			
Link Offset(m)			
Crosswalk Width(m)			
Two way Left Turn Lane			
Headway Factor			
Turning Speed (k/h)			
Number of Detectors			
Detector Template			
Leading Detector (m)			
Trailing Detector (m)			
Detector 1 Position(m)			
Detector 1 Size(m)			
Detector 1 Type			
Detector 1 Channel			
Detector 1 Extend (s)			
Detector 1 Queue (s)			
Detector 1 Delay (s)			
Detector 2 Position(m)			
Detector 2 Size(m)			
Detector 2 Type			
Detector 2 Channel			
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	5
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0

6: Churchill Avenue & Richmond Rd
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Total Traffic

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6	2.6	2.6	2.6	2.6
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Lost Time (s)	6.1	6.1		6.1	6.1			6.2	6.2		6.2	6.2
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag	Lag	Lag	Lag	Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	None		None	None		C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Walk Time (s)		16.0		16.0	16.0		7.0	7.0	7.0	7.0	7.0	7.0
Flash Dont Walk (s)		9.0		9.0	9.0		9.0	9.0	9.0	9.0	9.0	9.0
Pedestrian Calls (#/hr)		15		15	15		15	15	15	15	15	15
Act Effct Green (s)	47.3	42.3		32.3	32.3			23.6	23.6		23.6	23.6
Actuated g/C Ratio	0.53	0.47		0.36	0.36			0.26	0.26		0.26	0.26
v/c Ratio	0.62	0.48		0.43	0.83			0.75	0.14		0.59	0.66
Control Delay	19.7	17.0		25.2	37.7			45.2	4.2		37.9	21.2
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	0.0
Total Delay	19.7	17.0		25.2	37.7			45.2	4.2		37.9	21.2
LOS	B	B		C	D			D	A		D	C
Approach Delay		17.9			35.2			38.1			28.7	
Approach LOS		B			D			D			C	
Queue Length 50th (m)	16.3	42.7		16.4	77.3			52.4	0.7		39.5	19.0
Queue Length 95th (m)	23.4	57.1		28.8	104.3			m#102.6	m4.7		#75.1	#58.9
Internal Link Dist (m)		111.1			140.7			99.1			107.3	
Turn Bay Length (m)	30.0			25.0					15.0			15.0
Base Capacity (vph)	307	952		361	742			427	472		432	476
Starvation Cap Reductn	0	0		0	0			0	0		0	0
Spillback Cap Reductn	0	0		0	0			0	0		0	0
Storage Cap Reductn	0	0		0	0			0	0		0	0
Reduced v/c Ratio	0.62	0.42		0.36	0.69			0.75	0.14		0.59	0.66

Intersection Summary

Area Type: Other

Cycle Length: 90

Actuated Cycle Length: 90

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.83

Intersection Signal Delay: 29.3

Intersection LOS: C

Intersection Capacity Utilization 92.6%

ICU Level of Service F

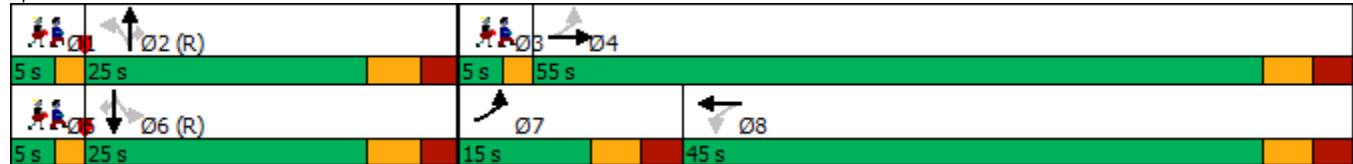
Analysis Period (min) 15

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: 6: Churchill Avenue & Richmond Rd



Lane Group	Ø1	Ø3	Ø5
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0
Recall Mode	Min	Min	Min
Walk Time (s)			
Flash Dont Walk (s)			
Pedestrian Calls (#/hr)			
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			










9: Highcroft Avenue & Byron Avenue
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Total Traffic

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	233	11	7	589	9	13
Future Volume (Veh/h)	233	11	7	589	9	13
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)	233	11	7	589	9	13
Pedestrians					10	
Lane Width (m)					3.7	
Walking Speed (m/s)					1.1	
Percent Blockage					1	
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Upstream signal (m)	85					
pX, platoon unblocked						
vC, conflicting volume			254		852	248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			254		852	248
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		97	98
cM capacity (veh/h)			1311		328	788
Direction, Lane #	EB 1	WB 1	NB 1			
Volume Total	244	596	22			
Volume Left	0	7	9			
Volume Right	11	0	13			
cSH	1700	1311	501			
Volume to Capacity	0.14	0.01	0.04			
Queue Length 95th (m)	0.0	0.1	1.0			
Control Delay (s)	0.0	0.2	12.5			
Lane LOS		A	B			
Approach Delay (s)	0.0	0.2	12.5			
Approach LOS			B			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization			48.6%	ICU Level of Service		A
Analysis Period (min)			15			

11: Highcroft Avenue & Access
PM Peak

433-435 Churchill Avenue and 468-472 Byron Place
2020 and 2025 Total Traffic

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	12	0	0	9	1	15
Future Volume (Veh/h)	12	0	0	9	1	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	12	0	0	9	1	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	18	8	16			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	18	8	16			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	100	100			
cM capacity (veh/h)	1000	1073	1602			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	12	9	16			
Volume Left	12	0	0			
Volume Right	0	0	15			
cSH	1000	1602	1700			
Volume to Capacity	0.01	0.00	0.01			
Queue Length 95th (m)	0.3	0.0	0.0			
Control Delay (s)	8.6	0.0	0.0			
Lane LOS	A					
Approach Delay (s)	8.6	0.0	0.0			
Approach LOS	A					
Intersection Summary						
Average Delay			2.8			
Intersection Capacity Utilization			13.3%	ICU Level of Service		A
Analysis Period (min)			15			

APPENDIX K

Intersection MMLOS Analysis

Pedestrian Level of Service (PLOS)

Criteria	North Approach		South Approach		East Approach		West Approach	
Churchill Avenue/Byron Avenue								
PETS I SCORE								
CROSSING DISTANCE CONDITIONS								
Median > 2.4m in Width	No	88	No	88	No	88	No	88
Lanes Crossed (3.5m Lane Width)	4		4		4		4	
SIGNAL PHASING AND TIMING								
Left Turn Conflict	Permissive	-8	Permissive	-8	Permissive	-8	Permissive	-8
Right Turn Conflict	Permissive or Yield	-5	Permissive or Yield	-5	Permissive or Yield	-5	Permissive or Yield	-5
Right Turn on Red	RTOR Allowed	-3	RTOR Allowed	-3	RTOR Allowed	-3	RTOR Allowed	-3
Leading Pedestrian Interval	No	-2	No	-2	No	-2	No	-2
CORNER RADIUS								
Parallel Radius	> 5m to 10m	-5	> 5m to 10m	-5	> 5m to 10m	-5	> 5m to 10m	-5
Parallel Right Turn Channel	No Right Turn Channel	-4	No Right Turn Channel	-4	No Right Turn Channel	-4	No Right Turn Channel	-4
Perpendicular Radius	N/A	0	N/A	0	N/A	0	N/A	0
Perpendicular Right Turn Channel	N/A	0	N/A	0	N/A	0	N/A	0
CROSSING TREATMENT								
Treatment	Zebra Stripe	-4	Zebra Stripe	-4	Zebra Stripe	-4	Zebra Stripe	-4
PETS I SCORE		57		57		57		57
LOS		D		D		D		D
DELAY SCORE								
Cycle Length		80		80		80		80
Pedestrian Walk Time		17.4		17.4		27.6		27.6
DELAY SCORE		24.5		24.5		17.2		17.2
LOS		C		C		B		B
OVERALL		D		D		D		D

Criteria	North Approach		South Approach		East Approach		West Approach	
Churchill Avenue/Richmond Road								
PETSI SCORE								
CROSSING DISTANCE CONDITIONS								
Median > 2.4m in Width	No	88	No	88	No	88	No	88
Lanes Crossed (3.5m Lane Width)	4		4		4		4	
SIGNAL PHASING AND TIMING								
Left Turn Conflict	Perm + Prot	-8	Permissive	-8	Permissive	-8	Permissive	-8
Right Turn Conflict	Permissive or Yield	-5	Permissive or Yield	-5	Permissive or Yield	-5	Permissive or Yield	-5
Right Turn on Red	RTOR Allowed	-3	RTOR Allowed	-3	RTOR Allowed	-3	RTOR Allowed	-3
Leading Pedestrian Interval	Yes	0	Yes	0	Yes	0	Yes	0
CORNER RADIUS								
Parallel Radius	> 5m to 10m	-5	> 5m to 10m	-5	> 5m to 10m	-5	> 5m to 10m	-5
Parallel Right Turn Channel	No Right Turn Channel	-4	No Right Turn Channel	-4	No Right Turn Channel	-4	No Right Turn Channel	-4
Perpendicular Radius	N/A	0	N/A	0	N/A	0	N/A	0
Perpendicular Right Turn Channel	N/A	0	N/A	0	N/A	0	N/A	0
CROSSING TREATMENT								
Treatment	Zebra Stripe	-4	Zebra Stripe	-4	Zebra Stripe	-4	Zebra Stripe	-4
PETSI SCORE		59	59		59		59	
LOS		D	D		D		D	
DELAY SCORE								
Cycle Length		80		80		80		80
Pedestrian Walk Time		15.9		24.9		14.8		14.8
DELAY SCORE		25.7	19		26.6		26.6	
LOS		C	B		C		C	
OVERALL		D	D		D		D	

Bicycle Level of Service (BLOS)

Approach	Bikeway Facility Type	Criteria	Travel Lanes and/or Speed	BLOS
Churchill Avenue/Byron Avenue				
North Approach	Mixed Traffic	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	One lane crossed, 60 km/hr	F
South Approach	Mixed Traffic	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	One lane crossed, 60 km/hr	F
East Approach	Mixed Traffic	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	No lanes crossed, 60 km/hr	D
West Approach	Bike Lane	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	No lanes crossed, 60 km/hr	C
Churchill Avenue/Richmond Road				
North Approach	Pocket Bike Lane	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	No lanes crossed, 60 km/hr	D
South Approach	Bike Lane	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	No lanes crossed, 60 km/hr	D
East Approach	Mixed Traffic	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	One lane crossed, 60 km/hr	F
West Approach	Mixed Traffic	Right Turn Lane Characteristics	No impact on LTS	A
		Left Turn Accommodation	One lane crossed, 60 km/hr	F

Transit Level of Service (TLOS)

Approach	Facility Type	Delay ¹	TLOS
Churchill Avenue/Byron Avenue			
North Approach	Mixed Traffic (No TSP)	20 seconds	C
South Approach	Mixed Traffic (No TSP)	19 seconds	C
East Approach	Mixed Traffic (No TSP)	N/A ²	N/A ²
West Approach	Mixed Traffic (No TSP)	N/A ²	N/A ²
Churchill Avenue/Richmond Road			
North Approach	Mixed Traffic (No TSP)	40 seconds	F
South Approach	Mixed Traffic (No TSP)	61 seconds	F
East Approach	Mixed Traffic (No TSP)	36 seconds	E
West Approach	Mixed Traffic (No TSP)	19 seconds	C

1. Mixed traffic delay based on the critical approach delay in Synchro analysis

2. No east-west transit along Byron Avenue

Truck Level of Service (TkLOS)

Approach	Effective Corner Radius	Number of Receiving Lanes on Departure from Intersection	LOS
Churchill Avenue/Byron Avenue			
North Approach	< 10m	One	F
South Approach	< 10m	One	F
East Approach	< 10m	One	F
West Approach	< 10m	One	F
Churchill Avenue/Richmond Road			
North Approach	< 10m	One	F
South Approach	< 10m	One	F
East Approach	< 10m	One	F
West Approach	< 10m	One	F

Auto LOS

Approach	AM Peak			PM Peak		
	V/C or Delay	LOS	Mvmt	V/C or Delay	LOS	Mvmt
Churchill Avenue/Byron Avenue						
North Approach	0.32	A	SBT/R	0.55	A	SBT/R
South Approach	0.39	A	NBT/R	0.55	A	NBT/R
East Approach	0.75	C	WB	0.92	D	WB
West Approach	0.75	C	EB	0.45	A	EB
Churchill Avenue/Richmond Road						
North Approach	0.54	A	SB	0.82	D	SB
South Approach	0.61	B	NB	0.96	E	NB
East Approach	0.62	B	WBT/R	0.86	D	WBT/R
West Approach	0.93	E	EBL	0.71	C	EBL

MMLOS Summary Table

Intersection		Churchill Avenue/Byron Avenue				Churchill Avenue/Richmond Road			
		North Approach	South Approach	East Approach	West Approach	North Approach	South Approach	East Approach	West Approach
Pedestrian	Median > 2.4m in Width	No	No	No	No	No	No	No	No
	Lanes (3.5m Lane Width)	Four	Four	Four	Four	Four	Four	Four	Four
	Conflicting Left Turns	Permissive	Permissive	Permissive	Permissive	Perm + Prot	Permissive	Permissive	Permissive
	Conflicting Right Turns	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive
	Right Turn on Red	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted
	Pedestrian Leading Interval	No	No	No	No	Yes	Yes	Yes	Yes
	Parallel Radius	5m to 10m	5m to 10m	5m to 10m	5m to 10m	5m to 10m	5m to 10m	5m to 10m	5m to 10m
	Parallel Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Perpendicular Radius	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Perpendicular Channel	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Crosswalk Type	Zebra Stripe	Zebra Stripe	Zebra Stripe	Zebra Stripe	Zebra Stripe	Zebra Stripe	Zebra Stripe	Zebra Stripe
	PETSI Score	57	57	57	57	59	59	59	59
	Delay Score	24.5	24.5	17.2	17.2	25.7	19	26.6	26.6
	Level of Service	D	D	D	D	D	D	D	D
	Target	D				D			
Cyclist	Type of Bikeway	Mixed Traffic	Mixed Traffic	Mixed Traffic	Bike Lane	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Turning Speed	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Right Turn Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Dual Right Turn Lanes	No	No	No	No	No	No	No	No
	Shared Through-Right Lane	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	Bike Box	No	No	No	No	No	No	No	No
	Lanes Crossed for Left Turns	One	One	None	None	None	None	One	One
	Dual Left Turn Lanes	No	No	No	No	No	No	No	No
	Approach Speed	60 km/hr	60 km/hr	60 km/hr	60 km/hr	60 km/hr	60 km/hr	60 km/hr	60 km/hr
	Level of Service	F	F	D	C	D	D	F	F
	Target	F				F			
	Target	B							
Transit	Facility Type	Mixed Traffic	Mixed Traffic	N/A	N/A	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic
	Average Signal Delay	20 Seconds	19 Seconds	N/A	N/A	40 Seconds	61 Seconds	36 Seconds	19 Seconds
	Level of Service	C	C	-	-	F	F	E	C
	Target	C				F			
Truck	Turning Radius	< 10m	< 10m	< 10m	< 10m	> 15m	> 15m	10m to 15m	10m to 15m
	Receiving Lanes	One	One	One	One	One	One	One	One
	Level of Service	F	D	F	F	C	C	E	E
	Target	F				E			
Auto	Volume to Capacity Ratio	0.55	0.55	0.92	0.75	0.82	0.96	0.86	0.93
	Level of Service	A	A	E	C	D	E	D	E
	Target	E				E			
	Target	E				E			