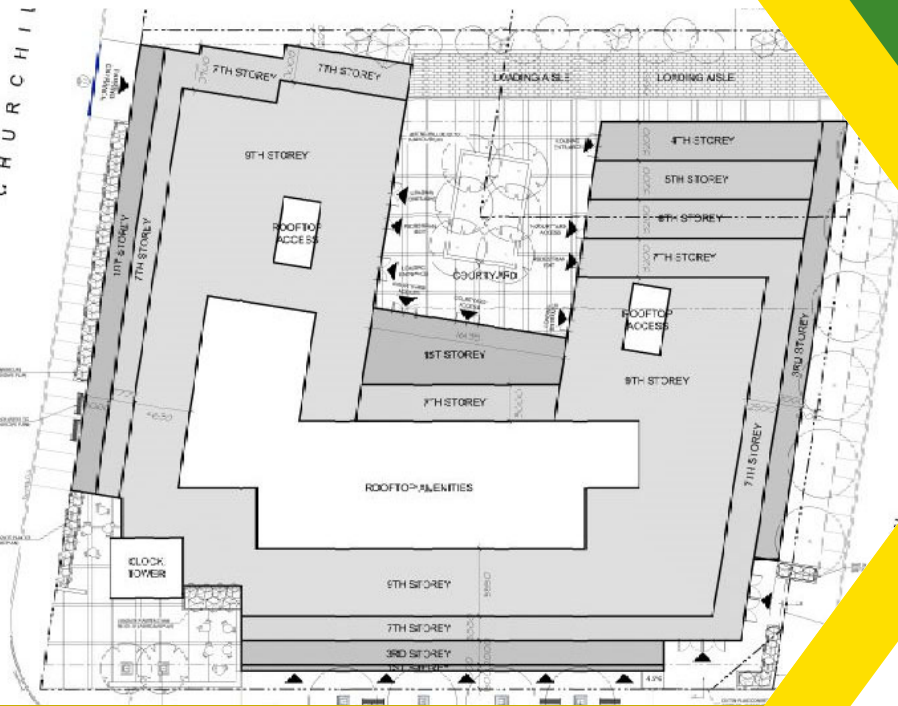


Richmond Churchill Limited Partnership

319-327 Richmond Rd, 380

Winona Ave, & 381 Churchill Ave

Transportation Impact Assessment



319-327 Richmond Road, 380 Winona Avenue, & 381 Churchill Avenue

Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Analysis Report

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1 Screening

This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required including the Design Review Component and the Network Impact Component.

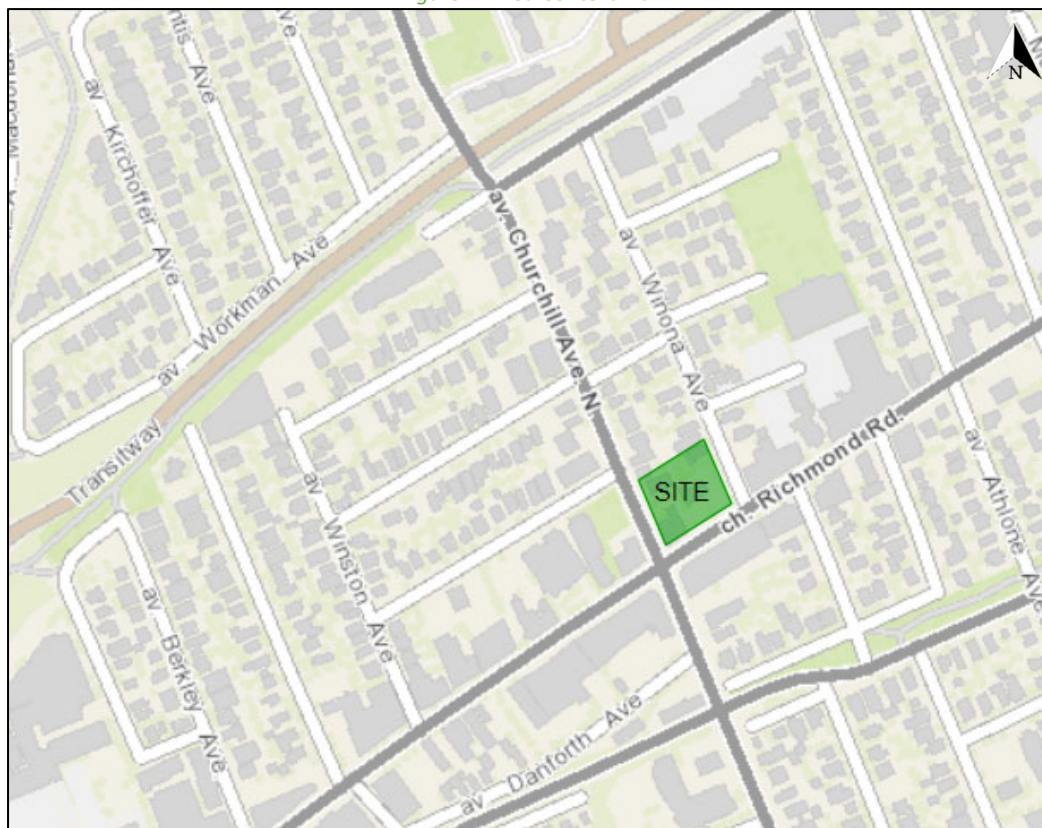
2 Existing and Planned Conditions

2.1 Proposed Development

The proposed development, located at 381 Churchill Avenue, 380 Winona Avenue, 319, 325, and 327 Richmond Road, is currently zoned as part Traditional Mainstreet (TM H15), part General Mixed Use (GM1), and part Residential Fourth Density (R4). The existing land uses include a car garage and maintenance shop, two small retail stores and a residential apartment with six units. TOD principles apply to the proposed development Study Area.

The proposed development is a nine-storey building with 184 apartment units, 1738 square metres of retail space, 130 vehicle parking spots, and 99 bicycle parking spaces. The site is proposed to have two accesses; one of which is a full movement access on Churchill Avenue approximately 65 metres north of the Churchill Avenue / Richmond Road intersection (measured from access centreline to intersection centre). The second access is located on Winona Avenue approximately 50 metres north of the Winona Avenue / Richmond Road intersection (measured from access centreline to intersection centre) and is a loading entrance with access solely to loading aisles. The anticipated full build-out and occupancy horizon is 2022. Figure 1 illustrates the Study Area context. Figure 2 illustrates the proposed site plan of the development.

Figure 1: Area Context Plan





2.2 Existing Conditions

2.2.1 Area Road Network

Richmond Road: Richmond Road is a City of Ottawa arterial road with a two-lane cross-section with parking lanes on both sides. Richmond Road has curbs and gutters within the Study Area. The posted speed limit is 50 km/h. The existing right-of-way is 20.0 metres, including sidewalks on both sides of the road. Richmond Road is designated as a trucking route.

Scott Street: Scott Street is a City of Ottawa arterial road with a two-lane cross-section and a posted speed limit of 50 km/h. Within the Study Area, Scott Street has gravel shoulders to the west of Churchill Avenue. To the east of Churchill Avenue and within the Study Area, Scott Street has a curb and gutter on the south side and a gravel shoulder on the north side. Bike lanes are provided on both sides of the roadway, parking is permitted on the gravel shoulder. The City Official Plan reserves a 26.0 metre right-of-way, including an existing sidewalk on the south side of the roadway. Scott Street is designated as a trucking route east of Churchill Avenue.

Churchill Avenue: Churchill Avenue is a City of Ottawa major collector road south of Richmond Road and an arterial road between Richmond Road and Scott Street with a two-lane cross-section and a posted speed of 50 km/h. Churchill Avenue has curbs and gutters within the Study Area. Parking lanes are provided north of Danforth Avenue and cycle tracks are provided south of Byron Avenue. The existing right-of-way is 20.0 metres, including existing sidewalks on both sides. Churchill Avenue is designated as a trucking route south of Scott Street.

Byron Avenue: Byron Avenue is a City of Ottawa collector road with a two-lane cross-section and an unposted speed limit of 50 km/h. Byron Avenue has curbs and gutters within the Study Area. The existing right-of-way is 20.0 metres with existing sidewalks on both sides, reducing to 15.0 metres to the east of Athlone Avenue with a sidewalk on only one side.

Roosevelt Avenue: Roosevelt Avenue is a City of Ottawa local road with a two-lane cross-section. To the north of Richmond Road there is a sidewalk on the east side, and to the south there are sidewalks on both sides. South of Richmond Road and within the Study Area, Roosevelt Avenue has curbs and gutters. To the north of Richmond Road and within the Study Area, Roosevelt Avenue has a curb and gutter on the east side and a grass shoulder on the west side. It has an unposted speed limit of 50 km/h. The existing right-of-way is 20.0 metres.

Athlone Avenue: Athlone Avenue is a City of Ottawa local road with a two-lane cross-section. To the north of Richmond Road there is a curb, gutter, and sidewalk on the west side and a dirt shoulder to the east. South of Richmond Road there are no sidewalks and only grass shoulders. To the north of Richmond Road, the measured right-of-way is approximately 12 metres and is approximately 9 metres to the south of Richmond Road. It has an unposted speed limit of 50 km/h.

Winona Avenue: Winona Avenue is a City of Ottawa local road with a two-lane urban cross-section, including pedestrian asphalt pathways, curbs and gutters on both sides of the roadway. It has a posted speed limit of 40 km/h. The measured right-of-way is approximately 12.5 metres.

2.2.2 Existing Intersections

A description and accompanying aerial photograph of the existing intersections within the Study Area can be found below.

Richmond Road / Churchill Avenue

The intersection of Richmond Road and Churchill Avenue is a signalized intersection. The north and south approaches consist of shared left/through and through /right lanes, and the east and west approaches are made up of an auxiliary left-turn lane and a shared through/right-turn lane. No turn restrictions were noted.



Richmond Road / Roosevelt Avenue

The intersection of Richmond Road and Roosevelt Avenue is a signalized intersection. All approaches consist of single shared all movement lanes and parking lanes are provided along Richmond Road. No turn restrictions were noted.



Richmond Road / Athlone Avenue

The intersection of Richmond Road and Athlone Avenue is an intersection pedestrian signal; consisting of a half-signal for pedestrian crossing of Richmond Road and stop-control for the minor approaches of Athlone Avenue. All approaches consist of single shared all movement lanes and parking lanes are provided along Richmond Road. No turn restrictions were noted.



Byron Avenue / Churchill Avenue

The intersection of Byron Avenue and Churchill Avenue is a signalized intersection. The eastbound and westbound approaches consist of single shared all movement lanes and the northbound and southbound approaches consist of an auxiliary left-turn lane and a shared through/right-turn lane. No turn restrictions were noted. Trucks are not permitted east of the intersection along Byron Avenue.



Scott Street / Churchill Avenue

The intersection of Scott Street and Churchill Avenue is an unsignalized intersection. All approaches consist of single shared all movement lanes. The east leg of the intersection, Scott Street, provides bike lanes. No turn restrictions were noted.



2.2.3 Existing Driveways

Existing driveways are located along Churchill Avenue, Winona Avenue, and Richmond Road to the east of the proposed site. The driveway accesses are both residential and commercial/retail accesses along Churchill Avenue and Winona Avenue and commercial/retail along Richmond Road.

Additionally, none of the driveways would provide access to significant traffic generators and would therefore have no impact on this TIA.

2.2.4 Cycling and Pedestrian Facilities

Sidewalks are provided along both sides of the major roadways and one side of the local roads in the Study Area. The cycling network consists of bike lanes on Scott Street and a small section of Byron Avenue, cycle tracks along Churchill Avenue south of Byron Avenue, and suggested bike routes along Richmond Road, Roosevelt Avenue and Byron Avenue. Major pathways systems are provided along the Confederation LRT Line, Sir John A Parkway, and Byron Linear Tramway Park. Figure 3 illustrates the pedestrian facilities in the Study Area and Figure 4 illustrates the cycling facilities.

Figure 3: Study Area Pedestrian Facilities

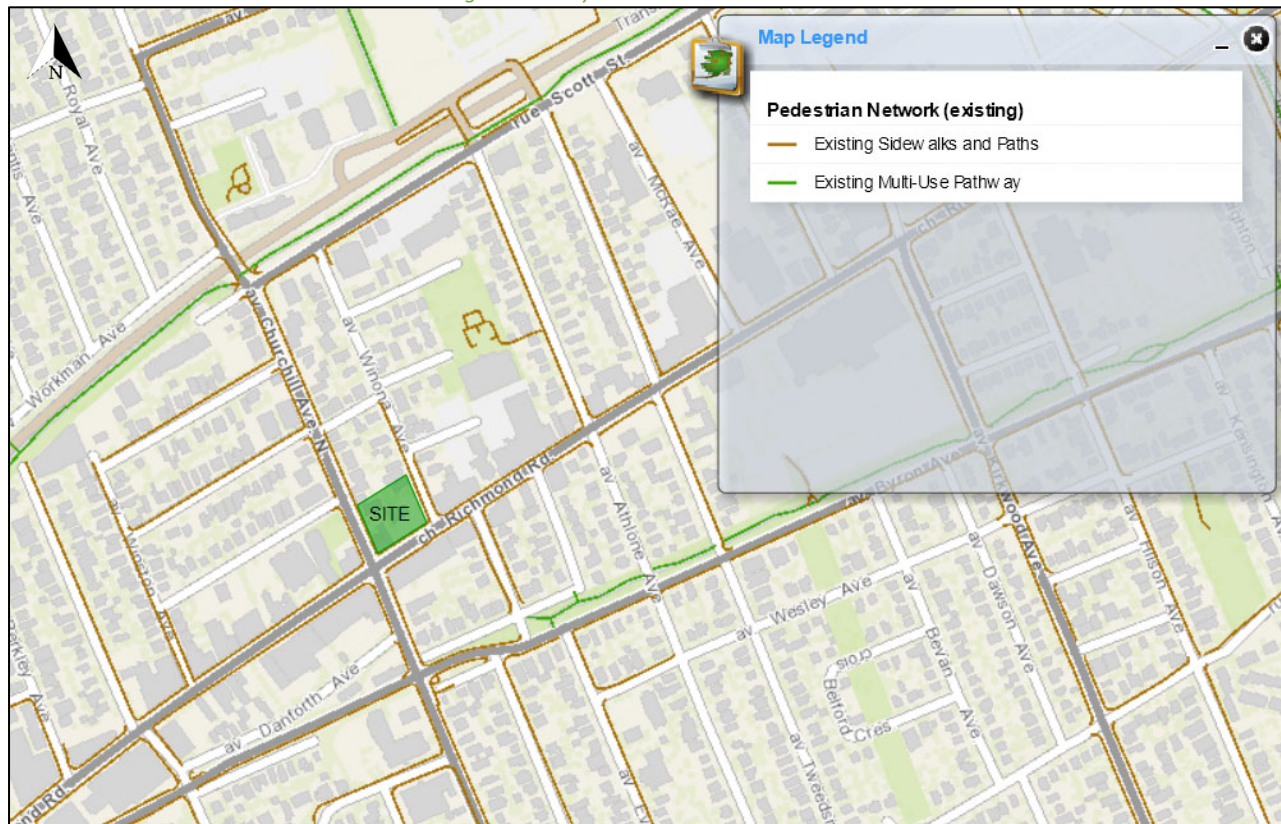
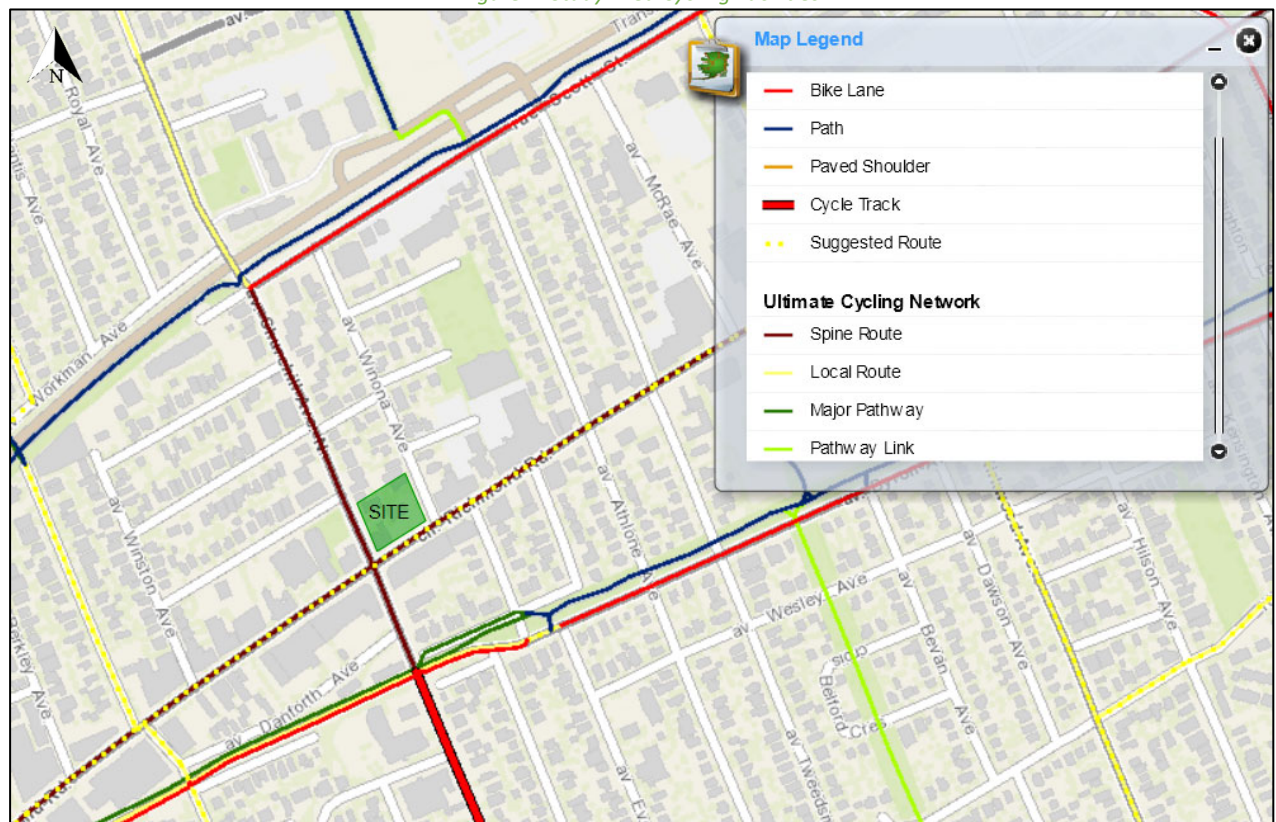


Figure 4: Study Area Cycling Facilities



2.2.5 Existing Transit

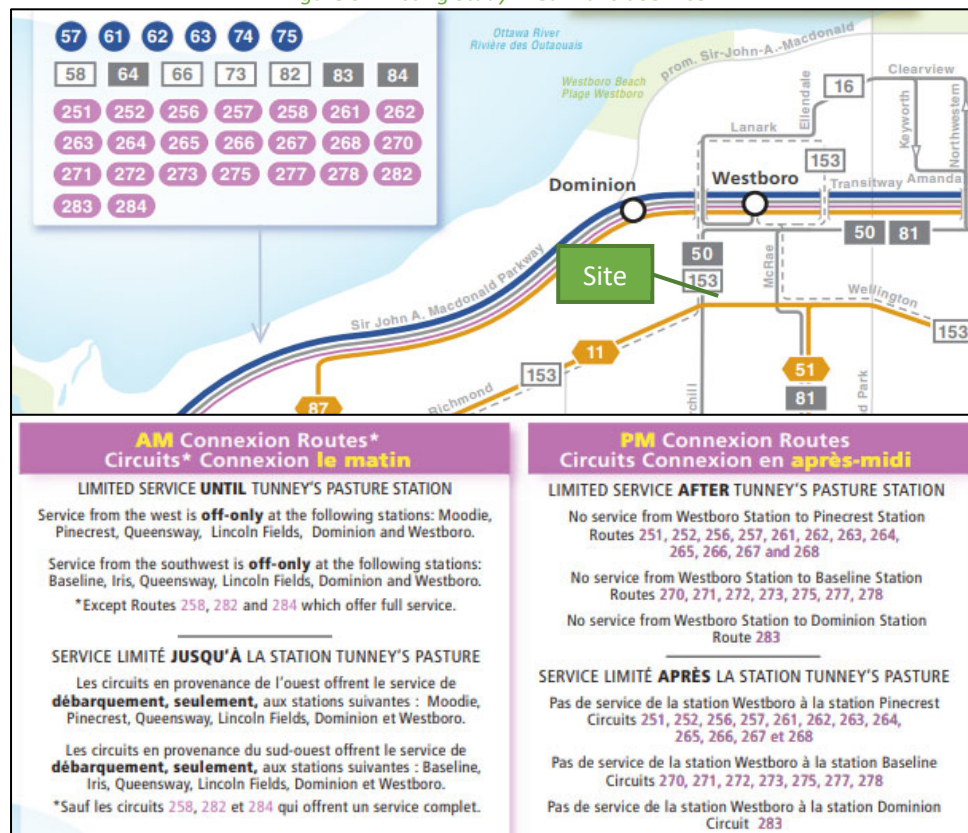
Within the Study Area, Routes #50 and #153 share four stops north of Richmond Road along Churchill Avenue with two of those stops directly beside the development site. Route #50 also has two stops south of Richmond Road just south of Byron Avenue. Routes #153 and #11 share three stops on Richmond Road to the west of Churchill Avenue and Route #11 has an additional three stops to the east of Churchill Avenue with one of those stops being directly south of the site. Within the Study Area, #81 has two stops north of Churchill Avenue and Scott Street. The frequencies of these routes within the proximity of the proposed site (as of April 24, 2020) are:

- Route #11— every 15 minutes from AM to PM weekday peak hours and mid-day weekend peak hours, and 30 minutes in the off-peak times
- Route #50— every 60 minutes from 8:00 to 10:00 AM and every 30 minutes onward for both weekdays and Saturdays with no operation on Sundays
- Route #81— every 30 minutes in the peak direction, and 60 minutes in the off-peak direction, off-peak times and weekends.
- Route #153— every two hours from approximately 11AM to 6PM with no operation on Sundays

Additionally, the Dominion and Westboro Rapid Route stations are located approximately 550m northwest and 450m northeast from the development site, respectively. Both stations are part of the Transitway and are future locations of LRT stations.

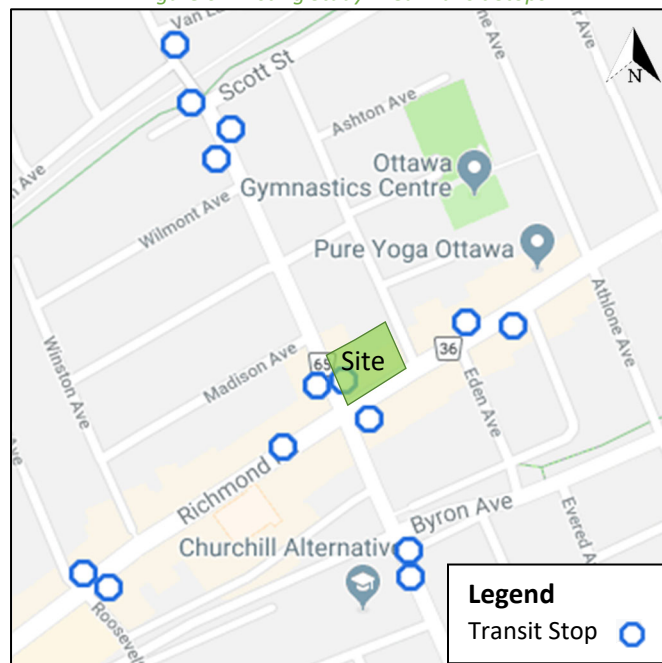
Figure 5 illustrates the transit system map and summarizes the route information for Dominion and Westboro stations. Figure 6 illustrates the transit stops in the Study Area.

Figure 5: Existing Study Area Transit Service



Accessed: April 24, 2020

Figure 6: Existing Study Area Transit Stops



Accessed: April 24, 2020

2.2.6 Existing Area Traffic Management Measures

Existing traffic management measures within the Study Area are primarily focused on truck traffic. Measures within the subject site include:

- Truck turning restriction at Churchill Avenue and Richmond Road – no WBL turn between 11PM-6AM
- No truck access on Roosevelt Avenue south of Richmond Road
- No truck access on Athlone Avenue north of Richmond Road

In 2011, a Richmond Road / Westboro Transportation Management Plan was completed and contains recommendations to be implemented over 15 years, to encourage a shift to more sustainable modes of transportation in the area. Recommendations that have been implemented in the Study Area since the plan's publication are:

- Pedestrian countdown signals at Roosevelt Avenue and Richmond Road
- Cycling lanes along Scott Street to the east of Churchill Avenue
- Six additional bus stops north of Richmond Road along Churchill Avenue

2.2.7 Existing Peak Hour Travel Demand

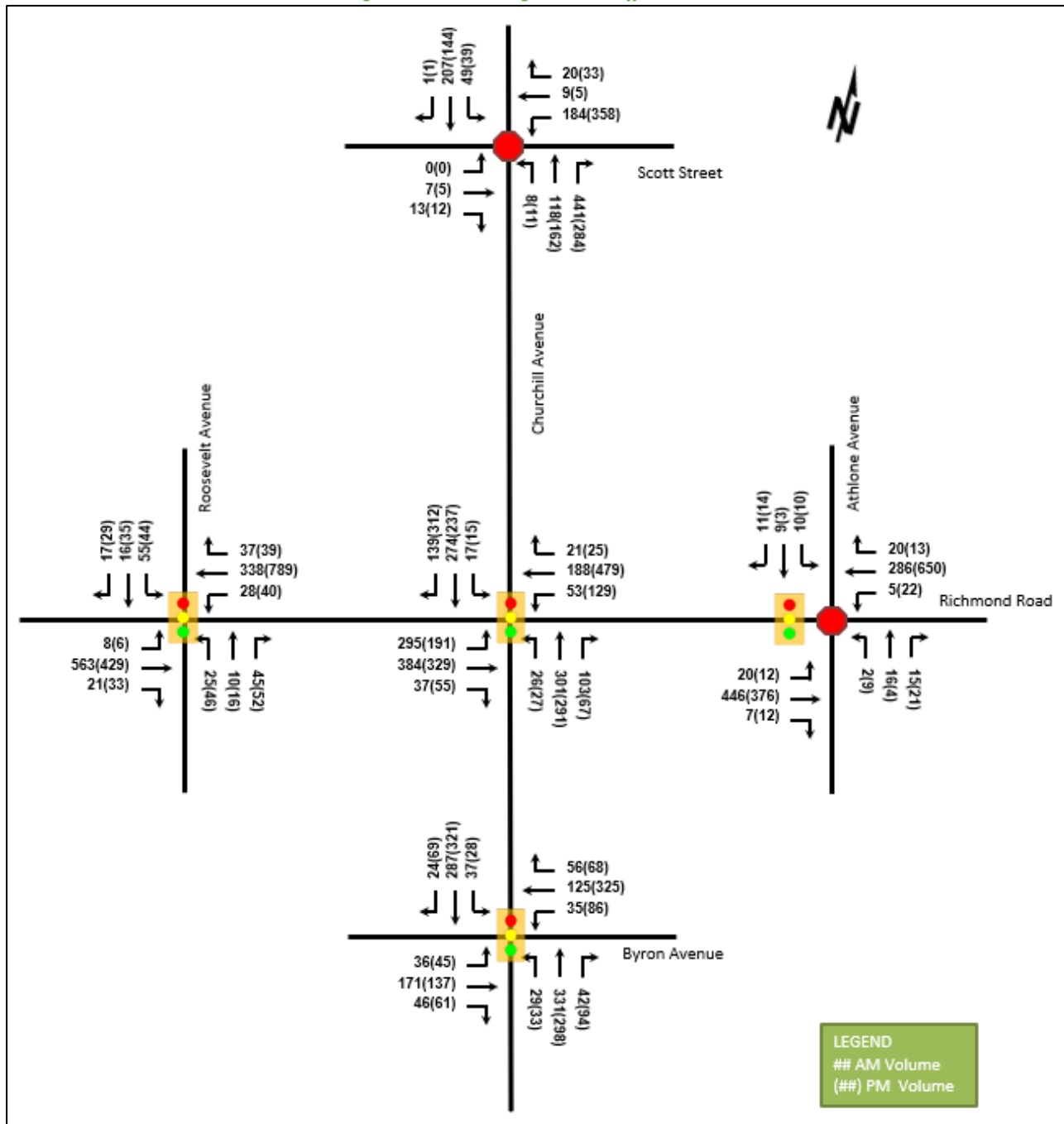
Existing turning movement counts were provided by the City of Ottawa for all existing Study Area intersections except for Churchill Avenue and Scott Street. Counts for this intersection were provided by Traffic Specialists instead. Table 1 summarizes the intersection count dates and data sources.

Table 1: Intersection Count Date

Intersection	Count Date	Data Source
Richmond Road and Churchill Avenue	Wednesday, November 22, 2017	City of Ottawa
Richmond Road and Roosevelt Avenue	Friday, June 12, 2015	City of Ottawa
Richmond Road and Athlone Avenue	Thursday, April 20, 2017	City of Ottawa
Churchill Avenue and Scott Street	Thursday, March 21, 2019	Traffic Specialists
Churchill Avenue and Byron Avenue	Thursday, August 25, 2016	City of Ottawa

Figure 7 illustrates the 2019 existing horizon traffic volumes. As suggested by City of Ottawa staff, an annual background growth of 0% will be used in order to produce a consistent horizon year. Using the AM and PM peak period intersection growth rate maps as provided by the City of Ottawa, a net 0% growth rate is confirmed within the Study Area. Detailed turning movement count data and signal timing plans are included in Appendix B.

Figure 7: 2019 Existing Horizon Traffic Volumes



2.2.8 Collision Analysis

Collision data has been acquired from the City of Ottawa for five years (2013-2017) prior to the commencement of this TIA for the surrounding Study Area road network. Specific attention is directed to the five primary intersections within the Study Area as well as the segment of Richmond Road between Winston Avenue and Churchill Avenue as a result of the large number of collisions on this segment. Figure 8 illustrates the intersections and segments analyzed, and Table 2 summarizes the total collisions for the intersections of interest. Collision data is included in Appendix C.

Figure 8: Study Area Representation of Collision Locations



Table 2: Summary of Collision Locations

Intersections / Segments	Number	%
	86	100%
Churchill Ave @ Scott St	3	3.49%
Churchill Ave @ Richmond Rd	33	38.37%
Churchill Ave @ Byron Ave	8	9.30%
Roosevelt Ave @ Richmond Rd	4	4.65%
Athlone Ave @ Richmond Rd	6	6.98%
Richmond Rd btwn Winston Ave and Churchill Ave	32	37.21%

Overall, no fatal collisions were documented in the Study Area and a total of eight collisions were noted involving pedestrians or cyclists. Two of these collisions involved cyclists, one occurring at the intersection of Athlone Avenue and Richmond Road and the other occurring at the intersection of Byron Avenue and Churchill Avenue. Five of the pedestrian collisions occurred at Churchill Avenue and Richmond Road and the other pedestrian collision occurred at Roosevelt Avenue and Richmond Road.

Table 3, Table 4, Table 5, Table 6, Table 7, and Table 8 summarize the collision types and conditions of the five intersections and one segment of interest within the Study Area on an individual basis.

Churchill Avenue and Scott Street experienced three collisions between 2013-2017. All three collisions resulted in property damage only, however each collision falls under a different impact type (Angle, SMV Unattended Vehicle and SMV Other). Weather/road conditions are considered a contributing factor for 33.33% of collisions at this intersection.

Table 3: Churchill Avenue at Scott Street Collision Summary

		Number	%
Total Collisions		3	100%
Classification	Property Damage Only	3	100.00%
Initial Impact Type	Angle	1	33.33%
	SMV Unattended Vehicle	1	33.33%
	SMV Other	1	33.33%
Road Surface Condition	Dry	2	66.66%
	Ice	1	33.33%
Pedestrian Involved		0	0.00%
Cyclists Involved		0	0.00%

Churchill Avenue and Richmond Road experienced 33 collisions between 2013-2017. Of these collisions, 27 resulted in property damage only and six resulted in non-fatal injuries. The impact types are varied, however the rear end, angle and sideswipe collision initial impact categories contained the largest proportions of the collisions at this intersection with 30.31%, 21.21% and 18.18% of all collisions respectively. Weather/road conditions are considered a contributing factor for 27.27% of collisions at this intersection.

Table 4: Churchill Ave @ Richmond Rd Collision Summary

		Number	%
Total Collisions		33	100%
Classification	Non-Fatal Injury	6	18.18%
	Property Damage Only	27	81.82%
Initial Impact Type	Angle	7	21.21%
	Rear end	10	30.31%
	Sideswipe	6	18.18%
	Turning Movement	2	6.06%
	SMV Unattended Vehicle	4	12.12%
	SMV Other	4	12.12%
Road Surface Condition	Dry	24	72.73%
	Wet	5	15.15%
	Loose Snow	2	6.06%
	Slush	1	3.03%
	Ice	1	3.03%
Pedestrian Involved		5	15.15%
Cyclists Involved		0	0.00%

Churchill Avenue and Byron Avenue experienced eight collisions between 2013-2017, all of which resulted in property damage only. The impact types of the collisions fall under the rear end, angle, turning movement and other categories with three, two, two, and one collision respectively. Weather/road conditions are considered a contributing factor for 62.50% of collisions at this intersection.

Table 5: Churchill Ave @ Byron Ave Collision Summary

		Number	%
Total Collisions		8	100%
Classification	Property Damage Only	8	100.00%
Initial Impact Type	Angle	2	25.00%
	Rear end	3	37.50%
	Turning Movement	2	25.00%
	Other	1	12.5%
Road Surface Condition	Dry	3	37.50%
	Wet	3	37.50%
	Ice	1	12.50%
	Loose sand or gravel	1	12.50%
Pedestrian Involved		0	0.00%
Cyclists Involved		1	12.50%

Roosevelt Avenue and Richmond Road experienced six collisions between 2014-2017. Three of these collisions resulted in non-fatal injuries and the other three in property damage only. The collisions have been classified as belonging to the angle, rear end, turning movement, SMV unattended vehicle and SMV other impact type categories with the turning movement classification having two collisions and the rest of the classifications having one. Weather/road conditions are considered a contributing factor for 33.33% of collisions at this intersection.

Table 6: Roosevelt Ave @ Richmond Rd Collision Summary

		Number	%
Total Collisions		6	100%
Classification	Non-Fatal Injury	3	50.00%
	Property Damage Only	3	50.00%
Initial Impact Type	Angle	1	16.67%
	Rear end	1	16.67%
	Turning Movement	2	33.32%
	SMV Unattended Vehicle	1	16.67%
	SMV Other	1	16.67%
Road Surface Condition	Dry	4	66.66%
	Wet	1	16.67%
	Ice	1	16.67%
Pedestrian Involved		1	16.67%
Cyclists Involved		0	0.00%

Athlone Avenue and Richmond Road has experienced six collisions between 2013-2017. Five of these collisions resulted in property damage only and one in non-fatal injuries. The impact types are split evenly between the rear end and angle categories. Weather/road conditions are considered a contributing factor for 16.67% of collisions at this intersection.

Table 7: Athlone Ave @ Richmond Rd Collision Summary

		Number	%
Total Collisions		6	100%
Classification	Non-Fatal Injury	1	16.66%
	Property Damage Only	5	83.33%
Initial Impact Type	Angle	3	50.00%
	Rear end	3	50.00%
Road Surface Condition	Dry	5	83.33%
	Loose Snow	1	16.67%
Pedestrian Involved		0	0.00%
Cyclists Involved		1	16.66%

Richmond Road between Winston Avenue and Churchill Avenue has experienced 32 collisions between 2013-2017. Thirty of these collisions resulted in property damage only and two in non-fatal injuries. The impact types primarily fall into the angle, sideswipe, and SMV unattended vehicle categories at 12.50%, 21.88% and 43.74% of the total collisions respectively. Weather/road conditions are considered a contributing factor for 28.12% of collisions at this intersection.

Table 8: Richmond Road btwn Winston Ave and Churchill Ave

		Number	%
Total Collisions		32	100%
Classification	Non-Fatal Injury	2	6.25%
	Property Damage Only	30	93.75%
Initial Impact Type	Angle	4	12.50%
	Rear end	3	9.38%
	Sideswipe	7	21.88%
	Turning Movement	3	9.38%
	SMV Unattended Vehicle	14	43.74%
	Other	1	3.12%
Road Surface Condition	Dry	23	71.88%
	Wet	7	21.88%
	Slush	1	3.12%
	Ice	1	3.12%
Pedestrian Involved		0	0.00%
Cyclists Involved		1	0.00%

2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

The proposed development is subject to the Richmond Road / Westboro Transportation Implementation Plan as well as TOD principles, both of which promote a shift towards sustainable modes of transportation in the area. These plans are expressed as elements of the Ottawa Pedestrian Plan and the Ottawa Transportation Master Plan.

The City of Ottawa Transportation Plan indicates both Scott Street and Richmond Road within the Study Area will be part of the primary urban cycling network as spine routes. Scott Street is also shown to be part of the cross-town bikeway and Byron Avenue is indicated to be part of the primary urban cycling network as a major pathway. The 2031 Affordable Network indicates a future isolated measure transit priority corridor along Richmond Road through the Study Area and future light rail infrastructure to the north of the Study Area with stops at what are currently the Dominion and Westboro Transitway stations. The Westboro and Dominion LRT Stations are expected

to be completed by 2025. As a timeline for the Richmond Road isolated transit priority measures has not been made available, it is assumed that this will occur beyond the proposed development's future horizons.

The Ottawa Pedestrian Plan does not require specific plans or changes with respect to pedestrian infrastructure to be implemented in the Study Area.

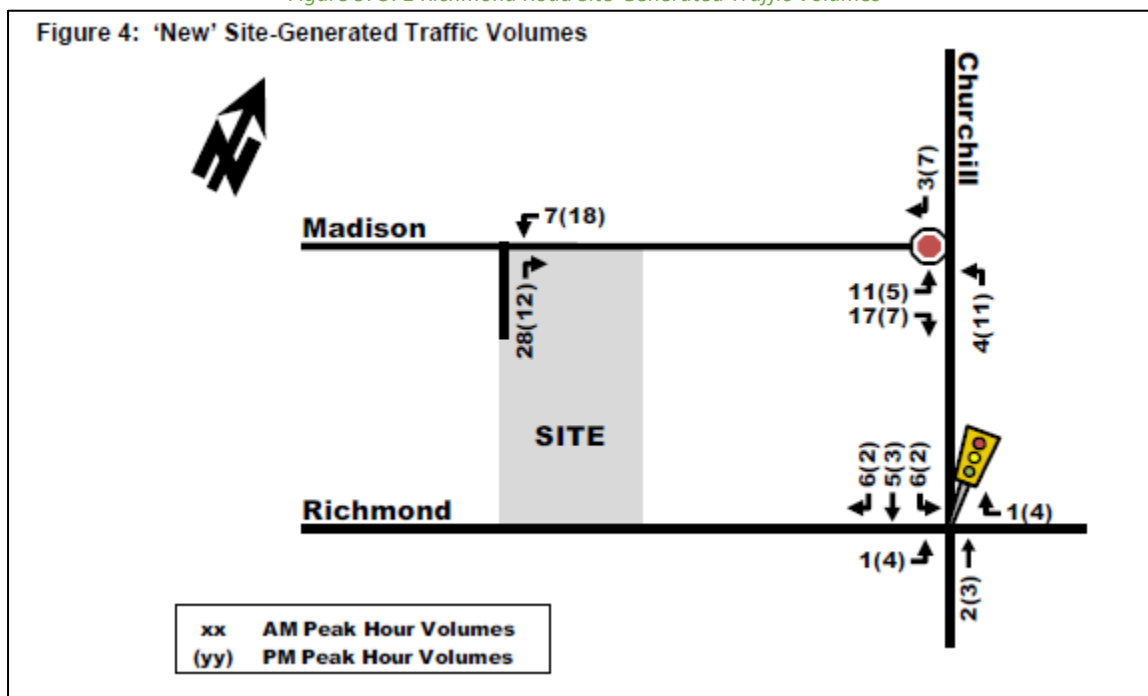
Additionally, as indicated by the City of Ottawa, road, sewer and water work is planned for Winona Avenue within the next three to five years. Further details are not yet available at this time.

2.3.2 Other Study Area Developments

At the time of this report, a few development applications were available for the adjacent properties as listed on the City's Development Application Search tool:

- 404 Eden – 13 unit, four-storey low rise residential unit with underground parking made up of nine vehicle parking spaces and nine bicycle parking spaces. The anticipated trip generation is expected to be minimal and therefore have a negligible impact on the surrounding area.
- 348/350 Winona – The City of Ottawa has received Zoning Bylaw Amendment and Site Plan Control applications to facilitate the establishment of a fourth unit in the basement of the two triplexes located at 348 and 350 Winona Avenue. Trip generation is expected to have negligible impacts on the surrounding area.
- 371 Richmond Road– 100-unit, nine storey residential unit. The existing surface parking is to be maintained and provides approximately 30 to 35 vehicle parking spaces. An additional 31 vehicle parking spaces are proposed. No completion date is identified and as such, it is assumed to be built-out by 2022 in order to produce a conservative analysis. The anticipated trip generation from this site can be seen in Figure 9 and is an excerpt from a Transportation Brief for 371 Richmond Road prepared by Parsons in 2014.

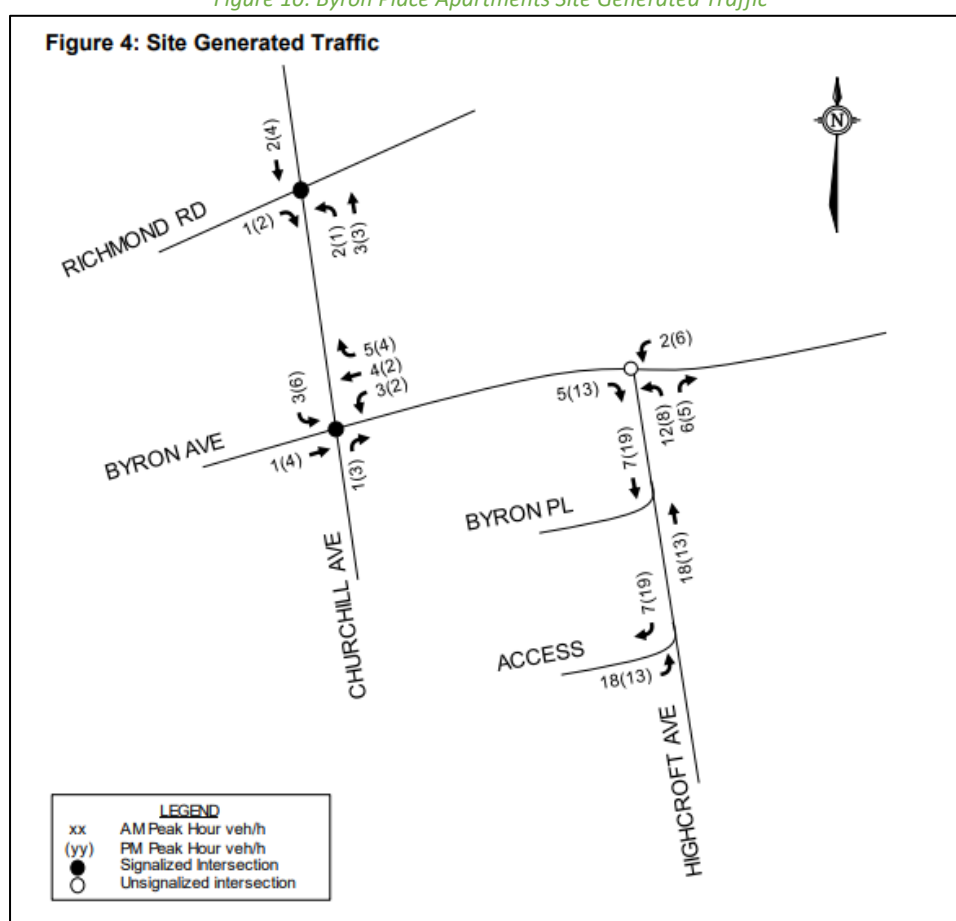
Figure 9: 371 Richmond Road Site-Generated Traffic Volumes



Source: 371 Richmond Road-Transportation Brief. July 2014

- 386 Richmond Road - Eight dwelling unit residential apartment with approximately 200 square metres of retail space. This development is proposed to have no vehicle access and therefore is transit and active mode only. The anticipated trip generation is expected to have a negligible impact on the surrounding area.
- 348 Whitby Avenue/ 364 Churchill Avenue – Expansion of the Westboro Animal Hospital at 364 Churchill Avenue and replacement of the existing dwelling at 348 Whitby Avenue with parking for the Animal hospital. The anticipated trip generation is expected to have a negligible impact on the surrounding area.
- 433-435 Churchill Avenue and 468-472 Byron Place – A six-storey mixed-use development with 76 apartment units, 321 square metres of retail space, 65 indoor vehicle parking spaces, and 45 indoor bicycle parking spaces. Full build-out is expected in 2020. The anticipated trip generation can be seen in Figure 10 and is an excerpt from the 2019 Byron Place Apartments Transportation Impact Assessment prepared by Novatech.

Figure 10: Byron Place Apartments Site Generated Traffic

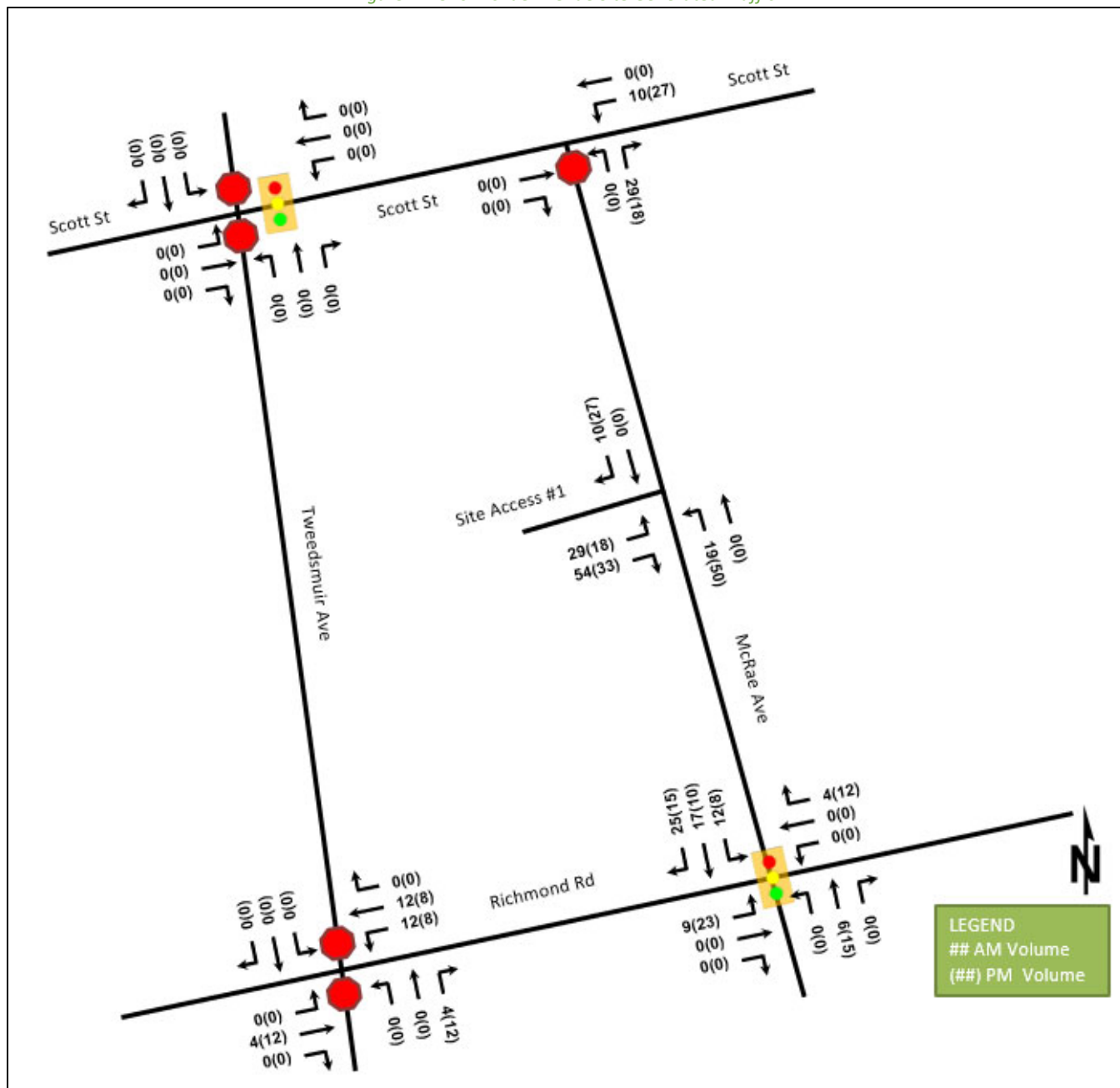


Source: Byron Place Apartments Transportation Impact Assessment. April 2019

- 320 McRae - The proposed development is made up of a four-storey commercial / residential tower, a commercial / residential tower with both a 26-storey and a six-storey component. The development is expected to have 882 square metres of commercial space, a total of 318 residential units, 181 parking spaces and 163 bicycle parking spaces. 320 McRae is projected to have a similar timeline as the proposed development, however given the uncertainties in a development application, it is unknown if full build-out of this development will occur in 2022. As such, the impact of the site traffic generated by 320 McRae

will be considered in the 2027 future horizon only. The anticipated trip generation can be seen in Figure 11 and is an excerpt from the 320 McRae Transportation Impact Study prepared by CGH Transportation.

Figure 11: 320 McRae Avenue Site Generated Traffic



Source: 320 McRae Transportation Impact Study. March 2020

3 Study Area and Time Periods

3.1 Study Area

The Study Area will include the intersections of Scott Street and Churchill Avenue, Richmond Road and Churchill Avenue, Byron Avenue and Churchill Avenue, Roosevelt Avenue and Richmond Road, and Athlone Avenue and Richmond Road. Churchill Avenue, Richmond Road and Winona Avenue are noted as the boundary roads for the site.

3.2 Time Periods

The AM and PM peak hours will be examined for the proposed development.

3.3 Horizon Years

The anticipated build-out year is 2022. As a result, the full build-out plus five years horizon year is 2027.

4 Exemption Review

Table 9 summarizes the exemptions for this TIA.

Table 9: Exemption Review

Module	Element	Explanation	Exempt/Required
Design Review Component			
4.1 Development Design	4.1.2 Circulation and Access	Only required for site plans	Required
	4.2.3 New Street Networks	Only required for plans of subdivision	Exempt
4.2 Parking	4.2.1 Parking Supply	Only required for site plans	Required
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	To be examined further once the parking plan and land uses are finalized.
Network Impact Component			
4.5 Transportation Demand Management	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Required
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	Exempt
4.8 Network Concept		Only required when proposed development generates more than 200 person-trips during the peak hour in excess of equivalent volume permitted by established zoning	Exempt

5 Development-Generated Travel Demand

5.1 Trip Generation and Mode Shares

This TIA has been prepared using the vehicle and person trip rates for the residential components using the TRANS Trip Generation Study Report (2009) and the vehicle trip rates for the retail components using the ITE Trip Generation Manual (10th Edition). To estimate person trip generation for the retail components, a factor of 1.28 has been applied to the ITE rates. Table 10 summarizes the person trip rates for the proposed land uses.

Table 10: Trip Generation Person Trip Rates

Dwelling Type	Land Use Code	Peak Hour	Vehicle Trip Rate	Person Trip Rates
Mid-rise Apartments	223 (TRANS)	AM	0.24	0.65
		PM	0.28	0.70
Shopping Centre	820	AM	0.94	1.2
		PM	3.81	4.88

Using the above Person Trip rates, the total person trip generation has been estimated. Table 11 below illustrates the total person trip generation by dwelling type.

Table 11: Total Person Trip Generation

Land Use	Units / GFA	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Mid-Rise Apartments	184 units	28	91	119	81	48	129
Shopping Centre	18, 706 sq.ft	14	8	22	44	47	91
Total Person Trips		42	99	141	125	95	220

Using the most recent National Capital Region Origin-Destination (OD Survey), the existing mode shares for Ottawa West have been summarized in Table 12. As the site is located within a TOD area, the mode share assumptions for developments in proximity to transit stations is included and will be used to generate the site trips for the proposed mixed-use building.

Table 12: Mode Share

Travel Mode	Ottawa West	TOD Mode Share
Auto Driver	50%	15%
Auto Passenger	15%	5%
Transit	20%	65%
Cycling	5%	5%
Walking	10%	10%
Total	100%	100%

Internal capture rates from the ITE Trip Generation Handbook 3rd Edition have been assigned to the development for the retail components for mixed-use developments. The retail portion of this development is the smaller of the two land uses. Therefore, the residential land use is treated as the anchor for this development and is not reduced based on the multi-use capture rate. The smaller portion of the development, the retail portion, has been reduced to reflect residents of the site utilizing the on-site retail instead of leaving the site and/or as a pass-by trip on the way to an ultimate destination (ie. work). The rates summarized in Table 13 represent the percentage of trips to/from the retail uses based on the residential component. Table 14 shows the resulting reduction in retail generated trips using the internal capture rates displayed in Table 13.

Table 13: Internal Capture Rates

Land Use	AM		PM	
	In	Out	In	Out
Residential to/from Shopping Centre	17%	14%	10%	26%

Table 14: Internal Capture Volumes

Land Use	AM		PM	
	In	Out	In	Out
Retail Person Generated Site Volumes	8	22	47	91
Internal Capture Rates	17%	14%	10%	26%
Internal Capture	-2	-1	-4	-12

Using the above mode shares and person trip rates, the person trips by mode have been projected. Table 15 summarizes the trip generation by mode.

Table 15: Trip Generation Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
Auto Driver	15%	6	15	21	19	14	33
Auto Passenger	5%	2	5	7	6	4	11
Transit	65%	28	64	92	81	63	143
Non-Auto Modes	5%	2	5	7	6	5	11
Walking	10%	4	10	14	13	9	22
Internal Capture	(varies)	-2	-1	-3	-4	-12	-16
Total	100%	40	98	138	121	83	204

As shown above, 21 AM and 33 PM new peak hour two-way vehicle trips are projected as a result of the proposed development.

5.2 Trip Distribution

To understand the travel patterns of the subject development, the OD survey has been reviewed to determine the existing travel patterns that will be applied to the new vehicle trips. Table 16 below summarizes the distribution for Ottawa West.

Table 16: OD Survey Existing Mode Share - Ottawa West

To/From	% of Trips
North	15%
South	35%
East	35%
West	15%
Total	100%

5.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network. No trips have been assigned to the loading access on Winona Avenue as this access will be used only during off-peak hours. Figure 12 illustrates the new site traffic assignment by percentage and Figure 13 illustrates the new site generated volumes.

Figure 12: New Site Generation Assignment (%)

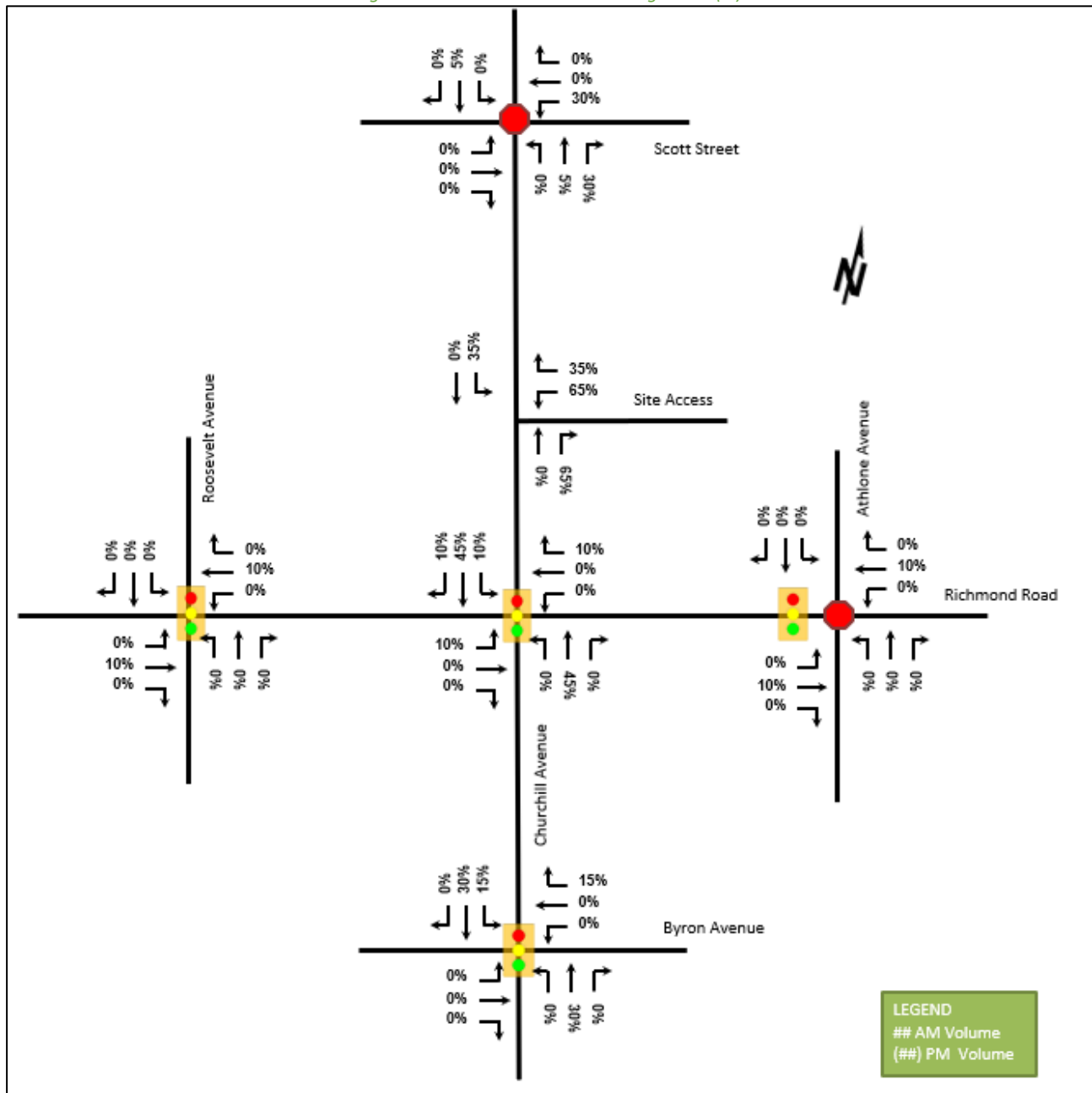
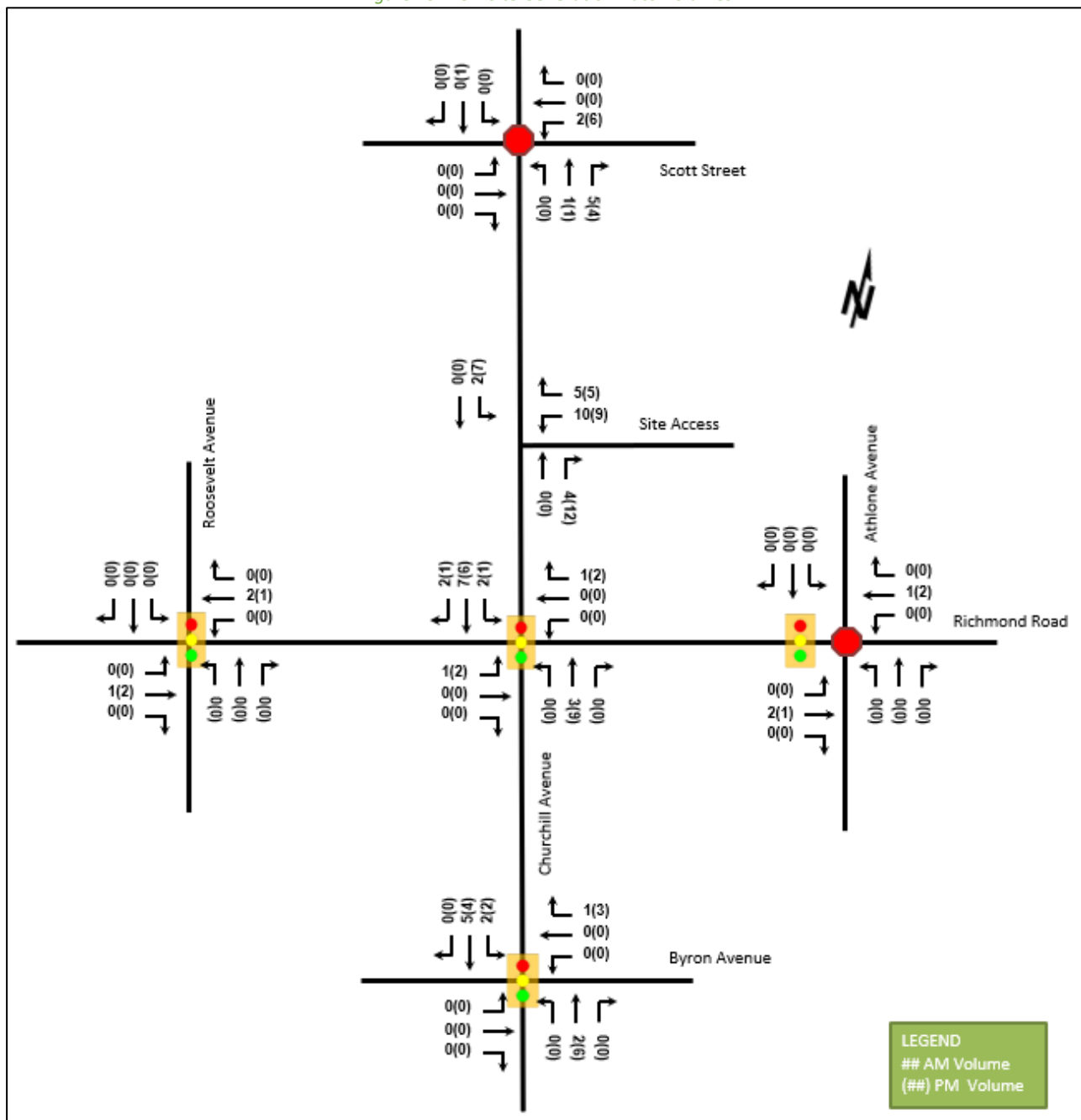


Figure 13: New Site Generation Auto Volumes



6 Background Network Travel Demands

6.1 Transportation Network Plans

The transportation network plans were discussed in Section 2.3.1. Both TOD policies and the opening of the Westboro LRT station and Dominion LRT station have been accounted for within the modal share assumptions. No road improvements are noted for this area with the exception of future road sewer, and water work along Winona Avenue.

The additional connectivity provided by future bicycle spine routes along Scott Street as part of the crosstown bikeway will improve the active mode network but is not anticipated to significantly impact the modal shares used in the future trip generation.

6.2 Background Growth and Other Developments

As stated in 2.2.7, using the AM and PM peak period intersection growth rate maps provided by the City of Ottawa, a net 0% growth rate can be seen within the Study Area and as a result, an annual background growth of 0% has been used.

The background developments explicitly considered in the background conditions include the 320 McRae Avenue development, the 371 Churchill development, and the Byron Place development. All of these developments are discussed in Section 2.3.2.

Figure 14 illustrates the 2022 background volumes and Figure 15 illustrates the 2027 background volumes

Figure 14: Background 2022 Volumes

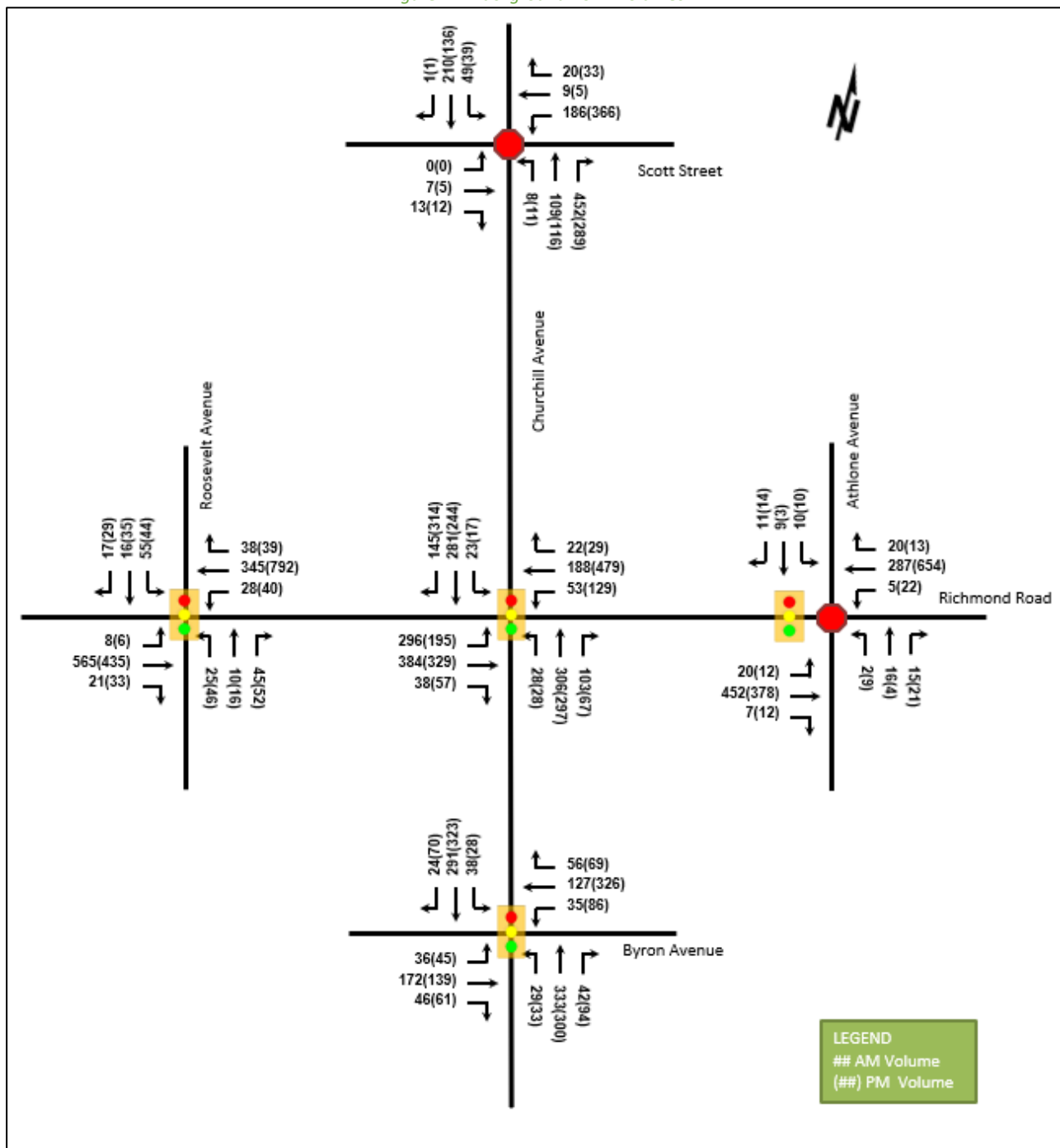
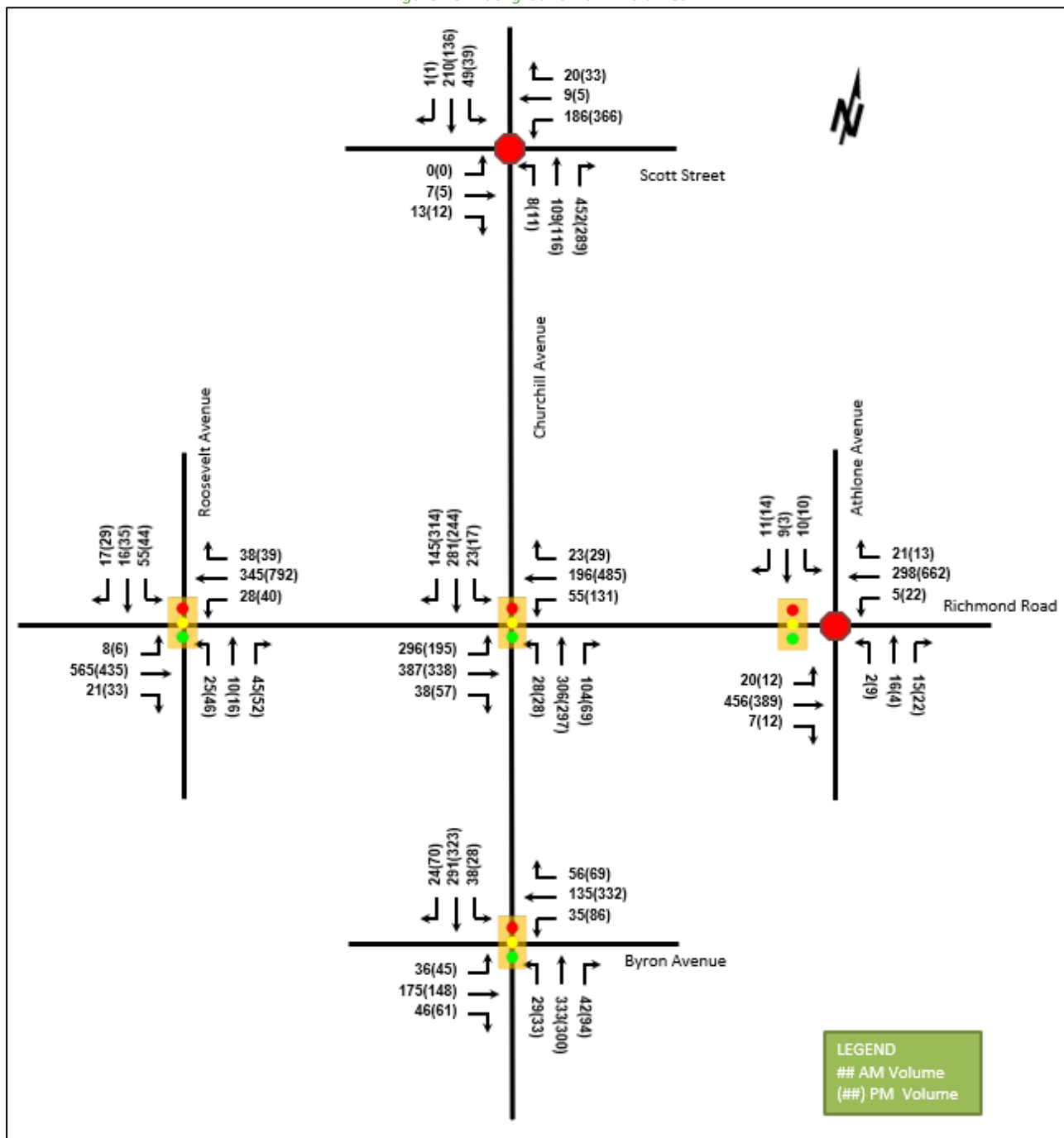


Figure 15: Background 2027 Volumes



7 Demand Rationalization

As documented in Section 16.2.1, the existing intersections within the Study Area are operating well and have additional capacity. Changes in traffic volumes between existing and future conditions will come from 320 McRae Avenue, 371 Richmond Road, the Byron Place development and the proposed development within this report.

The trip generation of this development is consistent with expected TOD modal shares as can be seen in Section 5.1. These TOD mode shares will be supported by the TDM measures recommended in Section 8.1 and Section 12

below. While the proposed development is not directly adjacent to the Westboro LRT Station or the Dominion LRT Station, the urban arterial mainstreet context promotes transit, pedestrian, and cycling connections between the development and these LRT stations. As such, the TOD modal shares are anticipated to be achieved and no adjustments are required. However, in the event that the TOD mode shares are not fully realized, it can be seen that in Section 16.2, additional capacity at the Study Area intersections is available to accommodate this.

The future total 2022 volumes are illustrated in Figure 16 and the future total 2027 volumes are illustrated in Figure 17.

Figure 16: Future Total 2022 Volumes

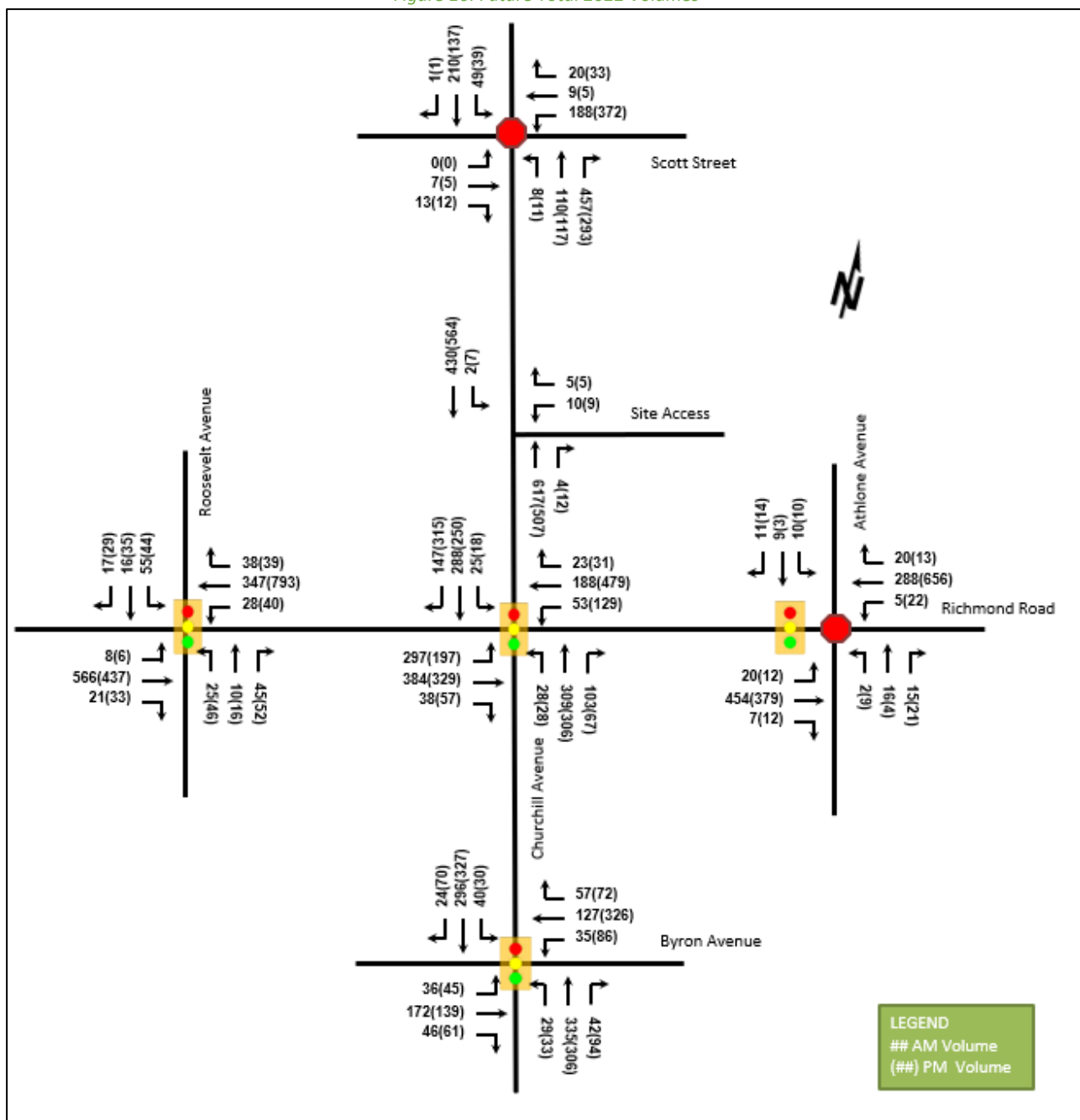
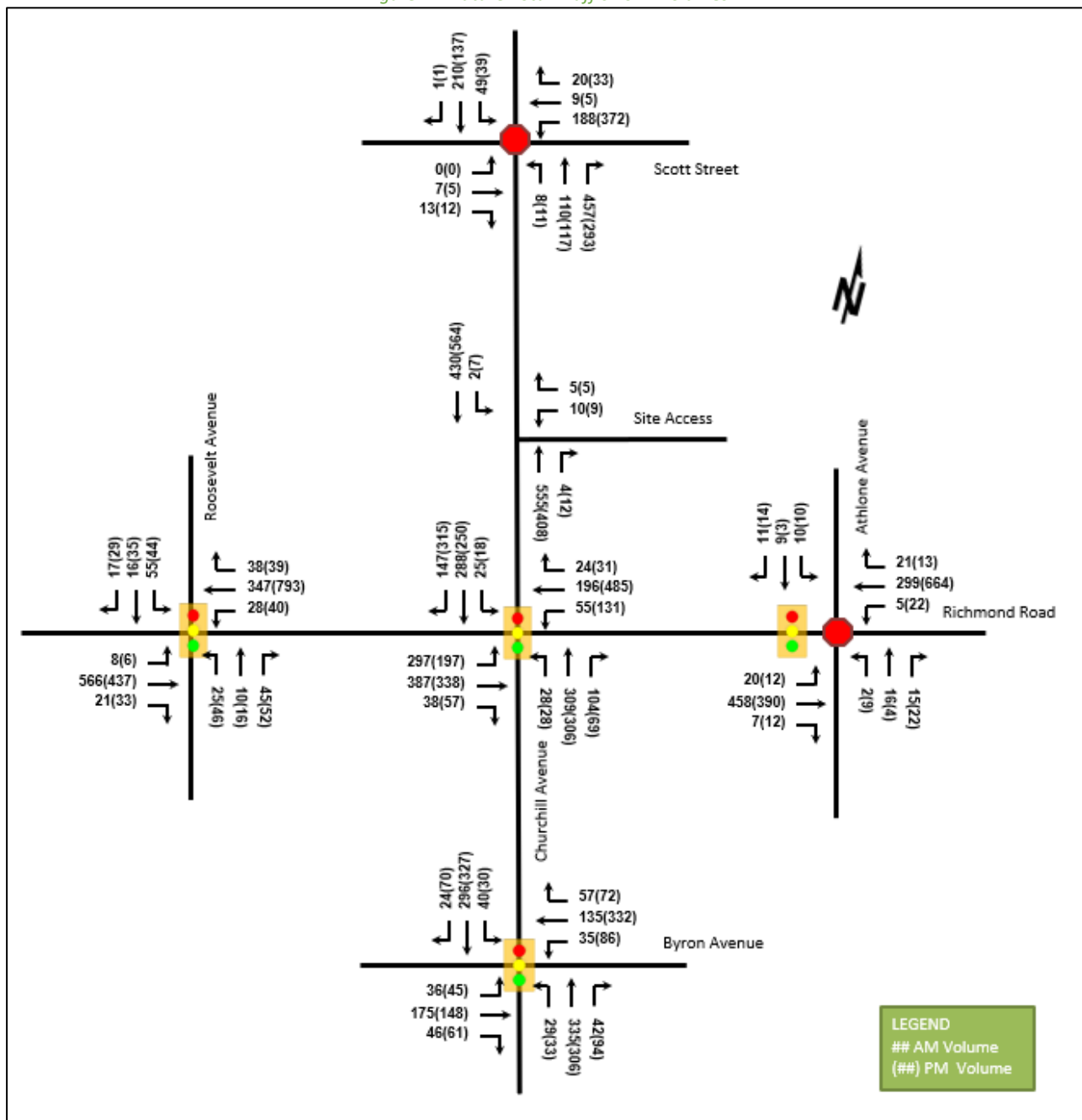


Figure 17: Future Total Traffic 2027 Volumes



8 Development Design

8.1 Design for Sustainable Modes

The proposed development is a nine-storey apartment building with ground floor retail space. Underground parking for both automobiles and bicycles is provided.

The proposed development fronts directly onto pedestrian facilities provided on Richmond Road, Churchill Avenue, and Winona Avenue. These pedestrian facilities provide access to the surrounding Study Area, the many

existing transit stops adjacent to and surrounding the proposed development, and the future Dominion and Westboro LRT Stations approximately 550m northwest and 450m northeast, respectively.

Additionally, facilities that are supportive of sustainable modes in the City of Ottawa's TDM-supportive Development Design and Infrastructure Checklist, which are required for zoning and standard site design, are recommended. The following additional measures are also recommended:

- Locate building close to the street, and do not locate parking areas between the street and building entrances.
- Locate building entrances in order to minimize walking distances to sidewalks and transit facilities.
- Locate building doors and entrances to ensure visibility of pedestrians from the building.
- Provide safe, direct, and attractive walking routes from the building entrances to nearby transit stops.
- Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible.
- Provide wayfinding signage for site access and egress.
- Provide lighting, landscaping, and benches along walking and cycling routes between building entrances and streets, sidewalks and trails.
- Provide a permanent bike repair station.
- Separate short-term and long-term parking areas using signage or physical barriers.

TDM Checklists for both residential and non-residential land uses can be found in Appendix D.

8.2 Circulation and Access

The site access on Churchill Avenue will accommodate passenger vehicles accessing the underground parking facilities. The other site access, located on Winona Avenue, is a loading entrance only and will be designated for loading vehicle and garbage truck use only. This loading access will also serve as an emergency vehicle access for the proposed development. Turning templates for the loading access will be provided as part of a future Site Plan Application submission.

8.3 New Street Networks

This TIA is exempt from this Module (see Table 9).

9 Parking

9.1 Parking Supply

The parking requirements and provisions for the proposed development are summarized in Table 17.

Table 17: Parking Provisions

Land Use	Parking Rate	Parking Required	Parking Provided
Residential	0.5 spaces/unit after 12 units	86	130
	-10% (Section 101(6)(c) of Zoning By-law)	-9	
Visitor	0.1 spaces / unit excluding the first 12 units	18	
Commercial	1.25 spaces/100m ² for units with GFA > 500 m ²	0	
Total Vehicle Parking		95	99
Residential (bicycle)	0.5 spaces/dwelling unit	92	
Commercial (bicycle)	1 space/250m ² GFA	7	
Total Bicycle Parking		99	

Despite the assumption that the Westboro and Dominion LRT Stations will be completed and that the surrounding area is operating as a TOD area, the proposed development's parking provisions have been applied based on the existing area zoning. As such, minimum residential and retail parking rates have been considered in comparison to a TOD area where no minimum automobile parking space requirements apply, with the exception of residential visitor parking.

Based on the City of Ottawa Zoning By-laws, a total of 77 residential automobile parking spaces are required as a minimum, and 18 residential visitor vehicle parking spaces are required. No commercial vehicle parking is required as vehicle parking spaces are not required for commercial / retail uses with a GFA less than 500 m². As can be seen in Table 17, the required parking space provisions for automobile parking are met in excess of 35 spaces.

A total of 92 residential bicycle parking spaces and 7 commercial bicycle parking spaces are required. As can be seen in Table 17, the required parking space provisions for bicycle parking have been met. It is noted that of the 99 bicycle parking spaces provided, seven will be exterior spaces.

9.2 Spillover Parking

Parking demand is not considered an issue as a result of the application of TOD principles as well as low vehicle traffic demand. Additionally, as reducing parking forms a key part of TDM strategy this module is not applicable in this TIA.

10 Boundary Street Design

Churchill Avenue, Richmond Road and Winona Avenue are noted as the boundary roads for the site in both the 2022 and 2027 future horizons. None of the boundary roads are considered Complete Streets and no plans currently exist to upgrade them to a Complete Street. While road, sewer, and water work is anticipated along Winona Avenue in three to five years, detailed plans on resulting changes to the roadway are not yet available and as such, existing conditions have been assumed in future horizons for the purpose of this analysis.

The Segment Multi-Modal Level of Service (MMLOS) is broken down into the Pedestrian Level of Service (PLOS), Bicycle Level of Service (BLOS), Transit Level of Service (TLOS) and Truck Level of Service (TkLOS) and are all recorded in Table 18. The MMLOS Worksheets can be found in Appendix E.

Table 18: Boundary Street MMLOS

Road Segment	Horizon	MMLOS							
		PLOS		BLOS		TLOS		TkLOS	
		Actual	Target	Actual	Target	Actual	Target	Actual	Target
Richmond Road	Existing								
	2022	D	A	E	C	F	N/A	F	D
	2027								
Churchill Avenue	Existing								
	2022	D	A	E	B	E	N/A	B	D
	2027								
Winona Avenue	Existing								
	2022	B	A	D	D	D	N/A	N/A	N/A
	2027								

As the Study Area is considered to be a TOD area for all horizons and no changes to the boundary road segments are planned within the study horizons, the existing and future horizons are the same.

The road segment of Richmond Road will not meet its pedestrian LOS target due to small boulevard widths and high vehicle operating speeds and will not meet its bicycle LOS targets due to mixed traffic conditions. Richmond Road will not meet its target truck LOS due to low truck lane widths. As Richmond Road is not subject to any transit priority measures, no transit target LOS is available.

The road segment of Churchill Avenue will not meet its pedestrian LOS target due to small boulevard widths and high vehicle operating speeds and will not meet its bicycle LOS targets due to mixed traffic conditions. Richmond Road will meet its target truck LOS. As Richmond Road is not subject to any transit priority measures, no transit target LOS is available.

The road segment of Winona Avenue will not meet its pedestrian LOS target due to small boulevard widths but will meet its bicycle LOS targets. As Winona Avenue is not part of a truck route, no truck LOS has been evaluated. Additionally, as Winona Avenue is not subject to any transit priority measures, no transit target LOS is available.

Future network plans mentioned in both Section 2.3.1 and Section 6.1 are anticipated to increase connectivity and improve the active mode network within the Study Area. These changes have the potential to improve the MMLOS of the boundary streets.

11 Access Intersection Design

11.1 Location and Design of Access

The site is proposed to have two accesses; one of which is a full movement access on Churchill Avenue approximately 65 metres north of the Churchill Avenue / Richmond Road intersection (measured from access centreline to intersection centre). The second access is located on Winona Avenue approximately 50 metres north of the Winona Avenue / Richmond Road intersection (measured from access centreline to intersection centre) and is a loading entrance only with access solely to loading aisles

11.2 Intersection Control

Based on the projected volumes, Site Access #1 will have stop-control on the minor approach for both future total horizons. No further traffic control is warranted to address operational issues. The signalization warrant for Site Access #1 in the 2027 future total scenario can be found in Appendix F.

11.3 Intersection Design

Left-turn lane warrants for unsignalized intersections were examined at Site Access #1 for both 2022 and 2027 total future horizons using the MTO Geometric Design Standards for Ontario Highways, Section E. A southbound left-turn lane was found to be warranted for both future total horizons. The left-turn lane warrant nomographs can be found in Appendix G.

The southbound left-turn volumes in the 2027 future total horizon are considered to be minimal at 2 vehicles in the AM peak period and 7 vehicles in the PM peak period. Additionally, a low left-turn % of <1% in the AM peak period and 1% in the PM peak period are shown in the left-turn warrant and as such, the left-turn can be assumed to be warranted as a result of the high opposing and advancing volumes. Given the low left-turn volumes, the constrained space, and proximity to nearby intersections, engineering judgment has been used to determine that a left-lane will not be required at Site Access #1.

12 Transportation Demand Management

Transportation Demand Management measures are implemented to encourage the use of non-auto modes of travel. This is aimed at reducing the reliance on single occupant auto trips in the City of Ottawa. The proposed development adheres to the City's TDM principles by facilitating connections to adjacent pedestrian, cycling, and transit facilities. As the proposed development is in a designated Transit-Oriented Development (TOD) zone, a TOD mode share has been used for all study horizons.

The following measures, consistent with the TDM Checklists for both non-residential and residential land uses included in Appendix D, could be implemented to ensure that the travel mode shares meet the TOD targets.

- Designate an internal coordinator, or contract with an external coordinator.
- Display local area maps with walking/cycling access routes and key destinations at major entrances.
- Display relevant transit schedules and route maps at entrances.
- Provide online links to OC Transpo and STO information.
- Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in.
- Unbundle parking cost from monthly rent.
- Provide a multimodal travel option information package to new residents.

In addition to these measures, providing more than the minimum bicycle parking required, will help in achieving the mode shares for the proposed development and is recommended.

13 Neighbourhood Traffic Management

This TIA is exempt from this Module (see Table 9).

14 Transit

In Section 5.1 the trip generation by mode was estimated, including the number of transit trips that will be generated by the proposed development. Table 19 summarizes the transit trip generation for both future horizon years of 2022 and 2027.

Table 19: Trip Generation by Transit Mode

Travel Mode	Mode Share	AM Peak Period			PM Peak Period		
		In	Out	Total	In	Out	Total
	65%	28	64	92	81	63	143

The Westboro LRT Station and the Dominion LRT Station are expected to provide adequate transit capacity to support the increase in travel demand by the proposed development.

15 Review of Network Concept

This TIA is exempt from this Module (see Table 9).

16 Intersection Design

16.1 Intersection Control

The intersection method of control will remain consistent with existing methods of control for all Study Area intersections at both future horizons.

16.2 Intersection Design

To understand the intersection design, an MMLOS analysis of existing, 2022 future horizon, and 2027 future horizon demands is required. The existing and future segment MMLOS has been discussed in Section 10. The following sections will discuss the vehicle LOS at Study Area intersections which is based on the HCM criteria for average delay at unsignalized intersections. At signalized intersections, the level of service is based on the V/C ratio as required by the City of Ottawa. Heavy Vehicle Percentages (HV%) have been calculated for each movement based on the intersection counts discussed in Section 2.2.7. These HV% calculations have been included in Appendix H.

As part of the Step 2 review process, comments were received from the City of Ottawa's Transportation Project Manager. The first comment regarding the intersection of Richmond Road and Churchill Avenue requested the lane configuration for the northbound and southbound movements be adjusted to reflect observed conditions. These changes have been made and the northbound and southbound approaches both consist of a shared left-turn / through lane and a shared through / right-turn lane. Another comment expressed a safety concern regarding existing queues extending past the site access, however with the new lane configuration implemented this is no longer valid as the queues have been reduced for all horizons. Additionally, in congested situations during the peak periods, a significant number of collisions are not expected due to the slower vehicle speeds and therefore the comment regarding concern over the left out/left in movements at the site access are not applicable. Step 2 comments from the City of Ottawa can be found in Appendix I.

As part of the Step 3 review process, comments were received from the City of Ottawa's Transportation Project Manager. Further correspondence with City of Ottawa staff regarding these comments has indicated that at the intersection of Richmond Road and Churchill Avenue, it is not necessary to model the advanced pedestrian walk phase in the east-west directions as the timing card notes that "For the east-west direction, there is a straight through green arrow displayed during the 5 second advanced walk interval. After this 5 seconds, the green arrow changes to a green ball." In order to maintain a conservative analysis, an east-west advanced pedestrian walk phase has been modelled below. This shortens the eastbound through split time by five seconds. Should this movement breakdown in future scenarios, the east-west advanced pedestrian walk phase will not be modelled. Discussion with the City of Ottawa regarding the intersection signal timing from the Step 3 review process can be found in Appendix J.

The intersection of Richmond Road and Athlone Avenue is made up of a two-way stop-controlled intersection with stop control of the north and south legs and a signalized pedestrian crossing directly to the west on Richmond Road. The limitations of Synchro are such that the intersection is required to be modelled as two intersections as close to one another as is allowable in Synchro. This approach was confirmed by the City of Ottawa for another similar situation at the intersection of Scott Street and Tweedsmuir Avenue.

This will be followed by a discussion of the intersection MMLOS for other modes.

16.2.1 Existing Conditions

The existing intersection volumes have been analyzed to establish a baseline condition and determine the impact of the subject development on the Study Area road network. Table 20 summarizes the operational analysis of the 2019 existing conditions. Appendix K contains the 2019 Existing Conditions Synchro sheets.

Table 20: Existing Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Churchill Avenue & Richmond Road <i>Signalized</i>	EBL	A	15	0.60	46	B	20	0.67	#29
	EBT/R	A	14	0.57	77	A	13	0.53	63
	WBL	A	24	0.24	17	A	25	0.48	35
	WBT/R	A	25	0.49	50	E	46	0.91	#155
	NBL/T/R	C	24	0.72	26	B	27	0.71	m35
	SBL/T/R	B	26	0.69	39	C	22	0.77	47
	Overall	C	21	-	-	C	27	-	-
Roosevelt Avenue & Richmond Road <i>Signalized</i>	EBL/T/R	B	12	0.65	#114	A	9	0.48	70
	WBL/T/R	A	9	0.46	54	E	17	0.91	#253
	NBL/T/R	A	23	0.28	15	A	31	0.41	28
	SBL/T/R	A	23	0.27	21	A	30	0.37	30
	Overall	B	12	-	-	B	16	-	-
Athlone Avenue & Richmond Road <i>Unsignalized</i>	EBL/T/R	A	8	0.02	<1	A	9	0.02	<1
	WBL/T/R	A	9	0.01	<1	A	8	0.02	1
	NBL/T/R	C	19	0.12	3	C	20	0.14	4
	SBL/T/R	C	19	0.12	3	C	24	0.14	4
Richmond Road & Pedestrian Crossing <i>Signalized</i>	EBT	A	13	0.60	66	A	12	0.51	52
	WBT	A	10	0.38	36	D	25	0.86	#139
	Overall	B	12	-	-	B	20	-	-
Churchill Avenue & Scott Street <i>Unsignalized</i>	EBL/T/R	A	10	0.04	1	A	10	0.04	1
	WBL/T/R	B	14	0.42	16	C	25	0.75	49
	NBL/T/R	D	27	0.83	72	C	24	0.77	54
	SBL/T/R	B	14	0.46	18	B	13	0.37	13
Churchill Avenue & Byron Avenue <i>Signalized</i>	EBL/T/R	B	30	0.68	55	A	21	0.53	51
	WBL/T/R	A	29	0.59	45	D	36	0.86	#144
	NBL	A	6	0.05	7	A	15	0.08	10
	NBT/R	A	10	0.44	65	A	21	0.60	87
	SBL	A	2	0.08	m3	A	7	0.10	m5
	SBT/R	A	1	0.37	24	A	4	0.60	m63
	Overall	B	15	-	-	C	21	-	-
Notes:	Saturation flow rate of 1800 veh/h/lane								
	PHF = 0.90								
	# indicates the volume for the 95 th percentile cycle exceeds capacity								
	m indicates the volume for the 95 th percentile queue is metered by an upstream signal								

The existing Study Area intersections operate satisfactorily during the peak hours with a few exceptions:

At the intersection of Churchill Avenue and Richmond Road, the 95th percentile cycle exceeds capacity for the eastbound left-turn and the westbound shared through / right movements in the PM peak. The V/C ratios for these movements are less than one and can therefore be assumed that in practice the 95th percentile queues will rarely be exceeded. The northbound shared left / through / right movements in the PM peak are shown to be metered by an upstream signal.

At the intersection of Roosevelt Avenue and Richmond Road, the 95th percentile cycle exceeds capacity for the eastbound shared left-turn / through / right-turn movements during the AM peak and the westbound shared left-turn / through / right-turn movements during the PM. Given the V/C <1.0, it can be assumed that in practice the 95th percentile queue will rarely be exceeded.

At the pedestrian crossing on Richmond Road, the 95th percentile cycle exceeds capacity for the westbound through movements during the PM peak. Given the $V/C < 1.0$, it can be assumed that in practice the 95th percentile queue will rarely be exceeded.

At the intersection of Churchill Avenue and Byron Avenue, the 95th percentile cycle exceeds capacity for the westbound shared left-turn / through / right-turn movements during the PM peak, however given the $V/C < 1.0$, it can be assumed that in practice the 95th percentile queue will rarely be exceeded. Additionally, the southbound left-turn movement in the AM peak, and the southbound left-turn and the southbound shared through / right-turn movements in the PM peak are shown to be metered by an upstream signal.

16.2.2 2022 Future Background

The 2022 future background intersection volumes and other development traffic has been analyzed to allow a comparison between the future volumes with and without the proposed development. Table 21 summarizes the operational analysis of 2022 future background conditions. Appendix L contains the 2022 Future Background Synchro sheets.

Table 21: 2022 Future Background Conditions Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Churchill Avenue & Richmond Road <i>Signalized</i>	EBL	A	12	0.52	39	A	13	0.53	25
	EBT/R	A	12	0.51	63	A	11	0.46	55
	WBL	A	22	0.20	15	A	22	0.40	31
	WBT/R	A	23	0.43	45	C	33	0.79	#134
	NBL/T/R	B	24	0.68	21	C	28	0.71	m28
	SBL/T/R	B	26	0.68	38	C	21	0.75	41
	Overall	B	20	-	-	C	23	-	-
Roosevelt Avenue & Richmond Road <i>Signalized</i>	EBL/T/R	A	11	0.59	80	A	8	0.44	57
	WBL/T/R	A	8	0.42	44	D	15	0.82	#216
	NBL/T/R	A	23	0.25	14	A	30	0.37	24
	SBL/T/R	A	23	0.24	20	A	30	0.34	27
	Overall	B	12	-	-	B	15	-	-
Athlone Avenue & Richmond Road <i>Unsignalized</i>	EBL/T/R	A	8	0.02	<1	A	9	0.01	<1
	WBL/T/R	A	9	0.01	<1	A	8	0.02	<1
	NBL/T/R	C	17	0.10	2	C	18	0.11	3
	SBL/T/R	C	17	0.09	2	C	21	0.11	3
Richmond Road & Pedestrian Crossing <i>Signalized</i>	EBT	A	12	0.55	57	A	11	0.46	45
	WBT	A	9	0.34	32	C	20	0.78	#109
	Overall	B	11	-	-	B	16	-	-
Churchill Avenue & Scott Street <i>Unsignalized</i>	EBL/T/R	A	10	0.04	1	A	9	0.03	1
	WBL/T/R	B	13	0.37	13	C	18	0.64	34
	NBL/T/R	C	19	0.73	49	C	15	0.59	30
	SBL/T/R	B	12	0.40	14	B	12	0.30	9
Churchill Avenue & Byron Avenue <i>Signalized</i>	EBL/T/R	B	30	0.64	51	A	23	0.50	45
	WBL/T/R	A	29	0.56	42	D	35	0.84	#121
	NBL	A	6	0.04	6	A	11	0.06	9
	NBT/R	A	8	0.39	54	A	17	0.51	76
	SBL	A	1	0.07	m3	A	3	0.07	m5
	SBT/R	A	1	0.33	21	A	2	0.51	m58
	Overall	B	14	-	-	B	19	-	-
Notes:	Saturation flow rate of 1800 veh/h/lane								
	PHF = 1.00								
	# indicates the volume for the 95 th percentile cycle exceeds capacity								
	m indicates the volume for the 95 th percentile queue is metered by an upstream signal								

With the addition of background growth to reflect the 2022 horizon, the existing intersections are anticipated to operate with similar operational characteristics to the existing conditions, and well within the City of Ottawa operational thresholds.

16.2.3 2027 Future Background

The 2027 future background intersection volumes and other development traffic has been analyzed to allow comparison between the future volumes with and without the proposed development. Table 22 summarizes the operational analysis of 2027 future background conditions. Appendix M contains the 2027 Future Background Synchro sheets.

Table 22: 2027 Future Background Intersection Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Churchill Avenue & Richmond Road <i>Signalized</i>	EBL	A	12	0.53	39	A	13	0.53	25
	EBT/R	A	12	0.51	63	A	11	0.47	57
	WBL	A	22	0.21	15	A	22	0.41	32
	WBT/R	A	23	0.45	47	C	33	0.80	#136
	NBL/T/R	B	24	0.69	22	C	28	0.71	m28
	SBL/T/R	B	26	0.68	38	C	21	0.75	41
	Overall	B	20	-	-	C	23	-	-
Roosevelt Avenue & Richmond Road <i>Signalized</i>	EBL/T/R	A	11	0.59	80	A	8	0.44	57
	WBL/T/R	A	8	0.42	44	D	14	0.82	#216
	NBL/T/R	A	23	0.25	14	A	30	0.37	24
	SBL/T/R	A	23	0.24	20	A	30	0.34	27
	Overall	B	12	-	-	B	15	-	-
Athlone Avenue & Richmond Road <i>Unsignalized</i>	EBL/T/R	A	8	0.02	<1	A	9	0.01	<1
	WBL/T/R	A	9	0.01	<1	A	8	0.02	<1
	NBL/T/R	C	17	0.10	3	C	18	0.11	3
	SBL/T/R	C	18	0.09	2	C	21	0.11	3
Richmond Road & Pedestrian Crossing <i>Signalized</i>	EBT	A	12	0.55	57	A	11	0.46	45
	WBT	A	9	0.34	32	C	20	0.78	#109
	Overall	B	11	-	-	B	16	-	-
Churchill Avenue & Scott Street <i>Unsignalized</i>	EBL/T/R	A	10	0.04	1	A	9	0.03	1
	WBL/T/R	B	13	0.37	13	C	18	0.64	34
	NBL/T/R	C	19	0.73	49	C	15	0.59	30
	SBL/T/R	B	12	0.40	14	B	12	0.30	9
Churchill Avenue & Byron Avenue <i>Signalized</i>	EBL/T/R	B	30	0.65	51	A	22	0.51	47
	WBL/T/R	A	29	0.58	44	D	35	0.84	#124
	NBL	A	6	0.04	6	A	12	0.06	9
	NBT/R	A	8	0.39	54	A	17	0.51	76
	SBL	A	1	0.07	m3	A	3	0.07	m5
	SBT/R	A	1	0.33	22	A	2	0.51	m58
	Overall	B	14	-	-	B	19	-	-
Notes:	Saturation flow rate of 1800 veh/h/lane								
	PHF = 1.00								
	# indicates the volume for the 95 th percentile cycle exceeds capacity								
	m indicates the volume for the 95 th percentile queue is metered by an upstream signal								

With the addition of background growth to reflect the 2027 horizon, the existing intersections are anticipated to operate with similar operational characteristics to the 2022 future background conditions and the 2019 existing conditions, and well within the City of Ottawa operational thresholds.

16.2.4 2022 Future Total

The 2022 total future intersection volumes, including the site generated traffic and other development traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections. Table 23 summarizes the operational analysis of the 2022 future total conditions. Appendix N contains the 2022 Future Total Synchro Sheets.

Table 23: 2022 Future Total Intersection Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Churchill Avenue & Richmond Road <i>Signalized</i>	EBL	A	12	0.52	39	A	14	0.54	25
	EBT/R	A	12	0.51	63	A	11	0.46	55
	WBL	A	22	0.20	15	A	22	0.40	31
	WBT/R	A	23	0.43	45	C	33	0.80	#134
	NBL/T/R	B	24	0.69	21	C	28	0.71	m29
	SBL/T/R	B	27	0.69	39	C	22	0.76	42
	Overall	C	20	-	-	C	23	-	-
Roosevelt Avenue & Richmond Road <i>Signalized</i>	EBL/T/R	A	11	0.59	80	A	8	0.44	58
	WBL/T/R	A	8	0.43	45	D	15	0.82	#216
	NBL/T/R	A	23	0.25	14	A	30	0.37	24
	SBL/T/R	A	23	0.24	20	A	30	0.34	27
	Overall	B	12	-	-	B	15	-	-
Athlone Avenue & Richmond Road <i>Unsignalized</i>	EBL/T/R	A	8	0.02	<1	A	9	0.01	<1
	WBL/T/R	A	9	0.01	<1	A	8	0.02	<1
	NBL/T/R	C	17	0.10	2	C	18	0.11	3
	SBL/T/R	C	17	0.09	2	C	21	0.11	3
Richmond Road & Pedestrian Crossing <i>Signalized</i>	EBT	A	12	0.55	57	A	8	0.35	45
	WBT	A	9	0.35	32	A	12	0.59	#109
	Overall	B	11	-	-	B	11	-	-
Churchill Avenue & Scott Street <i>Unsignalized</i>	EBL/T/R	A	10	0.04	1	A	9	0.03	1
	WBL/T/R	B	13	0.37	13	C	19	0.65	36
	NBL/T/R	C	20	0.74	52	C	16	0.60	30
	SBL/T/R	B	12	0.40	14	B	12	0.30	9
Churchill Avenue & Byron Avenue <i>Signalized</i>	EBL/T/R	B	30	0.64	51	A	22	0.50	45
	WBL/T/R	A	29	0.56	42	D	35	0.84	#122
	NBL	A	6	0.04	6	A	11	0.06	9
	NBT/R	A	8	0.39	54	A	17	0.52	77
	SBL	A	1	0.07	m3	A	3	0.08	m5
	SBT/R	A	1	0.33	21	A	2	0.51	m57
	Overall	B	14	-	-	B	19	-	-
Churchill Avenue & Site Access #1 <i>Unsignalized</i>	WBL/R	C	15	0.04	1	B	15	0.04	1
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	9	0.00	0	A	9	0.01	<1
Notes:	Saturation flow rate of 1800 veh/h/lane								
	PHF = 1.00								
	# indicates the volume for the 95 th percentile cycle exceeds capacity								
	m indicates the volume for the 95 th percentile queue is metered by an upstream signal								

With the addition of site generated traffic, the existing intersections are anticipated to operate with similar operational characteristics as the 2022 future background conditions, and well within the City of Ottawa operational thresholds. The intersection of Site Access #1 and Churchill Avenue operates well with no identified operational issues.

16.2.5 2027 Future Total

The 2027 total future intersection volumes, including the site generated traffic and other development traffic, have been analyzed to understand the impact of the subject development on the Study Area intersections. Table

24 summarizes the operational analysis of the 2027 future total conditions. Appendix O contains the 2027 Future Total Synchro Sheets.

Table 24: 2027 Future Total Intersection Operational Analysis

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 th)	LOS	Delay	V/C	Q (95 th)
Churchill Avenue & Richmond Road <i>Signalized</i>	EBL	A	12	0.53	39	A	14	0.55	25
	EBT/R	A	12	0.51	64	A	12	0.48	57
	WBL	A	22	0.21	15	A	22	0.41	32
	WBT/R	A	23	0.45	47	D	34	0.81	#136
	NBL/T/R	B	24	0.69	22	C	28	0.71	m29
	SBL/T/R	B	27	0.69	39	C	22	0.76	42
	Overall	C	20	-	-	C	23	-	-
Roosevelt Avenue & Richmond Road <i>Signalized</i>	EBL/T/R	A	11	0.59	80	A	8	0.44	58
	WBL/T/R	A	8	0.43	45	D	14	0.82	#216
	NBL/T/R	A	23	0.25	14	A	30	0.37	24
	SBL/T/R	A	23	0.24	20	A	30	0.34	27
	Overall	B	12	-	-	B	15	-	-
Athlone Avenue & Richmond Road <i>Unsignalized</i>	EBL/T/R	A	8	0.02	<1	A	9	0.01	<1
	WBL/T/R	A	9	0.01	<1	A	8	0.02	<1
	NBL/T/R	C	17	0.10	3	C	18	0.11	3
	SBL/T/R	C	18	0.10	2	C	21	0.11	3
Richmond Road & Pedestrian Crossing <i>Signalized</i>	EBT	A	12	0.55	57	A	11	0.46	45
	WBT	A	9	0.35	32	C	20	0.78	#110
	Overall	B	11	-	-	B	16	-	-
Churchill Avenue & Scott Street <i>Unsignalized</i>	EBL/T/R	A	10	0.04	1	A	9	0.03	1
	WBL/T/R	B	13	0.37	13	C	19	0.65	36
	NBL/T/R	C	20	0.74	52	C	16	0.60	30
	SBL/T/R	B	12	0.40	14	B	12	0.30	9
Churchill Avenue & Byron Avenue <i>Signalized</i>	EBL/T/R	B	30	0.65	51	A	22	0.51	47
	WBL/T/R	A	29	0.58	44	D	35	0.84	#125
	NBL	A	6	0.04	6	A	12	0.06	9
	NBT/R	A	9	0.39	55	A	17	0.52	77
	SBL	A	1	0.07	m3	A	3	0.08	m5
	SBT/R	A	1	0.33	21	A	2	0.52	m58
	Overall	B	14	-	-	B	19	-	-
Churchill Avenue & Site Access #1 <i>Unsignalized</i>	WBL/R	C	15	0.04	1	B	13	0.03	1
	NBT/R	-	-	-	-	-	-	-	-
	SBL/T	A	9	0.00	0	A	8	0.01	<1
Notes:	Saturation flow rate of 1800 veh/h/lane								
	PHF = 1.00								
	# indicates the volume for the 95 th percentile cycle exceeds capacity								
	m indicates the volume for the 95 th percentile queue is metered by an upstream signal								

With the addition of site generated traffic, the existing intersections are anticipated to operate with similar operational characteristics as the 2027 future background conditions, and well within the City of Ottawa operational thresholds. The intersection of Site Access #1 and Churchill Avenue operates well with no identified operational issues.

16.2.6 Intersection MMLOS

Intersection MMLOS is only undertaken at signalized intersections. The four signalized intersections considered in this study are Churchill Avenue at Richmond Road, Richmond Road at Roosevelt Avenue, Richmond Road at a pedestrian crossing, and Churchill Avenue at Byron Avenue.

Table 25 summarizes the MMLOS analysis for these four signalized intersections in the Study Area for the existing and future horizons as no changes to the intersections are anticipated. The analysis is based on the policy area within 600m of a rapid transit station. The MMLOS worksheets have been provided in Appendix E.

Table 25: Study Area Intersection MMLOS Analysis—All Horizons

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
Churchill Avenue & Richmond Road	D	A	F	B	D(E)	D	F	D	B(C)	E
Roosevelt Avenue & Richmond Road	D		F	C	D(E)		E		A(C)	
Richmond Road & Pedestrian Crossing	C		F	C	C(C)		E		A(B)	
Churchill Avenue & Byron Avenue	C		F	B	E(E)		E		B(C)	

The pedestrian and cycling LOS targets are not met at the network intersections due to crossing distances, permissive left and right-turns, and lack of cycling facilities in the Study Area. The transit LOS generally fails to meet the targets at some intersections well due to the intersection delays. Truck LOS is not met at any intersection due to the low number of receiving lanes. Auto LOS targets are met.

Due to restrictions on obtaining property from adjacent developments to implement cycling facilities within the Study Area road network, as well as restrictions on adjusting the signal timing of Study Area intersections, the changes required to improve the MMLOS are not considered feasible. As such, no mitigation measures or alterations to the intersections are recommended as a result of this analysis.

17 Conclusions

This Transportation Impact Assessment has documented the existing and future transportation conditions, for all travel modes, in the Study Area. The following conclusions can be offered based on the foregoing:

- The proposed development, located at 381 Churchill Avenue, 380 Winona Avenue, 319, 325, and 327 Richmond Road, is a nine-storey building with 184 apartment units, 1738 square metres of retail space, 130 vehicle parking spots, and 99 bicycle parking spaces.
- The site is proposed to have two accesses; one of which is a full movement access on Churchill Avenue approximately 65 metres north of the Churchill Avenue / Richmond Road intersection. The second access is located on Winona Avenue approximately 50 metres north of the Winona Avenue / Richmond Road intersection and is a loading entrance.
- Sections of the proposed development are within 600 metres of the future Westboro and Dominion LRT Stations and as such is zoned as a Transit Oriented Development (TOD) Zone.
- The existing Study Area is currently served by bus routes #11, 50, 81, and 153.
- The previous five years of collision history at the existing Study Area intersections has been reviewed. No patterns emerged that indicated that mitigation measures or further monitoring was required.

- F. Using the TRANS Study the residential trip generation rates were identified and using the ITE Trip Generation Manual, the retail trip rates were identified. TOD mode shares were used to determine the trip generation by mode in a manner that accounts for the proximity of the Westboro and Dominion LRT stations. It was found that the proposed development can be anticipated to generate 138 AM and 204 PM peak hour two-way person trips.
- G. Minimum vehicle parking space requirements are met with an excess of 35 spaces and bicycle parking space requirements are met exactly
- H. It was found that the road segments of Richmond Road, Churchill Road and Winona Avenue do not meet the majority of their MMLOS targets. As future changes to the road network are anticipated to improve the MMLOS of these segments, no resulting improvements to the three boundary roads are recommended.
- I. Both signalization warrant and left-turn lane warrants were evaluated at the Site Access (Site Access #1). Signalization was not warranted however a left-turn lane was warranted. Upon further evaluation of the warrant and the surrounding context of the access, a left-turn was not deemed to be required.
- J. The Study Area intersections operate satisfactorily during the peak hours in the existing conditions operational analysis.
- K. The Study Area intersections operate satisfactorily during the peak hours in the 2022 future background operational analysis.
- L. The Study Area intersections operate satisfactorily during the peak hours in the 2022 future total operational analysis with similar operational characteristics as the 2022 future background conditions.
- M. The Study Area intersections operate satisfactorily during the peak hours in the 2027 future background operational analysis.
- N. The Study Area intersections operate satisfactorily during the peak hours in the 2027 future total operational analysis with similar operational characteristics as the 2027 future background conditions
- O. The PLOS, BLOS, TLOS, and TkLOS were evaluated at all four signalized Study Area intersections. In most cases, the MMLOS targets were not met. No intersection alterations or mitigation measures are suggested as changes to these intersections are not feasible due to restrictions on obtaining property from adjacent developments, and restrictions on adjusting the signal timing of Study Area intersections.

The proposed development will function within the Study Area Road Network. It is recommended that, from a transportation perspective, the proposed development application process proceed.

Prepared By:

Reviewed By:



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Appendix A

TIA Screening Form and PM Certification Form



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.

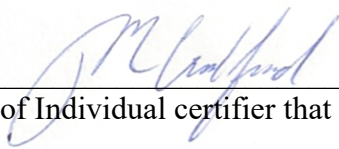
City Of Ottawa
Infrastructure Services and Community
Sustainability
Planning and Growth Management
110 Laurier Avenue West, 4th fl.
Ottawa, ON K1P 1J1
Tel. : 613-580-2424
Fax: 613-560-6006

Ville d'Ottawa
Services d'infrastructure et Viabilité des
collectivités
Urbanisme et Gestion de la croissance
110, avenue Laurier Ouest
Ottawa (Ontario) K1P 1J1
Tél. : 613-580-2424
Télécopieur: 613-560-6006

Dated at Newmarket this 28 day of June, 2019.
(City)

Name: Mark Crockford
(Please Print)

Professional Title: Professional Engineer



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

Office Contact Information (Please Print)
Address: 628 Haines Road
City / Postal Code: Newmarket / L3Y 6V5
Telephone / Extension: (905) 251-4070
E-Mail Address: Mark.Crockford@CGHTransportation.com



City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 20-May-20
Project Number: '2019-03
Project Reference: CLV Richmond-Churchill

1.1 Description of Proposed Development	
Municipal Address	381 Churchill Ave, 380 Winona Avenue, 319/325/327 Richmond Road
Description of Location	PLAN 37 PT LOT 1, 2, 3, 4 AND 28
Land Use Classification	Traditional Mainstreet, Residential Fourth Density, & General Mixed Use Zoning
Development Size	184 apartment units, 1,738m ² commercial, 130 parking spaces, 99 bike parking
Accesses	Two: Access on Churchill (approximately 65m north of Churchill /Richmond Intersection). Access on Winona Avenue for loading purposes only (approximately 50m north of Winona / Richmond Intersection)
Phase of Development	Single Phase
Buildout Year	2022
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger	
Land Use Type	Townhomes or apartments
Development Size	184 Units
Trip Generation Trigger	Yes

1.3 Location Triggers	
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?	Yes
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?	Yes
Location Trigger	Yes

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

Appendix B

Traffic Data

Turning Movement Count - Peak Hour Diagram

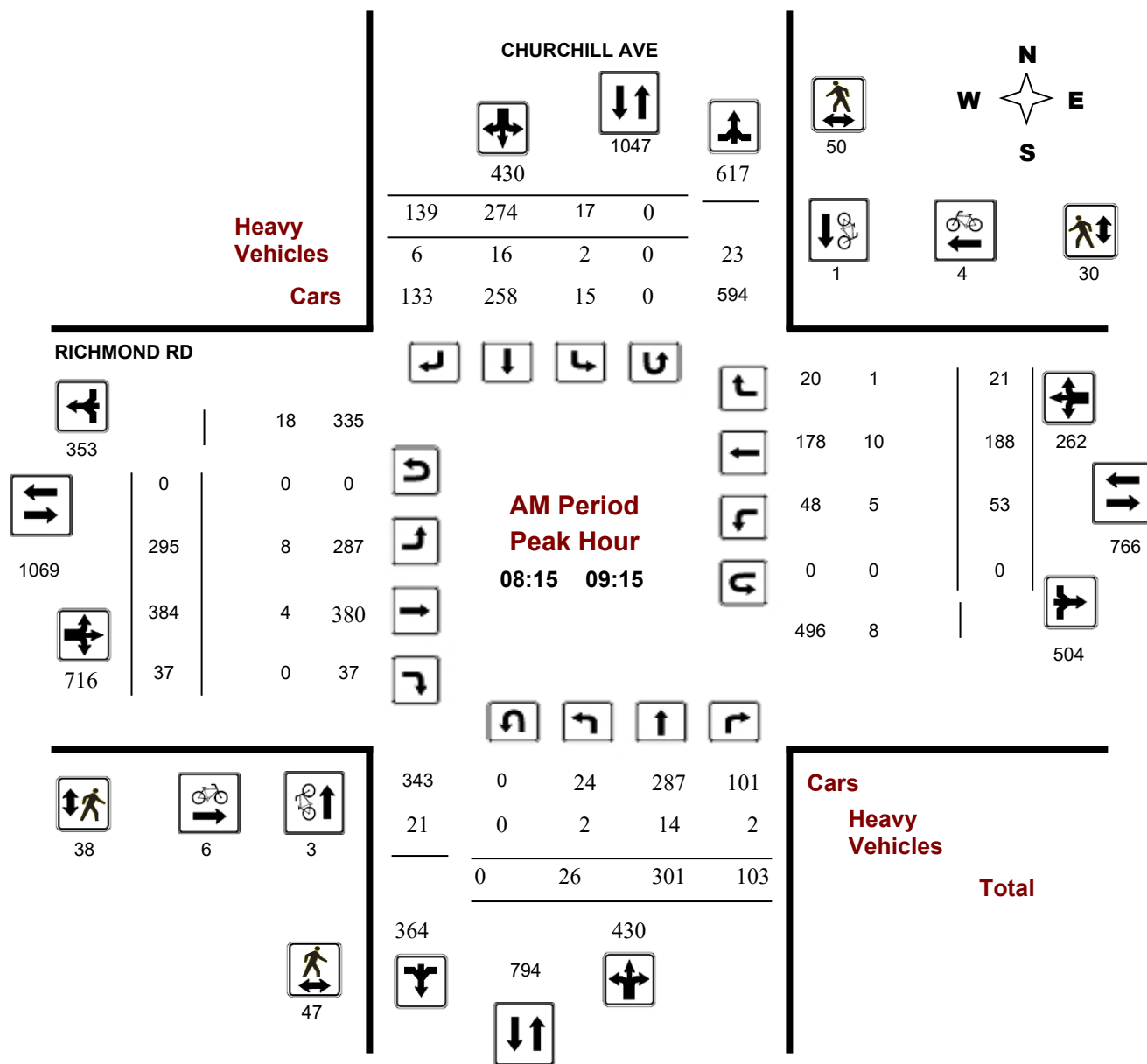
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Turning Movement Count - Peak Hour Diagram

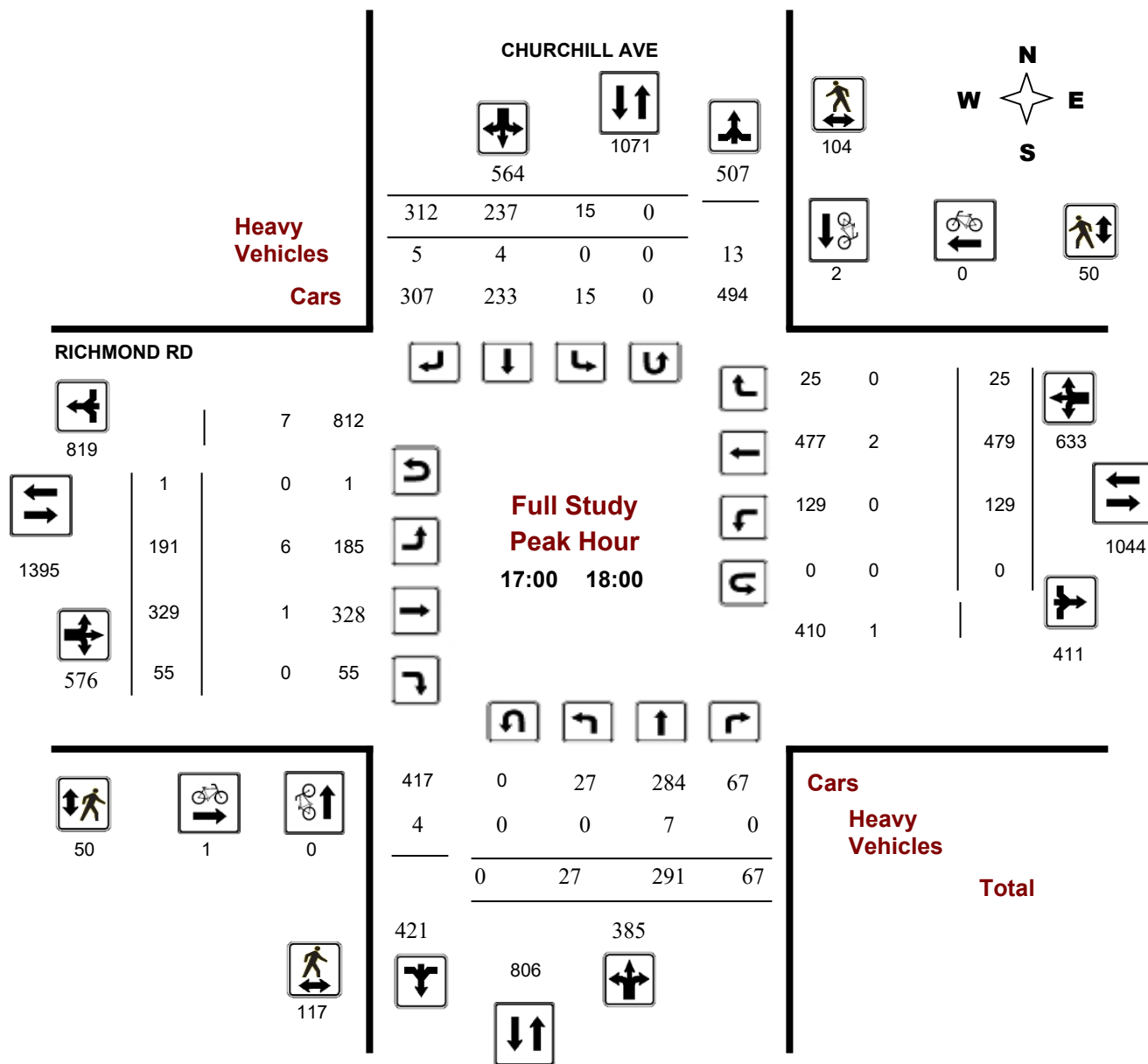
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Turning Movement Count - Peak Hour Diagram

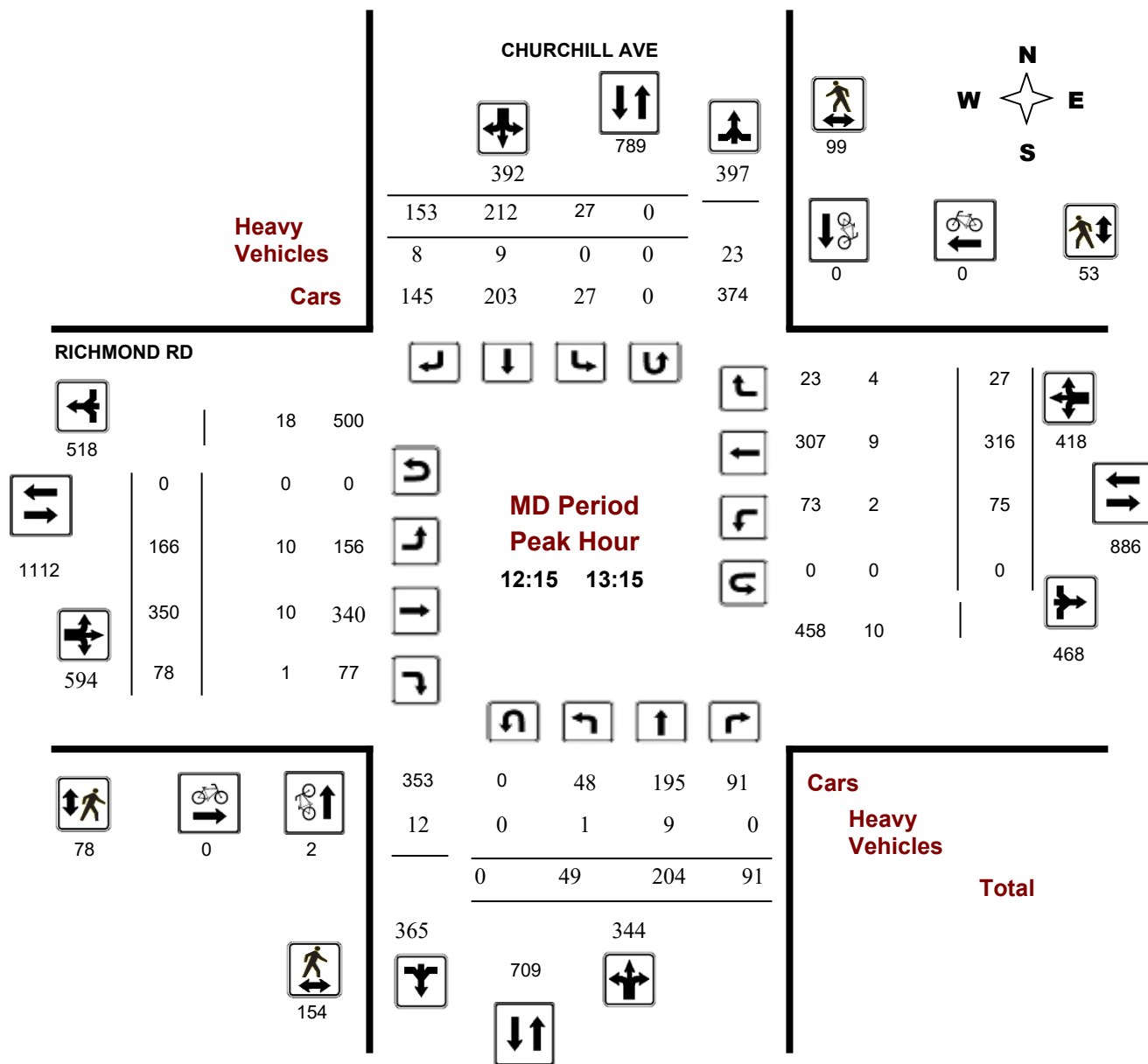
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Turning Movement Count - Peak Hour Diagram

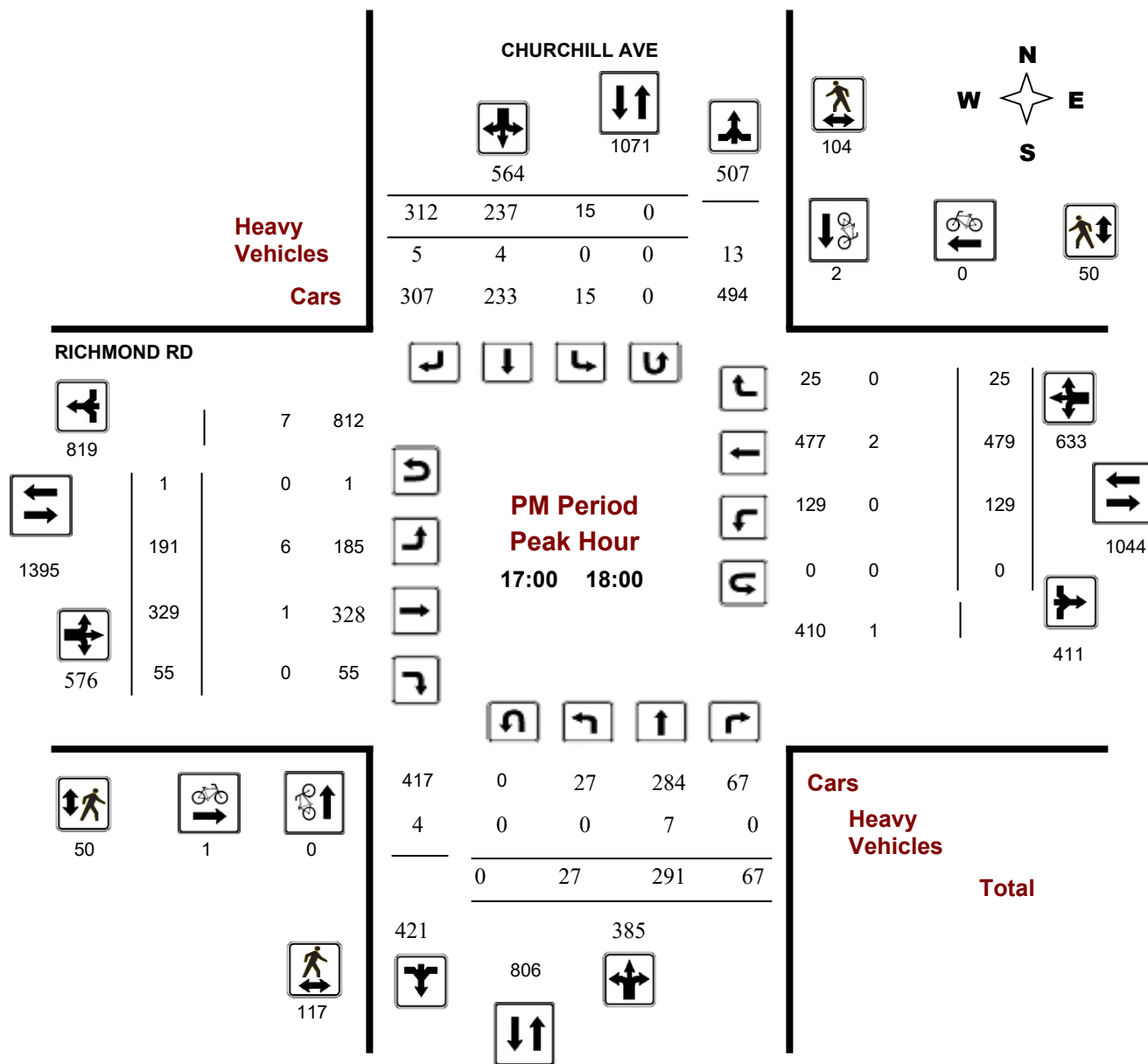
CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Start Time: 07:00

WO No: 37319

Device: Miovision



Transportation Services - Traffic Services

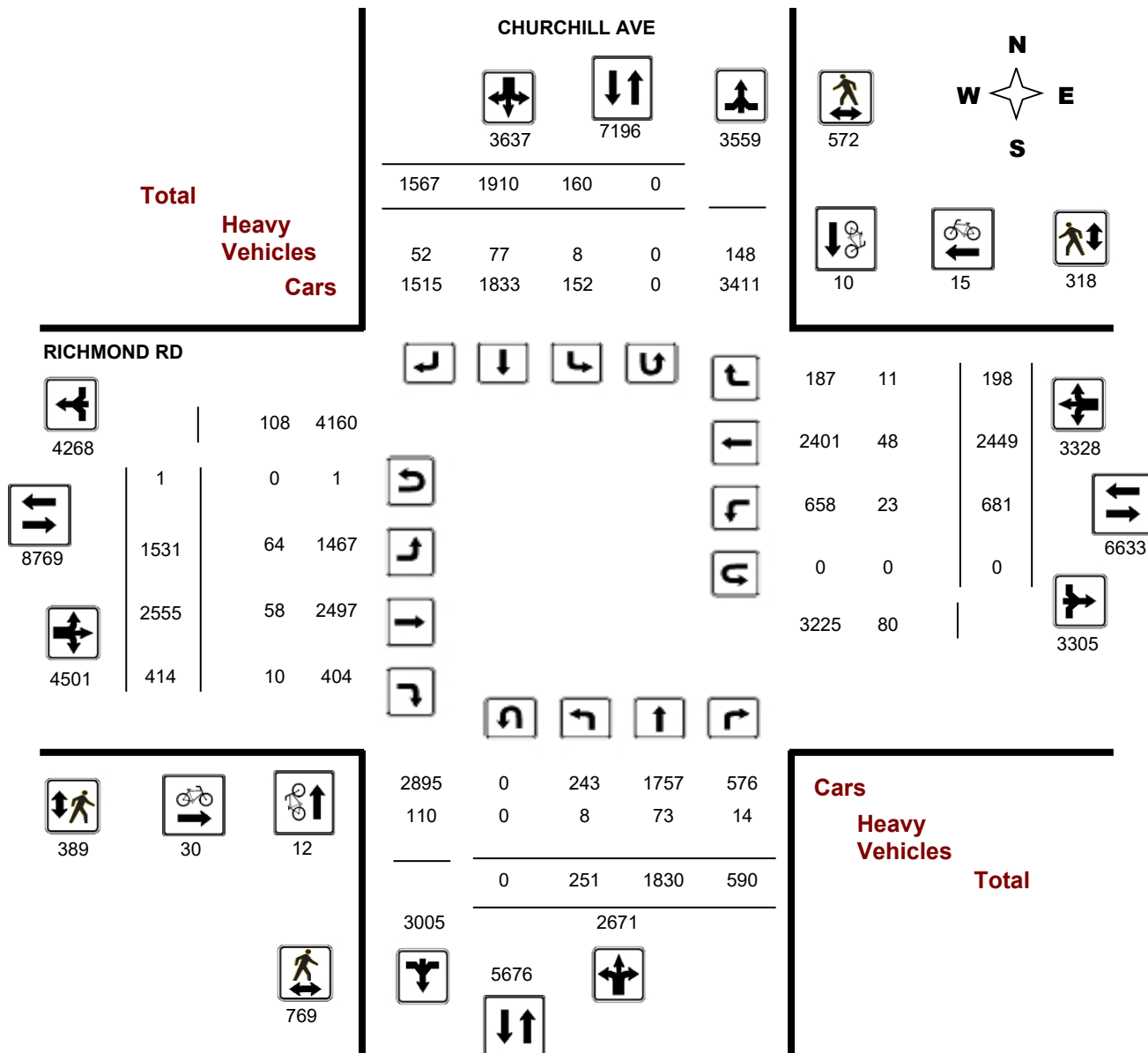
Turning Movement Count - Full Study Diagram

CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

WO#: 37319

Device: Miovision



Turning Movement Count - Full Study Summary Report

CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Total Observed U-Turns

AADT Factor

Northbound: 0 Southbound: 0
Eastbound: 1 Westbound: 0

.90

Full Study

CHURCHILL AVE

RICHMOND RD

Period	Northbound				Southbound				STR TOT	Eastbound				Westbound				STR TOT	Grand Total
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT		LT	ST	RT	EB TOT	LT	ST	RT	WB TOT		
07:00 08:00	20	142	44	206	19	254	104	377	583	244	328	32	604	49	112	19	180	784	1367
08:00 09:00	29	290	81	400	17	283	131	431	831	312	401	34	747	56	173	30	259	1006	1837
09:00 10:00	31	227	81	339	10	226	127	363	702	174	321	38	533	63	194	21	278	811	1513
11:30 12:30	43	206	92	341	36	220	158	414	755	146	294	75	515	60	349	33	442	957	1712
12:30 13:30	49	195	92	336	21	199	144	364	700	154	354	87	595	72	298	25	395	990	1690
15:00 16:00	27	208	69	304	25	247	282	554	858	159	256	47	462	114	370	22	506	968	1826
16:00 17:00	25	271	64	360	17	244	309	570	930	151	272	46	469	138	474	23	635	1104	2034
17:00 18:00	27	291	67	385	15	237	312	564	949	191	329	55	575	129	479	25	633	1208	2157
Sub Total	251	1830	590	2671	160	1910	1567	3637	6308	1531	2555	414	4500	681	2449	198	3328	7828	14136
U Turns				0				0	0				1				0	1	1
Total	251	1830	590	2671	160	1910	1567	3637	6308	1531	2555	414	4501	681	2449	198	3328	7829	14137
EQ 12Hr	349	2544	820	3713	222	2655	2178	5055	8768	2128	3551	575	6256	947	3404	275	4626	10882	19650
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.																			1.39
AVG 12Hr	314	2289	738	3341	200	2389	1960	4550	7891	1915	3196	518	5631	852	3064	248	4163	9794	17685
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.																			.90
AVG 24Hr	411	2999	967	4377	262	3130	2568	5960	10337	2509	4187	678	7376	1116	4013	324	5454	12830	23167
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.																			1.31

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Turning Movement Count - 15 Minute Summary Report

CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 1 Westbound: 0

CHURCHILL AVE

RICHMOND RD

Time Period	Northbound			N TOT	Southbound			S TOT	STR TOT	Eastbound			E TOT	Westbound			W TOT	STR TOT	Grand Total
	LT	ST	RT		LT	ST	RT			LT	ST	RT		LT	ST	RT			
07:00 07:15	2	26	5	33	3	44	17	64	97	48	83	12	143	8	27	3	38	181	278
07:15 07:30	3	35	9	47	5	62	22	89	136	53	76	4	133	13	26	8	47	180	316
07:30 07:45	6	39	9	54	4	80	33	117	171	68	76	8	152	14	28	2	44	196	367
07:45 08:00	9	42	21	72	7	68	32	107	179	75	93	8	176	14	31	6	51	227	406
08:00 08:15	7	66	5	78	3	78	21	102	180	69	114	6	189	20	48	12	80	269	449
08:15 08:30	7	68	23	98	7	52	33	92	190	91	81	12	184	11	40	9	60	244	434
08:30 08:45	6	79	26	111	4	90	44	138	249	85	90	6	181	17	36	4	57	238	487
08:45 09:00	9	77	27	113	3	63	33	99	212	67	116	10	193	8	49	5	62	255	467
09:00 09:15	4	77	27	108	3	69	29	101	209	52	97	9	158	17	63	3	83	241	450
09:15 09:30	8	53	19	80	3	62	32	97	177	53	85	9	147	14	43	8	65	212	389
09:30 09:45	8	51	17	76	3	47	29	79	155	45	66	12	123	17	45	7	69	192	347
09:45 10:00	11	46	18	75	1	48	37	86	161	24	73	8	105	15	43	3	61	166	327
11:30 11:45	11	51	18	80	7	58	39	104	184	29	80	17	126	13	81	9	103	229	413
11:45 12:00	10	54	24	88	7	49	43	99	187	37	70	17	124	15	96	7	118	242	429
12:00 12:15	11	46	24	81	11	51	34	96	177	36	51	24	111	14	83	8	105	216	393
12:15 12:30	11	55	26	92	11	62	42	115	207	44	93	17	154	18	89	9	116	270	477
12:30 12:45	17	51	18	86	6	63	42	111	197	39	84	16	139	19	83	6	108	247	444
12:45 13:00	10	44	26	80	6	49	35	90	170	45	84	28	157	20	62	9	91	248	418
13:00 13:15	11	54	21	86	4	38	34	76	162	38	89	17	144	18	82	3	103	247	409
13:15 13:30	11	46	27	84	5	49	33	87	171	32	97	26	155	15	71	7	93	248	419
15:00 15:15	11	36	17	64	6	63	62	131	195	40	64	14	118	20	75	8	103	221	416
15:15 15:30	10	56	16	82	6	66	70	142	224	34	67	13	114	30	97	0	127	241	465
15:30 15:45	3	60	17	80	7	58	72	137	217	42	56	10	108	34	96	7	137	245	462
15:45 16:00	3	56	19	78	6	60	78	144	222	43	69	10	122	30	102	7	139	261	483
16:00 16:15	8	54	15	77	4	59	90	153	230	42	62	8	112	32	111	9	152	264	494
16:15 16:30	5	71	16	92	1	67	66	134	226	39	73	11	123	33	113	3	149	272	498
16:30 16:45	4	73	13	90	10	55	71	136	226	30	70	14	114	35	124	8	167	281	507
16:45 17:00	8	73	20	101	2	63	82	147	248	40	67	13	120	38	126	3	167	287	535
17:00 17:15	6	73	21	100	4	54	83	141	241	37	61	8	106	36	115	7	158	264	505
17:15 17:30	7	62	23	92	3	58	74	135	227	48	87	16	151	20	127	6	153	304	531
17:30 17:45	9	74	13	96	2	64	78	144	240	50	80	15	145	41	116	6	163	308	548
17:45 18:00	5	82	10	97	6	61	77	144	241	56	101	16	174	32	121	6	159	333	574
TOTAL:	251	1830	590	2671	160	1910	1567	3637	6308	1531	2555	414	4501	681	2449	198	3328	7829	14137

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
37319

CHURCHILL AVE @ RICHMOND RD

Count Date: Wednesday, November 22, 2017

Start Time: 07:00

Time Period	CHURCHILL AVE			RICHMOND RD			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	2	2	4	3	5	8	12
08:00 09:00	3	0	3	8	4	12	15
09:00 10:00	1	3	4	2	0	2	6
11:30 12:30	1	0	1	0	2	2	3
12:30 13:30	2	0	2	3	0	3	5
15:00 16:00	1	1	2	3	3	6	8
16:00 17:00	2	2	4	10	1	11	15
17:00 18:00	0	2	2	1	0	1	3
Total	12	10	22	30	15	45	67

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

W.O.
37319

Turning Movement Count - Heavy Vehicle Report

CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

CHURCHILL AVE											RICHMOND RD									
Time Period		Northbound			Southbound			Eastbound			Westbound									Grand Total
		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	
07:00	08:00	0	8	1	9	2	11	7	20	29	7	10	1	18	3	3	1	7	25	54
08:00	09:00	1	13	3	17	2	12	4	18	35	8	7	0	15	5	11	1	17	32	67
09:00	10:00	2	10	5	17	0	13	7	20	37	7	14	1	22	5	5	2	12	34	71
11:30	12:30	1	10	2	13	2	7	8	17	30	9	8	4	21	4	8	2	14	35	65
12:30	13:30	2	12	0	14	1	8	8	17	31	10	11	3	24	2	9	4	15	39	70
15:00	16:00	2	7	0	9	1	9	6	16	25	12	5	1	18	2	5	0	7	25	50
16:00	17:00	0	6	3	9	0	13	7	20	29	5	2	0	7	2	5	1	8	15	44
17:00	18:00	0	7	0	7	0	4	5	9	16	6	1	0	7	0	2	0	2	9	25
Sub Total		8	73	14	95	8	77	52	137	232	64	58	10	132	23	48	11	82	214	446
U-Turns (Heavy Vehicles)					0				0	0				0				0	0	0
Total		8	73	14	0	8	77	52	137	232	64	58	10	132	23	48	11	82	214	446

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

Work Order

37319

Turning Movement Count - Pedestrian Volume Report

CHURCHILL AVE @ RICHMOND RD

Count Date: Wednesday, November 22, 2017

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	4	5	9	3	2	5	14
07:15 07:30	2	6	8	2	4	6	14
07:30 07:45	7	12	19	9	6	15	34
07:45 08:00	9	10	19	11	7	18	37
07:00 08:00	22	33	55	25	19	44	99
08:00 08:15	8	8	16	12	8	20	36
08:15 08:30	7	9	16	6	8	14	30
08:30 08:45	16	20	36	12	9	21	57
08:45 09:00	15	15	30	15	8	23	53
08:00 09:00	46	52	98	45	33	78	176
09:00 09:15	9	6	15	5	5	10	25
09:15 09:30	15	9	24	5	6	11	35
09:30 09:45	23	8	31	3	5	8	39
09:45 10:00	19	12	31	12	9	21	52
09:00 10:00	66	35	101	25	25	50	151
11:30 11:45	22	31	53	20	14	34	87
11:45 12:00	37	17	54	10	8	18	72
12:00 12:15	42	16	58	14	21	35	93
12:15 12:30	32	32	64	22	14	36	100
11:30 12:30	133	96	229	66	57	123	352
12:30 12:45	32	23	55	26	7	33	88
12:45 13:00	52	22	74	14	16	30	104
13:00 13:15	38	22	60	16	16	32	92
13:15 13:30	40	14	54	18	15	33	87
12:30 13:30	162	81	243	74	54	128	371
15:00 15:15	27	25	52	17	8	25	77
15:15 15:30	19	14	33	11	5	16	49
15:30 15:45	34	36	70	16	12	28	98
15:45 16:00	37	23	60	16	9	25	85
15:00 16:00	117	98	215	60	34	94	309
16:00 16:15	27	14	41	11	12	23	64
16:15 16:30	27	20	47	11	13	24	71
16:30 16:45	25	14	39	10	10	20	59
16:45 17:00	27	25	52	12	11	23	75
16:00 17:00	106	73	179	44	46	90	269
17:00 17:15	28	29	57	16	9	25	82
17:15 17:30	31	31	62	16	13	29	91
17:30 17:45	32	20	52	12	18	30	82
17:45 18:00	26	24	50	6	10	16	66
17:00 18:00	117	104	221	50	50	100	321
Total	769	572	1341	389	318	707	2048

Comment:

Turning Movement Count - 15 Min U-Turn Total Report

CHURCHILL AVE @ RICHMOND RD

Survey Date: Wednesday, November 22, 2017

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	1	0	1
Total		0	0	1	0	1



Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

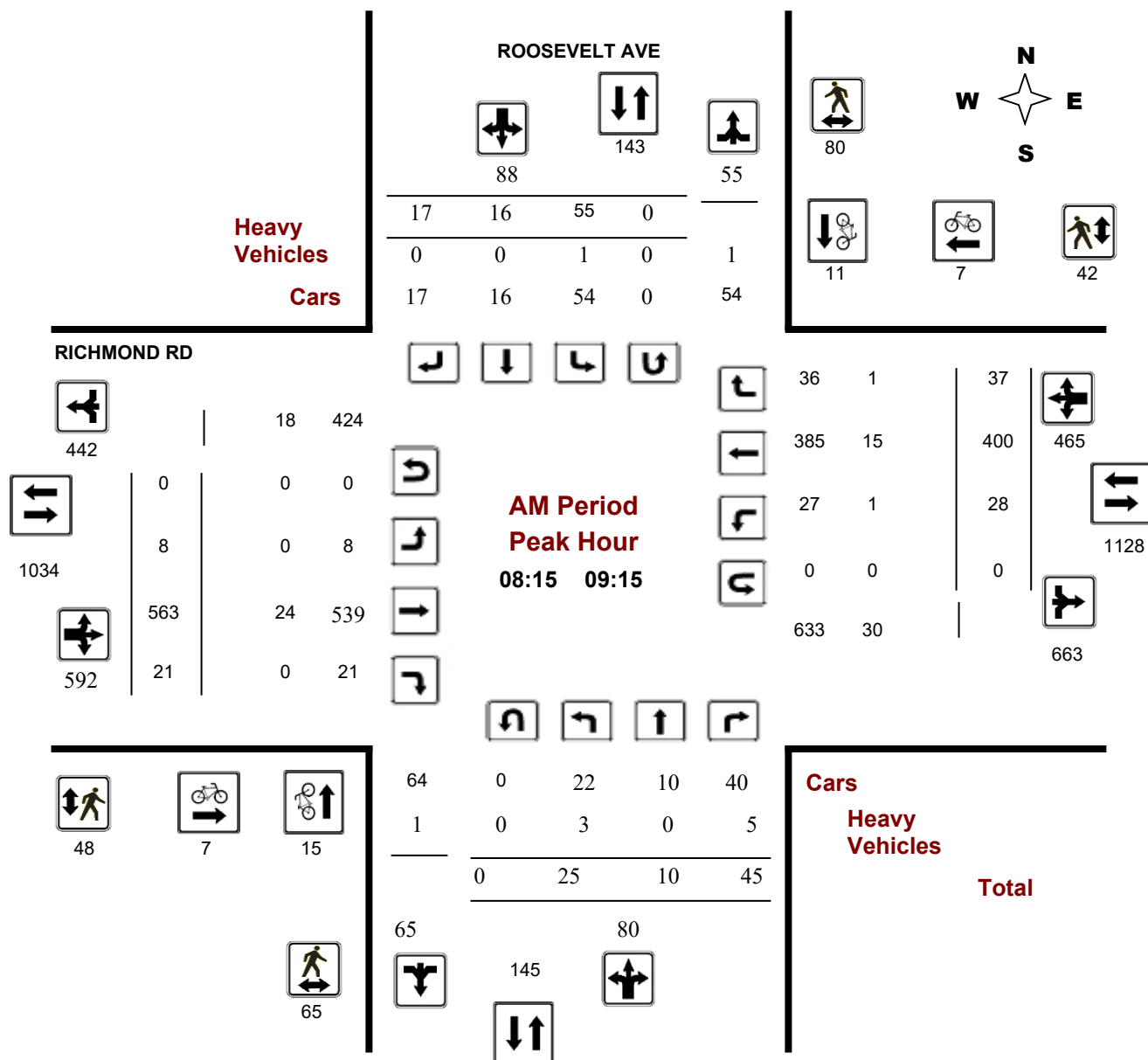
ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Start Time: 07:00

WO No: 34683

Device: Jamar Technologies, Inc



Comments

Turning Movement Count - Peak Hour Diagram

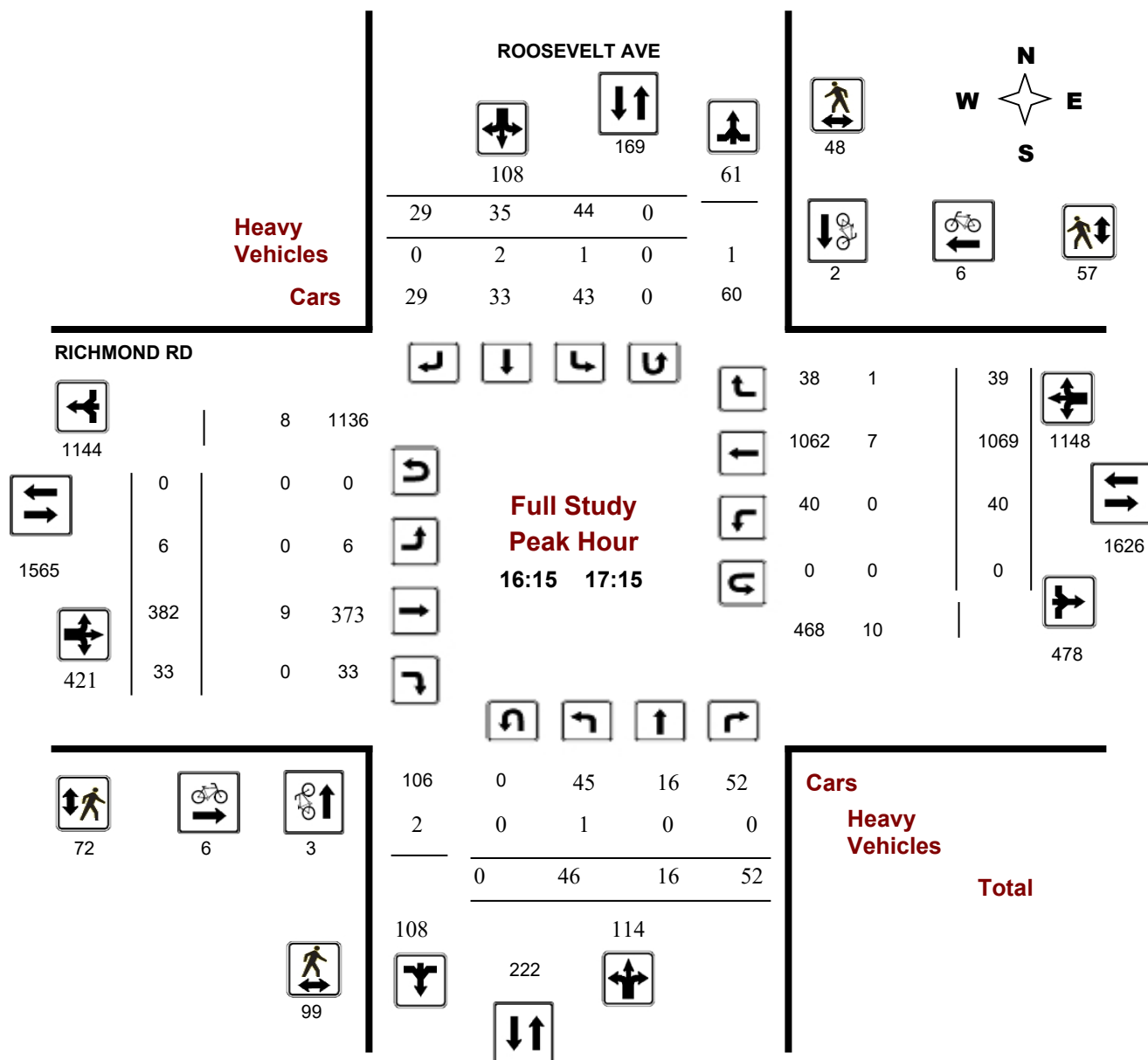
ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Start Time: 07:00

WO No: 34683

Device: Jamar Technologies, Inc





Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

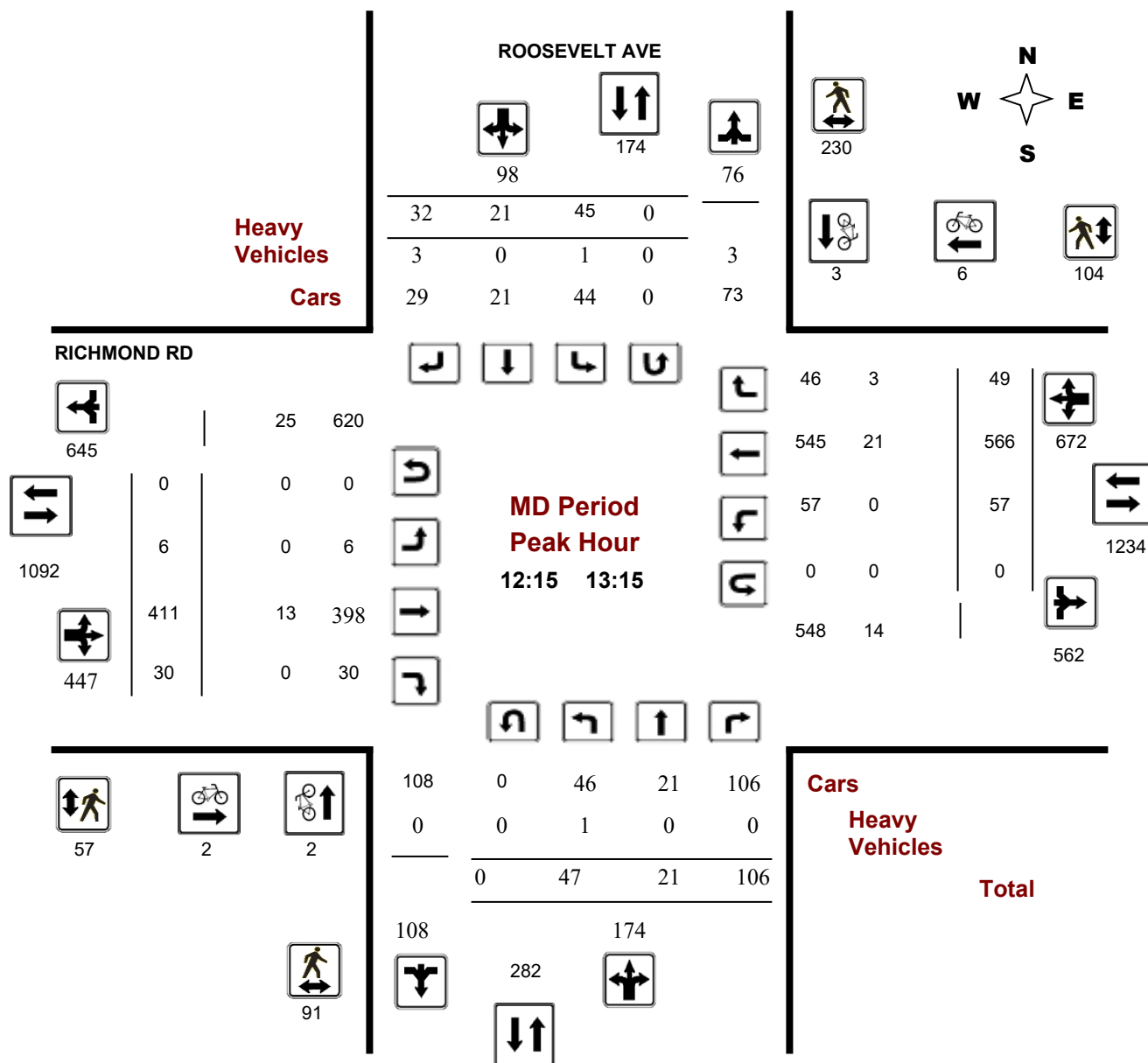
ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Start Time: 07:00

WO No: 34683

Device: Jamar Technologies, Inc





Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

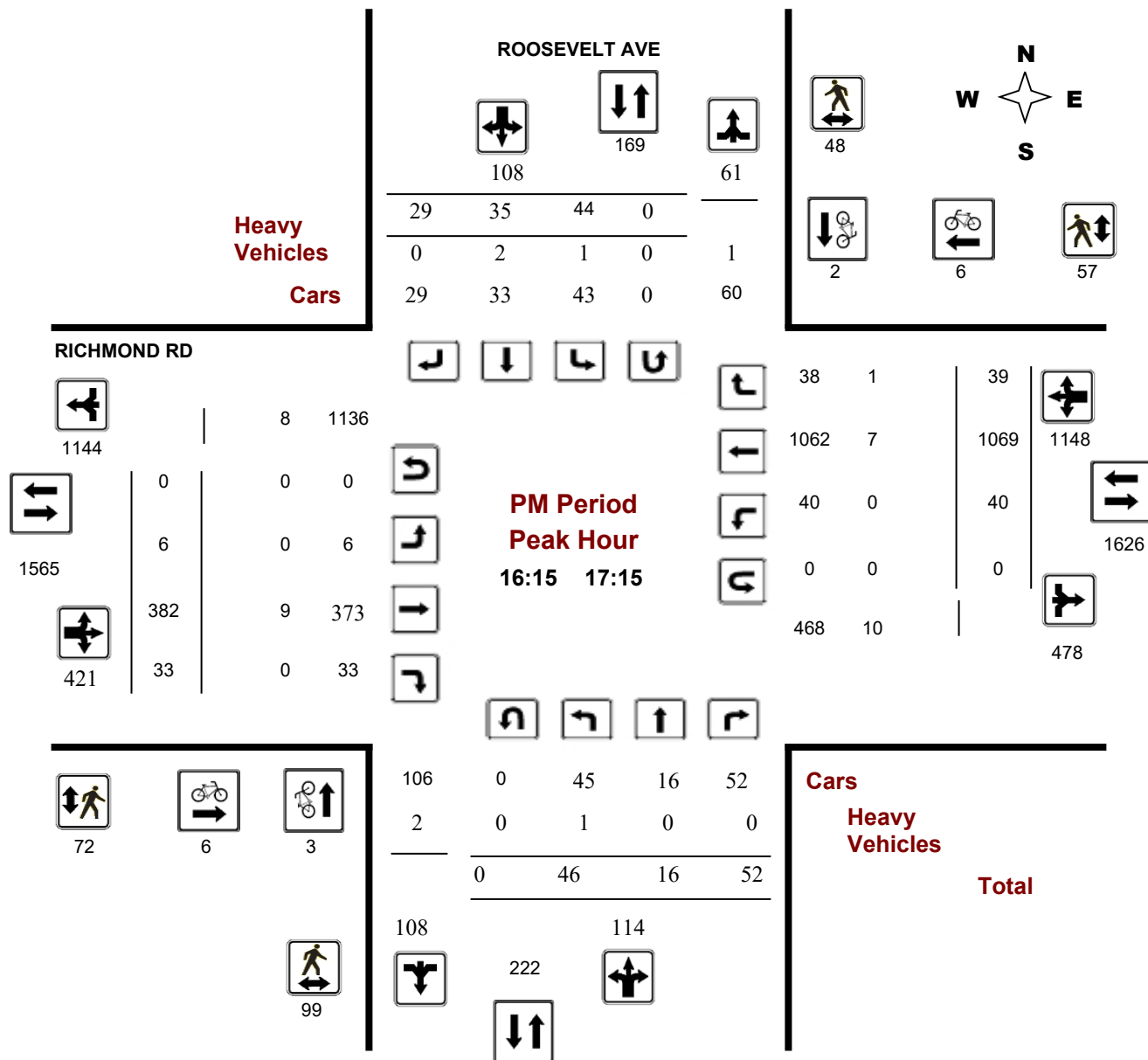
ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Start Time: 07:00

WO No: 34683

Device: Jamar Technologies, Inc



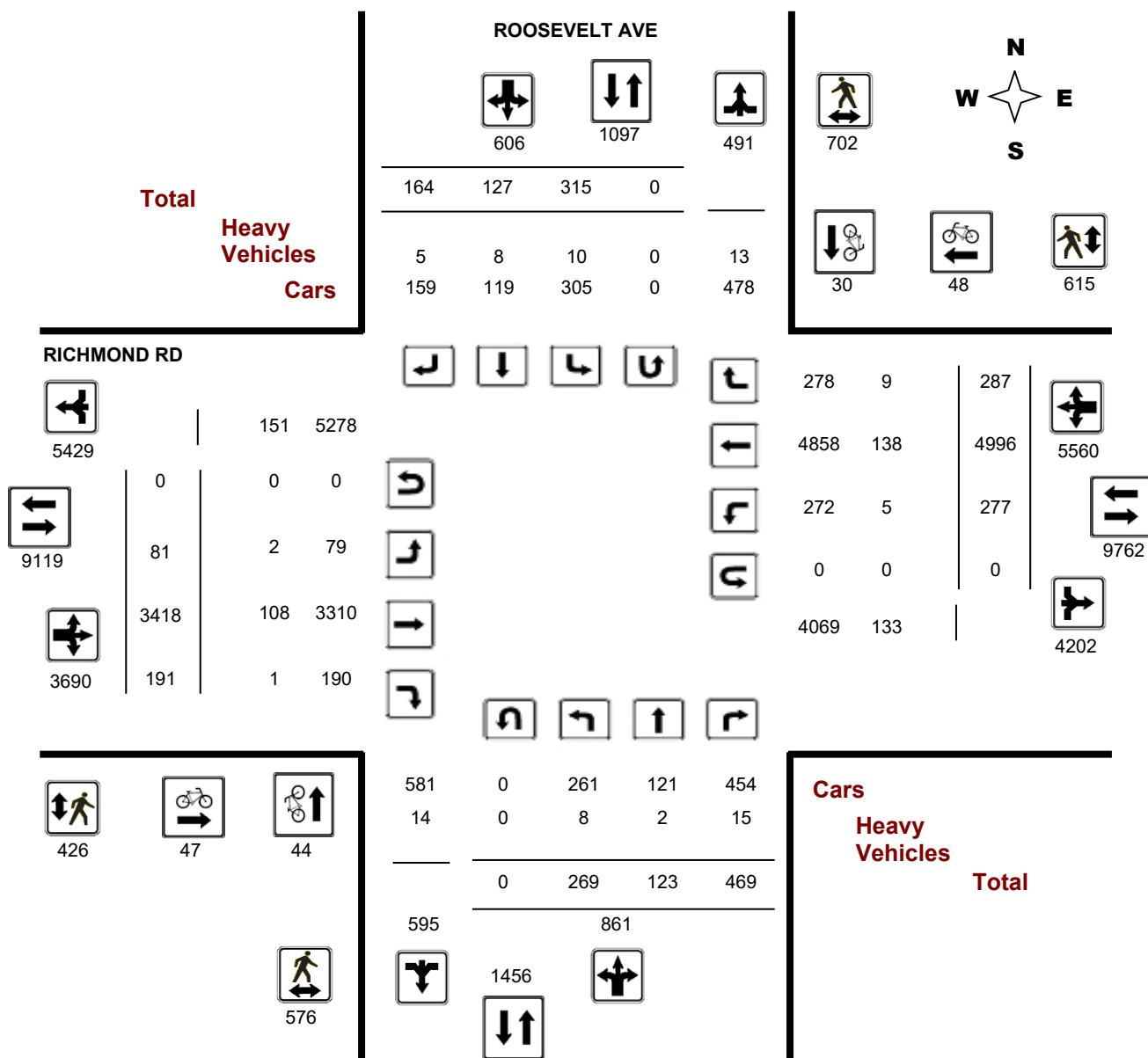
Transportation Services - Traffic Services

Turning Movement Count - Full Study Diagram

ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

WO#: 34683
Device: Jamar Technologies, Inc



Turning Movement Count - Full Study Summary Report

ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 0 Westbound: 0

AADT Factor

.80

Full Study

ROOSEVELT AVE										RICHMOND RD										STR TOT	Grand Total
Period	Northbound				Southbound				STR TOT	Eastbound				Westbound							
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT		LT	ST	RT	EB TOT	LT	ST	RT	WB TOT				
07:00	08:00	18	8	32	58	17	6	10	33	91	7	514	21	542	13	247	12	272	814	905	
08:00	09:00	24	10	43	77	58	11	17	86	163	12	546	23	581	23	407	49	479	1060	1223	
09:00	10:00	18	7	43	68	41	11	18	70	138	12	422	18	452	44	378	30	452	904	1042	
11:30	12:30	25	23	78	126	69	12	24	105	231	5	357	32	394	48	533	50	631	1025	1256	
12:30	13:30	53	21	103	177	33	24	34	91	268	5	417	26	448	50	558	45	653	1101	1369	
15:00	16:00	44	21	62	127	25	18	18	61	188	25	429	17	471	41	964	30	1035	1506	1694	
16:00	17:00	47	18	48	113	43	35	27	105	218	6	384	29	419	35	1022	36	1093	1512	1730	
17:00	18:00	40	15	60	115	29	10	16	55	170	9	349	25	383	23	887	35	945	1328	1498	
Sub Total		269	123	469	861	315	127	164	606	1467	81	3418	191	3690	277	4996	287	5560	9250	10717	
U Turns		0				0				0	0				0				0	0	0
Total		269	123	469	861	315	127	164	606	1467	81	3418	191	3690	277	4996	287	5560	9250	10717	
EQ 12Hr		374	171	652	1197	438	177	228	842	2039	113	4751	265	5129	385	6944	399	7728	12857	14896	
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.														1.39							
AVG 12Hr		299	137	522	957	350	141	182	674	1631	90	3801	212	4103	308	5556	319	6183	10286	11917	
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.														.80							
AVG 24Hr		392	179	683	1254	459	185	239	883	2137	118	4979	278	5375	404	7278	418	8099	13474	15611	
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.														1.31							

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.



Turning Movement Count - 15 Minute Summary Report

ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 0 Westbound: 0

ROOSEVELT AVE											RICHMOND RD										Grand Total
Northbound					Southbound					Eastbound					Westbound						
Time Period	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT			
07:00 07:15	3	1	4	8	1	2	2	5	13	2	105	2	109	1	60	2	63	172	185		
07:15 07:30	3	0	13	16	8	2	1	11	27	0	128	3	131	2	65	2	69	200	227		
07:30 07:45	7	2	6	15	3	2	3	8	23	2	134	7	143	2	58	5	65	208	231		
07:45 08:00	5	5	9	19	5	0	4	9	28	3	147	9	159	8	64	3	75	234	262		
08:00 08:15	8	1	11	20	8	0	5	13	33	6	115	7	128	4	99	15	118	246	279		
08:15 08:30	4	2	16	22	20	6	7	33	55	2	153	5	160	6	93	17	116	276	331		
08:30 08:45	3	5	2	10	21	2	2	25	35	3	143	5	151	8	97	10	115	266	301		
08:45 09:00	9	2	14	25	9	3	3	15	40	1	135	6	142	5	118	7	130	272	312		
09:00 09:15	9	1	13	23	5	5	5	15	38	2	132	5	139	9	92	3	104	243	281		
09:15 09:30	4	0	10	14	17	1	2	20	34	1	101	4	106	12	92	4	108	214	248		
09:30 09:45	2	2	9	13	12	2	4	18	31	1	98	4	103	7	86	11	104	207	238		
09:45 10:00	3	4	11	18	7	3	7	17	35	8	91	5	104	16	108	12	136	240	275		
11:30 11:45	7	5	21	33	19	5	3	27	60	1	98	4	103	10	118	7	135	238	298		
11:45 12:00	7	10	18	35	19	2	14	35	70	0	93	16	109	9	143	17	169	278	348		
12:00 12:15	4	4	20	28	15	2	2	19	47	3	78	4	85	9	146	13	168	253	300		
12:15 12:30	7	4	19	30	16	3	5	24	54	1	88	8	97	20	126	13	159	256	310		
12:30 12:45	10	7	34	51	8	7	7	22	73	2	102	8	112	10	127	11	148	260	333		
12:45 13:00	10	6	29	45	13	10	13	36	81	0	105	9	114	17	160	17	194	308	389		
13:00 13:15	20	4	24	48	8	1	7	16	64	3	116	5	124	10	153	8	171	295	359		
13:15 13:30	13	4	16	33	4	6	7	17	50	0	94	4	98	13	118	9	140	238	288		
15:00 15:15	16	4	12	32	5	2	8	15	47	1	106	6	113	7	265	8	280	393	440		
15:15 15:30	6	4	12	22	6	3	1	10	32	4	94	4	102	17	217	11	245	347	379		
15:30 15:45	14	10	24	48	10	9	3	22	70	19	130	6	155	5	246	3	254	409	479		
15:45 16:00	8	3	14	25	4	4	6	14	39	1	99	1	101	12	236	8	256	357	396		
16:00 16:15	10	5	12	27	9	5	3	17	44	1	88	3	92	5	244	11	260	352	396		
16:15 16:30	14	5	9	28	10	16	9	35	63	4	97	12	113	13	265	6	284	397	460		
16:30 16:45	16	5	15	36	14	11	7	32	68	1	110	6	117	9	252	10	271	388	456		
16:45 17:00	7	3	12	22	10	3	8	21	43	0	89	8	97	8	261	9	278	375	418		
17:00 17:15	9	3	16	28	10	5	5	20	48	1	86	7	94	10	291	14	315	409	457		
17:15 17:30	11	2	10	23	8	1	4	13	36	3	73	6	82	3	215	8	226	308	344		
17:30 17:45	10	0	17	27	9	2	7	18	45	1	111	6	118	8	291	6	305	423	468		
17:45 18:00	10	10	17	37	2	2	0	4	41	4	79	6	89	2	90	7	99	188	229		
TOTAL:	269	123	469	861	315	127	164	606	1467	81	3418	191	3690	277	4996	287	5560	9250	10717		

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
34683

ROOSEVELT AVE @ RICHMOND RD

Count Date: Friday, June 12, 2015

Start Time: 07:00

Time Period	ROOSEVELT AVE			RICHMOND RD			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	6	1	7	18	4	22	29
08:00 09:00	17	13	30	8	9	17	47
09:00 10:00	4	1	5	3	5	8	13
11:30 12:30	2	0	2	2	5	7	9
12:30 13:30	2	3	5	4	7	11	16
15:00 16:00	7	4	11	3	4	7	18
16:00 17:00	4	2	6	6	5	11	17
17:00 18:00	2	6	8	3	9	12	20
Total	44	30	74	47	48	95	169

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

W.O.
34683

Turning Movement Count - Heavy Vehicle Report

ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

ROOSEVELT AVE											RICHMOND RD									
Time Period		Northbound			Southbound			Eastbound			Westbound									Grand Total
		LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	
07:00	08:00	0	2	4	6	0	1	0	1	7	0	12	0	12	2	25	0	27	39	46
08:00	09:00	3	0	7	10	3	0	0	3	13	1	29	0	30	1	20	3	24	54	67
09:00	10:00	0	0	3	3	1	2	2	5	8	0	15	0	15	1	16	1	18	33	41
11:30	12:30	1	0	0	1	2	0	1	3	4	1	10	1	12	1	21	1	23	35	39
12:30	13:30	1	0	0	1	1	2	2	5	6	0	18	0	18	0	21	2	23	41	47
15:00	16:00	2	0	0	2	1	1	0	2	4	0	11	0	11	0	16	0	16	27	31
16:00	17:00	1	0	1	2	2	2	0	4	6	0	7	0	7	0	9	2	11	18	24
17:00	18:00	0	0	0	0	0	0	0	0	0	0	6	0	6	0	10	0	10	16	16
Sub Total		8	2	15	25	10	8	5	23	48	2	108	1	111	5	138	9	152	263	311
U-Turns (Heavy Vehicles)					0				0	0				0				0	0	0
Total		8	2	15	0	10	8	5	23	48	2	108	1	111	5	138	9	152	263	311

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

Work Order

34683

Turning Movement Count - Pedestrian Volume Report

ROOSEVELT AVE @ RICHMOND RD

Count Date: Friday, June 12, 2015

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	8	7	15	5	2	7	22
07:15 07:30	10	11	21	7	7	14	35
07:30 07:45	4	8	12	7	2	9	21
07:45 08:00	6	2	8	3	2	5	13
07:00 08:00	28	28	56	22	13	35	91
08:00 08:15	18	14	32	21	7	28	60
08:15 08:30	11	19	30	5	8	13	43
08:30 08:45	22	18	40	22	14	36	76
08:45 09:00	22	30	52	17	10	27	79
08:00 09:00	73	81	154	65	39	104	258
09:00 09:15	10	13	23	4	10	14	37
09:15 09:30	18	6	24	11	14	25	49
09:30 09:45	12	24	36	18	7	25	61
09:45 10:00	13	15	28	11	40	51	79
09:00 10:00	53	58	111	44	71	115	226
11:30 11:45	25	16	41	23	15	38	79
11:45 12:00	37	61	98	11	120	131	229
12:00 12:15	9	24	33	6	41	47	80
12:15 12:30	20	62	82	14	16	30	112
11:30 12:30	91	163	254	54	192	246	500
12:30 12:45	18	74	92	7	30	37	129
12:45 13:00	30	62	92	16	37	53	145
13:00 13:15	23	32	55	20	21	41	96
13:15 13:30	16	10	26	12	10	22	48
12:30 13:30	87	178	265	55	98	153	418
15:00 15:15	22	17	39	7	6	13	52
15:15 15:30	27	14	41	19	10	29	70
15:30 15:45	24	55	79	15	6	21	100
15:45 16:00	20	20	40	10	11	21	61
15:00 16:00	93	106	199	51	33	84	283
16:00 16:15	20	15	35	22	44	66	101
16:15 16:30	26	24	50	24	21	45	95
16:30 16:45	31	14	45	14	22	36	81
16:45 17:00	30	3	33	12	7	19	52
16:00 17:00	107	56	163	72	94	166	329
17:00 17:15	12	7	19	22	7	29	48
17:15 17:30	12	10	22	12	32	44	66
17:30 17:45	7	13	20	16	34	50	70
17:45 18:00	13	2	15	13	2	15	30
17:00 18:00	44	32	76	63	75	138	214
Total	576	702	1278	426	615	1041	2319

Comment:

Turning Movement Count - 15 Min U-Turn Total Report

ROOSEVELT AVE @ RICHMOND RD

Survey Date: Friday, June 12, 2015

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		0	0	0	0	0

Turning Movement Count - Peak Hour Diagram

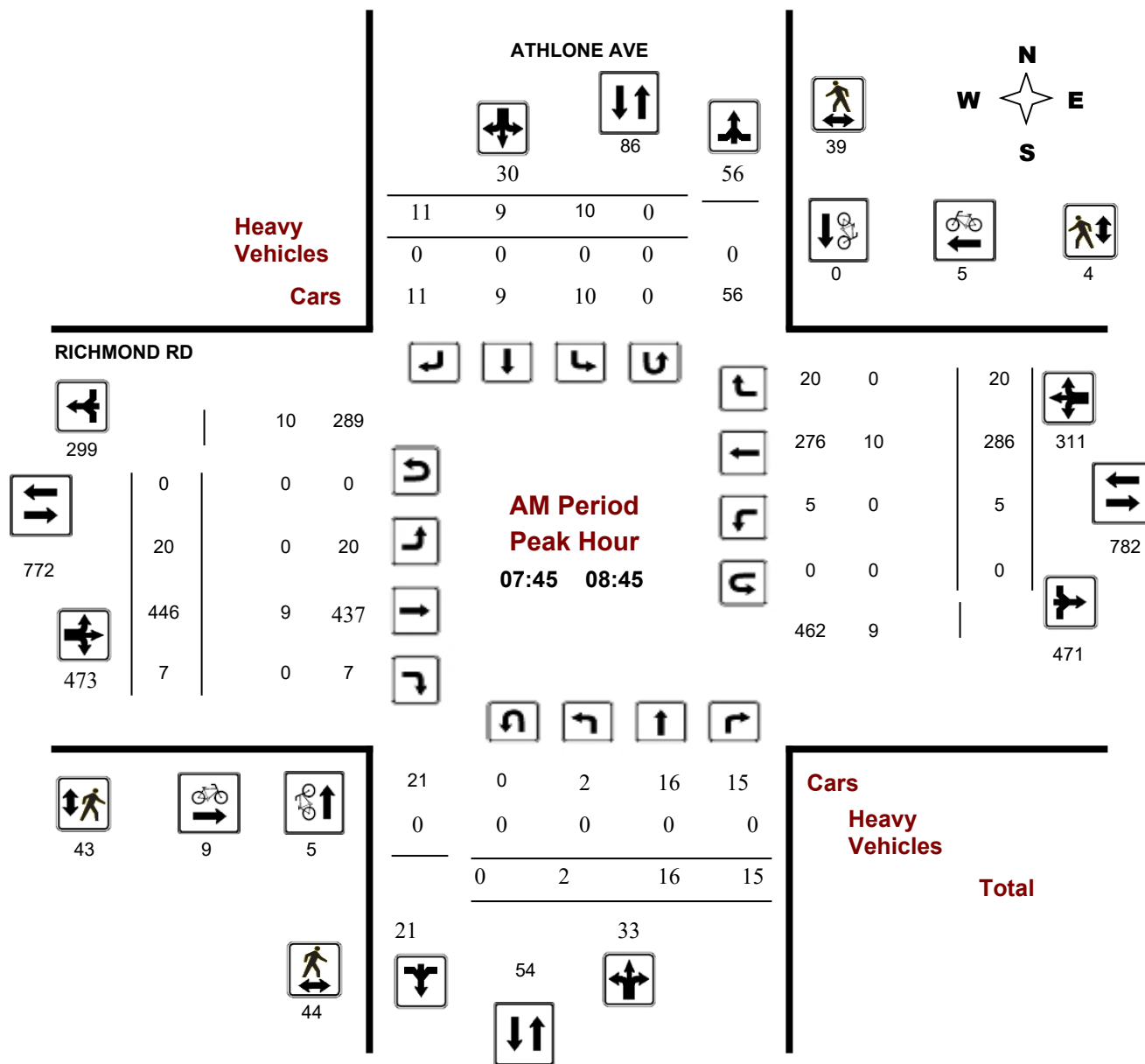
ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Start Time: 07:00

WO No: 36951

Device: Miovision



Turning Movement Count - Peak Hour Diagram

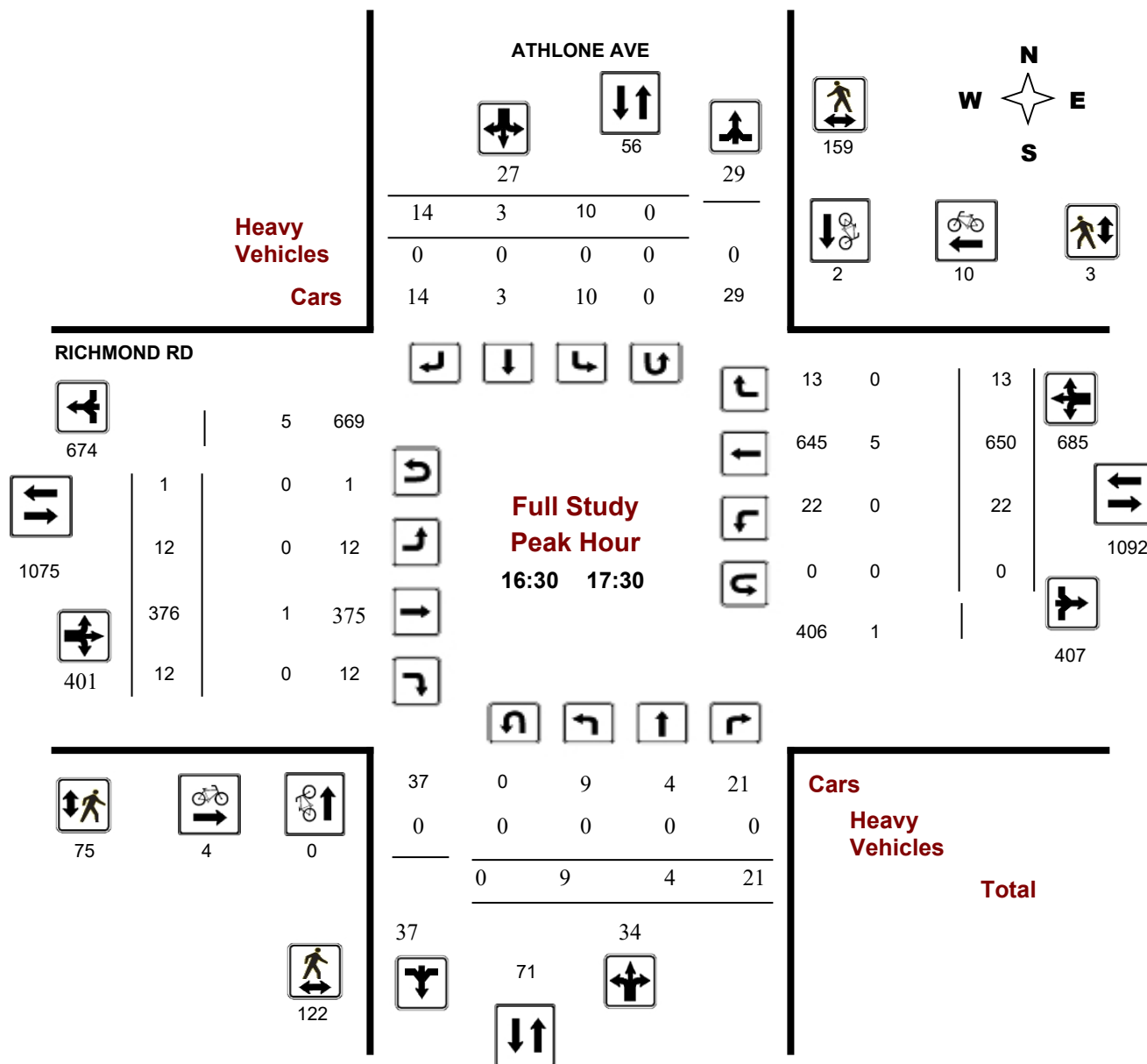
ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Start Time: 07:00

WO No: 36951

Device: Miovision



Comments

Turning Movement Count - Peak Hour Diagram

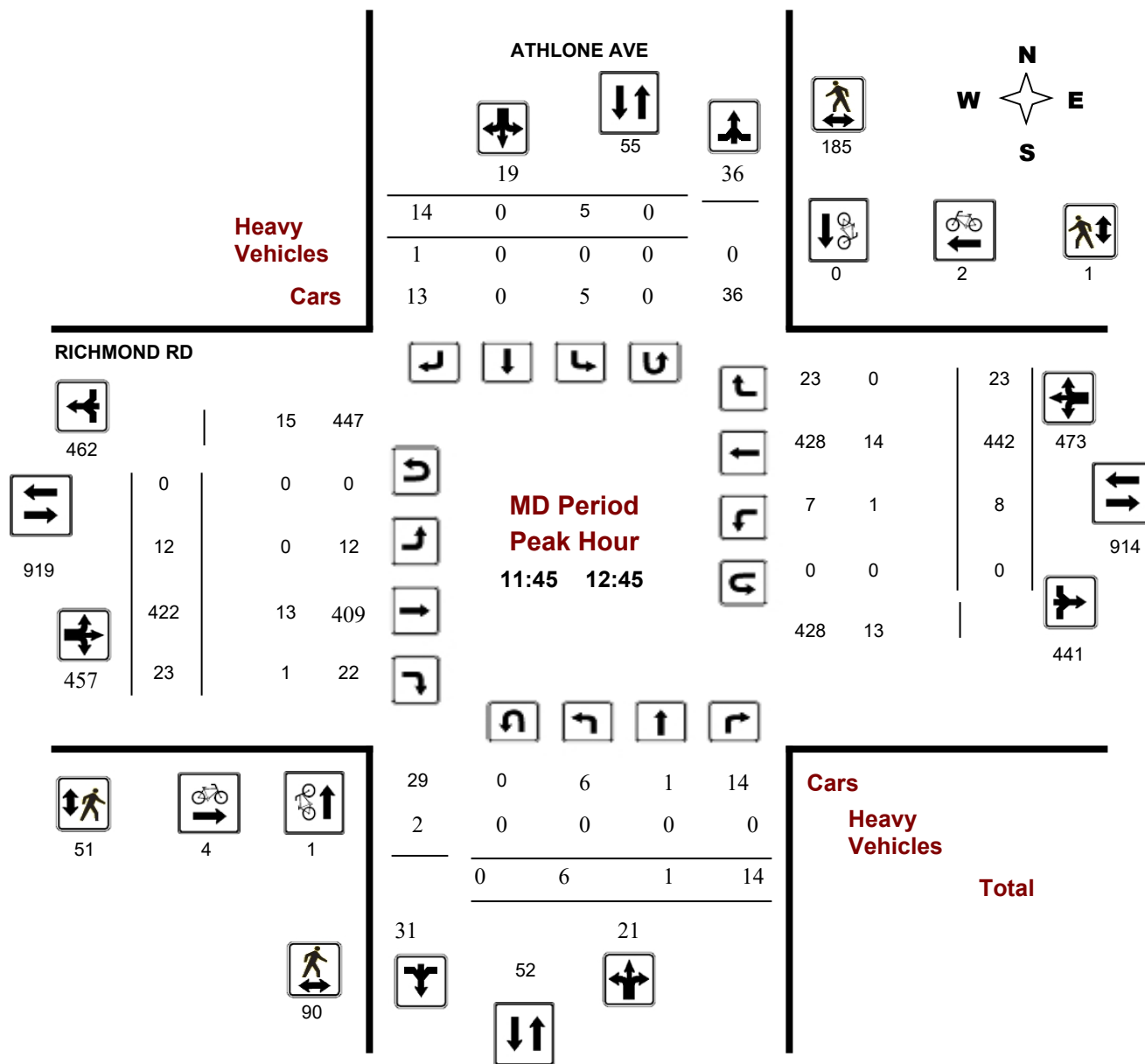
ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Start Time: 07:00

WO No: 36951

Device: Miovision



Turning Movement Count - Peak Hour Diagram

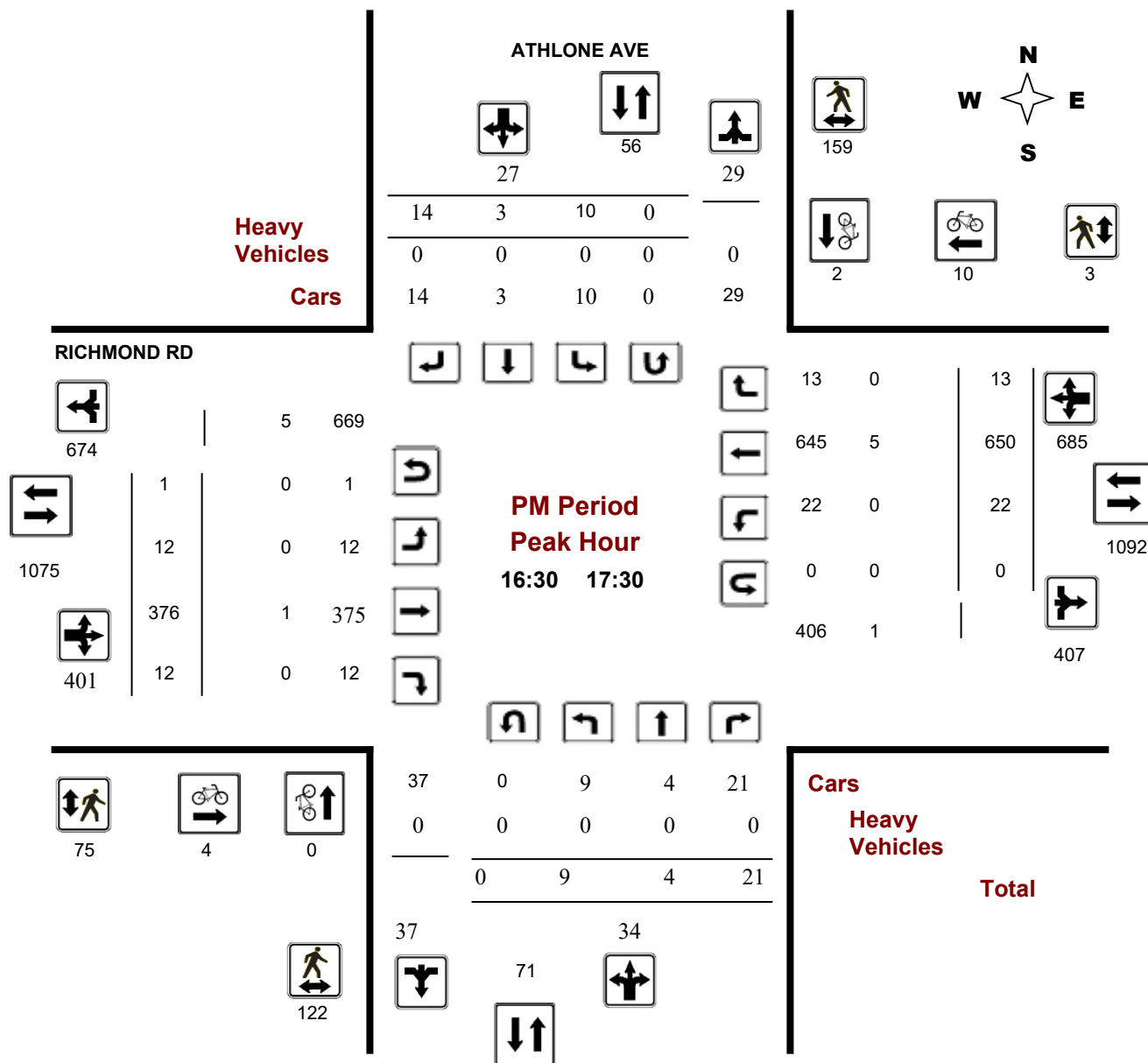
ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Start Time: 07:00

WO No: 36951

Device: Miovision



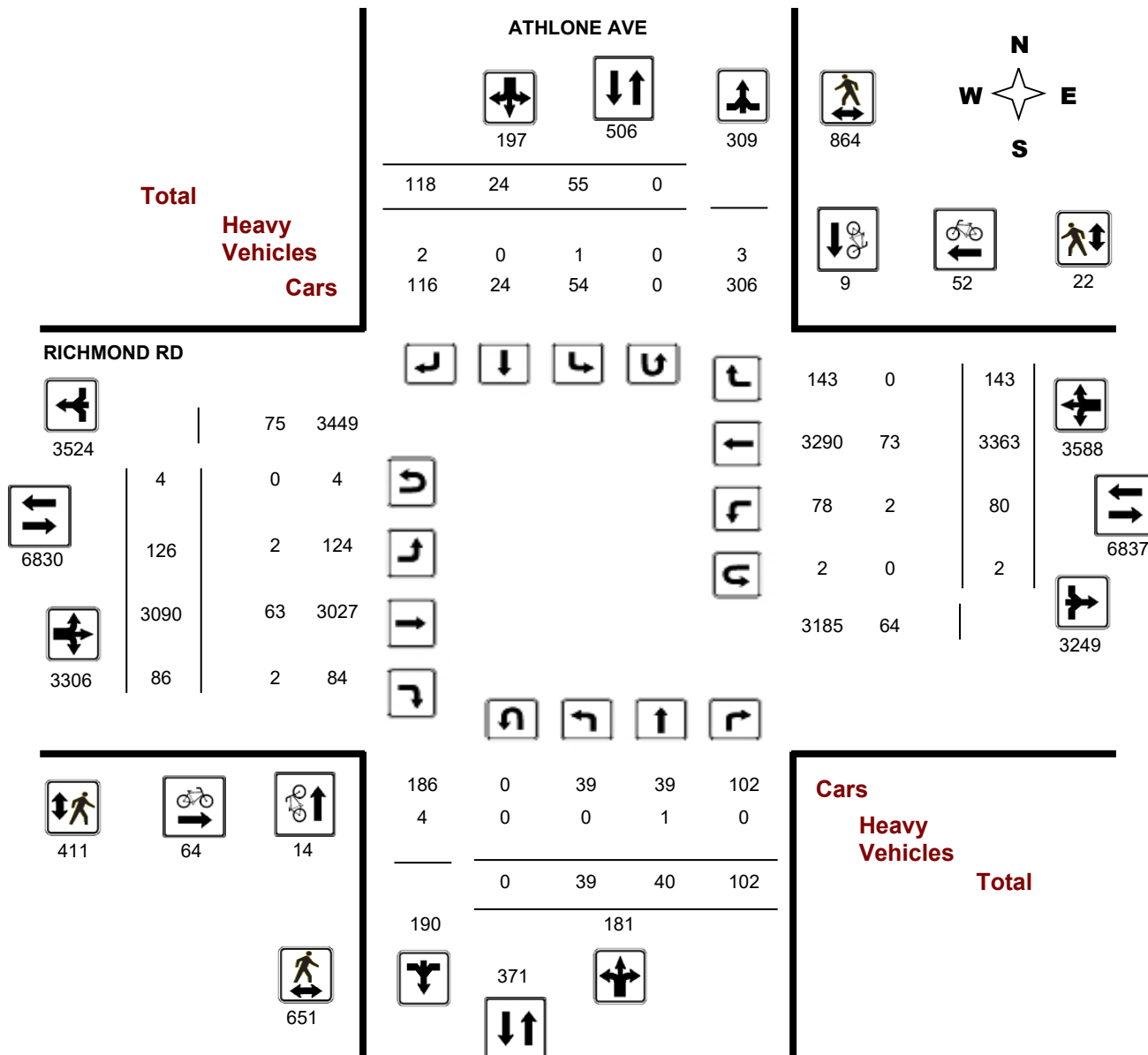
Transportation Services - Traffic Services

Turning Movement Count - Full Study Diagram

ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

WO#: 36951
Device: Miovision



Comments

Turning Movement Count - Full Study Summary Report

ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 4 Westbound: 2

AADT Factor

.90

Full Study

ATHLONE AVE

RICHMOND RD

		Northbound				Southbound				Eastbound				Westbound							
Period		LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total	
07:00	08:00	1	5	4	10	4	3	7	14	24	14	395	6	415	0	219	9	228	643	667	
08:00	09:00	2	14	15	31	9	9	9	27	58	17	408	9	434	6	287	17	310	744	802	
09:00	10:00	6	8	7	21	5	2	20	27	48	14	363	6	383	7	294	17	318	701	749	
11:30	12:30	5	2	9	16	6	0	12	18	34	15	423	22	460	6	423	21	450	910	944	
12:30	13:30	3	0	24	27	6	2	17	25	52	15	424	10	449	10	431	21	462	911	963	
15:00	16:00	5	2	13	20	9	1	16	26	46	14	351	9	374	8	520	10	538	912	958	
16:00	17:00	5	3	14	22	8	5	14	27	49	10	350	8	368	23	615	21	659	1027	1076	
17:00	18:00	12	6	16	34	8	2	23	33	67	27	376	16	419	20	574	27	621	1040	1107	
Sub Total		39	40	102	181	55	24	118	197	378	126	3090	86	3302	80	3363	143	3586	6888	7266	
U Turns		0								0	0	4				2				6	6
Total		39	40	102	181	55	24	118	197	378	126	3090	86	3306	80	3363	143	3588	6894	7272	
EQ 12Hr		54	56	142	252	76	33	164	274	526	175	4295	120	4595	111	4675	199	4987	9582	10108	
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.														1.39							
AVG 12Hr		49	50	128	226	69	30	148	246	472	158	3866	108	4136	100	4207	179	4489	8625	9097	
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.														.90							
AVG 24Hr		64	66	167	297	90	39	193	323	620	206	5064	141	5418	131	5511	234	5880	11298	11918	
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.														1.31							

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.



Turning Movement Count - 15 Minute Summary Report

ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 4 Westbound: 2

ATHLONE AVE

RICHMOND RD

		Northbound				Southbound				Eastbound				Westbound						
					N				S	STR				E				W	STR	Grand
Time Period		LT	ST	RT	TOT	LT	ST	RT	TOT	TOT	LT	ST	RT	TOT	LT	ST	RT	TOT	TOT	Total
07:00	07:15	0	0	0	0	1	0	1	2	2	0	78	3	81	0	47	1	48	129	131
07:15	07:30	1	0	1	2	0	1	0	1	3	3	88	0	91	0	48	2	50	141	144
07:30	07:45	0	2	1	3	1	1	1	3	6	6	97	2	105	0	46	1	47	152	158
07:45	08:00	0	3	2	5	2	1	5	8	13	5	132	1	138	0	78	5	83	221	234
08:00	08:15	0	6	4	10	1	2	2	5	15	9	105	0	114	3	62	3	68	182	197
08:15	08:30	0	5	5	10	4	2	2	8	18	3	100	0	103	1	63	6	70	173	191
08:30	08:45	2	2	4	8	3	4	2	9	17	3	109	6	118	1	83	6	90	208	225
08:45	09:00	0	1	2	3	1	1	3	5	8	2	94	3	100	1	79	2	82	182	190
09:00	09:15	3	2	2	7	2	1	8	11	18	4	100	1	106	1	57	1	59	165	183
09:15	09:30	0	3	0	3	2	1	4	7	10	5	90	1	96	3	85	6	94	190	200
09:30	09:45	0	3	3	6	1	0	3	4	10	4	88	3	95	2	76	0	79	174	184
09:45	10:00	3	0	2	5	0	0	5	5	10	1	85	1	87	1	76	10	87	174	184
11:30	11:45	0	1	1	2	2	0	1	3	5	3	100	3	106	0	93	3	96	202	207
11:45	12:00	2	0	1	3	2	0	3	5	8	7	113	4	124	5	112	4	121	245	253
12:00	12:15	1	0	3	4	2	0	4	6	10	2	113	11	126	0	110	6	116	242	252
12:15	12:30	2	1	4	7	0	0	4	4	11	3	97	4	104	1	108	8	117	221	232
12:30	12:45	1	0	6	7	1	0	3	4	11	0	99	4	103	2	112	5	119	222	233
12:45	13:00	0	0	5	5	1	1	4	6	11	4	97	4	105	5	96	2	103	208	219
13:00	13:15	1	0	5	6	1	0	6	7	13	7	107	1	115	2	111	8	122	237	250
13:15	13:30	1	0	8	9	3	1	4	8	17	4	121	1	126	1	112	6	119	245	262
15:00	15:15	0	0	4	4	1	0	3	4	8	5	92	3	101	1	117	1	119	220	228
15:15	15:30	1	0	0	1	4	0	2	6	7	4	96	2	102	0	116	1	117	219	226
15:30	15:45	1	2	3	6	1	0	5	6	12	5	86	1	92	5	145	5	155	247	259
15:45	16:00	3	0	6	9	3	1	6	10	19	0	77	3	80	2	142	3	147	227	246
16:00	16:15	2	0	5	7	0	0	4	4	11	2	81	1	84	7	137	6	150	234	245
16:15	16:30	2	1	1	4	2	2	3	7	11	2	84	2	88	6	144	7	157	245	256
16:30	16:45	1	2	5	8	4	2	5	11	19	4	102	2	108	5	158	7	170	278	297
16:45	17:00	0	0	3	3	2	1	2	5	8	2	83	3	88	5	176	1	182	270	278
17:00	17:15	3	0	5	8	2	0	2	4	12	3	107	3	114	4	171	2	177	291	303
17:15	17:30	5	2	8	15	2	0	5	7	22	3	84	4	91	8	145	3	156	247	269
17:30	17:45	3	2	1	6	0	1	10	11	17	16	92	6	114	5	140	10	155	269	286
17:45	18:00	1	2	2	5	4	1	6	11	16	5	93	3	101	3	118	12	133	234	250
TOTAL:		39	40	102	181	55	24	118	197	378	126	3090	86	3306	80	3363	143	3588	6894	7272

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
36951

ATHLONE AVE @ RICHMOND RD

Count Date: Thursday, April 20, 2017

Start Time: 07:00

Time Period	ATHLONE AVE			RICHMOND RD			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	2	2	4	13	5	18	22
08:00 09:00	3	1	4	9	6	15	19
09:00 10:00	1	1	2	6	5	11	13
11:30 12:30	0	0	0	4	5	9	9
12:30 13:30	1	0	1	3	0	3	4
15:00 16:00	6	0	6	6	4	10	16
16:00 17:00	1	2	3	14	7	21	24
17:00 18:00	0	3	3	9	20	29	32
Total	14	9	23	64	52	116	139

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

W.O.
36951

Turning Movement Count - Heavy Vehicle Report

ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

ATHLONE AVE										RICHMOND RD										
Time Period	Northbound			Southbound			S TOT	STR TOT	Eastbound			Westbound			W TOT	STR TOT	Grand Total			
	LT	ST	RT	N TOT	LT	ST			RT	LT	ST	RT	E TOT	LT				ST	RT	
07:00	08:00	0	0	0	0	0	0	0	0	0	12	0	12	0	9	0	9	21	21	
08:00	09:00	0	0	0	0	0	0	0	0	0	9	0	9	0	9	0	9	18	18	
09:00	10:00	0	1	0	1	0	0	0	0	1	11	0	11	0	10	0	10	21	22	
11:30	12:30	0	0	0	0	0	1	1	1	0	16	1	17	1	13	0	14	31	32	
12:30	13:30	0	0	0	0	0	1	1	1	2	8	0	10	0	17	0	17	27	28	
15:00	16:00	0	0	0	0	1	0	0	1	1	5	0	5	1	7	0	8	13	14	
16:00	17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	4	4	
17:00	18:00	0	0	0	0	0	0	0	0	0	2	1	3	0	4	0	4	7	7	
Sub Total		0	1	0	1	1	0	2	3	4	2	63	2	67	2	73	0	75	142	146
U-Turns (Heavy Vehicles)					0			0		0		0			0		0		0	
Total		0	1	0	0	1	0	2	3	4	2	63	2	67	2	73	0	75	142	146

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

Work Order

36951

Turning Movement Count - Pedestrian Volume Report

ATHLONE AVE @ RICHMOND RD

Count Date: Thursday, April 20, 2017

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	7	1	8	9	0	9	17
07:15 07:30	6	5	11	6	2	8	19
07:30 07:45	5	8	13	3	0	3	16
07:45 08:00	12	10	22	11	2	13	35
07:00 08:00	30	24	54	29	4	33	87
08:00 08:15	10	7	17	6	1	7	24
08:15 08:30	14	14	28	16	0	16	44
08:30 08:45	8	8	16	10	1	11	27
08:45 09:00	11	15	26	14	0	14	40
08:00 09:00	43	44	87	46	2	48	135
09:00 09:15	15	12	27	7	0	7	34
09:15 09:30	8	20	28	7	0	7	35
09:30 09:45	12	13	25	7	1	8	33
09:45 10:00	9	24	33	7	1	8	41
09:00 10:00	44	69	113	28	2	30	143
11:30 11:45	30	38	68	15	1	16	84
11:45 12:00	21	33	54	9	0	9	63
12:00 12:15	21	47	68	14	1	15	83
12:15 12:30	26	61	87	11	0	11	98
11:30 12:30	98	179	277	49	2	51	328
12:30 12:45	22	44	66	17	0	17	83
12:45 13:00	31	37	68	21	1	22	90
13:00 13:15	21	38	59	10	0	10	69
13:15 13:30	31	31	62	9	0	9	71
12:30 13:30	105	150	255	57	1	58	313
15:00 15:15	14	25	39	10	0	10	49
15:15 15:30	36	28	64	15	0	15	79
15:30 15:45	22	31	53	14	1	15	68
15:45 16:00	20	27	47	16	2	18	65
15:00 16:00	92	111	203	55	3	58	261
16:00 16:15	31	33	64	14	0	14	78
16:15 16:30	26	35	61	15	5	20	81
16:30 16:45	28	45	73	19	1	20	93
16:45 17:00	31	45	76	26	1	27	103
16:00 17:00	116	158	274	74	7	81	355
17:00 17:15	39	47	86	14	0	14	100
17:15 17:30	24	22	46	16	1	17	63
17:30 17:45	27	34	61	28	0	28	89
17:45 18:00	33	26	59	15	0	15	74
17:00 18:00	123	129	252	73	1	74	326
Total	651	864	1515	411	22	433	1948

Comment:

Turning Movement Count - 15 Min U-Turn Total Report

ATHLONE AVE @ RICHMOND RD

Survey Date: Thursday, April 20, 2017

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	1	0	1
09:00	09:15	0	0	1	0	1
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	1	1
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	1	1
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	1	0	1
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	1	0	1
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		0	0	4	2	6

Turning Movement Count - Peak Hour Diagram

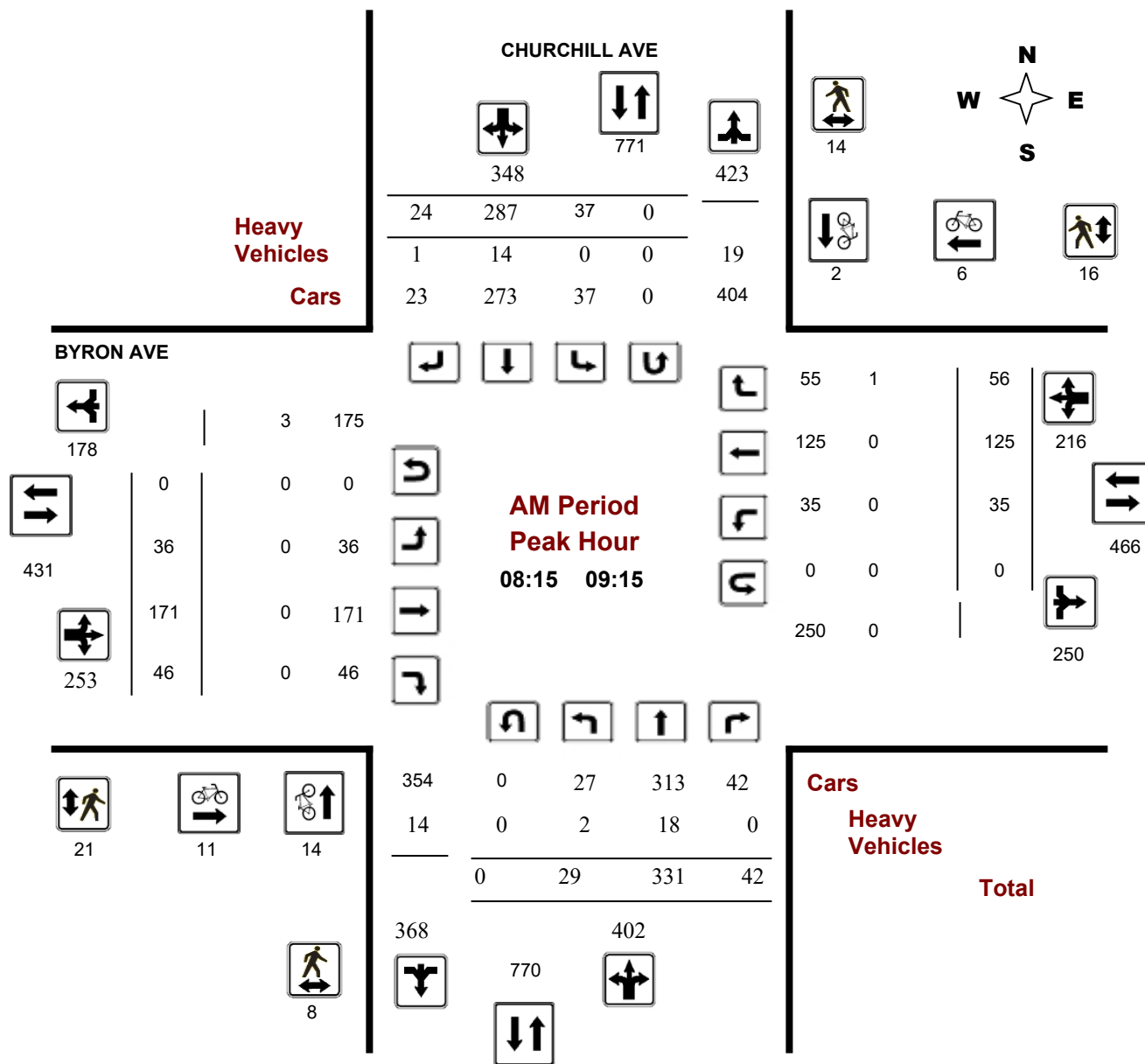
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Start Time: 07:00

WO No: 36253

Device: Miovision



Turning Movement Count - Peak Hour Diagram

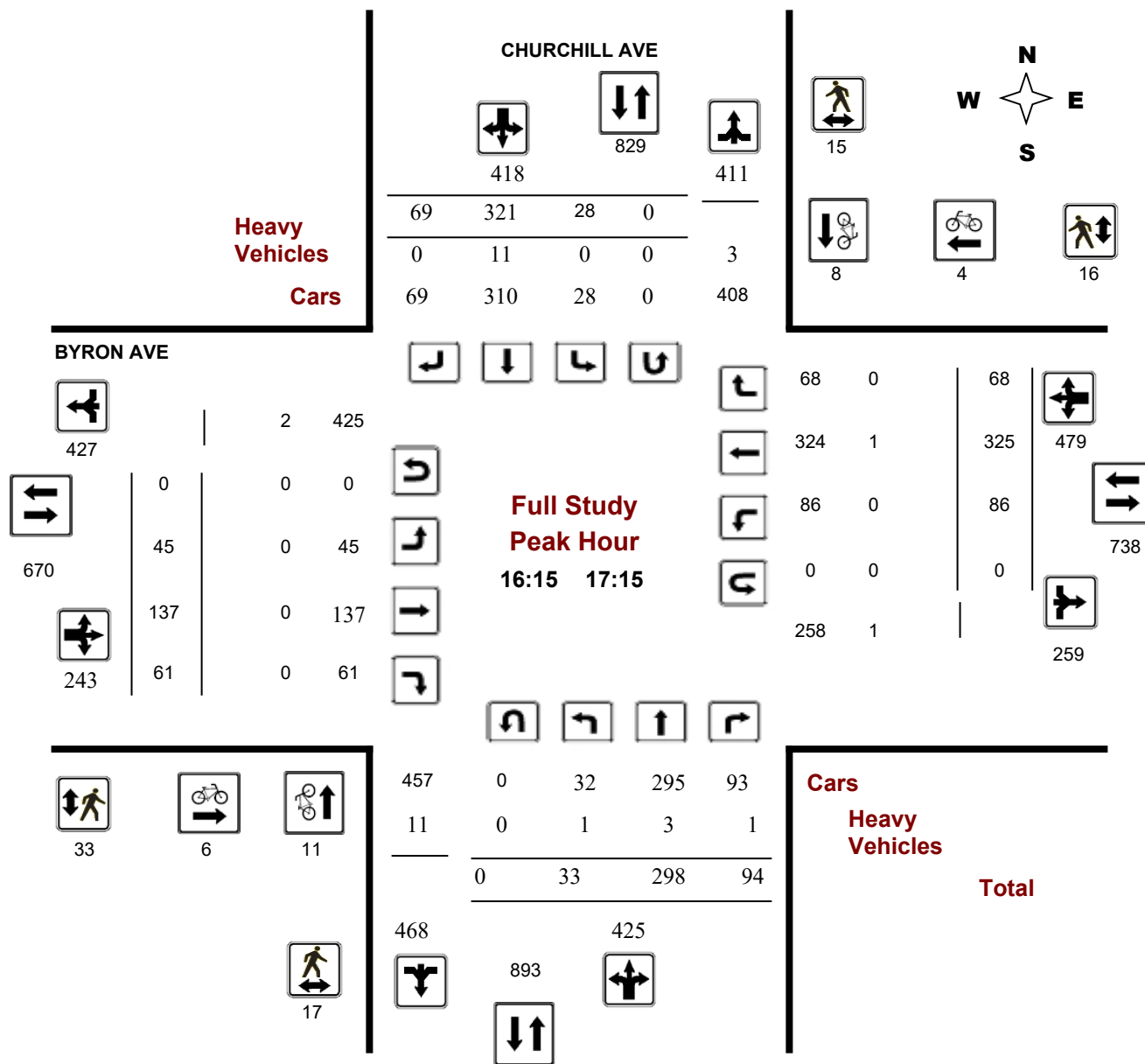
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Start Time: 07:00

WO No: 36253

Device: Miovision



Comments

Turning Movement Count - Peak Hour Diagram

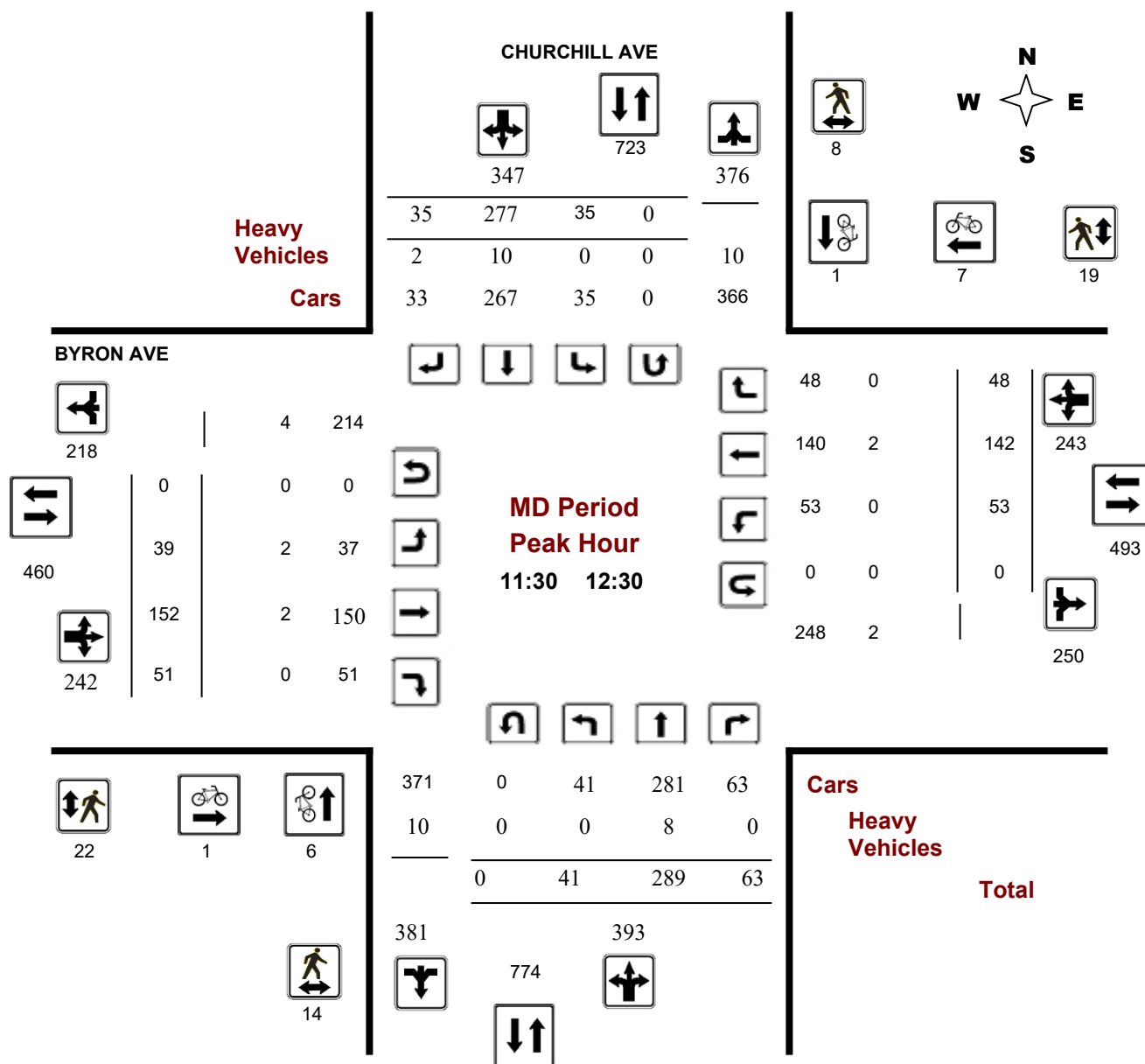
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Start Time: 07:00

WO No: 36253

Device: Miovision



Comments

Turning Movement Count - Peak Hour Diagram

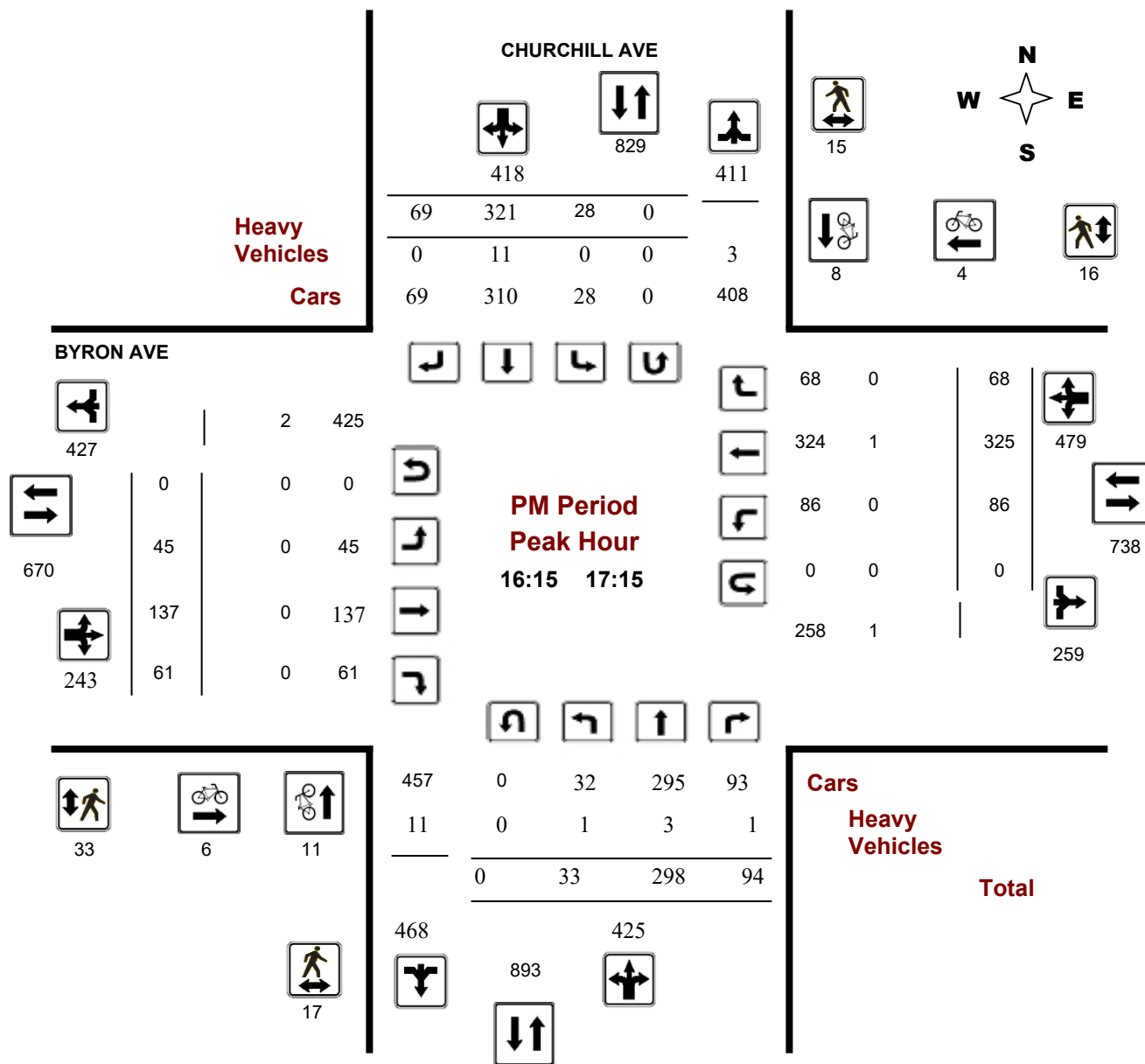
BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Start Time: 07:00

WO No: 36253

Device: Miovision



Transportation Services - Traffic Services

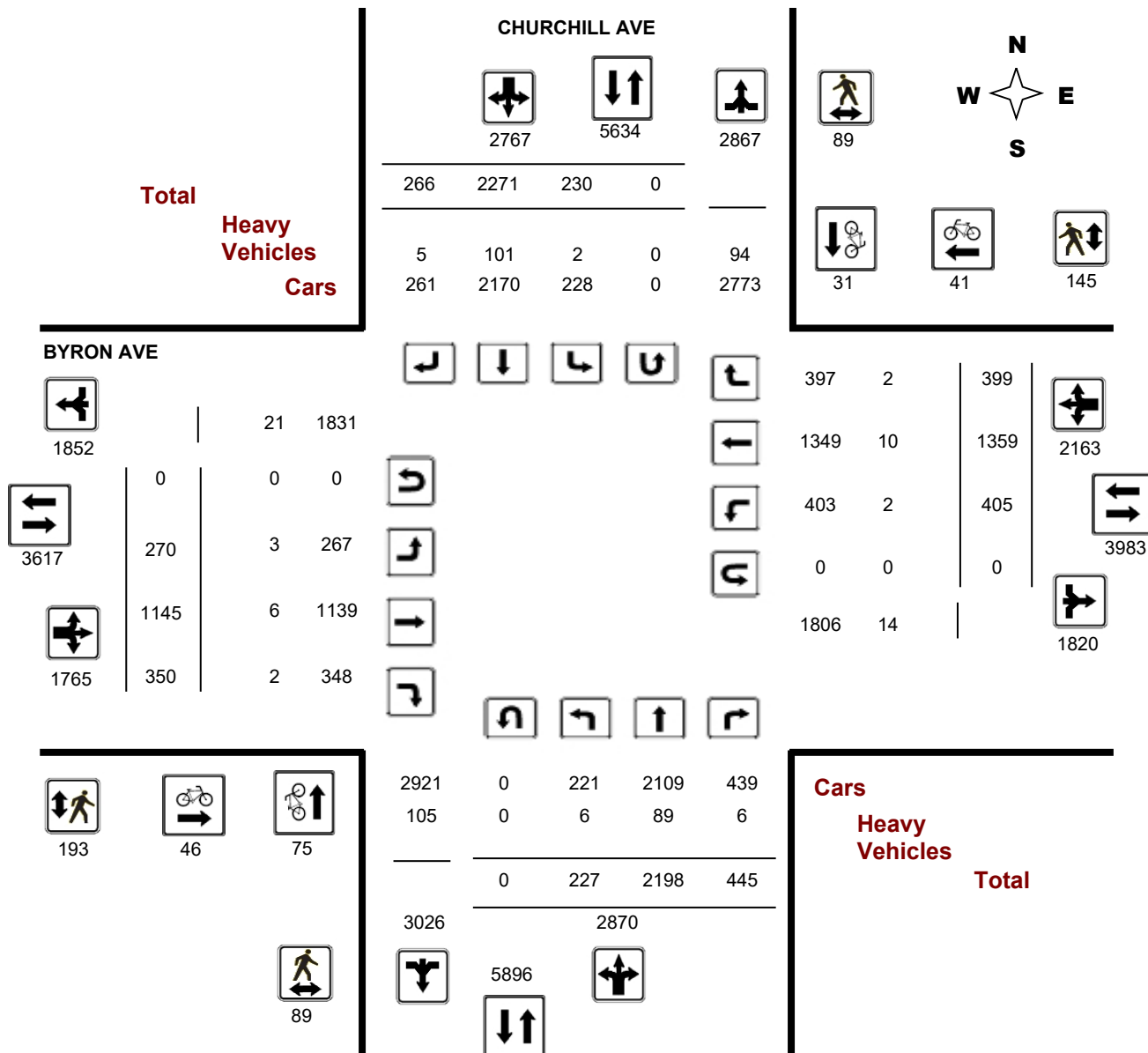
Turning Movement Count - Full Study Diagram

BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

WO#: 36253

Device: Miovision



Turning Movement Count - Full Study Summary Report

BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 0 Westbound: 0

AADT Factor

.90

Full Study

CHURCHILL AVE										BYRON AVE										STR TOT	Grand Total
Northbound					Southbound					Eastbound					Westbound						
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total		
07:00 08:00	16	199	19	234	27	230	6	263	497	25	85	19	129	30	54	27	111	240	737		
08:00 09:00	31	330	47	408	38	292	20	350	758	47	154	42	243	35	100	55	190	433	1191		
09:00 10:00	20	276	47	343	26	207	14	247	590	23	148	43	214	32	116	59	207	421	1011		
11:30 12:30	41	289	63	393	35	277	35	347	740	39	152	51	242	53	142	48	243	485	1225		
12:30 13:30	30	272	62	364	19	294	33	346	710	40	145	53	238	32	149	45	226	464	1174		
15:00 16:00	26	257	44	327	31	322	36	389	716	27	171	49	247	58	208	45	311	558	1274		
16:00 17:00	28	303	98	429	30	337	64	431	860	41	143	50	234	83	305	59	447	681	1541		
17:00 18:00	35	272	65	372	24	312	58	394	766	28	147	43	218	82	285	61	428	646	1412		
Sub Total	227	2198	445	2870	230	2271	266	2767	5637	270	1145	350	1765	405	1359	399	2163	3928	9565		
U Turns				0				0	0				0				0	0	0		
Total	227	2198	445	2870	230	2271	266	2767	5637	270	1145	350	1765	405	1359	399	2163	3928	9565		
EQ 12Hr	316	3055	619	3989	320	3157	370	3846	7835	375	1592	486	2453	563	1889	555	3007	5460	13295		
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													1.39								
AVG 12Hr	284	2750	557	3590	288	2841	333	3462	7052	338	1432	438	2208	507	1700	499	2706	4914	11966		
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													.90								
AVG 24Hr	372	3602	729	4703	377	3722	436	4535	9238	442	1876	574	2892	664	2227	654	3545	6437	15675		
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													1.31								

Comments:

Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.

Turning Movement Count - 15 Minute Summary Report

BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Total Observed U-Turns

Northbound: 0 Southbound: 0
Eastbound: 0 Westbound: 0

CHURCHILL AVE

BYRON AVE

Time Period	Northbound			N TOT	Southbound			S TOT	STR TOT	Eastbound			E TOT	Westbound			W TOT	STR TOT	Grand Total
	LT	ST	RT		LT	ST	RT			LT	ST	RT		LT	ST	RT			
07:00 07:15	4	38	2	44	6	41	4	51	95	0	15	4	19	3	9	3	15	34	129
07:15 07:30	5	54	5	64	8	49	0	57	121	2	14	4	20	8	12	6	26	46	167
07:30 07:45	2	52	6	60	7	65	2	74	134	7	21	5	33	13	17	10	40	73	207
07:45 08:00	5	55	6	66	6	75	0	81	147	16	35	6	57	6	16	8	30	87	234
08:00 08:15	7	73	14	94	6	60	0	66	160	14	29	10	53	8	13	9	30	83	243
08:15 08:30	11	76	8	95	10	69	4	83	178	14	46	10	70	5	16	10	31	101	279
08:30 08:45	6	86	10	102	10	89	8	107	209	10	30	9	49	9	28	15	52	101	310
08:45 09:00	7	95	15	117	12	74	8	94	211	9	49	13	71	13	43	21	77	148	359
09:00 09:15	5	74	9	88	5	55	4	64	152	3	46	14	63	8	38	10	56	119	271
09:15 09:30	5	64	15	84	6	54	1	61	145	6	35	7	48	8	20	11	39	87	232
09:30 09:45	7	77	4	88	10	46	4	60	148	6	34	9	49	12	30	22	64	113	261
09:45 10:00	3	61	19	83	5	52	5	62	145	8	33	13	54	4	28	16	48	102	247
11:30 11:45	10	74	14	98	12	77	7	96	194	11	27	13	51	13	32	11	56	107	301
11:45 12:00	11	90	16	117	7	62	6	75	192	7	43	12	62	9	38	10	57	119	311
12:00 12:15	7	62	14	83	10	75	12	97	180	9	35	15	59	18	39	12	69	128	308
12:15 12:30	13	63	19	95	6	63	10	79	174	12	47	11	70	13	33	15	61	131	305
12:30 12:45	10	72	13	95	5	61	7	73	168	14	39	16	69	7	36	9	52	121	289
12:45 13:00	6	65	15	86	4	71	7	82	168	11	27	12	50	6	33	8	47	97	265
13:00 13:15	9	77	16	102	4	71	8	83	185	9	45	14	68	11	46	18	75	143	328
13:15 13:30	5	58	18	81	6	91	11	108	189	6	34	11	51	8	34	10	52	103	292
15:00 15:15	6	61	14	81	9	69	9	87	168	6	44	12	62	10	42	12	64	126	294
15:15 15:30	7	56	10	73	7	102	9	118	191	7	30	12	49	15	46	7	68	117	308
15:30 15:45	5	69	9	83	9	80	8	97	180	7	42	14	63	18	62	12	92	155	335
15:45 16:00	8	71	11	90	6	71	10	87	177	7	55	11	73	15	58	14	87	160	337
16:00 16:15	7	77	22	106	10	86	10	106	212	6	40	8	54	24	56	14	94	148	360
16:15 16:30	4	84	28	116	8	84	17	109	225	18	34	14	66	18	74	21	113	179	404
16:30 16:45	12	72	28	112	6	75	20	101	213	6	38	18	62	25	96	13	134	196	409
16:45 17:00	5	70	20	95	6	92	17	115	210	11	31	10	52	16	79	11	106	158	368
17:00 17:15	12	72	18	102	8	70	15	93	195	10	34	19	63	27	76	23	126	189	384
17:15 17:30	8	68	15	91	5	85	12	102	193	5	48	6	59	26	86	18	130	189	382
17:30 17:45	7	65	23	95	6	77	10	93	188	5	32	6	43	15	63	8	86	129	317
17:45 18:00	8	67	9	84	5	80	21	106	190	8	33	12	53	14	60	12	86	139	329
TOTAL:	227	2198	445	2870	230	2271	266	2767	5637	270	1145	350	1765	405	1359	399	2163	3928	9565

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
36253

BYRON AVE @ CHURCHILL AVE

Count Date: Thursday, August 25, 2016

Start Time: 07:00

Time Period	CHURCHILL AVE			BYRON AVE			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	17	5	22	7	3	10	32
08:00 09:00	11	2	13	11	6	17	30
09:00 10:00	15	1	16	8	4	12	28
11:30 12:30	6	1	7	1	7	8	15
12:30 13:30	3	1	4	6	5	11	15
15:00 16:00	3	0	3	0	6	6	9
16:00 17:00	8	12	20	3	6	9	29
17:00 18:00	12	9	21	10	4	14	35
Total	75	31	106	46	41	87	193

Comment:

Note: These volumes consists of bicycles only (no mopeds or motorcycles) and ARE NOT included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

W.O.
36253

Turning Movement Count - Heavy Vehicle Report

BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

CHURCHILL AVE											BYRON AVE										
Time Period	Northbound			Southbound			S TOT	STR TOT	Eastbound			Westbound			W TOT	STR TOT	Grand Total				
	LT	ST	RT	N TOT	LT	ST			RT	LT	ST	RT	E TOT	LT				ST	RT		
07:00	08:00	0	17	1	18	1	14	0	15	33	0	0	0	0	0	3	1	4	4	37	
08:00	09:00	2	14	0	16	0	14	1	15	31	0	0	0	0	0	0	0	0	0	31	
09:00	10:00	1	24	2	27	0	16	0	16	43	0	2	1	3	0	0	1	1	4	47	
11:30	12:30	0	8	0	8	0	10	2	12	20	2	2	0	4	0	2	0	2	6	26	
12:30	13:30	0	8	2	10	1	8	1	10	20	1	0	1	2	2	1	0	3	5	25	
15:00	16:00	1	6	0	7	0	17	1	18	25	0	1	0	1	0	3	0	3	4	29	
16:00	17:00	2	6	1	9	0	12	0	12	21	0	1	0	1	0	1	0	1	2	23	
17:00	18:00	0	6	0	6	0	10	0	10	16	0	0	0	0	0	0	0	0	0	16	
Sub Total		6	89	6	101	2	101	5	108	209	3	6	2	11	2	10	2	14	25	234	
U-Turns (Heavy Vehicles)					0				0	0				0				0	0	0	
Total		6	89	6	0	2	101	5	108	209	3	6	2	11	2	10	2	14	25	234	

Heavy Vehicles include Buses, Single-Unit Trucks and Articulated Trucks. Further, they ARE included in the Turning Movement Count Summary.



Transportation Services - Traffic Services

Work Order

36253

Turning Movement Count - Pedestrian Volume Report

BYRON AVE @ CHURCHILL AVE

Count Date: Thursday, August 25, 2016

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	7	1	8	2	5	7	15
07:15 07:30	3	2	5	3	2	5	10
07:30 07:45	1	6	7	3	4	7	14
07:45 08:00	5	0	5	8	1	9	14
07:00 08:00	16	9	25	16	12	28	53
08:00 08:15	0	1	1	3	2	5	6
08:15 08:30	2	3	5	5	5	10	15
08:30 08:45	2	6	8	3	3	6	14
08:45 09:00	3	4	7	10	7	17	24
08:00 09:00	7	14	21	21	17	38	59
09:00 09:15	1	1	2	3	1	4	6
09:15 09:30	2	1	3	3	7	10	13
09:30 09:45	3	1	4	10	3	13	17
09:45 10:00	1	2	3	7	4	11	14
09:00 10:00	7	5	12	23	15	38	50
11:30 11:45	5	4	9	5	6	11	20
11:45 12:00	3	1	4	3	3	6	10
12:00 12:15	4	2	6	9	7	16	22
12:15 12:30	2	1	3	5	3	8	11
11:30 12:30	14	8	22	22	19	41	63
12:30 12:45	1	3	4	9	15	24	28
12:45 13:00	2	10	12	8	10	18	30
13:00 13:15	0	0	0	5	2	7	7
13:15 13:30	2	2	4	6	7	13	17
12:30 13:30	5	15	20	28	34	62	82
15:00 15:15	3	1	4	4	3	7	11
15:15 15:30	5	5	10	7	8	15	25
15:30 15:45	2	3	5	9	6	15	20
15:45 16:00	2	2	4	2	1	3	7
15:00 16:00	12	11	23	22	18	40	63
16:00 16:15	2	4	6	3	4	7	13
16:15 16:30	2	0	2	4	1	5	7
16:30 16:45	7	0	7	10	1	11	18
16:45 17:00	4	7	11	7	5	12	23
16:00 17:00	15	11	26	24	11	35	61
17:00 17:15	4	8	12	12	9	21	33
17:15 17:30	4	1	5	7	5	12	17
17:30 17:45	3	1	4	5	3	8	12
17:45 18:00	2	6	8	13	2	15	23
17:00 18:00	13	16	29	37	19	56	85
Total	89	89	178	193	145	338	516

Comment:

Turning Movement Count - 15 Min U-Turn Total Report

BYRON AVE @ CHURCHILL AVE

Survey Date: Thursday, August 25, 2016

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	0	0	0	0	0
09:15	09:30	0	0	0	0	0
09:30	09:45	0	0	0	0	0
09:45	10:00	0	0	0	0	0
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	0	0	0
12:00	12:15	0	0	0	0	0
12:15	12:30	0	0	0	0	0
12:30	12:45	0	0	0	0	0
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	0	0
15:00	15:15	0	0	0	0	0
15:15	15:30	0	0	0	0	0
15:30	15:45	0	0	0	0	0
15:45	16:00	0	0	0	0	0
16:00	16:15	0	0	0	0	0
16:15	16:30	0	0	0	0	0
16:30	16:45	0	0	0	0	0
16:45	17:00	0	0	0	0	0
17:00	17:15	0	0	0	0	0
17:15	17:30	0	0	0	0	0
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		0	0	0	0	0

Traffic Signal Timing

City of Ottawa, Transportation Services Department

Traffic Signal Operations Unit

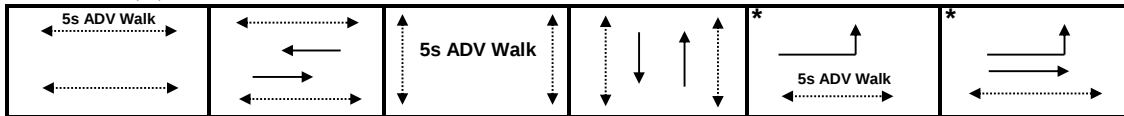
Intersection:	Main: Richmond	Side: Churchill N
Controller:	MS-3200	TSD: 5229
Author:	Yassine Bennani	Date: 15-Mar-2019

Existing Timing Plans†

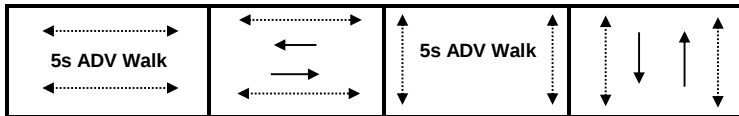
	Plan					Ped Minimum Time		
	AM Peak 1	Off Peak 2	PM Peak 3	Night 4	Weekend 5	Walk	DW	A+R
Cycle	80	75	90	65	75			
Offset	43	16	0	29	16			
EB Thru	45	43	60	33	43	14	11	3.3+2.8
WB Thru	31	31	45	33	31	14	11	3.3+2.8
NB Thru	35	32	30	32	32	7	11	3.6+2.6
SB Thru	35	32	30	32	32	7	11	3.6+2.6
EB Left	14	12	15	-	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

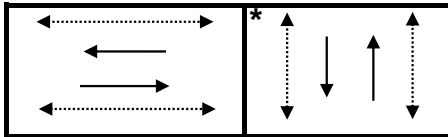
Intersection:	Main: Richmond	Side: Roosevelt
Controller:	MS-3200	TSD: 5231
Author:	Yassine Bennani	Date: 15-Mar-2019

Existing Timing Plans†

	Plan						Ped Minimum Time		
	AM Peak 1	Off Peak 2	PM Peak 3	Night 4	Weekend 5	Evening 12	Walk	DW	A+R
Cycle	70	65	85	60	65	70			
Offset	27	4	78	X	4	X			
EB Thru	45	40	60	35	40	45	18	8	3.3+2.1
WB Thru	45	40	60	35	40	45	18	8	3.3+2.1
NB Thru	25	25	25	25	25	25	9	10	3.3+2.3
SB Thru	25	25	25	25	25	25	9	10	3.3+2.3

Phasing Sequence‡

Plan: All



Schedule

Weekday

Time	Plan
0:15	4
6:30	1
9:30	2
15:00	3
18:30	2
20:00	12
23:00	4

Saturday

Time	Plan
0:15	4
9:10	5
18:30	2
20:00	12
23:30	4

Sunday

Time	Plan
0:15	4
9:10	2
20:00	12
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

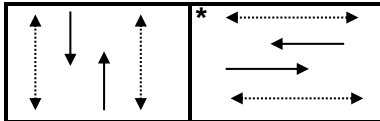
Intersection:	Main: Churchill	Side: Byron
Controller:	ATC-3	TSD: 5634
Author:	Yassine Bennani	Date: 15-Mar-2019

Existing Timing Plans†

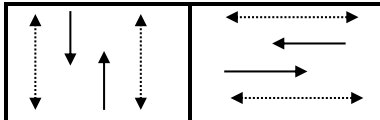
	Plan					Ped Minimum Time				
	AM Peak 1	Off Peak 2	PM Peak 3	Night 4	Weekend 5	AM School 11	PM School 12	Walk	DW	A+R
Cycle	80	75	90	60	75	80	75			
Offset	74	45	40	X	45	74	45			
NB Thru	42	40	45	32	40	42	40	10	9	3.3+2.1
SB Thru	42	40	45	32	40	42	40	10	9	3.3+2.1
EB Thru	38	35	45	28	35	38	35	10	15	3.3+2.3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

Traffic Signal Timing

City of Ottawa, Transportation Services Department

Traffic Signal Operations Unit

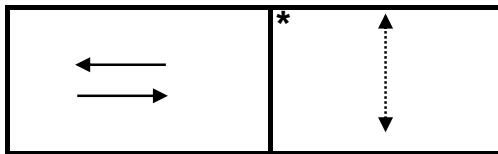
Intersection:	Main: Richmond	Side: Athlone
Controller:	ATC-3	TSD: 6523
Author:	Yassine Bennani	Date: 15-Mar-2019

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	65	65	65	65	65			
Offset	X	X	X	X	X			
EB Thru	42	42	42	42	42	-	-	3.3+2.7
WB Thru	42	42	42	42	42	-	-	3.3+2.7
NS Ped	23	23	23	23	23	7	12	3.0+1.0

Phasing Sequence‡

Plan: All



Schedule

Weekday

Time	Plan
0:15	4
6:30	1
9:30	2
15:00	3
18:30	2
22:30	4

Saturday

Time	Plan
0:15	4
6:30	2
9:00	5
18:30	2
22:30	4

Sunday

Time	Plan
0:15	4
6:30	2
9:00	5
18:00	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 C

Collision Data

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-12-08	2013	11:10:00 AM	CHURCHILL AVE @ SCOTT ST	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	02 - Angle	01 - Dry
2016-02-18	2016	7:15:00 AM	CHURCHILL AVE @ SCOTT ST	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	07 - SMV other	06 - Ice
2017-02-10	2017	12:00:00 AM	CHURCHILL AVE @ SCOTT ST	01 - Clear	00 - Unknown	02 - Stop sign	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2015-11-17	2015	7:50:00 PM	CHURCHILL AVE N btwn DANFORTH AVE & BYRON AVE	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-01-28	2013	12:40:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	03 - Snow	01 - Daylight	10 - No control	03 - P.D. only	01 - Approaching	04 - Slush
2013-08-24	2013	11:00:00 AM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	00 - Unknown	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2014-11-21	2014	4:22:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	05 - Dusk	10 - No control	02 - Non-fatal injury	03 - Rear end	01 - Dry
2016-12-16	2016	3:45:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	01 - Daylight	10 - No control	02 - Non-fatal injury	07 - SMV other	01 - Dry
2016-02-11	2016	3:37:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	01 - Dry
2016-01-04	2016	11:23:00 AM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	03 - Loose snow
2017-06-29	2017	4:39:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	02 - Rain	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	02 - Wet
2017-04-13	2017	3:00:00 PM	CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2016-11-28	2016	1:59:00 PM	CHURCHILL AVE N btwn SCOTT ST & WILMONT AVE	01 - Clear	01 - Daylight	10 - No control	02 - Non-fatal injury	07 - SMV other	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2014-04-11	2014	5:14:00 PM	CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	01 - Approaching	01 - Dry
2015-03-09	2015	5:30:00 PM	CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2015-04-04	2015	6:26:00 PM	CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE	01 - Clear	05 - Dusk	10 - No control	03 - P.D. only	05 - Turning movement	01 - Dry
2016-02-24	2016	4:09:00 PM	CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE	04 - Freezing Rain	01 - Daylight	10 - No control	03 - P.D. only	05 - Turning movement	04 - Slush
2017-12-20	2017	10:00:00 AM	CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE	03 - Snow	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	05 - Packed snow

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-11-12	2013	4:30:00 PM	CHURCHILL AVE N btwn WILMONT AVE & WHITBY AVE	01 - Clear	05 - Dusk	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2015-02-05	2015	3:15:00 PM	CHURCHILL AVE N btwn WILMONT AVE & WHITBY AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-02-08	2013	12:00:00 PM	CHURCHILL AVE @ MADISON AVE	03 - Snow	01 - Daylight	02 - Stop sign	03 - P.D. only	03 - Rear end	05 - Packed snow
2014-11-17	2014	7:25:00 AM	CHURCHILL AVE @ MADISON AVE	03 - Snow	01 - Daylight	02 - Stop sign	02 - Non-fatal injury	07 - SMV other	04 - Slush
2016-10-25	2016	6:16:00 PM	CHURCHILL AVE @ MADISON AVE	01 - Clear	07 - Dark	02 - Stop sign	03 - P.D. only	02 - Angle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-01-17	2013	4:33:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-02-16	2013	10:33:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	07 - SMV other	01 - Dry
2013-04-06	2013	11:44:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2013-06-13	2013	1:00:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2013-06-13	2013	2:30:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2013-06-17	2013	6:52:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2013-07-28	2013	12:50:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-08-28	2013	3:34:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2013-09-24	2013	11:51:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-05-01	2014	7:54:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	07 - SMV other	01 - Dry
2014-02-26	2014	2:52:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2014-06-13	2014	6:47:00 AM	CHURCHILL AVE @ RICHMOND RD	02 - Rain	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	02 - Wet
2014-10-06	2014	12:46:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	07 - Dark	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2014-10-20	2014	9:40:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-01-25	2015	2:02:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	03 - Rear end	01 - Dry
2015-01-16	2015	10:39:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	04 - Slush
2015-06-18	2015	9:14:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-02-26	2015	5:03:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	02 - Wet
2015-01-31	2015	8:21:00 PM	CHURCHILL AVE @ RICHMOND RD	03 - Snow	07 - Dark	01 - Traffic signal	03 - P.D. only	05 - Turning movement	03 - Loose snow
2015-04-11	2015	12:34:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-07-24	2015	2:25:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2015-11-19	2015	10:56:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	02 - Wet
2015-10-03	2015	11:00:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2016-06-02	2016	2:22:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	07 - SMV other	01 - Dry
2016-12-31	2016	12:01:00 PM	CHURCHILL AVE @ RICHMOND RD	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	07 - SMV other	03 - Loose snow
2016-06-17	2016	5:29:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	03 - Dawn	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry

2016-01-04	2016	12:08:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	02 - Wet
2016-08-07	2016	12:12:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2016-08-13	2016	12:00:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	00 - Unknown	01 - Traffic signal	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2016-12-09	2016	8:40:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	06 - Ice
2017-09-06	2017	12:00:00 AM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	00 - Unknown	01 - Traffic signal	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2017-09-26	2017	7:08:00 PM	CHURCHILL AVE @ RICHMOND RD	01 - Clear	05 - Dusk	01 - Traffic signal	03 - P.D. only	05 - Turning movement	01 - Dry
2017-01-28	2017	3:02:00 PM	CHURCHILL AVE @ RICHMOND RD	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	03 - Rear end	02 - Wet

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2015-02-10	2015	4:04:00 PM	CHURCHILL AVE @ WHITBY AVE	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	05 - Turning movement	02 - Wet
2016-06-21	2016	12:10:00 PM	CHURCHILL AVE @ WHITBY AVE	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	02 - Angle	01 - Dry
2017-06-09	2017	4:00:00 PM	CHURCHILL AVE @ WHITBY AVE	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	05 - Turning movement	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2017-04-26	2017	17:20	CHURCHILL AVE @ WILMONT AVE	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	04 - Sideswipe	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2016-02-18	2016	12:00:00 PM	EDEN AVE @ RICHMOND RD	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	04 - Sideswipe	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-01-24	2013	5:45:00 PM	EDGEWOOD AVE @ RICHMOND RD	01 - Clear	07 - Dark	02 - Stop sign	03 - P.D. only	05 - Turning movement	06 - Ice
2014-02-08	2014	1:04:00 PM	EDGEWOOD AVE @ RICHMOND RD	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	02 - Angle	02 - Wet

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2016-10-21	2016	8:43:00 PM	RICHMOND RD @ WINONA AVE	02 - Rain	07 - Dark	02 - Stop sign	03 - P.D. only	99 - Other	02 - Wet
2016-12-13	2016	12:15:00 PM	RICHMOND RD @ WINONA AVE	01 - Clear	01 - Daylight	02 - Stop sign	03 - P.D. only	04 - Sideswipe	01 - Dry
2017-05-24	2017	5:18:00 PM	RICHMOND RD @ WINONA AVE	01 - Clear	01 - Daylight	02 - Stop sign	02 - Non-fatal injury	02 - Angle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-01-10	2013	6:00:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-02-12	2013	7:00:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	02 - Rain	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2013-05-31	2013	5:53:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2013-10-17	2013	12:20:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2014-12-19	2014	9:30:00 AM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	05 - Packed snow
2015-04-12	2015	11:18:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-12-10	2015	11:46:00 AM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-06-22	2016	11:30:00 AM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2016-02-29	2016	12:27:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2016-07-18	2016	3:05:00 PM	RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	02 - Angle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-10-27	2013	4:55:00 PM	RICHMOND RD btwn EDEN AVE & EDGEWOOD AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-12-16	2014	11:40:00 AM	RICHMOND RD btwn EDEN AVE & EDGEWOOD AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2016-06-25	2016	11:20:00 AM	RICHMOND RD btwn EDEN AVE & EDGEWOOD AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-06-10	2013	5:50:00 PM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	02 - Rain	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2014-10-24	2014	7:50:00 PM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	01 - Clear	07 - Dark	10 - No control	02 - Non-fatal injury	04 - Sideswipe	01 - Dry
2014-03-05	2014	12:00:00 PM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	03 - Snow	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	03 - Loose snow
2015-08-18	2015	11:44:00 AM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	01 - Dry
2017-11-27	2017	11:15:00 AM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	02 - Angle	01 - Dry
2017-04-13	2017	10:30:00 AM	RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2015-11-03	2015	4:00:00 PM	RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2015-08-04	2015	1:30:00 PM	RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	01 - Dry
2015-12-31	2015	9:47:00 AM	RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	01 - Approaching	02 - Wet
2016-12-31	2016	4:20:00 PM	RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE	03 - Snow	05 - Dusk	10 - No control	03 - P.D. only	07 - SMV other	03 - Loose snow
2017-03-29	2017	12:00:00 AM	RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE	01 - Clear	00 - Unknown	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-02-07	2013	11:53:00 PM	RICHMOND RD btwn WINONA AVE & EDEN AVE	03 - Snow	07 - Dark	10 - No control	03 - P.D. only	01 - Approaching	03 - Loose snow
2013-04-10	2013	3:00:00 PM	RICHMOND RD btwn WINONA AVE & EDEN AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

2015-04-30	2015	3:46:00 PM	RICHMOND RD btwn WINONA AVE & EDEN AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
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Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-06-26	2013	6:00:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-07-10	2013	7:10:00 AM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2013-07-30	2013	4:37:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	05 - Turning movement	01 - Dry
2013-08-23	2013	7:30:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	02 - Angle	01 - Dry
2013-08-24	2013	1:45:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-08-31	2013	1:57:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2014-07-08	2014	1:15:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	02 - Non-fatal injury	03 - Rear end	01 - Dry
2014-02-06	2014	2:44:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	01 - Dry
2014-03-03	2014	11:00:00 AM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-03-28	2014	5:16:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	02 - Rain	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2014-04-09	2014	4:30:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2014-11-16	2014	1:18:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2014-12-21	2014	4:07:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	05 - Dusk	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-12-12	2014	2:20:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	05 - Turning movement	01 - Dry
2015-04-28	2015	10:10:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2015-01-10	2015	9:30:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	03 - Snow	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	04 - Slush
2015-09-11	2015	12:00:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	03 - Rear end	01 - Dry
2016-12-02	2016	1:00:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	02 - Non-fatal injury	02 - Angle	01 - Dry
2016-08-19	2016	3:45:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	02 - Rain	01 - Daylight	10 - No control	03 - P.D. only	02 - Angle	02 - Wet
2016-02-15	2016	10:35:00 AM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2016-01-28	2016	12:16:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	03 - Snow	01 - Daylight	10 - No control	03 - P.D. only	99 - Other	02 - Wet
2016-02-18	2016	5:12:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	02 - Rain	05 - Dusk	10 - No control	03 - P.D. only	04 - Sideswipe	02 - Wet
2016-02-26	2016	1:30:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	06 - Ice
2016-12-14	2016	7:16:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-11-25	2016	2:45:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	02 - Wet
2017-04-27	2017	8:51:00 AM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	02 - Angle	01 - Dry
2017-08-23	2017	12:30:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2017-08-21	2017	3:23:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2017-10-06	2017	4:39:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	04 - Sideswipe	01 - Dry
2017-10-19	2017	11:35:00 AM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2017-01-04	2017	7:38:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	05 - Turning movement	02 - Wet
2017-02-25	2017	12:35:00 PM	RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N	03 - Snow	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-12-25	2013	12:25:00 PM	ROOSEVELT AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	06 - Ice
2014-02-08	2014	6:48:00 PM	RICHMOND RD btwn ROOSEVELT AVE & ROOSEVELT AVE	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2014-06-29	2014	10:07:00 AM	ROOSEVELT AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	07 - SMV other	01 - Dry
2014-11-27	2014	10:09:00 AM	RICHMOND RD btwn ROOSEVELT AVE & ROOSEVELT AVE	01 - Clear	01 - Daylight	10 - No control	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-11-07	2015	6:34:00 PM	ROOSEVELT AVE @ RICHMOND RD	01 - Clear	07 - Dark	01 - Traffic signal	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2016-04-09	2016	10:57:00 AM	ROOSEVELT AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-03-01	2013	9:33:00 AM	SCOTT ST btwn CHURCHILL AVE N & END	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2013-10-27	2013	3:50:00 AM	SCOTT ST btwn CHURCHILL AVE N & END	01 - Clear	07 - Dark	10 - No control	03 - P.D. only	07 - SMV other	01 - Dry
2013-12-01	2013	2:43:00 AM	SCOTT ST btwn CHURCHILL AVE N & END	03 - Snow	07 - Dark	10 - No control	03 - P.D. only	07 - SMV other	03 - Loose snow

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-11-29	2013	5:28:00 PM	ATHLONE AVE @ RICHMOND RD	01 - Clear	07 - Dark	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2014-08-29	2014	6:22:00 PM	ATHLONE AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Non-fatal injury	03 - Rear end	01 - Dry
2014-12-10	2014	5:57:00 PM	ATHLONE AVE @ RICHMOND RD	03 - Snow	07 - Dark	01 - Traffic signal	03 - P.D. only	03 - Rear end	03 - Loose snow
2015-03-28	2015	11:02:00 AM	ATHLONE AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2015-09-16	2015	3:32:00 PM	ATHLONE AVE @ RICHMOND RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	01 - Dry
2015-11-20	2015	5:57:00 PM	ATHLONE AVE @ RICHMOND RD	01 - Clear	07 - Dark	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-03-14	2013	10:22:00 AM	ATHLONE AVE btwn RICHMOND RD & BYRON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry
2013-06-21	2013	9:00:00 AM	ATHLONE AVE btwn RICHMOND RD & BYRON AVE	01 - Clear	01 - Daylight	10 - No control	03 - P.D. only	06 - SMV unattended vehicle	01 - Dry

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Classification Of Accident	Initial Impact Type	Road Surface Condition
2013-06-11	2013	1:50:00 PM	BYRON AVE @ CHURCHILL AVE	02 - Rain	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	02 - Wet
2014-07-25	2014	3:29:00 PM	BYRON AVE @ CHURCHILL AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	99 - Other	08 - Loose sand or gravel
2014-10-02	2014	10:57:00 AM	BYRON AVE @ CHURCHILL AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2015-01-29	2015	4:00:00 PM	BYRON AVE @ CHURCHILL AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	02 - Angle	06 - Ice
2015-06-09	2015	10:04:00 AM	BYRON AVE @ CHURCHILL AVE	02 - Rain	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	02 - Wet

2016-03-26	2016	12:30:00 PM	BYRON AVE @ CHURCHILL AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	03 - Rear end	01 - Dry
2016-06-11	2016	9:49:00 AM	BYRON AVE @ CHURCHILL AVE	02 - Rain	01 - Daylight	01 - Traffic signal	03 - P.D. only	05 - Turning movement	02 - Wet
2017-09-12	2017	2:43:00 PM	BYRON AVE @ CHURCHILL AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - P.D. only	05 - Turning movement	01 - Dry

LOCATION & GEOID	TOTAL_COLLISIONS	TOTAL_CYCLIST_ COLLISIONS	TOTAL_PEDESTRIAN_ COLLISIONS
BYRON AVE @ CHURCHILL AVE (0006651)	8	1	0
CHURCHILL AVE N btwn DANFORTH AVE & BYRON AVE (_ 3ZA2FA)	1	0	0
CHURCHILL AVE N btwn RICHMOND RD & DANFORTH AVE (_ 3ZBOGA)	8	0	1
CHURCHILL AVE @ MADISON AVE (0006692)	3	0	1
CHURCHILL AVE @ RICHMOND RD (0002361)	33	0	5
CHURCHILL AVE @ SCOTT ST (0005132)	3	0	0
CHURCHILL AVE @ WHITBY AVE (0006688)	3	1	0
CHURCHILL AVE @ WILMONT AVE (0007103)	1	0	0
RICHMOND RD btwn CHURCHILL AVE N & WINONA AVE (_ 3ZA4OX)	10	0	0
RICHMOND RD btwn WINSTON AVE & CHURCHILL AVE N (_ 3ZA4OS)	32	0	0
SCOTT ST btwn CHURCHILL AVE N & END (_ 3ZA1BF)	3	0	0
ATHLONE AVE @ RICHMOND RD (0006293)	6	1	0
EDEN AVE @ RICHMOND RD (0006991)	1	0	0
EDGEWOOD AVE @ RICHMOND RD (0002305)	5	0	0
RICHMOND RD @ WINONA AVE (0006990)	4	1	0
RICHMOND RD btwn EDEN AVE & EDGEWOOD AVE (_ 3ZBN9U)	3	0	0
RICHMOND RD btwn EDGEWOOD AVE & ATHLONE AVE (_ 3ZA4O2)	7	1	0
RICHMOND RD btwn ROOSEVELT AVE & ROOSEVELT AVE (_ 3ZA26W)	2	0	0
RICHMOND RD btwn ROOSEVELT AVE & WINSTON AVE (_ 3ZA26V)	5	0	0
RICHMOND RD btwn WINONA AVE & EDEN AVE (_ 3ZA4OZ)	3	0	0
ROOSEVELT AVE @ RICHMOND RD (0006899)	4	0	1
CHURCHILL AVE N btwn SCOTT ST & WILMONT AVE (_ 3ZBN9T)	1	0	1
CHURCHILL AVE N btwn WILMONT AVE & WHITBY AVE (_ 3ZBODY)	2	0	0
CHURCHILL AVE N btwn WHITBY AVE & MADISON AVE (_ 3ZA4O1)	5	0	0

Appendix D

TDM Checklists

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

Legend	
REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

TDM-supportive design & infrastructure measures: <i>Non-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	☒
BASIC	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☒
BASIC	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☒
1.2 Facilities for walking & cycling		
REQUIRED	1.2.1 Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations (<i>see Official Plan policy 4.3.3</i>)	☒
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>)	☒

TDM-supportive design & infrastructure measures: <i>Non-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>)	☒
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>)	☒
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>)	☒
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☒
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☒
BASIC	1.2.8 Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
1.3 Amenities for walking & cycling		
BASIC	1.3.1 Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☒
BASIC	1.3.2 Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☒

TDM-supportive design & infrastructure measures: <i>Non-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>)	☒
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>)	☒
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>)	☒
BASIC	2.1.4 Provide bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	☐
BETTER	2.1.5 Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	☐
2.2 Secure bicycle parking		
REQUIRED	2.2.1 Where more than 50 bicycle parking spaces are provided for a single office building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers (see <i>Zoning By-law Section 111</i>)	☐
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met)	☐
2.3 Shower & change facilities		
BASIC	2.3.1 Provide shower and change facilities for the use of active commuters	☐
BETTER	2.3.2 In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	☐
2.4 Bicycle repair station		
BETTER	2.4.1 Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☒

TDM-supportive design & infrastructure measures: <i>Non-residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
3. TRANSIT		
3.1 Customer amenities		
BASIC	3.1.1 Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2 Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3 Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐
4. RIDESHARING		
4.1 Pick-up & drop-off facilities		
BASIC	4.1.1 Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
4.2 Carpool parking		
BASIC	4.2.1 Provide signed parking spaces for carpools in a priority location close to a major building entrance, sufficient in number to accommodate the mode share target for carpools	☐
BETTER	4.2.2 At large developments, provide spaces for carpools in a separate, access-controlled parking area to simplify enforcement	☐
5. CARSHARING & BIKESHARING		
5.1 Carshare parking spaces		
BETTER	5.1.1 Provide carshare parking spaces in permitted non-residential zones, occupying either required or provided parking spaces (<i>see Zoning By-law Section 94</i>)	☐
5.2 Bikeshare station location		
BETTER	5.2.1 Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐

TDM-supportive design & infrastructure measures: <i>Non-residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
6. PARKING		
6.1 Number of parking spaces		
REQUIRED	6.1.1 Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☒
BASIC	6.1.2 Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3 Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly (<i>see Zoning By-law Section 104</i>)	☐
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 (<i>see Zoning By-law Section 111</i>)	☐
6.2 Separate long-term & short-term parking areas		
BETTER	6.2.1 Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	☒
7. OTHER		
7.1 On-site amenities to minimize off-site trips		
BETTER	7.1.1 Provide on-site amenities to minimize mid-day or mid-commute errands	☐

TDM-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	☒
BASIC	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☒
BASIC	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☒
1.2 Facilities for walking & cycling		
REQUIRED	1.2.1 Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations (<i>see Official Plan policy 4.3.3</i>)	☒
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>)	☒

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>)	☒
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>)	☒
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>)	☒
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☒
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☒
BASIC	1.2.8 Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
1.3 Amenities for walking & cycling		
BASIC	1.3.1 Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☒
BASIC	1.3.2 Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☒

TDM-supportive design & infrastructure measures: <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>)	☒
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>)	☒
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>)	☒
BASIC	2.1.4 Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	☐
2.2 Secure bicycle parking		
REQUIRED	2.2.1 Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers (see <i>Zoning By-law Section 111</i>)	☐
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☐
2.3 Bicycle repair station		
BETTER	2.3.1 Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☒
3. TRANSIT		
3.1 Customer amenities		
BASIC	3.1.1 Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2 Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3 Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐

TDM-supportive design & infrastructure measures: <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	☐
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>)	☐
5.2 Bikeshare station location		
BETTER	5.2.1 Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐
6. PARKING		
6.1 Number of parking spaces		
REQUIRED	6.1.1 Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☐
BASIC	6.1.2 Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3 Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly (see <i>Zoning By-law Section 104</i>)	☐
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>)	☐
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)	☒

TDM Measures Checklist:

Non-Residential Developments (office, institutional, retail or industrial)

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

TDM measures: <i>Non-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	☒
1.2 Travel surveys		
BETTER	1.2.1 Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
2. WALKING AND CYCLING		
2.1 Information on walking/cycling routes & destinations		
BASIC	2.1.1 Display local area maps with walking/cycling access routes and key destinations at major entrances	☒
2.2 Bicycle skills training		
<i>Commuter travel</i>		
BETTER ★	2.2.1 Offer on-site cycling courses for commuters, or subsidize off-site courses	☐
2.3 Valet bike parking		
<i>Visitor travel</i>		
BETTER	2.3.1 Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games)	☐

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

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

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

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

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

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

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

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	☒
6.2 Personalized trip planning		
BETTER ★	6.2.1 Offer personalized trip planning to new residents	☐

Appendix E

MMLOS Worksheets

Consultant Scenario Comments	CGH Transportation	Project Date	2019-03
	All Horizons- AM & PM		May 20, 2020

SEGMENTS		Segments	Richmond Road	Churchill Avenue	Winona Avenue
			1	2	3
Pedestrian	Sidewalk Width Boulevard Width	-	≥ 2 m < 0.5	≥ 2 m < 0.5	1.5 m < 0.5 m
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000	≤ 3000
	Operating Speed On-Street Parking		> 50 to 60 km/h yes	> 50 to 60 km/h yes	> 30 to 50 km/h yes
	Exposure to Traffic PLoS		D	D	B
	Effective Sidewalk Width				
	Pedestrian Volume				
	Crowding PLoS		-	-	-
	Level of Service		-	-	-
	Bicycle		Type of Cycling Facility	-	Mixed Traffic
Number of Travel Lanes		2-3 lanes total	2-3 lanes total		2-3 lanes total
Operating Speed		≥ 50 to 60 km/h	≥ 50 to 60 km/h		>40 to <50 km/h
# of Lanes & Operating Speed LoS		E	E		D
Bike Lane (+ Parking Lane) Width					
Bike Lane Width LoS		-	-		-
Bike Lane Blockages					
Blockage LoS		-	-		-
Median Refuge Width (no median = < 1.8 m)					
No. of Lanes at Unsignalized Crossing					
Sidestreet Operating Speed					
Unsignalized Crossing - Lowest LoS		-	-		-
Level of Service		-	-		-
Transit		Facility Type	F		Mixed Traffic
	Friction or Ratio Transit:Posted Speed	Vt/Vp ≤ 0.4		Vt/Vp ≤ 0.6	Vt/Vp ≥ 0.8
	Level of Service	F		E	D
Truck	Truck Lane Width	F	≤ 3.0 m	> 3.7 m	
	Travel Lanes per Direction		1	1	
	Level of Service		F	B	-

Multi-Modal Level of Service - Intersections Form

Consultant

Scenario

Comments

CGH Transportation

All Horizons- 2027 FT AM

Project

Date

2019-03

May 20, 2020

INTERSECTIONS		Richmond Rd & Churchill Ave				Roosevelt Ave & Richmond Rd				Richmond Rd & Pedestrian Crossing				Churchill Ave & Byron Ave				
Crossing Side		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Pedestrian	Lanes	3	3	4	3	0 - 2	0 - 2	4	4	0 - 2	0 - 2		3	3	3	0 - 2	0 - 2	
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m		No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	
	Conflicting Left Turns	Protected/ Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive		Permissive	Permissive	Permissive	Permissive	Permissive	
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control		Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	
	Right Turns on Red (RTorR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed		RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	
	Ped Signal Leading Interval?	Yes	No	Yes	Yes	No	No	No	No	No	No		Yes	No	No	No	No	
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel		No Channel	No Channel	No Channel	No Channel	No Channel	
	Corner Radius	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m		5-10m	10-15m	5-10m	10-15m	10-15m	
	Crosswalk Type	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings		Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	
	PETSI Score	76	74	59	76	86	86	54	54	86	86		73	70	71	85	85	
	Ped. Exposure to Traffic LoS	B	C	D	B	B	B	D	D	B	B	-	C	C	C	B	B	
	Cycle Length																	
	Effective Walk Time																	
Average Pedestrian Delay																		
Pedestrian Delay LoS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Level of Service	B	C	D	B	B	B	D	D	B	B	-	C	C	C	B	B		
	D				D				C				C					
Approach From		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	
	Right Turn Lane Configuration	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m		
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h		
	Cyclist relative to RT motorists	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	Not Applicable	
	Separated or Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Separated	
	Left Turn Approach	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	
	Operating Speed	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	
	Left Turning Cyclist	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
Level of Service	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	B	
	F				F				F				F					
Transit	Average Signal Delay	≤ 30 sec	≤ 30 sec	≤ 30 sec	≤ 20 sec	≤ 30 sec	≤ 30 sec	≤ 10 sec	≤ 20 sec	≤ 10 sec				≤ 20 sec	≤ 10 sec	≤ 10 sec	≤ 30 sec	≤ 40 sec
	Level of Service	D	D	D	C	D	D	B	C	-	-	B	C	B	B	D	E	
		D				D				C				E				
Truck	Effective Corner Radius	10 - 15 m	< 10 m	< 10 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m		10 - 15 m	10 - 15 m		10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1		1	1		1	1	1	1	1	
	Level of Service	E	F	F	E	E	E	E	-	E	E	-	E	E	E	E	E	
		F				E				E				E				
Auto	Volume to Capacity Ratio	0.61 - 0.70				0.0 - 0.60				0.0 - 0.60				0.61 - 0.70				
	Level of Service	B				A				A				B				

Multi-Modal Level of Service - Intersections Form

Consultant

Scenario

Comments

CGH Transportation

All Horizons- 2027 FT PM

Project

Date

2019-03

May 20, 2020

INTERSECTIONS		Richmond Rd & Churchill Ave				Roosevelt Ave & Richmond Rd				Richmond Rd & Pedestrian Crossing				Churchill Ave & Byron Ave				
Crossing Side		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Pedestrian	Lanes	3	3	4	3	0 - 2	0 - 2	4	4	0 - 2	0 - 2		3	3	3	0 - 2	0 - 2	
	Median	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m		No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	
	Conflicting Left Turns	Protected/ Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive	Permissive		Permissive	Permissive	Permissive	Permissive	Permissive	
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control		Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	
	Right Turns on Red (RTor) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed		RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	
	Ped Signal Leading Interval?	Yes	No	Yes	Yes	No	No	No	No	No	No		Yes	No	No	No	No	
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel		No Channel	No Channel	No Channel	No Channel	No Channel	
	Corner Radius	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m	5-10m		5-10m	10-15m	5-10m	10-15m	10-15m	
	Crosswalk Type	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings		Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	
	PETSI Score	76	74	59	76	86	86	54	54	86	86		73	70	71	85	85	
	Ped. Exposure to Traffic LoS	B	C	D	B	B	B	D	D	B	B	-	C	C	C	B	B	
	Cycle Length																	
	Effective Walk Time																	
Average Pedestrian Delay																		
Pedestrian Delay LoS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Level of Service	B	C	D	B	B	B	D	D	B	B	-	C	C	C	B	B		
	D				D				C				C					
Approach From		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	
	Right Turn Lane Configuration	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m	> 50 m		
	Right Turning Speed	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h		
	Cyclist relative to RT motorists	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	Not Applicable	
	Separated or Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Separated	
	Left Turn Approach	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	No lane crossed	
	Operating Speed	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	> 40 to ≤ 50 km/h	
	Left Turning Cyclist	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
Level of Service	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	B	
	F				F				F				F					
Transit	Average Signal Delay	≤ 30 sec	≤ 30 sec	≤ 40 sec	≤ 20 sec	≤ 30 sec	≤ 40 sec	≤ 20 sec	≤ 10 sec	≤ 20 sec				≤ 20 sec	≤ 10 sec	≤ 20 sec	≤ 40 sec	≤ 30 sec
	Level of Service	D	D	E	C	D	E	C	B	-	-	C	C	B	C	E	D	
		E				E				C				E				
Truck	Effective Corner Radius	10 - 15 m	< 10 m	< 10 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m		10 - 15 m	10 - 15 m		10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	
	Number of Receiving Lanes on Departure from Intersection	1	1	1	1	1	1	1		1	1		1	1	1	1	1	
	Level of Service	E	F	F	E	E	E	E	-	E	E	-	E	E	E	E	E	
		F				E				E				E				
Auto	Volume to Capacity Ratio	0.71 - 0.80				0.71 - 0.80				0.61 - 0.70				0.71 - 0.80				
	Level of Service	C				C				B				C				

Appendix F

Signalization Warrants

Site Access #1 & Churchill Avenue
2027 FT

Justification #7

Justification	Description	Minimum Requirement		Minimum Requirement		Compliance		Signal	
		1 Lane Highway		2 or More Lanes		Sectional			
		Free Flow	Restr. Flow	Free Flow	Restr. Flow	Numerical	%		
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	480	720	600	900	589	82%	6%	No
	B. Vehicle volume, along minor streets (average hour)	120	170	120	170	11	6%		
2. Delay to Cross Traffic	A. Vehicle volumes, major street (average hour)	480	720	600	900	581	81%	6%	No
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	50	75	50	75	5	6%		

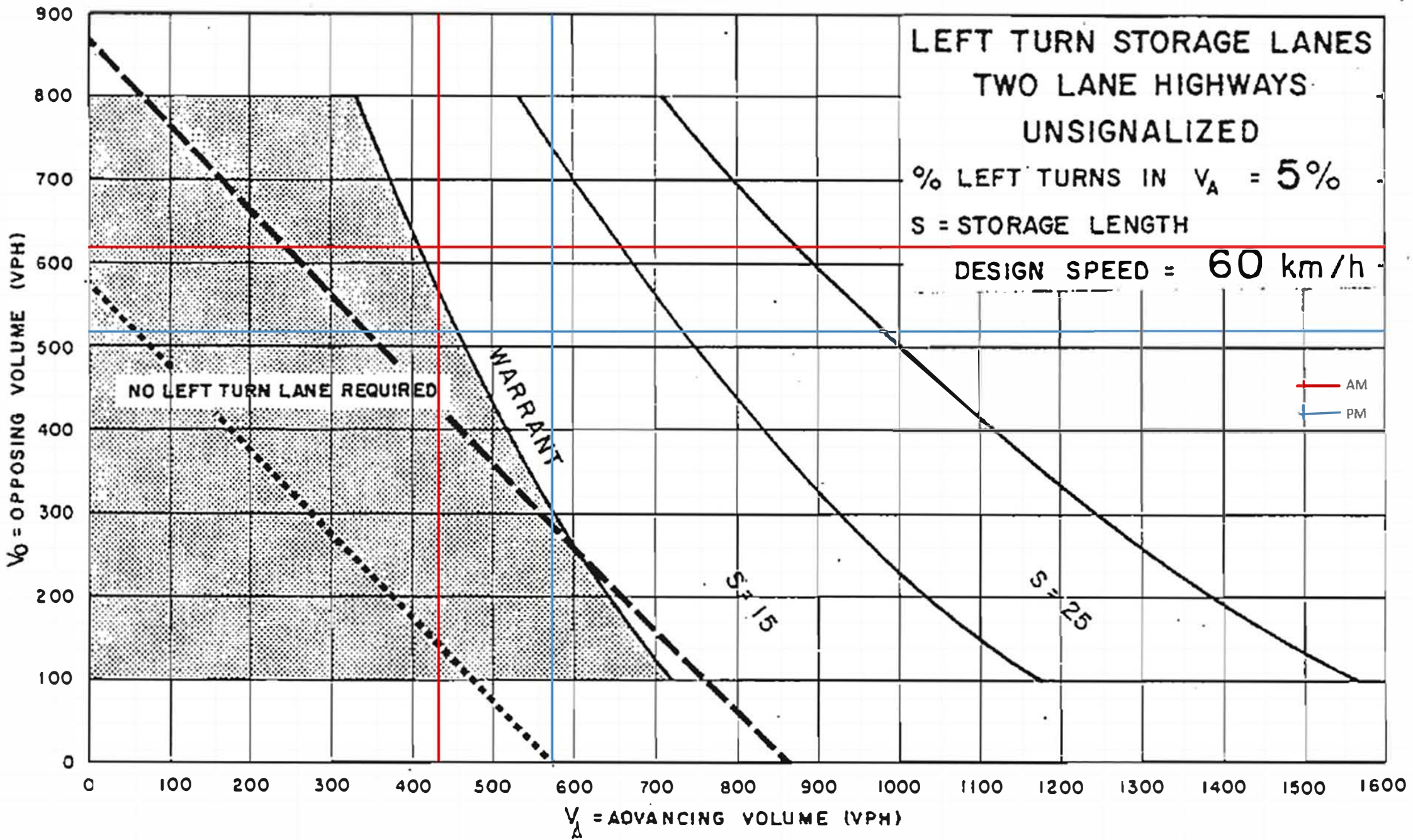
Notes

1. Refer to OTM Book 12, pg 88, Nov 2007
2. Lowest section percentage governs justification
3. Average hourly volumes estimated from peak hour volumes, $AHV = PM/2$ or $(AM + PM) / 4$
4. T-intersection factor corrected, applies only to 1B

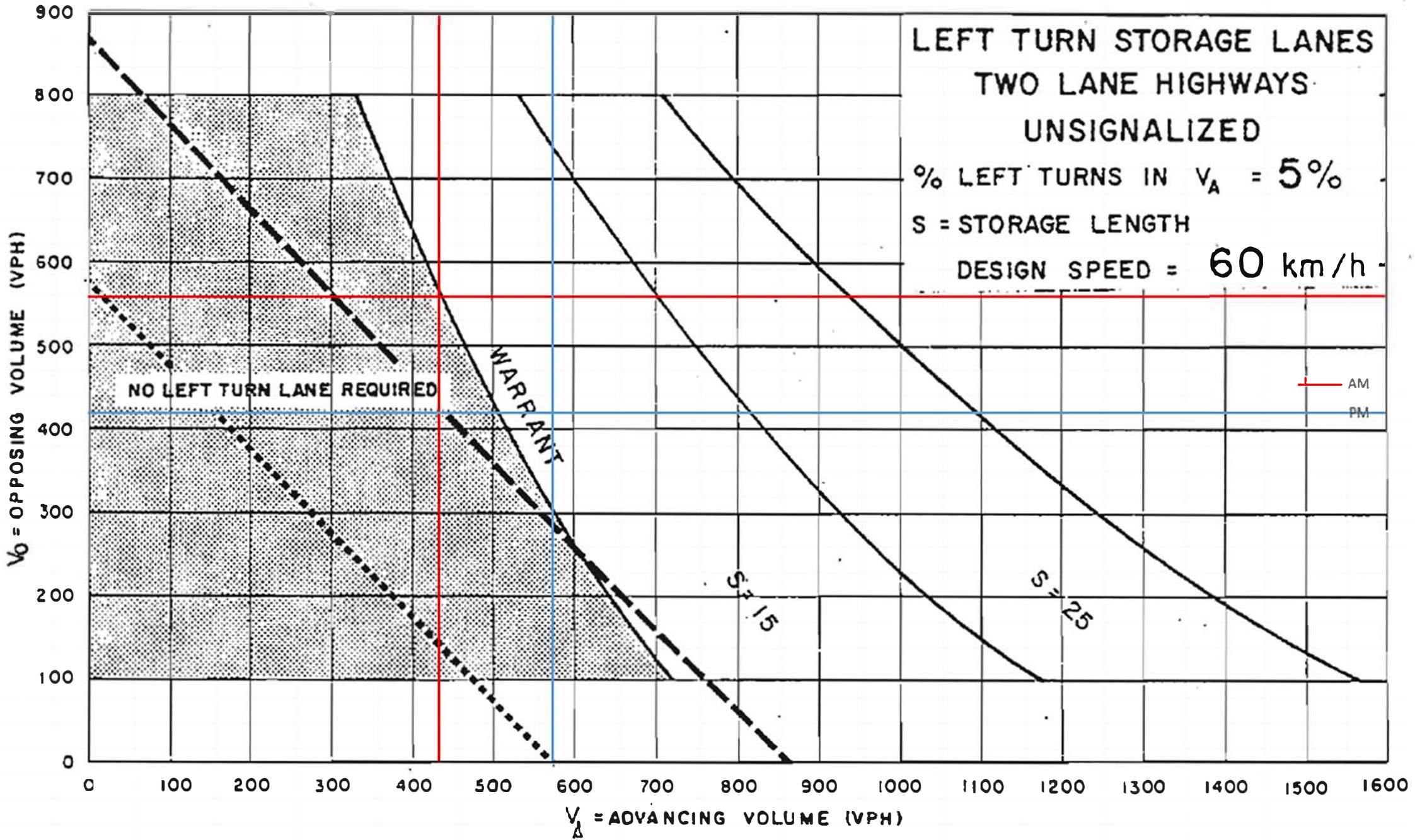
Appendix G

Left-turn Lane Warrants

Design Speed	Southbound Left										Yes						
60 km/h		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing	
2022 FT	AM	0	0	0	10	0	5	0	617	4	2	430	0	0.5%	432	621	
	PM	0	0	0	9	0	5	0	507	12	7	564	0	1.2%	571	519	



Design Speed	Southbound Left												Yes					
60 km/h	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	%Left Turn	Volume Advancing	Volume Opposing			
2027 FT	AM	0	0	0	10	0	5	0	555	4	2	430	0	0.5%	432	559		
	PM	0	0	0	9	0	5	0	408	12	7	564	0	1.2%	571	420		



Appendix H

HV% Calculations

[4] Scott Street at Churchill Avenue												
AM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	0	6	12	2	5	0	0	1	1	8	1	3
Total Volume	8	106	396	49	207	1		7	13	184	9	20
HV%	0%	6%	3%	4%	2%	0%	#DIV/0!	14%	8%	4%	11%	15%
PM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	0	4	5	4	5	0	0	0	0	7	0	4
Total Volume	11	113	199	39	133	1		5	12	332	5	33
HV%	0%	4%	3%	10%	4%	0%	#DIV/0!	0%	0%	2%	0%	12%

[5] Byron Avenue at Churchill Avenue												
AM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	2	18	0	0	14	1	0	0	0	0	0	0
Total Volume	29	331	42	37	287	24	36	171	46	35	125	56
HV%	7%	5%	0%	0%	5%	4%	0%	0%	0%	0%	0%	0%
PM												
	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
HV Volume	1	3	1	0	11	0	0	0	0	0	1	0
Total Volume	33	298	94	28	321	69	45	137	61	86	325	68
HV%	3%	1%	1%	0%	3%	0%	0%	0%	0%	0%	0%	0%

Appendix I

City of Ottawa Step 2 Comments - Email

Robin Marinac

From: Mark Crockford
Sent: April 16, 2020 9:47 AM
To: Robin Marinac
Subject: FW: 319-327 Richmond Road & 381 Churchill Ave - Scoping response



Mark Crockford, P.Eng.
CGH Transportation Inc.
P:905-251-4070
E:Mark.Crockford@CGHTransportation.com

From: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Sent: July 29, 2019 12:00 PM
To: Mark Crockford <mark.crockford@cghtransportation.com>
Cc: Baldwin, Kimberley <Kimberley.Baldwin@ottawa.ca>
Subject: 319-327 Richmond Road & 381 Churchill Ave - Scoping response

Mark,

Please address the following comments;

319-327 Richmond Road & 381 Churchill Ave TIA Scoping Report, Sent July 23, 20198

Transportation Engineering Services

435 Churchill Avenue should be included in section 2.3.2

If section 4.2.2 is to be exempt, please provide a split of how many parking spaces will be accessible to and/or reserved for the tenants and for the retail portions, respectively.

Traffic Signal Operations

Full movement access 65 m North of Churchill. Potential safety concerns with left out/left into site.

Richmond/Churchill, existing queues extends past proposed site access in the PM and PM peak periods. Safety concerns with full turning movements.

No southbound upstream signals for Richmond/Churchill.

Richmond & Churchill - north south approaches are shared left/through and shared right/through.

Athlone & Richmond is called an Intersection Pedestrian Signal.

Byron & Churchill - new eastbound and westbound bike facilities.

General

Both Churchill Avenue and Richmond Road are designated as an Arterial roads.

A 5.0 metres x 5.0 metres sight triangle would be required at the intersection of Richmond Road & Churchill Avenue and Richmond Road & Winona Avenue and are to be shown on all drawings. The sight triangle dimensions are to be measured from the protected ROW limits.

Please proceed with the TIA Step 3 – Forecasting report.

Thank you,

Wally Dubyk
Project Manager - Transportation Approvals
Development Review, Central & South Branches
613-580-2424 x13783

From: Mark Crockford <mark.crockford@cghtransportation.com>
Sent: July 23, 2019 8:15 AM
To: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Cc: Robin Marinac <robin.marinac@cghtransportation.com>
Subject: RE: 319-327 Richmond Road & 381 Churchill Ave

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Hi Wally,

Attached are the requested Synchro files for existing conditions.

Thanks,
Mark

Please note that I will be out of the office from Friday July 26 to Tuesday August 6 2019.



Mark Crockford, P.Eng.
CGH Transportation Inc.
P:905-251-4070
E:Mark.Crockford@CGHTransportation.com

Appendix J

City of Ottawa Step 3 Signal Comments - Email

Robin Marinac

From: Mark Crockford
Sent: May 20, 2020 1:24 PM
To: Robin Marinac
Subject: FW: 319-327 Richmond Rd - TIA Forecasting response



Mark Crockford, P.Eng.
CGH Transportation Inc.
P:905-251-4070
E:Mark.Crockford@CGHTransportation.com

From: Ha, Leng <Leng.Ha@ottawa.ca>
Sent: May 20, 2020 1:23 PM
To: Mark Crockford <mark.crockford@cghtransportation.com>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

Hi Mark,

My comments below.

Regards,

Leng

From: Mark Crockford <mark.crockford@cghtransportation.com>
Sent: May 14, 2020 11:45 AM
To: Ha, Leng <Leng.Ha@ottawa.ca>
Cc: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

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Thanks Wally,

Leng, I hope you can give us a hand, we are just trying to get our Synchro right so we can avoid future comments on this. Are you able to provide us with Synchro files for the following intersections so that we can match the intersection configuration, timing, phasing, etc? We will put our own volumes in.

Any help you can offer would be greatly appreciated.

Thanks,
Mark



Mark Crockford, P.Eng.
CGH Transportation Inc.
P:905-251-4070
E:Mark.Crockford@CGHTransportation.com

From: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Sent: May 14, 2020 11:43 AM
To: Mark Crockford <mark.crockford@cghtransportation.com>
Cc: Ha, Leng <Leng.Ha@ottawa.ca>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

Mark,

Please contact Leng - Ha, Leng <Leng.Ha@ottawa.ca> for further information.

Wally Dubyk
Transportation Project Manager - Transportation Approvals
Development Review, Central & South Branches
613-580-2424 x13783

From: Mark Crockford <mark.crockford@cghtransportation.com>
Sent: May 14, 2020 11:35 AM
To: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Cc: McCreight, Andrew <Andrew.McCreight@ottawa.ca>; Robin Marinac <robin.marinac@cghtransportation.com>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

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Thanks for the quick reply earlier as we have dug into these further we have a few other questions. Is it possible to have the signals group provide us with sample Synchro showing how these would be coded so that we can make sure we get this right on our next try? I don't mind connecting directly with them if you can let me know who would have provided the comments? We are hoping to get some more information on the following intersections:

Richmond at Churchill

- North-south is modeled correctly with the advance walk phase. For east-west movement, please model it with an actuated eastbound left turn phase if actuated, then on with the eastbound through phase. If not, actuated, then it's the standard eastbound/westbound through. We can accept that the advance walk for east-west pedestrian not be modeled since we provide an advance green straight through arrow.

Roosevelt at Richmond

- No changes required

Richmond at Athlone

- This should be modelled like Scott/Tweedsmuir (which was done for your submission for 320 McRae)

Thanks,
Mark



Mark Crockford, P.Eng.
CGH Transportation Inc.
P:905-251-4070
E:Mark.Crockford@CGHTransportation.com

From: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Sent: May 14, 2020 10:34 AM
To: Mark Crockford <mark.crockford@cghtransportation.com>
Cc: McCreight, Andrew <Andrew.McCreight@ottawa.ca>; Robin Marinac <robin.marinac@cghtransportation.com>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

Mark,

Please find attached Traffic Growth maps.

The comment about not achieving the 85% modal share can be a written explanation and the assumption is that the mode share just applies to the development although typically background traffic can also be expected to shift to some degree as well. When reviewing Demand Rationalization, this issue of impact is discussed if area intersections become over capacity. TDM strategies are often needed as part of the development plan to support the development in achieving the target modal shares.

Wally Dubyk
Transportation Project Manager - Transportation Approvals
Development Review, Central & South Branches
613-580-2424 x13783

From: Mark Crockford <mark.crockford@cghtransportation.com>
Sent: May 14, 2020 7:31 AM
To: Dubyk, Wally <Wally.Dubyk@ottawa.ca>
Cc: McCreight, Andrew <Andrew.McCreight@ottawa.ca>; Robin Marinac <robin.marinac@cghtransportation.com>
Subject: RE: 319-327 Richmond Rd - TIA Forecasting response

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Thanks for getting back to us with your comments.

Most of these seem straight forward, I just have a couple of quick questions.

With respect to the background growth, no problem implementing 0%, just for future reference, are there specific areas which we should apply this to? I would assume any TOD area would be logical, but would this apply to the whole urban core? In the absence of historical data do you have preferred rates for different roadways, areas, etc?

For the following comment:

Please explain impacts on the road network if TDM targets of 85% non-auto mode are not met in the future.

Is a written explanation of the anticipated impacts of not meeting the 85% non-auto mode share sufficient or is additional analysis being requested with a modified mode share? Assuming it is just a written explanation, I am assuming we are just examining the impact of the subject development not meeting the 85% non-auto mode share, not the entire area.

Thanks again and with those clarifications we will proceed with the Step 4 and integrate the comments into the report.

Mark



Mark Crockford, P.Eng.

CGH Transportation Inc.

P:905-251-4070

E:Mark.Crockford@CGHTransportation.com

From: Dubyk, Wally <Wally.Dubyk@ottawa.ca>

Sent: May 14, 2020 6:59 AM

To: Mark Crockford <mark.crockford@cghtransportation.com>

Cc: McCreight, Andrew <Andrew.McCreight@ottawa.ca>

Subject: 319-327 Richmond Rd - TIA Forecasting response

319-327 Richmond Road

TIA Forecasting Report, Received April 27, 2020

General

There are no additional ROW limits for Richmond Rd and Churchill Ave identified in the Official Plan.

Both Churchill Avenue and Richmond Road are arterial roadways and their intersection is signalized, a 5 m x 5 m sight triangle would be required.

A 5.0 metres x 5.0 metres sight triangle would be required at the intersection of Richmond Road and Winona Avenue and is to be shown on all drawings.

Road, sewer & water work along Winona Avenue is targeted 3 to 5 years.

Transportation Engineering

While relatively inconsequential, the shopping centre's generated trips are incorrect in Table 12 (22 AM, 91 PM).

Clarify Table 15. It is unclear how the internal capture rates have been applied to the person-trips generated by the development. Adjust associated trip generation figures, if necessary.

The background growth rate of 2% for the study area is not supported. This area is already experiencing a zero percent vehicle growth rate. Note that a 2% background growth of person-trips is possible with future development in the area but given the mode share shifts this is not translating to an equivalent vehicle growth rate.

Reconcile the demand rationalization module. The report does not illustrate that there are any existing failing intersections. If there is an expectation that future vehicular traffic would result in intersection failure without a shift to TOD mode shares this must be clearly expressed in the report. The vehicular demand (background traffic and site generated) expected to be rationalized by a shift to transit following revenue service of the Confederation Line Extension must be analyzed and supported by TDM measures. The transit mode share for a TOD area may be more difficult to achieve as the development moves further from the transit station.

Traffic Signal Operations

Richmond and Churchill:

This intersection can be properly modelled in Synchro.

Currently the intersection has not been modelled correctly. There is a traffic loop for the eastbound left turn movement and the advance walk for east/west is missing. The signal operates with pedestrian recalls for all directions with actuated eastbound left turn phase. Vehicle clearance times are not correct.

Richmond and Athlone:

Walk time should not be included for the east/west movements. No east-west pedestrian displays are provided.

This is an actuated pedestrian signal and should be modeled as a pedestrian signal.

Roosevelt and Richmond:

Operates with pedestrian recalls on main street.

Please explain impacts on the road network if TDM targets of 85% non-auto mode are not met in the future.

Ensure that changes are made to the document prior to submitting the Strategy report and that any unexpected results from revisions are discussed with staff before proceeding to the next step.

Thank you,

Wally Dubyk
Transportation Project Manager - Transportation Approvals
Development Review, Central & South Branches
613-580-2424 x13783

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,

Appendix K

2019 Existing Conditions Synchro Worksheets

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
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)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.99		0.96	0.99			0.98			0.97	
Frt		0.987			0.985			0.964			0.952	
Flt Protected	0.950			0.950				0.997			0.998	
Satd. Flow (prot)	1478	1384	0	1396	1339	0	0	2743	0	0	2647	0
Flt Permitted	0.475			0.495				0.895			0.920	
Satd. Flow (perm)	703	1384	0	700	1339	0	0	2457	0	0	2437	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			7			53			102	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
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%	2%	2%	9%	5%	5%	8%	5%	2%	13%	6%	4%
Parking (#/hr)		0			0							
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	477	0	0	477	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	30.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	36.1		31.1	31.1		24.2	24.2		24.2	24.2	
Total Split (s)	14.0	40.0		31.0	31.0		30.0	30.0		30.0	30.0	
Total Split (%)	17.5%	50.0%		38.8%	38.8%		37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	7.9	33.9		24.9	24.9		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	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	47.4	47.4		27.8	27.8			20.3			20.3	
Actuated g/C Ratio	0.59	0.59		0.35	0.35			0.25			0.25	
v/c Ratio	0.60	0.57		0.24	0.49			0.72			0.69	
Control Delay	14.9	14.0		23.6	25.4			24.4			26.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	14.9	14.0		23.6	25.4			24.4			26.2	
LOS	B	B		C	C			C			C	
Approach Delay		14.4			25.0			24.4			26.2	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	22.7	37.4		6.5	27.3			26.5			27.5	
Queue Length 95th (m)	46.2	76.5		16.5	49.9			26.1			39.4	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	546	822		243	470			775			802	
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	0.60	0.57		0.24	0.49			0.62			0.59	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 43 (54%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.72

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings 1: Churchill Ave N & Richmond Rd

2019 Existing - AM
Richmond / Churchill

Intersection Signal Delay: 21.0

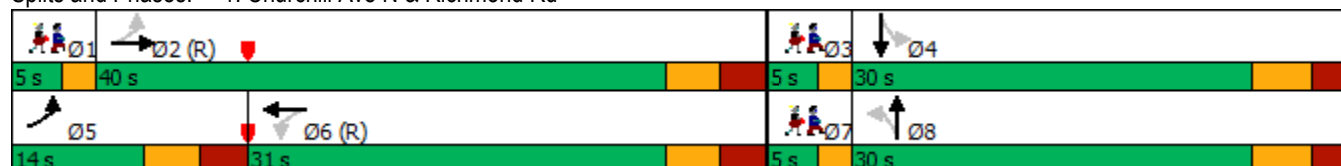
Intersection LOS: C

Intersection Capacity Utilization 91.4%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	563	21	28	338	37	25	10	45	55	16	17
Future Volume (vph)	8	563	21	28	338	37	25	10	45	55	16	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		1.00			0.99			0.92			0.94	
Frt		0.995			0.988			0.924			0.974	
Flt Protected		0.999			0.997			0.985			0.970	
Satd. Flow (prot)	0	1374	0	0	1351	0	0	1252	0	0	1453	0
Flt Permitted		0.994			0.940			0.888			0.821	
Satd. Flow (perm)	0	1366	0	0	1271	0	0	1101	0	0	1178	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			12			50			17	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	80		65	65		80	48		42	42		48
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 (%)	2%	4%	2%	4%	4%	3%	12%	2%	11%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	9	626	23	31	376	41	28	11	50	61	18	19
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	658	0	0	448	0	0	89	0	0	98	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		34.4	34.4		24.6	24.6		24.6	24.6	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.6	39.6		39.6	39.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		51.4			51.4			11.8			11.8	
Actuated g/C Ratio		0.73			0.73			0.17			0.17	
v/c Ratio		0.66			0.48			0.39			0.46	
Control Delay		11.9			7.9			18.4			28.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		11.9			7.9			18.4			28.8	
LOS		B			A			B			C	
Approach Delay		11.9			7.9			18.4			28.8	
Approach LOS		B			A			B			C	
Queue Length 50th (m)		41.0			21.7			4.6			9.9	
Queue Length 95th (m)		#114.1			53.8			15.0			21.2	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1003			936			341			338	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.66			0.48			0.26			0.29	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 27 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 70												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.66												
Intersection Signal Delay: 12.3							Intersection LOS: B					
Intersection Capacity Utilization 68.0%							ICU Level of Service C					
Analysis Period (min) 15												

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	563	21	28	338	37	25	10	45	55	16	17
Future Volume (veh/h)	8	563	21	28	338	37	25	10	45	55	16	17
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.94	0.99		0.94	0.91		0.89	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1559	1620	1620	1559	1620	1620	1470	1620	1620	1588	1620
Adj Flow Rate, veh/h	9	626	23	31	376	41	28	11	50	61	18	19
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	56	921	34	86	795	83	125	54	143	240	67	54
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	6	1480	54	50	1278	134	258	247	648	712	305	245
Grp Volume(v), veh/h	658	0	0	448	0	0	89	0	0	98	0	0
Grp Sat Flow(s),veh/h/ln	1540	0	0	1461	0	0	1154	0	0	1262	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	19.6	0.0	0.0	11.0	0.0	0.0	4.2	0.0	0.0	3.9	0.0	0.0
Prop In Lane	0.01		0.03	0.07		0.09	0.31		0.56	0.62		0.19
Lane Grp Cap(c), veh/h	1011	0	0	964	0	0	322	0	0	362	0	0
V/C Ratio(X)	0.65	0.00	0.00	0.46	0.00	0.00	0.28	0.00	0.00	0.27	0.00	0.00
Avail Cap(c_a), veh/h	1011	0	0	964	0	0	385	0	0	429	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.86	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.7	0.0	0.0	7.1	0.0	0.0	22.9	0.0	0.0	22.8	0.0	0.0
Incr Delay (d2), s/veh	3.3	0.0	0.0	1.4	0.0	0.0	0.5	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	9.1	0.0	0.0	5.0	0.0	0.0	1.5	0.0	0.0	1.6	0.0	0.0
LnGrp Delay(d),s/veh	11.9	0.0	0.0	8.5	0.0	0.0	23.4	0.0	0.0	23.2	0.0	0.0
LnGrp LOS	B			A			C			C		
Approach Vol, veh/h		658			448			89			98	
Approach Delay, s/veh		11.9			8.5			23.4			23.2	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		49.0		21.0		49.0		21.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		19.4		* 40		19.4				
Max Q Clear Time (g_c+I1), s		21.6		5.9		13.0		6.2				
Green Ext Time (p_c), s		5.2		0.4		3.8		0.4				
Intersection Summary												
HCM 2010 Ctrl Delay				12.4								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	446	7	5	286	20	2	16	15	10	9	11
Future Volume (vph)	20	446	7	5	286	20	2	16	15	10	9	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.998			0.991			0.938			0.951	
Flt Protected		0.998			0.999			0.997			0.984	
Satd. Flow (prot)	0	1408	0	0	1387	0	0	1469	0	0	1470	0
Flt Permitted		0.998			0.999			0.997			0.984	
Satd. Flow (perm)	0	1408	0	0	1387	0	0	1469	0	0	1470	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
Confl. Peds. (#/hr)	39		44	44		39						
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 (%)	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	22	496	8	6	318	22	2	18	17	11	10	12
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	526	0	0	346	0	0	37	0	0	33	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	53.8%				ICU Level of Service A							
Analysis Period (min)	15											

Intersection												
Int Delay, s/veh	1.6											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	446	7	5	286	20	2	16	15	10	9	11
Future Vol, veh/h	20	446	7	5	286	20	2	16	15	10	9	11
Conflicting Peds, #/hr	39	0	44	44	0	39	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	3	2	2	2	2	2	2	2
Mvmt Flow	22	496	8	6	318	22	2	18	17	11	10	12
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	379	0	0	548	0	0	940	979	544	942	972	368
Stage 1	-	-	-	-	-	-	588	588	-	380	380	-
Stage 2	-	-	-	-	-	-	352	391	-	562	592	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1179	-	-	1021	-	-	244	250	539	243	252	677
Stage 1	-	-	-	-	-	-	495	496	-	642	614	-
Stage 2	-	-	-	-	-	-	665	607	-	512	494	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1143	-	-	986	-	-	218	226	521	209	228	657
Mov Cap-2 Maneuver	-	-	-	-	-	-	218	226	-	209	228	-
Stage 1	-	-	-	-	-	-	465	466	-	606	591	-
Stage 2	-	-	-	-	-	-	636	584	-	464	464	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.1			18.5			19.1		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	303	1143	-	-	986	-	-	288				
HCM Lane V/C Ratio	0.121	0.019	-	-	0.006	-	-	0.116				
HCM Control Delay (s)	18.5	8.2	0	-	8.7	0	-	19.1				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.4				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	7	13	184	9	20	8	118	441	49	207	1
Future Volume (vph)	0	7	13	184	9	20	8	118	441	49	207	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.914			0.987			0.895				
Flt Protected					0.959			0.999			0.991	
Satd. Flow (prot)	0	1329	0	0	1440	0	0	1244	0	0	1551	0
Flt Permitted					0.959			0.999			0.991	
Satd. Flow (perm)	0	1329	0	0	1440	0	0	1244	0	0	1551	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			316.0			99.4	
Travel Time (s)		5.3			8.0			22.8			7.2	
Confl. Peds. (#/hr)	41		7	7		41	38		10	10		38
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 (%)	2%	14%	8%	4%	11%	15%	2%	6%	3%	4%	2%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	8	14	204	10	22	9	131	490	54	230	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	22	0	0	236	0	0	630	0	0	285	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	77.0%											
Analysis Period (min)	15											
	ICU Level of Service D											

Intersection	
Intersection Delay, s/veh	20.9
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	7	13	184	9	20	8	118	441	49	207	1
Future Vol, veh/h	0	7	13	184	9	20	8	118	441	49	207	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, %	2	14	8	4	11	15	2	6	3	4	2	2
Mvmt Flow	0	8	14	204	10	22	9	131	490	54	230	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10	14	27.3	13.5
HCM LOS	A	B	D	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	0%	86%	19%
Vol Thru, %	21%	35%	4%	81%
Vol Right, %	78%	65%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	567	20	213	257
LT Vol	8	0	184	49
Through Vol	118	7	9	207
RT Vol	441	13	20	1
Lane Flow Rate	630	22	237	286
Geometry Grp	1	1	1	1
Degree of Util (X)	0.836	0.041	0.418	0.453
Departure Headway (Hd)	4.779	6.649	6.365	5.711
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	756	534	563	628
Service Time	2.828	4.744	4.426	3.771
HCM Lane V/C Ratio	0.833	0.041	0.421	0.455
HCM Control Delay	27.3	10	14	13.5
HCM Lane LOS	D	A	B	B
HCM 95th-tile Q	9.5	0.1	2.1	2.4

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2019 Existing - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	171	46	35	125	56	29	331	42	37	287	24
Future Volume (vph)	36	171	46	35	125	56	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.98	0.99		0.98	1.00	
Frt		0.975			0.965			0.983			0.988	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1512	0	0	1494	0	1422	1496	0	1492	1501	0
Flt Permitted		0.920			0.888		0.529			0.476		
Satd. Flow (perm)	0	1399	0	0	1335	0	773	1496	0	736	1501	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			26			11			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
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 (%)	2%	2%	2%	2%	2%	2%	7%	5%	2%	2%	5%	4%
Adj. Flow (vph)	40	190	51	39	139	62	32	368	47	41	319	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	281	0	0	240	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2019 Existing - AM
Richmond / Churchill

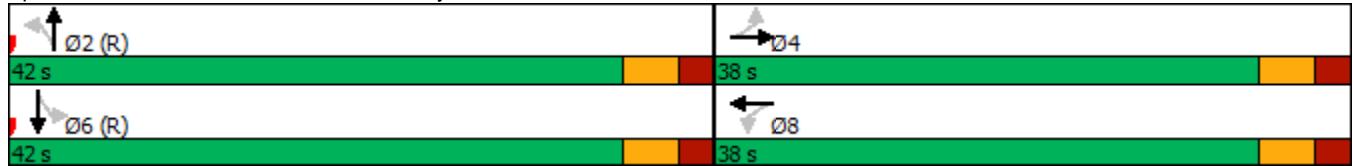
												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		20.6			20.6		48.4	48.4		48.4	48.4	
Actuated g/C Ratio		0.26			0.26		0.60	0.60		0.60	0.60	
v/c Ratio		0.76			0.66		0.07	0.46		0.09	0.38	
Control Delay		37.9			31.6		9.2	11.9		4.8	5.4	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		37.9			31.6		9.2	11.9		4.8	5.4	
LOS		D			C		A	B		A	A	
Approach Delay		37.9			31.6			11.7			5.3	
Approach LOS		D			C			B			A	
Queue Length 50th (m)		36.9			28.9		1.8	30.2		1.6	14.3	
Queue Length 95th (m)		54.6			45.0		6.8	65.2		m3.4	23.7	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		576			556		467	909		445	910	
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		0.49			0.43		0.07	0.46		0.09	0.38	
Intersection Summary												
Area Type:	CBD											
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: 18.8	Intersection LOS: B											

Lanes, Volumes, Timings
 5: Churchill Ave N & Byron Ave

2019 Existing - AM
 Richmond / Churchill

Intersection Capacity Utilization 62.4% ICU Level of Service B
 Analysis Period (min) 15
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2019 Existing - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	171	46	35	125	56	29	331	42	37	287	24
Future Volume (veh/h)	36	171	46	35	125	56	29	331	42	37	287	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.98	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1514	1548	1620	1588	1544	1620
Adj Flow Rate, veh/h	40	190	51	39	139	62	32	368	47	41	319	27
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	7	5	5	2	5	5
Cap, veh/h	85	265	66	88	225	91	630	829	106	500	866	73
Arrive On Green	0.25	0.25	0.25	0.25	0.25	0.25	0.62	0.62	0.62	1.00	1.00	1.00
Sat Flow, veh/h	136	1080	270	147	919	371	875	1343	171	868	1402	119
Grp Volume(v), veh/h	281	0	0	240	0	0	32	0	415	41	0	346
Grp Sat Flow(s),veh/h/ln	1485	0	0	1437	0	0	875	0	1514	868	0	1521
Q Serve(g_s), s	2.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	11.6	1.0	0.0	0.0
Cycle Q Clear(g_c), s	13.8	0.0	0.0	11.8	0.0	0.0	1.2	0.0	11.6	12.5	0.0	0.0
Prop In Lane	0.14		0.18	0.16		0.26	1.00		0.11	1.00		0.08
Lane Grp Cap(c), veh/h	416	0	0	405	0	0	630	0	935	500	0	939
V/C Ratio(X)	0.68	0.00	0.00	0.59	0.00	0.00	0.05	0.00	0.44	0.08	0.00	0.37
Avail Cap(c_a), veh/h	644	0	0	626	0	0	630	0	935	500	0	939
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.73	0.00	0.73
Uniform Delay (d), s/veh	27.9	0.0	0.0	27.2	0.0	0.0	6.1	0.0	8.1	1.5	0.0	0.0
Incr Delay (d2), s/veh	1.9	0.0	0.0	1.4	0.0	0.0	0.2	0.0	1.5	0.2	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	0.0	0.0	5.0	0.0	0.0	0.3	0.0	5.1	0.3	0.0	0.2
LnGrp Delay(d),s/veh	29.9	0.0	0.0	28.5	0.0	0.0	6.2	0.0	9.6	1.7	0.0	0.8
LnGrp LOS	C			C			A		A	A		A
Approach Vol, veh/h		281			240			447			387	
Approach Delay, s/veh		29.9			28.5			9.4			0.9	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		54.8		25.2		54.8		25.2				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 37		32.4		* 37		32.4				
Max Q Clear Time (g_c+I1), s		13.6		15.8		14.5		13.8				
Green Ext Time (p_c), s		3.4		1.8		2.8		1.6				
Intersection Summary												
HCM 2010 Ctrl Delay				14.6								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2019 Existing - AM
Richmond / Churchill

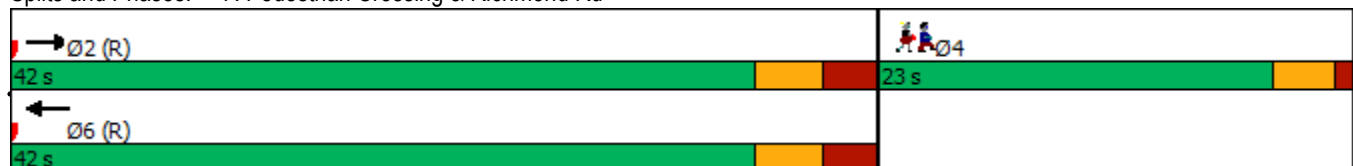
							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations							
Traffic Volume (vph)	473	0	0	299	0	0	
Future Volume (vph)	473	0	0	299	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	13.6		
Travel Time (s)	19.2			1.4	1.0		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Adj. Flow (vph)	526	0	0	332	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	526	0	0	332	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6			4
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0			5.0

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2019 Existing - AM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	11.0			11.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							43
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.60			0.38			
Control Delay	13.4			9.8			
Queue Delay	0.0			0.0			
Total Delay	13.4			9.8			
LOS	B			A			
Approach Delay	13.4			9.8			
Approach LOS	B			A			
Queue Length 50th (m)	38.4			20.4			
Queue Length 95th (m)	65.7			35.6			
Internal Link Dist (m)	242.4			0.1	0.1		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.60			0.38			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 55							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.60							
Intersection Signal Delay: 12.0				Intersection LOS: B			
Intersection Capacity Utilization 34.2%				ICU Level of Service A			
Analysis Period (min) 15							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
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)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.96	0.96		0.85	0.99			0.97			0.88	
Frt		0.979			0.992			0.974			0.917	
Flt Protected	0.950			0.950				0.996			0.999	
Satd. Flow (prot)	1478	1326	0	1492	1389	0	0	2820	0	0	2414	0
Flt Permitted	0.229			0.514				0.803			0.934	
Satd. Flow (perm)	340	1326	0	684	1389	0	0	2264	0	0	2253	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4			25			313	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	99		154	154		99	78		53	53		78
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%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
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	427	0	0	627	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	31.1		31.1	31.1		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	
Total Split (%)	16.7%	61.1%		50.0%	50.0%		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	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6		3.6	3.6	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effct Green (s)	54.5	54.5		39.7	39.7			23.2			23.2	
Actuated g/C Ratio	0.61	0.61		0.44	0.44			0.26			0.26	
v/c Ratio	0.67	0.53		0.48	0.91			0.71			0.77	
Control Delay	20.3	13.0		24.9	45.9			27.4			22.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.1	
Total Delay	20.3	13.0		24.9	45.9			27.4			22.3	
LOS	C	B		C	D			C			C	
Approach Delay		15.4			41.6			27.4			22.3	
Approach LOS		B			D			C			C	
Queue Length 50th (m)	15.7	38.4		17.2	88.7			17.4			26.2	
Queue Length 95th (m)	#29.0	63.1		35.3	#154.5			m34.5			47.1	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	318	808		301	614			602			813	
Starvation Cap Reductn	0	0		0	0			0			0	
Spillback Cap Reductn	0	0		0	0			0			5	
Storage Cap Reductn	0	0		0	0			0			0	
Reduced v/c Ratio	0.67	0.53		0.48	0.91			0.71			0.78	

Intersection Summary

Area Type: CBD
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.91

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings 1: Churchill Ave N & Richmond Rd

2019 Existing - PM
Richmond / Churchill

Intersection Signal Delay: 27.1

Intersection LOS: C

Intersection Capacity Utilization 96.7%

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: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	429	33	40	789	39	46	16	52	44	35	29
Future Volume (vph)	6	429	33	40	789	39	46	16	52	44	35	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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			0.89			0.91	
Frt		0.990			0.994			0.938			0.964	
Flt Protected		0.999			0.998			0.980			0.980	
Satd. Flow (prot)	0	1380	0	0	1396	0	0	1348	0	0	1396	0
Flt Permitted		0.989			0.961			0.822			0.810	
Satd. Flow (perm)	0	1366	0	0	1340	0	0	1073	0	0	1107	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			46			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	48		99	99		48	72		57	57		72
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 (%)	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	6%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	7	477	37	44	877	43	51	18	58	49	39	32
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	521	0	0	964	0	0	127	0	0	120	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		33.5	33.5		24.6	24.6		24.6	24.6	
Total Split (s)	60.0	60.0		60.0	60.0		25.0	25.0		25.0	25.0	
Total Split (%)	70.6%	70.6%		70.6%	70.6%		29.4%	29.4%		29.4%	29.4%	
Maximum Green (s)	54.6	54.6		54.6	54.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		60.5			60.5			13.5			13.5	
Actuated g/C Ratio		0.71			0.71			0.16			0.16	
v/c Ratio		0.53			1.01			0.61			0.63	
Control Delay		8.8			46.9			33.7			41.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		8.8			46.9			33.7			41.6	
LOS		A			D			C			D	
Approach Delay		8.8			46.9			33.7			41.6	
Approach LOS		A			D			C			D	
Queue Length 50th (m)		30.7			127.8			12.3			15.4	
Queue Length 95th (m)		70.1			#253.0			27.5			29.9	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		975			956			280			268	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.53			1.01			0.45			0.45	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 78 (92%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 110												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 1.01												
Intersection Signal Delay: 34.1							Intersection LOS: C					
Intersection Capacity Utilization 104.3%							ICU Level of Service G					
Analysis Period (min) 15												

Lanes, Volumes, Timings
 2: Roosevelt Ave & Richmond Rd

2019 Existing - PM
 Richmond / Churchill

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	429	33	40	789	39	46	16	52	44	35	29
Future Volume (veh/h)	6	429	33	40	789	39	46	16	52	44	35	29
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93	0.98		0.93	0.87		0.82	0.87		0.82
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1620	1588	1620	1620	1588	1620
Adj Flow Rate, veh/h	7	477	37	44	877	43	51	18	58	49	39	32
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	6	6	6
Cap, veh/h	47	957	73	73	942	45	142	54	115	147	104	70
Arrive On Green	0.67	0.67	0.67	0.67	0.67	0.67	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	6	1438	110	42	1415	68	402	264	560	425	508	339
Grp Volume(v), veh/h	521	0	0	964	0	0	127	0	0	120	0	0
Grp Sat Flow(s),veh/h/ln	1554	0	0	1525	0	0	1225	0	0	1273	0	0
Q Serve(g_s), s	0.0	0.0	0.0	26.9	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	14.3	0.0	0.0	48.4	0.0	0.0	6.9	0.0	0.0	6.2	0.0	0.0
Prop In Lane	0.01		0.07	0.05		0.04	0.40		0.46	0.41		0.27
Lane Grp Cap(c), veh/h	1077	0	0	1060	0	0	310	0	0	320	0	0
V/C Ratio(X)	0.48	0.00	0.00	0.91	0.00	0.00	0.41	0.00	0.00	0.37	0.00	0.00
Avail Cap(c_a), veh/h	1077	0	0	1060	0	0	337	0	0	348	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.29	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	7.1	0.0	0.0	12.6	0.0	0.0	29.6	0.0	0.0	29.4	0.0	0.0
Incr Delay (d2), s/veh	1.6	0.0	0.0	4.4	0.0	0.0	0.9	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.5	0.0	0.0	21.4	0.0	0.0	2.7	0.0	0.0	2.5	0.0	0.0
LnGrp Delay(d),s/veh	8.7	0.0	0.0	17.0	0.0	0.0	30.5	0.0	0.0	30.1	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		521			964			127			120	
Approach Delay, s/veh		8.7			17.0			30.5			30.1	
Approach LOS		A			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		62.0		23.0		62.0		23.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 55		19.4		* 55		19.4				
Max Q Clear Time (g_c+I1), s		16.3		8.2		50.4		8.9				
Green Ext Time (p_c), s		4.8		0.5		2.8		0.6				
Intersection Summary												
HCM 2010 Ctrl Delay				16.4								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	376	12	22	650	13	9	4	21	10	3	14
Future Volume (vph)	12	376	12	22	650	13	9	4	21	10	3	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Frt		0.996			0.998			0.916			0.928	
Flt Protected		0.999			0.998			0.987			0.982	
Satd. Flow (prot)	0	1406	0	0	1408	0	0	1420	0	0	1431	0
Flt Permitted		0.999			0.998			0.987			0.982	
Satd. Flow (perm)	0	1406	0	0	1408	0	0	1420	0	0	1431	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
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
Parking (#/hr)		0			0							
Adj. Flow (vph)	13	418	13	24	722	14	10	4	23	11	3	16
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	444	0	0	760	0	0	37	0	0	30	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization 62.2%	ICU Level of Service B											
Analysis Period (min) 15												

Intersection												
Int Delay, s/veh	1.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	376	12	22	650	13	9	4	21	10	3	14
Future Vol, veh/h	12	376	12	22	650	13	9	4	21	10	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	418	13	24	722	14	10	4	23	11	3	16
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	736	0	0	431	0	0	1238	1235	425	1241	1234	729
Stage 1	-	-	-	-	-	-	451	451	-	777	777	-
Stage 2	-	-	-	-	-	-	787	784	-	464	457	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	870	-	-	1129	-	-	152	176	629	152	177	423
Stage 1	-	-	-	-	-	-	588	571	-	390	407	-
Stage 2	-	-	-	-	-	-	385	404	-	578	568	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	870	-	-	1129	-	-	138	166	629	137	167	423
Mov Cap-2 Maneuver	-	-	-	-	-	-	138	166	-	137	167	-
Stage 1	-	-	-	-	-	-	576	560	-	382	392	-
Stage 2	-	-	-	-	-	-	354	389	-	541	557	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.3			20			24.1		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	277	870	-	-	1129	-	-	218				
HCM Lane V/C Ratio	0.136	0.015	-	-	0.022	-	-	0.138				
HCM Control Delay (s)	20	9.2	0	-	8.3	0	-	24.1				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.5	0	-	-	0.1	-	-	0.5				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	5	12	358	5	33	11	162	284	39	144	1
Future Volume (vph)	0	5	12	358	5	33	11	162	284	39	144	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.908			0.989			0.916			0.999	
Flt Protected					0.957			0.999			0.990	
Satd. Flow (prot)	0	1426	0	0	1474	0	0	1277	0	0	1505	0
Flt Permitted					0.957			0.999			0.990	
Satd. Flow (perm)	0	1426	0	0	1474	0	0	1277	0	0	1505	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			316.0			99.4	
Travel Time (s)		5.3			8.0			22.8			7.2	
Confl. Peds. (#/hr)	32		18	18		32	39		9	9		39
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 (%)	2%	2%	2%	2%	2%	12%	2%	4%	3%	10%	4%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	6	13	398	6	37	12	180	316	43	160	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	19	0	0	441	0	0	508	0	0	204	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	73.4%											
Analysis Period (min)	15											
	ICU Level of Service D											

Intersection	
Intersection Delay, s/veh	22.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	5	12	358	5	33	11	162	284	39	144	1
Future Vol, veh/h	0	5	12	358	5	33	11	162	284	39	144	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, %	2	2	2	2	2	12	2	4	3	10	4	2
Mvmt Flow	0	6	13	398	6	37	12	180	316	43	160	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10	24.7	24.1	13.3
HCM LOS	A	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	2%	0%	90%	21%
Vol Thru, %	35%	29%	1%	78%
Vol Right, %	62%	71%	8%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	457	17	396	184
LT Vol	11	0	358	39
Through Vol	162	5	5	144
RT Vol	284	12	33	1
Lane Flow Rate	508	19	440	204
Geometry Grp	1	1	1	1
Degree of Util (X)	0.764	0.035	0.741	0.371
Departure Headway (Hd)	5.414	6.699	6.065	6.529
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	660	537	590	554
Service Time	3.507	4.713	4.153	4.532
HCM Lane V/C Ratio	0.77	0.035	0.746	0.368
HCM Control Delay	24.1	10	24.7	13.3
HCM Lane LOS	C	A	C	B
HCM 95th-tile Q	7.1	0.1	6.4	1.7

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	137	61	86	325	68	33	298	94	28	321	69
Future Volume (vph)	45	137	61	86	325	68	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.99	0.98	
Frt		0.966			0.981			0.964			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1485	0	0	1521	0	1478	1493	0	1492	1490	0
Flt Permitted		0.839			0.883		0.388			0.387		
Satd. Flow (perm)	0	1256	0	0	1351	0	585	1493	0	599	1490	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)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	15		17	17		15	33		16	16		33
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 (%)	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%
Adj. Flow (vph)	50	152	68	96	361	76	37	331	104	31	357	77
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	270	0	0	533	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2019 Existing - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		37.4			37.4		41.6	41.6		41.6	41.6	
Actuated g/C Ratio		0.42			0.42		0.46	0.46		0.46	0.46	
v/c Ratio		0.50			0.94		0.14	0.62		0.11	0.62	
Control Delay		20.9			51.0		16.8	22.7		14.0	20.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.6	
Total Delay		20.9			51.0		16.8	22.7		14.0	20.7	
LOS		C			D		B	C		B	C	
Approach Delay		20.9			51.0			22.3			20.2	
Approach LOS		C			D			C			C	
Queue Length 50th (m)		29.2			80.9		3.7	54.3		3.2	50.0	
Queue Length 95th (m)		51.0			#143.8		10.0	87.0		m4.9	m62.7	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		563			598		270	702		276	697	
Starvation Cap Reductn		0			0		0	0		0	70	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.48			0.89		0.14	0.62		0.11	0.69	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 90												
Actuated Cycle Length: 90												
Offset: 40 (44%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Natural Cycle: 65												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.94												
Intersection Signal Delay: 30.3	Intersection LOS: C											

Lanes, Volumes, Timings
 5: Churchill Ave N & Byron Ave

2019 Existing - PM
 Richmond / Churchill

Intersection Capacity Utilization 82.0% ICU Level of Service E

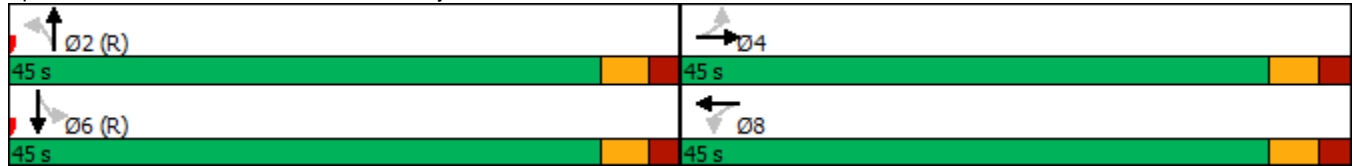
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2019 Existing - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	137	61	86	325	68	33	298	94	28	321	69
Future Volume (veh/h)	45	137	61	86	325	68	33	298	94	28	321	69
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.99	0.98		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1573	1588	1620	1588	1576	1620
Adj Flow Rate, veh/h	50	152	68	96	361	76	37	331	104	31	357	77
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	3	2	2	2	3	3
Cap, veh/h	107	289	118	131	405	81	452	548	172	307	595	128
Arrive On Green	0.40	0.40	0.40	0.40	0.40	0.40	0.48	0.48	0.48	0.95	0.95	0.95
Sat Flow, veh/h	149	722	293	209	1012	203	834	1148	361	855	1248	269
Grp Volume(v), veh/h	270	0	0	533	0	0	37	0	435	31	0	434
Grp Sat Flow(s),veh/h/ln	1165	0	0	1424	0	0	834	0	1509	855	0	1517
Q Serve(g_s), s	0.0	0.0	0.0	18.4	0.0	0.0	2.3	0.0	19.1	1.7	0.0	2.7
Cycle Q Clear(g_c), s	13.8	0.0	0.0	32.2	0.0	0.0	5.1	0.0	19.1	20.7	0.0	2.7
Prop In Lane	0.19		0.25	0.18		0.14	1.00		0.24	1.00		0.18
Lane Grp Cap(c), veh/h	514	0	0	618	0	0	452	0	720	307	0	724
V/C Ratio(X)	0.53	0.00	0.00	0.86	0.00	0.00	0.08	0.00	0.60	0.10	0.00	0.60
Avail Cap(c_a), veh/h	563	0	0	670	0	0	452	0	720	307	0	724
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.63	0.00	0.63
Uniform Delay (d), s/veh	19.9	0.0	0.0	25.7	0.0	0.0	14.4	0.0	17.3	6.4	0.0	1.1
Incr Delay (d2), s/veh	0.8	0.0	0.0	10.6	0.0	0.0	0.4	0.0	3.7	0.4	0.0	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	0.0	0.0	14.4	0.0	0.0	0.6	0.0	8.6	0.4	0.0	1.2
LnGrp Delay(d),s/veh	20.7	0.0	0.0	36.3	0.0	0.0	14.8	0.0	21.0	6.8	0.0	3.4
LnGrp LOS	C			D			B		C	A		A
Approach Vol, veh/h		270			533			472			465	
Approach Delay, s/veh		20.7			36.3			20.5			3.7	
Approach LOS		C			D			C			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		48.3		41.7		48.3		41.7				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		39.4		* 40		39.4				
Max Q Clear Time (g_c+I1), s		21.1		15.8		22.7		34.2				
Green Ext Time (p_c), s		3.4		2.1		3.2		1.8				
Intersection Summary												
HCM 2010 Ctrl Delay				20.9								
HCM 2010 LOS				C								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2019 Existing - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	400	0	0	673	0	0	
Future Volume (vph)	400	0	0	673	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Fr t							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	33.7		
Travel Time (s)	19.2			1.4	2.4		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	
Adj. Flow (vph)	444	0	0	748	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	444	0	0	748	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2019 Existing - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	24.0			24.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							51
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.51			0.86			
Control Delay	11.6			25.2			
Queue Delay	0.0			0.0			
Total Delay	11.6			25.2			
LOS	B			C			
Approach Delay	11.6			25.2			
Approach LOS	B			C			
Queue Length 50th (m)	30.1			69.4			
Queue Length 95th (m)	51.5			#139.2			
Internal Link Dist (m)	242.4			0.1	9.7		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.51			0.86			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 60							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.86							
Intersection Signal Delay: 20.2				Intersection LOS: C			
Intersection Capacity Utilization 46.5%				ICU Level of Service A			
Analysis Period (min) 15							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Appendix L

2022 Future Background Synchro Worksheets

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	296	384	38	53	188	22	28	306	103	23	281	145
Future Volume (vph)	296	384	38	53	188	22	28	306	103	23	281	145
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.99		0.96	0.99			0.98			0.97	
Frt		0.986			0.984			0.965			0.952	
Flt Protected	0.950			0.950				0.997			0.997	
Satd. Flow (prot)	1478	1382	0	1396	1337	0	0	2746	0	0	2642	0
Flt Permitted	0.507			0.516				0.895			0.910	
Satd. Flow (perm)	748	1382	0	727	1337	0	0	2459	0	0	2407	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			8			52			102	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
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%	2%	2%	9%	5%	5%	8%	5%	2%	13%	6%	4%
Parking (#/hr)		0			0							
Adj. Flow (vph)	296	384	38	53	188	22	28	306	103	23	281	145
Shared Lane Traffic (%)												
Lane Group Flow (vph)	296	422	0	53	210	0	0	437	0	0	449	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	30.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	36.1		31.1	31.1		24.2	24.2		24.2	24.2	
Total Split (s)	14.0	40.0		31.0	31.0		30.0	30.0		30.0	30.0	
Total Split (%)	17.5%	50.0%		38.8%	38.8%		37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	7.9	33.9		24.9	24.9		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	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	48.1	48.1		29.3	29.3			19.6			19.6	
Actuated g/C Ratio	0.60	0.60		0.37	0.37			0.24			0.24	
v/c Ratio	0.52	0.51		0.20	0.43			0.68			0.68	
Control Delay	12.2	12.1		22.0	23.0			23.5			26.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.2	12.1		22.0	23.0			23.5			26.2	
LOS	B	B		C	C			C			C	
Approach Delay		12.1			22.8			23.5			26.2	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	19.0	30.5		5.3	22.1			29.5			25.6	
Queue Length 95th (m)	39.1	62.7		14.9	44.7			21.4			37.7	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	566	834		266	494			768			787	
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	0.52	0.51		0.20	0.43			0.57			0.57	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 43 (54%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.68

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings 1: Churchill Ave N & Richmond Rd

2022 FB - AM
Richmond / Churchill

Intersection Signal Delay: 19.7

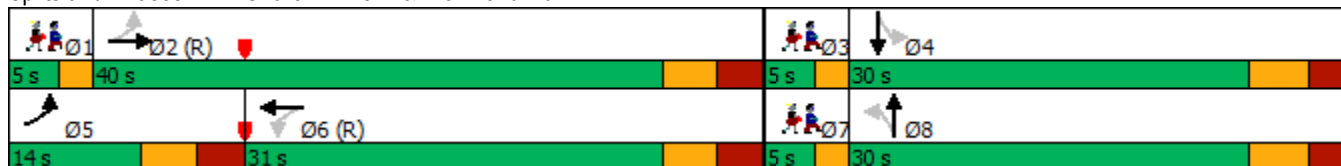
Intersection LOS: B

Intersection Capacity Utilization 92.3%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Future Volume (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		1.00			0.99			0.92			0.94	
Frt		0.995			0.988			0.924			0.974	
Flt Protected		0.999			0.997			0.985			0.970	
Satd. Flow (prot)	0	1374	0	0	1351	0	0	1252	0	0	1453	0
Flt Permitted		0.995			0.948			0.889			0.808	
Satd. Flow (perm)	0	1368	0	0	1282	0	0	1102	0	0	1158	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			12			45			17	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	80		65	65		80	48		42	42		48
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 (%)	2%	4%	2%	4%	4%	3%	12%	2%	11%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	594	0	0	411	0	0	80	0	0	88	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		34.4	34.4		24.6	24.6		24.6	24.6	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.6	39.6		39.6	39.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		51.8			51.8			11.4			11.4	
Actuated g/C Ratio		0.74			0.74			0.16			0.16	
v/c Ratio		0.59			0.43			0.37			0.44	
Control Delay		9.4			6.9			18.6			28.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		9.4			6.9			18.6			28.6	
LOS		A			A			B			C	
Approach Delay		9.4			6.9			18.6			28.6	
Approach LOS		A			A			B			C	
Queue Length 50th (m)		33.0			18.4			4.1			8.6	
Queue Length 95th (m)		79.5			44.2			14.2			19.6	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1013			952			337			333	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.59			0.43			0.24			0.26	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 27 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.59												
Intersection Signal Delay: 10.6							Intersection LOS: B					
Intersection Capacity Utilization 68.5%							ICU Level of Service C					
Analysis Period (min) 15												

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	565	21	28	345	38	25	10	45	55	16	17
Future Volume (veh/h)	8	565	21	28	345	38	25	10	45	55	16	17
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.94	0.99		0.94	0.91		0.89	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1559	1620	1620	1559	1620	1620	1470	1620	1620	1588	1620
Adj Flow Rate, veh/h	8	565	21	28	345	38	25	10	45	55	16	17
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	56	922	34	85	799	85	124	55	143	240	66	53
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	6	1480	54	49	1283	136	256	249	650	711	301	242
Grp Volume(v), veh/h	594	0	0	411	0	0	80	0	0	88	0	0
Grp Sat Flow(s),veh/h/ln	1540	0	0	1467	0	0	1155	0	0	1255	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	16.5	0.0	0.0	9.8	0.0	0.0	3.7	0.0	0.0	3.5	0.0	0.0
Prop In Lane	0.01		0.04	0.07		0.09	0.31		0.56	0.62		0.19
Lane Grp Cap(c), veh/h	1012	0	0	969	0	0	321	0	0	359	0	0
V/C Ratio(X)	0.59	0.00	0.00	0.42	0.00	0.00	0.25	0.00	0.00	0.24	0.00	0.00
Avail Cap(c_a), veh/h	1012	0	0	969	0	0	386	0	0	427	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.91	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.1	0.0	0.0	6.8	0.0	0.0	22.8	0.0	0.0	22.7	0.0	0.0
Incr Delay (d2), s/veh	2.5	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	0.0	0.0	4.3	0.0	0.0	1.3	0.0	0.0	1.5	0.0	0.0
LnGrp Delay(d),s/veh	10.6	0.0	0.0	8.0	0.0	0.0	23.2	0.0	0.0	23.0	0.0	0.0
LnGrp LOS	B			A			C			C		
Approach Vol, veh/h		594			411			80			88	
Approach Delay, s/veh		10.6			8.0			23.2			23.0	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		49.0		21.0		49.0		21.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		19.4		* 40		19.4				
Max Q Clear Time (g_c+I1), s		18.5		5.5		11.8		5.7				
Green Ext Time (p_c), s		4.8		0.4		3.4		0.3				
Intersection Summary												
HCM 2010 Ctrl Delay				11.5								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	452	7	5	287	20	2	16	15	10	9	11
Future Volume (vph)	20	452	7	5	287	20	2	16	15	10	9	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.998			0.991			0.939			0.950	
Flt Protected		0.998			0.999			0.997			0.984	
Satd. Flow (prot)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Flt Permitted		0.998			0.999			0.997			0.984	
Satd. Flow (perm)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
Confl. Peds. (#/hr)	39		44	44		39						
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 (%)	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	20	452	7	5	287	20	2	16	15	10	9	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	479	0	0	312	0	0	33	0	0	30	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	54.2%											
Analysis Period (min)	15											
	ICU Level of Service A											

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	452	7	5	287	20	2	16	15	10	9	11
Future Vol, veh/h	20	452	7	5	287	20	2	16	15	10	9	11
Conflicting Peds, #/hr	39	0	44	44	0	39	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	3	2	2	2	2	2	2	2
Mvmt Flow	20	452	7	5	287	20	2	16	15	10	9	11
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	346	0	0	503	0	0	857	896	500	857	889	336
Stage 1	-	-	-	-	-	-	540	540	-	346	346	-
Stage 2	-	-	-	-	-	-	317	356	-	511	543	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1213	-	-	1061	-	-	277	280	571	277	282	706
Stage 1	-	-	-	-	-	-	526	521	-	670	635	-
Stage 2	-	-	-	-	-	-	694	629	-	545	520	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1176	-	-	1025	-	-	251	255	552	243	257	685
Mov Cap-2 Maneuver	-	-	-	-	-	-	251	255	-	243	257	-
Stage 1	-	-	-	-	-	-	497	492	-	634	612	-
Stage 2	-	-	-	-	-	-	669	606	-	501	491	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.1			16.8			17.2		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	337	1176	-	-	1025	-	-	325				
HCM Lane V/C Ratio	0.098	0.017	-	-	0.005	-	-	0.092				
HCM Control Delay (s)	16.8	8.1	0	-	8.5	0	-	17.2				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Future Volume (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.912			0.987			0.893			0.999	
Flt Protected					0.959			0.999			0.991	
Satd. Flow (prot)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Flt Permitted					0.959			0.999			0.991	
Satd. Flow (perm)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			316.0			99.4	
Travel Time (s)		5.3			8.0			22.8			7.2	
Confl. Peds. (#/hr)	41		7	7		41	38		10	10		38
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 (%)	2%	14%	8%	4%	11%	15%	2%	6%	3%	4%	2%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	215	0	0	569	0	0	260	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	77.3%											
Analysis Period (min)	15											
ICU Level of Service D												

Intersection	
Intersection Delay, s/veh	16
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	7	13	186	9	20	8	109	452	49	210	1
Future Vol, veh/h	0	7	13	186	9	20	8	109	452	49	210	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, %	2	14	8	4	11	15	2	6	3	4	2	2
Mvmt Flow	0	7	13	186	9	20	8	109	452	49	210	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.6	12.6	19.2	12.1
HCM LOS	A	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	0%	87%	19%
Vol Thru, %	19%	35%	4%	81%
Vol Right, %	79%	65%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	569	20	215	260
LT Vol	8	0	186	49
Through Vol	109	7	9	210
RT Vol	452	13	20	1
Lane Flow Rate	569	20	215	260
Geometry Grp	1	1	1	1
Degree of Util (X)	0.732	0.035	0.364	0.396
Departure Headway (Hd)	4.632	6.262	6.103	5.478
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	785	568	587	655
Service Time	2.632	4.338	4.156	3.524
HCM Lane V/C Ratio	0.725	0.035	0.366	0.397
HCM Control Delay	19.2	9.6	12.6	12.1
HCM Lane LOS	C	A	B	B
HCM 95th-tile Q	6.5	0.1	1.7	1.9

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	172	46	35	127	56	29	333	42	38	291	24
Future Volume (vph)	36	172	46	35	127	56	29	333	42	38	291	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	1.00	
Frt		0.976			0.965			0.983			0.989	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1513	0	0	1494	0	1422	1496	0	1492	1503	0
Flt Permitted		0.926			0.897		0.558			0.512		
Satd. Flow (perm)	0	1409	0	0	1349	0	814	1496	0	791	1503	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			26			10			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
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 (%)	2%	2%	2%	2%	2%	2%	7%	5%	2%	2%	5%	4%
Adj. Flow (vph)	36	172	46	35	127	56	29	333	42	38	291	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	254	0	0	218	0	29	375	0	38	315	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		19.0			19.0		50.0	50.0		50.0	50.0	
Actuated g/C Ratio		0.24			0.24		0.62	0.62		0.62	0.62	
v/c Ratio		0.73			0.64		0.06	0.40		0.08	0.33	
Control Delay		38.0			31.9		8.3	10.2		4.4	4.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.0			31.9		8.3	10.2		4.4	4.9	
LOS		D			C		A	B		A	A	
Approach Delay		38.0			31.9			10.0			4.8	
Approach LOS		D			C			B			A	
Queue Length 50th (m)		33.3			26.2		1.5	24.5		1.4	12.1	
Queue Length 95th (m)		50.6			42.0		5.9	54.0		m3.2	21.2	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		580			561		509	939		494	942	
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			0.39		0.06	0.40		0.08	0.33	
Intersection Summary												
Area Type:	CBD											
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: 18.2	Intersection LOS: B											

Lanes, Volumes, Timings
 5: Churchill Ave N & Byron Ave

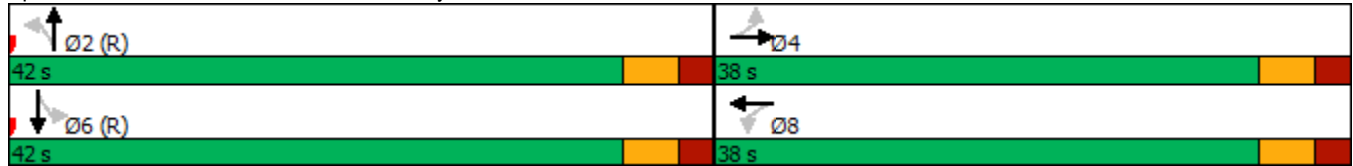
2022 FB - AM
 Richmond / Churchill

Intersection Capacity Utilization 62.7% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2022 FB - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	172	46	35	127	56	29	333	42	38	291	24
Future Volume (veh/h)	36	172	46	35	127	56	29	333	42	38	291	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.98	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1514	1548	1620	1588	1544	1620
Adj Flow Rate, veh/h	36	172	46	35	127	56	29	333	42	38	291	24
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	7	5	5	2	5	5
Cap, veh/h	82	251	62	85	216	86	659	851	107	550	889	73
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	133	1093	271	145	942	375	900	1345	170	899	1405	116
Grp Volume(v), veh/h	254	0	0	218	0	0	29	0	375	38	0	315
Grp Sat Flow(s),veh/h/ln	1497	0	0	1462	0	0	900	0	1515	899	0	1521
Q Serve(g_s), s	1.8	0.0	0.0	0.0	0.0	0.0	1.0	0.0	9.7	0.7	0.0	0.0
Cycle Q Clear(g_c), s	12.3	0.0	0.0	10.5	0.0	0.0	1.0	0.0	9.7	10.4	0.0	0.0
Prop In Lane	0.14		0.18	0.16		0.26	1.00		0.11	1.00		0.08
Lane Grp Cap(c), veh/h	395	0	0	388	0	0	659	0	958	550	0	963
V/C Ratio(X)	0.64	0.00	0.00	0.56	0.00	0.00	0.04	0.00	0.39	0.07	0.00	0.33
Avail Cap(c_a), veh/h	647	0	0	632	0	0	659	0	958	550	0	963
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.74	0.00	0.74
Uniform Delay (d), s/veh	28.4	0.0	0.0	27.7	0.0	0.0	5.6	0.0	7.2	1.0	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.0	1.3	0.0	0.0	0.1	0.0	1.2	0.2	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.0	0.0	4.5	0.0	0.0	0.3	0.0	4.3	0.2	0.0	0.2
LnGrp Delay(d),s/veh	30.2	0.0	0.0	29.0	0.0	0.0	5.7	0.0	8.4	1.2	0.0	0.7
LnGrp LOS	C			C			A		A	A		A
Approach Vol, veh/h		254			218			404			353	
Approach Delay, s/veh		30.2			29.0			8.2			0.7	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		56.0		24.0		56.0		24.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 37		32.4		* 37		32.4				
Max Q Clear Time (g_c+I1), s		11.7		14.3		12.4		12.5				
Green Ext Time (p_c), s		3.1		1.6		2.6		1.4				
Intersection Summary												
HCM 2010 Ctrl Delay				14.3								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FB - AM
Richmond / Churchill

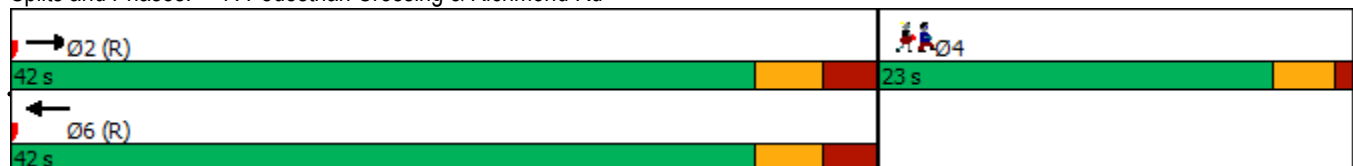
	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	479	0	0	300	0	0	
Future Volume (vph)	479	0	0	300	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	13.6		
Travel Time (s)	19.2			1.4	1.0		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	479	0	0	300	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	479	0	0	300	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FB - AM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	11.0			11.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							43
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.55			0.34			
Control Delay	12.3			9.4			
Queue Delay	0.0			0.0			
Total Delay	12.3			9.4			
LOS	B			A			
Approach Delay	12.3			9.4			
Approach LOS	B			A			
Queue Length 50th (m)	33.5			18.0			
Queue Length 95th (m)	57.1			31.8			
Internal Link Dist (m)	242.4			0.1	0.1		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.55			0.34			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 50							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.55							
Intersection Signal Delay: 11.2				Intersection LOS: B			
Intersection Capacity Utilization 34.6%				ICU Level of Service A			
Analysis Period (min) 15							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	195	329	57	129	479	29	28	297	67	17	244	314
Future Volume (vph)	195	329	57	129	479	29	28	297	67	17	244	314
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.96		0.84	0.99			0.97			0.88	
Frt		0.978			0.991			0.974			0.918	
Flt Protected	0.950			0.950				0.996			0.999	
Satd. Flow (prot)	1478	1323	0	1492	1385	0	0	2821	0	0	2421	0
Flt Permitted	0.286			0.533				0.810			0.933	
Satd. Flow (perm)	421	1323	0	701	1385	0	0	2283	0	0	2257	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4			24			305	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	99		154	154		99	78		53	53		78
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%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	195	329	57	129	479	29	28	297	67	17	244	314
Shared Lane Traffic (%)												
Lane Group Flow (vph)	195	386	0	129	508	0	0	392	0	0	575	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	31.1		31.1	31.1		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	
Total Split (%)	16.7%	61.1%		50.0%	50.0%		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	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6		3.6	3.6	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	56.5	56.5		41.5	41.5			21.2			21.2	
Actuated g/C Ratio	0.63	0.63		0.46	0.46			0.24			0.24	
v/c Ratio	0.53	0.46		0.40	0.79			0.71			0.75	
Control Delay	13.2	11.1		21.9	32.7			28.2			21.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.2	11.1		21.9	32.7			28.2			21.2	
LOS	B	B		C	C			C			C	
Approach Delay		11.8			30.5			28.2			21.2	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	13.2	30.5		14.9	74.7			16.6			22.4	
Queue Length 95th (m)	24.6	54.5		31.0	#133.7			m28.4			40.5	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	372	836		323	640			560			768	
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	0.52	0.46		0.40	0.79			0.70			0.75	

Intersection Summary

Area Type: CBD
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.79

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings

1: Churchill Ave N & Richmond Rd

2022 FB - PM
Richmond / Churchill

Intersection Signal Delay: 22.7

Intersection LOS: C

Intersection Capacity Utilization 98.5%

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: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Future Volume (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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			0.88			0.91	
Frt		0.991			0.994			0.938			0.964	
Flt Protected		0.999			0.998			0.980			0.980	
Satd. Flow (prot)	0	1382	0	0	1396	0	0	1348	0	0	1395	0
Flt Permitted		0.991			0.965			0.835			0.824	
Satd. Flow (perm)	0	1371	0	0	1345	0	0	1088	0	0	1124	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			46			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	48		99	99		48	72		57	57		72
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 (%)	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	6%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	474	0	0	871	0	0	114	0	0	108	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		33.5	33.5		24.6	24.6		24.6	24.6	
Total Split (s)	60.0	60.0		60.0	60.0		25.0	25.0		25.0	25.0	
Total Split (%)	70.6%	70.6%		70.6%	70.6%		29.4%	29.4%		29.4%	29.4%	
Maximum Green (s)	54.6	54.6		54.6	54.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		65.2			65.2			13.0			13.0	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
v/c Ratio		0.45			0.84			0.56			0.57	
Control Delay		7.0			20.5			30.9			38.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.0			20.5			30.9			38.8	
LOS		A			C			C			D	
Approach Delay		7.0			20.5			30.9			38.8	
Approach LOS		A			C			C			D	
Queue Length 50th (m)		25.3			87.7			10.3			13.5	
Queue Length 95th (m)		57.4			#215.5			24.4			27.2	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1054			1033			283			271	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.45			0.84			0.40			0.40	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 78 (92%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.84												
Intersection Signal Delay: 18.4							Intersection LOS: B					
Intersection Capacity Utilization 104.6%							ICU Level of Service G					
Analysis Period (min) 15												

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	435	33	40	792	39	46	16	52	44	35	29
Future Volume (veh/h)	6	435	33	40	792	39	46	16	52	44	35	29
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93	0.98		0.93	0.86		0.82	0.87		0.82
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1620	1588	1620	1620	1588	1620
Adj Flow Rate, veh/h	6	435	33	40	792	39	46	16	52	44	35	29
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	6	6	6
Cap, veh/h	46	957	72	72	945	46	141	53	113	146	103	70
Arrive On Green	0.67	0.67	0.67	0.67	0.67	0.67	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	5	1438	108	41	1420	68	399	260	552	421	505	340
Grp Volume(v), veh/h	474	0	0	871	0	0	114	0	0	108	0	0
Grp Sat Flow(s),veh/h/ln	1551	0	0	1530	0	0	1211	0	0	1266	0	0
Q Serve(g_s), s	0.0	0.0	0.0	14.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.4	0.0	0.0	36.8	0.0	0.0	6.2	0.0	0.0	5.5	0.0	0.0
Prop In Lane	0.01		0.07	0.05		0.04	0.40		0.46	0.41		0.27
Lane Grp Cap(c), veh/h	1075	0	0	1063	0	0	307	0	0	319	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.37	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	1075	0	0	1063	0	0	334	0	0	347	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.51	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	6.8	0.0	0.0	10.7	0.0	0.0	29.3	0.0	0.0	29.1	0.0	0.0
Incr Delay (d2), s/veh	1.3	0.0	0.0	3.8	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.0	16.6	0.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0
LnGrp Delay(d),s/veh	8.1	0.0	0.0	14.5	0.0	0.0	30.1	0.0	0.0	29.7	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		474			871			114			108	
Approach Delay, s/veh		8.1			14.5			30.1			29.7	
Approach LOS		A			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		62.0		23.0		62.0		23.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 55		19.4		* 55		19.4				
Max Q Clear Time (g_c+I1), s		14.4		7.5		38.8		8.2				
Green Ext Time (p_c), s		4.2		0.5		7.1		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.8								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	378	12	22	654	13	9	4	21	10	3	14
Future Volume (vph)	12	378	12	22	654	13	9	4	21	10	3	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Frt		0.996			0.997			0.917			0.930	
Flt Protected		0.999			0.998			0.987			0.982	
Satd. Flow (prot)	0	1406	0	0	1406	0	0	1422	0	0	1434	0
Flt Permitted		0.999			0.998			0.987			0.982	
Satd. Flow (perm)	0	1406	0	0	1406	0	0	1422	0	0	1434	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
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
Parking (#/hr)		0			0							
Adj. Flow (vph)	12	378	12	22	654	13	9	4	21	10	3	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	402	0	0	689	0	0	34	0	0	27	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	62.5%						ICU Level of Service B					
Analysis Period (min)	15											

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	378	12	22	654	13	9	4	21	10	3	14
Future Vol, veh/h	12	378	12	22	654	13	9	4	21	10	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	378	12	22	654	13	9	4	21	10	3	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	667	0	0	390	0	0	1121	1119	384	1126	1119	661
Stage 1	-	-	-	-	-	-	408	408	-	705	705	-
Stage 2	-	-	-	-	-	-	713	711	-	421	414	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	923	-	-	1169	-	-	183	207	664	182	207	462
Stage 1	-	-	-	-	-	-	620	597	-	427	439	-
Stage 2	-	-	-	-	-	-	423	436	-	610	593	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	923	-	-	1169	-	-	169	197	664	167	197	462
Mov Cap-2 Maneuver	-	-	-	-	-	-	169	197	-	167	197	-
Stage 1	-	-	-	-	-	-	609	587	-	420	426	-
Stage 2	-	-	-	-	-	-	395	423	-	577	583	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.3			17.5			20.7		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	323	923	-	-	1169	-	-	256				
HCM Lane V/C Ratio	0.105	0.013	-	-	0.019	-	-	0.105				
HCM Control Delay (s)	17.5	9	0	-	8.1	0	-	20.7				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Future Volume (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt	0.905				0.989				0.906		0.999	
Flt Protected					0.957				0.999		0.989	
Satd. Flow (prot)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Flt Permitted					0.957				0.999		0.989	
Satd. Flow (perm)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Link Speed (k/h)	50				50				50		50	
Link Distance (m)	73.0				110.8				316.0		99.4	
Travel Time (s)	5.3				8.0				22.8		7.2	
Confl. Peds. (#/hr)	32		18	18		32	39		9	9		39
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 (%)	2%	2%	2%	2%	2%	12%	2%	4%	3%	10%	4%	2%
Parking (#/hr)	0											
Adj. Flow (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	0	0	404	0	0	416	0	0	176	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				0.0		0.0	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	3.0				3.0				3.0		3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control	Stop				Stop				Stop		Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	72.6%											
Analysis Period (min)	15											
ICU Level of Service C												

Intersection												
Intersection Delay, s/veh	15.7											
Intersection LOS	C											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	5	12	366	5	33	11	116	289	39	136	1
Future Vol, veh/h	0	5	12	366	5	33	11	116	289	39	136	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, %	2	2	2	2	2	12	2	4	3	10	4	2
Mvmt Flow	0	5	12	366	5	33	11	116	289	39	136	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
Approach	EB		WB		NB		SB					
Opposing Approach	WB		EB		SB		NB					
Opposing Lanes	1		1		1		1					
Conflicting Approach Left	SB		NB		EB		WB					
Conflicting Lanes Left	1		1		1		1					
Conflicting Approach Right	NB		SB		WB		EB					
Conflicting Lanes Right	1		1		1		1					
HCM Control Delay	9.2		18.2		15.2		11.6					
HCM LOS	A		C		C		B					
Lane	NBLn1	EBLn1	WBLn1	SBLn1								
Vol Left, %	3%	0%	91%	22%								
Vol Thru, %	28%	29%	1%	77%								
Vol Right, %	69%	71%	8%	1%								
Sign Control	Stop	Stop	Stop	Stop								
Traffic Vol by Lane	416	17	404	176								
LT Vol	11	0	366	39								
Through Vol	116	5	5	136								
RT Vol	289	12	33	1								
Lane Flow Rate	416	17	404	176								
Geometry Grp	1	1	1	1								
Degree of Util (X)	0.588	0.028	0.637	0.294								
Departure Headway (Hd)	5.092	5.911	5.673	6.014								
Convergence, Y/N	Yes	Yes	Yes	Yes								
Cap	707	601	634	595								
Service Time	3.143	3.992	3.717	4.077								
HCM Lane V/C Ratio	0.588	0.028	0.637	0.296								
HCM Control Delay	15.2	9.2	18.2	11.6								
HCM Lane LOS	C	A	C	B								
HCM 95th-tile Q	3.9	0.1	4.5	1.2								

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	139	61	86	326	69	33	300	94	28	323	70
Future Volume (vph)	45	139	61	86	326	69	33	300	94	28	323	70
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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	0.98	
Frt		0.966			0.981			0.964			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1485	0	0	1521	0	1478	1493	0	1492	1490	0
Flt Permitted		0.854			0.893		0.440			0.439		
Satd. Flow (perm)	0	1278	0	0	1366	0	660	1493	0	678	1490	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)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	15		17	17		15	33		16	16		33
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 (%)	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%
Adj. Flow (vph)	45	139	61	86	326	69	33	300	94	28	323	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	245	0	0	481	0	33	394	0	28	393	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		35.0			35.0		44.0	44.0		44.0	44.0	
Actuated g/C Ratio		0.39			0.39		0.49	0.49		0.49	0.49	
v/c Ratio		0.48			0.89		0.10	0.53		0.08	0.53	
Control Delay		21.0			45.1		15.6	19.5		13.7	18.1	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.5	
Total Delay		21.0			45.1		15.6	19.5		13.7	18.6	
LOS		C			D		B	B		B	B	
Approach Delay		21.0			45.1			19.2			18.2	
Approach LOS		C			D			B			B	
Queue Length 50th (m)		26.6			71.3		3.1	44.7		2.7	44.1	
Queue Length 95th (m)		44.9			#120.9		9.0	75.9		m4.8	m58.0	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		572			604		322	740		331	735	
Starvation Cap Reductn		0			0		0	0		0	93	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.43			0.80		0.10	0.53		0.08	0.61	
Intersection Summary												
Area Type:	CBD											
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: 27.1	Intersection LOS: C											

Intersection Capacity Utilization 82.2% ICU Level of Service E

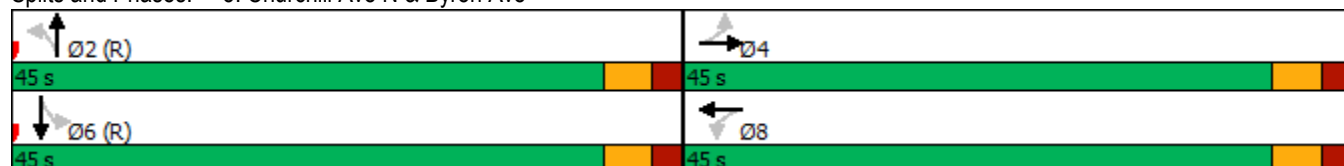
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2022 FB - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	139	61	86	326	69	33	300	94	28	323	70
Future Volume (veh/h)	45	139	61	86	326	69	33	300	94	28	323	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.99	0.98		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1573	1588	1620	1588	1576	1620
Adj Flow Rate, veh/h	45	139	61	86	326	69	33	300	94	28	323	70
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	3	2	2	2	3	3
Cap, veh/h	102	278	110	122	376	76	523	590	185	381	639	139
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	1.00	1.00	1.00
Sat Flow, veh/h	151	761	302	206	1030	207	863	1150	360	885	1247	270
Grp Volume(v), veh/h	245	0	0	481	0	0	33	0	394	28	0	393
Grp Sat Flow(s),veh/h/ln	1214	0	0	1444	0	0	863	0	1511	885	0	1517
Q Serve(g_s), s	0.0	0.0	0.0	16.0	0.0	0.0	1.7	0.0	15.5	1.0	0.0	0.0
Cycle Q Clear(g_c), s	12.4	0.0	0.0	28.4	0.0	0.0	1.7	0.0	15.5	16.5	0.0	0.0
Prop In Lane	0.18		0.25	0.18		0.14	1.00		0.24	1.00		0.18
Lane Grp Cap(c), veh/h	491	0	0	574	0	0	523	0	774	381	0	778
V/C Ratio(X)	0.50	0.00	0.00	0.84	0.00	0.00	0.06	0.00	0.51	0.07	0.00	0.51
Avail Cap(c_a), veh/h	587	0	0	677	0	0	523	0	774	381	0	778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.67	0.00	0.67
Uniform Delay (d), s/veh	21.7	0.0	0.0	27.0	0.0	0.0	11.1	0.0	14.5	2.8	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	8.0	0.0	0.0	0.2	0.0	2.4	0.2	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	0.0	12.6	0.0	0.0	0.4	0.0	7.0	0.3	0.0	0.3
LnGrp Delay(d),s/veh	22.5	0.0	0.0	34.9	0.0	0.0	11.3	0.0	16.8	3.0	0.0	1.6
LnGrp LOS	C			C			B		B	A		A
Approach Vol, veh/h		245			481			427			421	
Approach Delay, s/veh		22.5			34.9			16.4			1.7	
Approach LOS		C			C			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		51.5		38.5		51.5		38.5				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		39.4		* 40		39.4				
Max Q Clear Time (g_c+I1), s		17.5		14.4		18.5		30.4				
Green Ext Time (p_c), s		3.2		1.9		3.1		2.4				
Intersection Summary												
HCM 2010 Ctrl Delay				19.1								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FB - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	402	0	0	677	0	0	
Future Volume (vph)	402	0	0	677	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	33.7		
Travel Time (s)	19.2			1.4	2.4		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	402	0	0	677	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	402	0	0	677	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FB - PM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	24.0			24.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							51
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.46			0.78			
Control Delay	10.9			19.6			
Queue Delay	0.0			0.0			
Total Delay	10.9			19.6			
LOS	B			B			
Approach Delay	10.9			19.6			
Approach LOS	B			B			
Queue Length 50th (m)	26.3			57.8			
Queue Length 95th (m)	44.9			#108.7			
Internal Link Dist (m)	242.4			0.1	9.7		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.46			0.78			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 60							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.78							
Intersection Signal Delay: 16.3				Intersection LOS: B			
Intersection Capacity Utilization 46.8%				ICU Level of Service A			
Analysis Period (min) 15							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd

 Ø2 (R)	 Ø4
42 s	23 s
 Ø6 (R)	
42 s	

Appendix M

2027 Future Background Synchro Worksheets

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	296	387	38	55	196	23	28	306	104	23	281	145
Future Volume (vph)	296	387	38	55	196	23	28	306	104	23	281	145
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.99		0.96	0.99			0.98			0.97	
Frt		0.987			0.984			0.964			0.952	
Flt Protected	0.950			0.950				0.997			0.997	
Satd. Flow (prot)	1478	1383	0	1396	1337	0	0	2743	0	0	2642	0
Flt Permitted	0.497			0.515				0.895			0.910	
Satd. Flow (perm)	734	1383	0	725	1337	0	0	2456	0	0	2407	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			8			52			102	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
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%	2%	2%	9%	5%	5%	8%	5%	2%	13%	6%	4%
Parking (#/hr)		0			0							
Adj. Flow (vph)	296	387	38	55	196	23	28	306	104	23	281	145
Shared Lane Traffic (%)												
Lane Group Flow (vph)	296	425	0	55	219	0	0	438	0	0	449	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	30.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	36.1		31.1	31.1		24.2	24.2		24.2	24.2	
Total Split (s)	14.0	40.0		31.0	31.0		30.0	30.0		30.0	30.0	
Total Split (%)	17.5%	50.0%		38.8%	38.8%		37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	7.9	33.9		24.9	24.9		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	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	48.1	48.1		29.2	29.2			19.6			19.6	
Actuated g/C Ratio	0.60	0.60		0.36	0.36			0.24			0.24	
v/c Ratio	0.53	0.51		0.21	0.45			0.69			0.68	
Control Delay	12.3	12.2		22.2	23.4			23.7			26.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.3	12.2		22.2	23.4			23.7			26.2	
LOS	B	B		C	C			C			C	
Approach Delay		12.2			23.2			23.7			26.2	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	19.0	30.8		5.5	23.3			29.2			25.6	
Queue Length 95th (m)	39.1	63.2		15.4	46.8			21.8			37.7	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	561	835		264	492			767			787	
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	0.53	0.51		0.21	0.45			0.57			0.57	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 43 (54%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FB - AM
Richmond / Churchill

Intersection Signal Delay: 19.8	Intersection LOS: B
Intersection Capacity Utilization 92.4%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Future Volume (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		1.00			0.99			0.92			0.94	
Frt		0.995			0.988			0.924			0.974	
Flt Protected		0.999			0.997			0.985			0.970	
Satd. Flow (prot)	0	1374	0	0	1351	0	0	1252	0	0	1453	0
Flt Permitted		0.995			0.948			0.889			0.808	
Satd. Flow (perm)	0	1368	0	0	1282	0	0	1102	0	0	1158	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			12			45			17	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	80		65	65		80	48		42	42		48
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 (%)	2%	4%	2%	4%	4%	3%	12%	2%	11%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	8	565	21	28	345	38	25	10	45	55	16	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	594	0	0	411	0	0	80	0	0	88	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		34.4	34.4		24.6	24.6		24.6	24.6	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.6	39.6		39.6	39.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		51.8			51.8			11.4			11.4	
Actuated g/C Ratio		0.74			0.74			0.16			0.16	
v/c Ratio		0.59			0.43			0.37			0.44	
Control Delay		9.4			6.9			18.6			28.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		9.4			6.9			18.6			28.6	
LOS		A			A			B			C	
Approach Delay		9.4			6.9			18.6			28.6	
Approach LOS		A			A			B			C	
Queue Length 50th (m)		33.0			18.4			4.1			8.6	
Queue Length 95th (m)		79.5			44.2			14.2			19.6	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1013			952			337			333	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.59			0.43			0.24			0.26	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 27 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.59												
Intersection Signal Delay: 10.6							Intersection LOS: B					
Intersection Capacity Utilization 68.5%							ICU Level of Service C					
Analysis Period (min) 15												

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	565	21	28	345	38	25	10	45	55	16	17
Future Volume (veh/h)	8	565	21	28	345	38	25	10	45	55	16	17
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.94	0.99		0.94	0.91		0.89	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1559	1620	1620	1559	1620	1620	1470	1620	1620	1588	1620
Adj Flow Rate, veh/h	8	565	21	28	345	38	25	10	45	55	16	17
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	56	922	34	85	799	85	124	55	143	240	66	53
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	6	1480	54	49	1283	136	256	249	650	711	301	242
Grp Volume(v), veh/h	594	0	0	411	0	0	80	0	0	88	0	0
Grp Sat Flow(s),veh/h/ln	1540	0	0	1467	0	0	1155	0	0	1255	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	16.5	0.0	0.0	9.8	0.0	0.0	3.7	0.0	0.0	3.5	0.0	0.0
Prop In Lane	0.01		0.04	0.07		0.09	0.31		0.56	0.62		0.19
Lane Grp Cap(c), veh/h	1012	0	0	969	0	0	321	0	0	359	0	0
V/C Ratio(X)	0.59	0.00	0.00	0.42	0.00	0.00	0.25	0.00	0.00	0.24	0.00	0.00
Avail Cap(c_a), veh/h	1012	0	0	969	0	0	386	0	0	427	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.90	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.1	0.0	0.0	6.8	0.0	0.0	22.8	0.0	0.0	22.7	0.0	0.0
Incr Delay (d2), s/veh	2.5	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	0.0	0.0	4.3	0.0	0.0	1.3	0.0	0.0	1.5	0.0	0.0
LnGrp Delay(d),s/veh	10.6	0.0	0.0	8.0	0.0	0.0	23.2	0.0	0.0	23.0	0.0	0.0
LnGrp LOS	B			A			C			C		
Approach Vol, veh/h		594			411			80			88	
Approach Delay, s/veh		10.6			8.0			23.2			23.0	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		49.0		21.0		49.0		21.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		19.4		* 40		19.4				
Max Q Clear Time (g_c+I1), s		18.5		5.5		11.8		5.7				
Green Ext Time (p_c), s		4.8		0.4		3.4		0.3				
Intersection Summary												
HCM 2010 Ctrl Delay				11.5								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	456	7	5	298	21	2	16	15	10	9	11
Future Volume (vph)	20	456	7	5	298	21	2	16	15	10	9	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.998			0.991			0.939			0.950	
Flt Protected		0.998			0.999			0.997			0.984	
Satd. Flow (prot)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Flt Permitted		0.998			0.999			0.997			0.984	
Satd. Flow (perm)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
Confl. Peds. (#/hr)	39		44	44		39						
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 (%)	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	20	456	7	5	298	21	2	16	15	10	9	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	483	0	0	324	0	0	33	0	0	30	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	54.6%											
Analysis Period (min)	15											
	ICU Level of Service A											

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	456	7	5	298	21	2	16	15	10	9	11
Future Vol, veh/h	20	456	7	5	298	21	2	16	15	10	9	11
Conflicting Peds, #/hr	39	0	44	44	0	39	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	3	2	2	2	2	2	2	2
Mvmt Flow	20	456	7	5	298	21	2	16	15	10	9	11
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	358	0	0	507	0	0	873	912	504	873	905	348
Stage 1	-	-	-	-	-	-	544	544	-	358	358	-
Stage 2	-	-	-	-	-	-	329	368	-	515	547	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1201	-	-	1058	-	-	271	274	568	271	276	695
Stage 1	-	-	-	-	-	-	523	519	-	660	628	-
Stage 2	-	-	-	-	-	-	684	621	-	543	517	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1165	-	-	1022	-	-	245	249	549	238	251	674
Mov Cap-2 Maneuver	-	-	-	-	-	-	245	249	-	238	251	-
Stage 1	-	-	-	-	-	-	494	490	-	625	605	-
Stage 2	-	-	-	-	-	-	659	599	-	499	488	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.1			17.1			17.5		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	331	1165	-	-	1022	-	-	318				
HCM Lane V/C Ratio	0.1	0.017	-	-	0.005	-	-	0.094				
HCM Control Delay (s)	17.1	8.1	0	-	8.5	0	-	17.5				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Future Volume (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.912			0.987			0.893			0.999	
Flt Protected					0.959			0.999			0.991	
Satd. Flow (prot)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Flt Permitted					0.959			0.999			0.991	
Satd. Flow (perm)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			316.0			99.4	
Travel Time (s)		5.3			8.0			22.8			7.2	
Confl. Peds. (#/hr)	41		7	7		41	38		10	10		38
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 (%)	2%	14%	8%	4%	11%	15%	2%	6%	3%	4%	2%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	7	13	186	9	20	8	109	452	49	210	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	215	0	0	569	0	0	260	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	77.3%											
Analysis Period (min)	15											
	ICU Level of Service D											

Intersection	
Intersection Delay, s/veh	16
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	7	13	186	9	20	8	109	452	49	210	1
Future Vol, veh/h	0	7	13	186	9	20	8	109	452	49	210	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, %	2	14	8	4	11	15	2	6	3	4	2	2
Mvmt Flow	0	7	13	186	9	20	8	109	452	49	210	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.6	12.6	19.2	12.1
HCM LOS	A	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	0%	87%	19%
Vol Thru, %	19%	35%	4%	81%
Vol Right, %	79%	65%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	569	20	215	260
LT Vol	8	0	186	49
Through Vol	109	7	9	210
RT Vol	452	13	20	1
Lane Flow Rate	569	20	215	260
Geometry Grp	1	1	1	1
Degree of Util (X)	0.732	0.035	0.364	0.396
Departure Headway (Hd)	4.632	6.262	6.103	5.478
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	785	568	587	655
Service Time	2.632	4.338	4.156	3.524
HCM Lane V/C Ratio	0.725	0.035	0.366	0.397
HCM Control Delay	19.2	9.6	12.6	12.1
HCM Lane LOS	C	A	B	B
HCM 95th-tile Q	6.5	0.1	1.7	1.9

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	175	46	35	135	56	29	333	42	38	291	24
Future Volume (vph)	36	175	46	35	135	56	29	333	42	38	291	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	1.00	
Frt		0.976			0.967			0.983			0.989	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1513	0	0	1497	0	1422	1496	0	1492	1503	0
Flt Permitted		0.924			0.901		0.558			0.511		
Satd. Flow (perm)	0	1406	0	0	1358	0	814	1496	0	789	1503	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			25			10			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
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 (%)	2%	2%	2%	2%	2%	2%	7%	5%	2%	2%	5%	4%
Adj. Flow (vph)	36	175	46	35	135	56	29	333	42	38	291	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	257	0	0	226	0	29	375	0	38	315	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FB - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		19.2			19.2		49.8	49.8		49.8	49.8	
Actuated g/C Ratio		0.24			0.24		0.62	0.62		0.62	0.62	
v/c Ratio		0.74			0.66		0.06	0.40		0.08	0.34	
Control Delay		38.2			32.5		8.4	10.3		4.5	5.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.2			32.5		8.4	10.3		4.5	5.0	
LOS		D			C		A	B		A	A	
Approach Delay		38.2			32.5			10.2			4.9	
Approach LOS		D			C			B			A	
Queue Length 50th (m)		33.9			27.5		1.6	24.7		1.5	12.3	
Queue Length 95th (m)		51.2			43.5		5.9	54.5		m3.2	21.6	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		578			564		506	935		491	938	
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			0.40		0.06	0.40		0.08	0.34	
Intersection Summary												
Area Type:	CBD											
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: 0.74												
Intersection Signal Delay: 18.6	Intersection LOS: B											

Lanes, Volumes, Timings 5: Churchill Ave N & Byron Ave

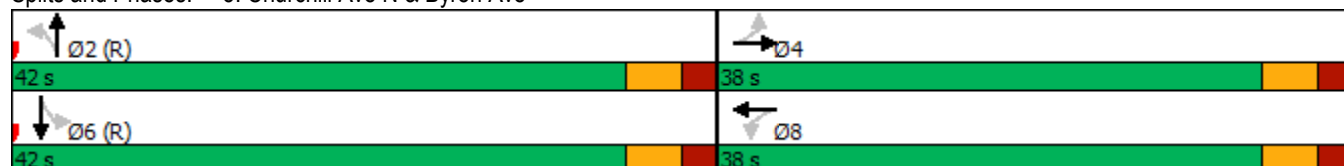
2027 FB - AM
Richmond / Churchill

Intersection Capacity Utilization 63.0% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2027 FB - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	175	46	35	135	56	29	333	42	38	291	24
Future Volume (veh/h)	36	175	46	35	135	56	29	333	42	38	291	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.98	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1514	1548	1620	1588	1544	1620
Adj Flow Rate, veh/h	36	175	46	35	135	56	29	333	42	38	291	24
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	7	5	5	2	5	5
Cap, veh/h	82	254	62	84	223	84	658	849	107	548	887	73
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	131	1097	268	140	962	363	900	1345	170	899	1405	116
Grp Volume(v), veh/h	257	0	0	226	0	0	29	0	375	38	0	315
Grp Sat Flow(s),veh/h/ln	1496	0	0	1464	0	0	900	0	1514	899	0	1521
Q Serve(g_s), s	1.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	9.7	0.7	0.0	0.0
Cycle Q Clear(g_c), s	12.4	0.0	0.0	10.9	0.0	0.0	1.0	0.0	9.7	10.4	0.0	0.0
Prop In Lane	0.14		0.18	0.15		0.25	1.00		0.11	1.00		0.08
Lane Grp Cap(c), veh/h	398	0	0	391	0	0	658	0	956	548	0	960
V/C Ratio(X)	0.65	0.00	0.00	0.58	0.00	0.00	0.04	0.00	0.39	0.07	0.00	0.33
Avail Cap(c_a), veh/h	646	0	0	634	0	0	658	0	956	548	0	960
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.74	0.00	0.74
Uniform Delay (d), s/veh	28.4	0.0	0.0	27.8	0.0	0.0	5.6	0.0	7.2	1.0	0.0	0.0
Incr Delay (d2), s/veh	1.8	0.0	0.0	1.4	0.0	0.0	0.1	0.0	1.2	0.2	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.0	0.0	4.7	0.0	0.0	0.3	0.0	4.4	0.2	0.0	0.2
LnGrp Delay(d),s/veh	30.2	0.0	0.0	29.1	0.0	0.0	5.8	0.0	8.4	1.2	0.0	0.7
LnGrp LOS	C			C			A		A	A		A
Approach Vol, veh/h		257			226			404			353	
Approach Delay, s/veh		30.2			29.1			8.3			0.7	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		55.9		24.1		55.9		24.1				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 37		32.4		* 37		32.4				
Max Q Clear Time (g_c+I1), s		11.7		14.4		12.4		12.9				
Green Ext Time (p_c), s		3.1		1.7		2.6		1.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.5								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FB - AM
Richmond / Churchill

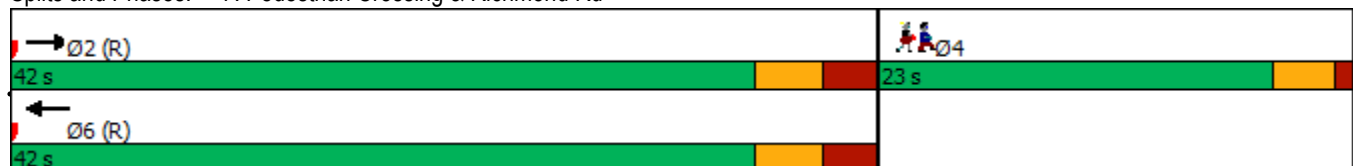
	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	479	0	0	300	0	0	
Future Volume (vph)	479	0	0	300	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	13.6		
Travel Time (s)	19.2			1.4	1.0		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	479	0	0	300	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	479	0	0	300	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FB - AM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	11.0			11.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							43
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.55			0.34			
Control Delay	12.3			9.4			
Queue Delay	0.0			0.0			
Total Delay	12.3			9.4			
LOS	B			A			
Approach Delay	12.3			9.4			
Approach LOS	B			A			
Queue Length 50th (m)	33.5			18.0			
Queue Length 95th (m)	57.1			31.8			
Internal Link Dist (m)	242.4			0.1	0.1		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.55			0.34			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 50							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.55							
Intersection Signal Delay: 11.2				Intersection LOS: B			
Intersection Capacity Utilization 34.6%				ICU Level of Service A			
Analysis Period (min) 15							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	195	338	57	131	485	29	28	297	69	17	244	314
Future Volume (vph)	195	338	57	131	485	29	28	297	69	17	244	314
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.96		0.84	0.99			0.97			0.88	
Frt		0.978			0.992			0.974			0.918	
Flt Protected	0.950			0.950				0.996			0.999	
Satd. Flow (prot)	1478	1324	0	1492	1387	0	0	2819	0	0	2421	0
Flt Permitted	0.281			0.529				0.811			0.932	
Satd. Flow (perm)	414	1324	0	698	1387	0	0	2284	0	0	2254	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4			25			305	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			316.0	
Travel Time (s)		21.4			19.2			9.0			22.8	
Confl. Peds. (#/hr)	99		154	154		99	78		53	53		78
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%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	195	338	57	131	485	29	28	297	69	17	244	314
Shared Lane Traffic (%)												
Lane Group Flow (vph)	195	395	0	131	514	0	0	394	0	0	575	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	31.1		31.1	31.1		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	
Total Split (%)	16.7%	61.1%		50.0%	50.0%		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	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6		3.6	3.6	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	56.5	56.5		41.4	41.4			21.2			21.2	
Actuated g/C Ratio	0.63	0.63		0.46	0.46			0.24			0.24	
v/c Ratio	0.53	0.47		0.41	0.80			0.71			0.75	
Control Delay	13.4	11.3		22.2	33.3			28.0			21.2	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.4	11.3		22.2	33.3			28.0			21.2	
LOS	B	B		C	C			C			C	
Approach Delay		12.0			31.1			28.0			21.2	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	13.2	31.7		15.2	76.3			16.6			22.4	
Queue Length 95th (m)	24.6	56.5		31.7	#136.1			m28.4			40.5	
Internal Link Dist (m)		273.0			242.4			101.1			292.0	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	369	835		321	640			562			768	
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	0.53	0.47		0.41	0.80			0.70			0.75	

Intersection Summary

Area Type: CBD
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.80

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings

1: Churchill Ave N & Richmond Rd

2027 FB - PM
Richmond / Churchill

Intersection Signal Delay: 22.8

Intersection LOS: C

Intersection Capacity Utilization 98.9%

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.

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

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Future Volume (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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			0.88			0.91	
Frt		0.991			0.994			0.938			0.964	
Flt Protected		0.999			0.998			0.980			0.980	
Satd. Flow (prot)	0	1382	0	0	1396	0	0	1348	0	0	1395	0
Flt Permitted		0.991			0.965			0.835			0.824	
Satd. Flow (perm)	0	1371	0	0	1345	0	0	1088	0	0	1124	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			46			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	48		99	99		48	72		57	57		72
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 (%)	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	6%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	6	435	33	40	792	39	46	16	52	44	35	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	474	0	0	871	0	0	114	0	0	108	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

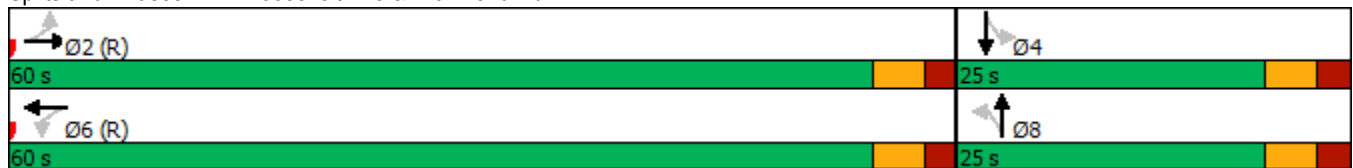
Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		33.5	33.5		24.6	24.6		24.6	24.6	
Total Split (s)	60.0	60.0		60.0	60.0		25.0	25.0		25.0	25.0	
Total Split (%)	70.6%	70.6%		70.6%	70.6%		29.4%	29.4%		29.4%	29.4%	
Maximum Green (s)	54.6	54.6		54.6	54.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		65.2			65.2			13.0			13.0	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
v/c Ratio		0.45			0.84			0.56			0.57	
Control Delay		7.0			20.5			30.9			38.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.0			20.5			30.9			38.8	
LOS		A			C			C			D	
Approach Delay		7.0			20.5			30.9			38.8	
Approach LOS		A			C			C			D	
Queue Length 50th (m)		25.3			87.7			10.3			13.5	
Queue Length 95th (m)		57.4			#215.5			24.4			27.2	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1054			1033			283			271	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.45			0.84			0.40			0.40	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 78 (92%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.84												
Intersection Signal Delay: 18.4							Intersection LOS: B					
Intersection Capacity Utilization 104.6%							ICU Level of Service G					
Analysis Period (min) 15												

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	435	33	40	792	39	46	16	52	44	35	29
Future Volume (veh/h)	6	435	33	40	792	39	46	16	52	44	35	29
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93	0.98		0.93	0.86		0.82	0.87		0.82
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1620	1588	1620	1620	1588	1620
Adj Flow Rate, veh/h	6	435	33	40	792	39	46	16	52	44	35	29
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	6	6	6
Cap, veh/h	46	957	72	72	945	46	141	53	113	146	103	70
Arrive On Green	0.67	0.67	0.67	0.67	0.67	0.67	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	5	1438	108	41	1420	68	399	260	552	421	505	340
Grp Volume(v), veh/h	474	0	0	871	0	0	114	0	0	108	0	0
Grp Sat Flow(s),veh/h/ln	1551	0	0	1530	0	0	1211	0	0	1266	0	0
Q Serve(g_s), s	0.0	0.0	0.0	14.1	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.4	0.0	0.0	36.8	0.0	0.0	6.2	0.0	0.0	5.5	0.0	0.0
Prop In Lane	0.01		0.07	0.05		0.04	0.40		0.46	0.41		0.27
Lane Grp Cap(c), veh/h	1075	0	0	1063	0	0	307	0	0	319	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.37	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	1075	0	0	1063	0	0	334	0	0	347	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.49	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	6.8	0.0	0.0	10.7	0.0	0.0	29.3	0.0	0.0	29.1	0.0	0.0
Incr Delay (d2), s/veh	1.3	0.0	0.0	3.6	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.0	16.6	0.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0
LnGrp Delay(d),s/veh	8.1	0.0	0.0	14.4	0.0	0.0	30.1	0.0	0.0	29.7	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		474			871			114			108	
Approach Delay, s/veh		8.1			14.4			30.1			29.7	
Approach LOS		A			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		62.0		23.0		62.0		23.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 55		19.4		* 55		19.4				
Max Q Clear Time (g_c+I1), s		14.4		7.5		38.8		8.2				
Green Ext Time (p_c), s		4.2		0.5		7.1		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.7								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	389	12	22	662	13	9	4	22	10	3	14
Future Volume (vph)	12	389	12	22	662	13	9	4	22	10	3	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Frt		0.996			0.997			0.915			0.930	
Flt Protected		0.999			0.998			0.987			0.982	
Satd. Flow (prot)	0	1406	0	0	1406	0	0	1418	0	0	1434	0
Flt Permitted		0.999			0.998			0.987			0.982	
Satd. Flow (perm)	0	1406	0	0	1406	0	0	1418	0	0	1434	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
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
Parking (#/hr)		0			0							
Adj. Flow (vph)	12	389	12	22	662	13	9	4	22	10	3	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	413	0	0	697	0	0	35	0	0	27	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	63.1%						ICU Level of Service B					
Analysis Period (min)	15											

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	389	12	22	662	13	9	4	22	10	3	14
Future Vol, veh/h	12	389	12	22	662	13	9	4	22	10	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	389	12	22	662	13	9	4	22	10	3	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	675	0	0	401	0	0	1140	1138	395	1145	1138	669
Stage 1	-	-	-	-	-	-	419	419	-	713	713	-
Stage 2	-	-	-	-	-	-	721	719	-	432	425	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	916	-	-	1158	-	-	178	201	654	177	201	458
Stage 1	-	-	-	-	-	-	612	590	-	423	435	-
Stage 2	-	-	-	-	-	-	419	433	-	602	586	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	916	-	-	1158	-	-	164	192	654	162	192	458
Mov Cap-2 Maneuver	-	-	-	-	-	-	164	192	-	162	192	-
Stage 1	-	-	-	-	-	-	602	580	-	416	422	-
Stage 2	-	-	-	-	-	-	391	420	-	568	576	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.3			17.6			21.1		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	320	916	-	-	1158	-	-	250				
HCM Lane V/C Ratio	0.109	0.013	-	-	0.019	-	-	0.108				
HCM Control Delay (s)	17.6	9	0	-	8.2	0	-	21.1				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	0.4				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Future Volume (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt	0.905				0.989				0.906		0.999	
Flt Protected					0.957				0.999		0.989	
Satd. Flow (prot)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Flt Permitted					0.957				0.999		0.989	
Satd. Flow (perm)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Link Speed (k/h)	50				50				50		50	
Link Distance (m)	73.0				110.8				316.0		99.4	
Travel Time (s)	5.3				8.0				22.8		7.2	
Confl. Peds. (#/hr)	32		18	18		32	39		9	9		39
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 (%)	2%	2%	2%	2%	2%	12%	2%	4%	3%	10%	4%	2%
Parking (#/hr)	0											
Adj. Flow (vph)	0	5	12	366	5	33	11	116	289	39	136	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	0	0	404	0	0	416	0	0	176	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				0.0		0.0	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	3.0				3.0				3.0		3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control	Stop				Stop				Stop		Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	72.6%											
Analysis Period (min)	15											
ICU Level of Service C												

Intersection	
Intersection Delay, s/veh	15.7
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔			↔			↔	
Traffic Vol, veh/h	0	5	12	366	5	33	11	116	289	39	136	1
Future Vol, veh/h	0	5	12	366	5	33	11	116	289	39	136	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, %	2	2	2	2	2	12	2	4	3	10	4	2
Mvmt Flow	0	5	12	366	5	33	11	116	289	39	136	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.2	18.2	15.2	11.6
HCM LOS	A	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	0%	91%	22%
Vol Thru, %	28%	29%	1%	77%
Vol Right, %	69%	71%	8%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	416	17	404	176
LT Vol	11	0	366	39
Through Vol	116	5	5	136
RT Vol	289	12	33	1
Lane Flow Rate	416	17	404	176
Geometry Grp	1	1	1	1
Degree of Util (X)	0.588	0.028	0.637	0.294
Departure Headway (Hd)	5.092	5.911	5.673	6.014
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	707	601	634	595
Service Time	3.143	3.992	3.717	4.077
HCM Lane V/C Ratio	0.588	0.028	0.637	0.296
HCM Control Delay	15.2	9.2	18.2	11.6
HCM Lane LOS	C	A	C	B
HCM 95th-tile Q	3.9	0.1	4.5	1.2

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	148	61	86	332	69	33	300	94	28	323	70
Future Volume (vph)	45	148	61	86	332	69	33	300	94	28	323	70
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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	0.98	
Frt		0.968			0.981			0.964			0.973	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1489	0	0	1521	0	1478	1493	0	1492	1490	0
Flt Permitted		0.858			0.892		0.439			0.438		
Satd. Flow (perm)	0	1287	0	0	1364	0	659	1493	0	676	1490	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			12			22			15	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	15		17	17		15	33		16	16		33
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 (%)	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%
Adj. Flow (vph)	45	148	61	86	332	69	33	300	94	28	323	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	254	0	0	487	0	33	394	0	28	393	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FB - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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)		35.3			35.3		43.7	43.7		43.7	43.7	
Actuated g/C Ratio		0.39			0.39		0.49	0.49		0.49	0.49	
v/c Ratio		0.49			0.90		0.10	0.54		0.09	0.54	
Control Delay		21.4			45.8		15.7	19.7		13.7	18.2	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.5	
Total Delay		21.4			45.8		15.7	19.7		13.7	18.7	
LOS		C			D		B	B		B	B	
Approach Delay		21.4			45.8			19.4			18.4	
Approach LOS		C			D			B			B	
Queue Length 50th (m)		28.0			72.1		3.1	45.1		2.8	44.5	
Queue Length 95th (m)		47.1			#123.7		9.0	75.9		m4.8	m58.0	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		575			603		320	736		328	731	
Starvation Cap Reductn		0			0		0	0		0	90	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.44			0.81		0.10	0.54		0.09	0.61	
Intersection Summary												
Area Type:	CBD											
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: 0.90												
Intersection Signal Delay: 27.5	Intersection LOS: C											

Lanes, Volumes, Timings 5: Churchill Ave N & Byron Ave

2027 FB - PM
Richmond / Churchill

Intersection Capacity Utilization 83.0% ICU Level of Service E

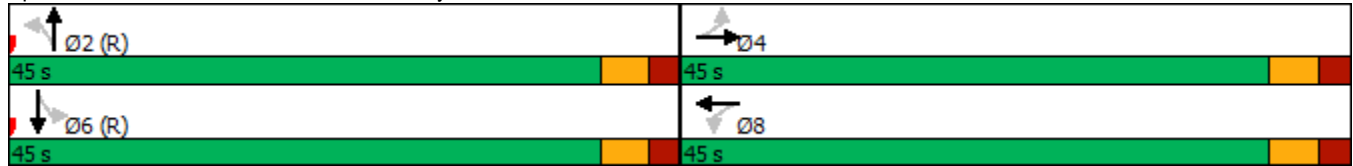
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2027 FB - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	148	61	86	332	69	33	300	94	28	323	70
Future Volume (veh/h)	45	148	61	86	332	69	33	300	94	28	323	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.99	0.98		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1573	1588	1620	1588	1576	1620
Adj Flow Rate, veh/h	45	148	61	86	332	69	33	300	94	28	323	70
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	3	2	2	2	3	3
Cap, veh/h	101	290	109	122	382	75	519	585	183	376	634	137
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	1.00	1.00	1.00
Sat Flow, veh/h	145	785	294	203	1034	204	863	1150	360	885	1247	270
Grp Volume(v), veh/h	254	0	0	487	0	0	33	0	394	28	0	393
Grp Sat Flow(s),veh/h/ln	1224	0	0	1441	0	0	863	0	1510	885	0	1517
Q Serve(g_s), s	0.0	0.0	0.0	16.1	0.0	0.0	1.8	0.0	15.6	1.0	0.0	0.0
Cycle Q Clear(g_c), s	12.8	0.0	0.0	28.9	0.0	0.0	1.8	0.0	15.6	16.7	0.0	0.0
Prop In Lane	0.18		0.24	0.18		0.14	1.00		0.24	1.00		0.18
Lane Grp Cap(c), veh/h	499	0	0	579	0	0	519	0	768	376	0	771
V/C Ratio(X)	0.51	0.00	0.00	0.84	0.00	0.00	0.06	0.00	0.51	0.07	0.00	0.51
Avail Cap(c_a), veh/h	590	0	0	676	0	0	519	0	768	376	0	771
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.67	0.00	0.67
Uniform Delay (d), s/veh	21.6	0.0	0.0	26.8	0.0	0.0	11.3	0.0	14.7	2.8	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	8.2	0.0	0.0	0.2	0.0	2.4	0.3	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	0.0	0.0	12.8	0.0	0.0	0.5	0.0	7.0	0.3	0.0	0.3
LnGrp Delay(d),s/veh	22.4	0.0	0.0	35.0	0.0	0.0	11.5	0.0	17.2	3.1	0.0	1.6
LnGrp LOS	C			D			B		B	A		A
Approach Vol, veh/h		254			487			427			421	
Approach Delay, s/veh		22.4			35.0			16.7			1.7	
Approach LOS		C			D			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		51.2		38.8		51.2		38.8				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		39.4		* 40		39.4				
Max Q Clear Time (g_c+I1), s		17.6		14.8		18.7		30.9				
Green Ext Time (p_c), s		3.2		1.9		3.1		2.4				
Intersection Summary												
HCM 2010 Ctrl Delay				19.3								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FB - PM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations							
Traffic Volume (vph)	402	0	0	677	0	0	
Future Volume (vph)	402	0	0	677	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	33.7		
Travel Time (s)	19.2			1.4	2.4		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	402	0	0	677	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	402	0	0	677	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FB - PM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	24.0			24.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							51
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.46			0.78			
Control Delay	10.9			19.6			
Queue Delay	0.0			0.0			
Total Delay	10.9			19.6			
LOS	B			B			
Approach Delay	10.9			19.6			
Approach LOS	B			B			
Queue Length 50th (m)	26.3			57.8			
Queue Length 95th (m)	44.9			#108.7			
Internal Link Dist (m)	242.4			0.1	9.7		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.46			0.78			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 60							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.78							
Intersection Signal Delay: 16.3				Intersection LOS: B			
Intersection Capacity Utilization 46.8%				ICU Level of Service A			
Analysis Period (min) 15							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd

 Ø2 (R)	 Ø4
42 s	23 s
 Ø6 (R)	
42 s	

Appendix N

2022 Future Total Synchro Worksheets

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	384	38	53	188	22	28	309	103	25	288	147
Future Volume (vph)	297	384	38	53	188	22	28	309	103	25	288	147
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.99		0.96	0.99			0.98			0.97	
Frt		0.986			0.984			0.965			0.952	
Flt Protected	0.950			0.950				0.997			0.997	
Satd. Flow (prot)	1478	1382	0	1396	1337	0	0	2747	0	0	2642	0
Flt Permitted	0.508			0.516				0.894			0.906	
Satd. Flow (perm)	750	1382	0	727	1337	0	0	2456	0	0	2397	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			8			51			99	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			63.4	
Travel Time (s)		21.4			19.2			9.0			4.6	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
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%	2%	2%	9%	5%	5%	8%	5%	2%	13%	6%	4%
Parking (#/hr)		0			0							
Adj. Flow (vph)	297	384	38	53	188	22	28	309	103	25	288	147
Shared Lane Traffic (%)												
Lane Group Flow (vph)	297	422	0	53	210	0	0	440	0	0	460	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	30.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	36.1		31.1	31.1		24.2	24.2		24.2	24.2	
Total Split (s)	14.0	40.0		31.0	31.0		30.0	30.0		30.0	30.0	
Total Split (%)	17.5%	50.0%		38.8%	38.8%		37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	7.9	33.9		24.9	24.9		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	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	48.1	48.1		29.3	29.3			19.6			19.6	
Actuated g/C Ratio	0.60	0.60		0.37	0.37			0.24			0.24	
v/c Ratio	0.52	0.51		0.20	0.43			0.69			0.69	
Control Delay	12.3	12.2		22.0	23.0			23.7			27.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.3	12.2		22.0	23.0			23.7			27.1	
LOS	B	B		C	C			C			C	
Approach Delay		12.2			22.8			23.7			27.1	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	19.1	30.5		5.3	22.1			30.2			27.0	
Queue Length 95th (m)	39.4	63.1		14.9	44.7			21.3			39.0	
Internal Link Dist (m)		273.0			242.4			101.1			39.4	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	566	833		265	494			766			782	
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	0.52	0.51		0.20	0.43			0.57			0.59	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 43 (54%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69

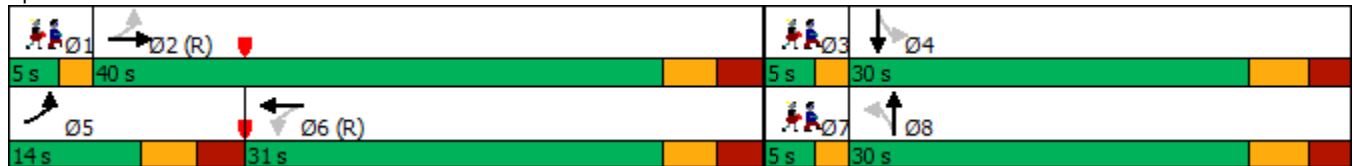
Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	3.0	3.0	3.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	6%	6%	6%
Maximum Green (s)	3.0	3.0	3.0
Yellow Time (s)	2.0	2.0	2.0
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	None	None	None
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FT - AM
Richmond / Churchill

Intersection Signal Delay: 20.0	Intersection LOS: C
Intersection Capacity Utilization 92.8%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Future Volume (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		1.00			0.99			0.92			0.94	
Frt		0.995			0.988			0.924			0.974	
Flt Protected		0.999			0.997			0.985			0.970	
Satd. Flow (prot)	0	1374	0	0	1351	0	0	1252	0	0	1453	0
Flt Permitted		0.995			0.948			0.889			0.808	
Satd. Flow (perm)	0	1368	0	0	1282	0	0	1102	0	0	1158	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			12			45			17	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	80		65	65		80	48		42	42		48
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 (%)	2%	4%	2%	4%	4%	3%	12%	2%	11%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	595	0	0	413	0	0	80	0	0	88	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		34.4	34.4		24.6	24.6		24.6	24.6	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.6	39.6		39.6	39.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		51.8			51.8			11.4			11.4	
Actuated g/C Ratio		0.74			0.74			0.16			0.16	
v/c Ratio		0.59			0.43			0.37			0.44	
Control Delay		9.4			6.9			18.6			28.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		9.4			6.9			18.6			28.6	
LOS		A			A			B			C	
Approach Delay		9.4			6.9			18.6			28.6	
Approach LOS		A			A			B			C	
Queue Length 50th (m)		33.1			18.5			4.1			8.6	
Queue Length 95th (m)		79.8			44.7			14.2			19.6	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1013			952			337			333	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.59			0.43			0.24			0.26	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 27 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.59												
Intersection Signal Delay: 10.6						Intersection LOS: B						
Intersection Capacity Utilization 68.6%						ICU Level of Service C						
Analysis Period (min) 15												

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	566	21	28	347	38	25	10	45	55	16	17
Future Volume (veh/h)	8	566	21	28	347	38	25	10	45	55	16	17
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.94	0.99		0.94	0.91		0.89	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1559	1620	1620	1559	1620	1620	1470	1620	1620	1588	1620
Adj Flow Rate, veh/h	8	566	21	28	347	38	25	10	45	55	16	17
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	56	922	34	85	800	84	124	55	143	240	66	53
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	6	1480	54	49	1284	135	256	249	650	711	301	242
Grp Volume(v), veh/h	595	0	0	413	0	0	80	0	0	88	0	0
Grp Sat Flow(s),veh/h/ln	1540	0	0	1468	0	0	1155	0	0	1255	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	16.5	0.0	0.0	9.8	0.0	0.0	3.7	0.0	0.0	3.5	0.0	0.0
Prop In Lane	0.01		0.04	0.07		0.09	0.31		0.56	0.62		0.19
Lane Grp Cap(c), veh/h	1012	0	0	970	0	0	321	0	0	359	0	0
V/C Ratio(X)	0.59	0.00	0.00	0.43	0.00	0.00	0.25	0.00	0.00	0.24	0.00	0.00
Avail Cap(c_a), veh/h	1012	0	0	970	0	0	386	0	0	427	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.91	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.1	0.0	0.0	6.8	0.0	0.0	22.8	0.0	0.0	22.7	0.0	0.0
Incr Delay (d2), s/veh	2.5	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	0.0	0.0	4.4	0.0	0.0	1.3	0.0	0.0	1.5	0.0	0.0
LnGrp Delay(d),s/veh	10.6	0.0	0.0	8.1	0.0	0.0	23.2	0.0	0.0	23.0	0.0	0.0
LnGrp LOS	B			A			C			C		
Approach Vol, veh/h		595			413			80			88	
Approach Delay, s/veh		10.6			8.1			23.2			23.0	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		49.0		21.0		49.0		21.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		19.4		* 40		19.4				
Max Q Clear Time (g_c+I1), s		18.5		5.5		11.8		5.7				
Green Ext Time (p_c), s		4.8		0.4		3.5		0.3				
Intersection Summary												
HCM 2010 Ctrl Delay				11.5								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	454	7	5	288	20	2	16	15	10	9	11
Future Volume (vph)	20	454	7	5	288	20	2	16	15	10	9	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.998			0.991			0.939			0.950	
Flt Protected		0.998			0.999			0.997			0.984	
Satd. Flow (prot)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Flt Permitted		0.998			0.999			0.997			0.984	
Satd. Flow (perm)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
Confl. Peds. (#/hr)	39		44	44		39						
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 (%)	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	20	454	7	5	288	20	2	16	15	10	9	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	481	0	0	313	0	0	33	0	0	30	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	54.3%											
Analysis Period (min)	15											
	ICU Level of Service A											

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	454	7	5	288	20	2	16	15	10	9	11
Future Vol, veh/h	20	454	7	5	288	20	2	16	15	10	9	11
Conflicting Peds, #/hr	39	0	44	44	0	39	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	3	2	2	2	2	2	2	2
Mvmt Flow	20	454	7	5	288	20	2	16	15	10	9	11
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	347	0	0	505	0	0	860	899	502	860	892	337
Stage 1	-	-	-	-	-	-	542	542	-	347	347	-
Stage 2	-	-	-	-	-	-	318	357	-	513	545	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1212	-	-	1060	-	-	276	279	569	276	281	705
Stage 1	-	-	-	-	-	-	525	520	-	669	635	-
Stage 2	-	-	-	-	-	-	693	628	-	544	519	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1175	-	-	1024	-	-	250	254	550	242	256	684
Mov Cap-2 Maneuver	-	-	-	-	-	-	250	254	-	242	256	-
Stage 1	-	-	-	-	-	-	496	491	-	634	612	-
Stage 2	-	-	-	-	-	-	668	605	-	500	490	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.1			16.9			17.2		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	336	1175	-	-	1024	-	-	324				
HCM Lane V/C Ratio	0.098	0.017	-	-	0.005	-	-	0.093				
HCM Control Delay (s)	16.9	8.1	0	-	8.5	0	-	17.2				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Future Volume (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.912			0.988			0.893			0.999	
Flt Protected					0.958			0.999			0.991	
Satd. Flow (prot)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Flt Permitted					0.958			0.999			0.991	
Satd. Flow (perm)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			252.6			99.4	
Travel Time (s)		5.3			8.0			18.2			7.2	
Confl. Peds. (#/hr)	41		7	7		41	38		10	10		38
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 (%)	2%	14%	8%	4%	11%	15%	2%	6%	3%	4%	2%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	217	0	0	575	0	0	260	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	77.6%											
Analysis Period (min)	15											
ICU Level of Service D												

Intersection	
Intersection Delay, s/veh	16.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	0	7	13	188	9	20	8	110	457	49	210	1
Future Vol, veh/h	0	7	13	188	9	20	8	110	457	49	210	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, %	2	14	8	4	11	15	2	6	3	4	2	2
Mvmt Flow	0	7	13	188	9	20	8	110	457	49	210	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.6	12.7	19.7	12.1
HCM LOS	A	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	0%	87%	19%
Vol Thru, %	19%	35%	4%	81%
Vol Right, %	79%	65%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	575	20	217	260
LT Vol	8	0	188	49
Through Vol	110	7	9	210
RT Vol	457	13	20	1
Lane Flow Rate	575	20	217	260
Geometry Grp	1	1	1	1
Degree of Util (X)	0.742	0.035	0.369	0.397
Departure Headway (Hd)	4.643	6.288	6.121	5.496
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	782	566	586	653
Service Time	2.643	4.368	4.175	3.546
HCM Lane V/C Ratio	0.735	0.035	0.37	0.398
HCM Control Delay	19.7	9.6	12.7	12.1
HCM Lane LOS	C	A	B	B
HCM 95th-tile Q	6.8	0.1	1.7	1.9

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	172	46	35	127	57	29	335	42	40	296	24
Future Volume (vph)	36	172	46	35	127	57	29	335	42	40	296	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	1.00	
Frt		0.976			0.965			0.983			0.989	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1513	0	0	1494	0	1422	1496	0	1492	1503	0
Flt Permitted		0.926			0.898		0.554			0.510		
Satd. Flow (perm)	0	1409	0	0	1350	0	808	1496	0	788	1503	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			27			10			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
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 (%)	2%	2%	2%	2%	2%	2%	7%	5%	2%	2%	5%	4%
Adj. Flow (vph)	36	172	46	35	127	57	29	335	42	40	296	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	254	0	0	219	0	29	377	0	40	320	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		19.0			19.0		50.0	50.0		50.0	50.0	
Actuated g/C Ratio		0.24			0.24		0.62	0.62		0.62	0.62	
v/c Ratio		0.73			0.64		0.06	0.40		0.08	0.34	
Control Delay		38.0			31.8		8.3	10.2		4.3	4.8	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.0			31.8		8.3	10.2		4.3	4.8	
LOS		D			C		A	B		A	A	
Approach Delay		38.0			31.8			10.1			4.7	
Approach LOS		D			C			B			A	
Queue Length 50th (m)		33.3			26.2		1.5	24.7		1.5	12.0	
Queue Length 95th (m)		50.6			42.0		5.9	54.2		m3.2	20.9	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		580			562		505	939		492	942	
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			0.39		0.06	0.40		0.08	0.34	
Intersection Summary												
Area Type:	CBD											
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: 18.1	Intersection LOS: B											

Lanes, Volumes, Timings
 5: Churchill Ave N & Byron Ave

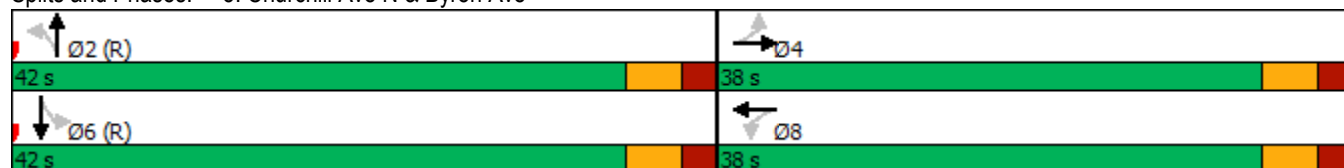
2022 FT - AM
 Richmond / Churchill

Intersection Capacity Utilization 62.8% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2022 FT - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	172	46	35	127	57	29	335	42	40	296	24
Future Volume (veh/h)	36	172	46	35	127	57	29	335	42	40	296	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.98	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1514	1548	1620	1588	1544	1620
Adj Flow Rate, veh/h	36	172	46	35	127	57	29	335	42	40	296	24
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	7	5	5	2	5	5
Cap, veh/h	82	251	62	85	215	87	657	852	107	549	891	72
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	133	1093	271	144	937	380	896	1346	169	897	1407	114
Grp Volume(v), veh/h	254	0	0	219	0	0	29	0	377	40	0	320
Grp Sat Flow(s),veh/h/ln	1497	0	0	1461	0	0	896	0	1515	897	0	1522
Q Serve(g_s), s	1.7	0.0	0.0	0.0	0.0	0.0	1.0	0.0	9.7	0.7	0.0	0.0
Cycle Q Clear(g_c), s	12.3	0.0	0.0	10.6	0.0	0.0	1.0	0.0	9.7	10.5	0.0	0.0
Prop In Lane	0.14		0.18	0.16		0.26	1.00		0.11	1.00		0.08
Lane Grp Cap(c), veh/h	395	0	0	388	0	0	657	0	958	549	0	963
V/C Ratio(X)	0.64	0.00	0.00	0.56	0.00	0.00	0.04	0.00	0.39	0.07	0.00	0.33
Avail Cap(c_a), veh/h	646	0	0	632	0	0	657	0	958	549	0	963
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.72	0.00	0.72
Uniform Delay (d), s/veh	28.4	0.0	0.0	27.8	0.0	0.0	5.6	0.0	7.2	1.0	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.0	1.3	0.0	0.0	0.1	0.0	1.2	0.2	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.3	0.0	0.0	4.5	0.0	0.0	0.3	0.0	4.3	0.2	0.0	0.2
LnGrp Delay(d),s/veh	30.2	0.0	0.0	29.1	0.0	0.0	5.7	0.0	8.4	1.2	0.0	0.7
LnGrp LOS	C			C			A		A	A		A
Approach Vol, veh/h		254			219			406			360	
Approach Delay, s/veh		30.2			29.1			8.2			0.7	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		56.0		24.0		56.0		24.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 37		32.4		* 37		32.4				
Max Q Clear Time (g_c+I1), s		11.7		14.3		12.5		12.6				
Green Ext Time (p_c), s		3.1		1.6		2.6		1.4				
Intersection Summary												
HCM 2010 Ctrl Delay				14.2								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
6: Churchill Ave N & Site Access #1

2022 FT - AM
Richmond / Churchill

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	10	5	617	4	2	430
Future Volume (vph)	10	5	617	4	2	430
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt	0.955		0.999			
Flt Protected	0.968					
Satd. Flow (prot)	1452	0	1569	0	0	2984
Flt Permitted	0.968					
Satd. Flow (perm)	1452	0	1569	0	0	2984
Link Speed (k/h)	30		50			50
Link Distance (m)	87.9		63.4			252.6
Travel Time (s)	10.5		4.6			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	5	617	4	2	430
Shared Lane Traffic (%)						
Lane Group Flow (vph)	15	0	621	0	0	432
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	3.0		3.0			3.0
Two way Left Turn Lane						
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	CBD					
Control Type:	Unsignalized					
Intersection Capacity Utilization	48.4%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	5	617	4	2	430
Future Vol, veh/h	10	5	617	4	2	430
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	5	617	4	2	430
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	838	619	0	0	621	0
Stage 1	619	-	-	-	-	-
Stage 2	219	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	320	488	-	-	958	-
Stage 1	536	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	319	488	-	-	958	-
Mov Cap-2 Maneuver	319	-	-	-	-	-
Stage 1	536	-	-	-	-	-
Stage 2	795	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	15.4	0		0		
HCM LOS	C					
Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT		
Capacity (veh/h)	-	-	361	958	-	
HCM Lane V/C Ratio	-	-	0.042	0.002	-	
HCM Control Delay (s)	-	-	15.4	8.8	0	
HCM Lane LOS	-	-	C	A	A	
HCM 95th %tile Q(veh)	-	-	0.1	0	-	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FT - AM
Richmond / Churchill

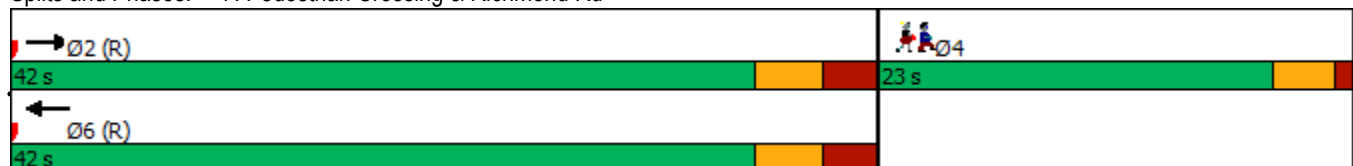
							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations							
Traffic Volume (vph)	481	0	0	301	0	0	
Future Volume (vph)	481	0	0	301	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	13.6		
Travel Time (s)	19.2			1.4	1.0		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	481	0	0	301	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	481	0	0	301	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FT - AM
Richmond / Churchill

							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	11.0			11.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							43
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.55			0.35			
Control Delay	12.4			9.4			
Queue Delay	0.0			0.0			
Total Delay	12.4			9.4			
LOS	B			A			
Approach Delay	12.4			9.4			
Approach LOS	B			A			
Queue Length 50th (m)	33.7			18.1			
Queue Length 95th (m)	57.4			31.8			
Internal Link Dist (m)	242.4			0.1	0.1		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.55			0.35			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 50							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.55							
Intersection Signal Delay: 11.2				Intersection LOS: B			
Intersection Capacity Utilization 34.7%				ICU Level of Service A			
Analysis Period (min) 15							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	329	57	129	479	29	28	306	67	18	250	315
Future Volume (vph)	197	329	57	129	479	29	28	306	67	18	250	315
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.96		0.84	0.99			0.97			0.88	
Frt		0.978			0.991			0.975			0.919	
Flt Protected	0.950			0.950				0.997			0.998	
Satd. Flow (prot)	1478	1323	0	1492	1385	0	0	2828	0	0	2425	0
Flt Permitted	0.283			0.533				0.812			0.931	
Satd. Flow (perm)	417	1323	0	701	1385	0	0	2293	0	0	2257	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4			24			301	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			63.4	
Travel Time (s)		21.4			19.2			9.0			4.6	
Confl. Peds. (#/hr)	99		154	154		99	78		53	53		78
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%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	197	329	57	129	479	29	28	306	67	18	250	315
Shared Lane Traffic (%)												
Lane Group Flow (vph)	197	386	0	129	508	0	0	401	0	0	583	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	31.1		31.1	31.1		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	
Total Split (%)	16.7%	61.1%		50.0%	50.0%		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	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6		3.6	3.6	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	56.2	56.2		41.2	41.2			21.5			21.5	
Actuated g/C Ratio	0.62	0.62		0.46	0.46			0.24			0.24	
v/c Ratio	0.54	0.46		0.40	0.80			0.71			0.76	
Control Delay	13.6	11.3		22.1	33.3			28.3			21.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.6	11.3		22.1	33.3			28.3			21.8	
LOS	B	B		C	C			C			C	
Approach Delay		12.1			31.1			28.3			21.8	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	13.7	31.3		15.1	75.7			16.9			23.4	
Queue Length 95th (m)	24.9	54.5		31.0	#133.7			m29.2			42.1	
Internal Link Dist (m)		273.0			242.4			101.1			39.4	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	369	831		320	635			570			771	
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	0.53	0.46		0.40	0.80			0.70			0.76	

Intersection Summary

Area Type: CBD
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.80

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings 1: Churchill Ave N & Richmond Rd

2022 FT - PM
Richmond / Churchill

Intersection Signal Delay: 23.1

Intersection LOS: C

Intersection Capacity Utilization 99.5%

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: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Future Volume (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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			0.88			0.91	
Frt		0.991			0.994			0.938			0.964	
Flt Protected		0.999			0.998			0.980			0.980	
Satd. Flow (prot)	0	1382	0	0	1396	0	0	1348	0	0	1395	0
Flt Permitted		0.991			0.965			0.835			0.824	
Satd. Flow (perm)	0	1371	0	0	1345	0	0	1088	0	0	1124	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			46			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	48		99	99		48	72		57	57		72
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 (%)	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	6%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	476	0	0	872	0	0	114	0	0	108	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		33.5	33.5		24.6	24.6		24.6	24.6	
Total Split (s)	60.0	60.0		60.0	60.0		25.0	25.0		25.0	25.0	
Total Split (%)	70.6%	70.6%		70.6%	70.6%		29.4%	29.4%		29.4%	29.4%	
Maximum Green (s)	54.6	54.6		54.6	54.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		65.2			65.2			13.0			13.0	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
v/c Ratio		0.45			0.84			0.56			0.57	
Control Delay		7.0			20.6			30.9			38.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.0			20.6			30.9			38.8	
LOS		A			C			C			D	
Approach Delay		7.0			20.6			30.9			38.8	
Approach LOS		A			C			C			D	
Queue Length 50th (m)		25.4			88.0			10.3			13.5	
Queue Length 95th (m)		57.9			#215.8			24.4			27.2	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1054			1033			283			271	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.45			0.84			0.40			0.40	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 78 (92%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.84												
Intersection Signal Delay: 18.5							Intersection LOS: B					
Intersection Capacity Utilization 104.7%							ICU Level of Service G					
Analysis Period (min) 15												

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	437	33	40	793	39	46	16	52	44	35	29
Future Volume (veh/h)	6	437	33	40	793	39	46	16	52	44	35	29
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93	0.98		0.93	0.86		0.82	0.87		0.82
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1620	1588	1620	1620	1588	1620
Adj Flow Rate, veh/h	6	437	33	40	793	39	46	16	52	44	35	29
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	6	6	6
Cap, veh/h	46	958	72	72	945	46	141	53	113	146	103	70
Arrive On Green	0.67	0.67	0.67	0.67	0.67	0.67	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	5	1438	108	41	1420	68	399	260	552	421	505	340
Grp Volume(v), veh/h	476	0	0	872	0	0	114	0	0	108	0	0
Grp Sat Flow(s),veh/h/ln	1551	0	0	1529	0	0	1211	0	0	1266	0	0
Q Serve(g_s), s	0.0	0.0	0.0	14.2	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.5	0.0	0.0	36.9	0.0	0.0	6.2	0.0	0.0	5.5	0.0	0.0
Prop In Lane	0.01		0.07	0.05		0.04	0.40		0.46	0.41		0.27
Lane Grp Cap(c), veh/h	1075	0	0	1063	0	0	307	0	0	319	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.37	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	1075	0	0	1063	0	0	334	0	0	347	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	0.00	0.50	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	6.8	0.0	0.0	10.8	0.0	0.0	29.3	0.0	0.0	29.1	0.0	0.0
Incr Delay (d2), s/veh	1.3	0.0	0.0	3.7	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.0	16.6	0.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0
LnGrp Delay(d),s/veh	8.2	0.0	0.0	14.5	0.0	0.0	30.1	0.0	0.0	29.7	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		476			872			114			108	
Approach Delay, s/veh		8.2			14.5			30.1			29.7	
Approach LOS		A			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		62.0		23.0		62.0		23.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 55		19.4		* 55		19.4				
Max Q Clear Time (g_c+I1), s		14.5		7.5		38.9		8.2				
Green Ext Time (p_c), s		4.2		0.5		7.1		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.7								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	379	12	22	656	13	9	4	21	10	3	14
Future Volume (vph)	12	379	12	22	656	13	9	4	21	10	3	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Frt		0.996			0.997			0.917			0.930	
Flt Protected		0.999			0.998			0.987			0.982	
Satd. Flow (prot)	0	1406	0	0	1406	0	0	1422	0	0	1434	0
Flt Permitted		0.999			0.998			0.987			0.982	
Satd. Flow (perm)	0	1406	0	0	1406	0	0	1422	0	0	1434	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
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
Parking (#/hr)		0			0							
Adj. Flow (vph)	12	379	12	22	656	13	9	4	21	10	3	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	403	0	0	691	0	0	34	0	0	27	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	62.6%						ICU Level of Service B					
Analysis Period (min)	15											

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	379	12	22	656	13	9	4	21	10	3	14
Future Vol, veh/h	12	379	12	22	656	13	9	4	21	10	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	379	12	22	656	13	9	4	21	10	3	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	669	0	0	391	0	0	1124	1122	385	1129	1122	663
Stage 1	-	-	-	-	-	-	409	409	-	707	707	-
Stage 2	-	-	-	-	-	-	715	713	-	422	415	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	921	-	-	1168	-	-	183	206	663	181	206	461
Stage 1	-	-	-	-	-	-	619	596	-	426	438	-
Stage 2	-	-	-	-	-	-	422	435	-	609	592	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	921	-	-	1168	-	-	169	197	663	167	197	461
Mov Cap-2 Maneuver	-	-	-	-	-	-	169	197	-	167	197	-
Stage 1	-	-	-	-	-	-	608	586	-	419	425	-
Stage 2	-	-	-	-	-	-	394	422	-	576	582	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.3			17.5			20.7		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	323	921	-	-	1168	-	-	256				
HCM Lane V/C Ratio	0.105	0.013	-	-	0.019	-	-	0.105				
HCM Control Delay (s)	17.5	9	0	-	8.1	0	-	20.7				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Future Volume (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt	0.905				0.989				0.906		0.999	
Flt Protected					0.957				0.999		0.989	
Satd. Flow (prot)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Flt Permitted					0.957				0.999		0.989	
Satd. Flow (perm)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Link Speed (k/h)	50				50				50		50	
Link Distance (m)	73.0				110.8				252.6		99.4	
Travel Time (s)	5.3				8.0				18.2		7.2	
Confl. Peds. (#/hr)	32			18	18			32	39			39
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 (%)	2%	2%	2%	2%	2%	12%	2%	4%	3%	10%	4%	2%
Parking (#/hr)	0											
Adj. Flow (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	0	0	410	0	0	421	0	0	177	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				0.0		0.0	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	3.0				3.0				3.0		3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		25	15		25	15		25	15	
Sign Control	Stop				Stop				Stop		Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	73.2%											
Analysis Period (min)	15											
ICU Level of Service D												

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	5	12	372	5	33	11	117	293	39	137	1
Future Vol, veh/h	0	5	12	372	5	33	11	117	293	39	137	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, %	2	2	2	2	2	12	2	4	3	10	4	2
Mvmt Flow	0	5	12	372	5	33	11	117	293	39	137	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.2	18.7	15.6	11.7
HCM LOS	A	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	0%	91%	22%
Vol Thru, %	28%	29%	1%	77%
Vol Right, %	70%	71%	8%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	421	17	410	177
LT Vol	11	0	372	39
Through Vol	117	5	5	137
RT Vol	293	12	33	1
Lane Flow Rate	421	17	410	177
Geometry Grp	1	1	1	1
Degree of Util (X)	0.598	0.028	0.648	0.297
Departure Headway (Hd)	5.117	5.952	5.694	6.049
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	703	597	631	591
Service Time	3.168	4.036	3.74	4.112
HCM Lane V/C Ratio	0.599	0.028	0.65	0.299
HCM Control Delay	15.6	9.2	18.7	11.7
HCM Lane LOS	C	A	C	B
HCM 95th-tile Q	4	0.1	4.7	1.2

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	139	61	86	326	72	33	306	94	30	327	70
Future Volume (vph)	45	139	61	86	326	72	33	306	94	30	327	70
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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	0.98	
Frt		0.966			0.980			0.965			0.974	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1485	0	0	1519	0	1478	1495	0	1492	1492	0
Flt Permitted		0.854			0.894		0.435			0.433		
Satd. Flow (perm)	0	1278	0	0	1366	0	653	1495	0	669	1492	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)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	15		17	17		15	33		16	16		33
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 (%)	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%
Adj. Flow (vph)	45	139	61	86	326	72	33	306	94	30	327	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	245	0	0	484	0	33	400	0	30	397	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2022 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		35.2			35.2		43.8	43.8		43.8	43.8	
Actuated g/C Ratio		0.39			0.39		0.49	0.49		0.49	0.49	
v/c Ratio		0.48			0.90		0.10	0.54		0.09	0.54	
Control Delay		20.9			45.3		15.7	19.8		13.5	17.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.5	
Total Delay		20.9			45.3		15.7	19.8		13.5	18.3	
LOS		C			D		B	B		B	B	
Approach Delay		20.9			45.3			19.5			18.0	
Approach LOS		C			D			B			B	
Queue Length 50th (m)		26.5			71.7		3.1	45.8		2.9	44.0	
Queue Length 95th (m)		44.9			#122.4		9.0	77.3		m5.0	m57.2	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		572			604		318	739		325	734	
Starvation Cap Reductn		0			0		0	0		0	87	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.43			0.80		0.10	0.54		0.09	0.61	
Intersection Summary												
Area Type:	CBD											
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: 0.90												
Intersection Signal Delay: 27.2	Intersection LOS: C											

Lanes, Volumes, Timings 5: Churchill Ave N & Byron Ave

2022 FT - PM
Richmond / Churchill

Intersection Capacity Utilization 82.5% ICU Level of Service E

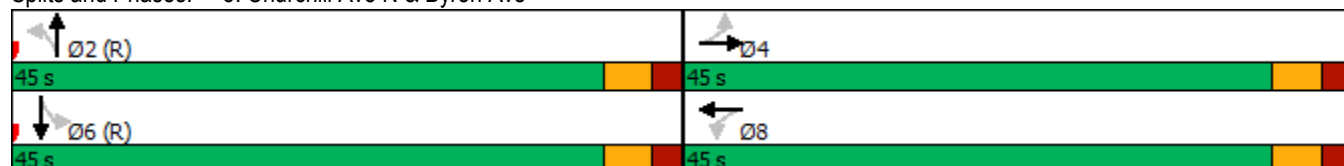
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2022 FT - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	139	61	86	326	72	33	306	94	30	327	70
Future Volume (veh/h)	45	139	61	86	326	72	33	306	94	30	327	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.99	0.98		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1573	1588	1620	1588	1576	1620
Adj Flow Rate, veh/h	45	139	61	86	326	72	33	306	94	30	327	70
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	3	2	2	2	3	3
Cap, veh/h	103	279	111	122	376	79	519	591	181	375	639	137
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	1.00	1.00	1.00
Sat Flow, veh/h	150	759	302	205	1024	215	860	1156	355	880	1250	268
Grp Volume(v), veh/h	245	0	0	484	0	0	33	0	400	30	0	397
Grp Sat Flow(s),veh/h/ln	1211	0	0	1444	0	0	860	0	1512	880	0	1518
Q Serve(g_s), s	0.0	0.0	0.0	16.2	0.0	0.0	1.8	0.0	15.8	1.1	0.0	0.0
Cycle Q Clear(g_c), s	12.4	0.0	0.0	28.6	0.0	0.0	1.8	0.0	15.8	17.0	0.0	0.0
Prop In Lane	0.18		0.25	0.18		0.15	1.00		0.23	1.00		0.18
Lane Grp Cap(c), veh/h	492	0	0	577	0	0	519	0	772	375	0	775
V/C Ratio(X)	0.50	0.00	0.00	0.84	0.00	0.00	0.06	0.00	0.52	0.08	0.00	0.51
Avail Cap(c_a), veh/h	586	0	0	677	0	0	519	0	772	375	0	775
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.66	0.00	0.66
Uniform Delay (d), s/veh	21.6	0.0	0.0	26.9	0.0	0.0	11.2	0.0	14.6	2.9	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	8.1	0.0	0.0	0.2	0.0	2.5	0.3	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.8	0.0	0.0	12.7	0.0	0.0	0.4	0.0	7.1	0.3	0.0	0.3
LnGrp Delay(d),s/veh	22.4	0.0	0.0	35.0	0.0	0.0	11.4	0.0	17.1	3.2	0.0	1.6
LnGrp LOS	C			C			B		B	A		A
Approach Vol, veh/h		245			484			433			427	
Approach Delay, s/veh		22.4			35.0			16.7			1.7	
Approach LOS		C			C			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		51.4		38.6		51.4		38.6				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		39.4		* 40		39.4				
Max Q Clear Time (g_c+I1), s		17.8		14.4		19.0		30.6				
Green Ext Time (p_c), s		3.3		1.9		3.1		2.4				
Intersection Summary												
HCM 2010 Ctrl Delay				19.1								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
6: Churchill Ave N & Site Access #1

2022 FT - PM
Richmond / Churchill

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	5	507	12	7	564
Future Volume (vph)	9	5	507	12	7	564
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt	0.952		0.997			
Flt Protected	0.969					0.999
Satd. Flow (prot)	1449	0	1566	0	0	2981
Flt Permitted	0.969					0.999
Satd. Flow (perm)	1449	0	1566	0	0	2981
Link Speed (k/h)	30		50			50
Link Distance (m)	80.5		63.4			252.6
Travel Time (s)	9.7		4.6			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	9	5	507	12	7	564
Shared Lane Traffic (%)						
Lane Group Flow (vph)	14	0	519	0	0	571
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	3.0		3.0			3.0
Two way Left Turn Lane						
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	CBD					
Control Type:	Unsignalized					
Intersection Capacity Utilization	42.1%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	5	507	12	7	564
Future Vol, veh/h	9	5	507	12	7	564
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	5	507	12	7	564
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	809	513	0	0	519	0
Stage 1	513	-	-	-	-	-
Stage 2	296	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	334	560	-	-	1045	-
Stage 1	600	-	-	-	-	-
Stage 2	729	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	331	560	-	-	1045	-
Mov Cap-2 Maneuver	331	-	-	-	-	-
Stage 1	600	-	-	-	-	-
Stage 2	722	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	14.6	0		0.1		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		388	1045	
HCM Lane V/C Ratio	-	-		0.036	0.007	
HCM Control Delay (s)	-	-		14.6	8.5	
HCM Lane LOS	-	-		B	A	
HCM 95th %tile Q(veh)	-	-		0.1	0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FT - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	403	0	0	679	0	0	
Future Volume (vph)	403	0	0	679	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	33.7		
Travel Time (s)	19.2			1.4	2.4		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	403	0	0	679	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	403	0	0	679	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2022 FT - PM
Richmond / Churchill



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	24.0			24.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							51
Act Effect Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.46			0.78			
Control Delay	10.9			19.7			
Queue Delay	0.0			0.0			
Total Delay	10.9			19.7			
LOS	B			B			
Approach Delay	10.9			19.7			
Approach LOS	B			B			
Queue Length 50th (m)	26.4			58.1			
Queue Length 95th (m)	45.2			#109.8			
Internal Link Dist (m)	242.4			0.1	9.7		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.46			0.78			

Intersection Summary

Area Type: CBD
Cycle Length: 65
Actuated Cycle Length: 65
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 16.4 Intersection LOS: B
Intersection Capacity Utilization 46.9% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Appendix O

2027 Future Total Synchro Worksheets

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	297	387	38	55	196	23	28	309	104	25	288	147
Future Volume (vph)	297	387	38	55	196	23	28	309	104	25	288	147
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.99		0.96	0.99			0.98			0.97	
Frt		0.987			0.984			0.965			0.952	
Flt Protected	0.950			0.950				0.997			0.997	
Satd. Flow (prot)	1478	1383	0	1396	1337	0	0	2746	0	0	2642	0
Flt Permitted	0.497			0.515				0.894			0.906	
Satd. Flow (perm)	734	1383	0	725	1337	0	0	2456	0	0	2397	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			8			52			99	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			63.4	
Travel Time (s)		21.4			19.2			9.0			4.6	
Confl. Peds. (#/hr)	50		47	47		50	38		30	30		38
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%	2%	2%	9%	5%	5%	8%	5%	2%	13%	6%	4%
Parking (#/hr)		0			0							
Adj. Flow (vph)	297	387	38	55	196	23	28	309	104	25	288	147
Shared Lane Traffic (%)												
Lane Group Flow (vph)	297	425	0	55	219	0	0	441	0	0	460	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	30.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	36.1		31.1	31.1		24.2	24.2		24.2	24.2	
Total Split (s)	14.0	40.0		31.0	31.0		30.0	30.0		30.0	30.0	
Total Split (%)	17.5%	50.0%		38.8%	38.8%		37.5%	37.5%		37.5%	37.5%	
Maximum Green (s)	7.9	33.9		24.9	24.9		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	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	48.1	48.1		29.2	29.2			19.6			19.6	
Actuated g/C Ratio	0.60	0.60		0.36	0.36			0.24			0.24	
v/c Ratio	0.53	0.51		0.21	0.45			0.69			0.69	
Control Delay	12.4	12.2		22.2	23.4			23.6			27.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	12.4	12.2		22.2	23.4			23.6			27.1	
LOS	B	B		C	C			C			C	
Approach Delay		12.3			23.2			23.6			27.1	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	19.1	30.8		5.5	23.3			29.3			27.0	
Queue Length 95th (m)	39.4	63.5		15.4	46.8			21.7			39.0	
Internal Link Dist (m)		273.0			242.4			101.1			39.4	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	559	834		264	492			767			782	
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	0.53	0.51		0.21	0.45			0.57			0.59	

Intersection Summary

Area Type: CBD
 Cycle Length: 80
 Actuated Cycle Length: 80
 Offset: 43 (54%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings

1: Churchill Ave N & Richmond Rd

2027 FT - AM
Richmond / Churchill

Intersection Signal Delay: 20.1

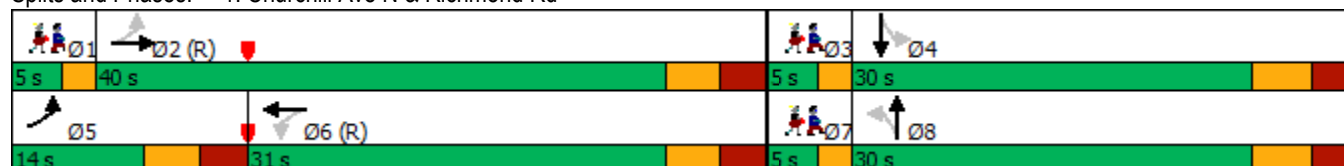
Intersection LOS: C

Intersection Capacity Utilization 92.9%

ICU Level of Service F

Analysis Period (min) 15

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Future Volume (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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		1.00			0.99			0.92			0.94	
Frt		0.995			0.988			0.924			0.974	
Flt Protected		0.999			0.997			0.985			0.970	
Satd. Flow (prot)	0	1374	0	0	1351	0	0	1252	0	0	1453	0
Flt Permitted		0.995			0.948			0.889			0.808	
Satd. Flow (perm)	0	1368	0	0	1282	0	0	1102	0	0	1158	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		4			12			45			17	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	80		65	65		80	48		42	42		48
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 (%)	2%	4%	2%	4%	4%	3%	12%	2%	11%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	8	566	21	28	347	38	25	10	45	55	16	17
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	595	0	0	413	0	0	80	0	0	88	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		34.4	34.4		24.6	24.6		24.6	24.6	
Total Split (s)	45.0	45.0		45.0	45.0		25.0	25.0		25.0	25.0	
Total Split (%)	64.3%	64.3%		64.3%	64.3%		35.7%	35.7%		35.7%	35.7%	
Maximum Green (s)	39.6	39.6		39.6	39.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		51.8			51.8			11.4			11.4	
Actuated g/C Ratio		0.74			0.74			0.16			0.16	
v/c Ratio		0.59			0.43			0.37			0.44	
Control Delay		9.4			6.9			18.6			28.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		9.4			6.9			18.6			28.6	
LOS		A			A			B			C	
Approach Delay		9.4			6.9			18.6			28.6	
Approach LOS		A			A			B			C	
Queue Length 50th (m)		33.1			18.5			4.1			8.6	
Queue Length 95th (m)		79.8			44.7			14.2			19.6	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1013			952			337			333	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.59			0.43			0.24			0.26	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 70												
Actuated Cycle Length: 70												
Offset: 27 (39%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.59												
Intersection Signal Delay: 10.6							Intersection LOS: B					
Intersection Capacity Utilization 68.6%							ICU Level of Service C					
Analysis Period (min) 15												

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	566	21	28	347	38	25	10	45	55	16	17
Future Volume (veh/h)	8	566	21	28	347	38	25	10	45	55	16	17
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.94	0.99		0.94	0.91		0.89	0.91		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1559	1620	1620	1559	1620	1620	1470	1620	1620	1588	1620
Adj Flow Rate, veh/h	8	566	21	28	347	38	25	10	45	55	16	17
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	4	4	4	4	4	4	2	2	2	2	2	2
Cap, veh/h	56	922	34	85	800	84	124	55	143	240	66	53
Arrive On Green	0.62	0.62	0.62	0.62	0.62	0.62	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	6	1480	54	49	1284	135	256	249	650	711	301	242
Grp Volume(v), veh/h	595	0	0	413	0	0	80	0	0	88	0	0
Grp Sat Flow(s),veh/h/ln	1540	0	0	1468	0	0	1155	0	0	1255	0	0
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	16.5	0.0	0.0	9.8	0.0	0.0	3.7	0.0	0.0	3.5	0.0	0.0
Prop In Lane	0.01		0.04	0.07		0.09	0.31		0.56	0.62		0.19
Lane Grp Cap(c), veh/h	1012	0	0	970	0	0	321	0	0	359	0	0
V/C Ratio(X)	0.59	0.00	0.00	0.43	0.00	0.00	0.25	0.00	0.00	0.24	0.00	0.00
Avail Cap(c_a), veh/h	1012	0	0	970	0	0	386	0	0	427	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.90	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	8.1	0.0	0.0	6.8	0.0	0.0	22.8	0.0	0.0	22.7	0.0	0.0
Incr Delay (d2), s/veh	2.5	0.0	0.0	1.2	0.0	0.0	0.4	0.0	0.0	0.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	0.0	0.0	4.3	0.0	0.0	1.3	0.0	0.0	1.5	0.0	0.0
LnGrp Delay(d),s/veh	10.6	0.0	0.0	8.0	0.0	0.0	23.2	0.0	0.0	23.0	0.0	0.0
LnGrp LOS	B			A			C			C		
Approach Vol, veh/h		595			413			80			88	
Approach Delay, s/veh		10.6			8.0			23.2			23.0	
Approach LOS		B			A			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		49.0		21.0		49.0		21.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		19.4		* 40		19.4				
Max Q Clear Time (g_c+I1), s		18.5		5.5		11.8		5.7				
Green Ext Time (p_c), s		4.8		0.4		3.5		0.3				
Intersection Summary												
HCM 2010 Ctrl Delay				11.5								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	458	7	5	299	21	2	16	15	10	9	11
Future Volume (vph)	20	458	7	5	299	21	2	16	15	10	9	11
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.998			0.991			0.939			0.950	
Flt Protected		0.998			0.999			0.997			0.984	
Satd. Flow (prot)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Flt Permitted		0.998			0.999			0.997			0.984	
Satd. Flow (perm)	0	1408	0	0	1387	0	0	1470	0	0	1468	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
Confl. Peds. (#/hr)	39		44	44		39						
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 (%)	2%	2%	2%	2%	3%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	20	458	7	5	299	21	2	16	15	10	9	11
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	485	0	0	325	0	0	33	0	0	30	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	54.7%											
Analysis Period (min)	15											
	ICU Level of Service A											

Intersection												
Int Delay, s/veh	1.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	20	458	7	5	299	21	2	16	15	10	9	11
Future Vol, veh/h	20	458	7	5	299	21	2	16	15	10	9	11
Conflicting Peds, #/hr	39	0	44	44	0	39	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	3	2	2	2	2	2	2	2
Mvmt Flow	20	458	7	5	299	21	2	16	15	10	9	11
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	359	0	0	509	0	0	876	915	506	876	908	349
Stage 1	-	-	-	-	-	-	546	546	-	359	359	-
Stage 2	-	-	-	-	-	-	330	369	-	517	549	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	1200	-	-	1056	-	-	269	273	566	269	275	694
Stage 1	-	-	-	-	-	-	522	518	-	659	627	-
Stage 2	-	-	-	-	-	-	683	621	-	541	516	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1164	-	-	1020	-	-	243	248	547	236	250	673
Mov Cap-2 Maneuver	-	-	-	-	-	-	243	248	-	236	250	-
Stage 1	-	-	-	-	-	-	493	489	-	624	604	-
Stage 2	-	-	-	-	-	-	658	599	-	497	487	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.1			17.2			17.5		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	329	1164	-	-	1020	-	-	317				
HCM Lane V/C Ratio	0.1	0.017	-	-	0.005	-	-	0.095				
HCM Control Delay (s)	17.2	8.1	0	-	8.5	0	-	17.5				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.3	0.1	-	-	0	-	-	0.3				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Future Volume (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt		0.912			0.988			0.893			0.999	
Flt Protected					0.958			0.999			0.991	
Satd. Flow (prot)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Flt Permitted					0.958			0.999			0.991	
Satd. Flow (perm)	0	1327	0	0	1440	0	0	1242	0	0	1549	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		73.0			110.8			252.6			99.4	
Travel Time (s)		5.3			8.0			18.2			7.2	
Confl. Peds. (#/hr)	41		7	7		41	38		10	10		38
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 (%)	2%	14%	8%	4%	11%	15%	2%	6%	3%	4%	2%	2%
Parking (#/hr)								0				
Adj. Flow (vph)	0	7	13	188	9	20	8	110	457	49	210	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	20	0	0	217	0	0	575	0	0	260	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Stop			Stop			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	77.6%											
Analysis Period (min)	15											
	ICU Level of Service D											

Intersection	
Intersection Delay, s/veh	16.3
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	7	13	188	9	20	8	110	457	49	210	1
Future Vol, veh/h	0	7	13	188	9	20	8	110	457	49	210	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, %	2	14	8	4	11	15	2	6	3	4	2	2
Mvmt Flow	0	7	13	188	9	20	8	110	457	49	210	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.6	12.7	19.7	12.1
HCM LOS	A	B	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	1%	0%	87%	19%
Vol Thru, %	19%	35%	4%	81%
Vol Right, %	79%	65%	9%	0%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	575	20	217	260
LT Vol	8	0	188	49
Through Vol	110	7	9	210
RT Vol	457	13	20	1
Lane Flow Rate	575	20	217	260
Geometry Grp	1	1	1	1
Degree of Util (X)	0.742	0.035	0.369	0.397
Departure Headway (Hd)	4.643	6.288	6.121	5.496
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	782	566	586	653
Service Time	2.643	4.368	4.175	3.546
HCM Lane V/C Ratio	0.735	0.035	0.37	0.398
HCM Control Delay	19.7	9.6	12.7	12.1
HCM Lane LOS	C	A	B	B
HCM 95th-tile Q	6.8	0.1	1.7	1.9

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	36	175	46	35	135	57	29	335	42	40	296	24
Future Volume (vph)	36	175	46	35	135	57	29	335	42	40	296	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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	1.00	
Frt		0.976			0.966			0.983			0.989	
Flt Protected		0.993			0.992		0.950			0.950		
Satd. Flow (prot)	0	1513	0	0	1496	0	1422	1496	0	1492	1503	0
Flt Permitted		0.924			0.901		0.554			0.510		
Satd. Flow (perm)	0	1406	0	0	1357	0	808	1496	0	788	1503	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			25			10			7	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	14		8	8		14	21		16	16		21
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 (%)	2%	2%	2%	2%	2%	2%	7%	5%	2%	2%	5%	4%
Adj. Flow (vph)	36	175	46	35	135	57	29	335	42	40	296	24
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	257	0	0	227	0	29	377	0	40	320	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FT - AM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		19.2			19.2		49.8	49.8		49.8	49.8	
Actuated g/C Ratio		0.24			0.24		0.62	0.62		0.62	0.62	
v/c Ratio		0.74			0.66		0.06	0.40		0.08	0.34	
Control Delay		38.2			32.7		8.4	10.3		4.4	4.9	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		38.2			32.7		8.4	10.3		4.4	4.9	
LOS		D			C		A	B		A	A	
Approach Delay		38.2			32.7			10.2			4.8	
Approach LOS		D			C			B			A	
Queue Length 50th (m)		33.9			27.7		1.6	25.0		1.5	12.2	
Queue Length 95th (m)		51.2			43.7		6.0	54.7		m3.2	21.2	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		578			564		502	935		490	938	
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			0.40		0.06	0.40		0.08	0.34	
Intersection Summary												
Area Type:	CBD											
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: 0.74												
Intersection Signal Delay: 18.5	Intersection LOS: B											

Lanes, Volumes, Timings 5: Churchill Ave N & Byron Ave

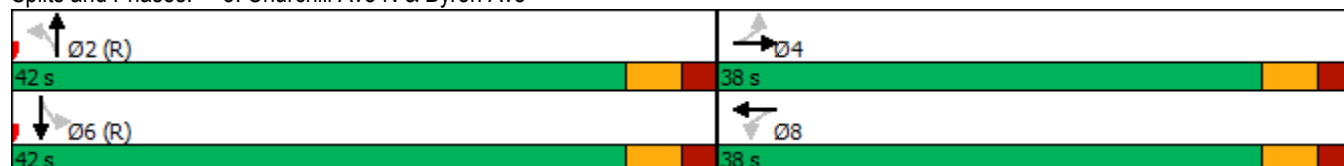
2027 FT - AM
Richmond / Churchill

Intersection Capacity Utilization 63.2% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2027 FT - AM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	175	46	35	135	57	29	335	42	40	296	24
Future Volume (veh/h)	36	175	46	35	135	57	29	335	42	40	296	24
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.97	0.99		0.98	0.99		0.98	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1514	1548	1620	1588	1544	1620
Adj Flow Rate, veh/h	36	175	46	35	135	57	29	335	42	40	296	24
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	7	5	5	2	5	5
Cap, veh/h	82	254	62	84	222	85	655	849	106	547	888	72
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.23	0.63	0.63	0.63	1.00	1.00	1.00
Sat Flow, veh/h	131	1097	268	139	957	368	896	1346	169	898	1407	114
Grp Volume(v), veh/h	257	0	0	227	0	0	29	0	377	40	0	320
Grp Sat Flow(s),veh/h/ln	1495	0	0	1464	0	0	896	0	1515	898	0	1522
Q Serve(g_s), s	1.5	0.0	0.0	0.0	0.0	0.0	1.0	0.0	9.8	0.7	0.0	0.0
Cycle Q Clear(g_c), s	12.5	0.0	0.0	11.0	0.0	0.0	1.0	0.0	9.8	10.5	0.0	0.0
Prop In Lane	0.14		0.18	0.15		0.25	1.00		0.11	1.00		0.08
Lane Grp Cap(c), veh/h	398	0	0	391	0	0	655	0	956	547	0	960
V/C Ratio(X)	0.65	0.00	0.00	0.58	0.00	0.00	0.04	0.00	0.39	0.07	0.00	0.33
Avail Cap(c_a), veh/h	646	0	0	634	0	0	655	0	956	547	0	960
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.72	0.00	0.72
Uniform Delay (d), s/veh	28.4	0.0	0.0	27.8	0.0	0.0	5.6	0.0	7.3	1.0	0.0	0.0
Incr Delay (d2), s/veh	1.8	0.0	0.0	1.4	0.0	0.0	0.1	0.0	1.2	0.2	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	0.0	0.0	4.7	0.0	0.0	0.3	0.0	4.4	0.2	0.0	0.2
LnGrp Delay(d),s/veh	30.2	0.0	0.0	29.2	0.0	0.0	5.8	0.0	8.5	1.2	0.0	0.7
LnGrp LOS	C			C			A		A	A		A
Approach Vol, veh/h		257			227			406			360	
Approach Delay, s/veh		30.2			29.2			8.3			0.7	
Approach LOS		C			C			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		55.9		24.1		55.9		24.1				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 37		32.4		* 37		32.4				
Max Q Clear Time (g_c+I1), s		11.8		14.5		12.5		13.0				
Green Ext Time (p_c), s		3.1		1.7		2.6		1.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.4								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
6: Churchill Ave N & Site Access #1

2027 FT - AM
Richmond / Churchill

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	10	5	555	4	2	430
Future Volume (vph)	10	5	555	4	2	430
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt	0.955		0.999			
Flt Protected	0.968					
Satd. Flow (prot)	1452	0	1569	0	0	2984
Flt Permitted	0.968					
Satd. Flow (perm)	1452	0	1569	0	0	2984
Link Speed (k/h)	30		50			50
Link Distance (m)	87.9		63.4			252.6
Travel Time (s)	10.5		4.6			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	5	555	4	2	430
Shared Lane Traffic (%)						
Lane Group Flow (vph)	15	0	559	0	0	432
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	3.0		3.0			3.0
Two way Left Turn Lane						
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	CBD					
Control Type:	Unsignalized					
Intersection Capacity Utilization	44.5%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	10	5	555	4	2	430
Future Vol, veh/h	10	5	555	4	2	430
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	5	555	4	2	430
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	776	557	0	0	559	0
Stage 1	557	-	-	-	-	-
Stage 2	219	-	-	-	-	-
Critical Hdwy	6.63	6.23	-	-	4.13	-
Critical Hdwy Stg 1	5.43	-	-	-	-	-
Critical Hdwy Stg 2	5.83	-	-	-	-	-
Follow-up Hdwy	3.519	3.319	-	-	2.219	-
Pot Cap-1 Maneuver	350	529	-	-	1010	-
Stage 1	573	-	-	-	-	-
Stage 2	797	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	349	529	-	-	1010	-
Mov Cap-2 Maneuver	349	-	-	-	-	-
Stage 1	573	-	-	-	-	-
Stage 2	795	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	14.5	0		0		
HCM LOS	B					
Minor Lane/Major Mvmt	NBT	NBRWBLn1		SBL	SBT	
Capacity (veh/h)	-	-		394	1010	
HCM Lane V/C Ratio	-	-		0.038	0.002	
HCM Control Delay (s)	-	-		14.5	8.6	
HCM Lane LOS	-	-		B	A	
HCM 95th %tile Q(veh)	-	-		0.1	0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FT - AM
Richmond / Churchill

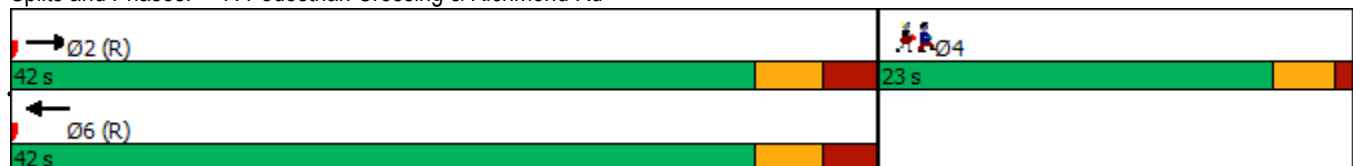
							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations							
Traffic Volume (vph)	481	0	0	301	0	0	
Future Volume (vph)	481	0	0	301	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	13.6		
Travel Time (s)	19.2			1.4	1.0		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	481	0	0	301	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	481	0	0	301	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6			4
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0			5.0

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FT - AM
Richmond / Churchill

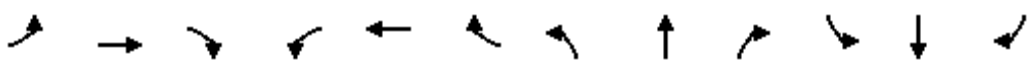
							
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	11.0			11.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							43
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.55			0.35			
Control Delay	12.4			9.4			
Queue Delay	0.0			0.0			
Total Delay	12.4			9.4			
LOS	B			A			
Approach Delay	12.4			9.4			
Approach LOS	B			A			
Queue Length 50th (m)	33.7			18.1			
Queue Length 95th (m)	57.4			31.8			
Internal Link Dist (m)	242.4			0.1	0.1		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.55			0.35			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 50							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.55							
Intersection Signal Delay: 11.2				Intersection LOS: B			
Intersection Capacity Utilization 34.7%				ICU Level of Service A			
Analysis Period (min) 15							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd



Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	338	57	131	485	29	28	306	69	18	250	315
Future Volume (vph)	197	338	57	131	485	29	28	306	69	18	250	315
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (m)	45.0		0.0	25.0		0.0	0.0		0.0	0.0		0.0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (m)	35.0			30.0			15.0			15.0		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95	0.95	0.95	0.95
Ped Bike Factor	0.95	0.96		0.84	0.99			0.97			0.88	
Frt		0.978			0.992			0.974			0.919	
Flt Protected	0.950			0.950				0.997			0.998	
Satd. Flow (prot)	1478	1324	0	1492	1387	0	0	2823	0	0	2425	0
Flt Permitted	0.278			0.529				0.814			0.931	
Satd. Flow (perm)	410	1324	0	698	1387	0	0	2295	0	0	2257	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		15			4			24			301	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		297.0			266.4			125.1			63.4	
Travel Time (s)		21.4			19.2			9.0			4.6	
Confl. Peds. (#/hr)	99		154	154		99	78		53	53		78
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%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	197	338	57	131	485	29	28	306	69	18	250	315
Shared Lane Traffic (%)												
Lane Group Flow (vph)	197	395	0	131	514	0	0	403	0	0	583	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)		3.5			3.5			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												

Lane Group	Ø1	Ø3	Ø7
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)			
Peak Hour Factor			
Heavy Vehicles (%)			
Parking (#/hr)			
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			

Lanes, Volumes, Timings
1: Churchill Ave N & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases	2			6			8			4		
Detector Phase	5	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	11.1	31.1		31.1	31.1		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	
Total Split (%)	16.7%	61.1%		50.0%	50.0%		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	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.6	3.6		3.6	3.6	
All-Red Time (s)	2.8	2.8		2.8	2.8		2.6	2.6		2.6	2.6	
Lost Time Adjust (s)	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	
Lead/Lag	Lead	Lag		Lag	Lag		Lag	Lag		Lag	Lag	
Lead-Lag Optimize?	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	
Recall Mode	None	C-Max		C-Max	C-Max		Ped	Ped		Ped	Ped	
Walk Time (s)		14.0		14.0	14.0		7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0		0	0		0	0		0	0	
Act Effect Green (s)	56.1	56.1		41.1	41.1			21.6			21.6	
Actuated g/C Ratio	0.62	0.62		0.46	0.46			0.24			0.24	
v/c Ratio	0.55	0.48		0.41	0.81			0.71			0.76	
Control Delay	13.9	11.5		22.4	33.9			28.1			21.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.9	11.5		22.4	33.9			28.1			21.8	
LOS	B	B		C	C			C			C	
Approach Delay		12.3			31.6			28.1			21.8	
Approach LOS		B			C			C			C	
Queue Length 50th (m)	13.8	32.6		15.4	77.1			16.9			23.3	
Queue Length 95th (m)	24.9	56.5		31.7	#136.1			m29.4			42.1	
Internal Link Dist (m)		273.0			242.4			101.1			39.4	
Turn Bay Length (m)	45.0			25.0								
Base Capacity (vph)	365	831		319	636			572			773	
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	0.54	0.48		0.41	0.81			0.70			0.75	

Intersection Summary

Area Type: CBD
 Cycle Length: 90
 Actuated Cycle Length: 90
 Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
 Natural Cycle: 90
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.81

Lane Group	Ø1	Ø3	Ø7
Detector 2 Extend (s)			
Turn Type			
Protected Phases	1	3	7
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
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	None	None	None
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			

Lanes, Volumes, Timings 1: Churchill Ave N & Richmond Rd

2027 FT - PM
Richmond / Churchill

Intersection Signal Delay: 23.2

Intersection LOS: C

Intersection Capacity Utilization 99.9%

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.

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

Splits and Phases: 1: Churchill Ave N & Richmond Rd



Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Future Volume (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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			0.88			0.91	
Frt		0.991			0.994			0.938			0.964	
Flt Protected		0.999			0.998			0.980			0.980	
Satd. Flow (prot)	0	1382	0	0	1396	0	0	1348	0	0	1395	0
Flt Permitted		0.991			0.965			0.835			0.824	
Satd. Flow (perm)	0	1371	0	0	1345	0	0	1088	0	0	1124	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			6			46			20	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		156.8			297.0			82.3			100.6	
Travel Time (s)		11.3			21.4			5.9			7.2	
Confl. Peds. (#/hr)	48		99	99		48	72		57	57		72
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 (%)	2%	2%	2%	2%	2%	3%	2%	2%	2%	2%	6%	2%
Parking (#/hr)		0			0							
Adj. Flow (vph)	6	437	33	40	793	39	46	16	52	44	35	29
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	476	0	0	872	0	0	114	0	0	108	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+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		2			6			8			4	

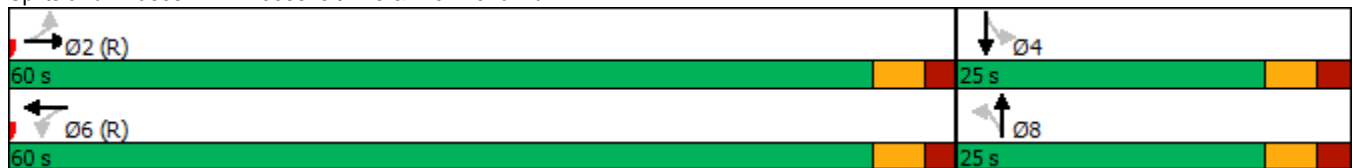
Lanes, Volumes, Timings
2: Roosevelt Ave & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	2			6			8			4		
Detector Phase	2	2		6	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	34.4	34.4		33.5	33.5		24.6	24.6		24.6	24.6	
Total Split (s)	60.0	60.0		60.0	60.0		25.0	25.0		25.0	25.0	
Total Split (%)	70.6%	70.6%		70.6%	70.6%		29.4%	29.4%		29.4%	29.4%	
Maximum Green (s)	54.6	54.6		54.6	54.6		19.4	19.4		19.4	19.4	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.1	2.1		2.1	2.1		2.3	2.3		2.3	2.3	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		5.4			5.4			5.6			5.6	
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	C-Max	C-Max		C-Max	C-Max		None	None		None	None	
Walk Time (s)	18.0	18.0		18.0	18.0		9.0	9.0		9.0	9.0	
Flash Dont Walk (s)	8.0	8.0		8.0	8.0		10.0	10.0		10.0	10.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		65.2			65.2			13.0			13.0	
Actuated g/C Ratio		0.77			0.77			0.15			0.15	
v/c Ratio		0.45			0.84			0.56			0.57	
Control Delay		7.0			20.6			30.9			38.8	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.0			20.6			30.9			38.8	
LOS		A			C			C			D	
Approach Delay		7.0			20.6			30.9			38.8	
Approach LOS		A			C			C			D	
Queue Length 50th (m)		25.4			88.0			10.3			13.5	
Queue Length 95th (m)		57.9			#215.8			24.4			27.2	
Internal Link Dist (m)		132.8			273.0			58.3			76.6	
Turn Bay Length (m)												
Base Capacity (vph)		1054			1033			283			271	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.45			0.84			0.40			0.40	
Intersection Summary												
Area Type:	CBD											
Cycle Length: 85												
Actuated Cycle Length: 85												
Offset: 78 (92%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green												
Natural Cycle: 90												
Control Type: Actuated-Coordinated												
Maximum v/c Ratio: 0.84												
Intersection Signal Delay: 18.5							Intersection LOS: B					
Intersection Capacity Utilization 104.7%							ICU Level of Service G					
Analysis Period (min) 15												

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Roosevelt Ave & Richmond Rd



HCM 2010 Signalized Intersection Summary

2: Roosevelt Ave & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	437	33	40	793	39	46	16	52	44	35	29
Future Volume (veh/h)	6	437	33	40	793	39	46	16	52	44	35	29
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.93	0.98		0.93	0.86		0.82	0.87		0.82
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1620	1588	1620	1620	1588	1620
Adj Flow Rate, veh/h	6	437	33	40	793	39	46	16	52	44	35	29
Adj No. of Lanes	0	1	0	0	1	0	0	1	0	0	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	6	6	6
Cap, veh/h	46	958	72	72	945	46	141	53	113	146	103	70
Arrive On Green	0.67	0.67	0.67	0.67	0.67	0.67	0.20	0.20	0.20	0.20	0.20	0.20
Sat Flow, veh/h	5	1438	108	41	1420	68	399	260	552	421	505	340
Grp Volume(v), veh/h	476	0	0	872	0	0	114	0	0	108	0	0
Grp Sat Flow(s),veh/h/ln	1551	0	0	1529	0	0	1211	0	0	1266	0	0
Q Serve(g_s), s	0.0	0.0	0.0	14.2	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.5	0.0	0.0	36.9	0.0	0.0	6.2	0.0	0.0	5.5	0.0	0.0
Prop In Lane	0.01		0.07	0.05		0.04	0.40		0.46	0.41		0.27
Lane Grp Cap(c), veh/h	1075	0	0	1063	0	0	307	0	0	319	0	0
V/C Ratio(X)	0.44	0.00	0.00	0.82	0.00	0.00	0.37	0.00	0.00	0.34	0.00	0.00
Avail Cap(c_a), veh/h	1075	0	0	1063	0	0	334	0	0	347	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.49	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	6.8	0.0	0.0	10.8	0.0	0.0	29.3	0.0	0.0	29.1	0.0	0.0
Incr Delay (d2), s/veh	1.3	0.0	0.0	3.6	0.0	0.0	0.7	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	0.0	0.0	16.6	0.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0
LnGrp Delay(d),s/veh	8.2	0.0	0.0	14.4	0.0	0.0	30.1	0.0	0.0	29.7	0.0	0.0
LnGrp LOS	A			B			C			C		
Approach Vol, veh/h		476			872			114			108	
Approach Delay, s/veh		8.2			14.4			30.1			29.7	
Approach LOS		A			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		62.0		23.0		62.0		23.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 55		19.4		* 55		19.4				
Max Q Clear Time (g_c+I1), s		14.5		7.5		38.9		8.2				
Green Ext Time (p_c), s		4.2		0.5		7.1		0.5				
Intersection Summary												
HCM 2010 Ctrl Delay				14.7								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
3: Athlone Ave & Richmond Rd

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	390	12	22	664	13	9	4	22	10	3	14
Future Volume (vph)	12	390	12	22	664	13	9	4	22	10	3	14
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Frt		0.996			0.997			0.915			0.930	
Flt Protected		0.999			0.998			0.987			0.982	
Satd. Flow (prot)	0	1406	0	0	1406	0	0	1418	0	0	1434	0
Flt Permitted		0.999			0.998			0.987			0.982	
Satd. Flow (perm)	0	1406	0	0	1406	0	0	1418	0	0	1434	0
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		19.5			116.6			133.7			141.3	
Travel Time (s)		1.4			8.4			9.6			10.2	
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
Parking (#/hr)		0			0							
Adj. Flow (vph)	12	390	12	22	664	13	9	4	22	10	3	14
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	414	0	0	699	0	0	35	0	0	27	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			0.0			0.0	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.41	1.24	1.24	1.41	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Sign Control		Free			Free			Stop			Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization 63.3%	ICU Level of Service B											
Analysis Period (min) 15												

Intersection												
Int Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	12	390	12	22	664	13	9	4	22	10	3	14
Future Vol, veh/h	12	390	12	22	664	13	9	4	22	10	3	14
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	100	100	100	100	100	100	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	390	12	22	664	13	9	4	22	10	3	14
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	677	0	0	402	0	0	1143	1141	396	1148	1141	671
Stage 1	-	-	-	-	-	-	420	420	-	715	715	-
Stage 2	-	-	-	-	-	-	723	721	-	433	426	-
Critical Hdwy	4.12	-	-	4.12	-	-	7.12	6.52	6.22	7.12	6.52	6.22
Critical Hdwy Stg 1	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.12	5.52	-	6.12	5.52	-
Follow-up Hdwy	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Cap-1 Maneuver	915	-	-	1157	-	-	177	201	653	176	201	456
Stage 1	-	-	-	-	-	-	611	589	-	422	434	-
Stage 2	-	-	-	-	-	-	417	432	-	601	586	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	915	-	-	1157	-	-	163	192	653	161	192	456
Mov Cap-2 Maneuver	-	-	-	-	-	-	163	192	-	161	192	-
Stage 1	-	-	-	-	-	-	601	579	-	415	421	-
Stage 2	-	-	-	-	-	-	389	419	-	567	576	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.3			0.3			17.7			21.2		
HCM LOS							C			C		
Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	319	915	-	-	1157	-	-	249				
HCM Lane V/C Ratio	0.11	0.013	-	-	0.019	-	-	0.108				
HCM Control Delay (s)	17.7	9	0	-	8.2	0	-	21.2				
HCM Lane LOS	C	A	A	-	A	A	-	C				
HCM 95th %tile Q(veh)	0.4	0	-	-	0.1	-	-	0.4				

Lanes, Volumes, Timings
4: Churchill Ave N & Scott St

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Future Volume (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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												
Frt	0.905				0.989				0.906		0.999	
Flt Protected					0.957				0.999		0.989	
Satd. Flow (prot)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Flt Permitted					0.957				0.999		0.989	
Satd. Flow (perm)	0	1421	0	0	1475	0	0	1264	0	0	1503	0
Link Speed (k/h)	50				50				50		50	
Link Distance (m)	73.0				110.8				252.6		99.4	
Travel Time (s)	5.3				8.0				18.2		7.2	
Confl. Peds. (#/hr)	32			18	18			32	39			39
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 (%)	2%	2%	2%	2%	2%	12%	2%	4%	3%	10%	4%	2%
Parking (#/hr)	0											
Adj. Flow (vph)	0	5	12	372	5	33	11	117	293	39	137	1
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	17	0	0	410	0	0	421	0	0	177	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				0.0		0.0	
Link Offset(m)	0.0				0.0				0.0		0.0	
Crosswalk Width(m)	3.0				3.0				3.0		3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.41	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		25	15		25	15		25	15	
Sign Control	Stop				Stop				Stop		Stop	
Intersection Summary												
Area Type:	CBD											
Control Type:	Unsignalized											
Intersection Capacity Utilization	73.2%											
Analysis Period (min)	15											
ICU Level of Service D												

Intersection	
Intersection Delay, s/veh	16.1
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	0	5	12	372	5	33	11	117	293	39	137	1
Future Vol, veh/h	0	5	12	372	5	33	11	117	293	39	137	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, %	2	2	2	2	2	12	2	4	3	10	4	2
Mvmt Flow	0	5	12	372	5	33	11	117	293	39	137	1
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.2	18.7	15.6	11.7
HCM LOS	A	C	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	3%	0%	91%	22%
Vol Thru, %	28%	29%	1%	77%
Vol Right, %	70%	71%	8%	1%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	421	17	410	177
LT Vol	11	0	372	39
Through Vol	117	5	5	137
RT Vol	293	12	33	1
Lane Flow Rate	421	17	410	177
Geometry Grp	1	1	1	1
Degree of Util (X)	0.598	0.028	0.648	0.297
Departure Headway (Hd)	5.117	5.952	5.694	6.049
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	703	597	631	591
Service Time	3.168	4.036	3.74	4.112
HCM Lane V/C Ratio	0.599	0.028	0.65	0.299
HCM Control Delay	15.6	9.2	18.7	11.7
HCM Lane LOS	C	A	C	B
HCM 95th-tile Q	4	0.1	4.7	1.2

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	148	61	86	332	72	33	306	94	30	327	70
Future Volume (vph)	45	148	61	86	332	72	33	306	94	30	327	70
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	25.0		0.0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (m)	15.0			15.0			25.0			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		0.99			0.99		0.97	0.99		0.98	0.98	
Frt		0.968			0.980			0.965			0.974	
Flt Protected		0.991			0.991		0.950			0.950		
Satd. Flow (prot)	0	1489	0	0	1519	0	1478	1495	0	1492	1492	0
Flt Permitted		0.858			0.893		0.434			0.432		
Satd. Flow (perm)	0	1287	0	0	1364	0	652	1495	0	667	1492	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			12			22			15	
Link Speed (k/h)		50			50			50			50	
Link Distance (m)		154.1			199.5			136.6			125.1	
Travel Time (s)		11.1			14.4			9.8			9.0	
Confl. Peds. (#/hr)	15		17	17		15	33		16	16		33
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 (%)	2%	2%	2%	2%	2%	2%	3%	2%	2%	2%	3%	2%
Adj. Flow (vph)	45	148	61	86	332	72	33	306	94	30	327	70
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	254	0	0	490	0	33	400	0	30	397	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			3.5			3.5	
Link Offset(m)		0.0			0.0			0.0			0.0	
Crosswalk Width(m)		3.0			3.0			3.0			3.0	
Two way Left Turn Lane												
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25		15	25		15	25		15	25		15
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (m)	2.0	10.0		2.0	10.0		2.0	10.0		2.0	10.0	
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)	2.0	0.6		2.0	0.6		2.0	0.6		2.0	0.6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+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)		9.4			9.4			9.4			9.4	
Detector 2 Size(m)		0.6			0.6			0.6			0.6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	

Lanes, Volumes, Timings
5: Churchill Ave N & Byron Ave

2027 FT - PM
Richmond / Churchill

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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		5.0	5.0		5.0	5.0	
Minimum Split (s)	30.6	30.6		30.6	30.6		26.4	26.4		26.4	26.4	
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	
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 Effect Green (s)		35.4			35.4		43.6	43.6		43.6	43.6	
Actuated g/C Ratio		0.39			0.39		0.48	0.48		0.48	0.48	
v/c Ratio		0.49			0.90		0.10	0.54		0.09	0.54	
Control Delay		21.3			46.0		15.8	19.9		13.6	18.0	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.5	
Total Delay		21.3			46.0		15.8	19.9		13.6	18.5	
LOS		C			D		B	B		B	B	
Approach Delay		21.3			46.0			19.6			18.1	
Approach LOS		C			D			B			B	
Queue Length 50th (m)		27.8			72.6		3.2	46.2		2.9	44.5	
Queue Length 95th (m)		47.1			#124.8		9.0	77.3		m5.1	m57.6	
Internal Link Dist (m)		130.1			175.5			112.6			101.1	
Turn Bay Length (m)							15.0			25.0		
Base Capacity (vph)		575			603		315	735		322	730	
Starvation Cap Reductn		0			0		0	0		0	85	
Spillback Cap Reductn		0			0		0	0		0	0	
Storage Cap Reductn		0			0		0	0		0	0	
Reduced v/c Ratio		0.44			0.81		0.10	0.54		0.09	0.62	
Intersection Summary												
Area Type:	CBD											
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: 0.90												
Intersection Signal Delay: 27.5	Intersection LOS: C											

Lanes, Volumes, Timings 5: Churchill Ave N & Byron Ave

2027 FT - PM
Richmond / Churchill

Intersection Capacity Utilization 83.3% ICU Level of Service E

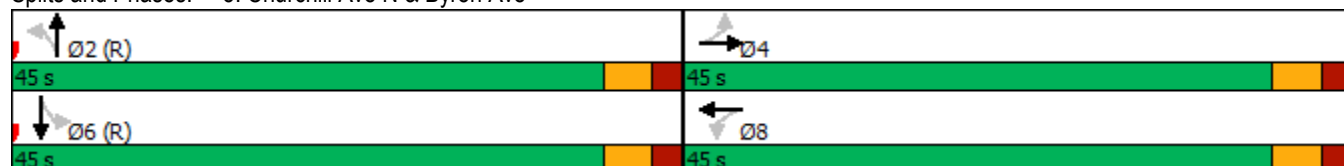
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Churchill Ave N & Byron Ave



HCM 2010 Signalized Intersection Summary
5: Churchill Ave N & Byron Ave

2027 FT - PM
Richmond / Churchill

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	148	61	86	332	72	33	306	94	30	327	70
Future Volume (veh/h)	45	148	61	86	332	72	33	306	94	30	327	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	0.99		0.99	0.98		0.97	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1620	1588	1620	1620	1588	1620	1573	1588	1620	1588	1576	1620
Adj Flow Rate, veh/h	45	148	61	86	332	72	33	306	94	30	327	70
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
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
Percent Heavy Veh, %	2	2	2	2	2	2	3	2	2	2	3	3
Cap, veh/h	101	291	109	122	381	79	516	586	180	370	633	136
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.51	0.51	0.51	1.00	1.00	1.00
Sat Flow, veh/h	145	783	293	202	1028	212	860	1156	355	880	1250	268
Grp Volume(v), veh/h	254	0	0	490	0	0	33	0	400	30	0	397
Grp Sat Flow(s),veh/h/ln	1221	0	0	1441	0	0	860	0	1511	880	0	1518
Q Serve(g_s), s	0.0	0.0	0.0	16.3	0.0	0.0	1.8	0.0	16.0	1.2	0.0	0.0
Cycle Q Clear(g_c), s	12.8	0.0	0.0	29.0	0.0	0.0	1.8	0.0	16.0	17.1	0.0	0.0
Prop In Lane	0.18		0.24	0.18		0.15	1.00		0.23	1.00		0.18
Lane Grp Cap(c), veh/h	500	0	0	582	0	0	516	0	766	370	0	769
V/C Ratio(X)	0.51	0.00	0.00	0.84	0.00	0.00	0.06	0.00	0.52	0.08	0.00	0.52
Avail Cap(c_a), veh/h	589	0	0	676	0	0	516	0	766	370	0	769
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	0.66	0.00	0.66
Uniform Delay (d), s/veh	21.5	0.0	0.0	26.7	0.0	0.0	11.4	0.0	14.9	3.0	0.0	0.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	8.4	0.0	0.0	0.2	0.0	2.5	0.3	0.0	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.0	0.0	0.0	12.9	0.0	0.0	0.5	0.0	7.2	0.3	0.0	0.3
LnGrp Delay(d),s/veh	22.3	0.0	0.0	35.1	0.0	0.0	11.6	0.0	17.4	3.3	0.0	1.6
LnGrp LOS	C			D			B		B	A		A
Approach Vol, veh/h		254			490			433			427	
Approach Delay, s/veh		22.3			35.1			17.0			1.7	
Approach LOS		C			D			B			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		51.0		39.0		51.0		39.0				
Change Period (Y+Rc), s		* 5.4		5.6		* 5.4		5.6				
Max Green Setting (Gmax), s		* 40		39.4		* 40		39.4				
Max Q Clear Time (g_c+I1), s		18.0		14.8		19.1		31.0				
Green Ext Time (p_c), s		3.3		1.9		3.1		2.4				
Intersection Summary												
HCM 2010 Ctrl Delay				19.3								
HCM 2010 LOS				B								
Notes												

Lanes, Volumes, Timings
6: Churchill Ave N & Site Access #1

2027 FT - PM
Richmond / Churchill

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	9	5	408	12	7	564
Future Volume (vph)	9	5	408	12	7	564
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	0.95
Frt	0.952		0.996			
Flt Protected	0.969					0.999
Satd. Flow (prot)	1449	0	1564	0	0	2981
Flt Permitted	0.969					0.999
Satd. Flow (perm)	1449	0	1564	0	0	2981
Link Speed (k/h)	30		50			50
Link Distance (m)	80.5		63.4			252.6
Travel Time (s)	9.7		4.6			18.2
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	9	5	408	12	7	564
Shared Lane Traffic (%)						
Lane Group Flow (vph)	14	0	420	0	0	571
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Right	Left	Left
Median Width(m)	3.5		0.0			0.0
Link Offset(m)	0.0		0.0			0.0
Crosswalk Width(m)	3.0		3.0			3.0
Two way Left Turn Lane						
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24
Turning Speed (k/h)	25	15		15	25	
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	CBD					
Control Type:	Unsignalized					
Intersection Capacity Utilization	36.0%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Int Delay, s/veh	0.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	9	5	408	12	7	564
Future Vol, veh/h	9	5	408	12	7	564
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	5	408	12	7	564

Major/Minor	Minor1	Major1	Major2
Conflicting Flow All	710	414	0
Stage 1	414	-	-
Stage 2	296	-	-
Critical Hdwy	6.63	6.23	-
Critical Hdwy Stg 1	5.43	-	-
Critical Hdwy Stg 2	5.83	-	-
Follow-up Hdwy	3.519	3.319	-
Pot Cap-1 Maneuver	384	637	-
Stage 1	666	-	-
Stage 2	729	-	-
Platoon blocked, %		-	-
Mov Cap-1 Maneuver	381	637	-
Mov Cap-2 Maneuver	381	-	-
Stage 1	666	-	-
Stage 2	722	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.4	0	0.1
HCM LOS	B		

Minor Lane/Major Mvmt	NBT	NBRWBLn1	SBL	SBT
Capacity (veh/h)	-	-	445	1137
HCM Lane V/C Ratio	-	-	0.031	0.006
HCM Control Delay (s)	-	-	13.4	8.2
HCM Lane LOS	-	-	B	A
HCM 95th %tile Q(veh)	-	-	0.1	0

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FT - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Lane Configurations	↑			↑			
Traffic Volume (vph)	403	0	0	679	0	0	
Future Volume (vph)	403	0	0	679	0	0	
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Flt							
Flt Protected							
Satd. Flow (prot)	1571	0	0	1571	0	0	
Flt Permitted							
Satd. Flow (perm)	1571	0	0	1571	0	0	
Right Turn on Red		Yes			Yes		
Satd. Flow (RTOR)							
Link Speed (k/h)	50			50	50		
Link Distance (m)	266.4			19.5	33.7		
Travel Time (s)	19.2			1.4	2.4		
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Adj. Flow (vph)	403	0	0	679	0	0	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	403	0	0	679	0	0	
Enter Blocked Intersection	No	No	No	No	No	No	
Lane Alignment	Left	Right	Left	Left	Left	Right	
Median Width(m)	3.5			3.5	0.0		
Link Offset(m)	0.0			0.0	0.0		
Crosswalk Width(m)	3.0			3.0	3.0		
Two way Left Turn Lane							
Headway Factor	1.24	1.24	1.24	1.24	1.24	1.24	
Turning Speed (k/h)		15	25		25	15	
Number of Detectors	2			2			
Detector Template	Thru			Thru			
Leading Detector (m)	10.0			10.0			
Trailing Detector (m)	0.0			0.0			
Detector 1 Position(m)	0.0			0.0			
Detector 1 Size(m)	0.6			0.6			
Detector 1 Type	Cl+Ex			Cl+Ex			
Detector 1 Channel							
Detector 1 Extend (s)	0.0			0.0			
Detector 1 Queue (s)	0.0			0.0			
Detector 1 Delay (s)	0.0			0.0			
Detector 2 Position(m)	9.4			9.4			
Detector 2 Size(m)	0.6			0.6			
Detector 2 Type	Cl+Ex			Cl+Ex			
Detector 2 Channel							
Detector 2 Extend (s)	0.0			0.0			
Turn Type	NA			NA			
Protected Phases	2			6		4	
Permitted Phases							
Detector Phase	2			6			
Switch Phase							
Minimum Initial (s)	5.0			5.0		5.0	

Lanes, Volumes, Timings
7: Pedestrian Crossing & Richmond Rd

2027 FT - PM
Richmond / Churchill

	→	↘	↙	←	↖	↗	
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø4
Minimum Split (s)	24.0			24.0			23.0
Total Split (s)	42.0			42.0			23.0
Total Split (%)	64.6%			64.6%			35%
Maximum Green (s)	36.0			36.0			19.0
Yellow Time (s)	3.3			3.3			3.0
All-Red Time (s)	2.7			2.7			1.0
Lost Time Adjust (s)	0.0			0.0			
Total Lost Time (s)	6.0			6.0			
Lead/Lag							
Lead-Lag Optimize?							
Vehicle Extension (s)	3.0			3.0			3.0
Recall Mode	C-Max			C-Max			Ped
Walk Time (s)							7.0
Flash Dont Walk (s)							12.0
Pedestrian Calls (#/hr)							51
Act Effct Green (s)	36.0			36.0			
Actuated g/C Ratio	0.55			0.55			
v/c Ratio	0.46			0.78			
Control Delay	10.9			19.7			
Queue Delay	0.0			0.0			
Total Delay	10.9			19.7			
LOS	B			B			
Approach Delay	10.9			19.7			
Approach LOS	B			B			
Queue Length 50th (m)	26.4			58.1			
Queue Length 95th (m)	45.2			#109.8			
Internal Link Dist (m)	242.4			0.1	9.7		
Turn Bay Length (m)							
Base Capacity (vph)	870			870			
Starvation Cap Reductn	0			0			
Spillback Cap Reductn	0			0			
Storage Cap Reductn	0			0			
Reduced v/c Ratio	0.46			0.78			
Intersection Summary							
Area Type:	CBD						
Cycle Length: 65							
Actuated Cycle Length: 65							
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green							
Natural Cycle: 60							
Control Type: Actuated-Coordinated							
Maximum v/c Ratio: 0.78							
Intersection Signal Delay: 16.4				Intersection LOS: B			
Intersection Capacity Utilization 46.9%				ICU Level of Service A			
Analysis Period (min) 15							
# 95th percentile volume exceeds capacity, queue may be longer.							
Queue shown is maximum after two cycles.							

Splits and Phases: 7: Pedestrian Crossing & Richmond Rd

 Ø2 (R) 42 s	 Ø4 23 s
 Ø6 (R) 42 s	