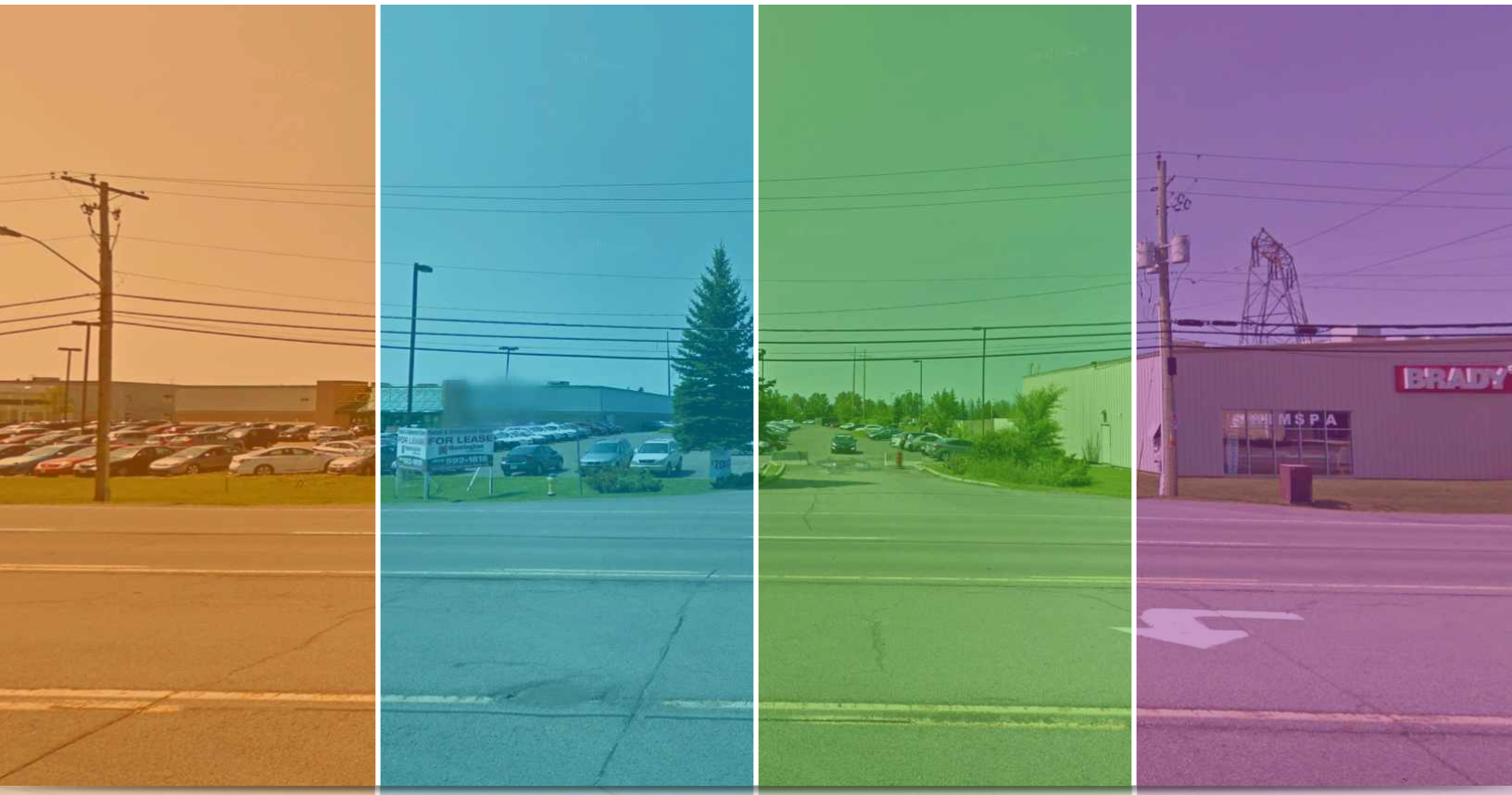
Huntington PROPERTIES

December 2018

2165 Robertson Road

TIA Forecasting Report



PARSONS

2165 Robertson Road

TIA Strategy Report

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TIA Screening and Scoping Report

1. SCREENING FORM

The Screening Form, in conjunction with the Scoping Report for the subject development, was submitted to the City of Ottawa staff for review and confirmation of the need for a Transportation Impact Assessment (TIA). Trip Generation triggers were met based on the type and size of the development. The Location triggers were met based on the site's location in the Robertson Arterial Mainstreet Design Priority Area (DPA) and fronting a designated Cycling Spine Route. The Safety trigger was met based on the proposed drive through facility and also on the site's proposed driveway location, which is within close proximity to Robertson/Fitzgerald signalized intersection. The Screening Form is provided as Appendix A.

2. SCOPING REPORT

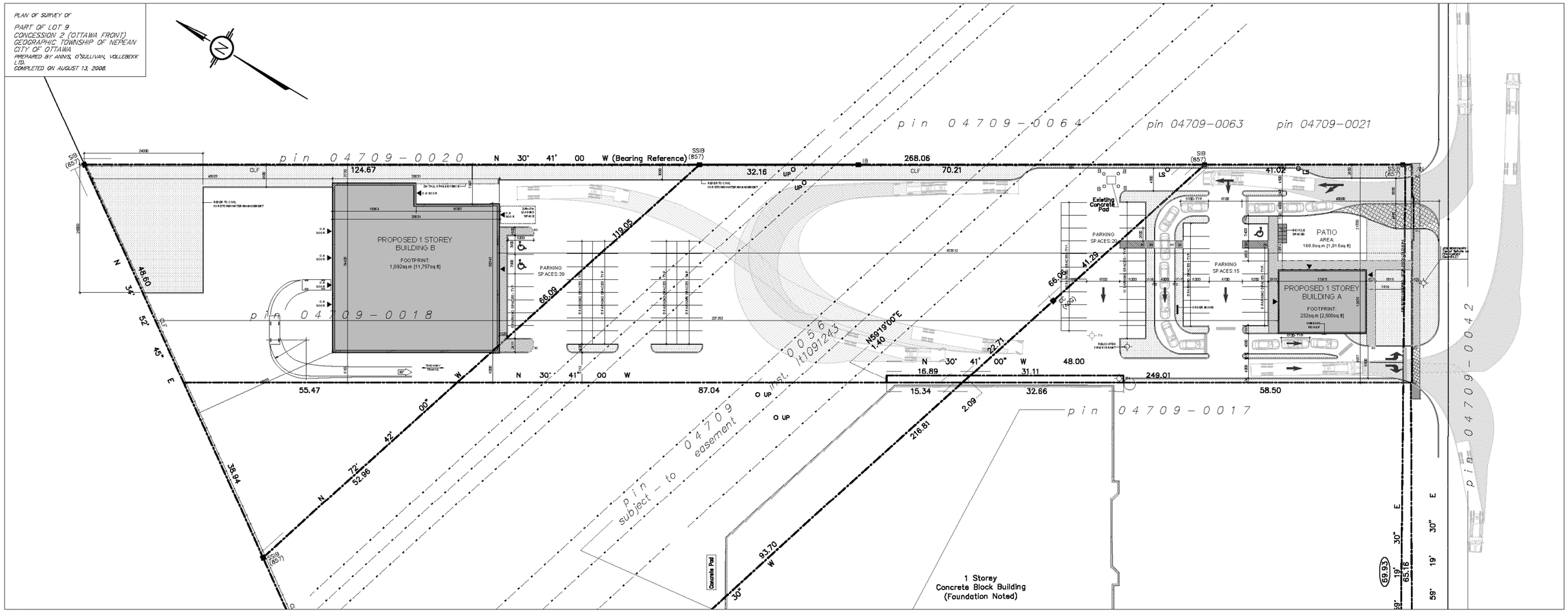
2.1. EXISTING AND PLANNED CONDITIONS

2.1.1. PROPOSED DEVELOPMENT

Based on the Site Plan provided by Lawrence Architect Incorporated, it is our understanding that the proponent is proposing a retail/warehouse complex at the rear of the site with drive-thru restaurant at the front of the site located at 2165 Robertson Road. The expected date of occupancy is 2019. The proposed single-phase development will consist of a 1,092 m^2 of Warehouse (ITE 150), a 232 m^2 of Fast-Food Restaurant with drive-thru (ITE 934) and 74 surface parking spaces. Of these spaces, 39 are for the warehouse and 35 are for the restaurant. . Access to the site is proposed via two one-way driveways on Robertson Road. The restaurant building has been located forward on the site with the parking and drive through at the rear of the building. The site is currently occupied by warehousing and parking, which has one 8.0m wide two-way driveway connection to Robertson Road. It is zoned as AM – Arterial Mainstreet Zone. The local context of the site is provided as Figure 1 and the proposed Site Plan is provided as Figure 2.

Figure 1: Local Context

Figure 2: Proposed Site Plan



01 SITE PLAN

2.1.2. EXISTING CONDITIONS

Area Road Network

Moodie Drive is a City-owned north-south arterial roadway that extends from Carling Avenue in the north to Brophy Drive in the south. Within the study area, Moodie Drive has a four-lane cross-section with auxiliary turn lanes provided at major intersections and a posted speed limit of 60 km/h.

Robertson Road is a City-owned east-west arterial roadway with a 5-lane cross-section, which includes a reversible center lane, and auxiliary turn lanes at major intersections. It extends from Eagleson Road in the west to Baseline Road in the east. Beyond Eagleson Road, Robertson Road continues as Hazeldean Road, and beyond Baseline Road, it continues as Richmond Road. Within the study area, the posted speed limit is 60 km/h.

Fitzgerald Road is a City-owned north-south collector road that extends from Moodie Drive in the north to Robertson Road in the south. Fitzgerald Road has a two-lane cross-section with auxiliary turn lanes pro0vided at major intersections and an unposted speed limit assumed to be 50 km/h.

Westcliffe Road is a City-owned north-south collector roadway that extends from Seyton Driveway in the south to Robertson Road in the north. Within the study area, it has a two-lane cross-section with auxiliary turn lanes provided at Robertson Road. The posted speed limit is 40 km/h.

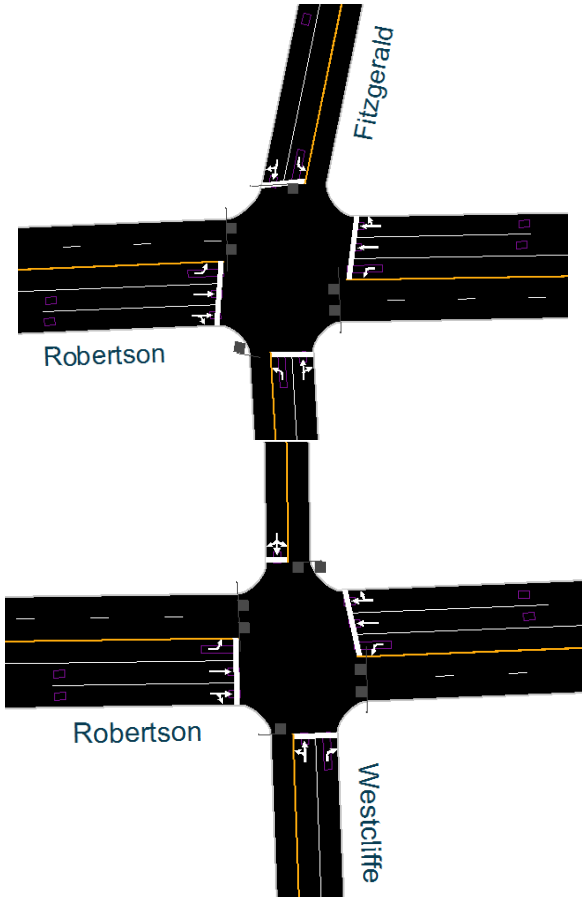
Existing Study Area Intersections

Robertson/Fitzgerald

The Robertson/Fitzgerald intersection is a signalized four-legged intersection. The westbound and eastbound approaches both consist of a left-turn lane, a through lane and a shared through/right-turn lane. The northbound and southbound approaches both consist of a left-turn lane and a shared through/right-turn lane. All movements are permitted at this location. The east leg of this intersection includes curbside bike lanes in each direction.

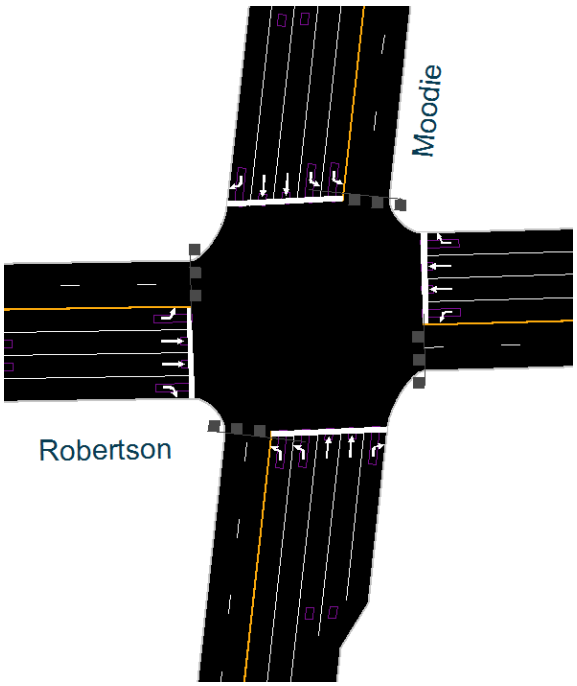
Robertson/Westcliffe

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



Robertson/Moodie

The Robertson/Moodie intersection is a signalized four-legged intersection. The westbound and eastbound approaches both consist of a single left-turn lane, two through lanes and a channelized right-turn lane with a bus queue jump area. The northbound and southbound approaches both consist of a single full-movement lane. All movements are permitted at this location. All legs of this intersection include curbside bike lanes in each direction. Both the east and west legs include bus queue-jump lanes



Existing Driveways to Adjacent Developments

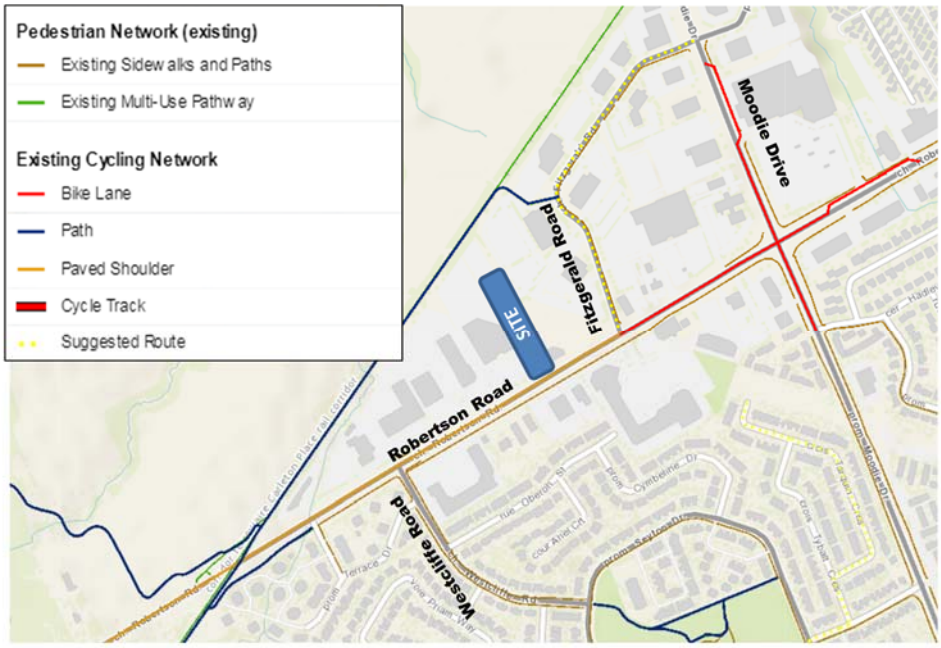
There are four private driveways located along the north side of Robertson Road between the proposed site and the Westcliffe/Robertson signalized intersection, and one private driveway between the site and the Fitzgerald/Robertson signalized intersection. There are five private driveways located along the south side of Robertson Road between the site and the Westcliffe/Robertson intersection, and two private driveways between the site and the Fitzgerald/Robertson intersection. There is an existing two-way 8.0m driveway serving the subject site.

Pedestrian/Cycling Network

Sidewalk facilities in the vicinity of the site are provided along the south side of Robertson Road, along the east side of Fitzgerald Road, along both sides of Westcliffe Road and along both sides of Moodie Drive.

According to the City's Cycling Plan, Robertson Road and Moodie Drive are classified as "Spine Routes", and Westcliffe Road and Fitzgerald Road are classified as "Local Routes". Bicycle facilities are currently provided in the form of curb-side bike lanes in both directions along Robertson Road between Moodie Drive and Fitzgerald Road. No bicycle facilities are provided along Robertson Road west of Fitzgerald Road. However, 2m to 3m wide paved shoulders are noted along this road segment. Within the area of study, the TransCanada Trail is located north of the site, connecting with Fitzgerald Road and with the grade separated multi-use crossing at Robertson Road, leading southwest to Kanata South. Figure 3 illustrates the existing adjacent active transportation network.

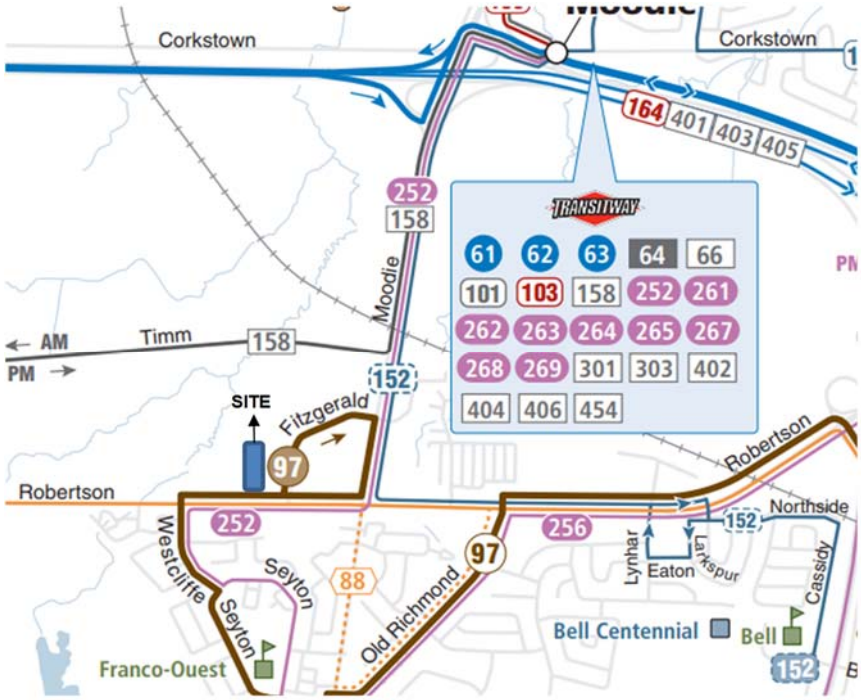
Figure 3:Existing Active Transportation Network



Transit Network

Transit service within the vicinity of the site is currently provided by OC Transpo frequent route #88, which provides frequent all-day service; route #97, which provides service every 30 minutes to Bayshore and the transitway; and connexion route #252, which provides connection to the transitway at Moodie. Bus stops for Routes #88, #97 and #252 are located on Robertson Road at the Fitzgerald/Robertson intersection and on Robertson Road, approximately 115m to the west of the site. The current transit area network is provided as Figure 3. A bus queue jump is currently provided at the Robertson/Moodie intersection in the west and eastbound directions.

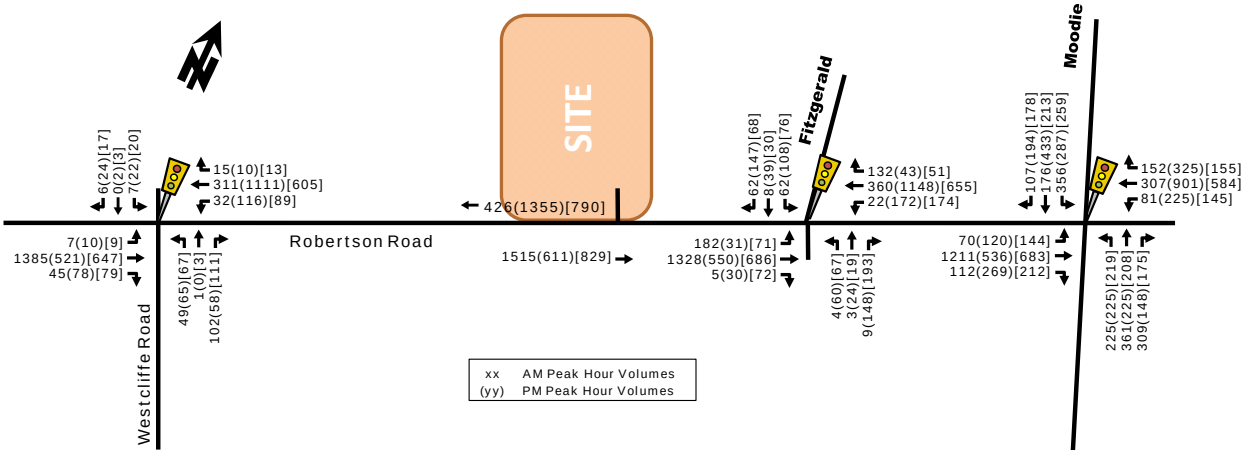
Figure 4: Area Transit Network



Peak Hour Travel Demands

The existing peak hour traffic volumes within the study area were obtained from the City of Ottawa and from traffic counts performed by Parsons on November 10th, 2018. The existing study area peak hour traffic volumes are illustrated in Figure 5. The peak hour traffic volume count data is included as Appendix B.

Figure 5: Existing Peak Hour Traffic Volumes



The performance of study area intersections is summarized in Table 1. As noted, all intersections are operating at an acceptable LoS 'D' or better. Regarding critical movements, the eastbound through movement at the Moodie/Robertson intersection during the morning peak hour operates at LoS 'E' and a v/c of 0.96. Existing conditions SYNCHRO analysis is included as Appendix C.

Table 1: Existing Intersection Performance

Intersection	Weekday AM Peak (PM Peak) [Saturday]					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Moodie/Robertson	E (D) [C]	0.96 (0.82) [0.71]	EBT (WBL) [EBT]	46.4 (35.5) [38.2]	D (A) [A]	0.82 (0.59) [0.59]
Robertson/Fitzgerald	A (C) [E]	0.54 (0.80) [0.92]	EBT (SBL) [SBL]	7.8 (18.3) [19.1]	A (A) [A]	0.53 (0.45) [0.50]
Westcliffe/Robertson	B (A) [A]	0.61 (0.49) [0.32]	EBT (WBT) [EBT]	10.0 (9.2) [8.5]	A (A) [A]	0.58 (0.46) [0.30]
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

Existing Road Safety Conditions

Collision history for study area intersections and roads (2013 to 2017, inclusive) was obtained from the City of Ottawa and most collisions (80%) involved only property damage, indicating low impact speeds, and 20% involved personal injuries. The primary causes of collisions cited by police include; rear end (32% or 52), angle (21% or 35), turning movement (18% or 30), sideswipe (17% or 28), single vehicle other (10% or 16) and other (2% or 3) type collisions.

Regarding rear end collisions, the majority (37 out of 52) were reported at the Moodie/Robertson intersection. Most of angle collisions (20 out of 35) and turning movement collision (16 out of 30) were reported along Robertson Road, between Fitzgerald Drive and Moodie Drive.

A standard unit of measure for assessing collisions at an intersection is based on the number collisions per million entering vehicles (MEV). At intersections within the study area, reported collisions have historically take place at a rate of:

- 0.77/MEV at the Moodie/Robertson intersection;
- 0.45/MEV at the Fitzgerald/Robertson intersection; and,
- 0.20/MEV at the Robertson/Westcliffe intersection.

It is noteworthy that within the five-years of recorded collision data there were seven (7) collisions involving pedestrians resulting in non-fatal injuries and no collisions involving cyclists. Collisions involving pedestrians were reported at the following locations:

- Fitzgerald/Robertson intersection (four collisions involving four pedestrians);
- Moodie/Robertson intersection (one collision involving one pedestrian);
- Robertson, between Fitzgerald and Moodie (one collision involving two pedestrians); and
- Robertson, between Westcliffe and Fitzgerald (one collision involving one pedestrian).

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

Existing Traffic Management Measures

A review of the study area has been performed to identify whether any of the following measures are present:

- Communication and enforcement;
- Minor adjustment;
- Engineering and Traffic Management; and
- Emerging measures.

It is noted that no existing traffic management measures have been identified.

2.1.3. PLANNED CONDITIONS

Planned Study Area Transportation Network Changes

Within the study area, notable transportation network changes are illustrated in Figure 5 (excerpt from the 2013 TMP) and are described as follows.

Robertson Road Cross-Town Bikeway
Within the 2013 Cycling Plan, Robertson Road between Richmond Road and the TransCanada Trail is identified as a future cross-town bikeway. The segment between Baseline Road and Moodie Drive is planned to be implemented during the 2020 - 2025 period. There is no date scheduled for the implementation of the segment located between Moodie Drive and the TransCanada Trail.

TransCanada Trail Bridge Renewal
Renewal of the TransCanada Trail multi-use bridge located approximately 340m to the west of Westcliffe Road is identified in the Ward 8 – College Construction Program. This work is scheduled to be done during the years 2018 to 2021.

Proposed Collector Roads
According to the Transportation Master Plan Road Network (Figure 6), there is a proposed east extension of Menten Place to Stafford Road. Limited development has been observed in this area in recent years and there is no schedule date for the construction of this collector road.

Figure 6: Transportation Master Plan Road Network (Map 6)

Transit

Within the TMP's affordable network, transit priority (isolated measures) are proposed along Robertson Road between Hazeldean Road to the west and Baseline Road to the east.

Other Area Development

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

300-303 Moodie Drive

Site Plan application to permit the construction of a six-storey hotel and a one-storey commercial retail unit at the above noted address. The Transportation Brief (prepared by Novatech) projects an increase in two-way traffic volumes of approximately 62 to 89 veh/h during the weekday PM peak hour and Saturday peak hour.

2015 Robertson Road

Site Plan Control application to modify the easterly free-standing building at the above noted address to add a drive thru along the west side; make alterations to interior of easterly building; close in canopy entrance of easterly building; minor modifications to on-site parking to accommodate drive thru and refuse containers. The Transportation Brief (prepared by D.J. Halpenny & Associates Ltd) projected an increase in vehicle traffic of approximately 52 inbound and 49 outbound veh/h during the afternoon peak hour. With the major traffic generator being the KFC restaurant, which is not open during the peak AM hours of the adjacent roads, the analysis determined the traffic impact for only the peak PM hour.

2235 and 2265 Robertson Road

Zoning By-law Amendment Application to permit auto body shop uses in the existing auto service bays for two buildings. The Transportation Brief prepared by Stantec in 2013 estimated the following site-generated traffic:

- Weekday AM peak- 16 westbound vehicles and 42 eastbound vehicles on Robertson Road, and
- Weekday PM peak- 23 westbound vehicles and 62 eastbound vehicles on Robertson Road.

The development has been constructed and, as such, the generated traffic has been accounted in the existing traffic counts.

2.2. STUDY AREA AND TIME PERIODS

2.2.1. DESIGN REVIEW COMPONENT

In accordance to the City of Ottawa Transportation Impact Assessment Guidelines, the study area for the Design Review Component includes the development property and the boundary road, which is Robertson Road.

2.2.2. NETWORK IMPACT COMPONENT

The transit network impact of the proposed development will be assessed at the closest transit stops, which are located on the north and south sides of Robertson Road, approximately 115 meters to the west of the site and 180 meters to the east of the site, respectively.

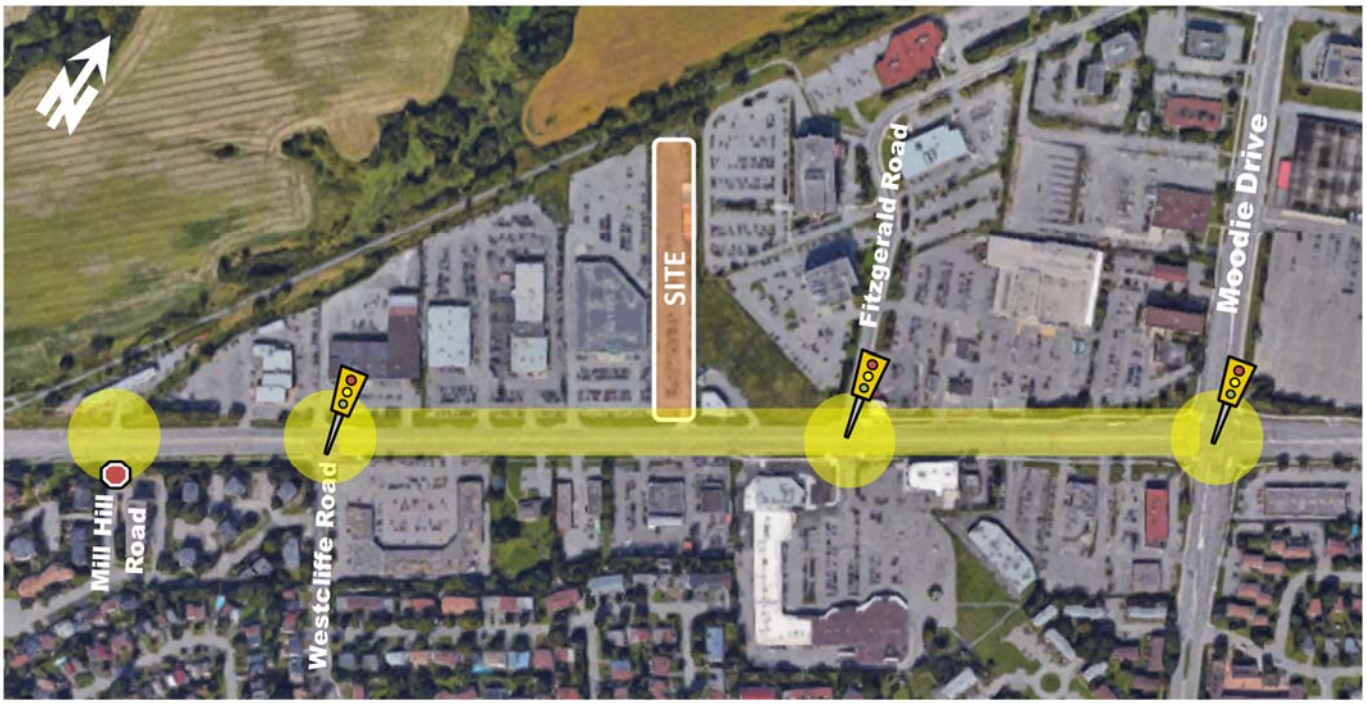
With regard to the network intersections, the City of Ottawa TIA Guidelines state that the study area should consider intersections on walking and cycling access routes within 600m of site, and arterial intersections impacted by auto demands from development (typically within 400m in urban conditions). According to Schedule B of the Official Plan, the site is located within an Urban Employment Area. As such, the foregoing study will include the following intersections.

- Robertson/Moodie signalized intersection: To be analyzed from the MMLOS and traffic operations perspective;
- Robertson/Fitzgerald signalized intersection: To be analyzed from the MMLOS and traffic operations perspective;
- Robertson/Westcliffe signalized intersection: To be analyzed from the MMLOS and traffic operations perspective;
- Robertson/Mill Hill Rd unsignalized intersection: To be analyzed from the MMLOS perspective;

The network concept analysis will include adjacent screenlines SL 10 at Robertson Road and SL 11 at Richmond Road.

As the proposed development is an industrial and retail, the time periods assessed will be the weekday morning, afternoon and Saturday peak hours. The proposed study area is outlined below and highlighted in Figure 7.

Figure 7: Study Area



2.3. HORIZON YEARS

The expected build-out date for the proposed development is assumed to be 2019. Depending on the growth rate of the study area, the horizon year 2024 will be assessed for 5-years beyond site build out.

2.4. EXEMPTION REVIEW

Based on the City's TIA guidelines and the subject site, the following modules/elements of the TIA process, summarized in Table 2, are recommended to be exempt in the subsequent steps of the TIA process:

Table 2: Exemptions Review Summary

Module	Element	Exemption Consideration
4.1 Development Design	4.1.2 New Streets Network	Not required for applications involving site plans.
4.2 Parking	4.2.2 Spillover Parking	According to the project's architect, the proposed development is required to provide 37 parking spaces for the industrial uses (warehouse) and 19 parking spaces for the drive-thru restaurant, for a total of 56 parking spaces. With a total of 74 proposed surface parking spaces, including 35 restaurant parking spaces and 39 industrial parking spaces, the development is meeting City By-Law requirements. As such, no Parking Spillover is anticipated.
4.5 Transportation Demand Management	All elements	Site expected to have less than 60 employees and no students on location at any given time.
4.6 Neighbourhood Traffic Management	All elements	The site relies on arterial roadways for access.
4.8 Review of Network Concept	All elements	The site is not expected to generate 200 trips more than the established zoning. This will be confirmed in Step 3.

3. FORECASTING

3.1. DEVELOPMENT GENERATED TRAVEL DEMAND

3.1.1. TRIP GENERATION AND MODE SHARES

The proposed development consists of a 1,092 m^2 retail/warehouse and 232 m^2 of retail with drive-thru. Appropriate trip generation rates for the proposed Phase 1 development were obtained from the 9th Edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual, which are summarized in Table 3.

Table 3: ITE Trip Generation Rates

Land Use	Data Source	Trip Rates		
		AM Peak	PM Peak	Saturday Peak
Fast-Food Restaurant with Drive-Thru	ITE 934	T = 40.19(X)	T = 32.67(X)	T = 54.86(X)
Retail/Warehouse	ITE 150	T = 0.17(X); T = 0.12(X)+25.32	T= 0.19(X); T = 0.12(X)+27.82	T= 0.05(X)

Notes:
T = Average Vehicle Trip Ends
X = 1000 ft^2 Gross Floor Area

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

To convert ITE vehicle trip rates to person trips, an auto occupancy factor and a non-auto trip factor were applied to the ITE vehicle trip rates. Our review of available literature suggests that a combined factor of approximately 1.28 is considered reasonable to account for typical North American auto occupancy values of approximately 1.15 and combined transit and non-motorized modal shares of less than 10%. The person trip generation for the proposed development is summarized in Table 4.

Table 4: Proposed Development Modified Person Trip Generation

Land Use	Area	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)			PM Peak (Person Trips/h)		
		In	Out	In	In	Out	Total	In	Out	Total
Fast Food Restaurant with Drive-Thru	232 m²	65	64	129	54	51	105	89	87	176
Retail/Warehouse	1092 m²	26	9	35	10	28	38	0	1	1
Total Person Trips		91	73	164	64	79	143	89	88	177
Note: 1.28 factor to account for typical North American auto occupancy values of approximately 1.15 and combined transit and non-motorized modal shares of less than 10%										

The person trips shown in Table 4 for the proposed site were then reduced by TRANS District modal share values. Table 5 summarizes the modal shares for the National Capital Region TRANS Survey, District Bayshore/Cedarview.

Table 5: OD Survey Trips by Primary Travel Mode – Bayshore/Cedarview

Time Period	24 Hours			AM Peak Hour			PM Peak Hour			Average	Selected Split
Mode	From District	To District	Within District	From District	To District	Within District	From District	To District	Within District		
Driver	64%	64%	47%	52%	71%	35%	70%	56%	49%	56%	60%
Passenger	16%	16%	15%	12%	10%	13%	15%	16%	18%	14%	10%
Transit	15%	18%	15%	34%	17%	28%	12%	25%	12%	21%	20%
Bike/Walk	2%	2%	23%	2%	2%	23%	3%	2%	21%	9%	10%

Based on the mode shares outlined in Table 5 from the TRANS report. Given site location, walking, cycling and transit modal shares are expected to be low. Pass-By trips were assumed to be 50% for the Fast-Food Restaurant with Drive-Thru and a 10% of Multi-Purpose trips was assumed for the site, considering some warehouse employees buying at the fast-food restaurant. The following Table 6 provides the mode shares for Fast-Food Restaurant trips and Table 7 provides mode shares for Warehousing trips. Table 8 summarizes the total site-vehicle trip generation considering pass-by vehicles and multi-purpose trips.

Table 6: Fast Food Restaurant with Drive Thru Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	60%	39	39	78	33	31	64	54	53	107
Auto Passenger	10%	7	7	14	6	5	11	9	9	18
Transit	20%	13	12	25	10	10	20	18	17	35
Non-motorized	10%	6	6	12	5	5	10	8	8	16
Total Person Trips	100%	65	64	129	54	51	105	89	87	176
Less Pass-by (50%)		-20	-20	-40	-16	-16	-32	-27	-27	-54
'New' Fast-Food w/Drive-Thru Auto Trips		**19**	**19**	**38**	**17**	**15**	**32**	**27**	**26**	**53**

Table 7: Retail/Warehousing Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	60%	16	6	22	6	17	23	0	1	1
Auto Passenger	10%	3	1	4	1	3	4	0	0	0
Transit	20%	5	2	7	2	6	8	0	0	0
Non-motorized	10%	2	0	2	1	2	3	0	0	0
Total Person Trips	100%	26	9	35	10	28	38	0	1	1
Less Pass-by (0%)		0	0	0	0	0	0	0	0	0
'New' Warehousing Auto Trips		**16**	**6**	**22**	**6**	**17**	**23**	**0**	**1**	**1**

Table 8: Total Site Vehicle Trip Generation

Land Use	AM Peak (veh/h)			PM Peak (veh/h)			SAT Peak (veh/h)		
	In	Out	Total	In	Out	Total	In	Out	Total
Fast-Food w/ Drive-Thru Trip Generation	39	39	78	33	31	64	54	53	107
Retail/Warehousing Trip Generation	16	6	22	6	17	23	0	1	1
Fast-Food w/ Drive-Thru Pass-by (50%)	-20	-20	-40	-16	-16	-32	-27	-27	-54
Retail/Warehousing Pass-by (0%)	0	0	0	0	0	0	0	0	0
Multi-purpose Trips (10%)	-3	-3	-6	-3	-3	-6	-2	-3	-5
Total 'New' Auto Trips	**32**	**22**	**54**	**20**	**29**	**49**	**25**	**24**	**49**

As shown in Table 8, the resulting number of potential 'new' two-way vehicle trips for the proposed development is approximately 54, 49 and 49 veh/h during the weekday morning, afternoon and Saturday peak hours, respectively.

Mode Shares

As mentioned previously, the mode shares were calculated based on data provided in the National Capital Region TRANS Survey – Bayshore/Cedarview District report.

3.1.2. TRIP DISTRIBUTION

Based on the existing traffic volume counts and the location of adjacent arterial roadways and neighbourhoods, the distribution of site-generated traffic volumes is as follows:

Fast Food Restaurant with Drive-Thru:

- 30% to/from the east; and
- 70% to/from the south.
- Pass-by distribution is assumed to be 50% to/from the east and 50% to/from the west.

Warehousing:

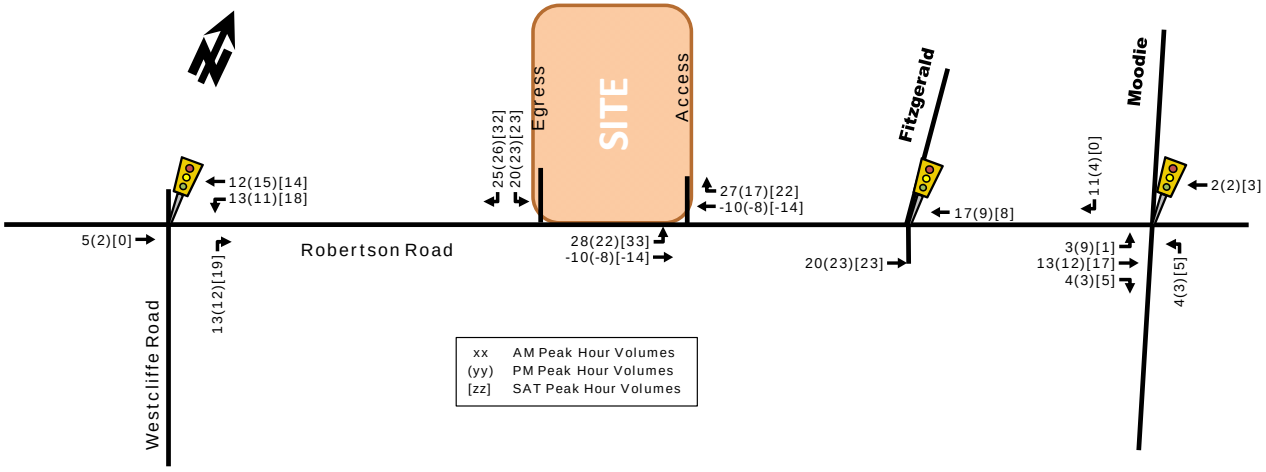
- 50% to/from the east;
- 10% to/from the northwest;
- 30% to/from the west;
- 10% to/from the southeast; and

3.1.3. TRIP ASSIGNMENT

A one-way inbound driveway connection with a through-lane and a left-turn lane, and a one-way outbound driveway connection with a right-turn lane and a left-turn lane are proposed to Robertson Road, located approximately 140m west

and 175m west of Fitzgerald Road, respectively. Given these driveway configurations, 'new' and 'pass-by' site-generated vehicle trips are assigned to the study area network and illustrated as Figure 8.

Figure 8: 'New', 'Pass-by' and Multi-Purpose Site-Generated Traffic



3.2. BACKGROUND NETWORK TRAVEL DEMANDS

3.2.1. TRANSPORTATION NETWORK PLANS

Refer to section 2.1.3 Planned Conditions – Planned Study Area Transportation Network Changes.

3.2.2. BACKGROUND GROWTH

According to the City of Ottawa intersection traffic growth rates, background growth at the Robertson/Moodie signalized intersection has ranged between 0.2% to 2% per annum. To be conservative and considering ongoing development at Stittsville and Kanata South, a 2% per annum background growth on Robertson Road will be used. To account for the traffic generated by the previously identified area developments, the corresponding volumes have been added to the study area intersections as per corresponding traffic studies or existing intersection vehicle movement proportions. Other area development-generated traffic is included in Appendix E. The resultant 2019 and 2024 background traffic volumes are depicted as Figure 9 and Figure 10 respectively.

Figure 9: 2019 Background Traffic Volumes

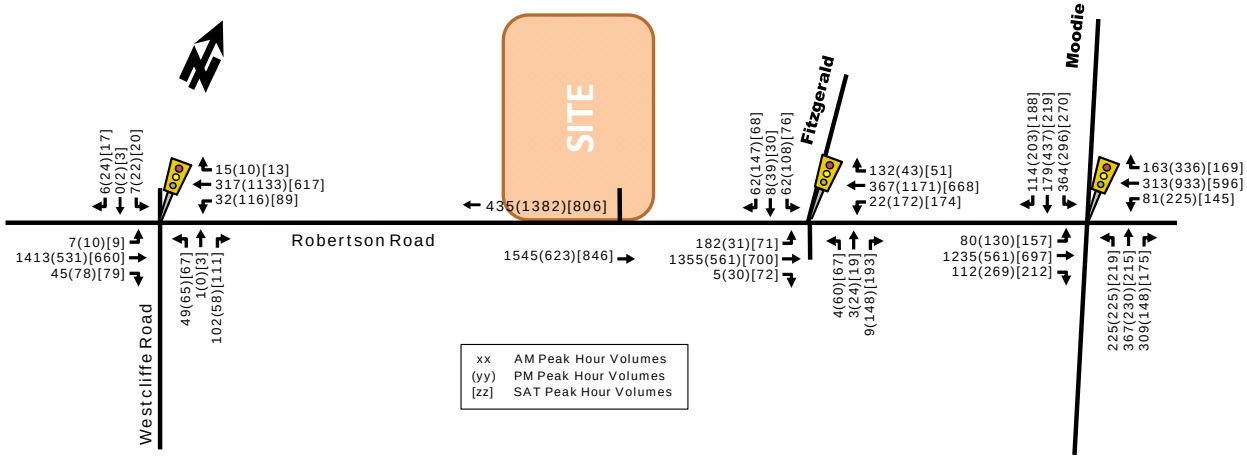
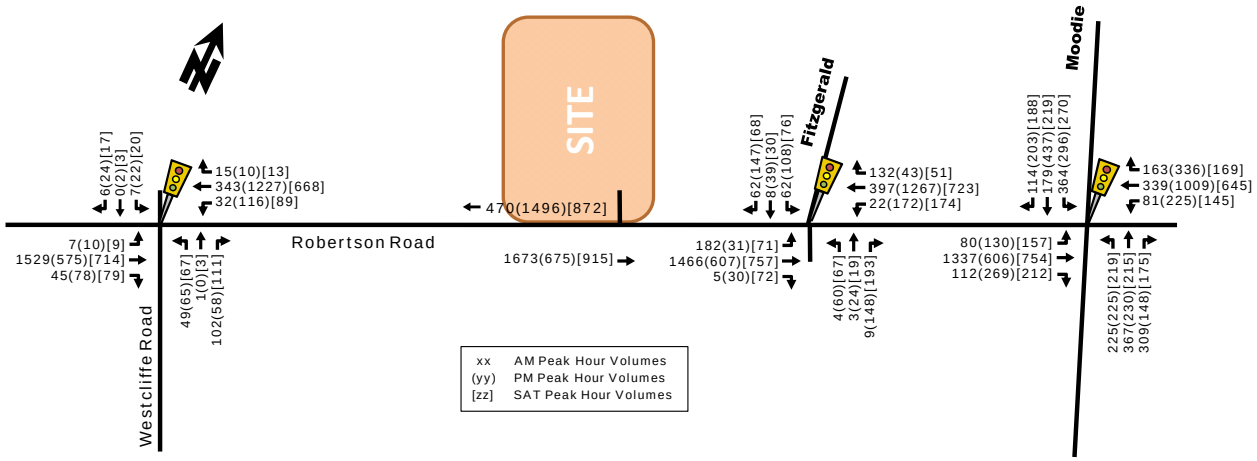


Figure 10: 2024 Background Traffic Volumes



3.2.3. OTHER DEVELOPMENTS

Refer to section 2.1.3 Planned Conditions – Other Area Developments.

3.3. DEMAND RATIONALIZATION

Based on the existing traffic volumes, there is an apparent capacity issue on the west leg of the Robertson/Moodie intersection and the north leg of the Robertson/Fitzgerald intersection, which are projected to operate at a congested LOS 'E' during the critical morning and Saturday peak hour. This issue is likely to worsen as time progresses and background traffic growth increases volumes along Robertson Road. Table 9 and Table 10 summarizes background 2019 and background 2024 intersection performance, respectively. This issue will be further explored in a more detailed review of the existing traffic conditions compared to the future traffic conditions in the ensuing analysis. Background conditions SYCNHRO analysis is included as Appendix F.

Table 9: Background 2019 Intersection Performance

Intersection	Weekday AM Peak (PM Peak) [Saturday]					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Moodie/Robertson	E (D) [C]	0.98 (0.84) [0.72]	EBT (WBT) [EBT]	47.9 (36.3) [38.6]	D (C) [A]	0.83 (0.73) [0.60]
Robertson/Fitzgerald	A (C) [E]	0.55 (0.80) [0.92]	EBT (SBL) [SBL]	7.7 (18.1) [19.0]	A (A) [A]	0.54 (0.45) [0.50]
Westcliffe/Robertson	B (A) [A]	0.62 (0.50) [0.33]	EBT (WBT) [EBT]	10.2 (9.4) [8.5]	A (A) [A]	0.59 (0.47) [0.31]
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

Table 10: Background 2024 Intersection Performance

Intersection	Weekday AM Peak (PM Peak) [Saturday]					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Moodie/Robertson	F (E) [C]	1.06 (0.91) [0.78]	EBT (WBT) [EBT]	55.7 (37.9) [39.6]	D (C) [B]	0.89 (0.78) [0.64]
Robertson/Fitzgerald	A (C) [E]	0.60 (0.80) [0.92]	EBT (SBL) [SBL]	7.7 (17.8) [18.6]	A (A) [A]	0.58 (0.46) [0.52]
Westcliffe/Robertson	B (A) [A]	0.67 (0.54) [0.35]	EBT (WBT) [EBT]	11.0 (10.2) [8.5]	B (A) [A]	0.64 (0.51) [0.33]
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

4. ANALYSIS

4.1. DEVELOPMENT DESIGN

4.1.1. DESIGN FOR SUSTAINABLE MODES

Sidewalks and cycling facilities are currently non-existent along the north side of Robertson Road adjacent to the site. Regardless, a 1.8m wide sidewalk is proposed along the site's frontage connecting to the on-site sidewalk system. Across the two site driveways the sidewalk will be depressed concrete. Bicycle parking spaces are proposed for the back of the patio in close proximity to the restaurant entrances, which is considered appropriate. Signage informing drivers about bicyclist presence and bicyclists about heavy vehicles presence is recommended. With the proposed on-site sidewalk linking to the proposed sidewalk along the site's frontage, overall walkability is improved.

All proposed development doors are within 400m of the adjacent transit stop (0930-Robertson/Fitzgerald). Proper signage informing drivers of presence of pedestrians between the warehouse uses and the fast-food restaurant patio is recommended at high visibility locations.

Transit service within the vicinity of the site is currently provided by OC Transpo frequent route #88, which provides frequent all-day service; route #97, which provides service every 30 minutes to Bayshore and the transitway; and connexion route #252, which provides connection to the transitway at Moodie. Bus stops for Routes #88, #97 and #252 are located on Robertson Road at the Fitzgerald/Robertson intersection and on Robertson Road, approximately 115m to the west of the site. Currently, walking connectivity towards these stops occurs on 2.5m to 3.0m wide paved shoulders. This is considered inadequate given the presence of high-speed traffic, transit service, transit priority plans and nearby destinations along Robertson Road (e.g. retail, restaurants, banking services, etc.)

4.1.2. CIRCULATION AND ACCESS

The proposed development includes a 5m wide one-lane inbound driveway, with another approximately 5m of depressed concrete to accommodate the turn requirement of tractor trailer trucks. The outbound driveway is two-lanes for a total width of 6.5m. The inbound driveway has 35m of clear throat length, which is 5m short of the TAC guideline, but is considered sufficient in this instance and a variance is requested. For the purposes of truck access to the warehousing uses, and as shown in the Site Plan, a mountable curb (depressed concrete) is proposed at the inbound driveway. No issues are anticipated at this driveway, as indicated by turning template analysis performed by Parsons and displayed on the Site Plan.

Regarding drive-thru requirements, according to the City of Ottawa Parking By-Law, Section 112, the site is required to provide seven (7) vehicle queueing spaces at/before the order board and a minimum of 11 total queueing spaces. With 12 proposed queueing spaces, seven (7) of which are at/before the order board, the proposed fast-food restaurant with drive-thru is meeting City By-Law requirements.

Based on vehicle turning templates shown on the Site Plan (enlargement included as Appendix G), no site access/circulation issues are anticipated.

4.2. PARKING

4.2.1. PARKING SUPPLY

According to the City of Ottawa By-Law, the proposed development is required to provide 37 parking spaces for the industrial uses (warehouse) and 19 parking spaces for the drive-thru restaurant, totaling 56 parking spaces. With a total of 74 proposed surface parking spaces, including 35 restaurant parking spaces, 39 industrial parking spaces, the development is meeting City By-Law requirements.

Bicycle Parking
According to the City of Ottawa By-Law, the proposed development is required to provide four (4) bicycle parking spaces for the warehouse and one (1) bicycle parking space for the fast-food restaurant. With a total of six (6) proposed bicycle parking spaces, the development is meeting City By-Law requirements. As per City of Ottawa requirements, bicycle parking spaces should be provided in well used, accessible and lit areas and protected from weather, if possible.

Loading Provisions
As per Section 113 of the City of Ottawa Parking provisions By-Law, the proposed development is required to provide a minimum of 1 loading spaces. With 6 proposed loading spaces located adjacent to the warehouse to the rear of the property, the proposed development is meeting City By-Law requirements and is noted to provide sufficient space for truck maneuvering purposes.

4.3. BOUNDARY STREET DESIGN

The boundary street for the development is Robertson Road. At this time, there has not been any complete street concepts prepared for Robertson Road. The existing adjacent roadway's geometry consists of the following features:

- 2 vehicle travel lanes in each direction;
- 1 shared centre lane for auxiliary left-turns;
- Non-existent walking facilities along the north side of the roadway;
- 1.5m asphalt sidewalk on the south side of the roadway;
- More than 3,000 vehicles per day along Robertson Road;
- Posted speed limit of 60 km/h, assumed operating speed of 60 to 70 km/h;
- 3.5m wide centre and curb lanes;
- 2.5m wide paved shoulders;
- No dedicated cycling facilities adjacent to site;
- No dedicated transit facilities; and
- No on-street parking.

The multi-modal level of service analysis for the road segment along Robertson Road adjacent to the site is summarized in Table 11, with detail analysis provided in Appendix H. Given the development's location within 100m of an Arterial Main Street, the target levels of service for pedestrians and cyclists are moderate (PLoS 'C' and BLoS 'C'). As mentioned in

section 2.1.3, there are transit priority isolated measures planned for Robertson Road and as such, transit level of service target is TLoS 'D'. Robertson Road is a designated truck route, and as such, has a truck level of service target of TKLoS 'D'.

Table 11: MMLOS – Existing Robertson Road Adjacent Segment (North Side of Roadway)

Road Segment	Level of Service							
	Pedestrian (PLoS)		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target
Robertson Road	F	C	F	C	D	D	A	D

The MMLOS road segment analysis shows that existing conditions on the north side of Robertson Road do not meet MMLOS area targets for pedestrians and bicyclists. To meet the target PLoS 'C' for Robertson Road west of Fitzgerald Road, the provision of a 2.0m sidewalk with a 2.0m boulevard and reducing vehicle speeds to 50 km/h along Robertson Road would be required. The Figure 2: Site Plan shows that a 1.8m wide sidewalk and an approximate 3.8m wide boulevard, are being proposed.

With regard to bicyclists, the high traffic volumes on Robertson Road, high operating speeds and lack of cycling facilities, result in a low level of service as well (BLoS 'F'). To achieve the target level of service, the City can consider the provision of curbside bike lanes which, paired with a speed reduction to 50 km/h, would result in BLoS 'C'. It is worth noting that the curbside bike lanes would provide additional benefits to pedestrian comfort.

4.4. ACCESS INTERSECTION DESIGN

4.4.1. LOCATION AND DESIGN OF ACCESS

The proposed development is located in a property with approximately 43 m of frontage onto Robertson Road. There are two proposed driveway connections to Robertson Road to serve the proposed development; a 5m wide inbound driveway with a mountable curb and depressed concrete that extends the width to approximately 10m to accommodate tractor trailer trucks. Outbound, there is a 6.5m wide two-lane outbound driveway. The two driveways are approximately 24 m from each other and approximately 140m from the Robertson/Fitzgerald signalized intersection and 290m from the Robertson/Westcliffe signalized intersection. These locations and configurations meet the City's Private Approach By-Law requirements.

The inbound driveway includes 35m of clear throat length, which is considered sufficient, and for the purposes of truck access to the warehousing uses, and as shown in the Site Plan, a mountable curb (depressed concrete) is proposed at the inbound driveway. No issues are anticipated at this driveway, as indicated by vehicle turning templates shown on the Site Plan.

4.4.2. INTERSECTION CONTROL AND DESIGN

Based on the projected volumes, the full-movement outbound driveway should be controlled with STOP signs on-site only. The inbound access does not require any control. The SYNCHRO analysis shows minimal queues and delays at both site driveways for the horizon years. The SYNCHRO model output for the horizon years are included in Appendices F, H and I.

Both access driveway intersections are unsignalized. Considering MMLoS intersection analysis is for signalized intersections, no MMLoS analysis can be provided at these driveway intersections.

4.5. TRANSPORTATION DEMAND MANAGEMENT

Exempt – See Section 2.3.

4.6. NEIGHBOURHOOD TRAFFIC MANAGEMENT

Exempt – See Section 2.3.

4.7. TRANSIT

Transit service within the vicinity of the site is currently provided by OC Transpo frequent route #88, which provides frequent all-day service; route #97, which provides service every 30 minutes to Bayshore and the transitway; and connexion route #252, which provides connection to the transitway at Moodie. Bus stops for Routes #88, #97 and #252 are located on Robertson Road at the Fitzgerald/Robertson intersection and on Robertson Road, approximately 115m to the west of the site. Table 12 summarizes the projected site-generated transit demand at adjacent transit stops.

Table 12: Transit Capacity at Adjacent Transit Stops

Stop	Direction	Average Frequency (Buses/Hr)		Total Capacity (Seats/hr)	Demanded Capacity (%)
0930	Eastbound	PM	3	165	11%
1313	Westbound	PM	3	225	8%
(1) Bus capacity is assumed to be 55 seats for a single bus, 75 seats for an articulated bus and 90 seats for a double decker bus.					

As shown in Section 3.1, the two-way transit people trips generated by the proposed development is 32, 28 and 35 passengers/h during the weekday morning, afternoon and Saturday peak hours, respectively. This transit demand corresponds to 8% to 11% of the capacity currently offered by adjacent transit services. As such, no issues are anticipated at the study area transit network in servicing the proposed development.

4.8. REVIEW OF NETWORK CONCEPT

Given the site's location, the closest strategic screenlines are SL 10 (Robertson 03603) and SL 11 (Richmond 03607). Table 13 and Table 14 summarize the SL 10 and SL 11 screenline analysis by comparing background and projected traffic demands to screenline estimated capacities, respectively.

Table 13: SL 10 Robertson - Screenline Analysis

Screenline #10 - Eagleson			Direction	Peak	Total Vehicles	v/c
Station	# lanes	Assumed Capacity*				
Robertson (Background 2019)	2	2,000	Inbound	AM	1465	0.73
				PM	619	0.31
				SAT	748	0.37
			Outbound	AM	372	0.19
				PM	1222	0.61
				SAT	701	0.35
Robertson (Background 2024)	2	2,000	Inbound	AM	1581	0.79
				PM	663	0.33
				SAT	802	0.40
			Outbound	AM	398	0.20
				PM	1316	0.66
				SAT	752	0.38
Robertson (Total Projected 2019)	2	2,000	Inbound	AM	1470	0.74
				PM	621	0.31
				SAT	748	0.37

			Outbound	AM	374	0.19
				PM	1228	0.61
				SAT	701	0.35
Robertson (Total Projected 2024)	2	2,000	Inbound	AM	1586	0.79
				PM	665	0.33
				SAT	802	0.40
			Outbound	AM	400	0.20
				PM	1322	0.66
				SAT	752	0.38
** Assumed capacity obtained from the 2008 Road Infrastructure Needs Study*						

Table 14: SL 11 Richmond – Screenline Analysis

Screenline #11 - Acres			Direction	Peak	Total Vehicles	v/c
Station	# lanes	Assumed Capacity*				
Richmond (Background 2019)	2	1,900	Inbound	AM	557	0.29
				PM	1494	0.79
				SAT	910	0.48
			Outbound	AM	1908	1.00
				PM	1005	0.53
				SAT	1142	0.60
Richmond (Background 2024)	2	1,900	Inbound	AM	583	0.31
				PM	1570	0.83
				SAT	959	0.50
			Outbound	AM	2010	1.06
				PM	1050	0.55
				SAT	1199	0.63
Richmond (Background 2019)	2	1,900	Inbound	AM	559	0.29
				PM	1496	0.79
				SAT	913	0.48
			Outbound	AM	1911	1.01
				PM	1008	0.53
				SAT	1144	0.60
Richmond (Background 2024)	2	1,900	Inbound	AM	585	0.31
				PM	1572	0.83
				SAT	962	0.51
			Outbound	AM	2013	1.06
				PM	1053	0.55
				SAT	1201	0.63
** Assumed capacity obtained from the 2008 Road Infrastructure Needs Study*						

As shown in Table 13 and Table 14, sufficient capacity exists at Screenline #10 to meet both the projected background and total future traffic demand, with inbound morning traffic reaching 80% capacity of the screenline in 2024. Background 2019 projections indicate that Screenline #11 will be operating at capacity during the morning peak hour for outbound movements. This condition will worsen as time progresses for background 2024 projections.

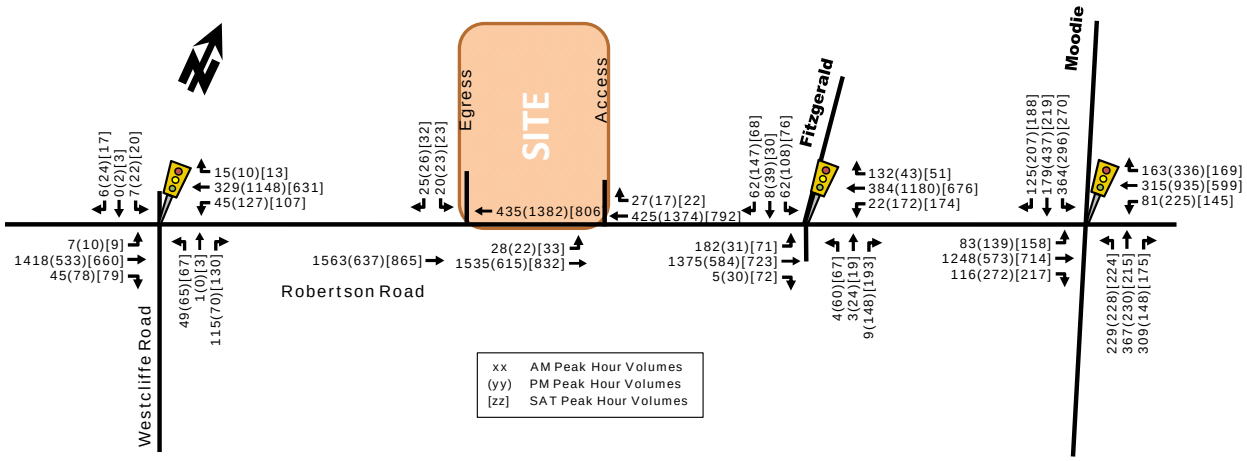
Comparing total projected demand (Table 14) to background projected volumes (Table 13), it can be concluded that the site-generated demand will not require a change of concept in the adjacent road and transit network concepts. Additional capacity is already required at screenline SL 11 for outbound movements, according to assumed capacities and projected future background traffic volumes.

4.9. INTERSECTION DESIGN

4.9.1. TOTAL PROJECTED 2019 CONDITIONS – PHASE 1 BUILD OUT

The total projected 2019 traffic volumes were derived by superimposing the site-generated traffic volumes (Figure 5) onto projected 2019 background traffic volumes (Figure 9). The resulting total projected traffic volumes are illustrated in Figure 11.

Figure 11: Total Projected 2019 Traffic Volumes



The following Table 15 provides a summary of the total projected operations at the study area intersection based on the SYNCHRO (V10) traffic analysis software. The SYNCHRO model output of total 2019 projected conditions is provided within Appendix I.

Table 15: Total Projected 2019 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak) [Saturday]					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Moodie/Robertson	E (D) [C]	0.98 (0.84) [0.73]	EBT (WBT) [EBT]	48.1 (36.5) [38.6]	D (C) [B]	0.83 (0.73) [0.61]
Robertson/Fitzgerald	A (C) [E]	0.55 (0.80) [0.92]	EBT (SBL) [SBL]	7.8 (18.1) [19.0]	A (A) [A]	0.54 (0.45) [0.50]
Westcliffe/Robertson	B (A) [A]	0.62 (0.50) [0.33]	EBT (WBT) [EBT]	10.5 (9.5) [8.5]	A (A) [A]	0.59 (0.47) [0.32]
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

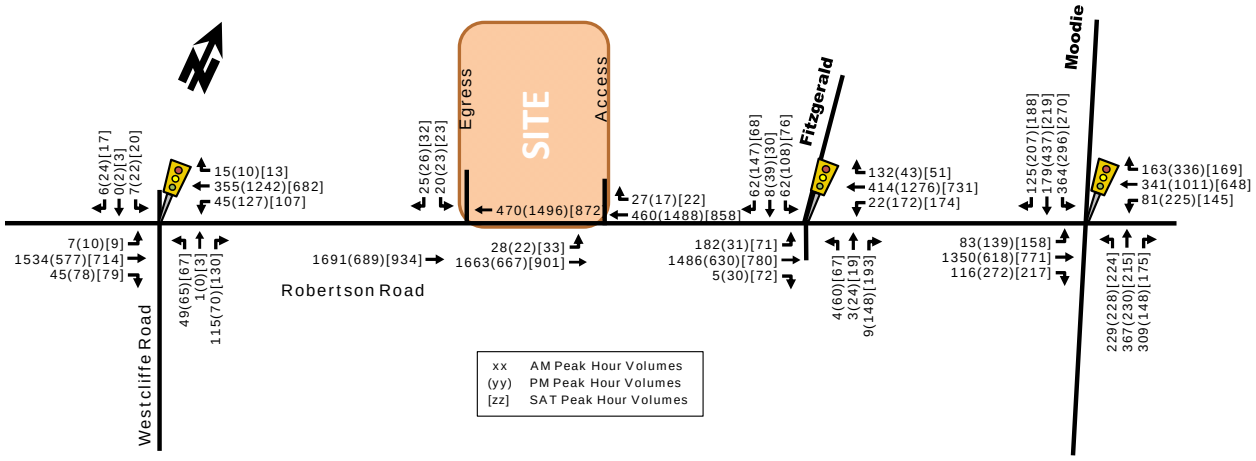
Similar to the background 2019 conditions, all study area intersections are projected to operate at an acceptable level of service LoS 'D' or better. The west leg of the Robertson/Moodie intersection and the north leg of the Robertson/Fitzgerald

intersection will both operate at a congested LoS 'E' during the weekday morning and Saturday peak hours, respectively (v/c ratio 0.98 and 0.92). The 95th percentile queues at the west leg of the Robertson/Moodie intersection during the critical weekday morning and Saturday peak hour reach 240m and 129m, respectively; covering approximately 80% of the distance to the Robertson/Fitzgerald intersection during the critical weekday morning peak hour. No issues are noted with eastbound left-turn queues. The 95th percentile queues at the north leg of the Robertson/Fitzgerald intersection during the critical weekday morning and Saturday peak hour reach 33m and 44m, respectively. No issues are anticipated at this approach.

4.9.2. TOTAL PROJECTED 2024 CONDITIONS – FULL SITE BUILD-OUT

The total projected 2024 traffic volumes were derived by superimposing the site-generated traffic volumes (Figure 5) onto projected 2024 background traffic volumes (Figure 10). The resulting total projected 2024 traffic volumes are illustrated in Figure 12.

Figure 12: Total Projected 2024 Traffic Volumes



The following Table 16 provides a summary of the total projected operations at the study area intersection based on the SYNCHRO (V10) traffic analysis software. The SYNCHRO model output of total 2019 projected conditions is provided within Appendix J.

Table 16: Total Projected 2024 Performance at Study Area Intersections

Intersection	Weekday AM Peak (PM Peak) [Saturday]					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Moodie/Robertson	F (E) [C]	1.07 (0.91) [0.79]	EBT (WBT) [EBT]	56.0 (38.2) [39.6]	D (C) [B]	0.90 (0.78) [0.65]
Robertson/Fitzgerald	A (C) [E]	0.60 (0.80) [0.92]	EBT (SBL) [SBL]	7.8 (17.8) [18.6]	A (A) [A]	0.58 (0.47) [0.52]
Westcliffe/Robertson	B (A) [A]	0.67 (0.55) [0.35]	EBT (WBT) [EBT]	11.4 (10.3) [8.5]	B (A) [A]	0.64 (0.52) [0.34]
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

Similar to the background 2024 conditions, all study area intersections are projected to operate at an acceptable level of service LoS 'D' or better. The west leg of the Robertson/Moodie intersection is projected to operate at capacity (LoS 'F') and the north leg of the Robertson/Fitzgerald intersection will continue to operate at a congested LoS 'E' during the weekday morning and Saturday peak hours, respectively (v/c ratio 1.06 and 0.92). As mentioned in Section 3.3, this is an

existing capacity issue augmented by background traffic projections with negligible impact form site-generated traffic. As such, the subject development has no proposed mitigation measures. Given the adjacent road network, and the absence of transit priority networks and cycling facilities, there are limited options for demand rationalization in the short-term other than a peak-hour spreading. In the medium to long-term, the LRT Kanata extension provides an opportunity for east-west travel demand to be reduced along Robertson Road corridor due to modal shift from automobile-based travel to rail.

With regard to queues, the 95th percentile queues at the west leg of the Robertson/Moodie intersection during the critical weekday morning and Saturday peak hour are projected to reach 270m and 150m, respectively; covering approximately 90% of the distance to the Robertson/Fitzgerald intersection during the critical weekday morning peak hour. No issues are noted with eastbound left-turn queues. The 95th percentile queues at the north leg of the Robertson/Fitzgerald intersection during the critical weekday morning and Saturday peak hour are projected to reach 33m and 53m, respectively. No issues are anticipated at this approach.

4.9.3. MULTI-MODAL LEVEL OF SERVICE – NETWORK INTERSECTIONS

The multi-modal level of service analysis for the study area signalized intersections is summarized in Table 17, with detail analysis provided in Appendix K. Given the development's location within 100m of an Arterial Main Street, the target levels of service for pedestrians and cyclists are moderate (PLoS 'C' and BLoS 'C'). As mentioned in section 2.1.3, there are transit priority isolated measures planned for Robertson Road and as such, transit level of service target is TLoS 'D'. Robertson Road is a designated truck route, and as such, has a truck level of service target of TKLoS 'D'.

Table 17: MMLOS – Existing Adjacent Network Intersections

Intersection	Level of Service							
	Pedestrian (PLoS)		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)	
	PLoS	Target	BLoS	Target	TkLoS	TkLoS	TkLoS	Target
Robertson/Moodie	F	C	F	C	F	D	A	D
Robertson/Fitzgerald	E	C	F	C	E	D	C	D
Robertson/Westcliffe	E	C	F	C	D	D	D	D

The MMLOS intersection analysis shows that existing conditions at study area intersections do not meet MMLOS area targets for pedestrians and bicyclists and that Moodie Drive and Fitzgerald Road approaches at Robertson Road do not meet targets for transit.

Robertson/Moodie Intersection

Regarding pedestrians, the target level of service PLoS 'C' is difficult to achieve for intersection legs with more than 3 lanes. To meet the target PLoS 'C' and BLoS 'C' the following measures would be required:

- Reducing the total number of vehicle lanes on all approaches to five (5);
- Implementing medians on all approaches that are at least 2.4m wide;
- Implementing curbside bike lanes on all approaches;
- Implementing a protected intersection with 2-stage left-turn boxes on all approaches;
- Protecting all conflicting left-turns and right-turns;
- Prohibiting RTOR on the south and north approaches;
- Providing pedestrian signal leading intervals;
- Eliminating right-turn channels on the north and south approaches and implementing smart channels on the east and west approaches;

- Reducing all corner radius to 15m or less; and
- Implementing zebra stripe hi-vis markings on all approaches.

Due to the arterial functionality of both Robertson Road and Moodie Drive, some of these measures are not considered feasible within the horizon analysis. For exploratory purposes, the following measures are offered and would result in PLoS 'F' and BLoS 'A':

- Reducing the total number of vehicle lanes in all approaches by one (1) lane;
- Implementing medians on all approaches that are at least 2.4m wide;
- Implementing curbside bike lanes on all approaches;
- Implementing a protected intersection with 2-stage left-turn boxes on all approaches;
- Protecting all conflicting left-turns and right-turns;
- Prohibiting RTOR on the south and north approaches;
- Providing pedestrian signal leading intervals;
- Implementing smart channels on all approaches;
- Reducing all corner radius to 15m or less; and
- Implementing zebra stripe hi-vis markings on all approaches.

With regard to transit, target LoS 'D' can be achieved by implementing isolated transit priority measures on Moodie Drive such as bus queue jump lanes and signal detectors.

Robertson/Fitzgerald and Robertson/Westcliffe Intersections

Regarding pedestrians and cyclists, to meet the target PLoS 'C' and BLoS 'C', the following measures are offered:

- Implementing > 2.4 m medians on the east and west approaches;
- Implementing curbside bike lanes on all approaches;
- Implementing a protected intersection with 2-stage left-turn boxes on all approaches;
- Protecting all conflicting left-turns;
- Protecting conflicting right-turns on the east and west approaches;
- Prohibiting RTOR on the east and west approaches;
- Implementing zebra stripe hi-vis markings on the east and west approaches.

With regard to transit, target TLoS 'D' can be achieved by implementing isolated transit priority measures on Moodie Drive such as bus queue jump lanes and signal detectors.

Robertson/Mill Hill Unsignalized Intersection

Given the MMLOS methodology is applicable only to signalized intersections. A descriptive analysis of the Robertson/Mill Hill Drive is offered. The Robertson/Mill Hill Unsignalized intersection includes the following facilities:

- One (1) full-movement lane on both the southbound and northbound approaches;
- One (1) through and one (1) shared through/right-turn lane on the eastbound approach;
- One (1) auxiliary left-turn lane, one (1) through and one (1) shared through/right-turn lane on the westbound approach;
- Stop controlled northbound approach;
- Posted 40 km/h speed limit on the northbound approach, assumed unposted 40 km/h speed limit on the southbound approach;
- Transit shelter on the southeast corner of the intersection, approximately 15meters to the east of Mill Hill Road;
- Transit stop on the northwest corner of the intersection, approximately 20 meters to the west of the southbound approach;
- Paved/concrete sidewalk on the south side of Robertson Road; and
- Paved shoulder on the north side of Robertson Road.

Opportunities of improvement include:

- Standard transverse crossing lines on both the north and south approaches; and
- Formalizing walking connectivity to/from the transit stop along the north side of Robertson Road.

5. FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

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

Proposed Development

- The proposed development will consist of a 1,092 m^2 of Warehouse (ITE 150), a 232 m^2 of Fast-Food Restaurant with drive-thru (ITE 934) and 74 surface parking spaces;
- In total, the proposed development is anticipated to generate approximately 54, 49 and 49 veh/h during the weekday morning, afternoon and Saturday peak hours, respectively;
- To be conservative and considering ongoing development at Stittsville and Kanata South, a 2% per annum background growth on Robertson Road has been used
- A total of 74 surface parking spaces are proposed, including 35 restaurant parking spaces (including one (1) restaurant handicap parking space) and 39 industrial parking spaces (including one (1) industrial handicap parking space) which meet zoning By-Law requirements; and
- A total of 6 bicycle parking spaces will be provided which meets the zoning requirements for 5 spaces.

Site Plan

- Vehicular access is proposed via two driveway connections to Robertson Road: a one lane 5.0m wide inbound driveway with a mountable curb (depressed concrete) to accommodate trucks, and a 6.5m two-lane outbound driveway. The two driveways are approximately 24m from each other and approximately 140m from the Robertson/Fitzgerald signalized intersection and 290m from the Robertson/Westcliffe signalized intersection. These locations and configurations meet the City's Private Approach By-Law requirements;
- The inbound driveway provides a minimum 35m throat length, which is considered sufficient;
- All required vehicle turn requirements can be accommodated;
- With 6 proposed loading spaces located adjacent to the warehouse to the rear of the property, the proposed development is meeting City By-Law requirements and is noted to provide sufficient space for truck maneuvering purposes;
- Based on the projected volumes, the outbound driveway should be controlled with STOP signs on its approach to Robertson; and
- A 1.8m wide concrete sidewalk is proposed along the site's frontage. This is offset 3.8m from the curb line and connects to the site's on-site sidewalks system.

Transit

- The projected two-way transit people trips generated by the proposed development corresponds to 11% of the capacity currently offered by adjacent transit services. As such, no issues are anticipated at the study area transit network in servicing the proposed development.

Network Performance

- Sufficient capacity exists at screenline #10 to meet both the projected background and total future traffic demand, with inbound morning traffic reaching 80% capacity of the screenline in 2024;

- Background 2019 projections indicate that screenline #11 will be operating at capacity during the morning peak hour for outbound movements. This condition is expected to worsen as time progresses for background 2024 projections; and
- Comparing total projected demand (Table 14) to background projected volumes (Table 13), it can be concluded that the site-generated demand will not require a change of concept in the adjacent road and transit network concepts. Additional capacity is already required at screenline SL 11 for outbound movements.
- All study area intersections are projected to operate at an acceptable level of service LoS 'D' or better on year 2024, with no significant change due to site-generated traffic with respect to background conditions;
- Regarding critical movements, the west leg of the Robertson/Moodie intersection is currently operating at capacity (LoS 'E') and is projected to operate at LoS 'F' in year 2024, with negligible impact from site-generated traffic. The north leg of the Robertson/Fitzgerald intersection will continue to operate at a congested LoS 'E' during the weekday morning and Saturday peak hours, respectively (v/c ratio 1.06 and 0.92);
- The LRT extension to Kanata provides the opportunity for east-west travel demand reductions along Robertson Road within the horizon analysis; and
- The 95th percentile queues at the west leg of the Robertson/Moodie intersection during the critical 2024 weekday morning and Saturday peak hour are projected to reach 270m and 150m, respectively; covering approximately 90% of the distance to the Robertson/Fitzgerald intersection during the critical weekday morning peak hour.

Boundary Streets and Intersection Design

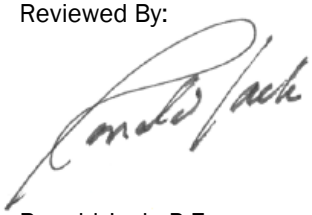
- The MMLOS road segment analysis shows that existing conditions on the north side of Robertson Road do not meet MMLOS area targets for pedestrians and bicyclists;
  - To meet the target PLoS 'C' for Robertson Road east of Fitzgerald Road, the provision of a 2.0m sidewalk with a 2.0m boulevard and reducing vehicle speeds to 50 km/h along Robertson Road would be required;
  - To achieve the target BLoS 'C' along Robertson Road, the City can consider the provision of curbside bike lanes paired with a speed reduction to 50 km/h;
- The MMLOS intersection analysis shows that existing conditions at study area intersections do not meet MMLOS area targets for pedestrians and bicyclists and that Moodie Drive and Fitzgerald Road approaches at Robertson Road do not meet targets for transit;
  - Robertson/Moodie intersection: Given the arterial functionality of both Robertson Road and Moodie Drive, measures required to achieve the PLoS 'C' and BLoS 'C' targets, as per the MMLoS Guidelines methodology, are not considered feasible within the horizon analysis. Exploratory measures are offered that would result in BLoS 'A';
  - Robertson/Fitzgerald and Robertson/Westcliffe intersections: measures are offered to meet the target PLoS 'C' and BLoS 'C'; and
  - Robertson/Mill Hill intersection: Given the MMLoS signalized intersection methodology, a descriptive analysis is offered and opportunities for improvement are identified.

Based on the foregoing findings and conclusions, this report satisfies the TIA requirements for the 2165 Robertson Road development and accordingly the Site Plan is recommended from a transportation perspective.

Prepared By:

Andrés Pena, M.Sc.
Engineering Intern

Reviewed By:



Ronald Jack, P.Eng.
Senior Transportation Engineer

Attachments

Appendix A

Screening Form

PARSONS

1223 Michael Street, Suite 100, Ottawa, Ontario, K1J 7T2
P: +1 613.738.4160 l F: +1 613.739.7105 l www.parsons.com

City of Ottawa 2017 TIA Guidelines

TIA Screening Form

Date	10-Oct-18
Project	2165 Robertson Road
Project Number	476734

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

Module 1.1 - Description of Proposed Development	
Municipal Address	2165 Robertson Road
Description of location	Parcel Type P. Ward 8. AM[287] - Arterial Mainstreet Zone. Currently used for parking.
Land Use	Multiple
Development Size	Industrial: 1,092 SQ.M (11,767 SQ.FT.). Drive Thru: 232SQ.M (2500 SQ.FT).
Number of Accesses and Locations	Two accesses to Robertson Road.
Development Phasing	Single Phase.
Buildout Year	2019
Sketch Plan / Site Plan	See attached

Module 1.2 - Trip Generation Trigger		
Land Use Type	st-food Restaurant or Coffee Shop	
Development Size	232	sq. m
Trip Generation Trigger Met?	Yes	

Module 1.3 - Location Triggers		
Development Proposes a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit, or Spine Bicycle Networks (See Sheet 3)	Yes	Robertson Road designated Cycling Spine Route.
Development is in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone. (See Sheet 3)	Yes	Development fronts Robertson Arterial Mainstreet.
Location Trigger Met?	Yes	

Module 1.4 - Safety Triggers		
Posted Speed Limit on any boundary road	<80	Posted Speed Limit 60 km/h
Horizontal / Vertical Curvature on a boundary street limits sight lines at a proposed driveway	No	
A proposed driveway is within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions) or within auxiliary lanes of an intersection;	Yes	Robertson/Fitzgerald intersection located 140m to the east.
A proposed driveway makes use of an existing median break that serves an existing site	No	Existing reversible central lane for left-turns.
There is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development	Yes	
The development includes a drive-thru facility	Yes	
Safety Trigger Met?	Yes	

Appendix B

Traffic Data

Transportation Services - Traffic Services

W.O. 36743

Turning Movement Count - 15 Minute Summary Report

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017

Total Observed U-Turns

Northbound: 6 Southbound: 1

Eastbound: 6 Westbound: 4

		MOODIE DR									ROBERTSON RD									
		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	Grand Total
07:00	07:15	36	60	77	**173**	49	33	15	**97**	**270**	13	318	34	**365**	12	59	16	**88**	**453**	**723**
07:15	07:30	47	68	87	**202**	67	31	17	**115**	**317**	7	321	31	**359**	12	61	27	**100**	**459**	**776**
07:30	07:45	48	83	88	**219**	91	35	16	**142**	**361**	13	384	19	**416**	20	66	32	**118**	**534**	**895**
07:45	08:00	66	91	80	**237**	100	44	27	**171**	**408**	16	307	28	**351**	21	90	52	**163**	**514**	**922**
08:00	08:15	50	92	76	**218**	75	48	30	**153**	**371**	19	293	36	**349**	22	77	39	**138**	**487**	**858**
08:15	08:30	61	95	65	**221**	90	49	34	**173**	**394**	22	227	29	**278**	18	74	29	**121**	**399**	**793**
08:30	08:45	70	70	67	**207**	93	58	31	**182**	**389**	24	256	34	**314**	31	95	41	**167**	**481**	**870**
08:45	09:00	62	76	74	**212**	87	60	28	**175**	**387**	20	221	23	**264**	21	108	52	**181**	**445**	**832**
09:00	09:15	65	72	59	**197**	64	43	30	**137**	**334**	18	197	28	**243**	28	88	60	**176**	**419**	**753**
09:15	09:30	46	70	51	**168**	68	40	30	**138**	**306**	21	155	38	**214**	26	104	34	**164**	**378**	**684**
09:30	09:45	39	52	50	**141**	49	36	36	**121**	**262**	26	145	24	**197**	30	103	35	**168**	**365**	**627**
09:45	10:00	48	50	47	**145**	60	30	35	**125**	**270**	24	144	24	**192**	18	102	52	**173**	**365**	**635**
11:30	11:45	48	40	45	**133**	78	35	42	**155**	**288**	20	144	35	**199**	29	139	58	**226**	**425**	**713**
11:45	12:00	62	47	39	**148**	102	64	41	**207**	**355**	32	145	39	**217**	28	151	44	**223**	**440**	**795**
12:00	12:15	58	53	46	**157**	77	47	43	**167**	**324**	24	146	39	**209**	38	141	51	**230**	**439**	**763**
12:15	12:30	58	36	39	**133**	67	51	44	**162**	**295**	37	142	47	**226**	43	152	77	**272**	**498**	**793**
12:30	12:45	54	49	37	**140**	63	51	39	**153**	**293**	46	158	46	**250**	36	147	51	**235**	**485**	**778**
12:45	13:00	45	65	43	**153**	64	38	48	**150**	**303**	32	169	39	**240**	31	142	66	**239**	**479**	**782**
13:00	13:15	47	41	44	**132**	61	59	39	**159**	**291**	29	137	43	**209**	28	184	59	**271**	**480**	**771**
13:15	13:30	64	58	43	**166**	62	44	42	**148**	**314**	26	148	53	**227**	31	130	65	**226**	**453**	**767**
15:00	15:15	43	43	30	**117**	59	75	42	**176**	**293**	28	170	52	**250**	43	169	42	**254**	**504**	**797**
15:15	15:30	42	44	31	**117**	47	90	55	**192**	**309**	26	158	61	**245**	52	169	63	**284**	**529**	**838**
15:30	15:45	59	55	34	**148**	70	80	37	**187**	**335**	35	148	49	**232**	62	197	47	**306**	**538**	**873**
15:45	16:00	57	69	64	**190**	73	85	42	**200**	**390**	26	144	51	**221**	69	190	60	**319**	**540**	**930**
16:00	16:15	54	54	48	**156**	69	108	47	**224**	**380**	29	143	57	**230**	52	252	76	**380**	**610**	**990**
16:15	16:30	63	70	29	**163**	68	105	44	**217**	**380**	32	126	66	**224**	51	237	75	**363**	**587**	**967**
16:30	16:45	59	42	32	**133**	78	91	48	**217**	**350**	30	140	72	**242**	40	241	71	**352**	**594**	**944**
16:45	17:00	54	63	41	**158**	68	133	53	**254**	**412**	22	115	59	**196**	73	194	82	**349**	**545**	**957**
17:00	17:15	49	50	46	**145**	73	104	49	**226**	**371**	36	155	72	**264**	61	229	97	**387**	**651**	**1022**
17:15	17:30	49	58	28	**135**	62	97	44	**203**	**338**	24	150	56	**230**	63	193	58	**315**	**545**	**883**
17:30	17:45	52	37	50	**140**	61	92	44	**198**	**338**	25	141	58	**224**	69	198	70	**337**	**561**	**899**
17:45	18:00	54	44	43	**141**	55	95	38	**188**	**329**	17	121	53	**191**	57	166	58	**281**	**472**	**801**
TOTAL:		1709	1897	1633	**5245**	2250	2051	1210	**5512**	**10757**	799	5868	1395	**8068**	1215	4648	1739	**7606**	**15674**	**26431**

Note: U-Turns are included in Totals.

Comment:

Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
36743

MOODIE DR @ ROBERTSON RD

Count Date: Wednesday, March 08, 2017 **Start Time:** 07:00

	MOODIE DR			ROBERTSON RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	0	0	**0**	0	0	**0**	**0**
08:00 09:00	0	0	**0**	0	0	**0**	**0**
09:00 10:00	0	0	**0**	0	0	**0**	**0**
11:30 12:30	0	0	**0**	0	0	**0**	**0**
12:30 13:30	1	0	**1**	0	0	**0**	**1**
15:00 16:00	0	1	**1**	0	1	**1**	**2**
16:00 17:00	0	0	**0**	0	0	**0**	**0**
17:00 18:00	0	0	**0**	0	0	**0**	**0**
Total	1	1	**2**	0	1	**1**	**3**

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

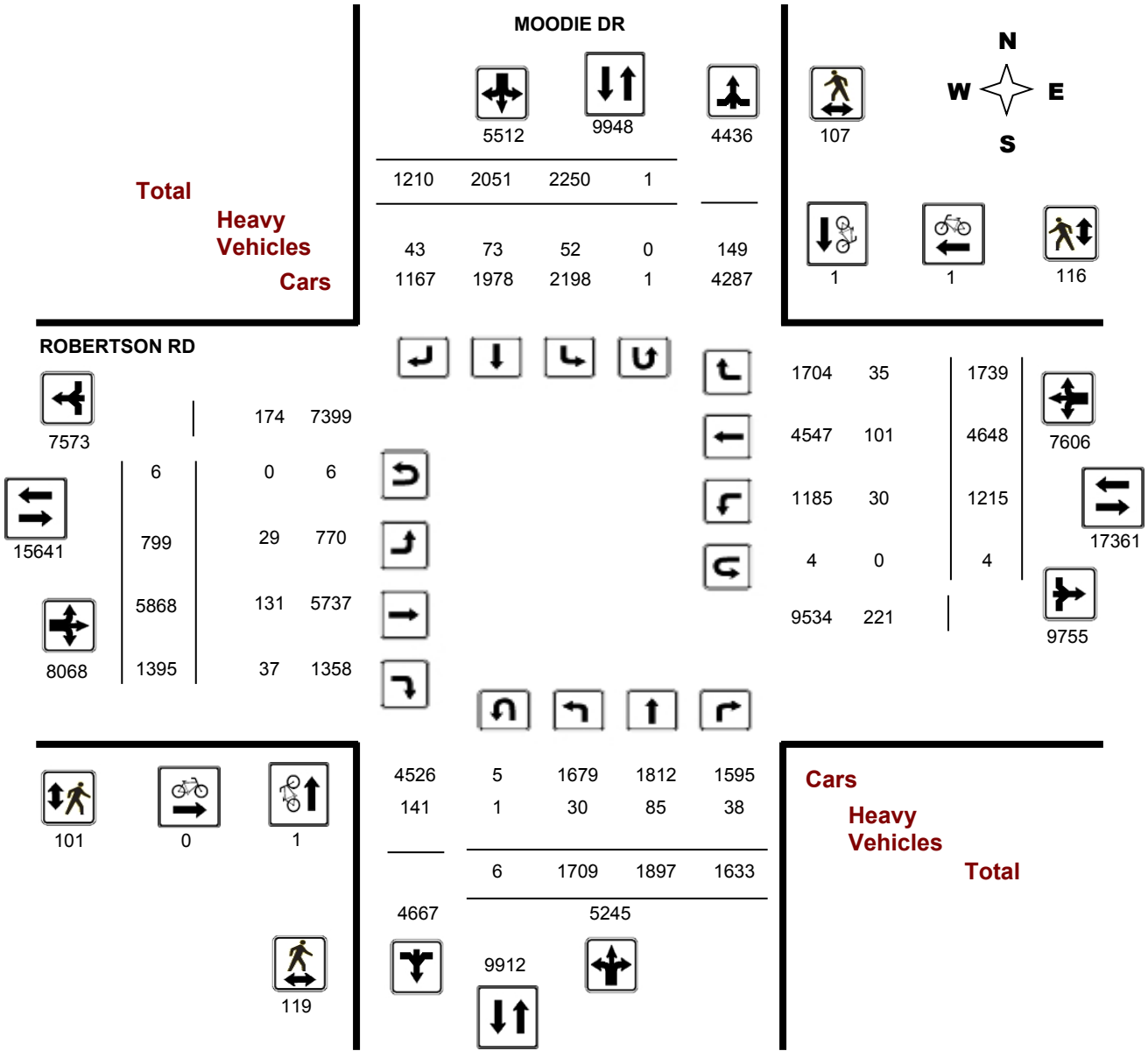
Turning Movement Count - Full Study Diagram

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017

WO#: 36743

Device: Miovision



Comments

Transportation Services - Traffic Services

W.O. 36743

Turning Movement Count - Heavy Vehicle Report

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017

		MOODIE DR									ROBERTSON RD									
		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	Grand Total
07:00	08:00	5	11	4	**20**	8	11	5	**24**	**44**	0	24	7	**31**	3	15	4	**22**	**53**	**97**
08:00	09:00	1	14	2	**17**	7	17	8	**32**	**49**	6	22	3	**31**	4	21	2	**27**	**58**	**107**
09:00	10:00	5	16	10	**31**	9	6	9	**24**	**55**	2	23	3	**28**	7	12	7	**26**	**54**	**109**
11:30	12:30	8	2	4	**14**	11	5	6	**22**	**36**	4	12	5	**21**	3	11	8	**22**	**43**	**79**
12:30	13:30	4	5	4	**13**	4	4	5	**13**	**26**	5	16	8	**29**	2	11	6	**19**	**48**	**74**
15:00	16:00	2	18	9	**29**	6	12	4	**22**	**51**	4	13	1	**18**	9	11	5	**25**	**43**	**94**
16:00	17:00	5	13	2	**21**	4	11	2	**17**	**38**	3	7	6	**16**	0	9	2	**11**	**27**	**65**
17:00	18:00	0	6	3	**9**	3	7	4	**14**	**23**	5	14	4	**23**	2	11	1	**14**	**37**	**60**
Sub Total		30	85	38	**154**	52	73	43	**168**	**322**	29	131	37	**197**	30	101	35	**166**	**363**	**685**
U-Turns (Heavy Vehicles)					**1**				**0**	**1**				**0**				**0**	**0**	**1**
Total		30	85	38	**0**	52	73	43	**168**	**323**	29	131	37	**197**	30	101	35	**166**	**363**	**686**

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
36743

Turning Movement Count - Pedestrian Volume Report

MOODIE DR @ ROBERTSON RD

Count Date: Wednesday, March 08, 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	1	1	**2**	1	1	**2**	**4**
07:15 07:30	0	2	**2**	0	0	**0**	**2**
07:30 07:45	3	1	**4**	2	0	**2**	**6**
07:45 08:00	0	3	**3**	1	3	**4**	**7**
07:00 08:00	4	7	**11**	4	4	**8**	**19**
08:00 08:15	1	2	**3**	1	0	**1**	**4**
08:15 08:30	0	0	**0**	2	1	**3**	**3**
08:30 08:45	0	3	**3**	4	1	**5**	**8**
08:45 09:00	2	2	**4**	2	1	**3**	**7**
08:00 09:00	3	7	**10**	9	3	**12**	**22**
09:00 09:15	1	1	**2**	0	1	**1**	**3**
09:15 09:30	4	1	**5**	2	1	**3**	**8**
09:30 09:45	1	3	**4**	1	4	**5**	**9**
09:45 10:00	2	4	**6**	4	0	**4**	**10**
09:00 10:00	8	9	**17**	7	6	**13**	**30**
11:30 11:45	2	3	**5**	4	5	**9**	**14**
11:45 12:00	7	5	**12**	2	2	**4**	**16**
12:00 12:15	3	5	**8**	9	5	**14**	**22**
12:15 12:30	6	8	**14**	10	7	**17**	**31**
11:30 12:30	18	21	**39**	25	19	**44**	**83**
12:30 12:45	16	13	**29**	7	16	**23**	**52**
12:45 13:00	10	9	**19**	6	7	**13**	**32**
13:00 13:15	3	4	**7**	4	3	**7**	**14**
13:15 13:30	5	10	**15**	6	10	**16**	**31**
12:30 13:30	34	36	**70**	23	36	**59**	**129**
15:00 15:15	5	2	**7**	3	3	**6**	**13**
15:15 15:30	5	2	**7**	4	1	**5**	**12**
15:30 15:45	9	4	**13**	6	6	**12**	**25**
15:45 16:00	3	0	**3**	3	3	**6**	**9**
15:00 16:00	22	8	**30**	16	13	**29**	**59**
16:00 16:15	5	4	**9**	0	4	**4**	**13**
16:15 16:30	4	0	**4**	2	7	**9**	**13**
16:30 16:45	2	0	**2**	1	0	**1**	**3**
16:45 17:00	2	2	**4**	3	9	**12**	**16**
16:00 17:00	13	6	**19**	6	20	**26**	**45**
17:00 17:15	7	3	**10**	6	5	**11**	**21**
17:15 17:30	4	3	**7**	3	4	**7**	**14**
17:30 17:45	3	3	**6**	1	2	**3**	**9**
17:45 18:00	3	4	**7**	1	4	**5**	**12**
17:00 18:00	17	13	**30**	11	15	**26**	**56**
Total	119	107	**226**	101	116	**217**	**443**

Comment:

Transportation Services - Traffic Services

Work Order 36743

Turning Movement Count - Full Study Summary Report

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017

Total Observed U-Turns

Northbound: 6 Southbound: 1

Eastbound: 6 Westbound: 4

AADT Factor 1.00

Full Study

	MOODIE DR									ROBERTSON 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	197	302	332	**831**	307	143	75	**525**	**1356**	49	1330	112	**1491**	65	276	127	**468**	**1959**	**3315**
08:00 09:00	243	333	282	**858**	345	215	123	**683**	**1541**	85	997	122	**1204**	92	354	161	**607**	**1811**	**3352**
09:00 10:00	198	244	207	**649**	241	149	131	**521**	**1170**	89	641	114	**844**	102	397	181	**680**	**1524**	**2694**
11:30 12:30	226	176	169	**571**	324	197	170	**691**	**1262**	113	577	160	**850**	138	583	230	**951**	**1801**	**3063**
12:30 13:30	210	213	167	**590**	250	192	168	**610**	**1200**	133	612	181	**926**	126	603	241	**970**	**1896**	**3096**
15:00 16:00	201	211	159	**571**	249	330	176	**755**	**1326**	115	620	213	**948**	226	725	212	**1163**	**2111**	**3437**
16:00 17:00	230	229	150	**609**	283	437	192	**912**	**1521**	113	524	254	**891**	216	924	304	**1444**	**2335**	**3856**
17:00 18:00	204	189	167	**560**	251	388	175	**814**	**1374**	102	567	239	**908**	250	786	283	**1319**	**2227**	**3601**
Sub Total	1709	1897	1633	**5239**	2250	2051	1210	**5511**	**10750**	799	5868	1395	**8062**	1215	4648	1739	**7602**	**15664**	**26414**
U Turns				**6**				**1**	**7**				**6**				**4**	**10**	**17**
Total	1709	1897	1633	**5245**	2250	2051	1210	**5512**	**10757**	799	5868	1395	**8068**	1215	4648	1739	**7606**	**15674**	**26431**
EQ 12Hr	2376	2637	2270	**7291**	3128	2851	1682	**7662**	**14953**	1111	8157	1939	**11215**	1689	6461	2417	**10572**	**21787**	**36740**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	2376	2637	2270	**7291**	3128	2851	1682	**7662**	**14953**	1111	8157	1939	**11215**	1689	6461	2417	**10572**	**21787**	**36740**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**1.00**						
AVG 24Hr	3112	3454	2974	**9551**	4097	3735	2203	**10037**	**19588**	1455	10685	2540	**14691**	2212	8464	3167	**13850**	**28541**	**48129**
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.

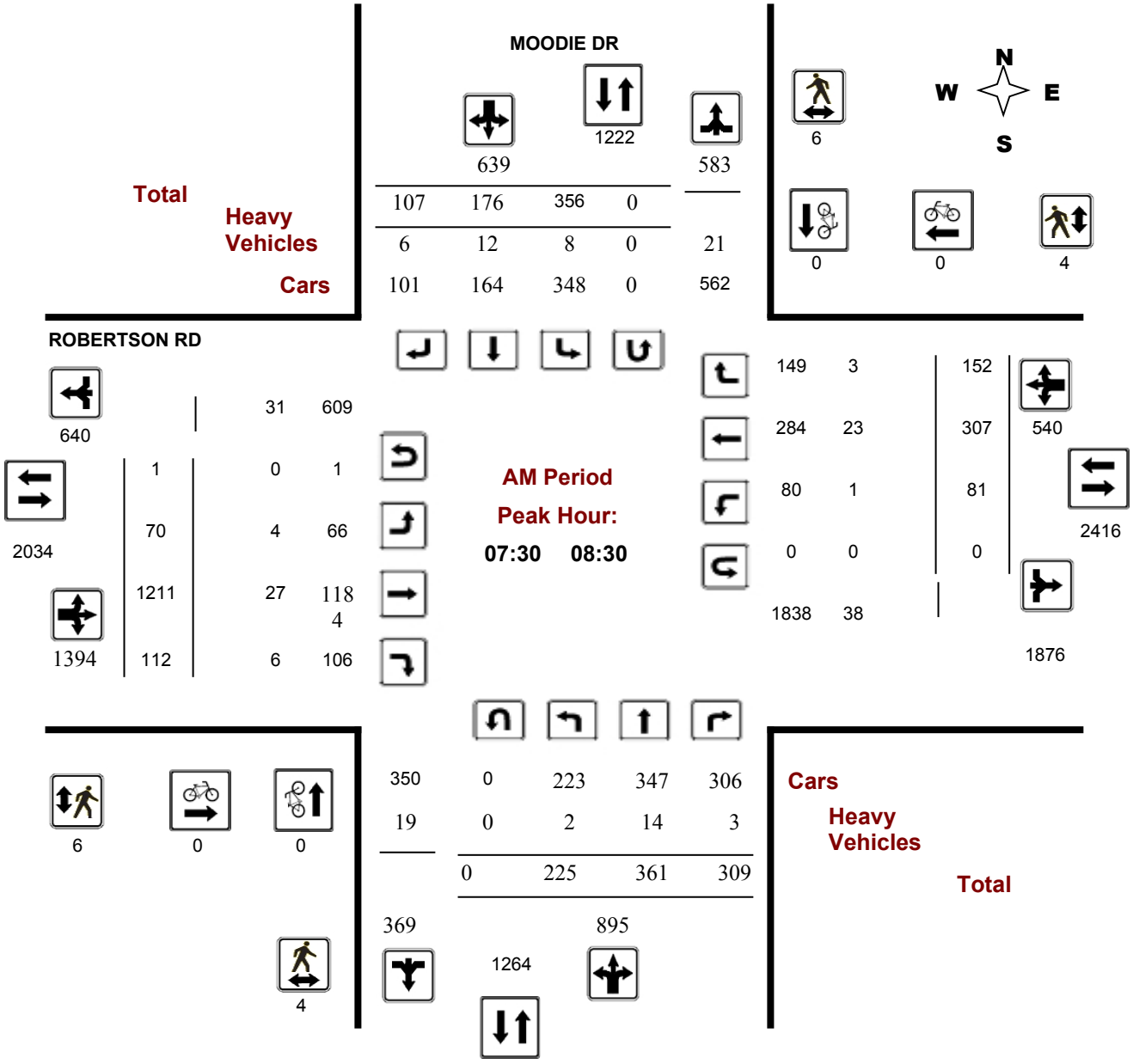
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36743

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



Comments

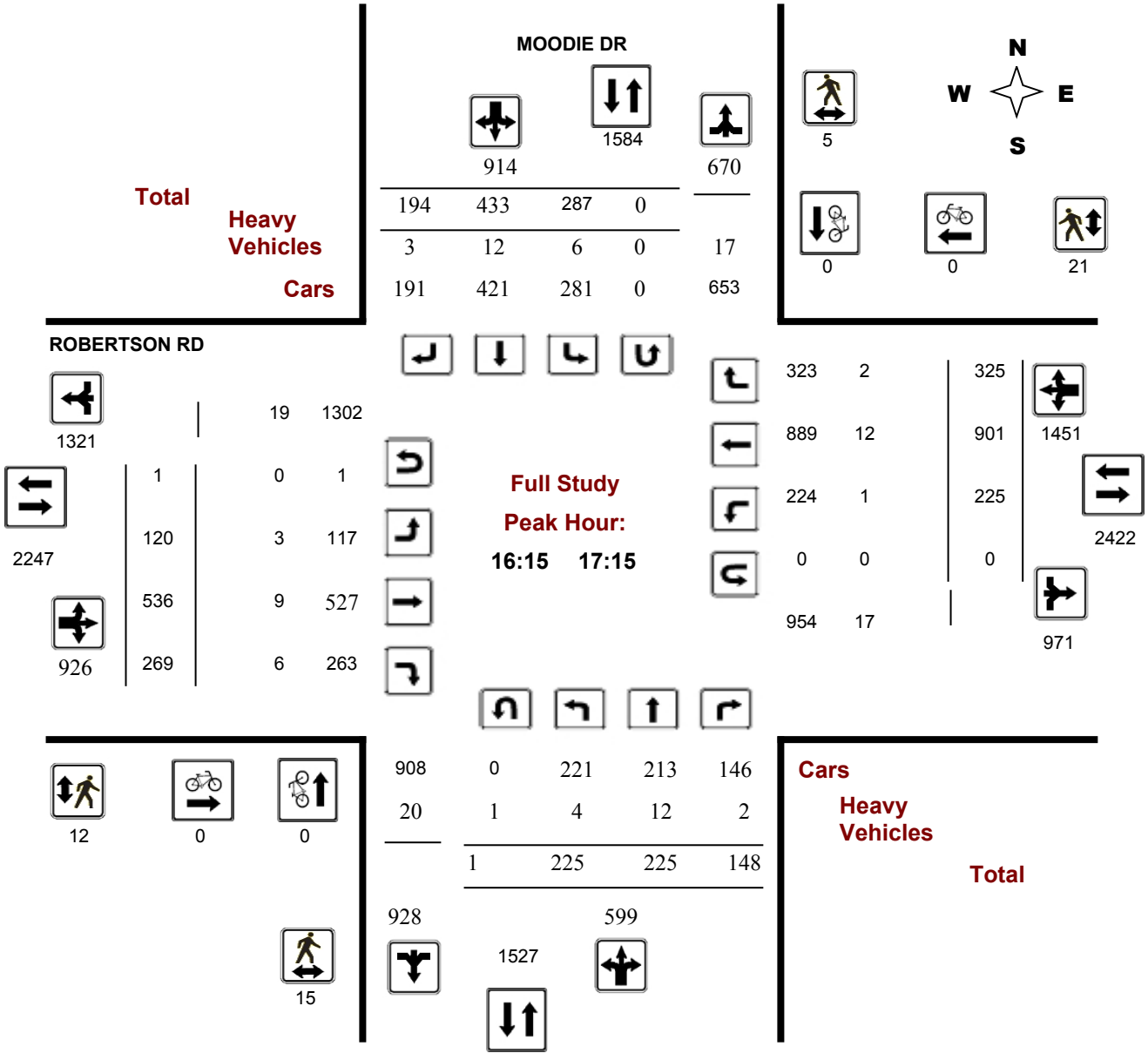
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36743

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



Comments

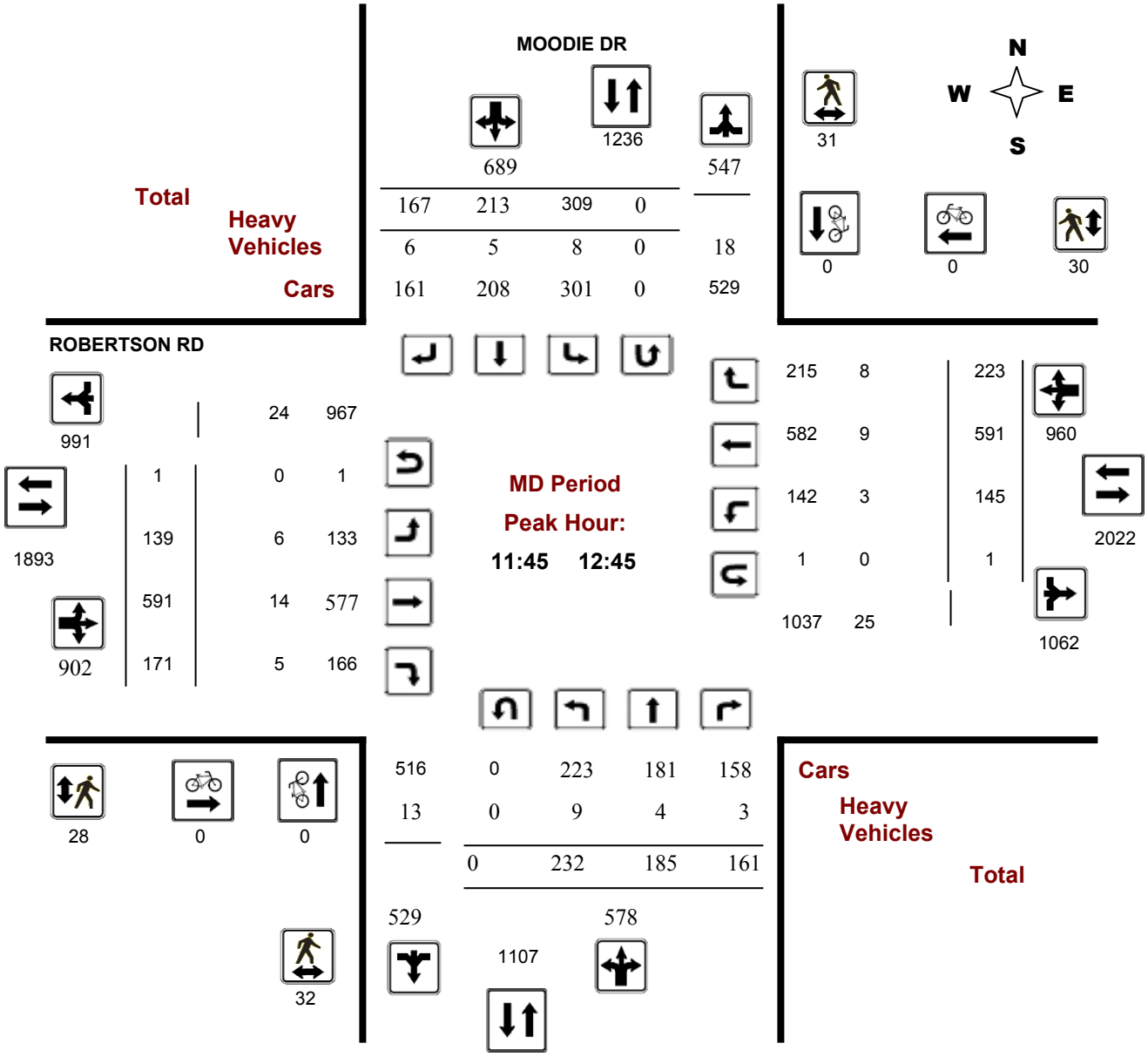
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36743

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



Comments

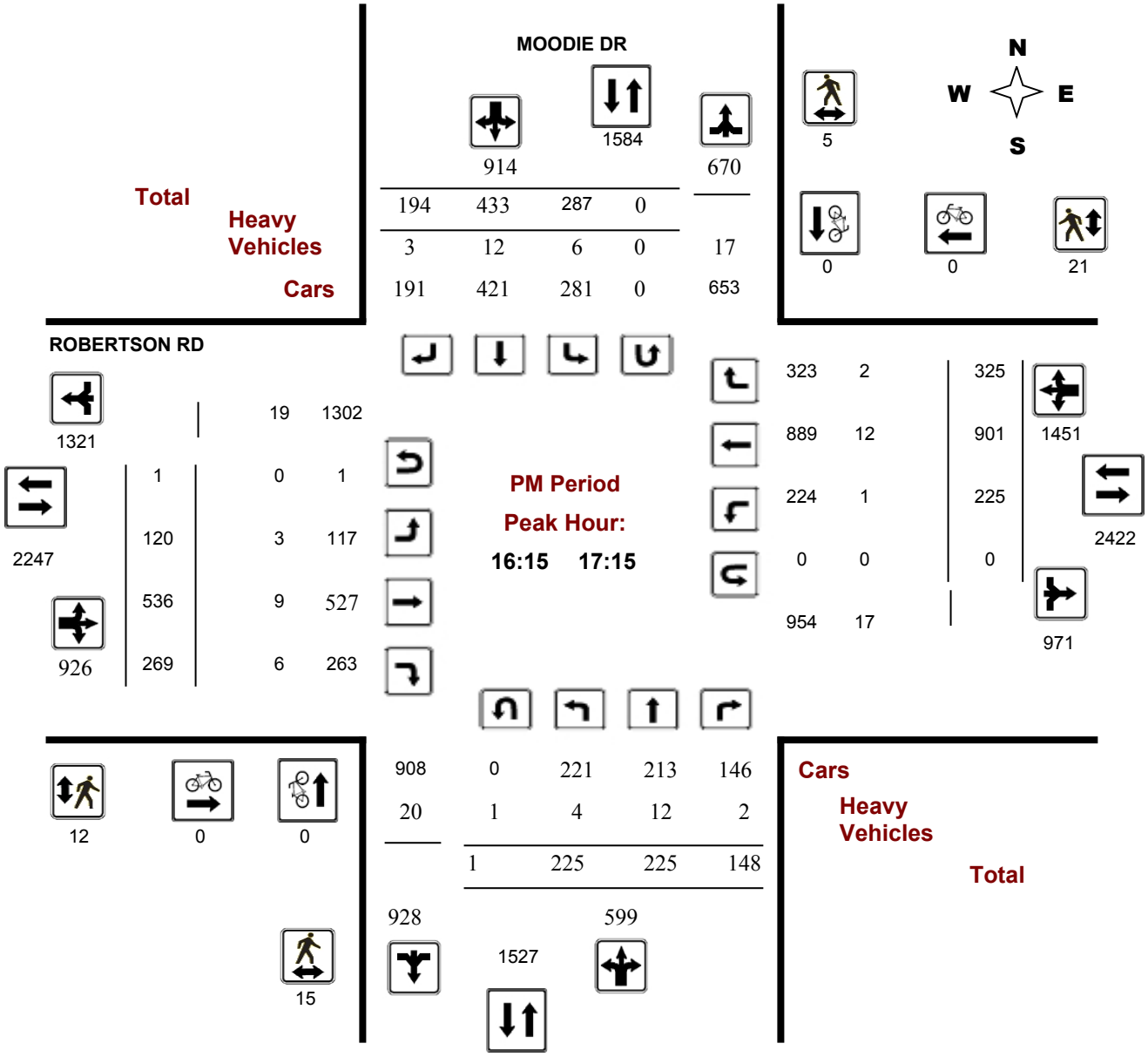
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36743

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



Comments

Transportation Services - Traffic Services

Work Order
36743

Turning Movement Count - 15 Min U-Turn Total Report

MOODIE DR @ ROBERTSON RD

Survey Date: Wednesday, March 08, 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	1	1
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	1	0	1
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	1	0	0	0	1
09:15	09:30	1	0	0	0	1
09:30	09:45	0	0	2	0	2
09:45	10:00	0	0	0	1	1
11:30	11:45	0	0	0	0	0
11:45	12:00	0	0	1	0	1
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	1	1
12:45	13:00	0	0	0	0	0
13:00	13:15	0	0	0	0	0
13:15	13:30	1	0	0	0	1
15:00	15:15	1	0	0	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	1	0	1
16:15	16:30	1	0	0	0	1
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	1	1
17:30	17:45	1	1	0	0	2
17:45	18:00	0	0	0	0	0
Total		6	1	6	4	17

Transportation Services - Traffic Services

W.O. 37325

Turning Movement Count - 15 Minute Summary Report

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017

Total Observed U-Turns

Northbound: 1 Southbound: 0

Eastbound: 0 Westbound: 9

		FITZGERALD RD									ROBERTSON RD									
		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	Grand Total
07:00	07:15	0	0	1	**2**	15	1	10	**26**	**28**	26	336	2	**364**	3	64	29	**96**	**460**	**488**
07:15	07:30	1	0	1	**2**	19	1	13	**33**	**35**	37	376	0	**413**	3	75	29	**107**	**520**	**555**
07:30	07:45	2	2	1	**5**	17	2	9	**28**	**33**	53	348	0	**401**	2	78	36	**117**	**518**	**551**
07:45	08:00	0	0	4	**4**	10	3	19	**32**	**36**	44	236	1	**281**	8	115	39	**163**	**444**	**480**
08:00	08:15	1	1	3	**5**	16	2	21	**39**	**44**	48	368	4	**420**	9	92	28	**129**	**549**	**593**
08:15	08:30	2	1	12	**15**	13	3	15	**31**	**46**	37	266	8	**311**	12	103	38	**154**	**465**	**511**
08:30	08:45	6	1	5	**12**	16	2	20	**38**	**50**	30	237	13	**280**	10	133	35	**178**	**458**	**508**
08:45	09:00	6	4	13	**23**	12	5	19	**36**	**59**	35	233	6	**274**	15	148	43	**206**	**480**	**539**
09:00	09:15	6	2	12	**20**	30	4	22	**56**	**76**	27	216	8	**251**	25	121	33	**179**	**430**	**506**
09:15	09:30	10	0	25	**35**	18	7	18	**43**	**78**	30	189	7	**226**	33	123	26	**182**	**408**	**486**
09:30	09:45	6	2	27	**35**	16	4	10	**30**	**65**	15	172	9	**196**	21	132	23	**177**	**373**	**438**
09:45	10:00	12	0	25	**37**	12	4	16	**32**	**69**	7	146	21	**174**	31	127	17	**175**	**349**	**418**
11:30	11:45	11	3	34	**48**	25	14	26	**65**	**113**	17	172	14	**203**	41	180	19	**240**	**443**	**556**
11:45	12:00	14	10	52	**76**	32	18	42	**92**	**168**	21	180	16	**217**	43	209	9	**261**	**478**	**646**
12:00	12:15	14	11	44	**69**	39	19	43	**101**	**170**	24	190	12	**226**	41	183	18	**242**	**468**	**638**
12:15	12:30	15	9	43	**67**	24	15	26	**65**	**132**	20	190	8	**218**	55	184	21	**260**	**478**	**610**
12:30	12:45	14	7	59	**80**	14	11	14	**39**	**119**	29	182	15	**226**	31	160	20	**211**	**437**	**556**
12:45	13:00	13	16	42	**71**	34	9	20	**63**	**134**	36	158	10	**204**	36	173	36	**247**	**451**	**585**
13:00	13:15	14	6	47	**67**	17	13	17	**47**	**114**	41	175	9	**225**	48	188	24	**260**	**485**	**599**
13:15	13:30	19	8	34	**61**	14	8	25	**47**	**108**	28	130	21	**179**	36	164	21	**222**	**401**	**509**
15:00	15:15	19	6	36	**61**	28	5	33	**66**	**127**	16	175	14	**205**	43	224	21	**288**	**493**	**620**
15:15	15:30	15	7	29	**51**	15	8	10	**33**	**84**	14	158	8	**180**	32	244	10	**286**	**466**	**550**
15:30	15:45	9	7	43	**59**	30	5	25	**60**	**119**	18	132	9	**159**	48	257	6	**311**	**470**	**589**
15:45	16:00	11	4	35	**50**	20	11	26	**57**	**107**	7	149	8	**164**	46	265	9	**320**	**484**	**591**
16:00	16:15	12	8	30	**50**	33	12	50	**95**	**145**	12	141	8	**161**	39	289	12	**340**	**501**	**646**
16:15	16:30	16	7	43	**66**	26	11	33	**70**	**136**	6	137	7	**150**	49	297	11	**357**	**507**	**643**
16:30	16:45	16	5	38	**59**	27	9	36	**72**	**131**	4	151	7	**162**	38	271	11	**320**	**482**	**613**
16:45	17:00	16	4	37	**57**	22	7	28	**57**	**114**	9	121	8	**138**	46	291	9	**346**	**484**	**598**
17:00	17:15	16	4	46	**66**	22	10	45	**77**	**143**	9	153	10	**172**	34	245	4	**284**	**456**	**599**
17:15	17:30	20	7	30	**57**	19	10	34	**63**	**120**	6	155	14	**175**	42	299	10	**352**	**527**	**647**
17:30	17:45	17	5	36	**58**	18	7	18	**43**	**101**	8	136	5	**149**	42	257	7	**306**	**455**	**556**
17:45	18:00	16	0	39	**55**	4	4	7	**15**	**70**	7	116	13	**136**	46	227	4	**277**	**413**	**483**
TOTAL:		349	147	926	**1423**	657	244	750	**1651**	**3074**	721	6224	295	**7240**	1008	5918	658	**7593**	**14833**	**17907**

Note: U-Turns are included in Totals.

Comment:

Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
37325

FITZGERALD RD @ ROBERTSON RD

Count Date: Thursday, November 30, 2017 **Start Time:** 07:00

	FITZGERALD RD			ROBERTSON RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	0	0	**0**	0	0	**0**	**0**
08:00 09:00	0	0	**0**	0	0	**0**	**0**
09:00 10:00	0	0	**0**	0	0	**0**	**0**
11:30 12:30	0	0	**0**	0	0	**0**	**0**
12:30 13:30	0	0	**0**	0	0	**0**	**0**
15:00 16:00	0	1	**1**	0	1	**1**	**2**
16:00 17:00	0	0	**0**	0	0	**0**	**0**
17:00 18:00	0	0	**0**	0	0	**0**	**0**
Total	0	1	**1**	0	1	**1**	**2**

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

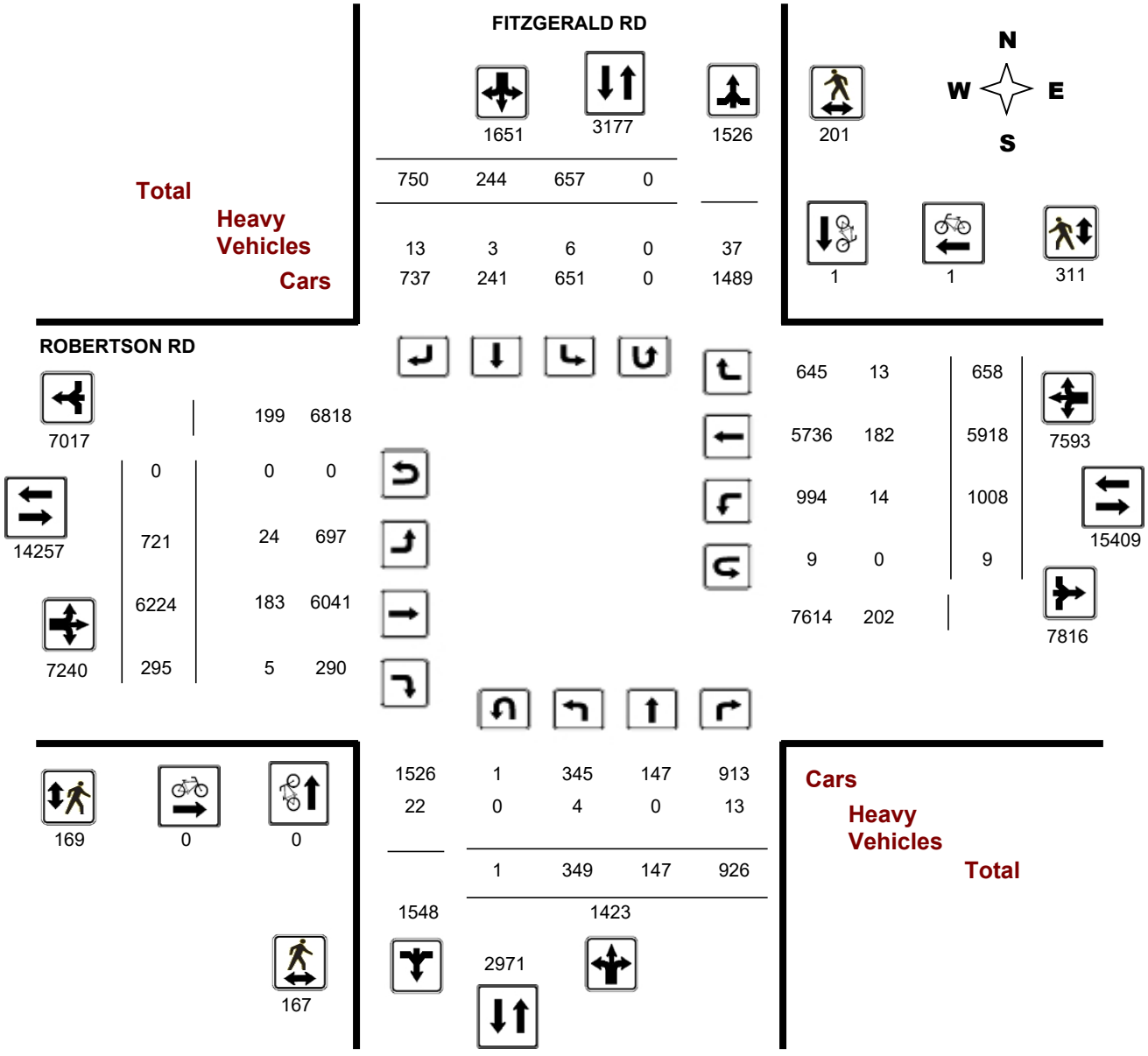
Turning Movement Count - Full Study Diagram

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017

WO#: 37325

Device: Miovision



Comments

Transportation Services - Traffic Services

W.O. 37325

Turning Movement Count - Heavy Vehicle Report

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017

		FITZGERALD RD									ROBERTSON RD									
		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**	**Grand Total**
07:00	08:00	0	0	1	**1**	2	0	2	**4**	**5**	4	19	0	**23**	1	23	2	**26**	**49**	**54**
08:00	09:00	0	0	1	**1**	3	0	2	**5**	**6**	2	24	1	**27**	0	26	4	**30**	**57**	**63**
09:00	10:00	1	0	2	**3**	1	0	1	**2**	**5**	1	37	2	**40**	6	26	1	**33**	**73**	**78**
11:30	12:30	1	0	2	**3**	0	2	2	**4**	**7**	3	31	0	**34**	4	33	2	**39**	**73**	**80**
12:30	13:30	2	0	6	**8**	0	0	1	**1**	**9**	4	22	1	**27**	2	24	0	**26**	**53**	**62**
15:00	16:00	0	0	1	**1**	0	0	1	**1**	**2**	5	26	1	**32**	1	29	2	**32**	**64**	**66**
16:00	17:00	0	0	0	**0**	0	0	2	**2**	**2**	2	13	0	**15**	0	14	1	**15**	**30**	**32**
17:00	18:00	0	0	0	**0**	0	1	2	**3**	**3**	3	11	0	**14**	0	7	1	**8**	**22**	**25**
Sub Total		4	0	13	**17**	6	3	13	**22**	**39**	24	183	5	**212**	14	182	13	**209**	**421**	**460**
U-Turns (Heavy Vehicles)					**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total		4	0	13	**0**	6	3	13	**22**	**39**	24	183	5	**212**	14	182	13	**209**	**421**	**460**

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
37325

Turning Movement Count - Pedestrian Volume Report

FITZGERALD RD @ ROBERTSON RD

Count Date: Thursday, November 30, 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	1	**5**	2	3	**5**	**10**
07:15 07:30	3	2	**5**	2	4	**6**	**11**
07:30 07:45	4	8	**12**	2	1	**3**	**15**
07:45 08:00	3	4	**7**	4	8	**12**	**19**
07:00 08:00	14	15	**29**	10	16	**26**	**55**
08:00 08:15	4	2	**6**	3	5	**8**	**14**
08:15 08:30	3	4	**7**	3	6	**9**	**16**
08:30 08:45	6	4	**10**	2	9	**11**	**21**
08:45 09:00	11	6	**17**	9	6	**15**	**32**
08:00 09:00	24	16	**40**	17	26	**43**	**83**
09:00 09:15	5	4	**9**	3	14	**17**	**26**
09:15 09:30	4	6	**10**	2	8	**10**	**20**
09:30 09:45	5	9	**14**	4	12	**16**	**30**
09:45 10:00	2	3	**5**	1	12	**13**	**18**
09:00 10:00	16	22	**38**	10	46	**56**	**94**
11:30 11:45	3	6	**9**	2	6	**8**	**17**
11:45 12:00	6	6	**12**	7	15	**22**	**34**
12:00 12:15	3	11	**14**	17	22	**39**	**53**
12:15 12:30	10	3	**13**	12	19	**31**	**44**
11:30 12:30	22	26	**48**	38	62	**100**	**148**
12:30 12:45	9	5	**14**	8	18	**26**	**40**
12:45 13:00	7	11	**18**	8	6	**14**	**32**
13:00 13:15	8	18	**26**	12	18	**30**	**56**
13:15 13:30	8	11	**19**	6	14	**20**	**39**
12:30 13:30	32	45	**77**	34	56	**90**	**167**
15:00 15:15	2	13	**15**	9	8	**17**	**32**
15:15 15:30	2	7	**9**	5	7	**12**	**21**
15:30 15:45	8	12	**20**	3	16	**19**	**39**
15:45 16:00	2	5	**7**	6	6	**12**	**19**
15:00 16:00	14	37	**51**	23	37	**60**	**111**
16:00 16:15	3	9	**12**	6	10	**16**	**28**
16:15 16:30	9	7	**16**	6	10	**16**	**32**
16:30 16:45	8	2	**10**	4	8	**12**	**22**
16:45 17:00	3	4	**7**	2	12	**14**	**21**
16:00 17:00	23	22	**45**	18	40	**58**	**103**
17:00 17:15	6	2	**8**	5	5	**10**	**18**
17:15 17:30	3	4	**7**	4	4	**8**	**15**
17:30 17:45	7	4	**11**	4	11	**15**	**26**
17:45 18:00	6	8	**14**	6	8	**14**	**28**
17:00 18:00	22	18	**40**	19	28	**47**	**87**
Total	167	201	**368**	169	311	**480**	**848**

Comment:

Transportation Services - Traffic Services

Work Order 37325

Turning Movement Count - Full Study Summary Report

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017

Total Observed U-Turns

Northbound: 1 Southbound: 0

Eastbound: 0 Westbound: 9

AADT Factor .90

Full Study

	FITZGERALD RD									ROBERTSON 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	3	2	7	**12**	61	7	51	**119**	**131**	160	1296	3	**1459**	16	332	133	**481**	**1940**	**2071**
08:00 09:00	15	7	33	**55**	57	12	75	**144**	**199**	150	1104	31	**1285**	46	476	144	**666**	**1951**	**2150**
09:00 10:00	34	4	89	**127**	76	19	66	**161**	**288**	79	723	45	**847**	110	503	99	**712**	**1559**	**1847**
11:30 12:30	54	33	173	**260**	120	66	137	**323**	**583**	82	732	50	**864**	180	756	67	**1003**	**1867**	**2450**
12:30 13:30	60	37	182	**279**	79	41	76	**196**	**475**	134	645	55	**834**	151	685	101	**937**	**1771**	**2246**
15:00 16:00	54	24	143	**221**	93	29	94	**216**	**437**	55	614	39	**708**	169	990	46	**1205**	**1913**	**2350**
16:00 17:00	60	24	148	**232**	108	39	147	**294**	**526**	31	550	30	**611**	172	1148	43	**1363**	**1974**	**2500**
17:00 18:00	69	16	151	**236**	63	31	104	**198**	**434**	30	560	42	**632**	164	1028	25	**1217**	**1849**	**2283**
Sub Total	349	147	926	**1422**	657	244	750	**1651**	**3073**	721	6224	295	**7240**	1008	5918	658	**7584**	**14824**	**17897**
U Turns				**1**				**0**	**1**				**0**				**9**	**9**	**10**
Total	349	147	926	**1423**	657	244	750	**1651**	**3074**	721	6224	295	**7240**	1008	5918	658	**7593**	**14833**	**17907**
EQ 12Hr	485	204	1287	**1978**	913	339	1042	**2295**	**4273**	1002	8651	410	**10064**	1401	8226	915	**10554**	**20618**	**24891**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	437	184	1158	**1780**	822	305	938	**2065**	**3845**	902	7786	369	**9057**	1261	7403	823	**9499**	**18556**	**22401**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	572	241	1518	**2332**	1077	400	1229	**2706**	**5038**	1182	10200	483	**11865**	1652	9698	1078	**12443**	**24308**	**29346**
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.

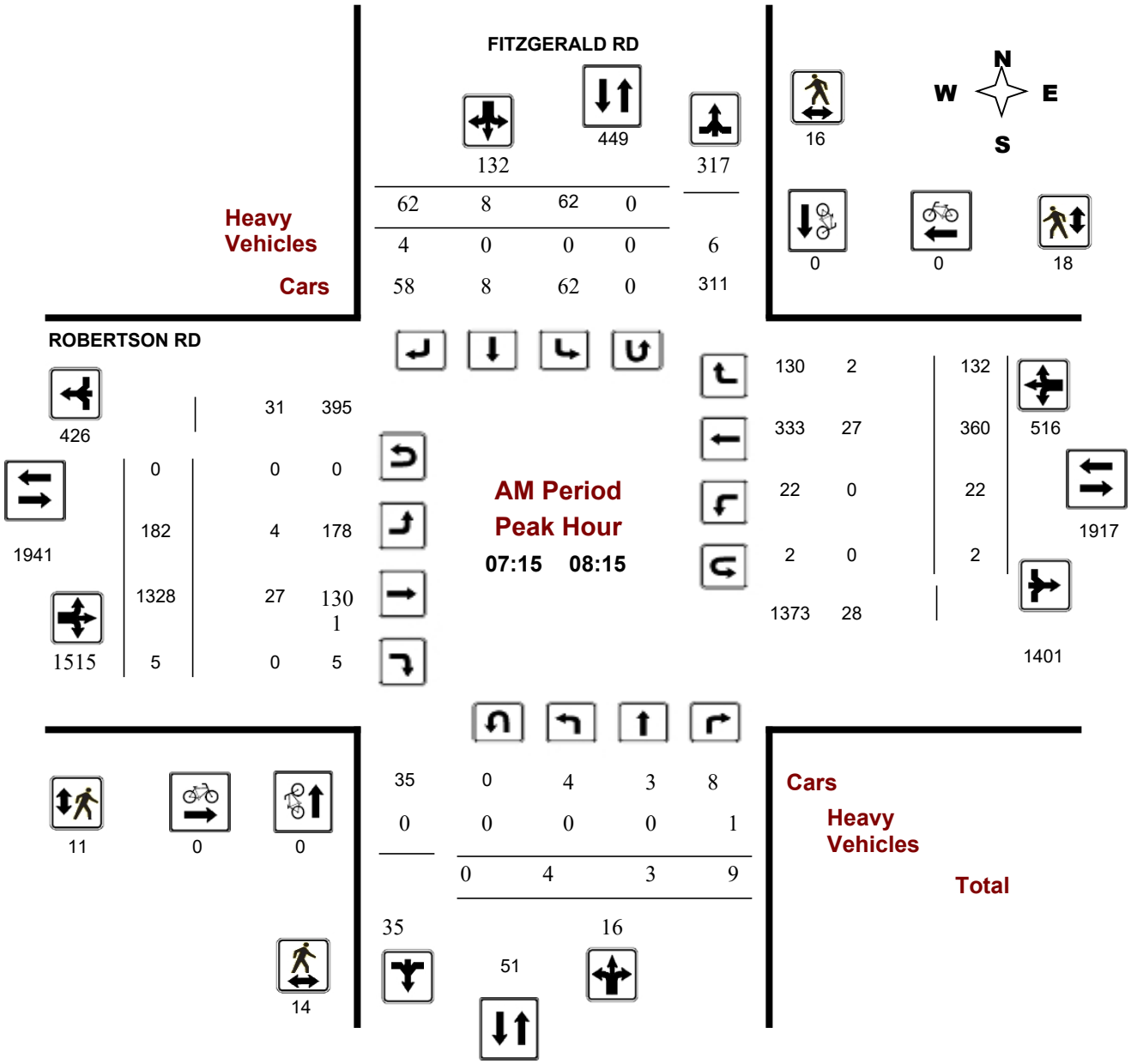
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017 **WO No:** 37325

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



Comments

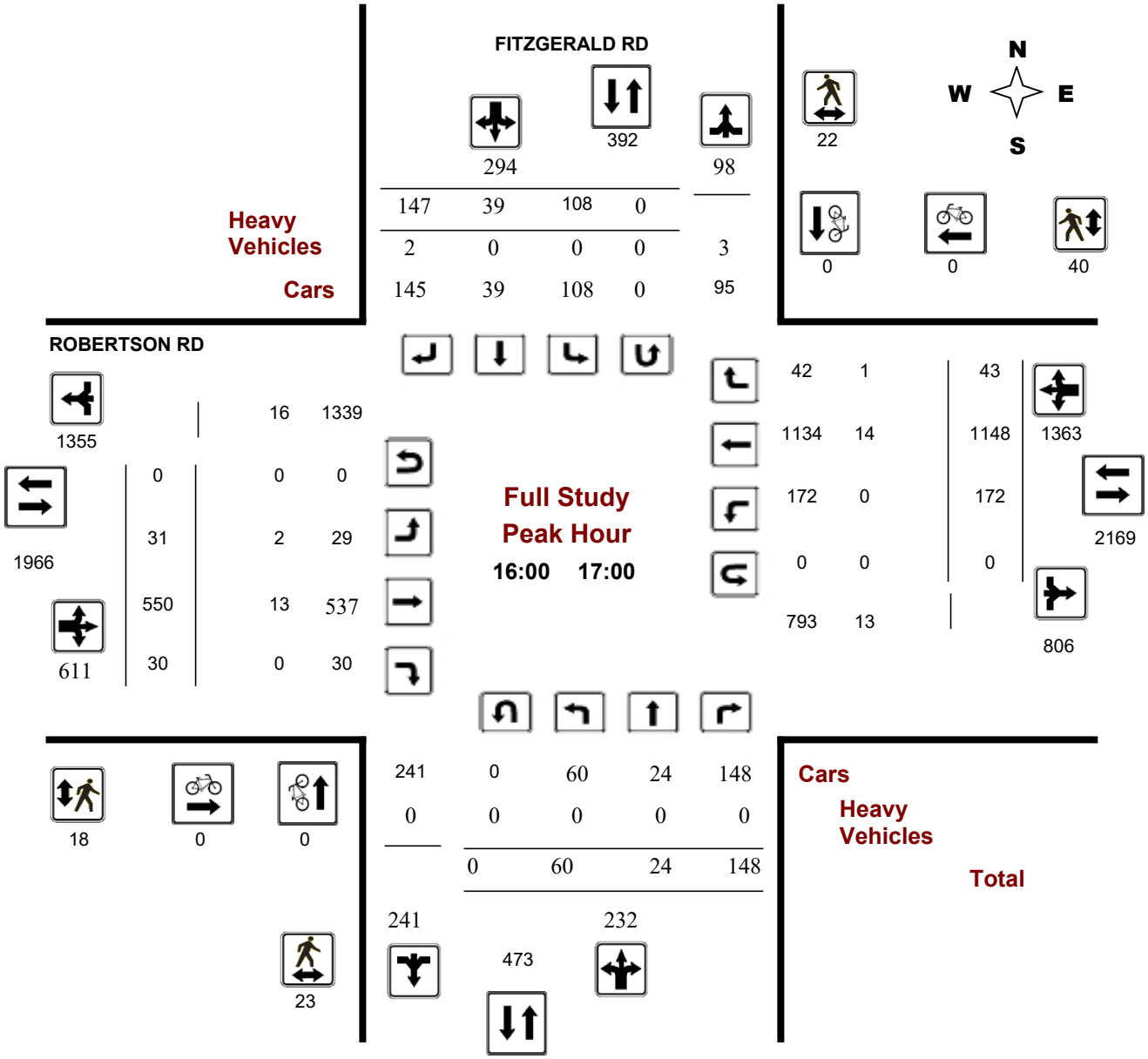
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017 **WO No:** 37325

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



Comments

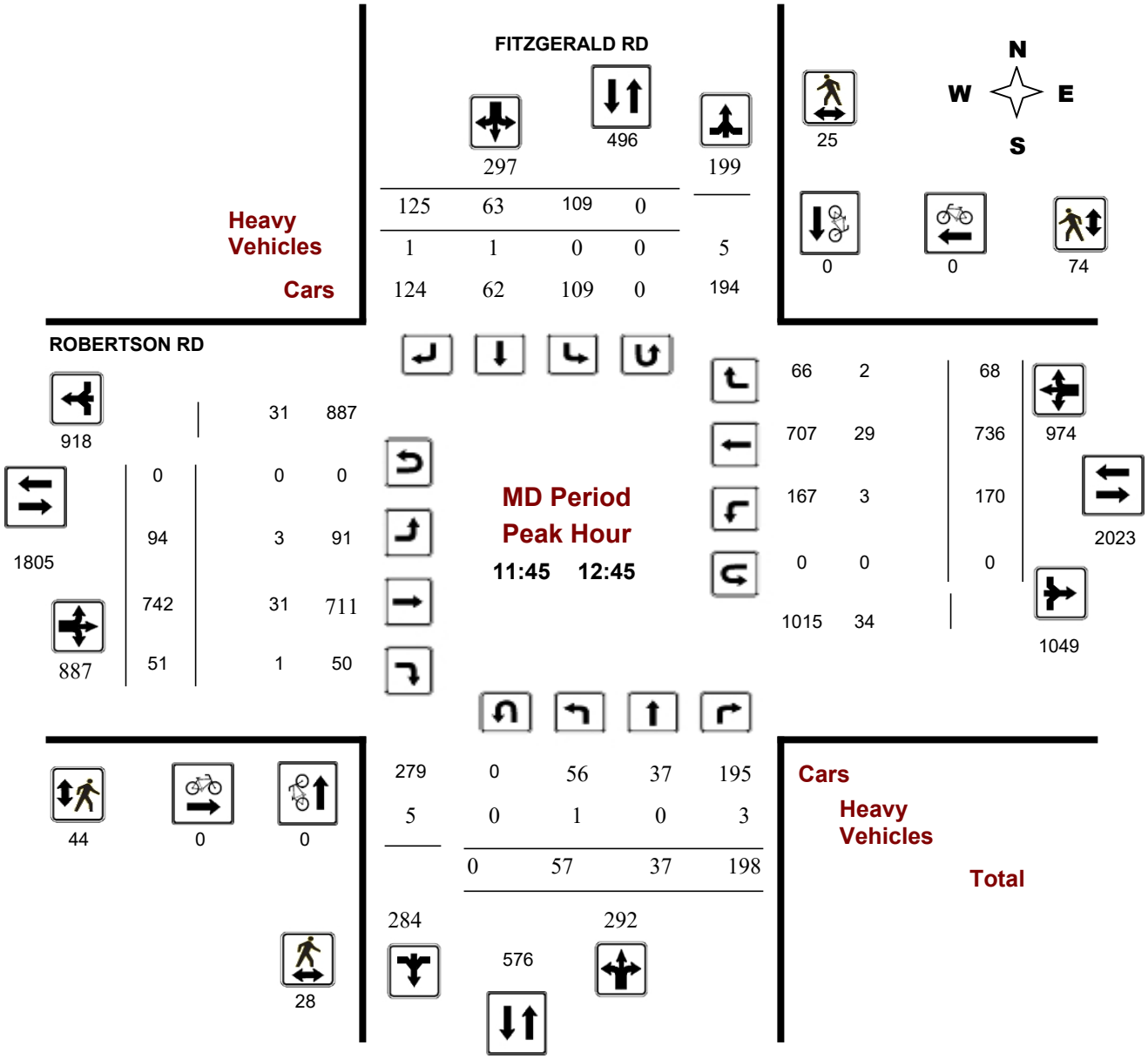
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017 **WO No:** 37325

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



Comments

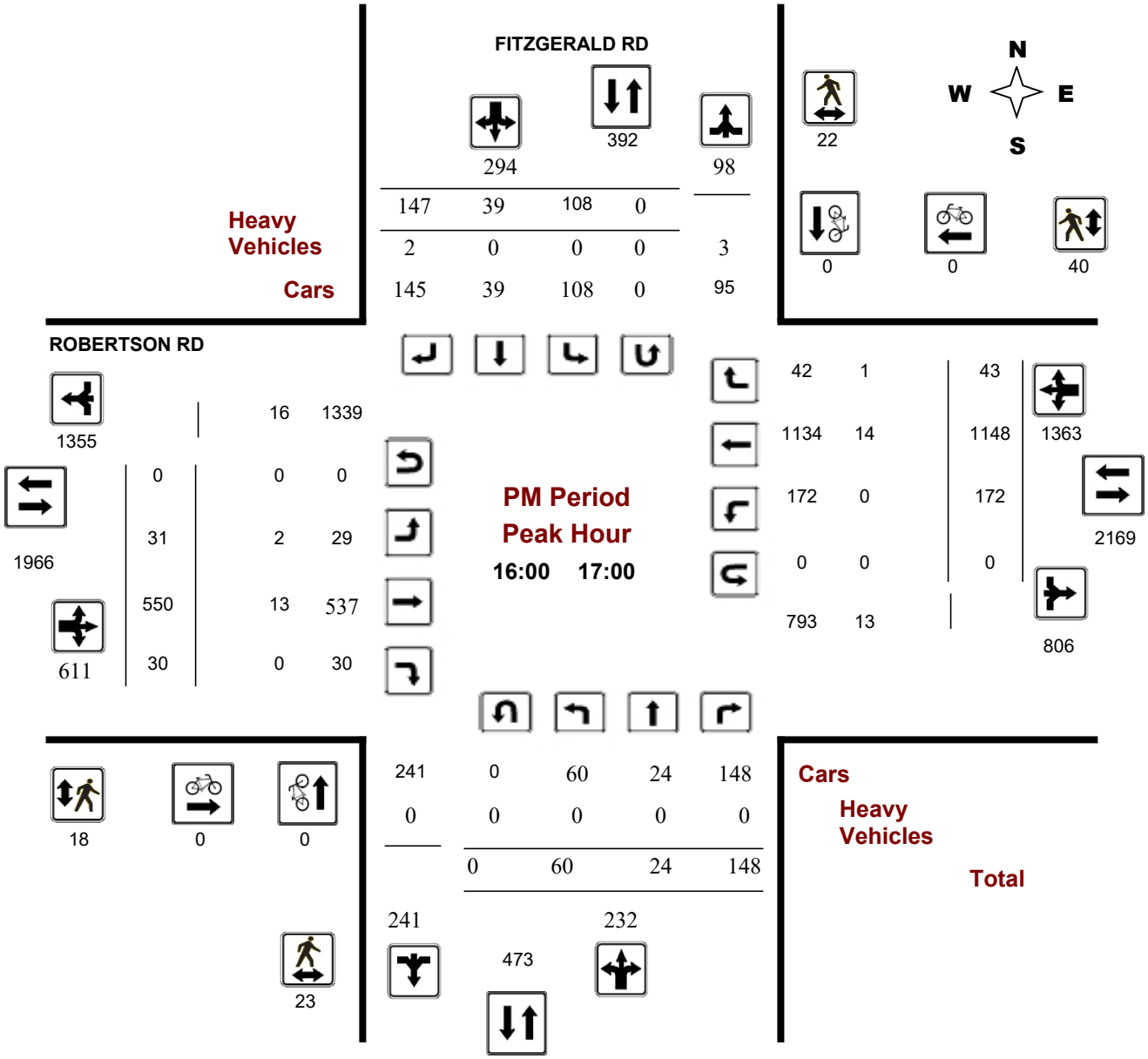
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017 **WO No:** 37325

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



Comments

Transportation Services - Traffic Services

Work Order
37325

Turning Movement Count - 15 Min U-Turn Total Report

FITZGERALD RD @ ROBERTSON RD

Survey Date: Thursday, November 30, 2017

Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	1	0	0	0	1
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	1	1
07:45	08:00	0	0	0	1	1
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	1	1
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	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	2	2
13:00	13:15	0	0	0	0	0
13:15	13:30	0	0	0	1	1
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	1	1
17:15	17:30	0	0	0	1	1
17:30	17:45	0	0	0	0	0
17:45	18:00	0	0	0	0	0
Total		1	0	0	9	10

Transportation Services - Traffic Services

W.O. 36748

Turning Movement Count - 15 Minute Summary Report

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 0 Westbound: 3

		WESTCLIFFE RD									ROBERTSON RD									
		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	Grand Total
07:00	07:15	8	0	15	**23**	1	0	0	**1**	**24**	6	344	2	**352**	2	37	2	**41**	**393**	**417**
07:15	07:30	10	1	24	**35**	3	0	0	**3**	**38**	1	371	13	**385**	5	65	4	**74**	**459**	**497**
07:30	07:45	16	0	22	**38**	2	0	2	**4**	**42**	2	366	12	**380**	7	73	7	**87**	**467**	**509**
07:45	08:00	12	0	30	**42**	2	0	2	**4**	**46**	3	360	13	**376**	7	87	4	**98**	**474**	**520**
08:00	08:15	11	0	26	**37**	0	0	2	**2**	**39**	1	288	7	**296**	13	86	0	**99**	**395**	**434**
08:15	08:30	17	0	19	**36**	5	0	1	**6**	**42**	5	271	6	**282**	6	84	0	**90**	**372**	**414**
08:30	08:45	19	0	16	**35**	2	0	4	**6**	**41**	4	287	10	**301**	5	92	3	**100**	**401**	**442**
08:45	09:00	15	0	40	**55**	1	0	1	**2**	**57**	6	231	23	**260**	15	93	1	**109**	**369**	**426**
09:00	09:15	20	1	36	**57**	5	0	2	**7**	**64**	2	182	13	**197**	15	116	2	**133**	**330**	**394**
09:15	09:30	9	1	24	**34**	3	0	5	**8**	**42**	5	178	13	**196**	16	81	0	**97**	**293**	**335**
09:30	09:45	15	0	20	**35**	4	0	3	**7**	**42**	3	127	10	**140**	16	90	1	**107**	**247**	**289**
09:45	10:00	13	0	13	**26**	7	0	5	**12**	**38**	4	149	16	**169**	12	120	5	**137**	**306**	**344**
11:30	11:45	10	1	20	**31**	5	0	7	**12**	**43**	5	130	12	**147**	15	146	3	**164**	**311**	**354**
11:45	12:00	14	0	13	**27**	7	0	3	**10**	**37**	4	149	22	**175**	13	146	1	**160**	**335**	**372**
12:00	12:15	13	1	14	**28**	9	1	2	**12**	**40**	5	140	11	**156**	13	169	5	**187**	**343**	**383**
12:15	12:30	12	0	22	**34**	10	0	5	**15**	**49**	2	146	12	**160**	23	153	1	**177**	**337**	**386**
12:30	12:45	12	0	15	**27**	5	2	3	**10**	**37**	4	147	11	**162**	10	141	6	**157**	**319**	**356**
12:45	13:00	15	0	15	**30**	6	2	4	**12**	**42**	3	156	8	**167**	21	145	1	**167**	**334**	**376**
13:00	13:15	10	1	13	**24**	4	0	6	**10**	**34**	3	142	9	**154**	9	148	5	**162**	**316**	**350**
13:15	13:30	13	0	18	**31**	6	0	2	**8**	**39**	5	133	15	**153**	18	126	3	**147**	**300**	**339**
15:00	15:15	18	0	17	**35**	9	0	6	**15**	**50**	2	137	13	**152**	30	179	4	**213**	**365**	**415**
15:15	15:30	3	1	21	**25**	6	0	6	**12**	**37**	1	157	20	**178**	31	180	0	**211**	**389**	**426**
15:30	15:45	24	0	22	**46**	3	0	3	**6**	**52**	3	133	18	**154**	26	202	0	**228**	**382**	**434**
15:45	16:00	17	0	18	**35**	7	0	2	**9**	**44**	0	126	13	**139**	27	212	2	**241**	**380**	**424**
16:00	16:15	17	0	24	**41**	2	1	8	**11**	**52**	3	126	15	**144**	18	249	2	**269**	**413**	**465**
16:15	16:30	16	0	16	**32**	5	0	5	**10**	**42**	3	146	17	**166**	29	293	2	**325**	**491**	**533**
16:30	16:45	20	0	16	**36**	7	0	6	**13**	**49**	2	112	22	**136**	28	284	5	**317**	**453**	**502**
16:45	17:00	16	0	11	**27**	3	1	4	**8**	**35**	2	133	23	**158**	24	273	1	**298**	**456**	**491**
17:00	17:15	13	0	15	**28**	7	1	9	**17**	**45**	3	130	16	**149**	35	261	2	**298**	**447**	**492**
17:15	17:30	15	0	19	**34**	5	1	2	**8**	**42**	1	139	22	**162**	30	246	0	**276**	**438**	**480**
17:30	17:45	11	0	19	**30**	6	0	3	**9**	**39**	0	102	13	**115**	22	242	0	**266**	**381**	**420**
17:45	18:00	17	0	20	**37**	0	1	0	**1**	**38**	1	112	16	**129**	23	216	0	**239**	**368**	**406**
TOTAL:		451	7	633	**1091**	147	10	113	**270**	**1361**	94	5850	446	**6390**	564	5035	72	**5674**	**12064**	**13425**

Note: U-Turns are included in Totals.

Comment:

Transportation Services - Traffic Services

Turning Movement Count - Cyclist Volume Report

Work Order
36748

ROBERTSON RD @ WESTCLIFFE RD

Count Date: Wednesday, March 08, 2017 **Start Time:** 07:00

	WESTCLIFFE RD			ROBERTSON RD			
Time Period	Northbound	Southbound	**Street Total**	Eastbound	Westbound	**Street Total**	**Grand Total**
07:00 08:00	0	0	**0**	0	0	**0**	**0**
08:00 09:00	0	0	**0**	0	0	**0**	**0**
09:00 10:00	0	0	**0**	0	1	**1**	**1**
11:30 12:30	0	0	**0**	0	0	**0**	**0**
12:30 13:30	0	0	**0**	0	0	**0**	**0**
15:00 16:00	0	0	**0**	0	1	**1**	**1**
16:00 17:00	0	0	**0**	0	0	**0**	**0**
17:00 18:00	0	0	**0**	0	0	**0**	**0**
Total	0	0	**0**	0	2	**2**	**2**

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

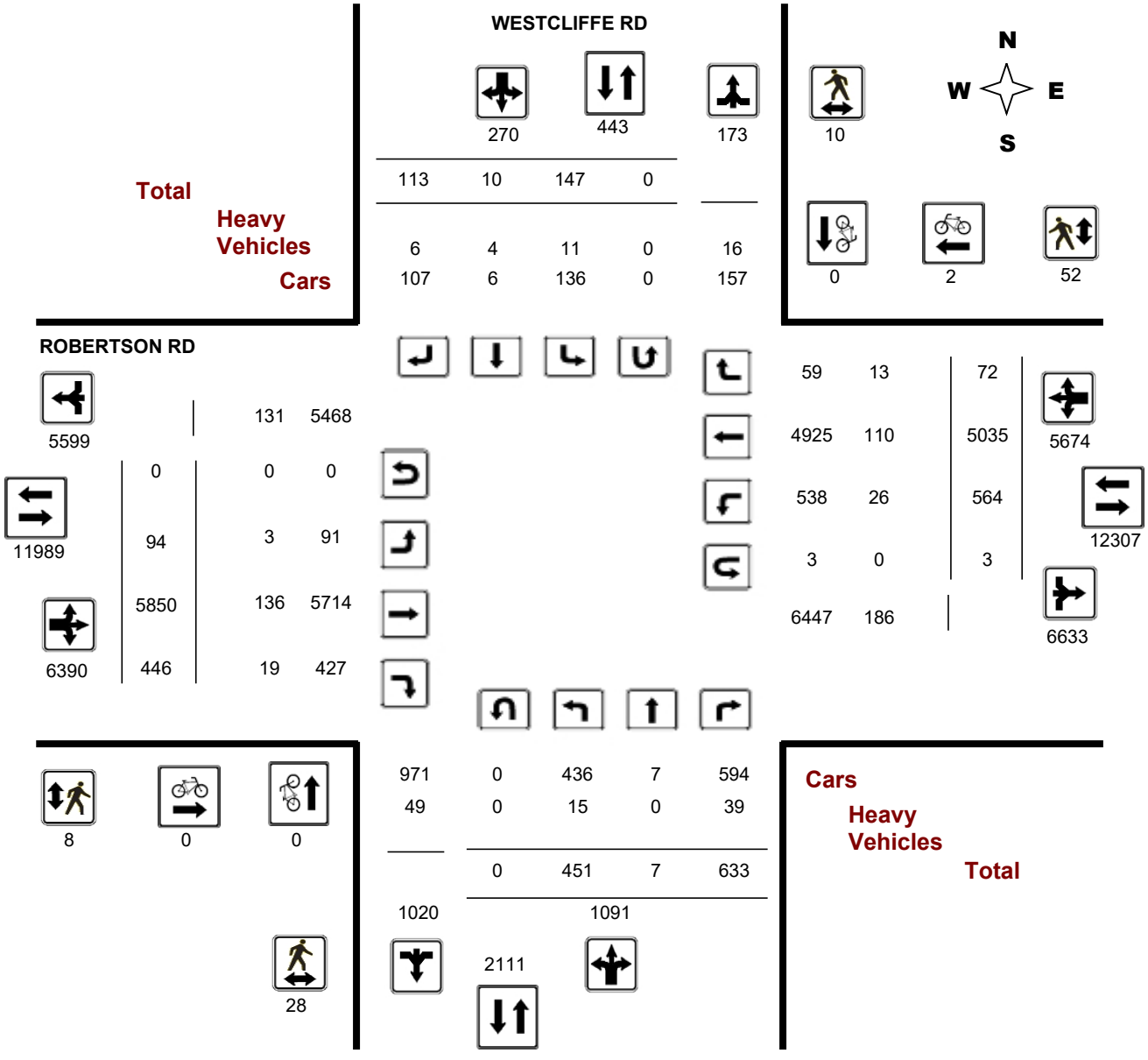
Turning Movement Count - Full Study Diagram

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017

WO#: 36748

Device: Miovision



Comments

Transportation Services - Traffic Services

W.O. 36748

Turning Movement Count - Heavy Vehicle Report

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017

Time Period		WESTCLIFFE RD Northbound LT	ST	RT	N TOT	Southbound LT	ST	RT	S TOT	STR TOT	ROBERTSON RD Eastbound LT	ST	RT	E TOT	Westbound LT	ST	RT	W TOT	STR TOT	Grand Total
07:00	08:00	0	0	4	**4**	1	0	0	**1**	**5**	1	21	2	**24**	5	10	0	**15**	**39**	**44**
08:00	09:00	3	0	7	**10**	1	0	1	**2**	**12**	0	21	9	**30**	5	29	1	**35**	**65**	**77**
09:00	10:00	3	0	7	**10**	1	0	2	**3**	**13**	0	15	2	**17**	3	14	2	**19**	**36**	**49**
11:30	12:30	1	0	3	**4**	5	1	1	**7**	**11**	0	16	1	**17**	3	15	5	**23**	**40**	**51**
12:30	13:30	1	0	4	**5**	1	3	1	**5**	**10**	1	17	1	**19**	3	12	3	**18**	**37**	**47**
15:00	16:00	7	0	5	**12**	1	0	1	**2**	**14**	0	16	3	**19**	3	12	1	**16**	**35**	**49**
16:00	17:00	0	0	5	**5**	1	0	0	**1**	**6**	1	15	1	**17**	1	11	1	**13**	**30**	**36**
17:00	18:00	0	0	4	**4**	0	0	0	**0**	**4**	0	15	0	**15**	3	7	0	**10**	**25**	**29**
Sub Total		15	0	39	**54**	11	4	6	**21**	**75**	3	136	19	**158**	26	110	13	**149**	**307**	**382**
U-Turns (Heavy Vehicles)					**0**				**0**	**0**				**0**				**0**	**0**	**0**
Total		15	0	39	**0**	11	4	6	**21**	**75**	3	136	19	**158**	26	110	13	**149**	**307**	**382**

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
36748

Turning Movement Count - Pedestrian Volume Report

ROBERTSON RD @ WESTCLIFFE RD

Count Date: Wednesday, March 08, 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	0	0	**0**	0	2	**2**	**2**
07:15 07:30	1	2	**3**	1	0	**1**	**4**
07:30 07:45	0	0	**0**	0	1	**1**	**1**
07:45 08:00	1	0	**1**	0	4	**4**	**5**
07:00 08:00	2	2	**4**	1	7	**8**	**12**
08:00 08:15	0	0	**0**	0	2	**2**	**2**
08:15 08:30	1	0	**1**	0	2	**2**	**3**
08:30 08:45	0	1	**1**	0	0	**0**	**1**
08:45 09:00	2	0	**2**	0	1	**1**	**3**
08:00 09:00	3	1	**4**	0	5	**5**	**9**
09:00 09:15	0	0	**0**	0	2	**2**	**2**
09:15 09:30	0	0	**0**	0	3	**3**	**3**
09:30 09:45	0	1	**1**	1	1	**2**	**3**
09:45 10:00	1	0	**1**	0	0	**0**	**1**
09:00 10:00	1	1	**2**	1	6	**7**	**9**
11:30 11:45	3	0	**3**	0	1	**1**	**4**
11:45 12:00	0	0	**0**	0	0	**0**	**0**
12:00 12:15	0	0	**0**	0	2	**2**	**2**
12:15 12:30	1	0	**1**	0	3	**3**	**4**
11:30 12:30	4	0	**4**	0	6	**6**	**10**
12:30 12:45	3	0	**3**	0	2	**2**	**5**
12:45 13:00	2	0	**2**	0	2	**2**	**4**
13:00 13:15	4	0	**4**	0	0	**0**	**4**
13:15 13:30	1	0	**1**	1	0	**1**	**2**
12:30 13:30	10	0	**10**	1	4	**5**	**15**
15:00 15:15	1	1	**2**	1	5	**6**	**8**
15:15 15:30	0	1	**1**	0	0	**0**	**1**
15:30 15:45	0	4	**4**	3	7	**10**	**14**
15:45 16:00	0	0	**0**	0	1	**1**	**1**
15:00 16:00	1	6	**7**	4	13	**17**	**24**
16:00 16:15	2	0	**2**	0	2	**2**	**4**
16:15 16:30	0	0	**0**	0	0	**0**	**0**
16:30 16:45	0	0	**0**	0	1	**1**	**1**
16:45 17:00	2	0	**2**	0	2	**2**	**4**
16:00 17:00	4	0	**4**	0	5	**5**	**9**
17:00 17:15	1	0	**1**	1	1	**2**	**3**
17:15 17:30	1	0	**1**	0	0	**0**	**1**
17:30 17:45	1	0	**1**	0	2	**2**	**3**
17:45 18:00	0	0	**0**	0	3	**3**	**3**
17:00 18:00	3	0	**3**	1	6	**7**	**10**
Total	28	10	**38**	8	52	**60**	**98**

Comment:

Transportation Services - Traffic Services

Work Order 36748

Turning Movement Count - Full Study Summary Report

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017

Total Observed U-Turns

Northbound: 0 Southbound: 0

Eastbound: 0 Westbound: 3

AADT Factor 1.00

Full Study

	WESTCLIFFE RD									ROBERTSON 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	46	1	91	**138**	8	0	4	**12**	**150**	12	1441	40	**1493**	21	262	17	**300**	**1793**	**1943**
08:00 09:00	62	0	101	**163**	8	0	8	**16**	**179**	16	1077	46	**1139**	39	355	4	**398**	**1537**	**1716**
09:00 10:00	57	2	93	**152**	19	0	15	**34**	**186**	14	636	52	**702**	59	407	8	**474**	**1176**	**1362**
11:30 12:30	49	2	69	**120**	31	1	17	**49**	**169**	16	565	57	**638**	64	614	10	**688**	**1326**	**1495**
12:30 13:30	50	1	61	**112**	21	4	15	**40**	**152**	15	578	43	**636**	58	560	15	**633**	**1269**	**1421**
15:00 16:00	62	1	78	**141**	25	0	17	**42**	**183**	6	553	64	**623**	114	773	6	**893**	**1516**	**1699**
16:00 17:00	69	0	67	**136**	17	2	23	**42**	**178**	10	517	77	**604**	99	1099	10	**1208**	**1812**	**1990**
17:00 18:00	56	0	73	**129**	18	3	14	**35**	**164**	5	483	67	**555**	110	965	2	**1077**	**1632**	**1796**
Sub Total	451	7	633	**1091**	147	10	113	**270**	**1361**	94	5850	446	**6390**	564	5035	72	**5671**	**12061**	**13422**
U Turns				**0**				**0**	**0**				**0**				**3**	**3**	**3**
Total	451	7	633	**1091**	147	10	113	**270**	**1361**	94	5850	446	**6390**	564	5035	72	**5674**	**12064**	**13425**
EQ 12Hr	627	10	880	**1516**	204	14	157	**375**	**1891**	131	8131	620	**8882**	784	6999	100	**7887**	**16769**	**18660**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	627	10	880	**1516**	204	14	157	**375**	**1891**	131	8131	620	**8882**	784	6999	100	**7887**	**16769**	**18660**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**1.00**						
AVG 24Hr	821	13	1153	**1987**	268	18	206	**492**	**2479**	171	10652	812	**11636**	1027	9168	131	**10332**	**21968**	**24447**
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.

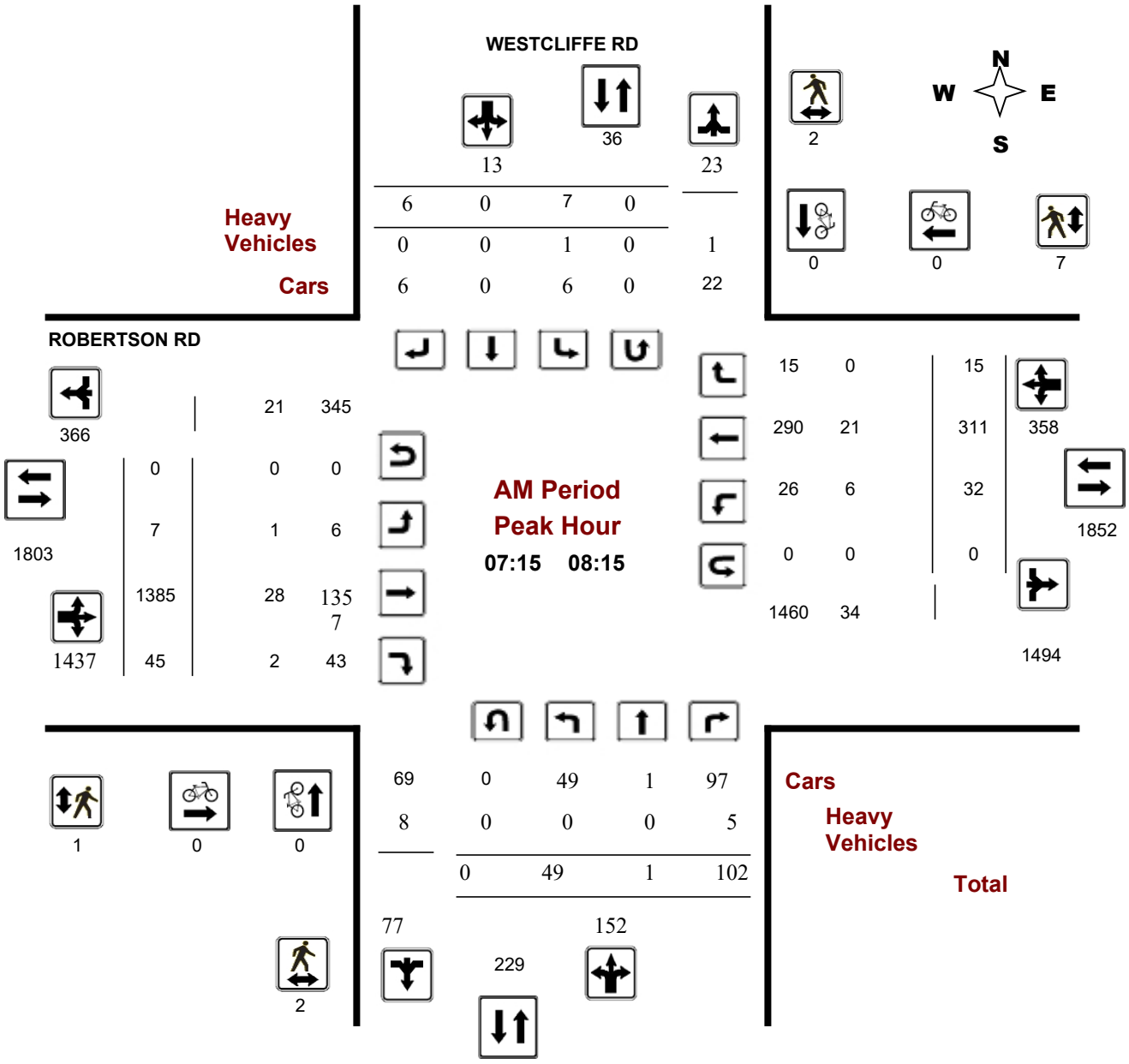
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36748

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



Comments

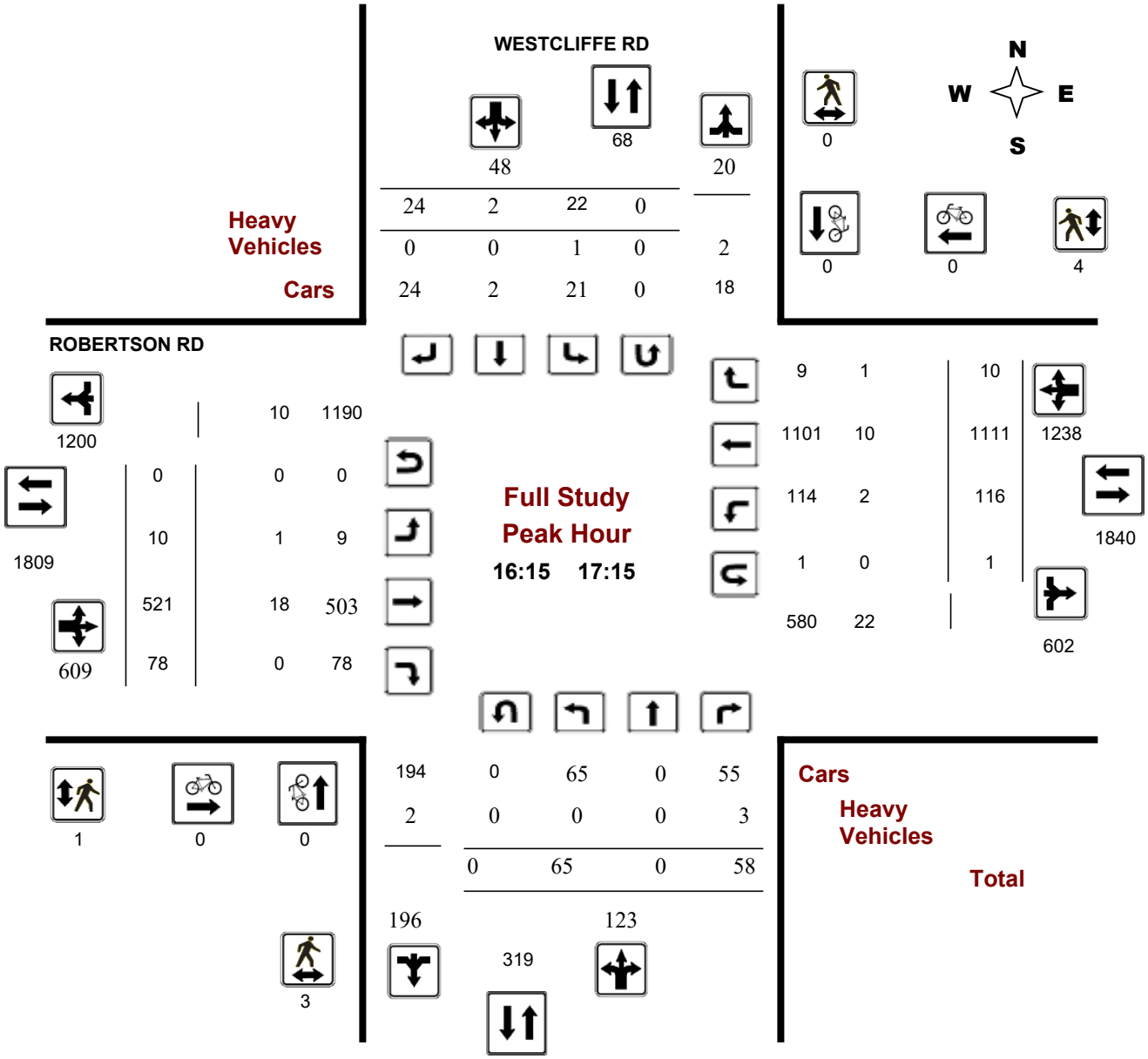
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36748

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



Comments

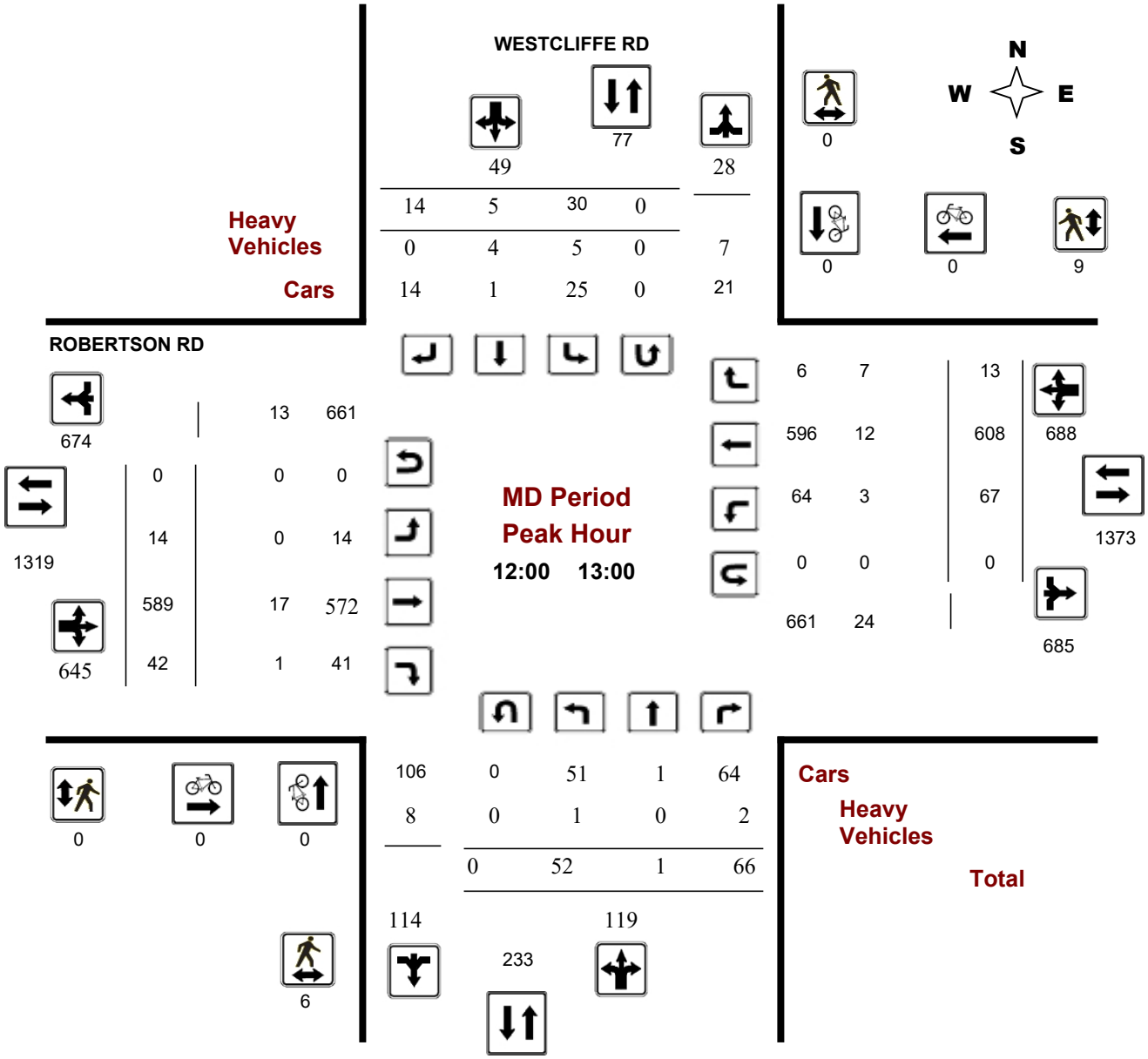
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36748

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



Comments

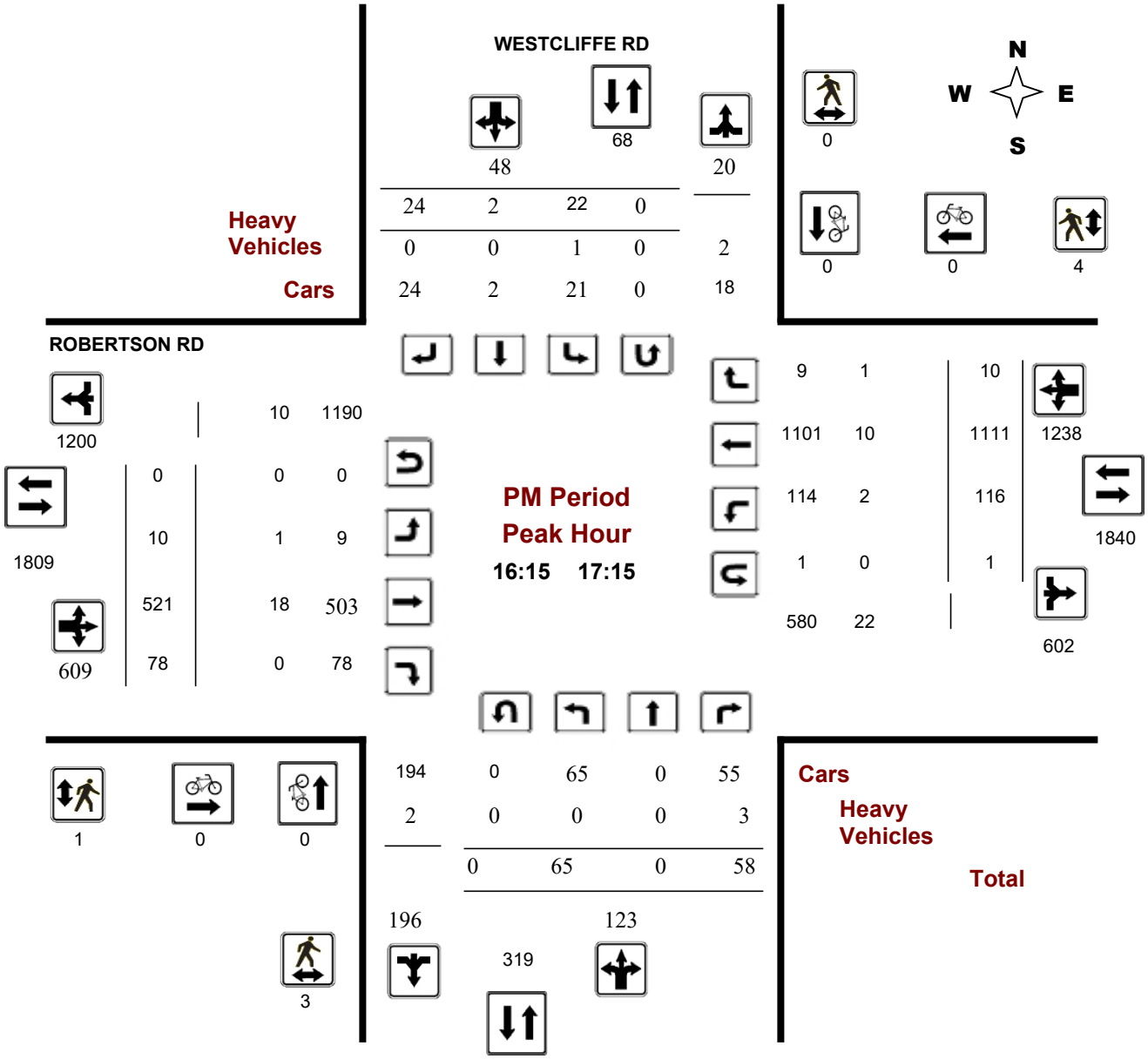
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017 **WO No:** 36748

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



Comments

Transportation Services - Traffic Services

Work Order
36748

Turning Movement Count - 15 Min U-Turn Total Report

ROBERTSON RD @ WESTCLIFFE RD

Survey Date: Wednesday, March 08, 2017

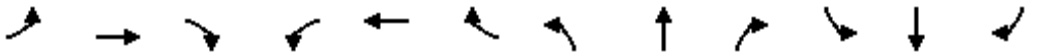
Time Period		Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0
07:15	07:30	0	0	0	0	0
07:30	07:45	0	0	0	0	0
07:45	08:00	0	0	0	0	0
08:00	08:15	0	0	0	0	0
08:15	08:30	0	0	0	0	0
08:30	08:45	0	0	0	0	0
08:45	09:00	0	0	0	0	0
09:00	09:15	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	1	1
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	2	2
17:45	18:00	0	0	0	0	0
Total		0	0	0	3	3

Appendix C

Existing Conditions SYNCHRO Analysis

Lanes, Volumes, Timings
1: Moodie & Robertson

11/21/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	1211	112	81	307	152	225	361	309	356	176	107
Future Volume (vph)	70	1211	112	81	307	152	225	361	309	356	176	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	1316	122	88	334	165	245	392	336	387	191	116
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	15.0	54.0	54.0	15.0	54.0	54.0	23.0	38.0	38.0	23.0	38.0	38.0
Total Split (%)	11.5%	41.5%	41.5%	11.5%	41.5%	41.5%	17.7%	29.2%	29.2%	17.7%	29.2%	29.2%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.6	50.3	50.3	10.7	53.0	53.0	16.6	34.3	34.3	18.7	36.4	36.4
Actuated g/C Ratio	0.08	0.39	0.39	0.08	0.41	0.41	0.13	0.26	0.26	0.14	0.28	0.28
v/c Ratio	0.53	0.96	0.18	0.60	0.23	0.22	0.56	0.42	0.64	0.78	0.19	0.21
Control Delay	57.5	60.0	11.6	75.3	26.6	4.5	58.1	41.4	30.4	65.8	36.9	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.5	60.0	11.6	75.3	26.6	4.5	58.1	41.4	30.4	65.8	36.9	4.7
LOS	E	E	B	E	C	A	E	D	C	E	D	A
Approach Delay		56.0			27.7			41.8			47.6	
Approach LOS		E			C			D			D	
Queue Length 50th (ft)	63	625	18	73	100	0	101	145	147	163	64	0
Queue Length 95th (ft)	115	#748	79	#133	136	45	142	194	256	220	100	33
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	149	1368	697	149	1443	743	501	933	521	501	990	541
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.96	0.18	0.59	0.23	0.22	0.49	0.42	0.64	0.77	0.19	0.21

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 46.4	Intersection LOS: D

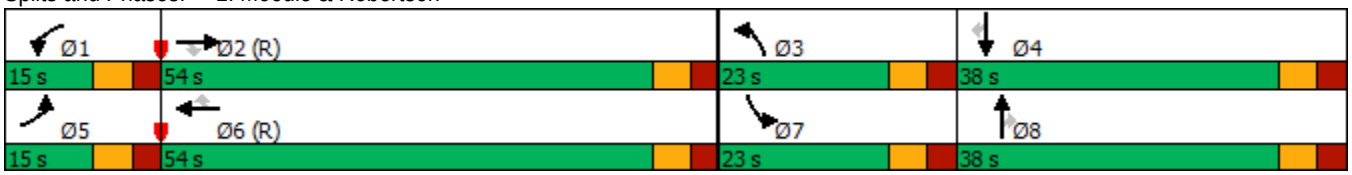
Intersection Capacity Utilization 72.8% ICU Level of Service C

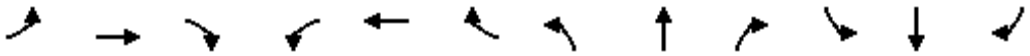
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	182	1328	5	22	360	132	4	3	9	62	8	62
Future Volume (vph)	182	1328	5	22	360	132	4	3	9	62	8	62
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	198	1448	0	24	534	0	4	13	0	67	76	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	84.0	84.0		13.0	97.0		33.0	33.0		33.0	33.0	
Total Split (%)	64.6%	64.6%		10.0%	74.6%		25.4%	25.4%		25.4%	25.4%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	98.6	98.6		9.5	107.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.76	0.76		0.07	0.83		0.11	0.11		0.11	0.11	
v/c Ratio	0.31	0.54		0.19	0.19		0.03	0.07		0.43	0.31	
Control Delay	5.9	5.5		56.4	3.5		49.8	28.4		61.6	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.9	5.5		56.4	3.5		49.8	28.4		61.6	17.9	
LOS	A	A		E	A		D	C		E	B	
Approach Delay		5.5			5.8			33.4			38.4	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	35	136		17	83		3	2		54	7	
Queue Length 95th (ft)	55	163		m47	112		14	22		99	53	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	640	2681		134	2822		272	375		311	412	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.31	0.54		0.18	0.19		0.01	0.03		0.22	0.18	

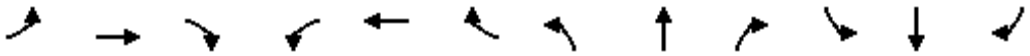
Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 97 (75%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 7.8	Intersection LOS: A

Intersection Capacity Utilization 61.1% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	1385	45	32	311	15	49	1	102	7	0	6
Future Volume (vph)	7	1385	45	32	311	15	49	1	102	7	0	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	8	1554	0	35	354	0	0	54	111	0	15	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	98.0	98.0		98.0	98.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	75.4%	75.4%		75.4%	75.4%		24.6%	24.6%	24.6%	24.6%	24.6%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	94.0	94.0		94.0	94.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.22	0.22		0.22	
v/c Ratio	0.01	0.61		0.22	0.14			0.18	0.28		0.04	
Control Delay	5.1	10.1		5.1	1.5			43.6	20.3		10.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.1	10.1		5.1	1.5			43.6	20.3		10.1	
LOS	A	B		A	A			D	C		B	
Approach Delay		10.1			1.9			27.9			10.1	
Approach LOS		B			A			C			B	
Queue Length 50th (ft)	2	303		2	10			37	29		0	
Queue Length 95th (ft)	6	361		6	10			76	83		14	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	725	2548		160	2543			300	394		354	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.61		0.22	0.14			0.18	0.28		0.04	

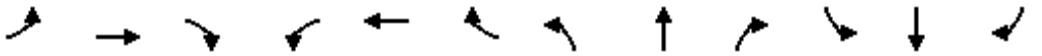
Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 80 (62%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 65	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.61	
Intersection Signal Delay: 10.0	Intersection LOS: A

Intersection Capacity Utilization 66.4% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Lanes, Volumes, Timings
1: Moodie & Robertson

11/21/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	536	269	225	901	325	225	225	148	287	433	194
Future Volume (vph)	120	536	269	225	901	325	225	225	148	287	433	194
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	583	292	245	979	353	245	245	161	312	471	211
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	20.0	39.0	39.0	25.0	44.0	44.0	18.0	38.0	38.0	18.0	38.0	38.0
Total Split (%)	16.7%	32.5%	32.5%	20.8%	36.7%	36.7%	15.0%	31.7%	31.7%	15.0%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.7	35.7	35.7	20.3	41.3	41.3	13.7	34.0	34.0	14.0	34.3	34.3
Actuated g/C Ratio	0.12	0.30	0.30	0.17	0.34	0.34	0.11	0.28	0.28	0.12	0.29	0.29
v/c Ratio	0.60	0.55	0.43	0.82	0.80	0.45	0.62	0.24	0.29	0.78	0.47	0.35
Control Delay	65.6	30.2	3.1	70.1	42.1	5.0	58.3	33.9	6.3	65.9	37.2	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.6	30.2	3.1	70.1	42.1	5.0	58.3	33.9	6.3	65.9	37.2	6.1
LOS	E	C	A	E	D	A	E	C	A	E	D	A
Approach Delay		26.9			38.2			36.3			39.6	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	105	138	6	184	365	0	94	76	0	122	158	0
Queue Length 95th (ft)	167	173	20	#310	452	65	138	112	51	#186	211	57
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	236	1052	675	309	1217	776	400	1002	563	400	1010	602
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.55	0.43	0.79	0.80	0.45	0.61	0.24	0.29	0.78	0.47	0.35

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 35.5	Intersection LOS: D

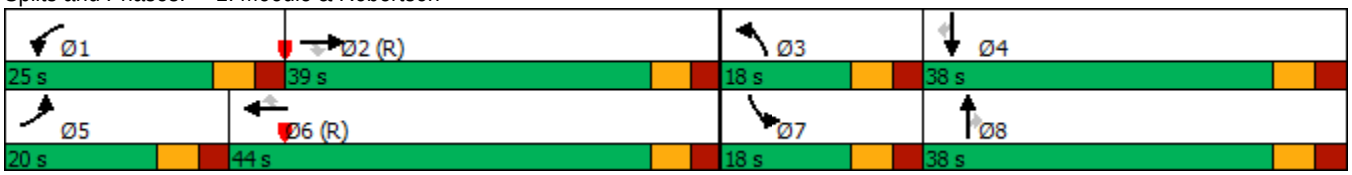
Intersection Capacity Utilization 63.3% ICU Level of Service B

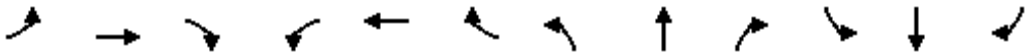
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	550	30	172	1148	43	60	24	148	108	39	147
Future Volume (vph)	31	550	30	172	1148	43	60	24	148	108	39	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	631	0	187	1295	0	65	187	0	117	202	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	67.7	67.7		18.1	89.8		22.2	22.2		22.2	22.2	
Actuated g/C Ratio	0.56	0.56		0.15	0.75		0.18	0.18		0.18	0.18	
v/c Ratio	0.15	0.32		0.70	0.49		0.48	0.43		0.80	0.53	
Control Delay	14.1	12.0		68.6	6.3		53.8	11.7		80.5	27.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.1	12.0		68.6	6.3		53.8	11.7		80.5	27.0	
LOS	B	B		E	A		D	B		F	C	
Approach Delay		12.1			14.2			22.5			46.6	
Approach LOS		B			B			C			D	
Queue Length 50th (ft)	9	84		153	110		45	17		87	74	
Queue Length 95th (ft)	22	114		m#218	155		86	74		147	138	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	223	1985		271	2637		189	538		205	493	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.15	0.32		0.69	0.49		0.34	0.35		0.57	0.41	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 18.3	Intersection LOS: B

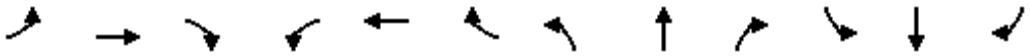
Intersection Capacity Utilization 74.2% ICU Level of Service D

Analysis Period (min) 15

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

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

Splits and Phases: 2: Robertson & Fitzgerald

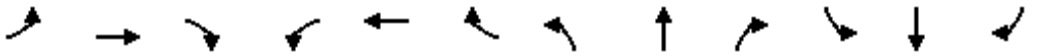


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	521	78	116	1111	10	65	0	58	22	2	24
Future Volume (vph)	10	521	78	116	1111	10	65	0	58	22	2	24
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	651	0	126	1219	0	0	71	63	0	52	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.05	0.27		0.25	0.49			0.22	0.15		0.14	
Control Delay	6.2	6.6		8.5	8.3			39.4	9.9		22.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	6.2	6.6		8.5	8.3			39.4	9.9		22.6	
LOS	A	A		A	A			D	A		C	
Approach Delay		6.6			8.3			25.5			22.6	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	82		29	152			45	0		16	
Queue Length 95th (ft)	9	107		60	215			87	37		50	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	243	2437		499	2475			325	417		372	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.05	0.27		0.25	0.49			0.22	0.15		0.14	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.49	
Intersection Signal Delay: 9.2	Intersection LOS: A

Intersection Capacity Utilization 58.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

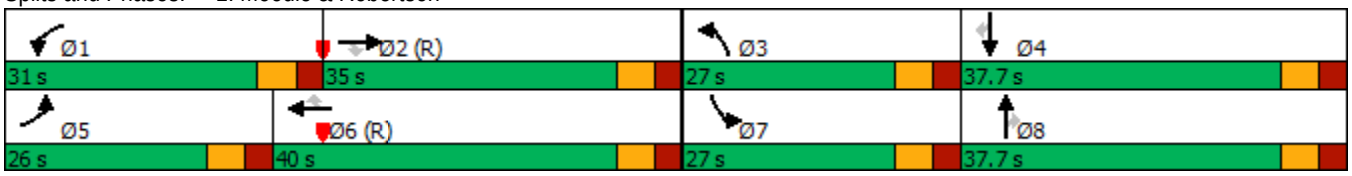


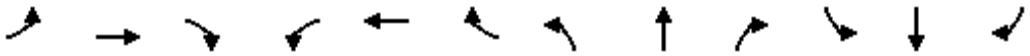
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	683	212	145	584	155	219	208	175	259	213	178
Future Volume (vph)	144	683	212	145	584	155	219	208	175	259	213	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	157	742	230	158	635	168	238	226	190	282	232	193
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	26.0	35.0	35.0	31.0	40.0	40.0	27.0	37.7	37.7	27.0	37.7	37.7
Total Split (%)	19.9%	26.8%	26.8%	23.7%	30.6%	30.6%	20.7%	28.8%	28.8%	20.7%	28.8%	28.8%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	18.5	38.7	38.7	19.3	39.5	39.5	16.8	38.2	38.2	18.5	39.9	39.9
Actuated g/C Ratio	0.14	0.30	0.30	0.15	0.30	0.30	0.13	0.29	0.29	0.14	0.31	0.31
v/c Ratio	0.63	0.71	0.37	0.61	0.59	0.28	0.54	0.22	0.32	0.58	0.22	0.31
Control Delay	63.7	46.2	6.5	61.4	42.2	6.5	57.6	36.4	6.5	57.1	35.1	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.7	46.2	6.5	61.4	42.2	6.5	57.6	36.4	6.5	57.1	35.1	6.2
LOS	E	D	A	E	D	A	E	D	A	E	D	A
Approach Delay		40.5			39.1			35.4			36.0	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	126	295	0	127	242	0	98	76	0	117	76	0
Queue Length 95th (ft)	197	393	65	192	318	55	137	116	59	158	116	58
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	297	1047	630	365	1068	595	604	1034	597	604	1079	617
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.71	0.37	0.43	0.59	0.28	0.39	0.22	0.32	0.47	0.22	0.31

Intersection Summary	
Cycle Length: 130.7	
Actuated Cycle Length: 130.7	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 38.2	Intersection LOS: D

Intersection Capacity Utilization 56.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	686	72	174	655	51	67	19	193	76	30	68
Future Volume (vph)	71	686	72	174	655	51	67	19	193	76	30	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	824	0	189	767	0	73	231	0	83	107	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	68.7	68.7		19.1	91.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.57	0.57		0.16	0.76		0.17	0.17		0.17	0.17	
v/c Ratio	0.20	0.41		0.67	0.29		0.38	0.52		0.92	0.31	
Control Delay	13.5	12.7		59.9	5.0		48.1	11.5		122.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.5	12.7		59.9	5.0		48.1	11.5		122.6	17.3	
LOS	B	B		E	A		D	B		F	B	
Approach Delay		12.8			15.9			20.3			63.3	
Approach LOS		B			B			C			E	
Queue Length 50th (ft)	20	112		137	76		51	14		64	22	
Queue Length 95th (ft)	42	152		#242	138		90	79		#135	67	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	384	2002		285	2680		292	571		138	486	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.20	0.41		0.66	0.29		0.25	0.40		0.60	0.22	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 19.1	Intersection LOS: B

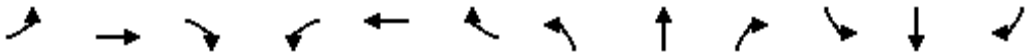
Intersection Capacity Utilization 65.5% ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	647	79	89	605	13	67	3	111	20	3	17
Future Volume (vph)	9	647	79	89	605	13	67	3	111	20	3	17
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	789	0	97	672	0	0	76	121	0	43	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.02	0.32		0.23	0.27			0.24	0.26		0.12	
Control Delay	5.7	7.1		6.9	5.8			39.9	8.0		25.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.7	7.1		6.9	5.8			39.9	8.0		25.1	
LOS	A	A		A	A			D	A		C	
Approach Delay		7.1			6.0			20.3			25.1	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	107		21	75			48	0		15	
Queue Length 95th (ft)	7	136		37	94			93	48		46	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	487	2445		423	2471			313	462		366	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.02	0.32		0.23	0.27			0.24	0.26		0.12	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.32	
Intersection Signal Delay: 8.5	Intersection LOS: A

Intersection Capacity Utilization 47.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Appendix D

Collision Data

Total Area

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	44	19	28	30	1	9	0	1	132	80%
Non-fatal injury	8	11	0	5	0	7	0	1	32	20%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**52**	**30**	**28**	**35**	**1**	**16**	**0**	**2**	**164**	100%
	#1 or 32%	#3 or 18%	#4 or 17%	#2 or 21%	#7 or 1%	#5 or 10%	#8 or 0%	#6 or 1%		

ROBERTSON RD, FITZGERALD RD to MOODIE DR

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2012-2016	47	28,470	1825	**0.90**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	1	10	5	18	0	2	0	1	37	79%
Non-fatal injury	1	6	0	2	0	1	0	0	10	21%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**2**	**16**	**5**	**20**	**0**	**3**	**0**	**1**	**47**	100%
	4%	34%	11%	43%	0%	6%	0%	2%		

FITZGERALD RD / ROBERTSON RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2012-2016	24	29,346	1825	**0.45**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	7	3	5	2	0	1	0	0	18	75%
Non-fatal injury	0	2	0	0	0	4	0	0	6	25%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**7**	**5**	**5**	**2**	**0**	**5**	**0**	**0**	**24**	100%
	29%	21%	21%	8%	0%	21%	0%	0%		

ROBERTSON RD, WESTCLIFFE RD to FITZGERALD RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2012-2016	16	22,405	1825	**0.39**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	4	1	3	4	1	2	0	0	15	94%
Non-fatal injury	0	0	0	0	0	1	0	0	1	6%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**4**	**1**	**3**	**4**	**1**	**3**	**0**	**0**	**16**	100%

ROBERTSON RD / WESTCLIFFE RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2012-2016	9	24,447	1825	**0.20**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	1	1	3	0	0	1	0	0	6	67%
Non-fatal injury	1	2	0	0	0	0	0	0	3	33%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**2**	**3**	**3**	**0**	**0**	**1**	**0**	**0**	**9**	100%
	22%	33%	33%	0%	0%	11%	0%	0%		

MOODIE DR / ROBERTSON RD

Years	*Total # Collisions*	*24 Hr AADT Veh Volume*	*Days*	*Collisions/MEV*
2012-2016	68	48,129	1825	**0.77**

Classification of Accident	*Rear End*	*Turning Movement*	*Sideswipe*	*Angle*	*Approaching*	*Single Vehicle (other)*	*Single vehicle (Unattended vehicle)*	*Other*	*Total*	
P.D. only	31	4	12	6	0	3	0	0	56	82%
Non-fatal injury	6	1	0	3	0	1	0	1	12	18%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**37**	**5**	**12**	**9**	**0**	**4**	**0**	**1**	**68**	100%

City Operations - Transportation Services

Collision Details Report - Public Version

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

Location: FITZGERALD RD @ ROBERTSON RD

Traffic Control: Traffic signal

Total Collisions: 24

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Dec-31, Sun,16:16	Clear	Rear end	P.D. only	Ice	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Sep-22, Fri,19:54	Clear	SMV other	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Pedestrian	1
2016-Oct-17, Mon,15:26	Rain	Rear end	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Sep-08, Thu,12:36	Clear	Turning movement	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Jul-06, Wed,07:50	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Mar-04, Fri,18:33	Clear	SMV other	Non-fatal injury	Dry	South	Turning left	Automobile, station wagon	Pedestrian	1

2015-Oct-13, Tue,15:15	Clear	Sideswipe	P.D. only	Dry	West	Going ahead	Unknown	Other motor vehicle	
					West	Stopped	Municipal transit bus	Other motor vehicle	
2015-May-22, Fri,14:57	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Pick-up truck	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2015-Feb-23, Mon,10:15	Drifting Snow	SMV other	P.D. only	Slush	West	Going ahead	Pick-up truck	Pole (utility, power)	
2014-Oct-30, Thu,10:46	Clear	Angle	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Truck - closed	Other motor vehicle	
2014-Oct-28, Tue,18:04	Rain	Turning movement	P.D. only	Wet	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Oct-20, Mon,09:52	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
2014-Jul-15, Tue,09:50	Rain	SMV other	Non-fatal injury	Wet	South	Turning right	Automobile, station wagon	Pedestrian	1
2014-Apr-07, Mon,12:15	Clear	Sideswipe	P.D. only	Dry	West	Pulling away from shoulder or curb	Passenger van	Other motor vehicle	
					West	Stopped	Municipal transit bus	Other motor vehicle	

2014-Feb-22, Sat,08:50	Clear	SMV other	Non-fatal injury	Dry	North	Turning right	Automobile, station wagon	Pedestrian	1
2013-Dec-16, Mon,17:10	Clear	Angle	P.D. only	Dry	North	Going ahead	Pick-up truck	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2013-Nov-08, Fri,11:46	Clear	Turning movement	P.D. only	Dry	East	Turning left	Delivery van	Other motor vehicle	
					West	Going ahead	Truck - closed	Other motor vehicle	
2013-Oct-17, Thu,14:50	Clear	Sideswipe	P.D. only	Loose sand or gravel	East	Turning left	Pick-up truck	Other motor vehicle	
					East	Turning left	Pick-up truck	Other motor vehicle	
2013-Sep-21, Sat,17:20	Rain	Sideswipe	P.D. only	Wet	West	Changing lanes	Automobile, station wagon	Other motor vehicle	
					West	Turning left	Automobile, station wagon	Other motor vehicle	
2013-Sep-11, Wed,07:20	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2013-Mar-15, Fri,20:59	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2013-Feb-06, Wed,15:45	Clear	Rear end	P.D. only	Dry	West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	

					West	Stopped	Pick-up truck	Other motor vehicle	
2013-Jan-28, Mon,12:01	Snow	Rear end	P.D. only	Slush	East	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Turning left	Automobile, station wagon	Other motor vehicle	
2013-Jan-21, Mon,11:30	Clear	Rear end	P.D. only	Dry	East	Slowing or stopping	Pick-up truck	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	

Location: MOODIE DR @ ROBERTSON RD

Traffic Control: Traffic signal **Total Collisions:** 68

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Nov-11, Sat,09:31	Clear	Rear end	Non-fatal injury	Dry	East	Slowing or stopping	Farm tractor	Other motor vehicle	
					East	Stopped	Pick-up truck	Other motor vehicle	
					East	Stopped	Passenger van	Other motor vehicle	
					East	Stopped	Pick-up truck	Other motor vehicle	
2017-Nov-09, Thu,17:43	Rain	Rear end	P.D. only	Wet	West	Going ahead	Unknown	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Automobile, station wagon	Other motor vehicle	

2017-Oct-31, Tue,16:20	Clear	Rear end	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					West	Turning left	Pick-up truck	Other motor vehicle
2017-Aug-02, Wed,11:56	Clear	Angle	Non-fatal injury	Dry	East	Turning right	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2017-Jul-23, Sun,17:42	Clear	Angle	P.D. only	Dry	East	Turning right	Pick-up truck	Other motor vehicle
					South	Turning left	Automobile, station wagon	Other motor vehicle
2017-Jun-13, Tue,14:45	Clear	Rear end	P.D. only	Dry	East	Turning right	Passenger van	Other motor vehicle
					East	Turning right	Automobile, station wagon	Other motor vehicle
2017-Feb-13, Mon,08:40	Clear	Rear end	Non-fatal injury	Slush	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Stopped	Passenger van	Other motor vehicle
					East	Stopped	Municipal transit bus	Other motor vehicle
2017-Jan-31, Tue,09:15	Clear	Rear end	Non-fatal injury	Ice	North	Going ahead	Pick-up truck	Other motor vehicle
					North	Stopped	Automobile, station wagon	Other motor vehicle
2017-Jan-18, Wed,08:18	Rain	Sideswipe	P.D. only	Wet	North	Changing lanes	Automobile, station wagon	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle

2017-Jan-18, Wed,06:45	Freezing Rain	Sideswipe	P.D. only	Packed snow	North	Changing lanes	Unknown	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2017-Jan-07, Sat,13:26	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2016-Dec-22, Thu,10:21	Clear	Rear end	P.D. only	Slush	North	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Turning left	Passenger van	Other motor vehicle
2016-Nov-20, Sun,17:20	Snow	SMV other	P.D. only	Packed snow	East	Going ahead	Automobile, station wagon	Skidding/sliding
2016-Oct-20, Thu,12:35	Rain	Sideswipe	P.D. only	Wet	South	Changing lanes	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Oct-18, Tue,07:49	Clear	Angle	Non-fatal injury	Wet	West	Turning left	Pick-up truck	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Oct-10, Mon,15:30	Clear	Rear end	P.D. only	Dry	East	Unknown	Unknown	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2016-Sep-23, Fri,10:45	Clear	Rear end	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle

					North	Turning right	Automobile, station wagon	Other motor vehicle
2016-Sep-04, Sun,14:01	Clear	Rear end	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle
					North	Turning right	Automobile, station wagon	Other motor vehicle
2016-Aug-27, Sat,11:24	Clear	Rear end	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					East	Turning left	Automobile, station wagon	Other motor vehicle
2016-Jun-23, Thu,17:52	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
2016-Jun-23, Thu,16:09	Clear	Rear end	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle
					South	Turning right	Pick-up truck	Other motor vehicle
2016-Jun-17, Fri,17:00	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2016-May-22, Sun,12:48	Clear	Angle	Non-fatal injury	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Turning left	Automobile, station wagon	Other motor vehicle

2016-Jan-12, Tue,22:03	Snow	Rear end	P.D. only	Loose snow	East	Slowing or stopping	Pick-up truck	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2015-Dec-31, Thu,20:34	Clear	Sideswipe	P.D. only	Wet	North	Changing lanes	Passenger van	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Nov-22, Sun,14:25	Clear	Angle	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Nov-03, Tue,13:15	Clear	Turning movement	Non-fatal injury	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Oct-09, Fri,11:34	Clear	Rear end	P.D. only	Dry	South	Turning right	Pick-up truck	Other motor vehicle
					South	Turning right	Automobile, station wagon	Other motor vehicle
2015-Sep-30, Wed,08:00	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2015-Sep-25, Fri,10:05	Clear	Rear end	Non-fatal injury	Dry	North	Turning right	Pick-up truck	Other motor vehicle
					North	Turning right	Automobile, station wagon	Other motor vehicle

2015-Jun-24, Wed,15:17	Clear	Turning movement	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Mar-29, Sun,15:10	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Feb-09, Mon,09:23	Snow	SMV other	P.D. only	Loose snow	North	Slowing or stopping	Automobile, station wagon	Snowbank/drift
2015-Jan-03, Sat,14:53	Snow	Angle	P.D. only	Loose snow	South	Slowing or stopping	Pick-up truck	Skidding/sliding
					East	Stopped	Pick-up truck	Other motor vehicle
2014-Dec-23, Tue,15:05	Rain	Sideswipe	P.D. only	Wet	East	Changing lanes	Automobile, station wagon	Other motor vehicle
					East	Turning right	Automobile, station wagon	Other motor vehicle
2014-Nov-22, Sat,12:15	Clear	Rear end	P.D. only	Dry	East	Turning right	Passenger van	Other motor vehicle
					East	Turning right	Pick-up truck	Other motor vehicle
2014-Nov-03, Mon,08:40	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
2014-Oct-10, Fri,09:59	Clear	Sideswipe	P.D. only	Dry	West	Changing lanes	Passenger van	Other motor vehicle

					West	Turning left	Passenger van	Other motor vehicle	
2014-Sep-12, Fri,12:19	Clear	Rear end	P.D. only	Dry	South	Turning left	Truck and trailer	Other motor vehicle	
					South	Turning left	Automobile, station wagon	Other motor vehicle	
2014-Sep-02, Tue,17:47	Rain	SMV other	Non-fatal injury	Wet	South	Turning right	Unknown	Pedestrian	1
2014-Aug-06, Wed,16:50	Clear	Rear end	P.D. only	Dry	East	Turning right	Pick-up truck	Other motor vehicle	
					East	Turning right	Automobile, station wagon	Other motor vehicle	
2014-May-27, Tue,16:47	Clear	Rear end	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle	
					North	Turning left	Automobile, station wagon	Other motor vehicle	
2014-May-22, Thu,15:05	Clear	Rear end	Non-fatal injury	Dry	East	Other	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2014-Apr-08, Tue,08:25	Rain	Turning movement	P.D. only	Wet	North	Turning left	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Passenger van	Other motor vehicle	
2014-Jan-21, Tue,16:15	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	

2014-Jan-20, Mon,18:10	Clear	Rear end	P.D. only	Packed snow	South	Turning left	Automobile, station wagon	Other motor vehicle
					South	Turning left	Automobile, station wagon	Other motor vehicle
2013-Dec-31, Tue,11:25	Snow	Rear end	P.D. only	Loose snow	North	Turning right	Automobile, station wagon	Other motor vehicle
					North	Turning right	Passenger van	Other motor vehicle
2013-Dec-15, Sun,00:29	Snow	Other	Non-fatal injury	Dry	North	Going ahead	Pick-up truck	Pole (sign, parking meter)
					West	Turning left	Automobile, station wagon	Other motor vehicle
2013-Dec-11, Wed,18:18	Clear	Rear end	Non-fatal injury	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
2013-Dec-04, Wed,15:20	Clear	Sideswipe	P.D. only	Wet	West	Changing lanes	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Oct-28, Mon,18:10	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2013-Oct-22, Tue,13:20	Clear	Sideswipe	P.D. only	Dry	South	Turning left	Pick-up truck	Other motor vehicle
					South	Stopped	Municipal transit bus	Other motor vehicle

2013-Oct-07, Mon,11:22	Clear	Sideswipe	P.D. only	Dry	North	Changing lanes	Automobile, station wagon	Other motor vehicle
					North	Stopped	Automobile, station wagon	Other motor vehicle
2013-Sep-23, Mon,13:41	Clear	Sideswipe	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					West	Stopped	Passenger van	Other motor vehicle
2013-Sep-12, Thu,19:21	Rain	Sideswipe	P.D. only	Wet	East	Changing lanes	Passenger van	Other motor vehicle
					East	Stopped	Passenger van	Other motor vehicle
2013-Sep-07, Sat,13:00	Clear	Rear end	P.D. only	Dry	West	Going ahead	Delivery van	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
2013-Sep-10, Tue,14:26	Clear	Angle	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Sep-01, Sun,16:58	Clear	SMV other	P.D. only	Dry	East	Going ahead	Municipal transit bus	Pole (utility, power)
2013-Aug-29, Thu,07:55	Clear	Rear end	P.D. only	Dry	West	Turning right	Passenger van	Other motor vehicle
					West	Turning right	Automobile, station wagon	Other motor vehicle
2013-Aug-07, Wed,13:08	Clear	Turning movement	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle

					North	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Jul-18, Thu,17:06	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2013-Jul-03, Wed,15:45	Clear	Rear end	P.D. only	Wet	North	Turning left	Pick-up truck	Other motor vehicle
					North	Turning left	Pick-up truck	Other motor vehicle
2013-Apr-30, Tue,16:15	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Stopped	Pick-up truck	Other motor vehicle
2013-Apr-23, Tue,11:55	Clear	Sideswipe	P.D. only	Dry	West	Turning right	Automobile, station wagon	Other motor vehicle
					West	Stopped	Automobile, station wagon	Other motor vehicle
2013-Mar-22, Fri,10:57	Clear	Rear end	P.D. only	Dry	West	Turning right	Automobile, station wagon	Other motor vehicle
					West	Turning right	Automobile, station wagon	Other motor vehicle
2013-Feb-27, Wed,13:50	Snow	Rear end	P.D. only	Loose snow	North	Slowing or stopping	Automobile, station wagon	Other motor vehicle
					North	Stopped	Pick-up truck	Other motor vehicle
2013-Feb-09, Sat,12:39	Snow	Rear end	P.D. only	Ice	South	Turning left	Passenger van	Other motor vehicle

					South	Turning left	Automobile, station wagon	Other motor vehicle
2013-Jan-05, Sat,14:03	Clear	Turning movement	P.D. only	Wet	North	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle

Location: ROBERTSON RD @ WESTCLIFFE RD

Traffic Control: Traffic signal **Total Collisions:** 9

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Nov-29, Wed,22:21	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Curb	
2017-Oct-15, Sun,12:35	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-May-16, Mon,16:18	Clear	Rear end	Non-fatal injury	Dry	East	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
					East	Turning right	Pick-up truck	Other motor vehicle	
2015-Jan-21, Wed,07:46	Snow	Rear end	P.D. only	Wet	West	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					West	Stopped	Pick-up truck	Other motor vehicle	
2014-Dec-16, Tue,18:41	Rain	Sideswipe	P.D. only	Wet	West	Changing lanes	Pick-up truck	Other motor vehicle	
					West	Turning left	Pick-up truck	Other motor vehicle	

2014-Apr-26, Sat,18:59	Rain	Sideswipe	P.D. only	Wet	West	Changing lanes	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Apr-11, Thu,15:03	Clear	Turning movement	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Feb-08, Fri,20:28	Snow	Sideswipe	P.D. only	Loose snow	West	Turning left	Snow plow	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Jan-22, Tue,17:23	Clear	Turning movement	Non-fatal injury	Wet	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle

Location: ROBERTSON RD btwn FITZGERALD RD & MOODIE DR

Traffic Control: No control

Total Collisions: 47

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Dec-22, Fri,14:00	Freezing Rain	Turning movement	P.D. only	Loose snow	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Turning right	Passenger van	Other motor vehicle	
2017-Dec-12, Tue,10:04	Snow	Turning movement	P.D. only	Loose snow	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Nov-27, Mon,17:23	Clear	Angle	P.D. only	Wet	South	Turning left	Delivery van	Other motor vehicle	

					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Nov-23, Thu,14:35	Clear	Angle	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Oct-26, Thu,07:25	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2017-Oct-10, Tue,08:36	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Sep-26, Tue,08:11	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Jun-15, Thu,11:58	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Pick-up truck	Other motor vehicle	
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-May-20, Sat,12:44	Clear	SMV other	Non-fatal injury	Dry	South	Turning left	Pick-up truck	Pedestrian	2
2017-Apr-29, Sat,13:06	Clear	Angle	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	

2017-Feb-09, Thu,14:00	Clear	Other	P.D. only	Dry	Unknown	Unknown	Unknown	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2017-Jan-04, Wed,12:34	Clear	Angle	P.D. only	Wet	North	Going ahead	Passenger van	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Dec-20, Tue,09:23	Clear	Angle	Non-fatal injury	Slush	North	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2016-Dec-14, Wed,07:57	Clear	Turning movement	Non-fatal injury	Wet	West	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Dec-12, Mon,09:31	Snow	Angle	P.D. only	Loose snow	North	Turning left	Truck and trailer	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2016-Nov-24, Thu,07:55	Snow	Angle	P.D. only	Ice	South	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Pick-up truck	Other motor vehicle
2016-May-08, Sun,15:10	Clear	Angle	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle

2015-Nov-28, Sat,14:45	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Oct-25, Sun,22:34	Clear	SMV other	P.D. only	Dry	East	Turning right	Automobile, station wagon	Skidding/sliding
2015-Oct-02, Fri,13:14	Clear	Angle	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Aug-25, Tue,16:51	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Pick-up truck	Other motor vehicle
2015-Jun-19, Fri,06:31	Clear	Angle	Non-fatal injury	Dry	North	Turning right	Automobile, station wagon	Cyclist
					East	Going ahead	Bicycle	Other motor vehicle
2015-Jun-16, Tue,07:54	Rain	Turning movement	P.D. only	Wet	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2015-Mar-28, Sat,12:10	Clear	Angle	P.D. only	Dry	North	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2014-Oct-29, Wed,07:56	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle

					East	Going ahead	Pick-up truck	Other motor vehicle
2014-Oct-10, Fri,17:08	Clear	Turning movement	Non-fatal injury	Dry	East	Turning right	Pick-up truck	Cyclist
					East	Going ahead	Bicycle	Other motor vehicle
2014-Jul-16, Wed,07:19	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Jul-09, Wed,09:00	Clear	Sideswipe	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Stopped	Municipal transit bus	Other motor vehicle
2014-Jun-18, Wed,12:30	Clear	Turning movement	Non-fatal injury	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Turning right	Automobile, station wagon	Other motor vehicle
2014-Jun-13, Fri,15:58	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Jun-02, Mon,08:43	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2014-May-15, Thu,16:40	Clear	Rear end	Non-fatal injury	Unknown	West	Going ahead	Pick-up truck	Other motor vehicle

					West	Slowing or stopping	Pick-up truck	Other motor vehicle
2014-Feb-19, Wed,08:06	Clear	Turning movement	P.D. only	Wet	West	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Feb-18, Tue,09:15	Snow	Angle	P.D. only	Slush	North	Going ahead	Pick-up truck	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Stopped	Pick-up truck	Other motor vehicle
2013-Dec-28, Sat,13:00	Clear	Angle	P.D. only	Dry	North	Turning left	Pick-up truck	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Nov-15, Fri,08:19	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2013-Oct-15, Tue,13:45	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Oct-12, Sat,15:00	Clear	Sideswipe	P.D. only	Dry	West	Changing lanes	Truck - closed	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle

2013-Sep-04, Wed,00:06	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Aug-28, Wed,17:02	Clear	Angle	P.D. only	Dry	North	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2013-Aug-22, Thu,20:54	Clear	Turning movement	P.D. only	Dry	West	Turning left	Pick-up truck	Other motor vehicle
					West	Going ahead	Pick-up truck	Other motor vehicle
2013-Aug-20, Tue,23:00	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Aug-09, Fri,15:15	Clear	Sideswipe	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Mar-22, Fri,12:54	Clear	Turning movement	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Turning left	Pick-up truck	Other motor vehicle
2013-Mar-03, Sun,00:16	Clear	SMV other	P.D. only	Wet	South	Going ahead	Truck - dump	Other
2013-Jan-30, Wed,09:10	Rain	Angle	P.D. only	Ice	North	Turning left	Automobile, station wagon	Other motor vehicle

					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2013-Jan-28, Mon,14:00	Snow	Angle	P.D. only	Slush	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Going ahead	Pick-up truck	Other motor vehicle	

Location: ROBERTSON RD btwn WESTCLIFFE RD & FITZGERALD RD

Traffic Control: No control **Total Collisions:** 16

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Dec-17, Sun,14:36	Clear	Angle	P.D. only	Dry	North	Changing lanes	Automobile, station wagon	Other motor vehicle	
					East	Turning left	Automobile, station wagon	Other motor vehicle	
2017-Nov-03, Fri,14:59	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Oct-30, Mon,15:00	Clear	Rear end	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2017-Aug-22, Tue,13:26	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle	
					East	Going ahead	Truck - closed	Other motor vehicle	
					East	Stopped	Pick-up truck	Other motor vehicle	
2017-May-16, Tue,18:37	Clear	Sideswipe	P.D. only	Dry	West	Changing lanes	Pick-up truck	Other motor vehicle	

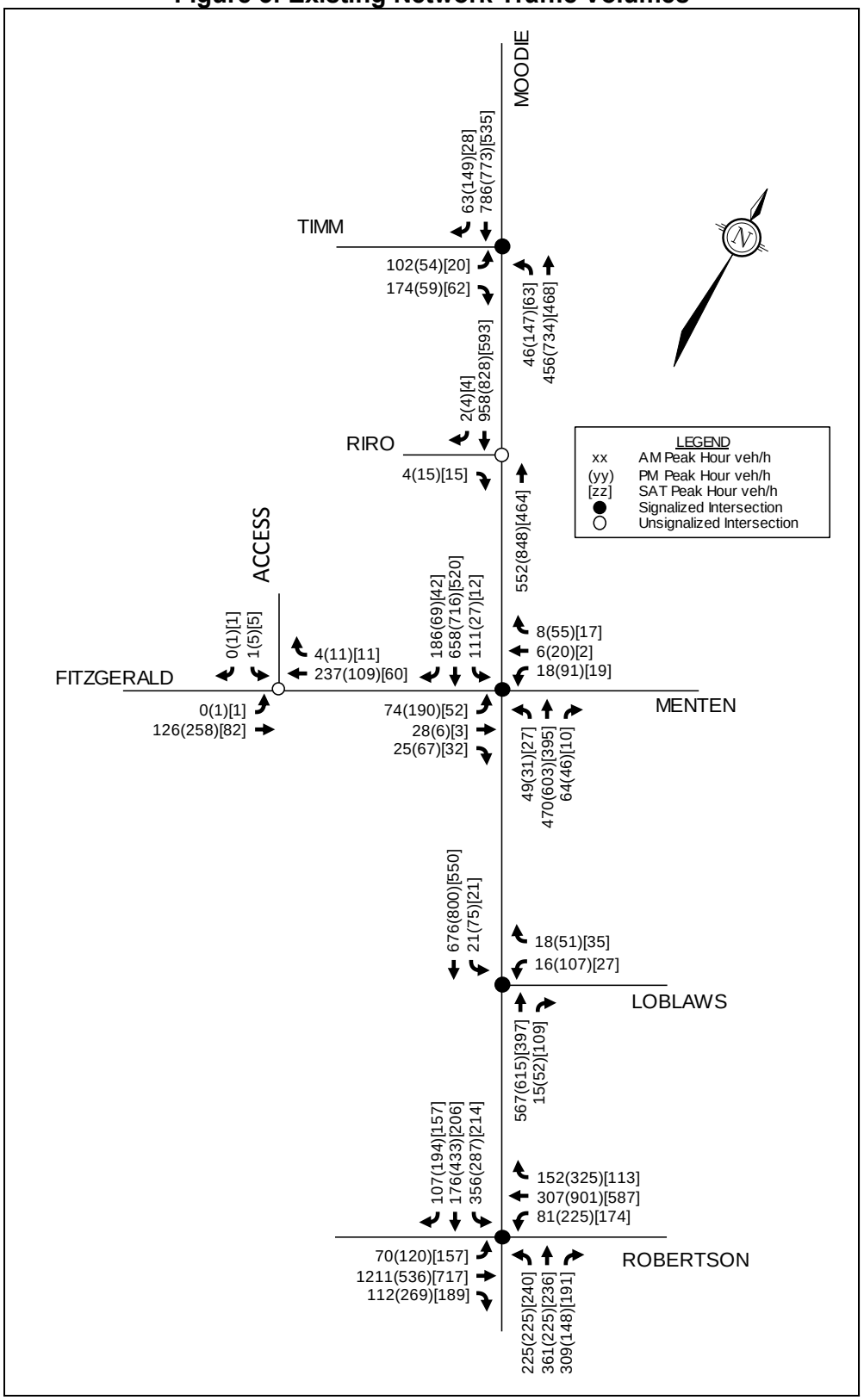
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Dec-20, Tue,19:04	Clear	SMV other	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Animal - wild	
2016-Dec-02, Fri,17:44	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Passenger van	Other motor vehicle	
2016-Jun-02, Thu,17:50	Clear	SMV other	Non-fatal injury	Dry	South	Turning right	Unknown	Pedestrian	1
2015-Dec-10, Thu,22:42	Clear	SMV other	P.D. only	Dry	East	Going ahead	Pick-up truck	Ran off road	
2015-Jan-22, Thu,17:21	Clear	Angle	P.D. only	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Pick-up truck	Other motor vehicle	
2014-Apr-09, Wed,18:48	Clear	Rear end	P.D. only	Dry	West	Overtaking	Pick-up truck	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Feb-01, Sat,05:45	Snow	Rear end	P.D. only	Packed snow	East	Slowing or stopping	Pick-up truck	Other motor vehicle	
					East	Turning left	Automobile, station wagon	Other motor vehicle	
2013-Nov-23, Sat,12:30	Snow	Approaching	P.D. only	Loose snow	East	Slowing or stopping	Pick-up truck	Skidding/sliding	
					West	Going ahead	Pick-up truck	Other motor vehicle	

					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Nov-05, Tue,08:06	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Pick-up truck	Other motor vehicle
					East	Going ahead	Truck and trailer	Other motor vehicle
2013-Mar-05, Tue,17:05	Clear	Angle	P.D. only	Wet	South	Turning left	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Passenger van	Other motor vehicle
2013-Jan-14, Mon,18:00	Clear	Turning movement	P.D. only	Dry	West	Turning left	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle

Appendix E

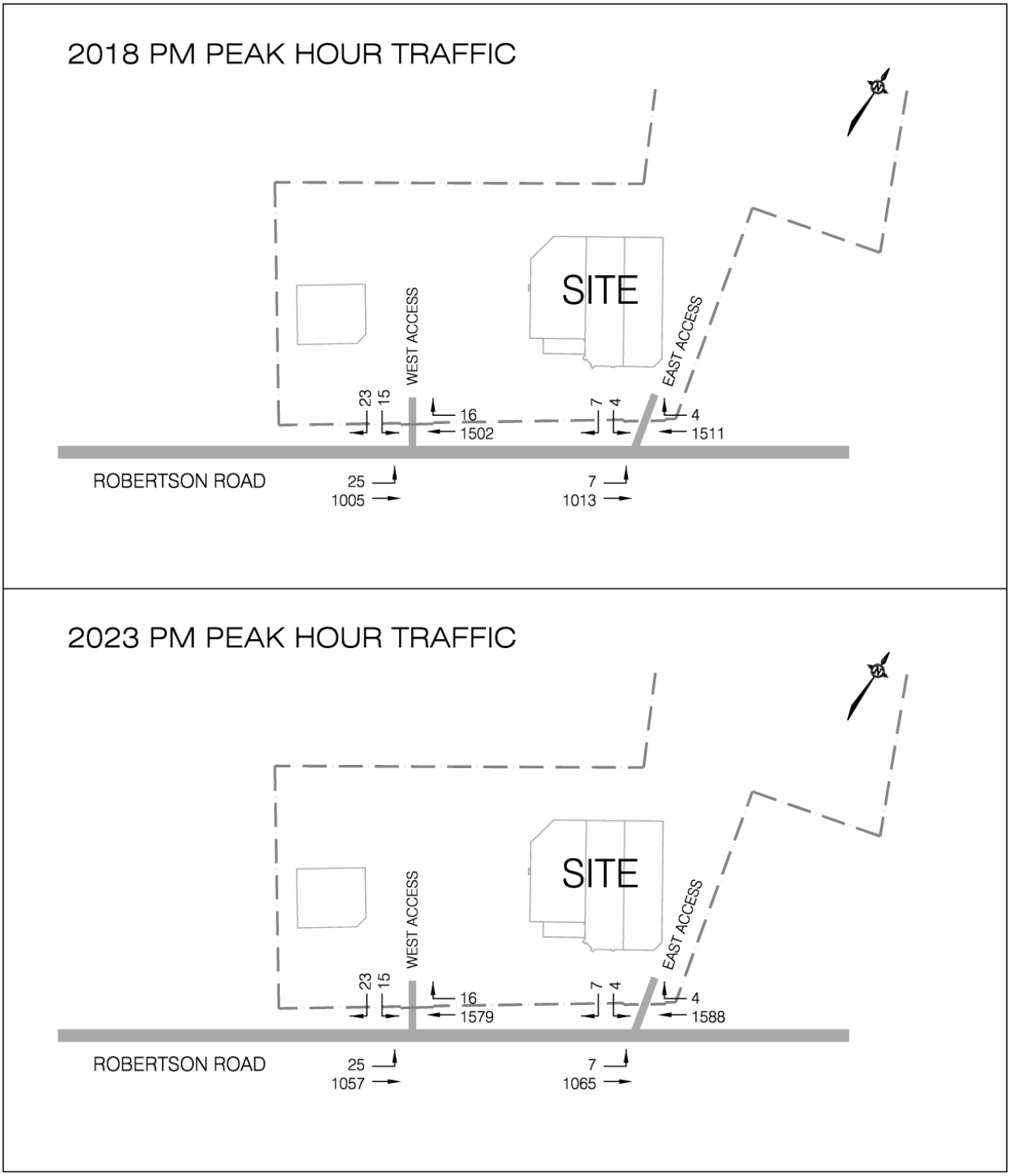
Other Area Development-Generated Traffic

Figure 3: Existing Network Traffic Volumes



NOTE: Existing trips at access are based on trip generation in Section 5.1

FIGURE 4.1
WEEKDAY PEAK PM HOUR TOTAL TRAFFIC



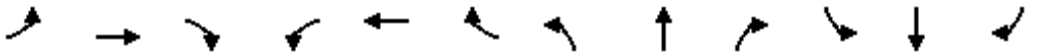
NOT TO SCALE

Appendix F

Background Conditions year 2019 and year 2024 SYNCHRO Analysis

Lanes, Volumes, Timings
1: Moodie & Robertson

11/21/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	1235	112	81	313	152	225	361	309	356	176	107
Future Volume (vph)	70	1235	112	81	313	152	225	361	309	356	176	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	1342	122	88	340	165	245	392	336	387	191	116
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	15.0	54.0	54.0	15.0	54.0	54.0	23.0	38.0	38.0	23.0	38.0	38.0
Total Split (%)	11.5%	41.5%	41.5%	11.5%	41.5%	41.5%	17.7%	29.2%	29.2%	17.7%	29.2%	29.2%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.6	50.3	50.3	10.7	53.0	53.0	16.6	34.3	34.3	18.7	36.4	36.4
Actuated g/C Ratio	0.08	0.39	0.39	0.08	0.41	0.41	0.13	0.26	0.26	0.14	0.28	0.28
v/c Ratio	0.53	0.98	0.18	0.60	0.24	0.22	0.56	0.42	0.64	0.78	0.19	0.21
Control Delay	57.2	63.5	11.5	75.3	26.7	4.5	58.1	41.4	30.4	65.8	36.9	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.2	63.5	11.5	75.3	26.7	4.5	58.1	41.4	30.4	65.8	36.9	4.7
LOS	E	E	B	E	C	A	E	D	C	E	D	A
Approach Delay		59.1			27.7			41.8			47.6	
Approach LOS		E			C			D			D	
Queue Length 50th (ft)	62	637	18	73	102	0	101	145	147	163	64	0
Queue Length 95th (ft)	114	#772	79	#133	139	45	142	194	256	220	100	33
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	149	1368	697	149	1443	743	501	933	521	501	990	541
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	0.98	0.18	0.59	0.24	0.22	0.49	0.42	0.64	0.77	0.19	0.21

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 47.7	Intersection LOS: D

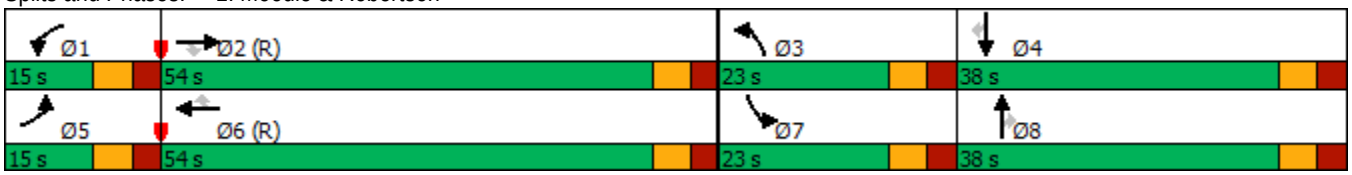
Intersection Capacity Utilization 73.4% ICU Level of Service D

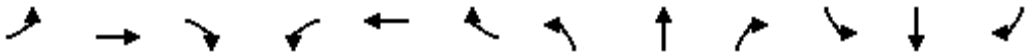
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	182	1355	5	22	367	132	4	3	9	62	8	62
Future Volume (vph)	182	1355	5	22	367	132	4	3	9	62	8	62
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	198	1478	0	24	542	0	4	13	0	67	76	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	84.0	84.0		13.0	97.0		33.0	33.0		33.0	33.0	
Total Split (%)	64.6%	64.6%		10.0%	74.6%		25.4%	25.4%		25.4%	25.4%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	98.6	98.6		9.5	107.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.76	0.76		0.07	0.83		0.11	0.11		0.11	0.11	
v/c Ratio	0.31	0.55		0.19	0.19		0.03	0.07		0.43	0.31	
Control Delay	5.9	5.5		56.0	3.5		49.8	28.4		61.6	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.9	5.5		56.0	3.5		49.8	28.4		61.6	17.9	
LOS	A	A		E	A		D	C		E	B	
Approach Delay		5.6			5.8			33.4			38.4	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	35	141		17	86		3	2		54	7	
Queue Length 95th (ft)	55	166		m47	115		14	22		99	53	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	635	2681		134	2821		272	375		311	412	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.31	0.55		0.18	0.19		0.01	0.03		0.22	0.18	

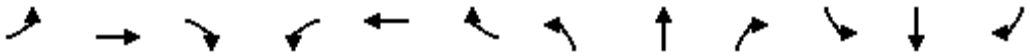
Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 97 (75%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 7.8	Intersection LOS: A

Intersection Capacity Utilization 61.9% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald

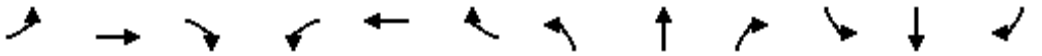


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	1413	45	32	317	15	49	1	102	7	0	6
Future Volume (vph)	7	1413	45	32	317	15	49	1	102	7	0	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	8	1585	0	35	361	0	0	54	111	0	15	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	98.0	98.0		98.0	98.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	75.4%	75.4%		75.4%	75.4%		24.6%	24.6%	24.6%	24.6%	24.6%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	94.0	94.0		94.0	94.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.22	0.22		0.22	
v/c Ratio	0.01	0.62		0.23	0.14			0.18	0.28		0.04	
Control Delay	5.1	10.3		5.6	1.5			43.6	21.6		10.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.1	10.3		5.6	1.5			43.6	21.6		10.1	
LOS	A	B		A	A			D	C		B	
Approach Delay		10.3			1.9			28.8			10.1	
Approach LOS		B			A			C			B	
Queue Length 50th (ft)	2	315		2	10			37	32		0	
Queue Length 95th (ft)	6	374		8	10			76	86		14	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	720	2548		151	2543			300	391		354	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.62		0.23	0.14			0.18	0.28		0.04	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 80 (62%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 10.2	Intersection LOS: B

Intersection Capacity Utilization 67.2% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	547	269	225	919	325	225	225	148	287	433	194
Future Volume (vph)	120	547	269	225	919	325	225	225	148	287	433	194
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	595	292	245	999	353	245	245	161	312	471	211
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	20.0	39.0	39.0	25.0	44.0	44.0	18.0	38.0	38.0	18.0	38.0	38.0
Total Split (%)	16.7%	32.5%	32.5%	20.8%	36.7%	36.7%	15.0%	31.7%	31.7%	15.0%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.7	35.7	35.7	20.3	41.3	41.3	13.7	34.0	34.0	14.0	34.3	34.3
Actuated g/C Ratio	0.12	0.30	0.30	0.17	0.34	0.34	0.11	0.28	0.28	0.12	0.29	0.29
v/c Ratio	0.60	0.57	0.43	0.82	0.82	0.45	0.62	0.24	0.29	0.78	0.47	0.35
Control Delay	65.6	30.3	3.1	70.1	43.0	5.0	58.3	33.9	6.3	65.9	37.2	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.6	30.3	3.1	70.1	43.0	5.0	58.3	33.9	6.3	65.9	37.2	6.1
LOS	E	C	A	E	D	A	E	C	A	E	D	A
Approach Delay		27.0			38.7			36.3			39.6	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	104	141	6	184	376	0	94	76	0	122	158	0
Queue Length 95th (ft)	167	175	20	#310	464	65	138	112	51	#186	211	57
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	236	1052	675	309	1217	776	400	1002	563	400	1010	602
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.57	0.43	0.79	0.82	0.45	0.61	0.24	0.29	0.78	0.47	0.35

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 35.8	Intersection LOS: D

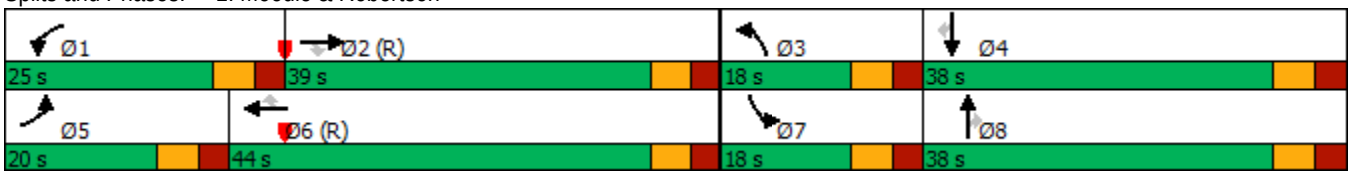
Intersection Capacity Utilization 63.8% ICU Level of Service B

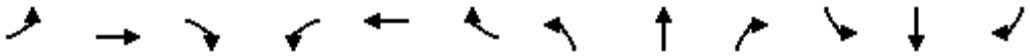
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	561	30	172	1171	43	60	24	148	108	39	147
Future Volume (vph)	31	561	30	172	1171	43	60	24	148	108	39	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	643	0	187	1320	0	65	187	0	117	202	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	67.7	67.7		18.1	89.8		22.2	22.2		22.2	22.2	
Actuated g/C Ratio	0.56	0.56		0.15	0.75		0.18	0.18		0.18	0.18	
v/c Ratio	0.16	0.32		0.70	0.50		0.48	0.43		0.80	0.54	
Control Delay	14.2	12.0		68.3	6.3		53.8	11.7		80.5	28.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.2	12.0		68.3	6.3		53.8	11.7		80.5	28.3	
LOS	B	B		E	A		D	B		F	C	
Approach Delay		12.1			14.0			22.5			47.5	
Approach LOS		B			B			C			D	
Queue Length 50th (ft)	9	85		152	111		45	17		87	78	
Queue Length 95th (ft)	22	115		m#210	156		86	74		147	142	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	218	1985		271	2637		189	538		205	489	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.16	0.32		0.69	0.50		0.34	0.35		0.57	0.41	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 18.2	Intersection LOS: B

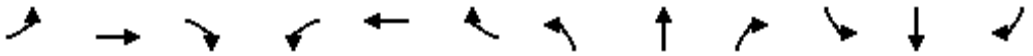
Intersection Capacity Utilization 74.8% ICU Level of Service D

Analysis Period (min) 15

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

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

Splits and Phases: 2: Robertson & Fitzgerald

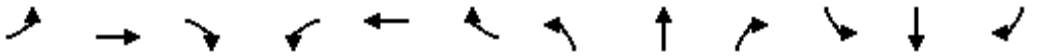


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	531	78	116	1133	10	65	0	58	22	2	24
Future Volume (vph)	10	531	78	116	1133	10	65	0	58	22	2	24
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	662	0	126	1243	0	0	71	63	0	52	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.05	0.27		0.26	0.50			0.22	0.15		0.14	
Control Delay	6.2	6.6		8.7	8.5			39.4	9.9		22.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	6.2	6.6		8.7	8.5			39.4	9.9		22.6	
LOS	A	A		A	A			D	A		C	
Approach Delay		6.6			8.5			25.5			22.6	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	84		30	161			45	0		16	
Queue Length 95th (ft)	9	109		60	219			87	37		50	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	234	2440		492	2475			325	417		372	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.05	0.27		0.26	0.50			0.22	0.15		0.14	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.50	
Intersection Signal Delay: 9.3	Intersection LOS: A

Intersection Capacity Utilization 59.4% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	697	212	145	596	155	219	208	175	259	213	178
Future Volume (vph)	144	697	212	145	596	155	219	208	175	259	213	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	157	758	230	158	648	168	238	226	190	282	232	193
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	26.0	35.0	35.0	31.0	40.0	40.0	27.0	37.7	37.7	27.0	37.7	37.7
Total Split (%)	19.9%	26.8%	26.8%	23.7%	30.6%	30.6%	20.7%	28.8%	28.8%	20.7%	28.8%	28.8%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	18.5	38.7	38.7	19.3	39.5	39.5	16.8	38.2	38.2	18.5	39.9	39.9
Actuated g/C Ratio	0.14	0.30	0.30	0.15	0.30	0.30	0.13	0.29	0.29	0.14	0.31	0.31
v/c Ratio	0.63	0.72	0.37	0.61	0.61	0.28	0.54	0.22	0.32	0.58	0.22	0.31
Control Delay	63.7	46.7	6.5	61.4	42.5	6.5	57.6	36.4	6.5	57.1	35.1	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.7	46.7	6.5	61.4	42.5	6.5	57.6	36.4	6.5	57.1	35.1	6.2
LOS	E	D	A	E	D	A	E	D	A	E	D	A
Approach Delay		41.0			39.4			35.4			36.0	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	126	303	0	127	248	0	98	76	0	117	76	0
Queue Length 95th (ft)	197	#412	65	192	325	55	137	116	59	158	116	58
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	297	1047	630	365	1068	595	604	1034	597	604	1079	617
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.72	0.37	0.43	0.61	0.28	0.39	0.22	0.32	0.47	0.22	0.31

Intersection Summary	
Cycle Length: 130.7	
Actuated Cycle Length: 130.7	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.72	
Intersection Signal Delay: 38.5	Intersection LOS: D

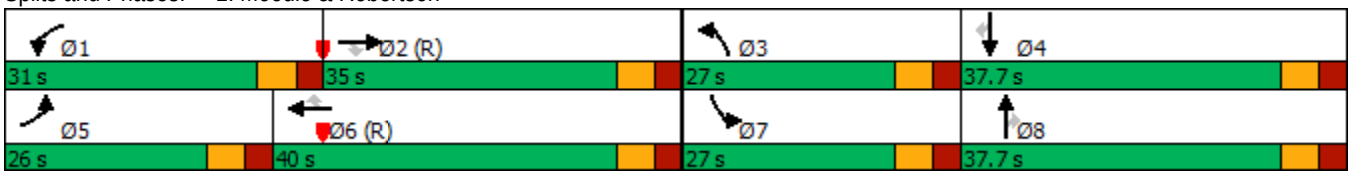
Intersection Capacity Utilization 56.4% ICU Level of Service B

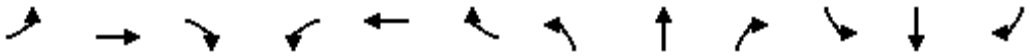
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	700	72	174	668	51	67	19	193	76	30	68
Future Volume (vph)	71	700	72	174	668	51	67	19	193	76	30	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	839	0	189	781	0	73	231	0	83	107	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	68.7	68.7		19.1	91.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.57	0.57		0.16	0.76		0.17	0.17		0.17	0.17	
v/c Ratio	0.20	0.42		0.67	0.29		0.38	0.52		0.92	0.31	
Control Delay	13.5	12.7		59.9	5.1		48.1	11.5		122.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.5	12.7		59.9	5.1		48.1	11.5		122.6	17.3	
LOS	B	B		E	A		D	B		F	B	
Approach Delay		12.8			15.7			20.3			63.3	
Approach LOS		B			B			C			E	
Queue Length 50th (ft)	20	114		137	78		51	14		64	22	
Queue Length 95th (ft)	42	154		#242	141		90	79		#135	67	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	379	2002		285	2680		292	571		138	486	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.20	0.42		0.66	0.29		0.25	0.40		0.60	0.22	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 19.0	Intersection LOS: B

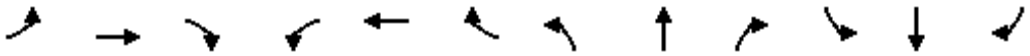
Intersection Capacity Utilization 65.9% ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	660	79	89	617	13	67	3	111	20	3	17
Future Volume (vph)	9	660	79	89	617	13	67	3	111	20	3	17
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	803	0	97	685	0	0	76	121	0	43	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.02	0.33		0.23	0.28			0.24	0.26		0.12	
Control Delay	5.7	7.2		6.9	5.8			39.9	8.0		25.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.7	7.2		6.9	5.8			39.9	8.0		25.1	
LOS	A	A		A	A			D	A		C	
Approach Delay		7.2			6.0			20.3			25.1	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	110		21	76			48	0		15	
Queue Length 95th (ft)	7	138		37	95			93	48		46	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	479	2445		415	2471			313	462		366	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.02	0.33		0.23	0.28			0.24	0.26		0.12	

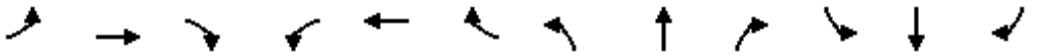
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.33	
Intersection Signal Delay: 8.5	Intersection LOS: A

Intersection Capacity Utilization 48.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Lanes, Volumes, Timings
1: Moodie & Robertson

11/21/2018



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	70	1337	112	81	339	152	225	361	309	356	176	107
Future Volume (vph)	70	1337	112	81	339	152	225	361	309	356	176	107
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	1453	122	88	368	165	245	392	336	387	191	116
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	15.0	54.0	54.0	15.0	54.0	54.0	23.0	38.0	38.0	23.0	38.0	38.0
Total Split (%)	11.5%	41.5%	41.5%	11.5%	41.5%	41.5%	17.7%	29.2%	29.2%	17.7%	29.2%	29.2%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.6	50.3	50.3	10.7	53.0	53.0	16.6	34.3	34.3	18.7	36.4	36.4
Actuated g/C Ratio	0.08	0.39	0.39	0.08	0.41	0.41	0.13	0.26	0.26	0.14	0.28	0.28
v/c Ratio	0.53	1.06	0.18	0.60	0.26	0.22	0.56	0.42	0.65	0.78	0.19	0.21
Control Delay	56.4	84.1	10.9	75.3	26.9	4.5	58.1	41.4	30.8	65.8	36.9	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.4	84.1	10.9	75.3	26.9	4.5	58.1	41.4	30.8	65.8	36.9	4.7
LOS	E	F	B	E	C	A	E	D	C	E	D	A
Approach Delay		77.4			27.8			41.9			47.6	
Approach LOS		E			C			D			D	
Queue Length 50th (ft)	62	~734	18	73	111	0	101	145	148	163	64	0
Queue Length 95th (ft)	m104	#879	80	#133	150	45	142	194	258	220	100	33
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	149	1368	697	149	1443	743	501	933	520	501	990	541
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.51	1.06	0.18	0.59	0.26	0.22	0.49	0.42	0.65	0.77	0.19	0.21

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.06	
Intersection Signal Delay: 55.6	Intersection LOS: E

Intersection Capacity Utilization 76.2% ICU Level of Service D

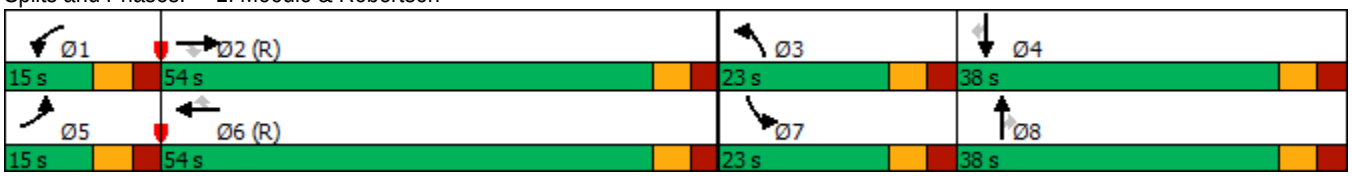
Analysis Period (min) 15

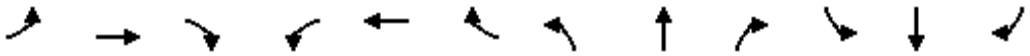
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

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

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	182	1466	5	22	397	132	4	3	9	62	8	62
Future Volume (vph)	182	1466	5	22	397	132	4	3	9	62	8	62
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	198	1598	0	24	575	0	4	13	0	67	76	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	84.0	84.0		13.0	97.0		33.0	33.0		33.0	33.0	
Total Split (%)	64.6%	64.6%		10.0%	74.6%		25.4%	25.4%		25.4%	25.4%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	98.6	98.6		9.5	107.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.76	0.76		0.07	0.83		0.11	0.11		0.11	0.11	
v/c Ratio	0.32	0.60		0.19	0.20		0.03	0.07		0.43	0.31	
Control Delay	5.9	5.7		54.7	3.8		49.8	28.4		61.6	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	5.9	5.7		54.7	3.8		49.8	28.4		61.6	17.9	
LOS	A	A		D	A		D	C		E	B	
Approach Delay		5.7			5.8			33.4			38.4	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	36	154		17	97		3	2		54	7	
Queue Length 95th (ft)	56	179		m45	128		14	22		99	53	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	616	2684		134	2828		272	375		311	412	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.32	0.60		0.18	0.20		0.01	0.03		0.22	0.18	

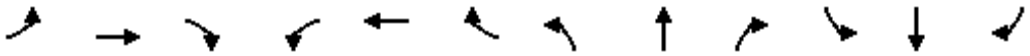
Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 97 (75%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 7.8	Intersection LOS: A

Intersection Capacity Utilization 65.0% ICU Level of Service C

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald

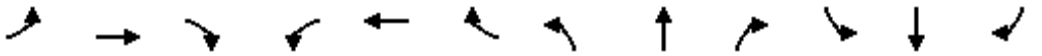


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	1529	45	32	343	15	49	1	102	7	0	6
Future Volume (vph)	7	1529	45	32	343	15	49	1	102	7	0	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	8	1711	0	35	389	0	0	54	111	0	15	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	98.0	98.0		98.0	98.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	75.4%	75.4%		75.4%	75.4%		24.6%	24.6%	24.6%	24.6%	24.6%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	94.0	94.0		94.0	94.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.22	0.22		0.22	
v/c Ratio	0.01	0.67		0.28	0.15			0.18	0.29		0.04	
Control Delay	5.1	11.3		8.5	1.5			43.6	26.2		10.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.1	11.3		8.5	1.5			43.6	26.2		10.1	
LOS	A	B		A	A			D	C		B	
Approach Delay		11.3			2.1			31.9			10.1	
Approach LOS		B			A			C			B	
Queue Length 50th (ft)	2	363		2	10			37	42		0	
Queue Length 95th (ft)	6	431		13	10			76	97		14	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	697	2550		123	2546			300	380		354	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.67		0.28	0.15			0.18	0.29		0.04	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 80 (62%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 11.0	Intersection LOS: B

Intersection Capacity Utilization 70.4% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	120	592	269	225	995	325	225	225	148	287	433	194
Future Volume (vph)	120	592	269	225	995	325	225	225	148	287	433	194
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	130	643	292	245	1082	353	245	245	161	312	471	211
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	20.0	39.0	39.0	25.0	44.0	44.0	18.0	38.0	38.0	18.0	38.0	38.0
Total Split (%)	16.7%	32.5%	32.5%	20.8%	36.7%	36.7%	15.0%	31.7%	31.7%	15.0%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	14.7	35.7	35.7	20.3	41.3	41.3	13.7	34.0	34.0	14.0	34.3	34.3
Actuated g/C Ratio	0.12	0.30	0.30	0.17	0.34	0.34	0.11	0.28	0.28	0.12	0.29	0.29
v/c Ratio	0.60	0.61	0.43	0.82	0.89	0.45	0.62	0.24	0.29	0.78	0.47	0.35
Control Delay	66.0	31.0	3.2	70.1	47.8	5.0	58.3	33.9	6.3	65.9	37.2	6.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.0	31.0	3.2	70.1	47.8	5.0	58.3	33.9	6.3	65.9	37.2	6.1
LOS	E	C	A	E	D	A	E	C	A	E	D	A
Approach Delay		27.6			42.0			36.3			39.6	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	105	150	5	184	421	0	94	76	0	122	158	0
Queue Length 95th (ft)	168	187	21	#310	#551	65	138	112	51	#186	211	57
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	236	1052	675	309	1217	776	400	1002	563	400	1010	602
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.61	0.43	0.79	0.89	0.45	0.61	0.24	0.29	0.78	0.47	0.35

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.89	
Intersection Signal Delay: 37.1	Intersection LOS: D

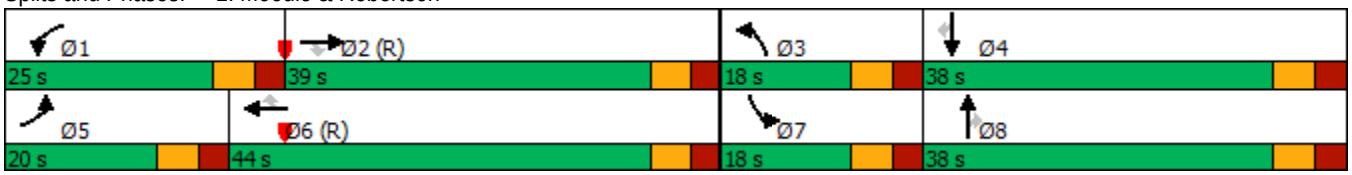
Intersection Capacity Utilization 65.9% ICU Level of Service C

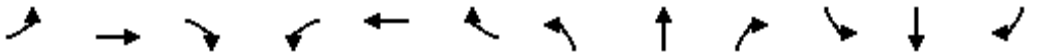
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	607	30	172	1267	43	60	24	148	108	39	147
Future Volume (vph)	31	607	30	172	1267	43	60	24	148	108	39	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	693	0	187	1424	0	65	187	0	117	202	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	67.7	67.7		18.1	89.8		22.2	22.2		22.2	22.2	
Actuated g/C Ratio	0.56	0.56		0.15	0.75		0.18	0.18		0.18	0.18	
v/c Ratio	0.17	0.35		0.70	0.54		0.48	0.43		0.80	0.56	
Control Delay	14.6	12.1		67.4	6.2		53.8	11.7		80.5	32.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.6	12.1		67.4	6.2		53.8	11.7		80.5	32.9	
LOS	B	B		E	A		D	B		F	C	
Approach Delay		12.2			13.3			22.5			50.4	
Approach LOS		B			B			C			D	
Queue Length 50th (ft)	9	92		152	115		45	17		87	91	
Queue Length 95th (ft)	23	122		m194	161		86	74		147	155	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	196	1986		271	2637		189	538		205	477	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.17	0.35		0.69	0.54		0.34	0.35		0.57	0.42	

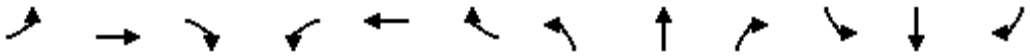
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 17.9	Intersection LOS: B

Intersection Capacity Utilization 77.5% ICU Level of Service D

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald

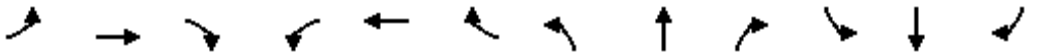


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	575	78	116	1227	10	65	0	58	22	2	24
Future Volume (vph)	10	575	78	116	1227	10	65	0	58	22	2	24
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	710	0	126	1345	0	0	71	63	0	52	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.05	0.29		0.27	0.54			0.22	0.15		0.14	
Control Delay	6.4	6.8		9.7	9.8			39.4	9.9		22.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	6.4	6.8		9.7	9.8			39.4	9.9		22.6	
LOS	A	A		A	A			D	A		C	
Approach Delay		6.8			9.8			25.5			22.6	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	93		34	196			45	0		16	
Queue Length 95th (ft)	9	119		62	244			87	37		50	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	203	2441		465	2475			325	417		372	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.05	0.29		0.27	0.54			0.22	0.15		0.14	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.54	
Intersection Signal Delay: 10.0	Intersection LOS: B

Intersection Capacity Utilization 62.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

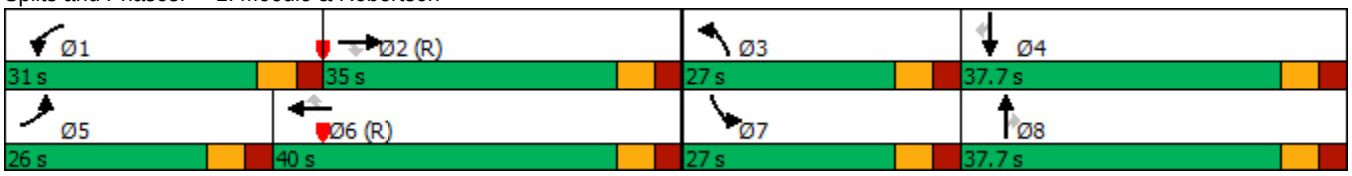


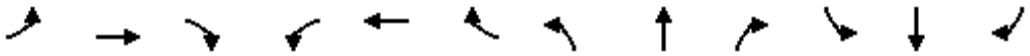
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	144	683	212	145	584	155	219	208	175	259	213	178
Future Volume (vph)	144	683	212	145	584	155	219	208	175	259	213	178
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	157	742	230	158	635	168	238	226	190	282	232	193
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	26.0	35.0	35.0	31.0	40.0	40.0	27.0	37.7	37.7	27.0	37.7	37.7
Total Split (%)	19.9%	26.8%	26.8%	23.7%	30.6%	30.6%	20.7%	28.8%	28.8%	20.7%	28.8%	28.8%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	18.5	38.7	38.7	19.3	39.5	39.5	16.8	38.2	38.2	18.5	39.9	39.9
Actuated g/C Ratio	0.14	0.30	0.30	0.15	0.30	0.30	0.13	0.29	0.29	0.14	0.31	0.31
v/c Ratio	0.63	0.71	0.37	0.61	0.59	0.28	0.54	0.22	0.32	0.58	0.22	0.31
Control Delay	63.7	46.2	6.5	61.4	42.2	6.5	57.6	36.4	6.5	57.1	35.1	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.7	46.2	6.5	61.4	42.2	6.5	57.6	36.4	6.5	57.1	35.1	6.2
LOS	E	D	A	E	D	A	E	D	A	E	D	A
Approach Delay		40.5			39.1			35.4			36.0	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	126	295	0	127	242	0	98	76	0	117	76	0
Queue Length 95th (ft)	197	393	65	192	318	55	137	116	59	158	116	58
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	297	1047	630	365	1068	595	604	1034	597	604	1079	617
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.71	0.37	0.43	0.59	0.28	0.39	0.22	0.32	0.47	0.22	0.31

Intersection Summary	
Cycle Length: 130.7	
Actuated Cycle Length: 130.7	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 38.2	Intersection LOS: D

Intersection Capacity Utilization 56.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	686	72	174	655	51	67	19	193	76	30	68
Future Volume (vph)	71	686	72	174	655	51	67	19	193	76	30	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	824	0	189	767	0	73	231	0	83	107	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	68.7	68.7		19.1	91.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.57	0.57		0.16	0.76		0.17	0.17		0.17	0.17	
v/c Ratio	0.20	0.41		0.67	0.29		0.38	0.52		0.92	0.31	
Control Delay	13.5	12.7		59.9	5.0		48.1	11.5		122.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.5	12.7		59.9	5.0		48.1	11.5		122.6	17.3	
LOS	B	B		E	A		D	B		F	B	
Approach Delay		12.8			15.9			20.3			63.3	
Approach LOS		B			B			C			E	
Queue Length 50th (ft)	20	112		137	76		51	14		64	22	
Queue Length 95th (ft)	42	152		#242	138		90	79		#135	67	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	384	2002		285	2680		292	571		138	486	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.20	0.41		0.66	0.29		0.25	0.40		0.60	0.22	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 19.1	Intersection LOS: B

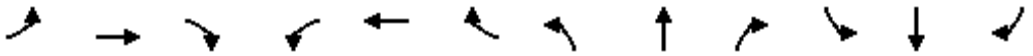
Intersection Capacity Utilization 65.5% ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	647	79	89	605	13	67	3	111	20	3	17
Future Volume (vph)	9	647	79	89	605	13	67	3	111	20	3	17
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	789	0	97	672	0	0	76	121	0	43	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.02	0.32		0.23	0.27			0.24	0.26		0.12	
Control Delay	5.7	7.1		6.9	5.8			39.9	8.0		25.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.7	7.1		6.9	5.8			39.9	8.0		25.1	
LOS	A	A		A	A			D	A		C	
Approach Delay		7.1			6.0			20.3			25.1	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	107		21	75			48	0		15	
Queue Length 95th (ft)	7	136		37	94			93	48		46	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	487	2445		423	2471			313	462		366	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.02	0.32		0.23	0.27			0.24	0.26		0.12	

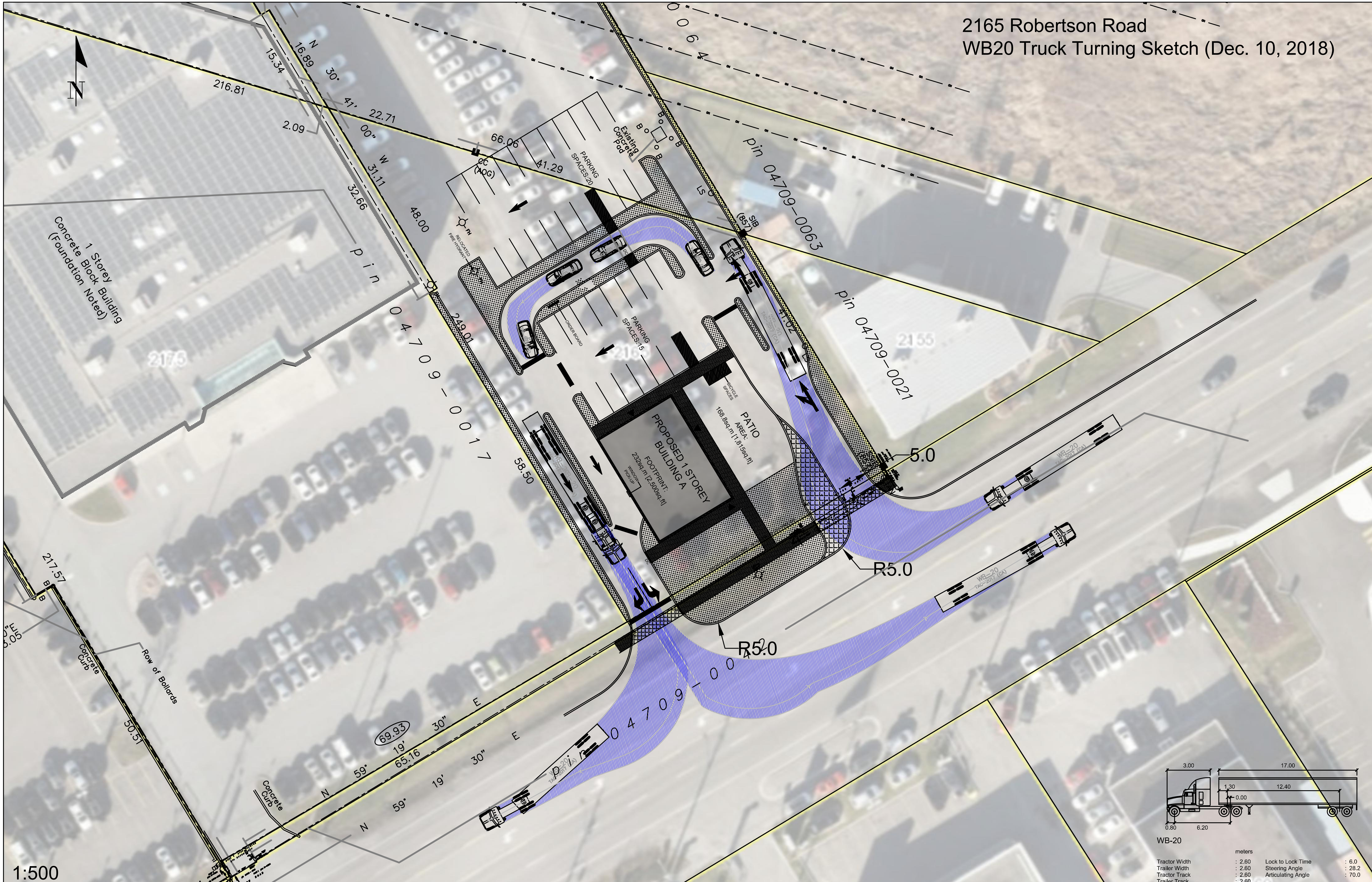
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.32	
Intersection Signal Delay: 8.5	Intersection LOS: A

Intersection Capacity Utilization 47.7% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Appendix G

Vehicle Turn Paths Enlarged



2165 Robertson Road
WB20 Truck Turning Sketch (Dec. 10, 2018)
N
1:500
PROPOSED 1 STOREY BUILDING A
FOOTPRINT: 232sq.m (2,500sq.ft)
PATIO AREA: 168.6sq.m (1,815sq.ft)
PARKING SPACES:20
PARKING SPACES:15
Existing Concrete Pad
1 Storey Concrete Block Building (Foundation Noted)
pin 04709-0063
pin 04709-0021
pin 04709-0017
2155
2175
R5.0
R5.0
5.0
Row of Bollards
Concrete Curb
Concrete Curb
WB-20
3.00
17.00
1.30
12.40
0.00
0.80
6.20
meters
Tractor Width : 2.60
Trailer Width : 2.60
Tractor Track : 2.60
Trailer Track : 2.60
Lock to Lock Time : 6.0
Steering Angle : 28.2
Articulating Angle : 70.0

Appendix H

Road Segment Multi-Modal Level of Service Analysis

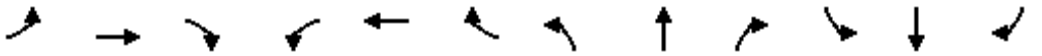
Multi-Modal Level of Service - Segments Form

Consultant	**Parsons**	**Project**	**2165 Robertson Road**
Scenario		**Date**	**12/11/2018**
Comments	**Robertson Road, Moodie to Westcliffe**		
	Existing, Proposed and Improvements		

SEGMENTS		**Street A**	Existing	Future 1	Improvements
			1	2	3
Pedestrian	Sidewalk Width Boulevard Width	**C**	no sidewalk n/a	1.8 m > 2 m	≥ 2 m > 2 m
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000	> 3000
	Operating Speed On-Street Parking		> 60 km/h no	> 50 to 60 km/h no	> 50 to 60 km/h no
	Exposure to Traffic PLoS		**F**	**D**	**C**
	Effective Sidewalk Width				2.0 m
	Pedestrian Volume				250 ped/hr
	Crowding PLoS		**-**	**-**	**B**
	Level of Service		**-**	**-**	**C**
Bicycle	Type of Cycling Facility	**F**	Mixed Traffic	Mixed Traffic	Curbside Bike Lane
	Number of Travel Lanes		2-3 lanes total	2-3 lanes total	2 ea. dir. (no median)
	Operating Speed		≥ 60 km/h	≥ 50 to 60 km/h	>50 to 70 km/h
	# of Lanes & Operating Speed LoS		**F**	**E**	**C**
	Bike Lane (+ Parking Lane) Width		~~≥1.5 to <1.8 m~~		
	Bike Lane Width LoS		~~**B**~~	~~**-**~~	**-**
	Bike Lane Blockages		~~Rare~~	~~Frequent~~	Frequent
	Blockage LoS		~~**A**~~	~~**C**~~	**C**
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge	≥ 1.8 m refuge	< 1.8 m refuge
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes	≤ 3 lanes	≤ 3 lanes
	Sidestreet Operating Speed		≤ 40 km/h	>40 to 50 km/h	>40 to 50 km/h
	Unsignalized Crossing - Lowest LoS		**A**	**A**	**B**
	Level of Service		**F**	**E**	**C**
Transit	Facility Type	**D**	Mixed Traffic	Mixed Traffic	
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8	
	Level of Service		**D**	**D**	**-**
Truck	Truck Lane Width	**A**	≤ 3.5 m		
	Travel Lanes per Direction		> 1		
	Level of Service		**A**	**-**	**-**

Appendix I

Total Projected Conditions 2019 SYNCHRO Analysis



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	1238	115	81	315	163	228	367	309	364	179	125
Future Volume (vph)	83	1238	115	81	315	163	228	367	309	364	179	125
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	90	1346	125	88	342	177	248	399	336	396	195	136
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	15.0	54.0	54.0	15.0	54.0	54.0	23.0	38.0	38.0	23.0	38.0	38.0
Total Split (%)	11.5%	41.5%	41.5%	11.5%	41.5%	41.5%	17.7%	29.2%	29.2%	17.7%	29.2%	29.2%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.8	50.3	50.3	10.7	50.2	50.2	16.7	34.2	34.2	18.8	36.3	36.3
Actuated g/C Ratio	0.08	0.39	0.39	0.08	0.39	0.39	0.13	0.26	0.26	0.14	0.28	0.28
v/c Ratio	0.62	0.98	0.18	0.60	0.25	0.25	0.56	0.43	0.65	0.80	0.20	0.25
Control Delay	62.1	64.4	12.0	75.3	27.8	4.5	58.1	41.6	30.6	66.7	37.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.1	64.4	12.0	75.3	27.8	4.5	58.1	41.6	30.6	66.7	37.0	7.1
LOS	E	E	B	E	C	A	E	D	C	E	D	A
Approach Delay		60.1			27.9			42.0			47.6	
Approach LOS		E			C			D			D	
Queue Length 50th (ft)	75	639	20	73	102	0	102	147	147	168	66	0
Queue Length 95th (ft)	#141	#777	84	#133	140	47	144	198	257	#234	101	50
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	149	1368	697	149	1367	720	501	931	520	501	987	540
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	0.98	0.18	0.59	0.25	0.25	0.50	0.43	0.65	0.79	0.20	0.25

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.98	
Intersection Signal Delay: 48.1	Intersection LOS: D

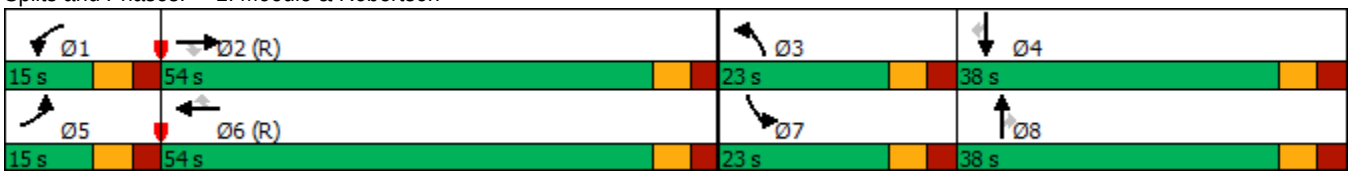
Intersection Capacity Utilization 73.7% ICU Level of Service D

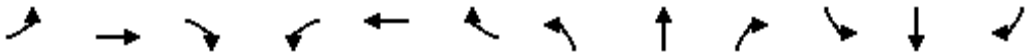
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	182	1363	5	22	383	132	4	3	9	62	8	62
Future Volume (vph)	182	1363	5	22	383	132	4	3	9	62	8	62
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	198	1487	0	24	559	0	4	13	0	67	76	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	84.0	84.0		13.0	97.0		33.0	33.0		33.0	33.0	
Total Split (%)	64.6%	64.6%		10.0%	74.6%		25.4%	25.4%		25.4%	25.4%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	98.6	98.6		9.5	107.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.76	0.76		0.07	0.83		0.11	0.11		0.11	0.11	
v/c Ratio	0.32	0.55		0.19	0.20		0.03	0.07		0.43	0.31	
Control Delay	6.0	5.6		56.0	3.4		49.8	28.4		61.6	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.0	5.6		56.0	3.4		49.8	28.4		61.6	17.9	
LOS	A	A		E	A		D	C		E	B	
Approach Delay		5.7			5.5			33.4			38.4	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	36	147		17	87		3	2		54	7	
Queue Length 95th (ft)	58	174		m47	115		14	22		99	53	
Internal Link Dist (ft)		341			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	624	2681		134	2826		272	375		311	412	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.32	0.55		0.18	0.20		0.01	0.03		0.22	0.18	

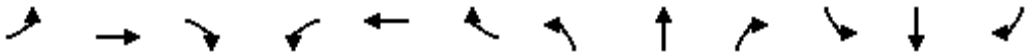
Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 97 (75%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 7.8	Intersection LOS: A

Intersection Capacity Utilization 62.1% ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald

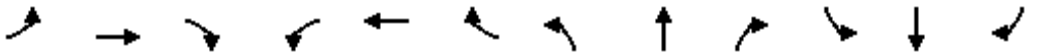


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	1418	45	44	319	15	49	1	114	7	0	6
Future Volume (vph)	7	1418	45	44	319	15	49	1	114	7	0	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	8	1590	0	48	363	0	0	54	124	0	15	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	98.0	98.0		98.0	98.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	75.4%	75.4%		75.4%	75.4%		24.6%	24.6%	24.6%	24.6%	24.6%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	94.0	94.0		94.0	94.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.22	0.22		0.22	
v/c Ratio	0.01	0.62		0.32	0.14			0.18	0.32		0.04	
Control Delay	5.1	10.4		8.5	1.8			43.6	24.2		10.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.1	10.4		8.5	1.8			43.6	24.2		10.1	
LOS	A	B		A	A			D	C		B	
Approach Delay		10.4			2.6			30.1			10.1	
Approach LOS		B			A			C			B	
Queue Length 50th (ft)	2	316		4	13			37	42		0	
Queue Length 95th (ft)	6	377		13	14			76	100		14	
Internal Link Dist (ft)		498			849			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	719	2548		151	2543			300	390		354	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.62		0.32	0.14			0.18	0.32		0.04	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 80 (62%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 70	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.62	
Intersection Signal Delay: 10.5	Intersection LOS: B

Intersection Capacity Utilization 67.3% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	564	272	225	935	336	228	230	148	296	437	207
Future Volume (vph)	138	564	272	225	935	336	228	230	148	296	437	207
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	150	613	296	245	1016	365	248	250	161	322	475	225
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	20.0	39.0	39.0	25.0	44.0	44.0	18.0	38.0	38.0	18.0	38.0	38.0
Total Split (%)	16.7%	32.5%	32.5%	20.8%	36.7%	36.7%	15.0%	31.7%	31.7%	15.0%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.1	35.7	35.7	20.3	40.9	40.9	13.7	34.0	34.0	14.0	34.3	34.3
Actuated g/C Ratio	0.13	0.30	0.30	0.17	0.34	0.34	0.11	0.28	0.28	0.12	0.29	0.29
v/c Ratio	0.67	0.58	0.44	0.82	0.84	0.47	0.63	0.25	0.29	0.81	0.47	0.37
Control Delay	69.8	30.7	3.1	70.1	44.5	5.1	58.5	34.0	6.3	67.8	37.3	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	69.8	30.7	3.1	70.1	44.5	5.1	58.5	34.0	6.3	67.8	37.3	6.0
LOS	E	C	A	E	D	A	E	C	A	E	D	A
Approach Delay		28.5			39.5			36.5			40.0	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	121	146	6	184	385	0	95	78	0	127	160	0
Queue Length 95th (ft)	189	180	19	#310	474	66	139	114	51	#195	213	59
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	236	1052	678	309	1205	780	400	1002	563	400	1010	612
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.58	0.44	0.79	0.84	0.47	0.62	0.25	0.29	0.81	0.47	0.37

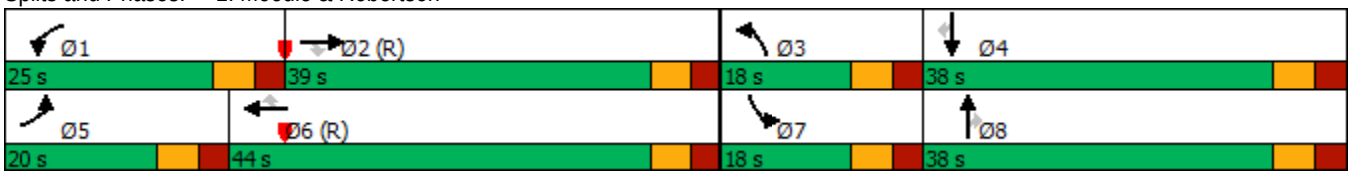
Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 36.5 Intersection LOS: D

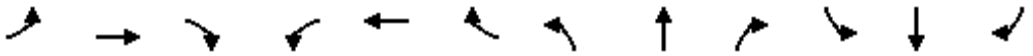
Intersection Capacity Utilization 65.4% ICU Level of Service C

Analysis Period (min) 15

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

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	574	30	172	1180	43	60	24	148	108	39	147
Future Volume (vph)	31	574	30	172	1180	43	60	24	148	108	39	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	657	0	187	1330	0	65	187	0	117	202	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	67.7	67.7		18.1	89.8		22.2	22.2		22.2	22.2	
Actuated g/C Ratio	0.56	0.56		0.15	0.75		0.18	0.18		0.18	0.18	
v/c Ratio	0.16	0.33		0.70	0.50		0.48	0.43		0.80	0.54	
Control Delay	14.3	12.1		67.7	6.3		53.8	11.7		80.5	28.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.3	12.1		67.7	6.3		53.8	11.7		80.5	28.8	
LOS	B	B		E	A		D	B		F	C	
Approach Delay		12.2			13.8			22.5			47.8	
Approach LOS		B			B			C			D	
Queue Length 50th (ft)	9	88		153	111		45	17		87	79	
Queue Length 95th (ft)	22	120		m#203	157		86	74		147	144	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	216	1984		271	2637		189	538		205	488	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.16	0.33		0.69	0.50		0.34	0.35		0.57	0.41	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 18.1	Intersection LOS: B

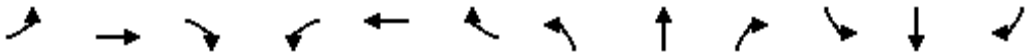
Intersection Capacity Utilization 75.1% ICU Level of Service D

Analysis Period (min) 15

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

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

Splits and Phases: 2: Robertson & Fitzgerald

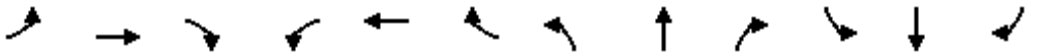


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	533	78	126	1139	10	65	0	69	22	2	24
Future Volume (vph)	10	533	78	126	1139	10	65	0	69	22	2	24
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	664	0	137	1249	0	0	71	75	0	52	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.05	0.27		0.28	0.50			0.22	0.18		0.14	
Control Delay	6.2	6.6		9.2	8.9			39.4	9.3		22.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	6.2	6.6		9.2	8.9			39.4	9.3		22.6	
LOS	A	A		A	A			D	A		C	
Approach Delay		6.6			8.9			23.9			22.6	
Approach LOS		A			A			C			C	
Queue Length 50th (ft)	2	84		34	166			45	0		16	
Queue Length 95th (ft)	9	109		64	221			87	39		50	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	233	2440		491	2475			325	426		372	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.05	0.27		0.28	0.50			0.22	0.18		0.14	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.50	
Intersection Signal Delay: 9.5	Intersection LOS: A

Intersection Capacity Utilization 59.6% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	158	699	217	145	599	169	224	215	175	270	219	188
Future Volume (vph)	158	699	217	145	599	169	224	215	175	270	219	188
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	172	760	236	158	651	184	243	234	190	293	238	204
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	26.0	35.0	35.0	31.0	40.0	40.0	27.0	37.7	37.7	27.0	37.7	37.7
Total Split (%)	19.9%	26.8%	26.8%	23.7%	30.6%	30.6%	20.7%	28.8%	28.8%	20.7%	28.8%	28.8%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	19.2	38.7	38.7	19.3	38.8	38.8	17.0	37.9	37.9	18.8	39.7	39.7
Actuated g/C Ratio	0.15	0.30	0.30	0.15	0.30	0.30	0.13	0.29	0.29	0.14	0.30	0.30
v/c Ratio	0.66	0.73	0.37	0.61	0.62	0.31	0.54	0.23	0.32	0.59	0.22	0.33
Control Delay	65.1	46.8	6.4	61.4	43.2	6.4	57.5	36.8	6.6	57.1	35.3	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.1	46.8	6.4	61.4	43.2	6.4	57.5	36.8	6.6	57.1	35.3	6.2
LOS	E	D	A	E	D	A	E	D	A	E	D	A
Approach Delay		41.3			39.3			35.8			35.9	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	138	304	0	127	253	0	101	79	0	121	79	0
Queue Length 95th (ft)	214	#423	65	192	326	57	140	120	59	163	120	59
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	297	1047	634	365	1051	599	604	1025	593	604	1074	622
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.73	0.37	0.43	0.62	0.31	0.40	0.23	0.32	0.49	0.22	0.33

Intersection Summary	
Cycle Length: 130.7	
Actuated Cycle Length: 130.7	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.73	
Intersection Signal Delay: 38.6	Intersection LOS: D

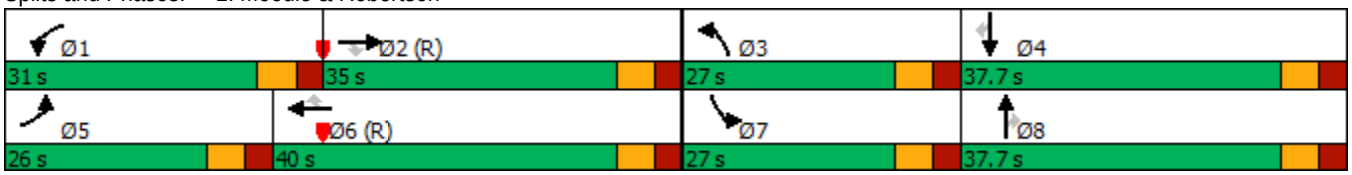
Intersection Capacity Utilization 56.7% ICU Level of Service B

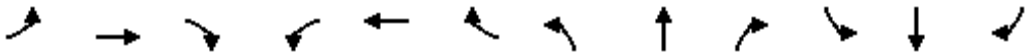
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	708	72	174	676	51	67	19	193	76	30	68
Future Volume (vph)	71	708	72	174	676	51	67	19	193	76	30	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	848	0	189	790	0	73	231	0	83	107	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	68.7	68.7		19.1	91.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.57	0.57		0.16	0.76		0.17	0.17		0.17	0.17	
v/c Ratio	0.20	0.42		0.67	0.29		0.38	0.52		0.92	0.31	
Control Delay	13.5	12.9		59.9	5.1		48.1	11.5		122.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.5	12.9		59.9	5.1		48.1	11.5		122.6	17.3	
LOS	B	B		E	A		D	B		F	B	
Approach Delay		12.9			15.7			20.3			63.3	
Approach LOS		B			B			C			E	
Queue Length 50th (ft)	20	116		137	80		51	14		64	22	
Queue Length 95th (ft)	42	157		#242	143		90	79		#135	67	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	376	2002		285	2683		292	571		138	486	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.20	0.42		0.66	0.29		0.25	0.40		0.60	0.22	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 19.0	Intersection LOS: B

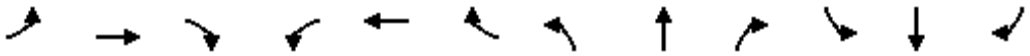
Intersection Capacity Utilization 66.1% ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	660	79	105	617	13	67	3	129	20	3	17
Future Volume (vph)	9	660	79	105	617	13	67	3	129	20	3	17
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	803	0	114	685	0	0	76	140	0	43	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.02	0.33		0.27	0.28			0.24	0.29		0.12	
Control Delay	5.7	7.2		7.3	5.8			39.9	7.8		25.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.7	7.2		7.3	5.8			39.9	7.8		25.1	
LOS	A	A		A	A			D	A		C	
Approach Delay		7.2			6.0			19.1			25.1	
Approach LOS		A			A			B			C	
Queue Length 50th (ft)	2	110		25	76			48	0		15	
Queue Length 95th (ft)	7	138		42	95			93	52		46	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	479	2445		415	2471			313	476		366	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.02	0.33		0.27	0.28			0.24	0.29		0.12	

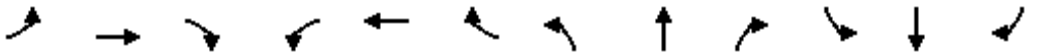
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.33	
Intersection Signal Delay: 8.5	Intersection LOS: A

Intersection Capacity Utilization 48.1% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Appendix J

Total Projected Conditions 2024 SYNCHRO Analysis



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	83	1340	115	81	341	163	228	367	309	364	179	125
Future Volume (vph)	83	1340	115	81	341	163	228	367	309	364	179	125
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	90	1457	125	88	371	177	248	399	336	396	195	136
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	15.0	54.0	54.0	15.0	54.0	54.0	23.0	38.0	38.0	23.0	38.0	38.0
Total Split (%)	11.5%	41.5%	41.5%	11.5%	41.5%	41.5%	17.7%	29.2%	29.2%	17.7%	29.2%	29.2%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	10.8	50.3	50.3	10.7	50.2	50.2	16.7	34.2	34.2	18.8	36.3	36.3
Actuated g/C Ratio	0.08	0.39	0.39	0.08	0.39	0.39	0.13	0.26	0.26	0.14	0.28	0.28
v/c Ratio	0.62	1.07	0.18	0.60	0.27	0.25	0.56	0.43	0.65	0.80	0.20	0.25
Control Delay	61.2	85.3	11.4	75.3	28.1	4.5	58.1	41.6	31.0	66.7	37.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	61.2	85.3	11.4	75.3	28.1	4.5	58.1	41.6	31.0	66.7	37.0	7.1
LOS	E	F	B	E	C	A	E	D	C	E	D	A
Approach Delay		78.5			28.1			42.1			47.6	
Approach LOS		E			C			D			D	
Queue Length 50th (ft)	75	~738	20	73	112	0	102	147	149	168	66	0
Queue Length 95th (ft)	m#125	#882	84	#133	151	47	144	198	259	#234	101	50
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	149	1368	697	149	1367	720	501	931	518	501	987	540
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.60	1.07	0.18	0.59	0.27	0.25	0.50	0.43	0.65	0.79	0.20	0.25

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 115	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 1.07	
Intersection Signal Delay: 56.0	Intersection LOS: E

Intersection Capacity Utilization 76.6% ICU Level of Service D

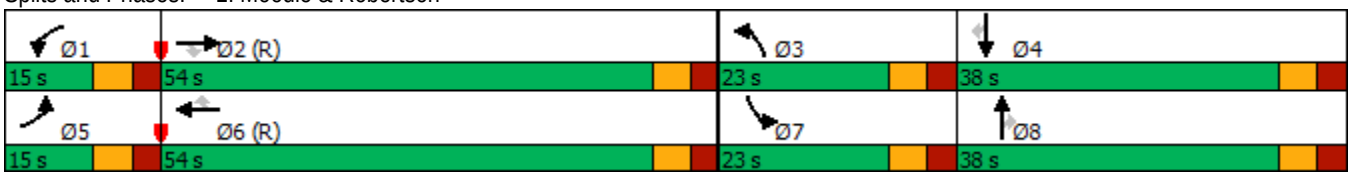
Analysis Period (min) 15

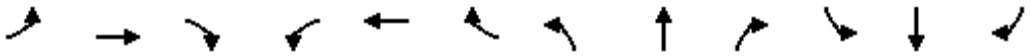
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

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

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

Splits and Phases: 1: Moodie & Robertson



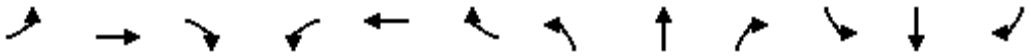


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	182	1474	5	22	413	132	4	3	9	62	8	62
Future Volume (vph)	182	1474	5	22	413	132	4	3	9	62	8	62
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	198	1607	0	24	592	0	4	13	0	67	76	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	84.0	84.0		13.0	97.0		33.0	33.0		33.0	33.0	
Total Split (%)	64.6%	64.6%		10.0%	74.6%		25.4%	25.4%		25.4%	25.4%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	98.6	98.6		9.5	107.3		14.7	14.7		14.7	14.7	
Actuated g/C Ratio	0.76	0.76		0.07	0.83		0.11	0.11		0.11	0.11	
v/c Ratio	0.33	0.60		0.19	0.21		0.03	0.07		0.43	0.31	
Control Delay	6.0	5.8		55.2	3.6		49.8	28.4		61.6	17.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	6.0	5.8		55.2	3.6		49.8	28.4		61.6	17.9	
LOS	A	A		E	A		D	C		E	B	
Approach Delay		5.8			5.6			33.4			38.4	
Approach LOS		A			A			C			D	
Queue Length 50th (ft)	37	161		16	98		3	2		54	7	
Queue Length 95th (ft)	58	188		m45	128		14	22		99	53	
Internal Link Dist (ft)		341			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	604	2684		134	2830		272	375		311	412	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.33	0.60		0.18	0.21		0.01	0.03		0.22	0.18	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 97 (75%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.60	
Intersection Signal Delay: 7.8	Intersection LOS: A

Intersection Capacity Utilization 65.2% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Robertson & Fitzgerald

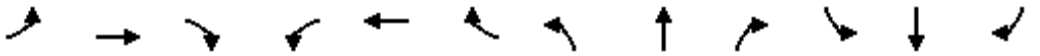


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	7	1534	45	44	345	15	49	1	114	7	0	6
Future Volume (vph)	7	1534	45	44	345	15	49	1	114	7	0	6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	8	1716	0	48	391	0	0	54	124	0	15	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	98.0	98.0		98.0	98.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	75.4%	75.4%		75.4%	75.4%		24.6%	24.6%	24.6%	24.6%	24.6%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	94.0	94.0		94.0	94.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.72	0.72		0.72	0.72			0.22	0.22		0.22	
v/c Ratio	0.01	0.67		0.39	0.15			0.18	0.33		0.04	
Control Delay	5.1	11.3		13.5	1.8			43.6	28.4		10.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.1	11.3		13.5	1.8			43.6	28.4		10.1	
LOS	A	B		B	A			D	C		B	
Approach Delay		11.3			3.0			33.0			10.1	
Approach LOS		B			A			C			B	
Queue Length 50th (ft)	2	365		4	14			37	53		0	
Queue Length 95th (ft)	6	434		21	15			76	111		14	
Internal Link Dist (ft)		498			849			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	696	2550		122	2546			300	379		354	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.01	0.67		0.39	0.15			0.18	0.33		0.04	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 80 (62%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.67	
Intersection Signal Delay: 11.4	Intersection LOS: B

Intersection Capacity Utilization 70.5% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	609	272	225	1011	336	228	230	148	296	437	207
Future Volume (vph)	138	609	272	225	1011	336	228	230	148	296	437	207
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	150	662	296	245	1099	365	248	250	161	322	475	225
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	20.0	39.0	39.0	25.0	44.0	44.0	18.0	38.0	38.0	18.0	38.0	38.0
Total Split (%)	16.7%	32.5%	32.5%	20.8%	36.7%	36.7%	15.0%	31.7%	31.7%	15.0%	31.7%	31.7%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	15.1	35.7	35.7	20.3	40.9	40.9	13.7	34.0	34.0	14.0	34.3	34.3
Actuated g/C Ratio	0.13	0.30	0.30	0.17	0.34	0.34	0.11	0.28	0.28	0.12	0.29	0.29
v/c Ratio	0.67	0.63	0.44	0.82	0.91	0.47	0.63	0.25	0.29	0.81	0.47	0.37
Control Delay	70.0	31.6	3.4	70.1	50.4	5.1	58.5	34.0	6.3	67.8	37.3	6.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.0	31.6	3.4	70.1	50.4	5.1	58.5	34.0	6.3	67.8	37.3	6.0
LOS	E	C	A	E	D	A	E	C	A	E	D	A
Approach Delay		29.3			43.5			36.5			40.0	
Approach LOS		C			D			D			D	
Queue Length 50th (ft)	121	155	4	184	431	0	95	78	0	127	160	0
Queue Length 95th (ft)	189	196	22	#310	#566	66	139	114	51	#195	213	59
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	236	1052	678	309	1205	780	400	1002	563	400	1010	612
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.63	0.44	0.79	0.91	0.47	0.62	0.25	0.29	0.81	0.47	0.37

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 100 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 105	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.91	
Intersection Signal Delay: 38.2	Intersection LOS: D

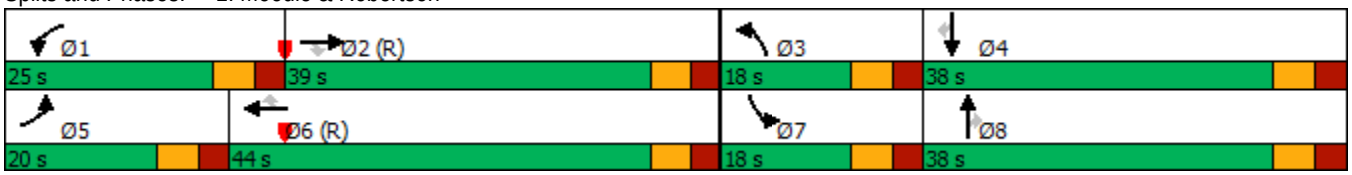
Intersection Capacity Utilization 67.5% ICU Level of Service C

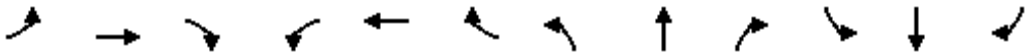
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	31	620	30	172	1276	43	60	24	148	108	39	147
Future Volume (vph)	31	620	30	172	1276	43	60	24	148	108	39	147
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	34	707	0	187	1434	0	65	187	0	117	202	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	67.7	67.7		18.1	89.8		22.2	22.2		22.2	22.2	
Actuated g/C Ratio	0.56	0.56		0.15	0.75		0.18	0.18		0.18	0.18	
v/c Ratio	0.18	0.36		0.70	0.54		0.48	0.43		0.80	0.56	
Control Delay	14.8	12.2		66.8	6.2		53.8	11.7		80.5	33.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.8	12.2		66.8	6.2		53.8	11.7		80.5	33.5	
LOS	B	B		E	A		D	B		F	C	
Approach Delay		12.4			13.2			22.5			50.7	
Approach LOS		B			B			C			D	
Queue Length 50th (ft)	9	94		153	115		45	17		87	92	
Queue Length 95th (ft)	23	126		m190	m160		86	74		147	156	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	194	1986		271	2637		189	538		205	475	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.18	0.36		0.69	0.54		0.34	0.35		0.57	0.43	

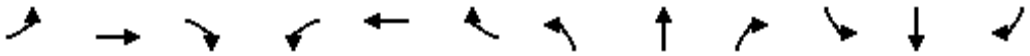
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.80	
Intersection Signal Delay: 17.8	Intersection LOS: B

Intersection Capacity Utilization 77.7% ICU Level of Service D

Analysis Period (min) 15

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

Splits and Phases: 2: Robertson & Fitzgerald

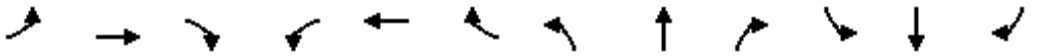


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	10	577	78	126	1233	10	65	0	69	22	2	24
Future Volume (vph)	10	577	78	126	1233	10	65	0	69	22	2	24
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	11	712	0	137	1351	0	0	71	75	0	52	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.05	0.29		0.30	0.55			0.22	0.18		0.14	
Control Delay	6.4	6.8		10.2	10.2			39.4	9.3		22.6	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	6.4	6.8		10.2	10.2			39.4	9.3		22.6	
LOS	A	A		B	B			D	A		C	
Approach Delay		6.8			10.2			23.9			22.6	
Approach LOS		A			B			C			C	
Queue Length 50th (ft)	2	93		38	202			45	0		16	
Queue Length 95th (ft)	9	120		68	250			87	39		50	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	202	2441		464	2475			325	426		372	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.05	0.29		0.30	0.55			0.22	0.18		0.14	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.55	
Intersection Signal Delay: 10.3	Intersection LOS: B

Intersection Capacity Utilization 62.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	158	756	217	145	648	169	224	215	175	270	219	188
Future Volume (vph)	158	756	217	145	648	169	224	215	175	270	219	188
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	172	822	236	158	704	184	243	234	190	293	238	204
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases			2			6			8			4
Detector Phase	5	2	2	1	6	6	3	8	8	7	4	4
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0	10.0
Minimum Split (s)	11.4	34.4	34.4	11.4	34.4	34.4	11.5	37.7	37.7	11.5	37.7	37.7
Total Split (s)	26.0	35.0	35.0	31.0	40.0	40.0	27.0	37.7	37.7	27.0	37.7	37.7
Total Split (%)	19.9%	26.8%	26.8%	23.7%	30.6%	30.6%	20.7%	28.8%	28.8%	20.7%	28.8%	28.8%
Yellow Time (s)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	2.7	2.8	3.0	3.0	2.8	3.0	3.0
Lost Time Adjust (s)	-2.4	-2.4	-2.4	-2.4	-2.4	-2.4	-2.5	-2.7	-2.7	-2.5	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	Max	Max	None	Max	Max
Act Effct Green (s)	19.2	38.7	38.7	19.3	38.8	38.8	17.0	37.9	37.9	18.8	39.7	39.7
Actuated g/C Ratio	0.15	0.30	0.30	0.15	0.30	0.30	0.13	0.29	0.29	0.14	0.30	0.30
v/c Ratio	0.66	0.79	0.37	0.61	0.67	0.31	0.54	0.23	0.32	0.59	0.22	0.33
Control Delay	65.1	49.1	6.4	61.4	44.7	6.4	57.5	36.8	6.6	57.1	35.3	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	65.1	49.1	6.4	61.4	44.7	6.4	57.5	36.8	6.6	57.1	35.3	6.2
LOS	E	D	A	E	D	A	E	D	A	E	D	A
Approach Delay		43.2			40.4			35.8			35.9	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	138	336	0	127	279	0	101	79	0	121	79	0
Queue Length 95th (ft)	214	#483	65	192	357	57	140	120	59	163	120	59
Internal Link Dist (ft)		983			2221			789			1500	
Turn Bay Length (ft)	260		770	270		930	221		80	285		250
Base Capacity (vph)	297	1047	634	365	1051	599	604	1025	593	604	1074	622
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.58	0.79	0.37	0.43	0.67	0.31	0.40	0.23	0.32	0.49	0.22	0.33

Intersection Summary	
Cycle Length: 130.7	
Actuated Cycle Length: 130.7	
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green	
Natural Cycle: 95	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 39.6	Intersection LOS: D

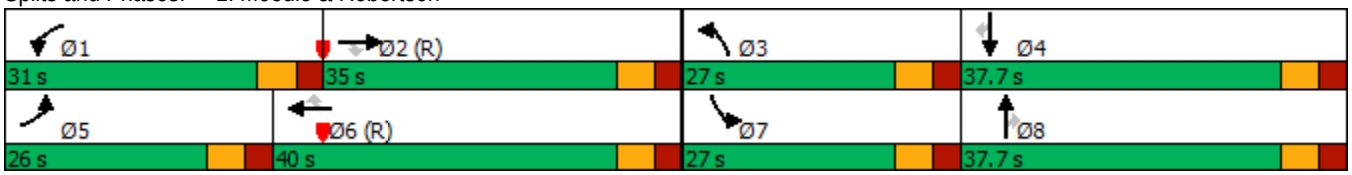
Intersection Capacity Utilization 58.3% ICU Level of Service B

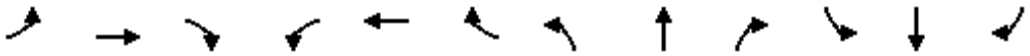
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Moodie & Robertson





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	71	765	72	174	731	51	67	19	193	76	30	68
Future Volume (vph)	71	765	72	174	731	51	67	19	193	76	30	68
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	77	910	0	189	850	0	73	231	0	83	107	0
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases		2		1	6			8			4	
Permitted Phases	2						8			4		
Detector Phase	2	2		1	6		8	8		4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		5.0	10.0		10.0	10.0		10.0	10.0	
Minimum Split (s)	28.4	28.4		12.0	28.4		32.3	32.3		32.3	32.3	
Total Split (s)	65.0	65.0		20.0	85.0		35.0	35.0		35.0	35.0	
Total Split (%)	54.2%	54.2%		16.7%	70.8%		29.2%	29.2%		29.2%	29.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.3	3.3		3.3	3.3	
All-Red Time (s)	2.7	2.7		2.5	2.7		3.0	3.0		3.0	3.0	
Lost Time Adjust (s)	-2.4	-2.4		-2.2	-2.4		-2.3	-2.3		-2.3	-2.3	
Total Lost Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lead/Lag	Lag	Lag		Lead								
Lead-Lag Optimize?	Yes	Yes		Yes								
Recall Mode	C-Max	C-Max		None	C-Max		None	None		None	None	
Act Effct Green (s)	68.7	68.7		19.1	91.8		20.2	20.2		20.2	20.2	
Actuated g/C Ratio	0.57	0.57		0.16	0.76		0.17	0.17		0.17	0.17	
v/c Ratio	0.22	0.45		0.67	0.32		0.38	0.52		0.92	0.31	
Control Delay	13.7	13.1		59.9	5.2		48.1	11.5		122.6	17.3	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.7	13.1		59.9	5.2		48.1	11.5		122.6	17.3	
LOS	B	B		E	A		D	B		F	B	
Approach Delay		13.2			15.2			20.3			63.3	
Approach LOS		B			B			C			E	
Queue Length 50th (ft)	20	124		137	87		51	14		64	22	
Queue Length 95th (ft)	42	166		#242	156		90	79		#135	67	
Internal Link Dist (ft)		1411			983			115			563	
Turn Bay Length (ft)	300			300			120			150		
Base Capacity (vph)	355	2004		285	2682		292	571		138	486	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.22	0.45		0.66	0.32		0.25	0.40		0.60	0.22	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 97 (81%), Referenced to phase 2:EBTL and 6:WBT, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.92	
Intersection Signal Delay: 18.6	Intersection LOS: B

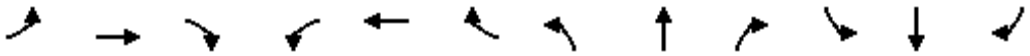
Intersection Capacity Utilization 67.7% ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 2: Robertson & Fitzgerald



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	9	714	79	105	668	13	67	3	129	20	3	17
Future Volume (vph)	9	714	79	105	668	13	67	3	129	20	3	17
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	10	862	0	114	740	0	0	76	140	0	43	0
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		
Detector Phase	2	2		6	6		8	8	8	4	4	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0		10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	24.0	24.0		24.0	24.0		31.5	31.5	31.5	31.5	31.5	
Total Split (s)	88.0	88.0		88.0	88.0		32.0	32.0	32.0	32.0	32.0	
Total Split (%)	73.3%	73.3%		73.3%	73.3%		26.7%	26.7%	26.7%	26.7%	26.7%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.0	3.0	3.0	3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		3.5	3.5	3.5	3.5	3.5	
Lost Time Adjust (s)	-1.7	-1.7		-1.7	-1.7			-2.5	-2.5		-2.5	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	C-Max	C-Max		C-Max	C-Max		Max	Max	Max	Max	Max	
Act Effct Green (s)	84.0	84.0		84.0	84.0			28.0	28.0		28.0	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.23	0.23		0.23	
v/c Ratio	0.02	0.35		0.29	0.30			0.24	0.29		0.12	
Control Delay	5.7	7.4		7.6	5.9			39.9	7.8		25.1	
Queue Delay	0.0	0.0		0.0	0.0			0.0	0.0		0.0	
Total Delay	5.7	7.4		7.6	5.9			39.9	7.8		25.1	
LOS	A	A		A	A			D	A		C	
Approach Delay		7.4			6.1			19.1			25.1	
Approach LOS		A			A			B			C	
Queue Length 50th (ft)	2	122		24	81			48	0		15	
Queue Length 95th (ft)	8	152		41	99			93	52		46	
Internal Link Dist (ft)		498			1411			621			31	
Turn Bay Length (ft)	367			300					170			
Base Capacity (vph)	448	2447		387	2471			313	476		366	
Starvation Cap Reductn	0	0		0	0			0	0		0	
Spillback Cap Reductn	0	0		0	0			0	0		0	
Storage Cap Reductn	0	0		0	0			0	0		0	
Reduced v/c Ratio	0.02	0.35		0.29	0.30			0.24	0.29		0.12	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 120	
Offset: 80 (67%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.35	
Intersection Signal Delay: 8.5	Intersection LOS: A

Intersection Capacity Utilization 49.6% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 5: Westcliffe & Robertson

Appendix K

Network Intersections Multi-Modal Level of Service Analysis

Multi-Modal Level of Service - Intersections Form

Consultant	**Parsons**	**Project**	**2165 Robertson Road**
Scenario	**Existing conditions**	**Date**	**30/11/18**
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Robertson/Moodie				Robertson/Fitzgerald				Robertson/Westcliffe			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	8	8	9	9	3	3	5	5	0 - 2	3	5	5
	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
	Conflicting Left Turns	Protected	Protected	Protected	Protected	Protected/ Permissive	Protected	Protected/ Permissive	Protected/ Permissive	Protected/ Permissive	Protected/ Permissive	Protected/ Permissive	Protected/ 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
	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
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No
	Right Turn Channel	Conv'tl without Receiving Lane	Conv'tl without Receiving Lane	Conv'tl without Receiving Lane	Conv'tl without Receiving Lane	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	15-25m	15-25m	15-25m	15-25m	10-15m	10-15m	10-15m	10-15m	5-10m	5-10m	5-10m	5-10m
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings
	PETSI Score	**-2**	**-2**	**-19**	**-19**	**70**	**78**	**37**	**37**	**86**	**71**	**38**	**38**
	Ped. Exposure to Traffic LoS	**F**	**F**	**#N/A**	**#N/A**	**C**	**B**	**E**	**E**	**B**	**C**	**E**	**E**
	Cycle Length	130	130	130	130	130	130	130	130	130	130	130	130
	Effective Walk Time	31	31	28	28	26	26	22	22	25	25	17	17
	Average Pedestrian Delay	**38**	**38**	**40**	**40**	**42**	**42**	**45**	**45**	**42**	**42**	**49**	**49**
	Pedestrian Delay LoS	**D**	**D**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
	Level of Service	**F**	**F**	**#N/A**	**#N/A**	**E**	**E**	**E**	**E**	**E**	**E**	**E**	**E**
		#N/A				**E**				**E**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Pocket Bike Lane	Pocket Bike Lane	Pocket Bike Lane	Pocket Bike Lane	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic	Mixed Traffic	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP
	Right Turn Lane Configuration	Bike lane shifts to the left of right turn	Bike lane shifts to the left of right turn	≤ 50 m Introduced right turn lane	≤ 50 m Introduced right turn lane	≤ 50 m	≤ 50 m	Not Applicable	Not Applicable	≤ 50 m	≤ 50 m	≤ 50 m	Not Applicable
	Right Turning Speed	>25 to 30 km/h	>25 to 30 km/h	>25 to 30 km/h	>25 to 30 km/h	≤ 25 km/h	≤ 25 km/h	Not Applicable	Not Applicable	≤ 25 km/h	≤ 25 km/h	>25 km/h	Not Applicable
	Cyclist relative to RT motorists	**F**	**F**	**C**	**C**	**D**	**D**	**Not Applicable**	**Not Applicable**	**D**	**D**	**E**	**Not Applicable**
	Separated or Mixed Traffic	**Separated**	**Separated**	**Separated**	**Separated**	**Mixed Traffic**	**Mixed Traffic**	**Separated**	**Separated**	**Mixed Traffic**	**Mixed Traffic**	**Mixed Traffic**	**Separated**
	Left Turn Approach	≥ 2 lanes crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	One lane crossed	One lane crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	No lane crossed	One lane crossed	≥ 2 lanes crossed	≥ 2 lanes crossed
	Operating Speed	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	≥ 60 km/h	≥ 60 km/h	≤ 40 km/h	> 40 to ≤ 50 km/h	≥ 60 km/h	≥ 60 km/h
	Left Turning Cyclist	**F**	**F**	**F**	**F**	**E**	**E**	**F**	**F**	**B**	**D**	**F**	**F**
	Level of Service	**F**	**F**	**F**	**F**	**E**	**E**	**F**	**F**	**D**	**D**	**F**	**F**
		F				**F**				**F**			
Transit	Average Signal Delay	> 40 sec	> 40 sec	≤ 20 sec	≤ 30 sec	≤ 40 sec		≤ 10 sec	≤ 10 sec		≤ 30 sec	≤ 10 sec	≤ 20 sec
	Level of Service	**F**	**F**	**C**	**D**	**E**	**-**	**B**	**B**	**-**	**D**	**B**	**C**
		F				**E**				**D**			
Truck	Effective Corner Radius	> 15 m	> 15 m	> 15 m	> 15 m	10 - 15 m	10 - 15 m	> 15 m	> 15 m	< 10 m	< 10 m	> 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	1	1	≥ 2	≥ 2	1	1
	Level of Service	**A**	**A**	**A**	**A**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**
		A				**C**				**D**			

Multi-Modal Level of Service - Intersections Form

Consultant	**Parsons**	**Project**	**2165 Robertson Road**
Scenario	**Improvements**	**Date**	**30/11/18**
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Robertson/Moodie				Robertson/Fitzgerald				Robertson/Westcliffe			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	7	7	8	8	3	3	5	5	0 - 2	3	5	5
	Median	Median > 2.4 m	Median > 2.4 m	Median > 2.4 m	Median > 2.4 m	No Median - 2.4 m	No Median - 2.4 m	Median > 2.4 m	Median > 2.4 m	No Median - 2.4 m	No Median - 2.4 m	Median > 2.4 m	Median > 2.4 m
	Conflicting Left Turns	Protected	Protected	Protected	Protected	Protected/ Permissive	Protected	Protected	Protected	Protected/ Permissive	Protected/ Permissive	Protected	Protected
	Conflicting Right Turns	Protected	Protected	Protected/ Permissive	Protected/ Permissive	Permissive or yield control	Permissive or yield control	Protected	Protected	Permissive or yield control	Permissive or yield control	Protected	Protected
	Right Turns on Red (RToR) ?	RTOR prohibited	RTOR prohibited	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR prohibited	RTOR prohibited	RTOR allowed	RTOR allowed	RTOR prohibited	RTOR prohibited
	Ped Signal Leading Interval?	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
	Right Turn Channel	Smart Channel	Smart Channel	Smart Channel	Smart Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel	No Channel
	Corner Radius	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	5-10m	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	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Std transverse markings	Std transverse markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings
	PETSI Score	**37**	**37**	**14**	**14**	**70**	**78**	**61**	**61**	**86**	**71**	**61**	**61**
	Ped. Exposure to Traffic LoS	**E**	**E**	**F**	**F**	**C**	**B**	**C**	**C**	**B**	**C**	**C**	**C**
	Cycle Length	120	120	120	120	120	120	120	120	120	120	120	120
	Effective Walk Time	36	36	36	36	36	36	36	36	36	36	36	36
	Average Pedestrian Delay	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**	**29**
	Pedestrian Delay LoS	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**
	Level of Service	**E**	**E**	**F**	**F**	**C**	**C**	**C**	**C**	**C**	**C**	**C**	**C**
		F				**C**				**C**			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP
	Right Turn Lane Configuration	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Right Turning Speed	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
	Cyclist relative to RT motorists	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**	**Not Applicable**
	Separated or Mixed Traffic	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**	**Separated**
	Left Turn Approach	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box
	Operating Speed	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	≥ 60 km/h	≥ 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	≥ 60 km/h	≥ 60 km/h
	Left Turning Cyclist	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
	Level of Service	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
		A				**A**				**A**			
Transit	Average Signal Delay	≤ 30 sec	≤ 30 sec	≤ 20 sec	≤ 30 sec	≤ 30 sec		≤ 10 sec	≤ 10 sec		≤ 30 sec	≤ 10 sec	≤ 20 sec
	Level of Service	**D**	**D**	**C**	**D**	**D**	**-**	**B**	**B**	**-**	**D**	**B**	**C**
		D				**D**				**D**			
Truck	Effective Corner Radius	> 15 m	> 15 m	> 15 m	> 15 m	10 - 15 m	10 - 15 m	> 15 m	> 15 m	< 10 m	< 10 m	> 15 m	> 15 m
	Number of Receiving Lanes on Departure from Intersection	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	1	1	≥ 2	≥ 2	1	1
	Level of Service	**A**	**A**	**A**	**A**	**B**	**B**	**C**	**C**	**D**	**D**	**C**	**C**
		A				**C**				**D**			