

# 3194 Jockvale Road

## Transportation Impact Assessment

Step 1 & 2 Screening and Scoping Report

Step 3 Forecasting Report

Step 4: Strategy Report (Draft)

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## 1 Screening

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

## 2 Existing and Planned Conditions

### 2.1 Proposed Development

The proposed development (zoning bylaw amendment and plan of subdivision application), located at 3194 Jockvale Road, is currently zoned as part Mixed-Use Centre (MC) and partially Development Reserve (DR). The existing land is currently a mix of farm fields and tree buffer areas. The proposed development would include a total of 210 stacked townhome units and approximately 200,000 sq. ft of retail space. Jockvale Road will be extended south from the Barrhaven Towncentre and a new east-west road will be constructed along the south frontage and the adjacent property with a new intersection at Greenbank Road. Two additional right-in/right-out accesses are proposed along Greenbank Road. The existing service road crossing of the Kennedy-Burnett SWM pond will be formalized into a pedestrian connection. The anticipated full build-out will be in a single phase and occupancy horizon is 2026. The development is located within the Nepean Towncentre Design Priority and Community Design Plan area, and the Nepean Area 7 Secondary Plan area. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

An ongoing OPA, and separate application, will rezone the whole area as MC with site specific exceptions. Separate TIAs may be required to support future site plan applications.

Figure 1: Area Context Plan



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: November 5, 2018



## 2.2 Existing Conditions

### 2.2.1 Area Road Network

*Greenbank Road:* Greenbank Road is a City of Ottawa arterial road with a four-lane urban cross-section, transitioning to two-lanes south of Jockvale Road. Sidewalks are provided on the east side of the road and transition to a paved shoulder on the east side. The posted speed limit is 60 km/h. The Ottawa Official Plan reserves a 37.5 metre right of way between Strandherd Drive and future Chapman Mills Drive, and 44.5 metre south of Chapman Mills Drive.

*Jockvale Road (rural):* Jockvale Road, adjacent to Greenbank Road, is a City of Ottawa local road with a two-lane cross-section that transitions between an urban cross section and a rural cross section, with gravel shoulders. The posted speed is 60 km/h and the right-of-way is 26.0 metre west of Greenbank Road and 20.0 metre to the east.

*Jockvale Road (urban):* Jockvale Road, north of Strandherd Drive, is a City of Ottawa major collector road with a two-lane rural cross-section including gravel shoulders. The posted speed limit is 60 km/h and the right-of-way is 26.0 metre. South of Strandherd Drive, Jockvale Road is a City of Ottawa collector road with an unposted 50 km/h speed limit. The road is an urban cross-section, with 24.0 metre dedicated to the right-of-way, narrowing to 20.0 metre between the existing commercial/retail (currently a Best Buy and Home Depot).

*Strandherd Drive:* Strandherd Drive is a City of Ottawa arterial road with a four-lane urban cross-section, including sidewalks. The posted speed limit is 60 km/h and the Ottawa Official Plan reserves a 44.5 metre right of way.

*Marketplace Avenue:* Marketplace Avenue is a City of Ottawa collector road with a two-lane urban cross-section, including sidewalks and on-street parking. The posted speed limit is 50 km/h and the right-of-way is 20.0 metre.

### 2.2.2 Existing Intersections

#### *Greenbank Road / Jockvale Road*

The intersection of Greenbank Road and Jockvale Road is a signalized intersection with shared all movement lanes on the north and east bound approaches. The southbound approach consists of an auxiliary left-turn lane and a shared through/right-turn lane, and the westbound approach consists of a shared left-turn/through lane and an auxiliary right-turn lane. No turn restrictions were noted.

#### *Greenbank Road / Marketplace Avenue*

The intersection of Greenbank Road and Marketplace Avenue is a signalized intersection. The east and west bound approaches consist of an auxiliary left-turn lane and a shared through/right-turn lane. The southbound approach consists of dual auxiliary left-turn lanes, a through lane, a shared through/right-turn lane, and a bike lane. The northbound approach consists of an auxiliary left-turn lane, a through lane, and a shared through/right-turn lane. No turn restrictions were noted.

*Strandherd Drive / Greenbank Road*

The intersection of Strandherd Drive and Greenbank Road is a signalized intersection. The east and west bound approaches consist of an auxiliary left-turn lane, two through lanes, an auxiliary channelized right-turn lane, and a pocket bike lane. The northbound approach consists of dual auxiliary left-turn lanes, a through lane, a shared through/right-turn lane and a bike lane. The southbound approach consists of dual auxiliary left-turn lanes, two through lanes, an auxiliary channelized right-turn lane, and a pocket bike lane. No turn restrictions were noted.

*Strandherd Drive / Jockvale Road*

The intersection of Strandherd Drive and Greenbank Road is a signalized intersection. The east and west bound approaches consist of an auxiliary left-turn lane, a through lane, and a shared through/right-turn lane. The northbound approach consists of an auxiliary left-turn lane, through lane, and an auxiliary right-turn lane. The southbound approach consists of an auxiliary left-turn lane, and a shared through/right-turn lane. No turn restrictions were noted.

### 2.2.3 Existing Driveways

Along Greenbank Road, there are two accesses to the Barrhaven Towncentre, two accesses to the Loblaws site in the Chapman Mills Marketplace, and a residential access south of the Jockvale Road intersection. The Barrhaven Towncentre accesses are both right-in/right-out, the Loblaws access to the parking lot is right-in/right-out, and the loading access at the back of Loblaws permits full movements.

Along Strandherd Drive, there are an additional three right-in/right-out accesses and a signalized intersection for the Barrhaven Towncentre.

The On The Green golf range and mini putt access is located on Jockvale Road, west of Greenbank Road.

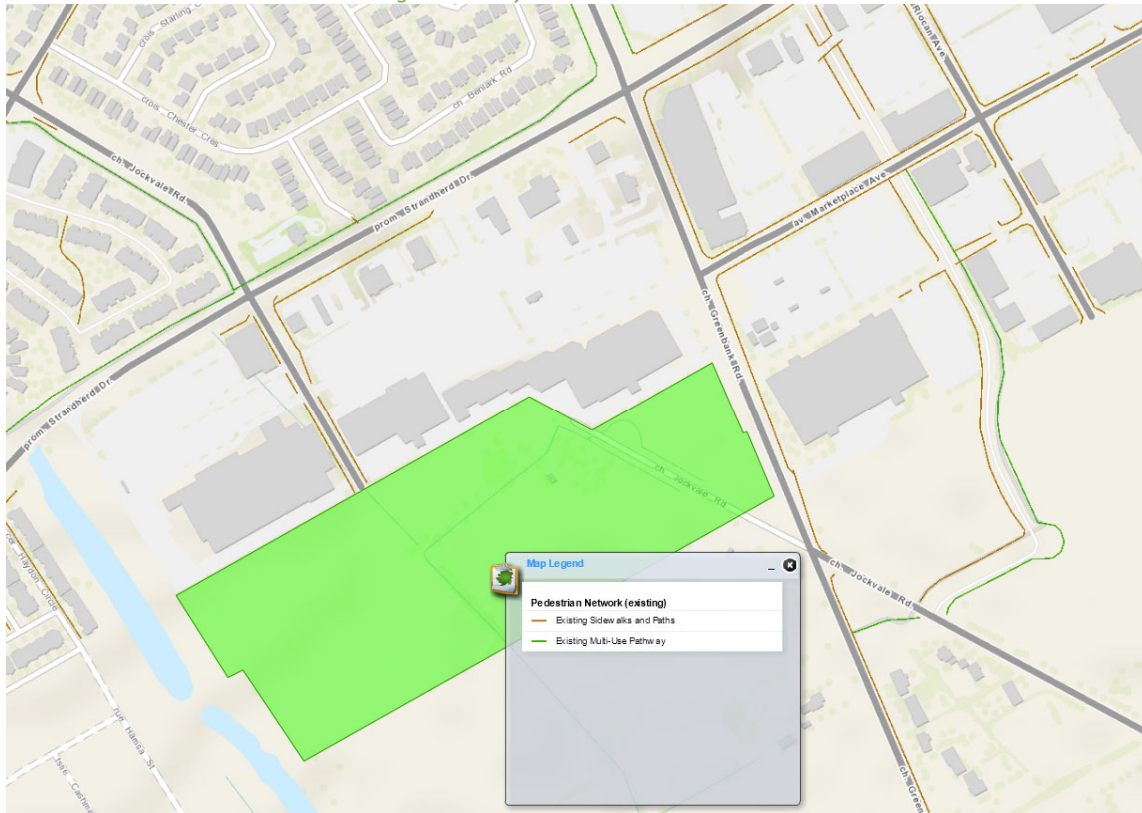
### 2.2.4 Cycling and Pedestrian Facilities

Figure 3 illustrates the pedestrian facilities in the study area and Figure 4 illustrates the cycling facilities.

Sidewalks are provided along both sides of the roadways in the study area with a multi-use pathway on the north side of Strandherd Drive and along the Southwest Transitway. The cycling network consists of the bike lanes north and east of the Greenbank Road and Strandherd Drive intersection, the multi-use pathways and a path along the east side of Greenbank Road, south of Jockvale Road.

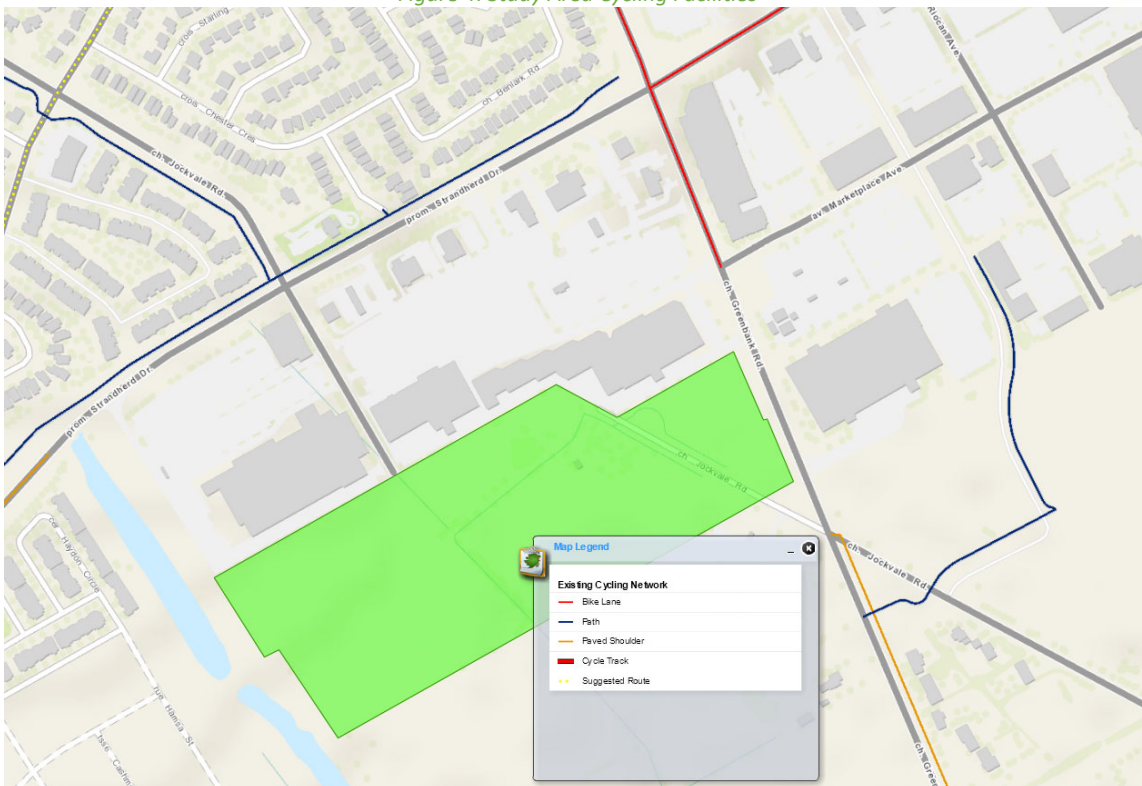


Figure 3: Study Area Pedestrian Facilities



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: November 5, 2018

Figure 4: Study Area Cycling Facilities



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: November 5, 2018

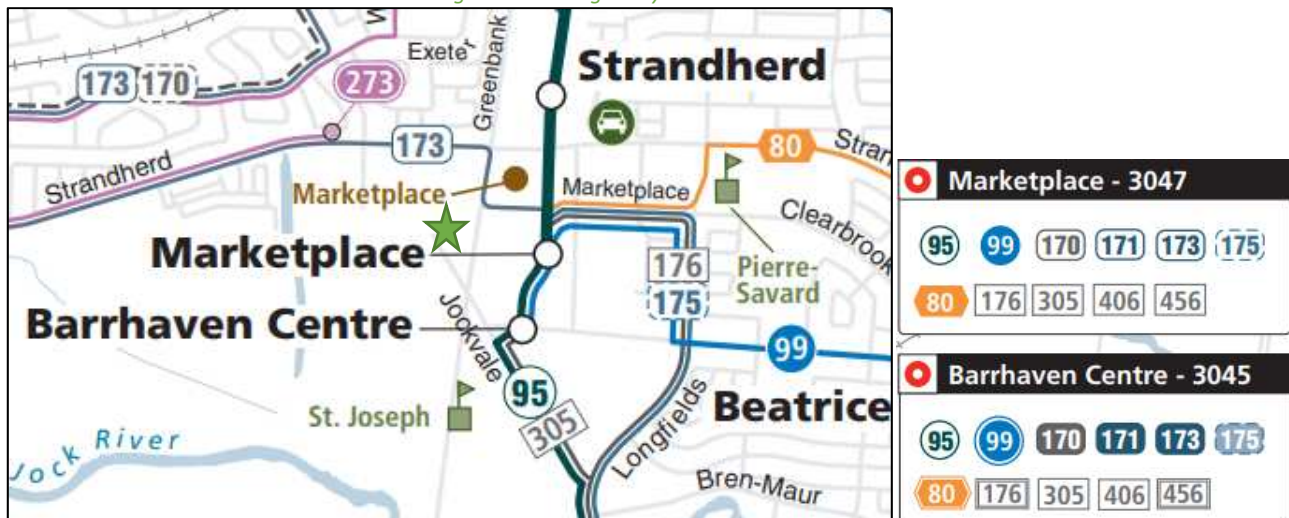
2.2.5 Existing Transit

Within the study area, the Southwest Transitway ends at the Barrhaven Towncentre Station, and includes Marketplace and Strandherd Stations. Routes #80, 95, 99, 170, 171, 173, 175, 176, 305, 406, and 456 stop at the Marketplace and Barrhaven Towncentre Stations, with route #173 traveling along Marketplace Avenue to Greenbank Road and west on Strandherd Drive, and routes #95 and 305 south on Greenbank Road from Jockvale Road. An additional route #273 travels along Strandherd Drive, west of Jockvale Road. The frequency of these routes within proximity of the proposed site currently are:

- Route #95 – under 5 minutes in the peak direction, and 10-15 minutes or 30 minutes in the off-peak direction and off-peak times
- Route #99 – every 15 minutes in the peak direction, and 30 minutes in the off-peak direction and off-peak times
- Route #173 – every 30 minutes

Figure 5 illustrates the transit system map in the study area and Figure 6 illustrates the walking distance for the Southwest Transitway. The Transitway stations will be beyond the 400m walk distance to the residential component and only encompass part of the retail component of the proposed site.

Figure 5: Existing Study Area Transit Service



Source: <http://www.octranspo.com/> Accessed: October 5, 2018

Figure 6: Study Area Transit Stations



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: November 5, 2018

2.2.6 Existing Area Traffic Management Measures

No existing area traffic management measures are noted within the Study Area.

2.2.7 Existing Peak Hour Travel Demand

Existing turning movement counts were acquired from the City of Ottawa for the existing Study Area intersection. Table 1 summarizes the intersection count dates.

Table 1: Intersection Count Date

Intersection	Count Date
<b>Greenbank Road and Jockvale Road</b>	August 16, 2016
<b>Greenbank Road and Marketplace Avenue</b>	February 10, 2016
<b>Strandherd Drive and Greenbank Road</b>	August 16, 2016
<b>Strandherd Drive and Jockvale Road</b>	January 18, 2018

Figure 7 illustrates the existing traffic counts and Table 2 summarizes the existing intersection operations. The level of service is based on the HCM criteria for average delay at signalized intersections. Detailed turning movement count data is included in Appendix B and the synchro worksheets are provided in Appendix C.

Figure 7: Existing Traffic Counts

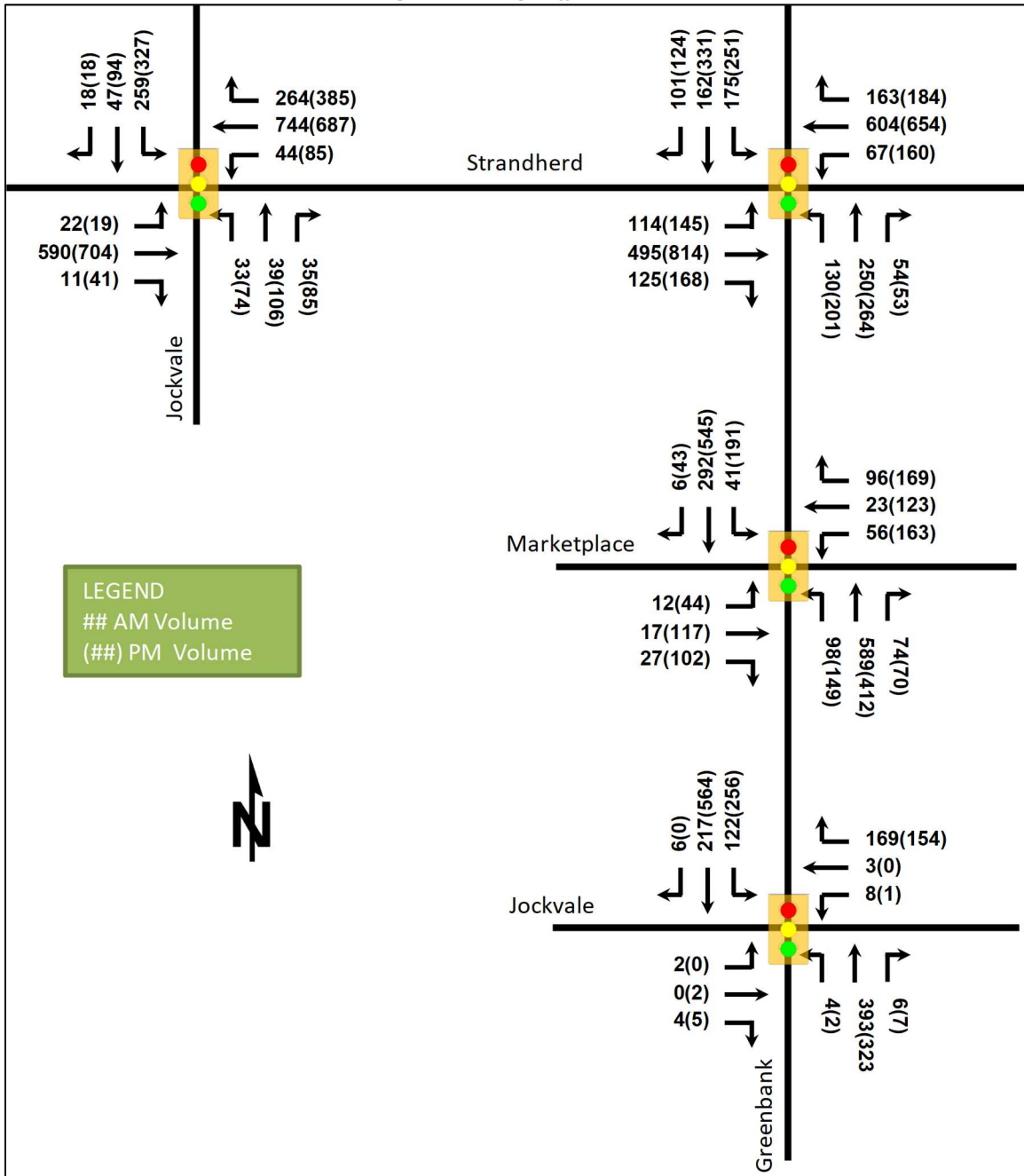


Table 2: Existing Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
Greenbank Road & Jockvale Road <i>Signalized</i>	EB	A	0.2	0.02	0.0	C	29.0	0.05	5.5
	WBL/T	D	42.5	0.07	8.7	D	42.0	0.01	1.9
	WBR	B	13.8	0.59	18.0	B	12.5	0.55	16.5
	NB	A	5.9	0.34	65.4	A	6.0	0.29	57.7
	SBL	A	1.6	0.17	10.0	A	2.2	0.33	20.4
	SBT/R	A	1.1	0.15	17.4	A	1.9	0.38	54.7
	<b>Overall</b>	<b>A</b>	<b>6.0</b>	-	-	<b>A</b>	<b>4.4</b>	-	-
Greenbank Road & Marketplace Avenue <i>Signalized</i>	EBL	C	31.9	0.60	7.2	C	30.3	0.25	17.3
	EBT/R	C	25.4	0.25	15.0	D	46.5	0.69	74.5
	WBL	D	35.6	0.27	21.9	D	53.2	0.75	#57.7
	WBT/R	B	14.7	0.37	23.4	D	52.1	0.81	#108.0
	NBL	E	77.6	0.76	#53.7	<b>F</b>	<b>87.5</b>	<b>0.86</b>	<b>#82.2</b>
	NBT/R	B	13.2	0.38	66.2	C	25.0	0.40	65.4
	SBL	D	47.2	0.21	10.6	D	58.7	0.63	39.2
	SBT/R	B	13.7	0.19	28.8	C	27.8	0.50	82.9
<b>Overall</b>	<b>C</b>	<b>20.8</b>	-	-	<b>D</b>	<b>41.4</b>	-	-	
Greenbank Road & Strandherd Drive <i>Signalized</i>	EBL	C	25.6	0.48	30.7	C	32.5	0.63	40.0
	EBT	C	34.0	0.55	77.4	E	58.4	0.94	#157.7
	EBR	A	5.4	0.25	12.9	A	6.3	0.33	17.3
	WBL	C	21.0	0.25	19.5	E	55.3	0.82	#67.7
	WBT	D	44.6	0.80	98.2	D	42.9	0.74	110.2
	WBR	A	6.7	0.35	17.0	A	6.2	0.35	18.2
	NBL	D	51.5	0.46	27.7	E	56.3	0.60	39.5
	NBT/R	C	31.3	0.36	48.8	D	35.7	0.41	51.2
	SBL	D	51.2	0.54	34.8	E	57.3	0.68	48.4
	SBT	C	30.0	0.18	27.8	D	36.6	0.40	55.5
	SBR	A	3.1	0.20	7.0	A	6.0	0.27	13.8
<b>Overall</b>	<b>C</b>	<b>32.9</b>	-	-	<b>D</b>	<b>44.2</b>	-	-	
Jockvale Road & Strandherd Drive <i>Signalized</i>	EBL	B	11.1	0.10	6.0	B	13.4	0.10	6.4
	EBT/R	B	19.0	0.40	69.2	C	26.6	0.59	104.7
	WBL	B	10.9	0.12	10.2	B	14.9	0.31	19.6
	WBT/R	B	19.9	0.63	132.5	C	23.5	0.72	157.8
	NBL	D	51.7	0.29	18.7	E	60.9	0.57	34.6
	NBT	D	48.7	0.24	20.5	E	55.4	0.55	44.9
	NBR	A	1.0	0.14	0.0	A	4.1	0.30	4.0
	SBL	E	60.7	0.88	#79.4	E	75.1	0.97	#137.7
	SBT/R	C	22.8	0.15	19.9	C	26.2	0.22	34.1
	<b>Overall</b>	<b>C</b>	<b>25.0</b>	-	-	<b>C</b>	<b>32.3</b>	-	-

The existing intersection operations generally operate satisfactorily during the peak hours, with the exception of the northbound left-turn movement at the Greenbank Road and Marketplace Avenue intersection during the PM peak. The delay for this movement exceeds 80 seconds and has a LOS 'F'.

### 2.2.8 Existing Collision Analysis

Collision data has been acquired from the City of Ottawa open data website (data.ottawa.ca) for four years prior to the commencement of this TIA for the surrounding study area road network. Table 3 summarizes the collisions types and conditions in the study area, Figure 8 illustrates the intersections and segments analyzed, and Table 4 summarizes the total collisions for each of these locations.

Table 3: Study Area Collision Summary

		Number	%
<b>Total Collisions</b>		<b>211</b>	<b>100%</b>
<b>Classification</b>	<b>Fatality</b>	1	0%
	<b>Non-Fatal Injury</b>	39	18%
	<b>Property Damage Only</b>	171	81%
<b>Initial Impact Type</b>	<b>Approaching</b>	1	0%
	<b>Angle</b>	12	6%
	<b>Rear end</b>	104	49%
	<b>Sideswipe</b>	29	14%
	<b>Turning Movement</b>	49	23%
	<b>SMV Other</b>	12	6%
	<b>Other</b>	4	2%
<b>Road Surface Condition</b>	<b>Dry</b>	138	65%
	<b>Wet</b>	43	20%
	<b>Loose Snow</b>	16	8%
	<b>Slush</b>	2	1%
	<b>Packed Snow</b>	3	1%
	<b>Ice</b>	9	4%
<b>Pedestrian Involved</b>		1	0.5%
<b>Cyclists Involved</b>		0	0%

Figure 8: Study Area Collision Records – Representation of 2014-2016



Table 4: Summary of Collision Locations

Intersections / Segments	Number	%
	<b>211</b>	<b>100%</b>
Greenbank Rd @ Jockvale Rd	19	9%
Greenbank Rd @ Marketplace Ave	14	7%
Greenbank Rd @ Strandherd Dr	101	48%

Strandherd Dr @ 215 W of Greenbank Rd/Barrhaven Mall SC	6	3%
Jockvale Rd @ Strandherd Dr	44	21%
Greenbank Rd btwn Marketplace Ave & Jockvale Rd	7	3%
Greenbank Rd btwn Strandherd Dr & Marketplace Ave	3	1%
Strandherd Dr btwn 215 W of Greenbank Rd/Barrhaven Mall SC & Greenbank Rd	5	2%
Strandherd Dr btwn Jockvale Rd & 215 W of Greenbank Rd/Barrhaven Mall SC	3	1%
Strandherd Dr btwn Andora Ave & Jockvale Rd	9	4%

Within the study area, the intersections of Greenbank Road at Strandherd Drive, and Jockvale Road at Strandherd Drive are noted to have significantly higher collision rates than the other study area intersections. Table 5 and The Greenbank Road at Strandherd Drive intersection had a total of 101 collisions during the 2014-2017 time period, with 89 involving property damage only, and the remaining 19 having non-fatal injuries. The high volume of rear end and turning movement collisions would indicate congestion being a major factor in the cause for the high collision rates. Combined with the predominantly property damage classification, these are low speed impacts. The turning movement collisions typically present a potential hazard to pedestrians and cyclists in the area, although none were documented and is not considered a concern in the future. Weather conditions are not considered to have a major impact on the collisions.

Table 6 summarize the collision types and conditions for the Greenbank Road at Strandherd Drive, Jockvale Road at Strandherd Drive intersections.

*Table 5: Greenbank Road at Strandherd Drive Collision Summary*

		<b>Number</b>	<b>%</b>
<b>Total Collisions</b>		<b>101</b>	<b>100%</b>
Classification	Non-Fatal Injury	19	19%
	Property Damage Only	82	81%
Initial Impact Type	Angle	3	3%
	Rear end	54	53%
	Sideswipe	14	14%
	Turning Movement	26	26%
	SMV Other	2	2%
	Other	2	2%
Road Surface Condition	Dry	71	70%
	Wet	18	18%
	Loose Snow	8	8%
	Slush	1	1%
	Packed Snow	1	1%
	Ice	2	2%
Pedestrian Involved		0	0%
Cyclists Involved		0	0%

The Greenbank Road at Strandherd Drive intersection had a total of 101 collisions during the 2014-2017 time period, with 89 involving property damage only, and the remaining 19 having non-fatal injuries. The high volume of rear end and turning movement collisions would indicate congestion being a major factor in the cause for the high collision rates. Combined with the predominantly property damage classification, these are low speed impacts. The turning movement collisions typically present a potential hazard to pedestrians and cyclists in the area, although none were documented and is not considered a concern in the future. Weather conditions are not considered to have a major impact on the collisions.

Table 6: Jockvale Road at Strandherd Drive Collision Summary

		Number	%
<b>Total Collisions</b>		<b>44</b>	<b>100%</b>
Classification	Fatality	1	2%
	Non-Fatal Injury	9	20%
	Property Damage Only	34	77%
Initial Impact Type	Angle	1	2%
	Rear end	26	59%
	Sideswipe	1	2%
	Turning Movement	14	32%
	SMV Other	2	5%
Road Surface Condition	Dry	28	64%
	Wet	9	20%
	Loose Snow	5	11%
	Ice	2	5%
Pedestrian Involved		1	2%
Cyclists Involved		0	0%

Similar to Greenbank Road at Strandherd Drive, property damage classification with rear end and turning movement collisions are the predominant trend at the Jockvale Road at Strandherd Drive intersection. Similar conclusions can also be drawn at this intersection, although a fatal collision with a pedestrian did occur. The fatal collision was at night and likely contributed to the incident.

Collision data is included in Appendix D.

## 2.3 Planned Conditions

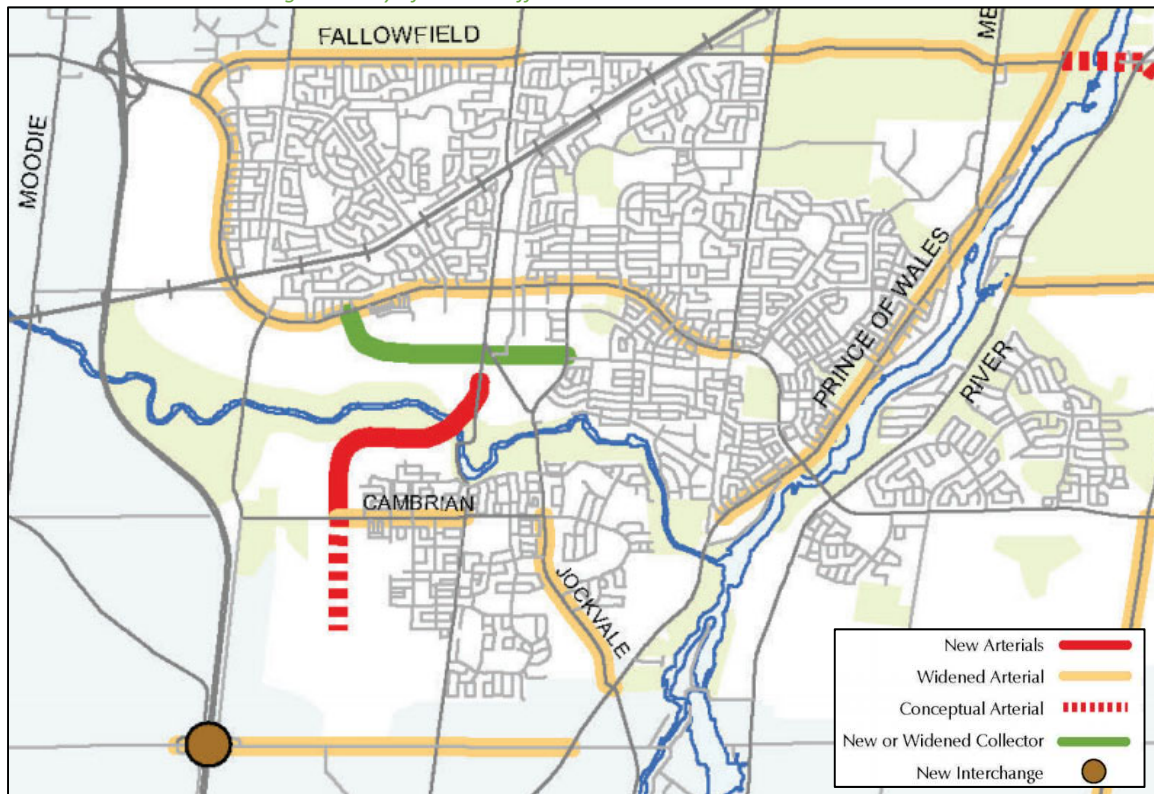
### 2.3.1 Changes to the Area Transportation Network

The subject development is within the South Nepean Towncentre (SNTC) Community Design Plan (CDP) and the Nepean South Area 7 Secondary Plan. A revision to the SNTC CDP is currently underway and this development is being proposed within the context of these revisions. The following projects are currently included within the 2031 Affordable Network and illustrated in Figure 9:

- Strandherd Drive Widening is in the process of being designed and constructed between Kennevale Road and Jockvale Road, including a 4-lane cross-section, and is estimated to be completed by 2020
- Chapman Mills Drive Extension from Longfields Drive to Strandherd Drive, including the extension of the bus rapid transit (BRT) corridor to the Southwest Transitway/Greenbank Road within the centre median
- Greenbank Road Re-Alignment, south of Chapman Mills Drive, to loop west around the existing Half Moon Bay development and connect to Cambrian Road, and will include cycle tracks and a future BRT extension within the centre median



Figure 9: City of Ottawa Affordable Network – Barrhaven Context



Beyond the 2031 Affordable Network horizon, the following network improvements are planned for the study area:

- Chapman Mills Drive BRT extension from Greenbank Road to Borrisokane Road
- Greenbank Road Re-Alignment extension south of Cambrian Road that will ultimately connect to Barnsdale Road and include connectivity improvements to Manotick

### 2.3.2 Other Study Area Developments

#### 3311 Greenbank Road

A residential subdivision has been proposed south of St Joseph High School by Minto Communities, in conjunction with the City of Ottawa. A total 144 townhome units (119 Minto and 25 City), and 64 mid-rise units (City) will ultimately be constructed within the proposed lands.

#### 3201 Greenbank Road

Currently under construction, approximately 11,000 ft<sup>2</sup> of retail and an 8,000 ft<sup>2</sup> restaurant space will be incorporated into the existing retail development of the Loblaws and Home Sense.

#### Barrhaven Towncentre – 3777 Strandherd Drive

A new pad is proposed for the Barrhaven Towncentre, with a total of 5,025 ft<sup>2</sup>. The new pad is located south of the existing BMO building.

#### Nepean Town Centre Development Corp. (NTCDC) – 3288 Greenbank Road

The proposed site is approximately 12.75-hectare site and is located south of the future Chapman Mills Drive corridor. The site is proposed to include 482 mid-rise mixed-use units, 343 high-rise units, and 496 mid-rise residential units. The file has completed an official plan amendment to adjust the land use (school and park), and

to modify policies related to building heights, street, density, to allow the development of a compact residential development.

#### *Burnett Lands – 3370 Greenbank Road (Claridge)*

The Burnett Lands are located south of the 3288 Greenbank Road development and is proposed to include 177 townhomes in Phase 1, 70 townhomes in Phase 2 and 720 condo units in Phase 3. Originally proposed to be completed by 2020, the plan of subdivision application is currently pending, and the Official Plan and Zoning By-Law Amendment have been adopted.

## 3 Study Area and Time Periods

### 3.1 Study Area

The study area will include the intersections of Greenbank Road and Jockvale Road, Greenbank Road and Marketplace Avenue, Greenbank Road and Strandherd Drive, and Strandherd Drive and Jockvale Road. Greenbank Road is noted as the boundary roads for the site.

The TRANS screenline SL-9 is located to the north at Fallowfield Road and SL-49 is located to the south along the Jock River and will not be reviewed as part of this study.

### 3.2 Time Periods

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

### 3.3 Horizon Years

The anticipated build-out year is 2026. As a result, the full build-out plus five years horizon year is 2031.

## 4 Exemption Review

Table 7 summarizes the exemptions for this TIA.

*Table 7: Exemption Review*

Module	Element	Explanation	Exempt/Required
<b>Design Review Component</b>			
<b>4.1 Development Design</b>	4.1.2 Circulation and Access	Only required for site plans	Exempt
	4.2.3 New Street Networks	Only required for plans of subdivision	Required
<b>4.2 Parking</b>	4.2.1 Parking Supply	Only required for site plans	Exempt
	4.2.2 Spillover Parking	Only required for site plans where parking supply is 15% below unconstrained demand	Exempt
<b>Network Impact Component</b>			
<b>4.5 Transportation Demand Management</b>	All Elements	Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Required
<b>4.6 Neighbourhood Traffic Management</b>	4.6.1 Adjacent Neighbourhoods	Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Exempt
<b>4.8 Network Concept</b>		Only required when proposed development generates more than 200 person-trips during the peak hour in	Exempt

Module	Element	Explanation	Exempt/Required
		excess of equivalent volume permitted by established zoning	

## 5 Development-Generated Travel Demand

### 5.1 Trip Generation and Mode Shares

This TIA has been prepared using the vehicle and person trip rates for the residential components using the TRANS Trip Generation Study Report (2009) and the vehicle trip rates for the retail components using the ITE Trip Generation Manual (10<sup>th</sup> Edition). To estimate person trip generation for the retail components, a factor of 1.28 has been applied to the ITE rates. Table 8 summarizes the person trip rates for the proposed land uses.

*Table 8: Trip Generation Person Trip Rates*

Dwelling Type	Land Use Code	Peak Hour	Vehicle Trip Rate	Person Trip Rates
Townhomes	224 (TRANS)	AM	0.54	0.98
		PM	0.71	1.16
Shopping Centre	820	AM	0.94	1.2
		PM	3.81	4.88

Using the above Person Trip rates, the total person trip generation has been estimates. Table 9 below illustrates the total person trip generation by dwelling type.

*Table 9: Total Person Trip Generation*

Land Use	Units / GFA	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Townhomes	210	76	130	206	129	115	244
Shopping Centre	200,000	149	91	240	468	508	976
<b>Total Person Trips</b>		<b>225</b>	<b>241</b>	<b>406</b>	<b>597</b>	<b>623</b>	<b>1,220</b>

Using the most recent National Capital Region Origin-Destination survey (OD Survey), the existing mode shares for South Nepean have been summarized in Table 10.

*Table 10: South Nepean Mode Share*

Travel Mode	Mode Share
Auto Driver	60%
Auto Passenger	15%
Transit	15%
Non-Auto	10%
<b>Total</b>	<b>100%</b>

Internal capture rates from the ITE Trip Generation Handbook 3<sup>rd</sup> Edition assigned to the development for the retail components for mixed-use developments. The rates summarized in Table 11 represent the percentage of trips to/from the retail uses based on the residential component. The pass-by reduction has also been included.

*Table 11: Internal Capture Rates*

Land Use	AM		PM	
	In	Out	In	Out
Residential to/from Shopping Centre	17%	14%	10%	26%
Pass-By Trips	20%			

Using the above mode shares and person trip rates the person trips by mode have been projected. Table 12 summarizes the trip generation by mode.

Table 12: Trip Generation by Mode

Travel Mode	Mode Share	In	Out	Total	In	Out	Total
<b>Auto Driver</b>	60%	110	111	221	294	295	589
<b>Auto Passenger</b>	15%	27	28	55	73	73	148
<b>Transit</b>	15%	27	28	55	73	73	148
<b>Non-Auto Modes</b>	10%	19	19	37	49	50	98
<b>Internal Capture</b>	-	13	18	31	13	30	43
<b>Pass-By</b>	-	30	18	48	94	102	195
<b>Total</b>	100%	226	222	447	596	623	1221

As shown above, 221 AM and 589 PM new peak hour two-way vehicle trips are projected as a result of the proposed development.

## 5.2 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the travel for the residential component and the retail travel patterns were applied based on the build-out of Barrhaven. Table 13 below summarizes the distributions.

Table 13: OD Survey Existing Mode Share – Ottawa Inner

To/From	Residential % of Trips	Retail % of Trips
<b>North</b>	80%	35%
<b>South</b>	5%	20%
<b>East</b>	10%	15%
<b>West</b>	5%	30%
<b>Total</b>	100%	100%

## 5.3 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the Study Area road network. Figure 10 illustrates the new site generated volumes and Figure 11 illustrates the pass-by volumes for the existing traffic.

Figure 10: New Site Generation Auto Volumes

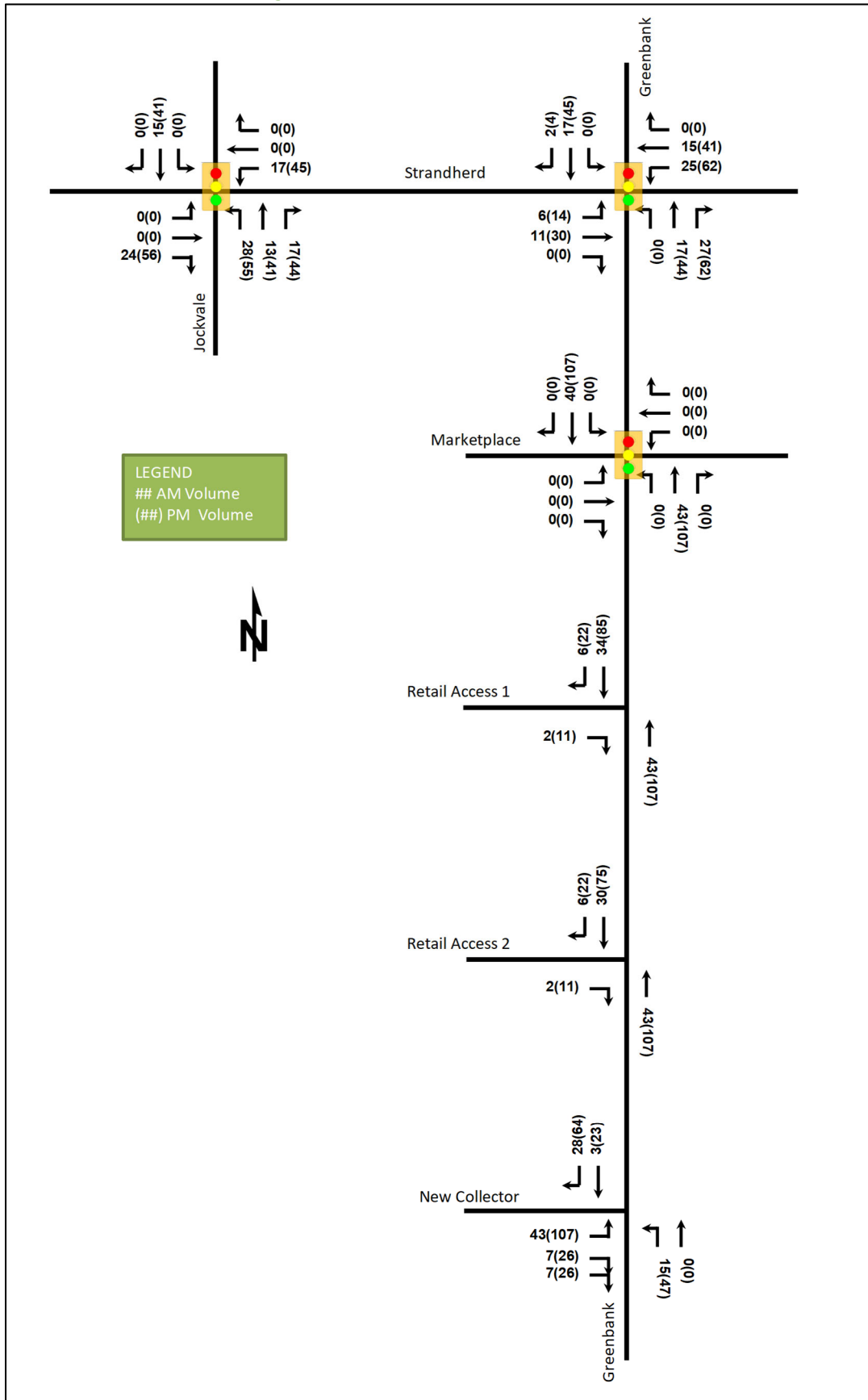
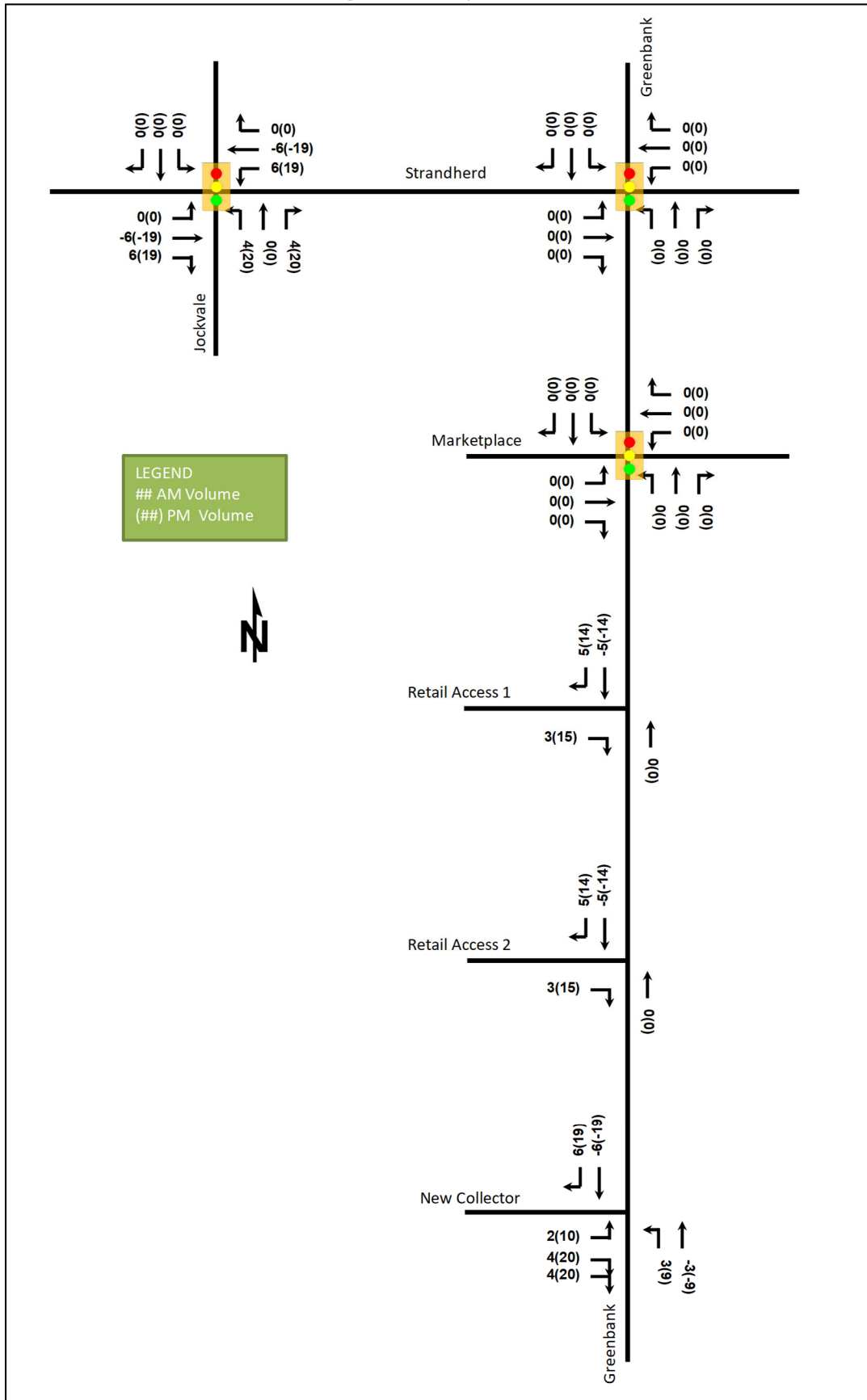


Figure 11: Pass-By Volumes



## 6 Background Network Travel Demands

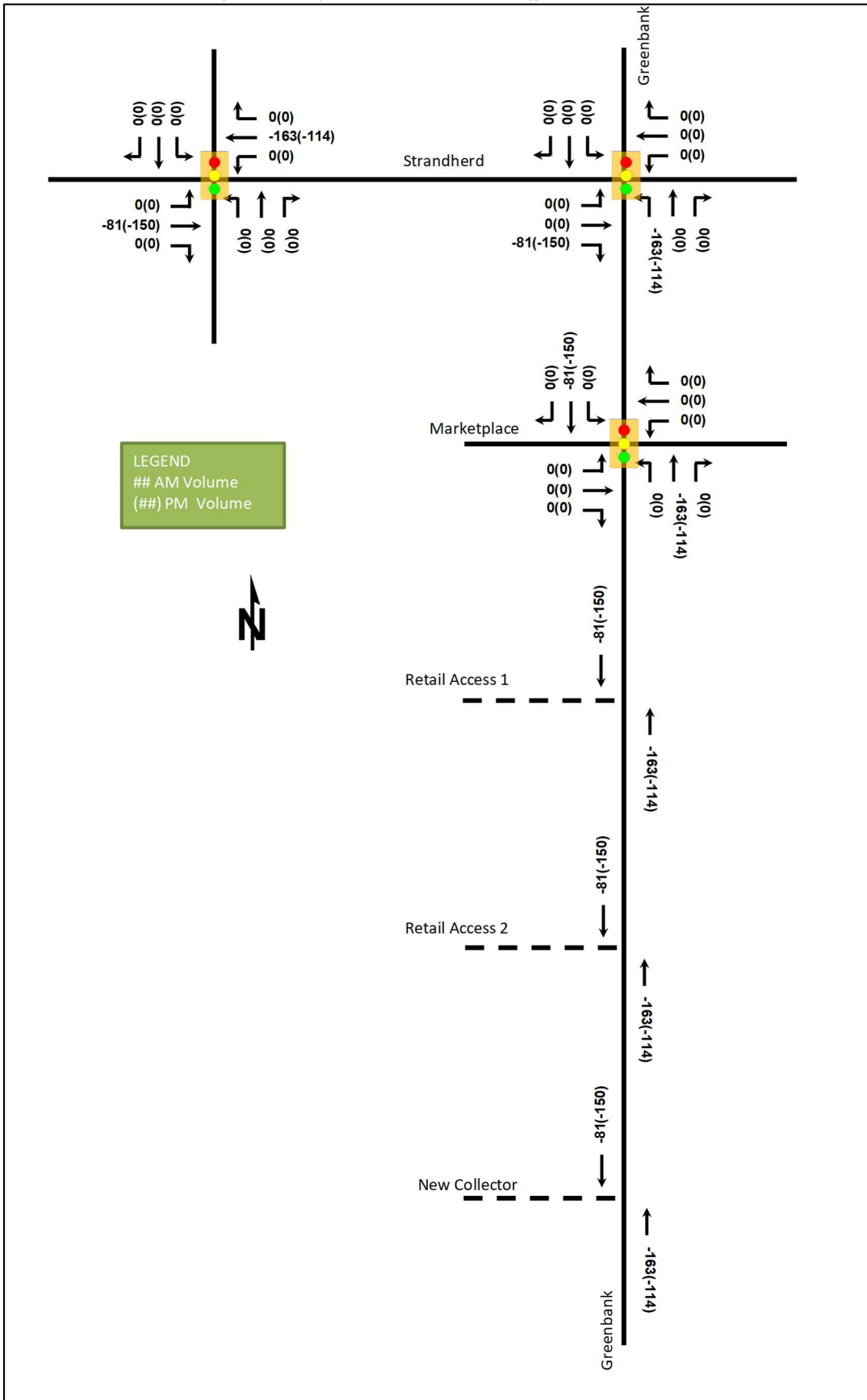
### 6.1 Transportation Network Plans

The transportation network plans were discussed in Section 2.3.2. The widening of Strandherd Drive (west of the study area) and the re-alignment of Greenbank Road (south of the study area) are not considered to have any notable impact on the study area traffic volumes and travel patterns. The extension of Chapman Mills Drive to Strandherd Drive is anticipated to have an impact along Greenbank Road, as commuters are likely going to travel west from Greenbank Road along Chapman Mills Drive, as an alternative to the Greenbank Road and Strandherd intersection.

To account for the diversion of traffic along Greenbank Road to the Chapman Mills Drive extension, a 25% shift from Greenbank Road has been assumed. The net trip reduction is illustrated in Figure 12 and will be incorporated within the 2031 horizon.

While the connection through to Strandherd Drive is not anticipated to be operational by 2031, an extension of Chapman Mills Drive from Longfields Drive to Greenbank Road will likely occur prior to 2026. Once extended to Greenbank Road, Jockvale Road will be decommissioned. Therefore, Jockvale Road is not considered during the future build-out horizons.

Figure 12: Chapman Mills Extension – Traffic Redistribution





## 6.2 Background Growth

The adjacent area transportation studies have used a 2-3% traffic growth in the area. This background growth would be conservative for the short-term horizons, but by the 2031 horizon may not be realistic given the location of the growth areas and limits on the roadway capacity prior to reaching the adjacent road/intersections. For example, Greenbank Road is a two-lane roadway south of the proposed site and has a reduced growth capacity available prior to the four-lane section along Barrhaven Town Centre and Chapman Mills Marketplace. Therefore, a 10% growth total is proposed for the area, between 2018 and 2031. This results in an approximate 0.76% growth annually along the mainline volumes.

Figure 13 illustrates the 2026 background volumes and Table 14 summarizes the 2026 background intersection operations. Figure 14 illustrates the 2031 background volumes and Table 15 summarizes the 2031 background intersection operations. The level of service is based on the HCM criteria for average delay at signalized intersections.

The synchro worksheets for the 2026 and 2031 background horizons are provided in Appendix E and Appendix F, respectively.

Figure 13: Background 2026 Volumes

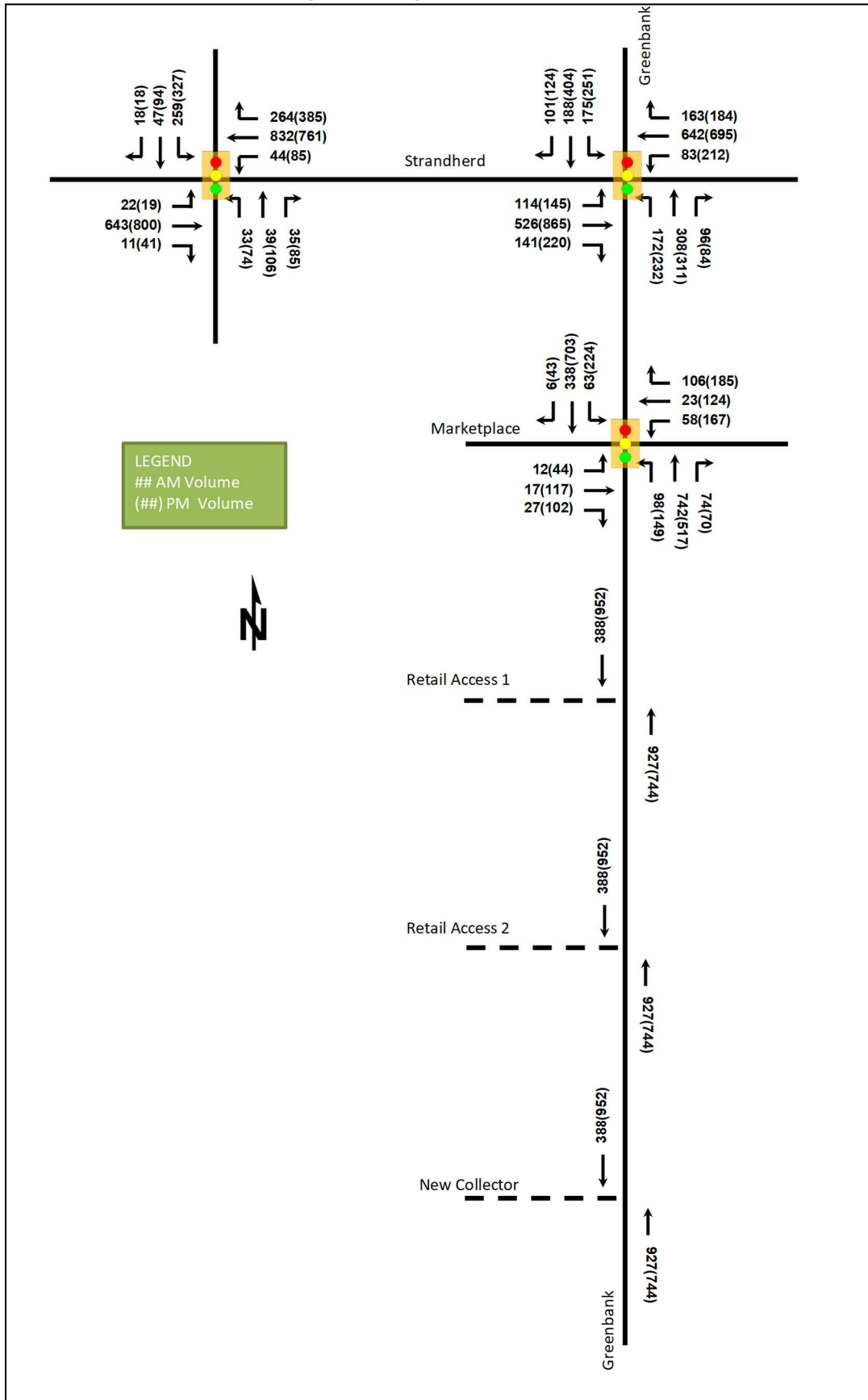


Table 14: 2026 Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Marketplace Avenue Signalized</b>	EBL	C	32.0	0.07	6.9	C	29.8	0.22	16.0
	EBT/R	C	25.5	0.23	13.9	D	44.0	0.64	66.3
	WBL	D	36.6	0.29	20.9	D	45.8	0.66	48.5
	WBT/R	B	15.1	0.40	22.4	D	49.1	0.78	92.2
	NBL	E	67.9	0.67	#47.2	E	77.9	0.78	#71.4
	NBT/R	B	14.2	0.43	75.4	C	25.5	0.43	72.8
	SBL	D	46.9	0.27	13.4	E	58.6	0.65	41.2
	SBT/R	B	12.9	0.19	29.6	C	28.5	0.56	97.2
<b>Overall</b>	<b>B</b>	<b>20.0</b>	-	-	-	<b>D</b>	<b>38.8</b>	-	-
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	24.2	0.43	27.6	C	28.4	0.55	36.2
	EBT	C	34.2	0.54	73.5	D	53.8	0.91	#146.6
	EBR	A	5.7	0.26	13.4	A	6.2	0.38	18.7
	WBL	C	21.2	0.27	21.1	E	77.6	0.95	#88.9
	WBT	D	43.6	0.78	92.6	D	41.1	0.70	104.6
	WBR	A	6.9	0.33	16.0	A	6.2	0.32	17.2
	NBL	D	50.1	0.51	31.7	D	55.8	0.61	40.8
	NBT/R	C	30.3	0.42	56.4	C	35.5	0.45	56.8
	SBL	D	50.0	0.51	32.0	D	56.2	0.64	44.0
	SBT	C	30.2	0.19	29.4	C	37.7	0.45	61.2
	SBR	A	2.3	0.19	4.6	A	4.5	0.24	10.2
<b>Overall</b>	<b>C</b>	<b>32.5</b>	-	-	-	<b>D</b>	<b>41.6</b>	-	-
<b>Jockvale Road &amp; Strandherd Drive Signalized</b>	EBL	B	10.7	0.08	5.5	B	12.7	0.09	5.7
	EBT/R	B	18.6	0.39	66.7	C	25.0	0.57	104.8
	WBL	B	10.7	0.11	9.2	B	14.1	0.28	17.5
	WBT/R	B	19.1	0.61	126.8	C	22.7	0.70	146.7
	NBL	D	50.8	0.26	17.0	E	58.3	0.51	31.8
	NBT	D	48.4	0.22	18.9	D	53.6	0.50	41.0
	NBR	A	0.9	0.12	0.0	A	4.6	0.29	4.6
	SBL	D	51.8	0.80	#81.7	D	45.5	0.79	#98.1
	SBT/R	C	22.1	0.14	18.1	C	25.7	0.20	31.1
<b>Overall</b>	<b>C</b>	<b>23.3</b>	-	-	-	<b>C</b>	<b>27.4</b>	-	-

The intersection operations for the 2026 background horizon generally operate satisfactorily during the peak hours. The northbound left-turn movement at the Greenbank Road and Marketplace Avenue intersection sees a slight drop in delay due to the increased traffic along Marketplace Avenue (the 3201 Greenbank Road development) and additional triggering of the protected left-turn phase.

Figure 14: Background 2031 Volumes

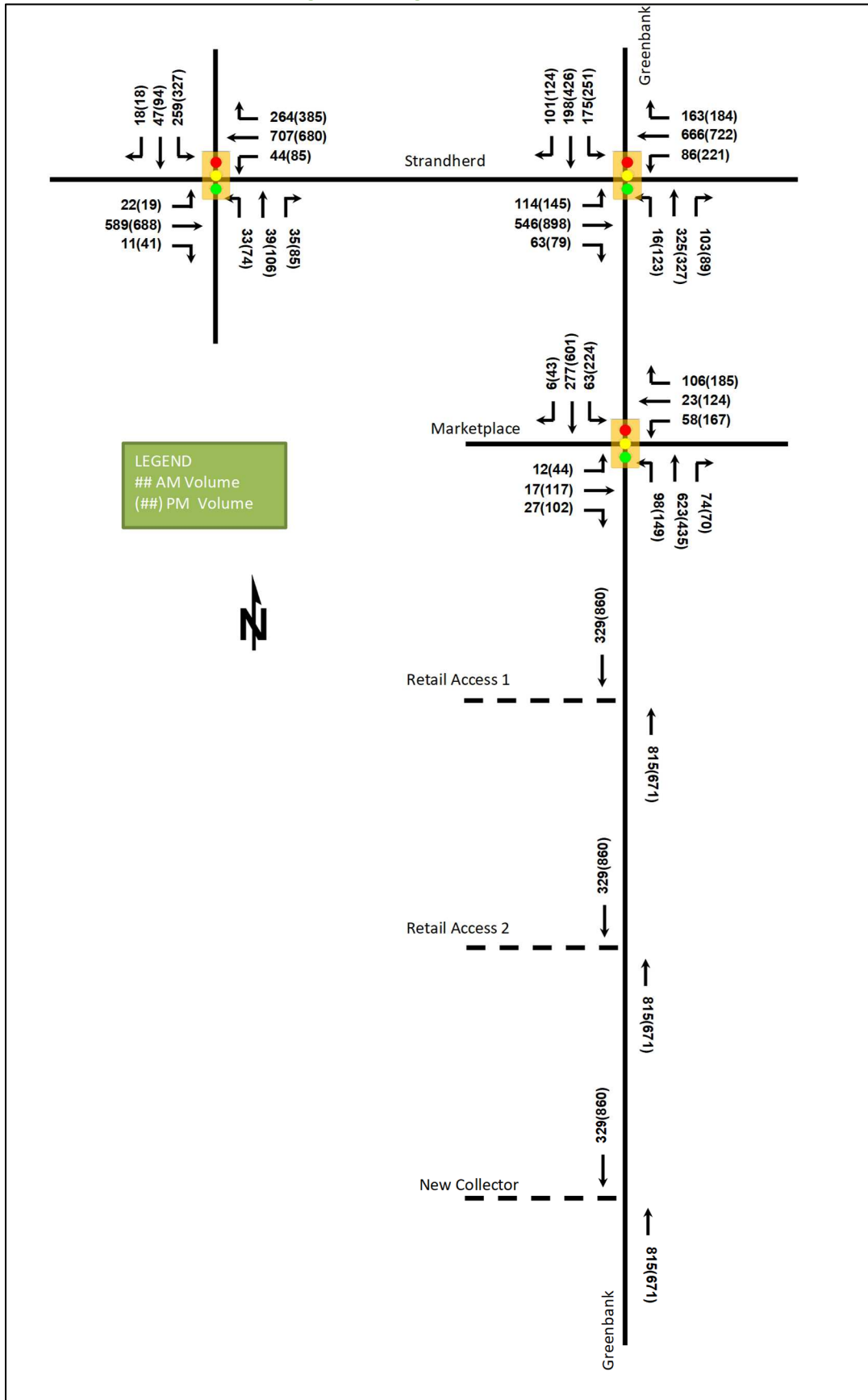


Table 15: 2031 Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
Greenbank Road & Marketplace Avenue <i>Signalized</i>	EBL	C	32.0	0.07	6.9	C	29.8	0.22	16.0
	EBT/R	C	25.5	0.23	13.9	D	44.0	0.64	66.3
	WBL	D	36.6	0.29	20.9	D	45.8	0.66	48.5
	WBT/R	B	15.1	0.40	22.4	D	49.1	0.78	92.2
	NBL	E	67.9	0.67	#47.2	E	77.9	0.78	#71.4
	NBT/R	B	13.4	0.37	62.2	C	24.4	0.37	61.2
	SBL	D	46.9	0.27	13.4	E	58.6	0.65	41.2
	SBT/R	B	12.6	0.16	24.7	C	27.0	0.48	81.6
	<b>Overall</b>	<b>C</b>	<b>20.3</b>	-	-	<b>D</b>	<b>39.0</b>	-	-
Greenbank Road & Strandherd Drive <i>Signalized</i>	EBL	B	24.7	0.45	27.6	C	29.0	0.56	36.2
	EBT	C	34.5	0.56	76.7	E	56.8	0.93	#155.8
	EBR	A	0.4	0.12	0.0	A	0.6	0.15	0.0
	WBL	C	21.4	0.29	21.9	<b>F</b>	<b>88.5</b>	<b>0.99</b>	<b>#95.1</b>
	WBT	D	44.1	0.80	96.5	D	41.7	0.72	109.4
	WBR	A	6.8	0.33	16.0	A	6.2	0.32	17.2
	NBL	D	51.0	0.08	5.7	E	56.1	0.45	24.8
	NBT/R	C	31.1	0.45	60.0	D	36.1	0.48	59.8
	SBL	D	50.4	0.51	32.0	E	56.4	0.64	44.0
	SBT	C	22.7	0.15	27.7	C	34.4	0.43	60.7
	SBR	A	1.7	0.14	4.2	A	4.0	0.23	9.6
	<b>Overall</b>	<b>C</b>	<b>31.9</b>	-	-	<b>D</b>	<b>43.8</b>	-	-
Jockvale Road & Strandherd Drive <i>Signalized</i>	EBL	B	10.6	0.07	5.5	B	12.6	0.08	5.7
	EBT/R	B	18.2	0.36	60.6	C	23.5	0.49	87.6
	WBL	B	10.6	0.10	9.2	B	13.5	0.24	17.5
	WBT/R	B	17.5	0.55	105.6	C	20.8	0.65	128.8
	NBL	D	50.8	0.26	17.0	E	58.3	0.51	31.8
	NBT	D	48.4	0.22	18.9	D	53.6	0.50	41.0
	NBR	A	0.9	0.12	0.0	A	4.6	0.29	4.6
	SBL	D	51.8	0.80	#81.7	D	45.5	0.79	#98.1
	SBT/R	C	22.1	0.14	18.1	C	25.7	0.20	31.1
	<b>Overall</b>	<b>C</b>	<b>22.7</b>	-	-	<b>C</b>	<b>26.5</b>	-	-

The overall intersection operations for the 2031 background horizon generally operate satisfactorily during the peak hours. Of note, the westbound left-turn movement at the Greenbank Road and Strandherd Drive is forecasted to be over capacity and have a delay exceeding 88 seconds during the PM peak hour. Signal timing adjustments, such as increasing the cycle length to 125 seconds and adjusting the phase splits would rectify the capacity constraint identified. Table 16 summarizes these adjustments and the synchro worksheet is provided within Appendix F. It is noted that the Strandherd Drive corridor would likely need similar adjustments to ensure the corridor progression remains intact and operations were as fluid as possible.

Table 16: 2031 Future Background Adjusted Greenbank Road and Strandherd Drive Intersection Operations

Intersection	Lane	PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	28.4	0.54	36.5
	EBT	E	57.4	0.92	#159.3
	EBR	A	0.6	0.15	0.0
	WBL	E	71.5	0.92	#93.1
	WBT	D	40.3	0.69	109.8
	WBR	A	5.9	0.31	17.2
	NBL	E	58.9	0.46	25.7
	NBT/R	D	38.1	0.48	62.4
	SBL	E	59.5	0.66	45.8
	SBT	D	36.3	0.43	63.4
	SBR	A	4.7	0.23	10.9
<b>Overall</b>	<b>D</b>	<b>43.4</b>	<b>-</b>	<b>-</b>	

### 6.3 Background Growth and Other Developments

The background developments explicitly considered in the background conditions (Section 6.2) include:

- 3201 Greenbank Road
- 3311 Greenbank Road
- 3370 Greenbank Road (Phase 1 for 2026, ultimate with the Chapman Mills Drive reduction for 2031)

The development within the Barrhaven Towncentre (3777 Strandherd Drive) is for a 5,000 sq. ft. pad and is anticipated to be negligible within the existing trips within the Towncentre. 3288 Greenbank Road has not proceeded in recent years with only zoning applications being completed. Therefore, both of these developments have not been included in the analysis.

The background development volumes within the study area have been provided in Appendix G.

## 7 Demand Rationalization

Given the background growth assumptions and future road network changes, no capacity constraints are currently noted for the area and rationalization for adjusted demand is not required for this TIA.

## 8 Development Design

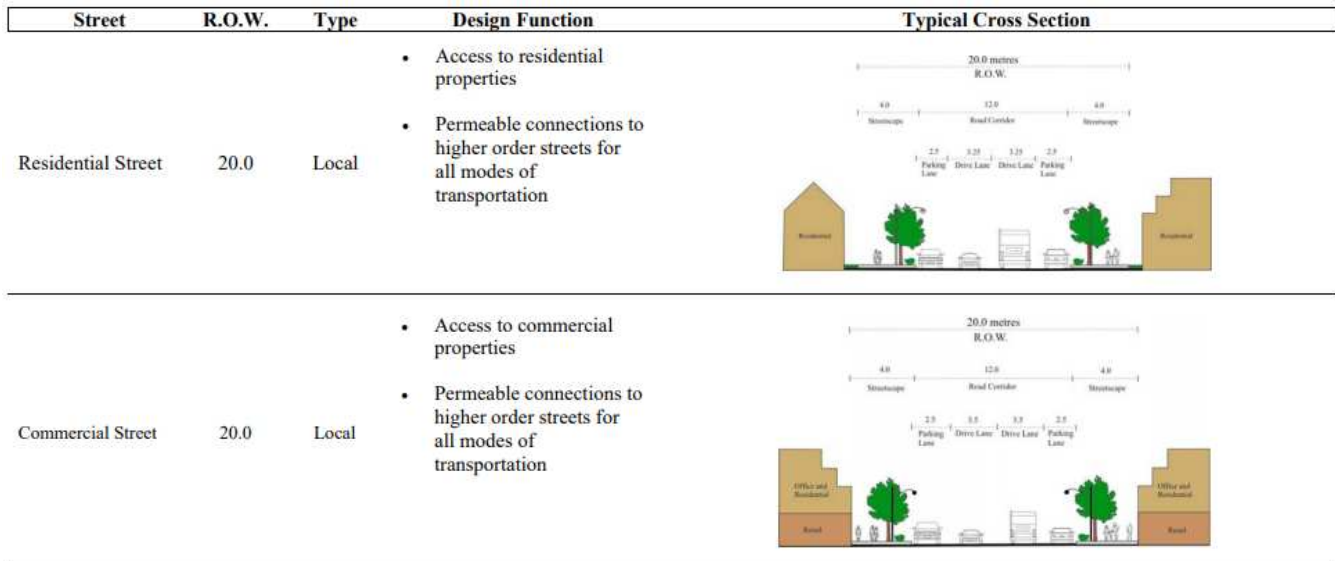
### 8.1 Design for Sustainable Modes

The bike and auto parking areas will be located near the main entrances for the residential and retail land-uses. Pedestrian connections will be made along Jockvale Road to the north, to Greenbank Road, and to the Kennedy-Burnett stormwater pond pathways. A cycling path will also be connected to the Kennedy-Burnett stormwater pond. The transit network is provided along the Southwest Transitway, while being beyond the 400m walking distance, is close enough in proximity for residents to walk to the transit routes.

### 8.2 New Street Networks

The new streets proposed as part of the plan of subdivision include the extension of Jockvale Road and a new collector road along the southern edge of the property. Figure 15 illustrates the cross-sections included within the South Nepean Town Centre Community Design Plan (2006) for Jockvale Road and the new collector road.

Figure 15: South Nepean Town Centre CDP Concept Cross-Sections



Recent developments in the area have highlighted the need to review these cross-sections to include additional space for utilities within the right-of-way. As illustrated, the cross-sections will need to support pedestrian, cycling, and transit modes.

Traffic calming elements will be recommended at the future intersection of Jockvale Road and the new collector road, including bulb-outs to narrow each approach to the intersection (e.g. reduced crossing distance). Within both of the residential and retail parts of the subdivision, narrowings should be considered at pedestrian crossing locations.

### 9 Boundary Streets Design

Table 17 summarizes the MMLOS analysis for the boundary road of Greenbank Road. The existing and future conditions have been summarized in separate rows. The future conditions are based on the existing four-lane divided cross section along Greenbank Road to the north. The MMLOS targets are based on the mixed-use centre land use. The MMLOS worksheet has been provided in Appendix F.

Table 17: Boundary Street MMLOS Analysis

Segment	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target
Greenbank Road (existing)	E	C	F	C	D	N/A	A	D
Greenbank Road (future)	E	C	C	C	D	N/A	A	D

Existing Greenbank Road does not meet the pedestrian and cycling MMLOS targets. The current cross-section is a transition location from a 4-lane divided urban cross section to a 2-lane rural cross-section. As such, it is understandable why these targets are not met in this location. With the extension of the urban cross-section of Greenbank Road, the bicycle target will be met, and the pedestrian target will continue to not be met. The travel speed and volumes along Greenbank Road are the primary influence on the pedestrian LOS and will not be met along any arterial.

The MMLOS analysis is provided in Appendix H.

## 10 Access Intersections Design

### 10.1 Location and Design of Access

The residential accesses will connect via local roads to the extension of Jockvale Road and the new collector road. The retail accesses will connect to Greenbank Road and the new collector road. No turning lanes are proposed for the access locations (e.g. right-turn lanes) and no median breaks are proposed for the access locations. As the accesses will be private approaches, the curb and sidewalk will be depressed across the access.

### 10.2 Intersection Control

Based on the projected volumes, a minor street stop-control is recommended on the site accesses. No further traffic control or turn lanes are warranted to address operational issues.

The new intersection at Greenbank Road and the New Collector Road does not meet signal warrants but operationally will require signalization for eastbound operational requirements.

Signal warrants have been provided in Appendix I.

### 10.3 Intersection Design

#### 10.3.1 2026 Future Total Intersection Operations

The 2026 future total intersection volumes are illustrated in Figure 16 and the operations are summarized below in Table 18. The level of service is based on the HCM criteria for average delay at signalized intersections. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix J.

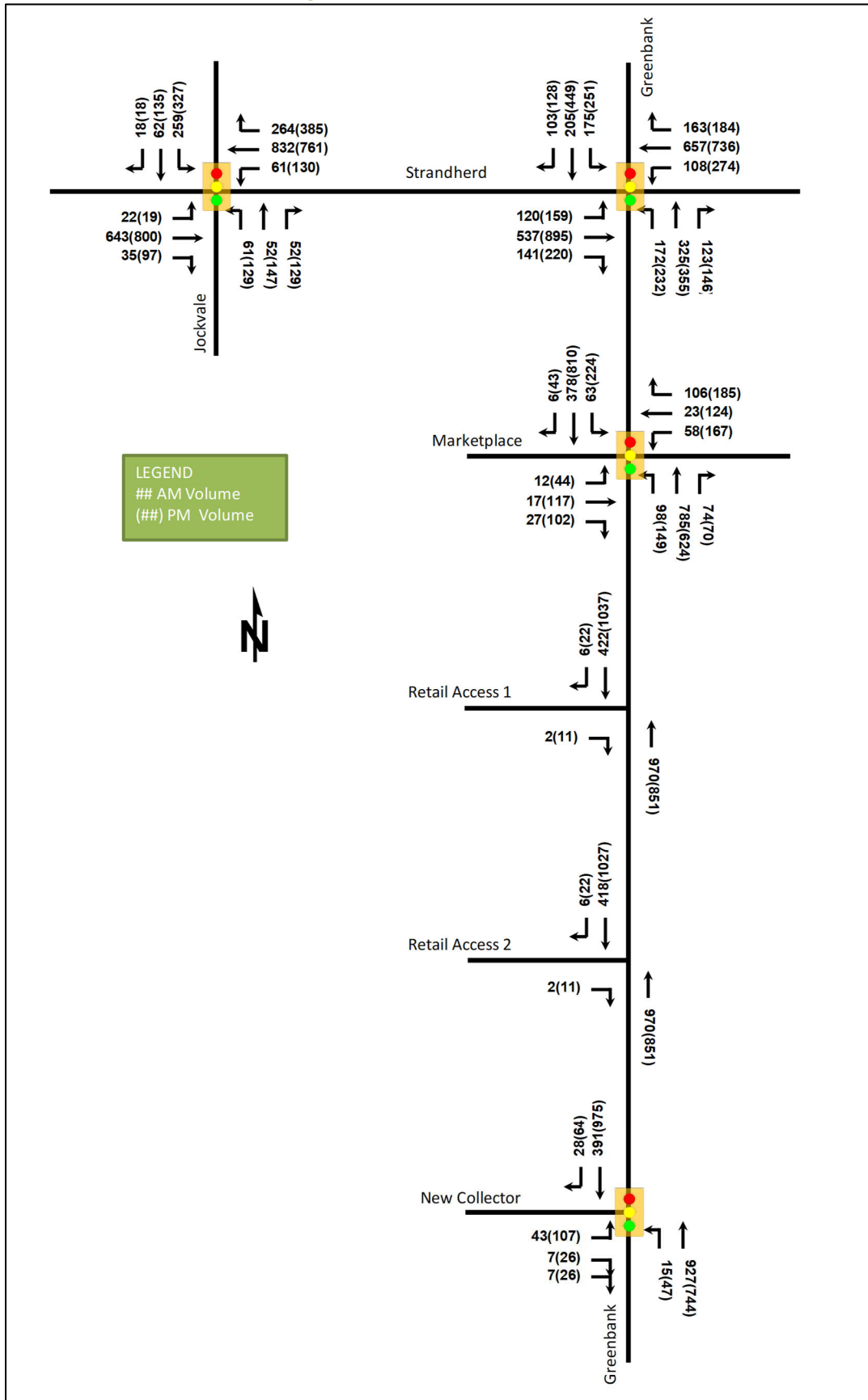
*Table 18: 2026 Future Total Site Intersection Operations*

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; New Collector Road</b> <i>Signalized</i>	EBL	B	15.6	0.13	9.2	B	16.3	0.31	16.2
	EBR	B	10.4	0.02	2.3	A	6.8	0.08	4.1
	NBL	A	3.0	0.02	1.8	A	6.4	0.15	6.0
	NBT	A	2.8	0.31	25.0	A	5.1	0.32	23.5
	SBT/R	A	2.2	0.14	10.0	A	5.9	0.46	35.7
	<b>Overall</b>	<b>A</b>	<b>3.1</b>	-	-	-	<b>A</b>	<b>6.2</b>	-

The 2026 future total conditions are forecasted to operate satisfactorily at the Greenbank Road and New Collector Road intersection. The minimum storage length of 37.5m (City of Ottawa) for signalized intersections is proposed for the left-turn lanes.



Figure 16: Future Total 2026 Volumes



### 10.3.2 2031 Future Total Intersection Operations

The 2031 future total intersection volumes are illustrated above in Figure 17 and the operations are summarized below in Table 19. The level of service is based on the HCM criteria for average delay at signalized intersections. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix K.

*Table 19: 2031 Future Total Site Intersection Operations*

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; New Collector Road</b> <i>Signalized</i>	EBL	C	24.9	0.21	11.7	C	24.8	0.41	20.3
	EBR	B	14.3	0.04	3.0	A	8.8	0.10	4.9
	NBL	A	2.4	0.02	1.6	A	5.0	0.13	5.5
	NBT	A	2.1	0.28	22.2	A	4.1	0.28	22.1
	SBT/R	A	1.7	0.12	8.7	A	4.6	0.39	33.3
	<b>Overall</b>	<b>A</b>	<b>2.9</b>	-	-	-	<b>A</b>	<b>5.7</b>	-

The 2031 future total conditions are forecasted to operate satisfactorily at the Greenbank Road and New Collector Road intersection. The minimum storage length of 37.5m (City of Ottawa) for signalized intersections is proposed for the left-turn lanes.

### 10.3.3 Intersection MMLOS

The Greenbank Road and New Collector Road intersection has been assessed under the assumed signalization and auxiliary lane configuration of northbound and eastbound auxiliary left-turn. Table 20 summarizes the MMMLOS analysis for the site access intersection. No MMLOS analysis has been provided for the right-in/right-out intersections as they are private approaches. The MMLOS worksheet has been provided in Appendix H.

*Table 20: Site Access Intersection MMLOS Analysis*

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
<b>Greenbank Road &amp; New Collector</b>	<b>D</b>	C	<b>F</b>	C	C	N/A	<b>E</b>	D	A	D

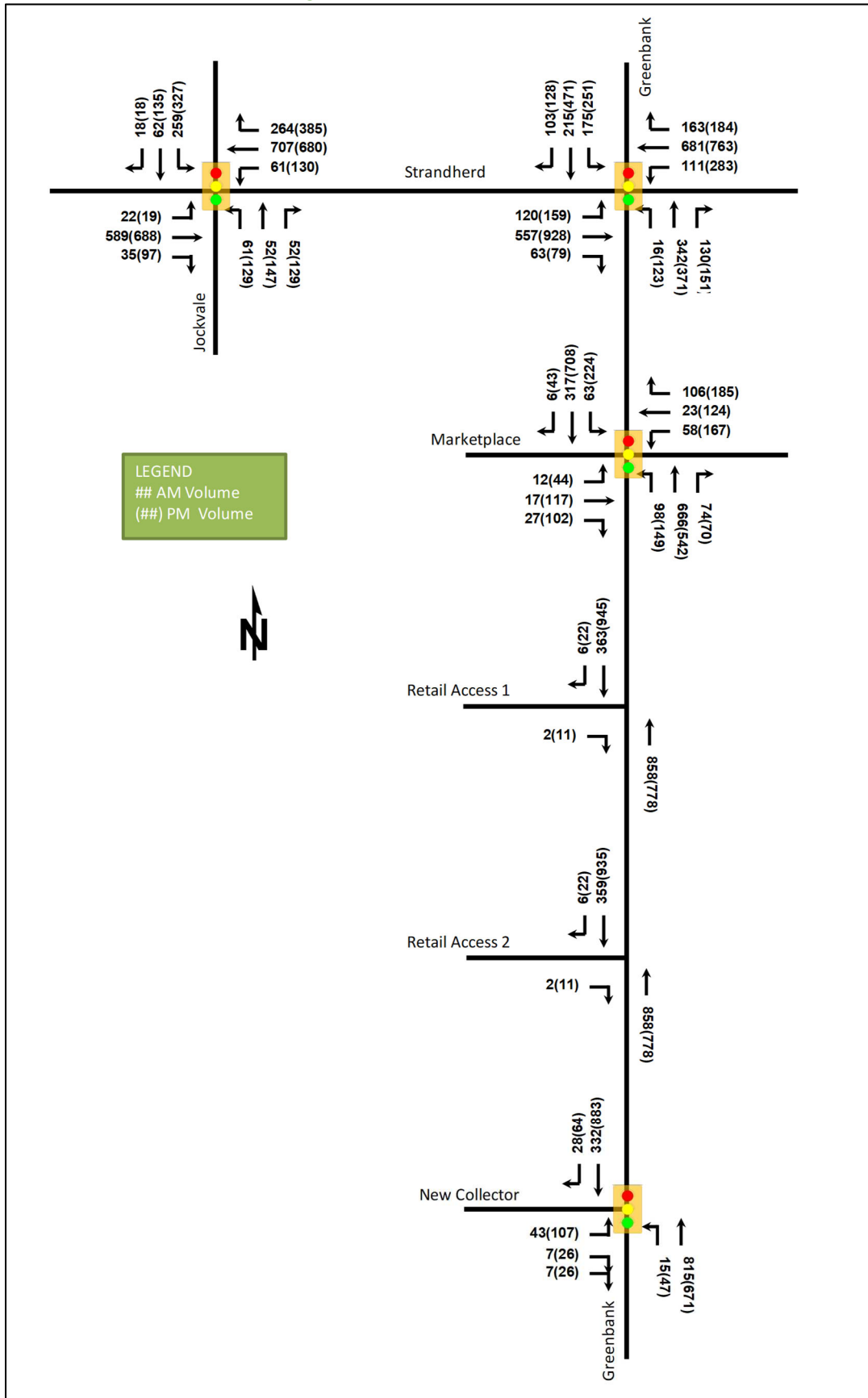
The MMLOS targets for a conceptual signalized intersection will not be met for the pedestrian, bicycle and truck levels of service. The pedestrian level of service would require a maximum of four lanes at a crossing to meet a LOS 'C'. A bike lane along Greenbank Road and the New Collector Road would satisfy the bicycle LOS, although a bike box or alternate left-turn configuration would be required on all approaches to meet the targets. The truck level of service is limited on the southbound right-turn due to the planned single receiving lane on the New Collector Road. It is likely that the bike lane, or similar facility, can be provided along the New Collector Road, but the restrictions of Greenbank Road as an arterial road, will limit the ability to address the other MMLOS targets.

### 10.3.4 Recommended Design Elements

The design elements for the site intersections, including the New Collector Road intersection, are summarized below:

- Yield or stop-control for the right-in/right-out accesses, typical for private approach accesses
- Signalization for the future Greenbank Road and New Collector Road intersection:
  - Does not meet signalization warrants, although operationally will be required to facilitate the eastbound movements
  - Northbound and westbound auxiliary left-turn lanes, with the City minimum storage of 37.5m
- Bike lanes along Greenbank Road and the New Collector Road

Figure 17: Future Total 2031 Volumes



## 11 Transportation Demand Management

### 11.1 Context for TDM

The mode shares used within the TIA represent this area of the City and have not been altered. The modal shares are likely to be achieved.

The subject site is within a design priority area.

Total bedrooms within the development is subject to the final unit count. No age restrictions are noted.

### 11.2 Need and Opportunity

The subject site has been assumed to rely predominantly on auto travel and those assumptions have been carried through the analysis. A decrease in the low transit or non-auto mode shares will result in a slight increase in volumes along Jockvale Road and Greenbank Road. The study area intersections are anticipated to have residual capacity and will not significantly impact its operations should the auto mode share increase. Dependent on the final retail uses, an increase of transit use may be achievable.

### 11.3 TDM Program

Any “suite of post-occupancy TDM measures” are limited in their applicability to an increase in transit use. It is anticipated that this development will rely predominantly on auto travel due to the retail component of the plan of subdivision and those assumptions have been carried through the analysis.

## 12 Transit

### 12.1 Route Capacity

Overall, the forecasted new transit trips would result in the need for approximately half a single bus (55-person capacity) in each direction during the AM peak hour, and an additional articulated bus or double decker (75/95-person capacity) in each direction during the PM peak hour to accommodate the additional transit trips from the subject site.

As no transit routes are currently routed along the boundary roads, this capacity is considered to be required along the Southwest Transitway, at the Marketplace and Barrhaven Towncentre Stations.

### 12.2 Transit Priority

No transit priority is required/considered for the study area.

## 13 Intersection Design

### 13.1 Intersection Control

The study area intersections of Greenbank Road and Marketplace Avenue, Greenbank Road and Strandherd Drive, and Jockvale Road and Strandherd are currently signalized and are considered to remain signalized in the future.

### 13.2 Intersection Design

#### 13.2.1 2026 Future Total Intersection Operations

The 2026 future total intersection volumes are illustrated above in Figure 16 and the operations are summarized below in Table 21. The level of service is based on the HCM criteria for average delay at signalized intersections. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix J.

Table 21: 2026 Future Total Study Area Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Marketplace Avenue Signalized</b>	EBL	C	32.0	0.13	6.9	C	29.8	0.22	16.0
	EBT/R	C	25.5	0.11	13.9	D	44.0	0.64	66.3
	WBL	D	36.6	0.17	20.9	D	45.8	0.66	48.5
	WBT/R	B	15.1	0.16	22.4	D	49.1	0.78	92.2
	NBL	E	67.9	0.09	#47.2	E	77.9	0.78	#71.4
	NBT/R	B	14.6	0.58	80.7	C	27.0	0.51	88.5
	SBL	D	46.9	0.07	13.4	E	58.6	0.65	41.2
	SBT/R	B	13.1	0.54	33.1	C	30.4	0.64	114.6
<b>Overall</b>	<b>B</b>	<b>19.9</b>	-	-	-	<b>D</b>	<b>38.8</b>	-	-
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	22.4	0.40	28.9	C	31.8	0.62	39.6
	EBT	C	33.9	0.51	75.8	E	56.5	0.93	#155.3
	EBR	A	5.5	0.25	13.5	A	6.2	0.37	18.7
	WBL	C	20.9	0.32	26.5	<b>F</b>	<b>163.8</b>	<b>1.23</b>	<b>#127.0</b>
	WBT	D	37.5	0.64	95.0	C	42.6	0.74	111.6
	WBR	A	6.1	0.29	16.0	A	6.2	0.32	17.2
	NBL	D	54.4	0.53	31.7	E	55.9	0.61	40.8
	NBT/R	C	34.6	0.51	62.1	D	36.6	0.57	70.6
	SBL	D	54.3	0.54	32.0	E	56.4	0.64	44.0
	SBT	C	33.9	0.23	31.6	D	38.8	0.51	68.1
	SBR	A	2.6	0.21	5.0	A	5.0	0.25	11.2
<b>Overall</b>	<b>C</b>	<b>32.2</b>	-	-	-	<b>D</b>	<b>49.1</b>	-	-
<b>Jockvale Road &amp; Strandherd Drive Signalized</b>	EBL	B	11.8	0.09	6.1	B	14.9	0.09	6.2
	EBT/R	B	19.8	0.41	74.2	C	30.6	0.66	121.3
	WBL	B	12.0	0.16	12.9	B	19.8	0.47	27.6
	WBT/R	C	20.3	0.62	135.8	C	25.4	0.71	158.0
	NBL	E	55.5	0.43	27.2	E	71.4	0.74	51.9
	NBT	D	48.2	0.26	23.3	D	53.3	0.56	54.1
	NBR	A	1.2	0.17	0.0	B	10.6	0.39	16.8
	SBL	D	48.4	0.78	#74.0	D	46.4	0.81	#96.0
	SBT/R	C	24.1	0.17	22.4	C	27.1	0.26	41.8
<b>Overall</b>	<b>C</b>	<b>24.2</b>	-	-	-	<b>C</b>	<b>31.6</b>	-	-

The 2026 future total conditions are forecasted to operate similarly to the background conditions. Of note, the westbound left-turn movement at the Greenbank Road and Strandherd Drive is forecasted to be over capacity and have a delay exceeding 163 seconds during the PM peak hour. Signal timing adjustments, such as increasing the cycle length to 130 seconds and adjusting the phase splits would rectify the capacity constraint identified. Table 22 summarizes these adjustments and the synchro worksheet is provided within Appendix J. It is noted that the Strandherd Drive corridor would likely need similar adjustments to ensure the corridor progression remains intact and operations were as fluid as possible.

Table 22: 2026 Future Total Adjusted Greenbank Road and Strandherd Drive Intersection Operations

Intersection	Lane	PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	28.4	0.56	39.2
	EBT	E	63.5	0.95	#169.1
	EBR	A	6.5	0.38	19.3
	WBL	E	73.7	0.94	#114.7
	WBT	D	39.2	0.65	113.2
	WBR	A	5.6	0.29	16.7
	NBL	E	62.4	0.64	44.4
	NBT/R	D	42.1	0.61	77.8
	SBL	E	62.9	0.67	47.6
	SBT	D	44.0	0.53	74.3
	SBR	A	6.7	0.27	14.0
<b>Overall</b>	<b>E</b>	<b>45.9</b>	<b>-</b>	<b>-</b>	

## 13.2.2 2031 Future Total Intersection Operations

The 2031 future total intersection volumes are illustrated above in Figure 17 and the operations are summarized below in Table 23. The level of service is based on the HCM criteria for average delay at signalized intersections. The signal timing has been optimized for the horizon. The synchro worksheets have been provided in Appendix I.

Table 23: 2031 Future Total Study Area Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Marketplace Avenue Signalized</b>	EBL	C	32.0	0.07	6.9	C	29.8	0.22	16.0
	EBT/R	C	25.5	0.23	13.9	D	44.0	0.64	66.3
	WBL	D	36.6	0.29	20.9	D	45.8	0.66	48.5
	WBT/R	B	15.1	0.40	22.4	D	49.1	0.78	92.2
	NBL	E	67.9	0.67	#47.2	E	77.9	0.78	#71.4
	NBT/R	B	13.7	0.39	66.7	C	25.9	0.45	76.4
	SBL	D	46.9	0.27	13.4	E	58.6	0.65	41.2
	SBT/R	B	12.8	0.18	28.0	C	28.6	0.56	97.7
	<b>Overall</b>	<b>C</b>	<b>20.1</b>	<b>-</b>	<b>-</b>	<b>D</b>	<b>38.7</b>	<b>-</b>	<b>-</b>
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	25.8	0.48	28.9	C	32.8	0.64	39.6
	EBT	D	37.7	0.64	79.0	E	59.3	0.95	#164.3
	EBR	A	0.5	0.13	0.0	A	0.6	0.15	0.0
	WBL	C	23.0	0.39	27.0	<b>F</b>	<b>182.3</b>	<b>1.27</b>	<b>#133.2</b>
	WBT	D	44.2	0.80	99.0	D	43.2	0.76	116.8
	WBR	A	6.7	0.32	16.0	A	6.2	0.32	17.2
	NBL	D	51.4	0.09	5.7	E	56.3	0.46	24.8
	NBT/R	C	31.8	0.50	65.6	D	37.6	0.60	74.2
	SBL	D	50.8	0.51	32.0	E	56.7	0.64	44.0
	SBT	C	23.1	0.16	29.9	D	35.4	0.47	67.3
	SBR	A	1.9	0.15	4.5	A	4.4	0.23	10.6
<b>Overall</b>	<b>C</b>	<b>32.8</b>	<b>-</b>	<b>-</b>	<b>D</b>	<b>52.4</b>	<b>-</b>	<b>-</b>	

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )	LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Jockvale Road &amp; Strandherd Drive Signalized</b>	EBL	B	11.6	0.08	6.1	B	14.7	0.08	6.2
	EBT/R	B	19.3	0.38	67.5	C	28.5	0.58	102.2
	WBL	B	11.9	0.15	12.9	B	18.2	0.42	27.6
	WBT/R	B	18.5	0.55	112.8	C	23.3	0.66	138.4
	NBL	E	55.5	0.43	27.2	E	71.4	0.74	51.9
	NBT	D	48.2	0.26	23.3	D	53.3	0.56	54.1
	NBR	A	1.2	0.17	0.0	B	10.6	0.39	16.8
	SBL	D	48.4	0.78	#74.0	D	46.4	0.81	#96.0
	SBT/R	C	24.1	0.17	22.4	C	27.1	0.26	41.8
<b>Overall</b>	<b>C</b>	<b>23.6</b>	<b>-</b>	<b>-</b>	<b>C</b>	<b>30.3</b>	<b>-</b>	<b>-</b>	

In generally, the 2031 future total conditions are forecasted to operate similarly to the background conditions. As identified in the 2026 future total conditions, the Greenbank Road and Strandherd Drive intersection will require timing adjustments to improve the westbound left-turn movement. Table 22 summarizes the operations if similar adjustments, as shown in Section 13.2.1, were made, and the synchro worksheet is provided within Appendix J.

Table 24: 2031 Future Total Adjusted Greenbank Road and Strandherd Drive Intersection Operations

Intersection	Lane	PM Peak Hour			
		LOS	Delay	V/C	Q (95 <sup>th</sup> )
<b>Greenbank Road &amp; Strandherd Drive Signalized</b>	EBL	C	26.8	0.54	38.2
	EBT	E	61.2	0.93	#174.9
	EBR	A	0.5	0.14	0.0
	WBL	E	72.8	0.93	#119.5
	WBT	D	37.7	0.63	117.3
	WBR	A	5.2	0.28	16.3
	NBL	E	64.6	0.48	27.4
	NBT/R	D	47.4	0.67	86.6
	SBL	E	65.7	0.68	49.5
	SBT	D	43.8	0.53	79.2
	SBR	A	2.1	0.24	3.4
	<b>Overall</b>	<b>D</b>	<b>46.6</b>	<b>-</b>	<b>-</b>

13.2.3 14.2.3 Intersection MMLOS

The signalization intersections have been assessed for the MMLOS targets for mixed-use arterial roads. Table 25 summarizes the MMLOS analysis and the worksheets have been provided in Appendix H.

Table 25: Study Area Intersection MMLOS Analysis

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
<b>Greenbank Road &amp; Marketplace Avenue</b>	<b>F</b>	C	<b>F</b>	C	F	N/A	B	D	B	D
<b>Greenbank Road &amp; Strandherd Drive</b>	<b>F</b>	C	<b>F</b>	C	F	N/A	B	D	C	D
<b>Jockvale Road &amp; Strandherd Drive</b>	<b>E</b>	C	<b>E</b>	C	F	N/A	<b>E</b>	D	B	D

Throughout the study area, the arterial road intersections do not meet the pedestrian or bicycle MMLOS targets. This is a systemic issue with the targets and analysis, as any leg of an intersection with one of the following elements will not meet the targets set out in the MMLOS Guidelines:

- more than four lanes to cross
- on roadways with 60km/h or higher travel speeds
- multiple lanes needing to be crossed for a bike left-turn will not meet the targets set out in the MMLOS Guidelines.

Given these intersections, and recent City of Ottawa reconstruction along Greenbank Road, no improvements are recommended as part of this study.

The truck level of service at the Jockvale Road and Strandherd Drive intersection receives a LOS 'E' due to the single receiving lane on the north leg of the intersection. If Jockvale Road, heading north from Strandherd Drive, had a second receiving lane, the LOS would become a 'B'. As Jockvale Road is not a truck route, no mitigation is recommended as part of this study.

#### 13.2.4 Recommended Design Elements

No study area intersection design elements are proposed as part of this study.

## 14 Summary of Improvements Indicated and Modifications Options

The following summarizes the analysis and results presented in this TIA report:

### Proposed Site and Screening

- The proposed site includes 210 stacked townhome units and approximately 200,000 sq. ft. of retail space
- Accesses will be provided along Greenbank Road, the extension of Jockvale Road, and a New Collector Road
- The development is proposed to be completed as a single phase by 2026
- The Trip Generation, Location, and Safety triggers were met for the TIA Screening

### Existing Conditions

- Greenbank Road and Strandherd Drive are arterial roads, and Jockvale Road and Marketplace Avenue are collector roads in the study area
- Sidewalks/MUPS are generally provided on both sides of the study area roadways, and on-street bike lanes on both sides of the roadway on Greenbank Road and on Strandherd Drive, east of Greenbank Road
- The high volumes roadways have produced a high number of collisions at the study area intersections, primarily at the Greenbank Road and Strandherd Drive, and Jockvale Road and Strandherd Drive intersections
- The collisions are predominantly rear end and turning movement collisions indicating that they are lower speed and a result of congestion

### Development Generated Travel Demand

- The proposed development is forecasted produce 447 two-way people trips during the AM peak hour and 1221 two-way people trips during the PM peak hour
- Of the forecasted people trips, 221 two-way trips will be vehicle trips during the AM peak hour and 586 two-way trips will be vehicle trips during the PM peak hour
- Of the forecasted trips, 80% are anticipated to travel north, 10% to the west, and 5% to both the east and south



### Background Conditions

- The background developments of 3201 Greenbank Road, 3311 Greenbank Road, and 3370 Greenbank Road (Phase 1 for 2026, ultimate with the Chapman Mills Drive reduction for 2031) were included in the background conditions, along with a total background growth of 10% along the mainline volumes
- By the 2031 horizon, the Chapman Mills Drive Extension to the west of the Kennedy-Burnett stormwater pond as been assumed to be constructed and an 25% diversion from Greenbank Road was assumed to use Chapman Mills Drive.
- Generally, the study area intersections will operate acceptably during the background horizons

### Development Design

- The bike and auto parking areas are to be located near the main entrances for the residential and retail land-uses
- Pedestrian connections will be made along Jockvale Road to the north, to Greenbank Road, and to the Kennedy-Burnett stormwater pond
- A cycling connection will also be connected to the Kennedy-Burnett stormwater pond
- The new streets proposed as part of the plan of subdivision include the extension of Jockvale Road and a new collector road along the southern edge of the property
- The cross-sections provided as part of the South Nepean Town Centre Community Design Plan (2006) should be used as the basis for the Jockvale Road extension and the New Collector Road
- The cross-sections noted above will need to be reviewed to assess the need for additional space to accommodate utilities within the right-of-way
- Traffic calming elements are recommended at the future intersection of Jockvale Road and the New Collector Road, including bulb-outs to narrow each approach to the intersection within both of the residential and retail parts of the subdivision at pedestrian crossing locations

### Boundary Street Design

- The future widened Greenbank Road will not meet pedestrian MMLOS targets, due to auto volumes, and posted speed limits (60km/h)
- Due to the issues limiting the ability to meet the MMLOS targets, no improvements are recommended for the future Greenbank Road to meet the pedestrian MMLOS targets

### Access Intersections Design

- Accesses are proposed along Greenbank Road, the Jockvale Road extension and the New Collector Road
- The accesses along Greenbank Road will be right-in/right-out, with a yield or stop control on the private approach, and will not require auxiliary turn lanes
- The accesses will have depressed curbs and sidewalks that carry across the access
- The design elements for the New Collector Road intersection, are summarized below:
  - Signalization for the future Greenbank Road and New Collector Road intersection
  - Does not meet signalization warrants, although operationally will be required to facilitate the eastbound movements
  - Northbound and westbound auxiliary left-turn lanes, with the City minimum storage of 37.5m
  - Bike lanes along Greenbank Road and the New Collector Road

### TDM

- The retail land use limits the potential for TDM measures to reduce the auto reliance anticipated for the proposed development

#### **Transit**

- No transit service is provided on the boundary road network, nor do future route plans include the proposed development at this time
- To meet minimum area transit use, a single bus, or equivalent capacity, would be required to support the proposed development during the AM peak hours, and an articulated or double decker bus would be required to support the proposed development during the PM peak hours

#### **Network Intersection Design**

- Generally, the study area intersections will operate acceptably during the background horizons, with the northbound left-turn at Greenbank Road and Strandherd Drive exceeding the capacity in both horizons
- A revision to the signal timing and cycle length (up to 130 seconds) would provide the additional capacity required and would need to be completed as part of a corridor signal timing adjustments along Strandherd Drive to ensure the appropriate corridor progression
- The MMLOS analysis identified that the pedestrian and bicycle targets cannot be met on the study area intersections due to intersection legs having more than four lanes to cross, 60km/h or higher travel speeds, or multiple lanes needing to be crossed for a bike left-turn
- The Jockvale Road and Strandherd Drive intersection did not meet the truck LOS on the north leg of the intersection due to a single receiving lane, although no mitigation is recommended as Jockvale Road is not a truck route

## 15 Next Steps

Following the circulation and review of this Strategy Report, any outstanding comments will be addressed within the context of the draft plan of subdivision submission. Once remaining TIA Steps are completed and sign-off has been received from City Transportation Project Manager, a signed and stamped final report will be provided to City staff.

# Appendix A

TIA Screening Form and PM Certification Form



## **TIA Plan Reports**

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

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

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

### **CERTIFICATION**

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

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


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Télécopieur: 613-560-6006

Dated at Ottawa this 20 day of September, 2018.  
(City)

Name: Andrew Harte  
(Please Print)

Professional Title: Professional Engineer

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

<b>Office Contact Information (Please Print)</b>
Address: 13 Markham Avenue
City / Postal Code: Ottawa / K2G 3Z1
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City of Ottawa 2017 TIA Guidelines  
Step 1 - Screening Form

Date: November 5, 2018  
Project Number: 2018-46  
Project Reference: Richcraft Barrhaven Towncentre

1.1 Description of Proposed Development	
Municipal Address	3194 Jockvale Road
Description of Location	NEPEAN CON 3 RF PT LOT 15 RP; 4R25501 PARTS 1 TO 3
Land Use Classification	Residential and Commerical/Retail
Development Size	210 apartment units, 200,855 sq. ft retail
Accesses	2 RIRO & 1 Signal on Greenbank, Extend Jockvale
Phase of Development	2
Buildout Year	2022
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger	
Land Use Type	Townhomes or apartments
Development Size	210 Units
Trip Generation Trigger	Yes

1.3 Location Triggers	
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	Yes
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?	Yes
Location Trigger	Yes

1.4. Safety Triggers	
Are posted speed limits on a boundary street are 80 km/hr or greater?	No
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?	No
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?	Yes
Is the proposed driveway within auxiliary lanes of an intersection?	Yes
Does the proposed driveway make use of an existing median break that serves an existing site?	No
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?	No
Does the development include a drive-thru facility?	No
Safety Trigger	Yes

# Appendix B

Turning Movement Counts



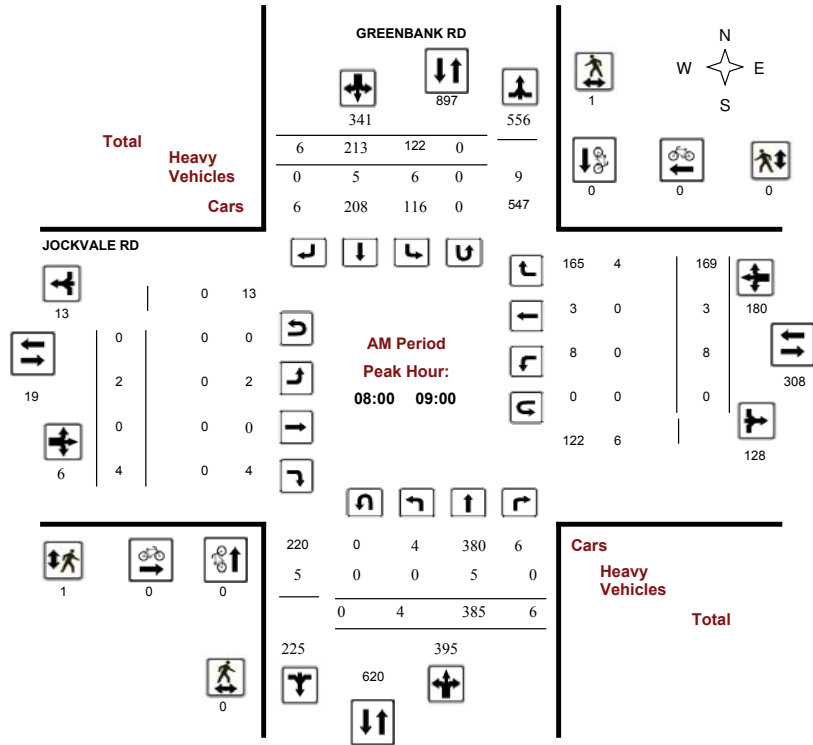
# Transportation Services - Traffic Services

## Turning Movement Count - Full Study Peak Hour Diagram

### GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36178  
Device: Miovision



Comments



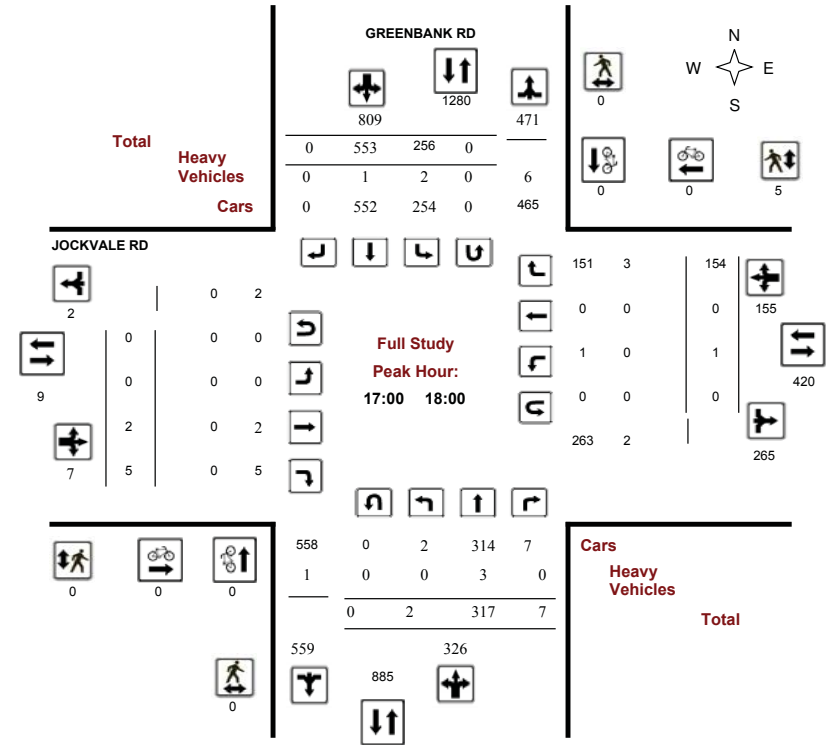
# Transportation Services - Traffic Services

## Turning Movement Count - Full Study Peak Hour Diagram

### GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36178  
Device: Miovision



Comments





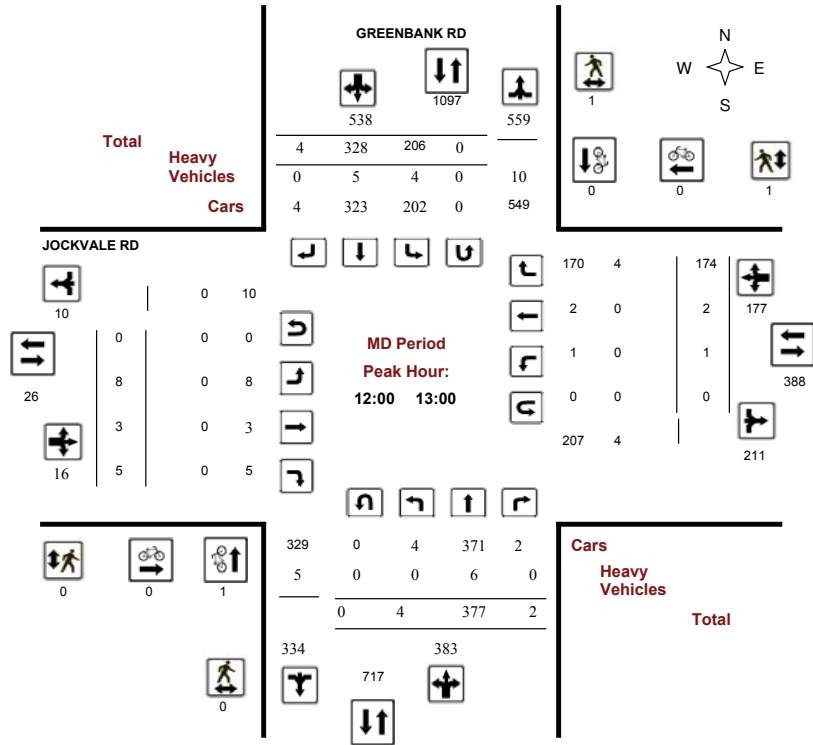
### Transportation Services - Traffic Services

#### Turning Movement Count - Full Study Peak Hour Diagram

#### GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36178  
Device: Miovision



Comments



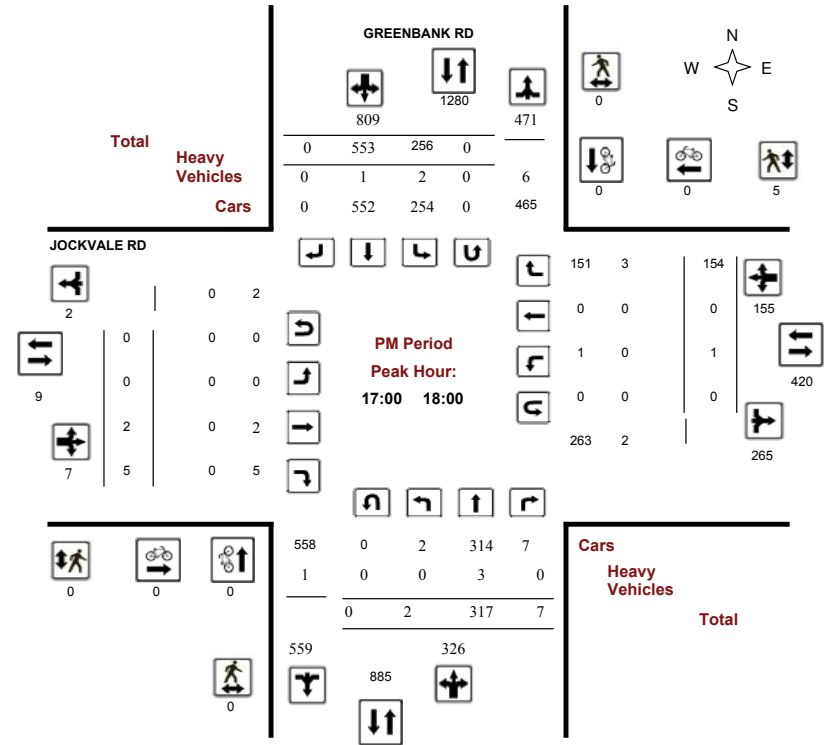
### Transportation Services - Traffic Services

#### Turning Movement Count - Full Study Peak Hour Diagram

#### GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36178  
Device: Miovision



Comments

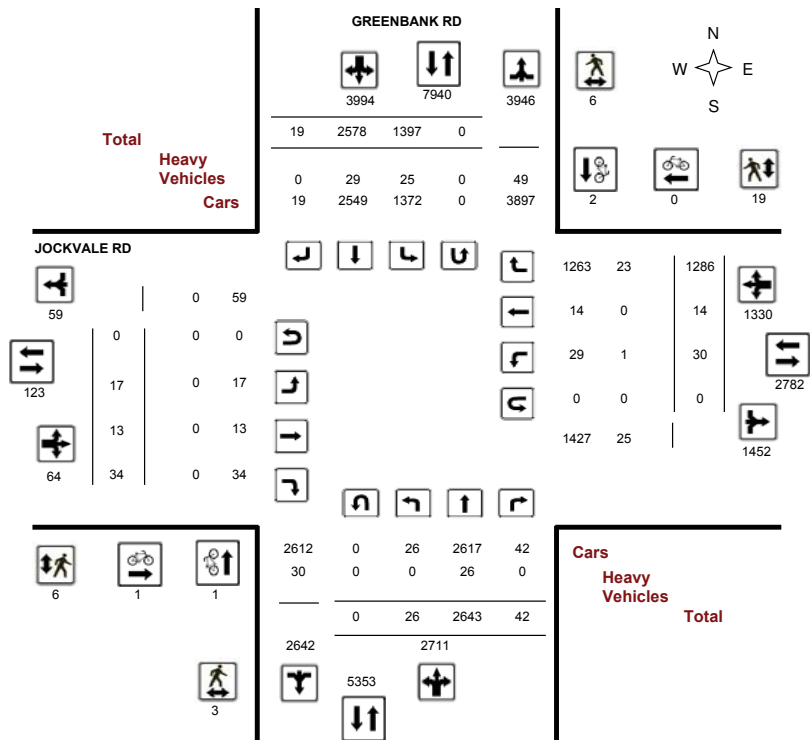


**Transportation Services - Traffic Services**  
**Turning Movement Count - Full Study Diagram**

**GREENBANK RD @ JOCKVALE RD**

Survey Date: Tuesday, August 16, 2016

WO#: 36178  
 Device: Miovision



Comments



**Transportation Services - Traffic Services**

Work Order  
36178

**Turning Movement Count - Full Study Summary Report**

**GREENBANK RD @ JOCKVALE RD**

Survey Date: Tuesday, August 16, 2016

**Total Observed U-Turns**      **AADT Factor**  
 Northbound: 0      Southbound: 0      .90  
 Eastbound: 0      Westbound: 0

**Full Study**

Period	GREENBANK RD						JOCKVALE RD						WB TOT	STR TOT	Grand Total				
	Northbound			Southbound			Eastbound			Westbound									
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT				EB TOT	LT	ST	RT
07:00 08:00	4	415	2	421	85	162	0	247	668	0	1	3	4	5	1	160	166	170	838
08:00 09:00	4	385	6	395	122	213	6	341	736	2	0	4	6	8	3	169	180	186	922
09:00 10:00	8	313	5	326	109	197	2	308	634	6	2	1	9	4	1	179	184	193	827
11:30 12:30	7	328	7	342	193	317	9	519	861	8	4	5	17	0	3	155	158	175	1036
12:30 13:30	0	318	2	320	210	316	2	528	848	1	3	6	10	2	3	201	206	216	1064
15:00 16:00	0	238	1	239	194	363	0	557	796	0	0	4	4	5	0	140	145	149	945
16:00 17:00	1	329	12	342	228	457	0	685	1027	0	1	6	7	5	3	128	136	143	1170
17:00 18:00	2	317	7	326	256	553	0	809	1135	0	2	5	7	1	0	154	155	162	1297
Sub Total	26	2643	42	2711	1397	2578	19	3994	6705	17	13	34	64	30	14	1286	1330	1394	8099
U Turns				0				0	0				0			0	0	0	0
Total	26	2643	42	2711	1397	2578	19	3994	6705	17	13	34	64	30	14	1286	1330	1394	8099
EQ 12Hr	36	3674	58	3768	1942	3583	26	5552	9320	24	18	47	89	42	19	1788	1849	1938	11258
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.																<b>1.39</b>			
AVG 12Hr	33	3306	53	3391	1748	3225	24	4996	8387	21	16	43	80	38	18	1609	1664	1744	10131
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.																<b>.90</b>			
AVG 24Hr	43	4331	69	4443	2289	4225	31	6545	10988	28	21	56	105	49	23	2108	2180	2285	13273
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.																<b>1.31</b>			

**Comments:**

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



Transportation Services - Traffic Services W.O. 36178

Turning Movement Count - 15 Minute Summary Report

GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016

Total Observed U-Turns

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

Time Period	GREENBANK RD Northbound			GREENBANK RD Southbound			JOCKVALE RD Eastbound			JOCKVALE RD Westbound			W TOT	STR TOT	Grand Total				
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT				E TOT	LT	ST	RT
07:00 07:15	0	112	0	112	22	39	0	61	173	0	0	0	0	1	0	27	28	201	
07:15 07:30	0	107	0	107	18	36	0	54	161	0	1	0	1	0	1	46	47	209	
07:30 07:45	2	108	0	110	16	40	0	56	166	0	0	1	1	0	0	40	40	207	
07:45 08:00	2	88	2	92	29	47	0	76	168	0	0	2	2	4	0	47	51	221	
08:00 08:15	1	107	3	111	29	46	1	76	187	0	0	1	1	4	0	46	50	238	
08:15 08:30	2	96	2	100	30	44	1	75	175	0	0	2	2	0	0	37	37	214	
08:30 08:45	1	85	0	86	25	60	0	85	171	0	0	0	0	0	0	40	40	211	
08:45 09:00	0	97	1	98	38	63	4	105	203	2	0	1	3	4	3	46	53	259	
09:00 09:15	3	88	1	92	23	43	2	68	160	3	1	0	4	0	0	41	41	205	
09:15 09:30	1	77	1	79	29	51	0	80	159	1	0	0	1	3	1	38	42	202	
09:30 09:45	4	81	2	87	29	55	0	84	171	1	1	0	2	1	0	40	41	214	
09:45 10:00	0	67	1	68	28	48	0	76	144	1	0	1	2	0	0	60	60	206	
11:30 11:45	1	73	5	79	44	66	2	112	191	1	0	2	3	0	1	36	37	231	
11:45 12:00	2	76	1	79	52	76	3	131	210	0	2	1	3	0	2	39	41	254	
12:00 12:15	3	86	1	90	56	87	2	145	235	3	2	0	5	0	0	40	40	280	
12:15 12:30	1	93	0	94	41	88	2	131	225	4	0	2	6	0	0	40	40	271	
12:30 12:45	0	112	1	113	51	88	0	139	252	1	1	2	4	1	1	50	52	308	
12:45 13:00	0	86	0	86	58	65	0	123	209	0	0	1	1	0	1	44	45	255	
13:00 13:15	0	60	1	61	44	79	1	124	185	0	0	3	3	0	1	54	55	243	
13:15 13:30	0	60	0	60	57	84	1	142	202	0	2	0	2	1	0	53	54	258	
15:00 15:15	0	50	1	51	44	86	0	130	181	0	0	0	0	0	0	34	34	215	
15:15 15:30	0	46	0	46	58	74	0	132	178	0	0	1	1	3	0	39	42	221	
15:30 15:45	0	63	0	63	47	95	0	142	205	0	0	2	2	0	0	27	27	234	
15:45 16:00	0	79	0	79	45	108	0	153	232	0	0	1	1	2	0	40	42	275	
16:00 16:15	0	65	2	67	59	120	0	179	246	0	0	0	0	0	2	31	33	279	
16:15 16:30	1	79	3	83	64	111	0	175	258	0	0	3	3	1	0	30	31	292	
16:30 16:45	0	93	4	97	55	119	0	174	271	0	0	2	2	2	0	28	30	303	
16:45 17:00	0	92	3	95	50	107	0	157	252	0	1	1	2	2	1	39	42	296	
17:00 17:15	0	91	3	94	53	145	0	198	292	0	1	2	3	1	0	34	35	330	
17:15 17:30	1	73	1	75	70	135	0	205	280	0	0	1	1	0	0	36	36	317	
17:30 17:45	1	77	2	80	66	140	0	206	286	0	0	2	2	0	0	46	46	334	
17:45 18:00	0	76	1	77	67	133	0	200	277	0	1	0	1	0	0	38	38	316	
TOTAL:	26	2643	42	2711	1397	2578	19	3994	6705	17	13	34	64	30	14	1286	1330	1394	8099

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services  
Turning Movement Count - Cyclist Volume Report

Work Order  
36178

GREENBANK RD @ JOCKVALE RD

Count Date: Tuesday, August 16, 2016

Start Time: 07:00

Time Period	GREENBANK RD			JOCKVALE RD			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	0	1	1	1	0	1	2
08:00 09:00	0	0	0	0	0	0	0
09:00 10:00	0	1	1	0	0	0	1
11:30 12:30	1	0	1	0	0	0	1
12:30 13:30	0	0	0	0	0	0	0
15:00 16:00	0	0	0	0	0	0	0
16:00 17:00	0	0	0	0	0	0	0
17:00 18:00	0	0	0	0	0	0	0
Total .....	1	2	3	1	0	1	4

Comment:

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



# Transportation Services - Traffic Services

W.O.  
36178

## Turning Movement Count - Heavy Vehicle Report

### GREENBANK RD @ JOCKVALE RD

Survey Date: Tuesday, August 16, 2016

GREENBANK RD										JOCKVALE RD										Grand Total
Northbound					Southbound					Eastbound					Westbound					
Time Period	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT		
07:00 08:00	0	2	0	2	0	5	0	5	7	0	0	0	0	0	0	7	7	7	14	
08:00 09:00	0	5	0	5	6	5	0	11	16	0	0	0	0	0	0	4	4	4	20	
09:00 10:00	0	5	0	5	4	8	0	12	17	0	0	0	0	0	0	2	2	2	19	
11:30 12:30	0	5	0	5	5	4	0	9	14	0	0	0	0	0	0	2	2	2	16	
12:30 13:30	0	6	0	6	6	3	0	9	15	0	0	0	0	0	0	4	4	4	19	
15:00 16:00	0	0	0	0	2	2	0	4	4	0	0	0	0	1	0	1	2	2	6	
16:00 17:00	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	
17:00 18:00	0	3	0	3	2	1	0	3	6	0	0	0	0	0	0	3	3	3	9	
<b>Sub Total</b>	<b>0</b>	<b>26</b>	<b>0</b>	<b>26</b>	<b>25</b>	<b>29</b>	<b>0</b>	<b>54</b>	<b>80</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>23</b>	<b>24</b>	<b>24</b>	<b>104</b>	
<b>U-Turns (Heavy Vehicles)</b>	<b>0</b>				<b>0</b>				<b>0</b>				<b>0</b>				<b>0</b>			
<b>Total</b>	<b>0</b>	<b>26</b>	<b>0</b>	<b>26</b>	<b>25</b>	<b>29</b>	<b>0</b>	<b>54</b>	<b>80</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>23</b>	<b>24</b>	<b>24</b>	<b>104</b>	

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  
36178

## Turning Movement Count - Pedestrian Volume Report

### GREENBANK RD @ JOCKVALE RD

Count Date: Tuesday, August 16, 2016

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	0	0	0	0	0
07:15 07:30	0	0	0	0	1	1	1
07:30 07:45	0	0	0	0	0	0	0
07:45 08:00	0	0	0	0	0	0	0
07:00 08:00	0	0	0	0	1	1	1
08:00 08:15	0	0	0	1	0	1	1
08:15 08:30	0	0	0	0	0	0	0
08:30 08:45	0	1	1	0	0	0	1
08:45 09:00	0	0	0	0	0	0	0
08:00 09:00	0	1	1	1	0	1	2
09:00 09:15	0	2	2	3	5	7	7
09:15 09:30	0	0	0	0	0	0	0
09:30 09:45	0	2	2	3	3	5	5
09:45 10:00	0	0	0	1	1	1	1
09:00 10:00	0	4	4	2	7	9	13
11:30 11:45	0	0	0	1	1	1	1
11:45 12:00	0	0	0	0	0	0	0
12:00 12:15	0	1	1	1	1	2	2
12:15 12:30	0	0	0	0	0	0	0
11:30 12:30	0	1	1	0	2	2	3
12:30 12:45	0	0	0	0	0	0	0
12:45 13:00	0	0	0	0	0	0	0
13:00 13:15	0	0	0	0	0	0	0
13:15 13:30	3	0	3	3	0	3	6
12:30 13:30	3	0	3	3	0	3	6
15:00 15:15	0	0	0	2	2	2	2
15:15 15:30	0	0	0	0	0	0	0
15:30 15:45	0	0	0	0	0	0	0
15:45 16:00	0	0	0	1	1	1	1
15:00 16:00	0	0	0	3	3	3	3
16:00 16:15	0	0	0	0	0	0	0
16:15 16:30	0	0	0	0	0	0	0
16:30 16:45	0	0	0	0	0	0	0
16:45 17:00	0	0	0	1	1	1	1
16:00 17:00	0	0	0	0	1	1	1
17:00 17:15	0	0	0	0	0	0	0
17:15 17:30	0	0	0	2	2	2	2
17:30 17:45	0	0	0	0	0	0	0
17:45 18:00	0	0	0	3	3	3	3
17:00 18:00	0	0	0	5	5	5	5
<b>Total</b>	<b>3</b>	<b>6</b>	<b>9</b>	<b>6</b>	<b>19</b>	<b>25</b>	<b>34</b>

Comment:



**Transportation Services - Traffic Services**  
**Turning Movement Count - Pedestrian Volume Report**

Work Order  
36178

**GREENBANK RD @ JOCKVALE RD**

Count Date: Tuesday, August 16, 2016

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	0	0	0	0	0	0
07:15 07:30	0	0	0	0	1	1	1
07:30 07:45	0	0	0	0	0	0	0
07:45 08:00	0	0	0	0	0	0	0
07:00 08:00	0	0	0	0	1	1	1
08:00 08:15	0	0	0	1	0	1	1
08:15 08:30	0	0	0	0	0	0	0
08:30 08:45	0	1	1	0	0	0	1
08:45 09:00	0	0	0	0	0	0	0
08:00 09:00	0	1	1	1	0	1	2
09:00 09:15	0	2	2	3	2	5	7
09:15 09:30	0	0	0	0	0	0	0
09:30 09:45	0	2	2	0	3	3	5
09:45 10:00	0	0	0	0	1	1	1
09:00 10:00	0	4	4	2	7	9	13
11:30 11:45	0	0	0	1	1	1	1
11:45 12:00	0	0	0	0	0	0	0
12:00 12:15	0	1	1	0	1	1	2
12:15 12:30	0	0	0	0	0	0	0
11:30 12:30	0	1	1	0	2	2	3
12:30 12:45	0	0	0	0	0	0	0
12:45 13:00	0	0	0	0	0	0	0
13:00 13:15	0	0	0	0	0	0	0
13:15 13:30	3	0	3	3	0	3	6
12:30 13:30	3	0	3	3	0	3	6
15:00 15:15	0	0	0	2	0	2	2
15:15 15:30	0	0	0	0	0	0	0
15:30 15:45	0	0	0	0	0	0	0
15:45 16:00	0	0	0	1	1	1	1
15:00 16:00	0	0	0	3	3	3	3
16:00 16:15	0	0	0	0	0	0	0
16:15 16:30	0	0	0	0	0	0	0
16:30 16:45	0	0	0	0	0	0	0
16:45 17:00	0	0	0	1	1	1	1
16:00 17:00	0	0	0	1	1	1	1
17:00 17:15	0	0	0	0	0	0	0
17:15 17:30	0	0	0	2	2	2	2
17:30 17:45	0	0	0	0	0	0	0
17:45 18:00	0	0	0	3	3	3	3
17:00 18:00	0	0	0	5	5	5	5
Total .....	3	6	9	6	19	25	34

Comment:



**Transportation Services - Traffic Services**

Work Order  
36178

**Turning Movement Count - 15 Min U-Turn Total Report**  
**GREENBANK RD @ JOCKVALE RD**

Survey Date: Tuesday, August 16, 2016

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



### Transportation Services - Traffic Services

#### Turning Movement Count - Peak Hour Diagram

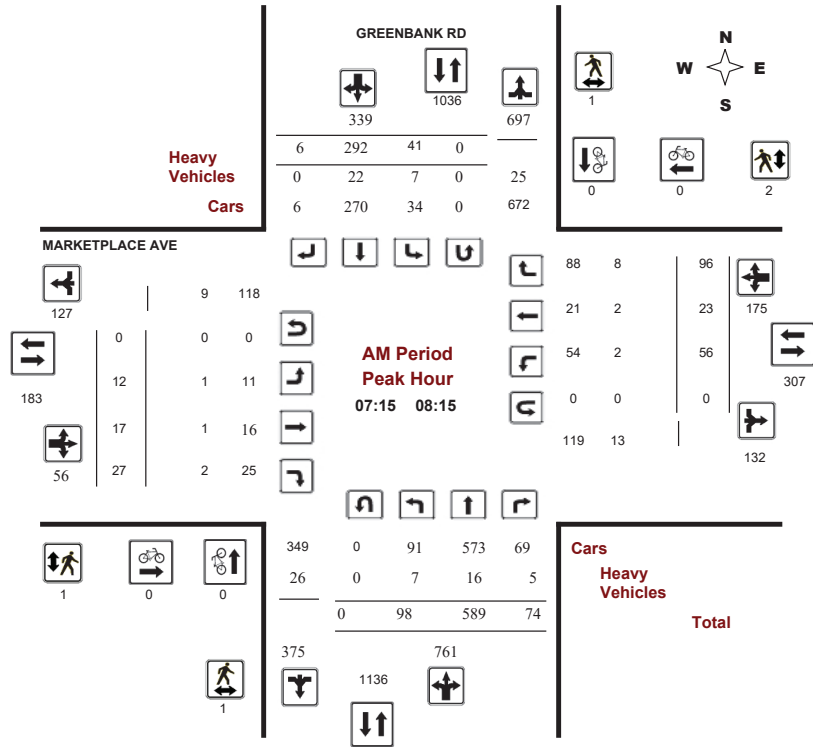
#### GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016

Start Time: 07:00

WO No: 35721

Device: Miovision



Comments



### Transportation Services - Traffic Services

#### Turning Movement Count - Peak Hour Diagram

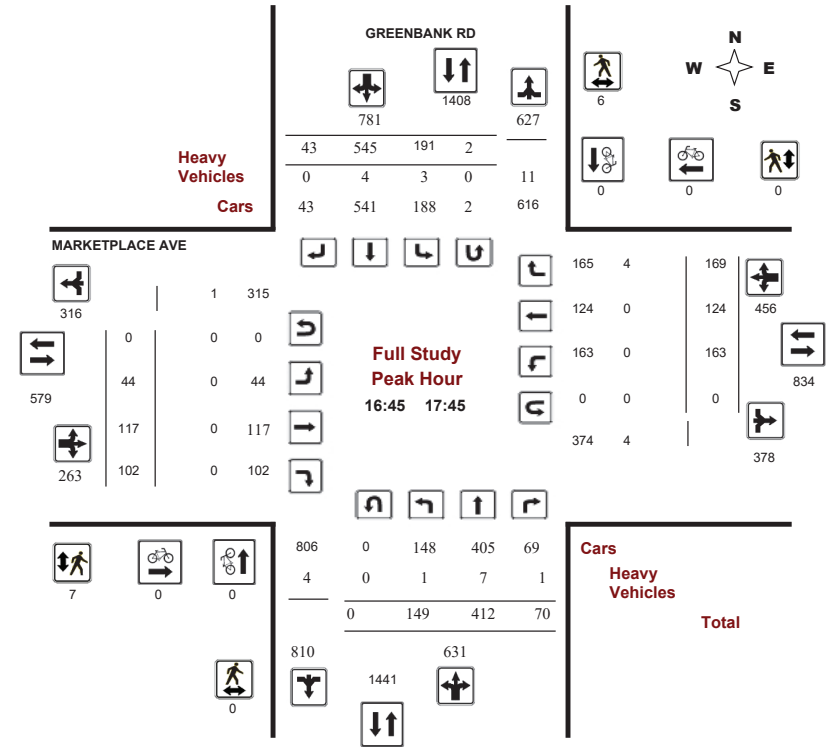
#### GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016

Start Time: 07:00

WO No: 35721

Device: Miovision



Comments



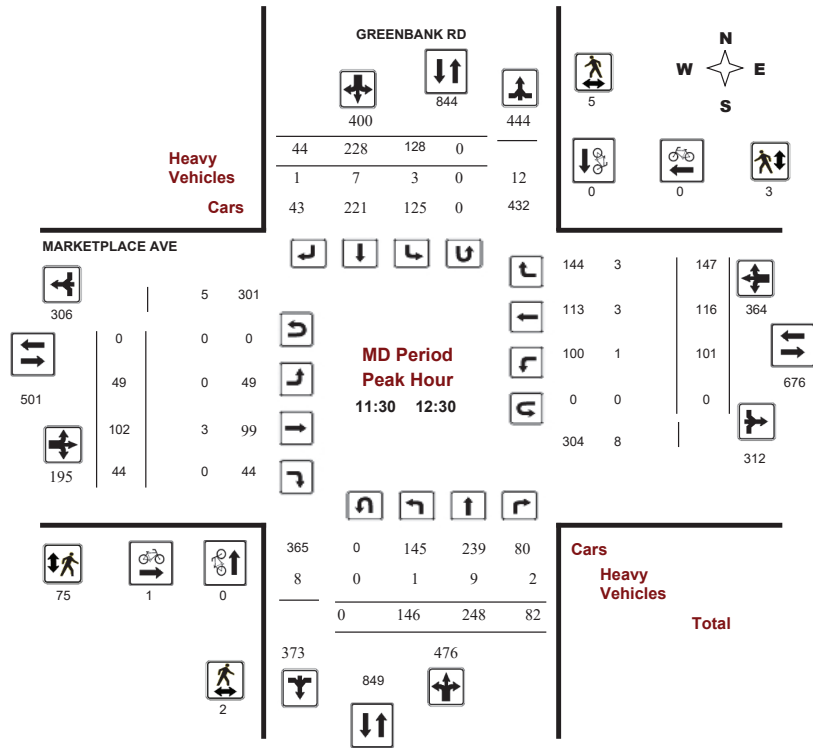
### Transportation Services - Traffic Services

#### Turning Movement Count - Peak Hour Diagram

#### GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016  
Start Time: 07:00

WO No: 35721  
Device: Miovision



Comments



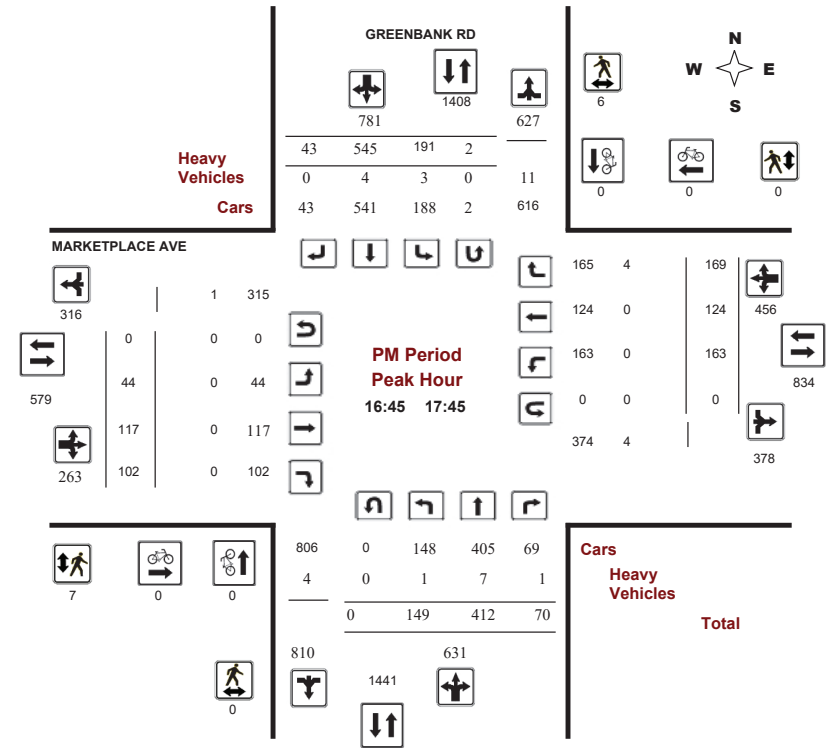
### Transportation Services - Traffic Services

#### Turning Movement Count - Peak Hour Diagram

#### GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016  
Start Time: 07:00

WO No: 35721  
Device: Miovision



Comments

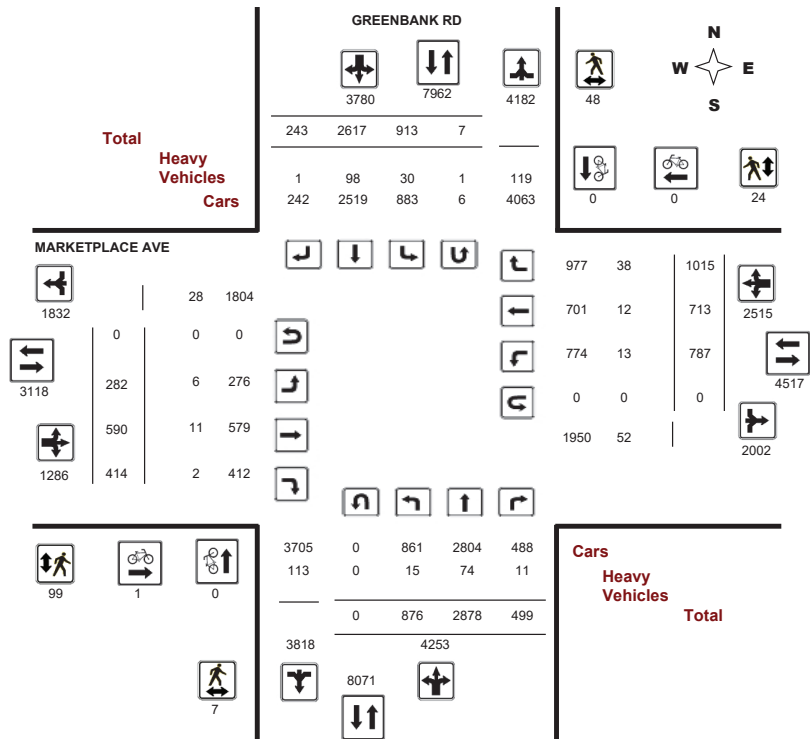


**Transportation Services - Traffic Services**  
**Turning Movement Count - Full Study Diagram**

**GREENBANK RD @ MARKETPLACE AVE**

**Survey Date:** Wednesday, February 10, 2016

**WO#:** 35721  
**Device:** Miovision



Comments



**Transportation Services - Traffic Services**

**Work Order**  
35721

**Turning Movement Count - Full Study Summary Report**

**GREENBANK RD @ MARKETPLACE AVE**

**Survey Date:** Wednesday, February 10, 2016

**Total Observed U-Turns**

**AADT Factor**

Northbound: 0      Southbound: 7  
 Eastbound: 0      Westbound: 0

1.00

**Full Study**

Period	GREENBANK RD					MARKETPLACE AVE					Grand Total								
	Northbound		Southbound		NB TOT	Eastbound		Westbound		WB TOT		STR TOT							
	LT	ST	RT	RT		LT	ST	RT	LT		ST		RT	RT					
07:00 08:00	75	543	78	696	34	281	6	321	1017	10	18	20	48	53	25	90	168	216	1233
08:00 09:00	90	514	45	649	57	231	11	299	948	8	22	23	53	39	40	118	197	250	1198
09:00 10:00	104	300	62	466	82	226	37	345	811	29	52	27	108	66	69	81	216	324	1135
11:30 12:30	146	248	82	476	128	228	44	400	876	49	102	44	195	101	116	147	364	559	1435
12:30 13:30	93	226	57	376	140	237	39	416	792	52	86	46	184	90	110	144	344	528	1320
15:00 16:00	101	302	45	448	134	385	30	549	997	31	86	72	189	114	111	140	365	554	1551
16:00 17:00	113	324	64	501	149	491	39	679	1180	57	109	81	247	157	128	124	409	656	1836
17:00 18:00	154	421	66	641	189	538	37	764	1405	46	115	101	262	167	114	171	452	714	2119
<b>Sub Total</b>	<b>876</b>	<b>2878</b>	<b>499</b>	<b>4253</b>	<b>913</b>	<b>2617</b>	<b>243</b>	<b>3773</b>	<b>8026</b>	<b>282</b>	<b>590</b>	<b>414</b>	<b>1286</b>	<b>787</b>	<b>713</b>	<b>1015</b>	<b>2515</b>	<b>3801</b>	<b>11827</b>
<b>U Turns</b>				<b>0</b>				<b>7</b>	<b>7</b>				<b>0</b>				<b>0</b>	<b>0</b>	<b>7</b>
<b>Total</b>	<b>876</b>	<b>2878</b>	<b>499</b>	<b>4253</b>	<b>913</b>	<b>2617</b>	<b>243</b>	<b>3780</b>	<b>8033</b>	<b>282</b>	<b>590</b>	<b>414</b>	<b>1286</b>	<b>787</b>	<b>713</b>	<b>1015</b>	<b>2515</b>	<b>3801</b>	<b>11834</b>
<b>EQ 12Hr</b>	<b>1218</b>	<b>4000</b>	<b>694</b>	<b>5912</b>	<b>1269</b>	<b>3638</b>	<b>338</b>	<b>5254</b>	<b>11166</b>	<b>392</b>	<b>820</b>	<b>575</b>	<b>1788</b>	<b>1094</b>	<b>991</b>	<b>1411</b>	<b>3496</b>	<b>5284</b>	<b>16450</b>
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													<b>1.39</b>						
<b>AVG 12Hr</b>	<b>1218</b>	<b>4000</b>	<b>694</b>	<b>5912</b>	<b>1269</b>	<b>3638</b>	<b>338</b>	<b>5254</b>	<b>11166</b>	<b>392</b>	<b>820</b>	<b>575</b>	<b>1788</b>	<b>1094</b>	<b>991</b>	<b>1411</b>	<b>3496</b>	<b>5284</b>	<b>16450</b>
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													<b>1.00</b>						
<b>AVG 24Hr</b>	<b>1595</b>	<b>5241</b>	<b>909</b>	<b>7744</b>	<b>1662</b>	<b>4765</b>	<b>442</b>	<b>6883</b>	<b>14627</b>	<b>513</b>	<b>1074</b>	<b>754</b>	<b>2342</b>	<b>1433</b>	<b>1298</b>	<b>1848</b>	<b>4580</b>	<b>6922</b>	<b>21549</b>
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													<b>1.31</b>						

**Comments:**

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





Transportation Services - Traffic Services **w.o.** 35721

Turning Movement Count - 15 Minute Summary Report

**GREENBANK RD @ MARKETPLACE AVE**

Survey Date: Wednesday, February 10, 2016

Total Observed U-Turns

Northbound: 0 Southbound: 7  
Eastbound: 0 Westbound: 0

Time Period	GREENBANK RD									MARKETPLACE AVE									Grand Total
	Northbound			Southbound			Eastbound			Westbound			Eastbound			Westbound			
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT	
07:00 07:15	10	112	18	140	5	46	0	51	191	1	5	1	7	11	6	14	31	38	229
07:15 07:30	17	143	18	178	6	46	2	54	232	2	3	7	12	8	8	21	37	49	281
07:30 07:45	19	152	22	193	10	98	1	109	302	5	6	7	18	22	6	28	56	74	376
07:45 08:00	29	136	20	185	13	91	3	107	292	2	4	5	11	12	5	27	44	55	347
08:00 08:15	33	158	14	205	12	57	0	69	274	3	4	8	15	14	4	20	38	53	327
08:15 08:30	15	97	5	117	6	45	3	54	171	0	8	5	13	8	10	35	53	66	237
08:30 08:45	20	119	16	155	18	75	4	97	252	1	4	6	11	11	12	35	58	69	321
08:45 09:00	22	140	10	172	21	54	4	79	251	4	6	4	14	6	14	28	48	62	313
09:00 09:15	30	109	13	152	21	69	15	105	257	11	11	4	26	10	12	13	35	61	318
09:15 09:30	31	69	18	118	17	52	11	80	198	5	11	9	25	17	17	22	56	81	279
09:30 09:45	22	67	20	109	17	51	4	72	181	7	16	11	34	18	27	31	76	110	291
09:45 10:00	21	55	11	87	27	54	7	89	176	6	14	3	23	21	13	15	49	72	248
11:30 11:45	38	60	14	112	33	53	11	97	209	13	26	12	51	12	30	34	76	127	336
11:45 12:00	32	57	28	117	22	59	9	90	207	11	22	12	45	22	26	38	86	131	338
12:00 12:15	35	60	24	119	36	60	14	110	229	15	29	7	51	29	27	35	91	142	371
12:15 12:30	41	71	16	128	37	56	10	103	231	10	25	13	48	38	33	40	111	159	390
12:30 12:45	21	63	15	99	33	49	12	94	193	11	19	9	39	17	28	43	88	127	320
12:45 13:00	25	55	19	99	36	70	11	118	217	16	13	11	40	19	28	32	79	119	336
13:00 13:15	22	62	10	94	36	63	8	107	201	13	31	13	57	24	14	30	68	125	326
13:15 13:30	25	46	13	84	35	55	8	98	182	12	23	13	48	30	40	39	109	157	339
15:00 15:15	30	84	12	126	34	73	7	114	240	13	23	12	48	21	27	34	82	130	370
15:15 15:30	24	82	4	110	24	104	7	135	245	5	16	20	41	32	32	37	101	142	387
15:30 15:45	26	78	15	119	41	100	7	149	268	7	23	17	47	35	24	30	89	136	404
15:45 16:00	21	58	14	93	35	108	9	153	246	6	24	23	53	26	28	39	93	146	392
16:00 16:15	26	73	20	119	32	124	10	166	285	17	30	28	75	29	30	24	83	158	443
16:15 16:30	24	93	8	125	30	112	12	154	279	15	25	12	52	34	24	26	84	136	415
16:30 16:45	28	69	16	113	42	140	5	187	300	10	30	21	61	51	38	41	130	191	491
16:45 17:00	35	89	20	144	45	115	12	172	316	15	24	20	59	43	36	33	112	171	487
17:00 17:15	42	115	18	175	48	141	9	200	375	11	33	26	70	42	39	45	126	196	571
17:15 17:30	35	106	19	160	48	144	9	201	361	10	28	23	61	38	29	51	118	179	540
17:30 17:45	37	102	13	152	50	145	13	208	360	8	32	33	73	40	20	40	100	173	533
17:45 18:00	40	98	16	154	43	108	6	158	312	17	22	19	58	47	26	35	108	166	478
TOTAL:	876	2878	499	4253	913	2617	243	3780	8033	282	590	414	1286	787	713	1015	2515	3801	11834

Note: U-Turns are included in Totals.

Comment:



Transportation Services - Traffic Services  
Turning Movement Count - Cyclist Volume Report

Work Order  
35721

**GREENBANK RD @ MARKETPLACE AVE**

Count Date: Wednesday, February 10, 2016

Start Time: 07:00

Time Period	GREENBANK RD			MARKETPLACE AVE			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street 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	1	0	1	1
12:30 13:30	0	0	0	0	0	0	0
15:00 16:00	0	0	0	0	0	0	0
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	1	0	1	1

Comment:

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



Transportation Services - Traffic Services

W.O. 35721

Turning Movement Count - Heavy Vehicle Report

GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016

Table with columns for Time Period, GREENBANK RD (Northbound, Southbound), and MARKETPLACE AVE (Eastbound, Westbound). Includes sub-totals for U-Turns and Total.

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 35721

Turning Movement Count - Pedestrian Volume Report

GREENBANK RD @ MARKETPLACE AVE

Count Date: Wednesday, February 10, 2016

Start Time: 07:00

Table with columns for Time Period, NB Approach, SB Approach, Total, EB Approach, WB Approach, Total, and Grand Total. Shows pedestrian volume data for various time intervals.

Comment:



# Transportation Services - Traffic Services

Work Order  
35721

## Turning Movement Count - 15 Min U-Turn Total Report

### GREENBANK RD @ MARKETPLACE AVE

Survey Date: Wednesday, February 10, 2016

Time Period	Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0
07:15	07:30	0	0	0	0
07:30	07:45	0	0	0	0
07:45	08:00	0	0	0	0
08:00	08:15	0	0	0	0
08:15	08:30	0	0	0	0
08:30	08:45	0	0	0	0
08:45	09:00	0	0	0	0
09:00	09:15	0	0	0	0
09:15	09:30	0	0	0	0
09:30	09:45	0	0	0	0
09:45	10:00	0	1	0	1
11:30	11:45	0	0	0	0
11:45	12:00	0	0	0	0
12:00	12:15	0	0	0	0
12:15	12:30	0	0	0	0
12:30	12:45	0	0	0	0
12:45	13:00	0	1	0	1
13:00	13:15	0	0	0	0
13:15	13:30	0	0	0	0
15:00	15:15	0	0	0	0
15:15	15:30	0	0	0	0
15:30	15:45	0	1	0	1
15:45	16:00	0	1	0	1
16:00	16:15	0	0	0	0
16:15	16:30	0	0	0	0
16:30	16:45	0	0	0	0
16:45	17:00	0	0	0	0
17:00	17:15	0	2	0	2
17:15	17:30	0	0	0	0
17:30	17:45	0	0	0	0
17:45	18:00	0	1	0	1
Total		0	7	0	7



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

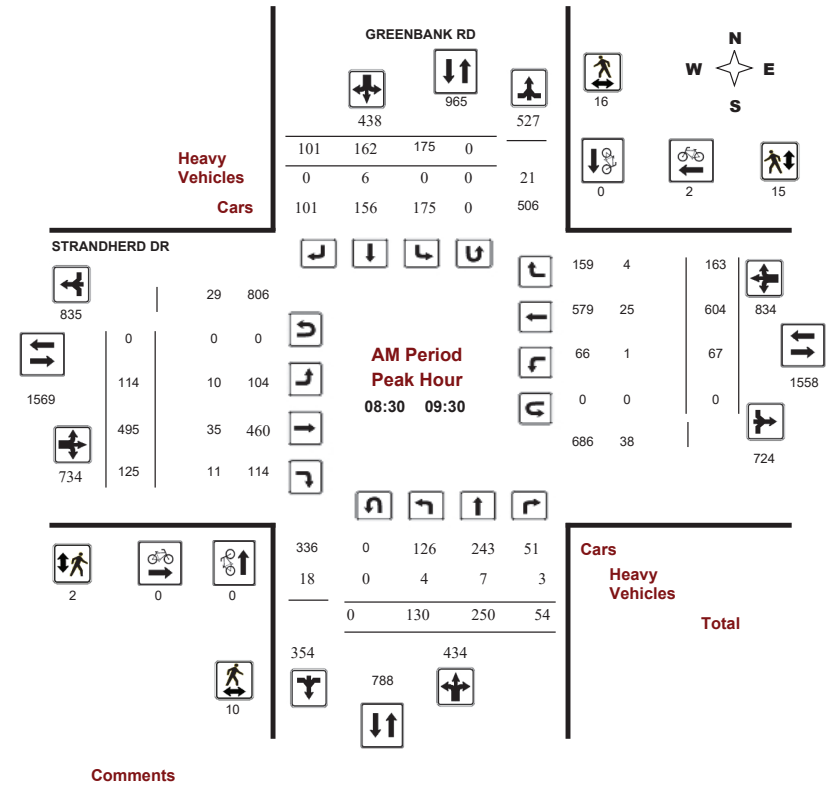
### GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016

Start Time: 07:00

WO No: 36175

Device: Miovision





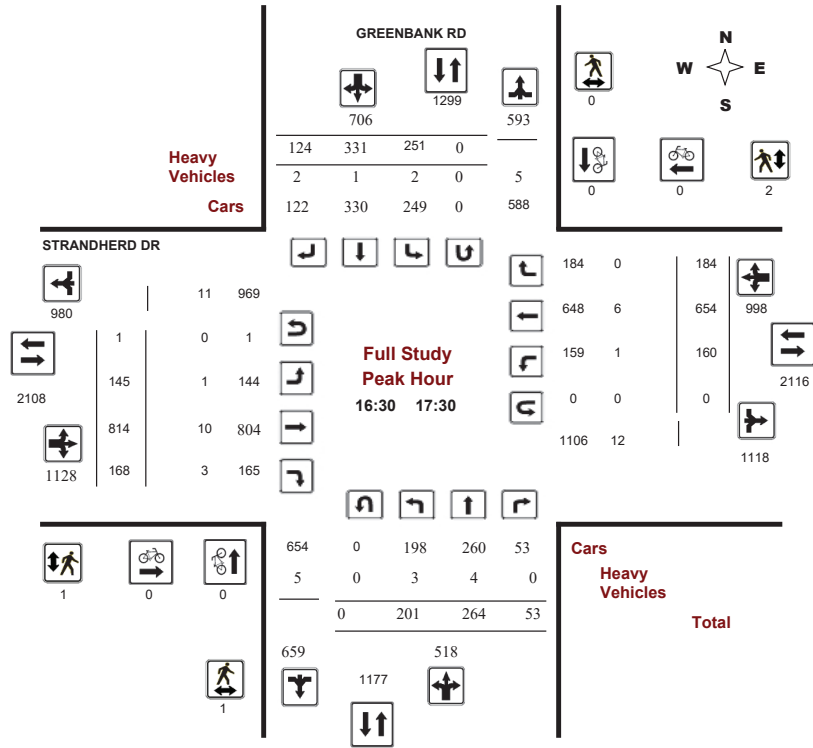
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36175  
Device: Miovision



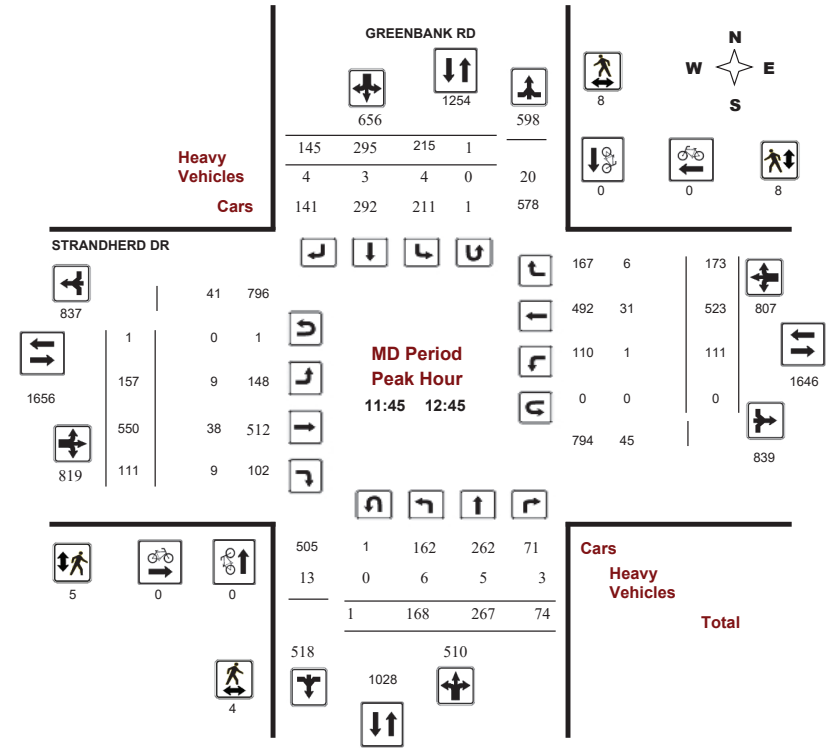
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016  
Start Time: 07:00

WO No: 36175  
Device: Miovision

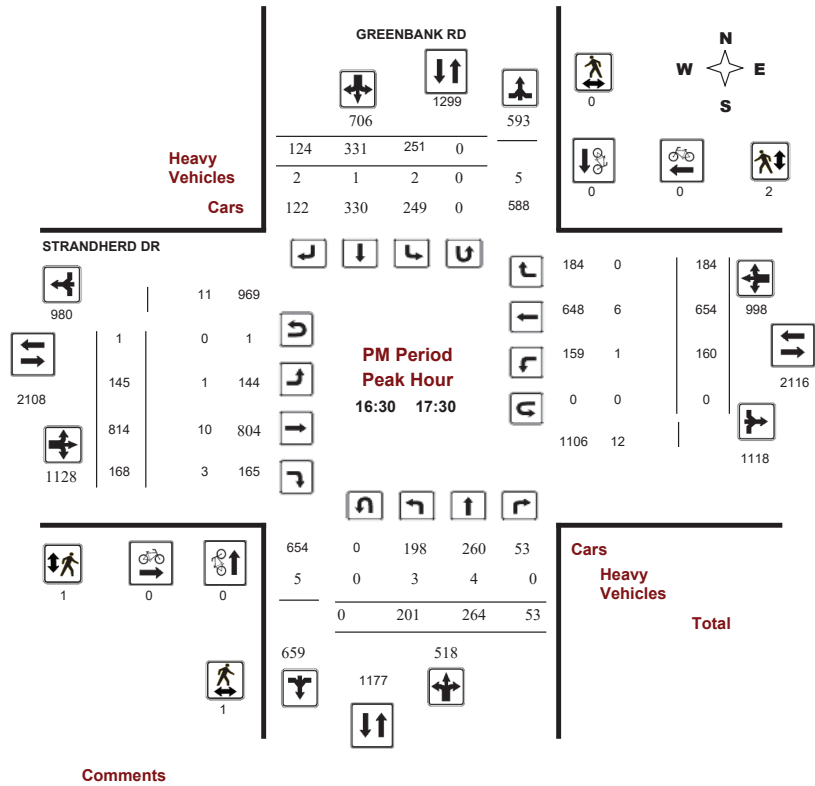




**Transportation Services - Traffic Services**  
**Turning Movement Count - Peak Hour Diagram**  
**GREENBANK RD @ STRANDHERD DR**

**Survey Date:** Tuesday, August 16, 2016  
**Start Time:** 07:00

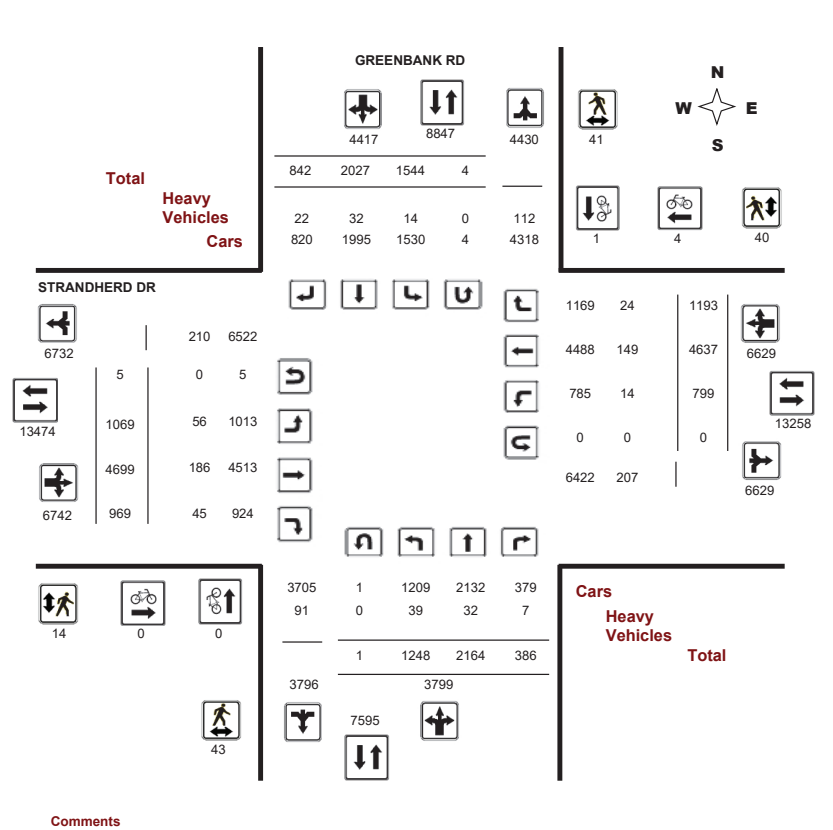
**WO No:** 36175  
**Device:** Miovision



**Transportation Services - Traffic Services**  
**Turning Movement Count - Full Study Diagram**  
**GREENBANK RD @ STRANDHERD DR**

**Survey Date:** Tuesday, August 16, 2016

**WO#:** 36175  
**Device:** Miovision





Transportation Services - Traffic Services

Work Order 36175

Turning Movement Count - Full Study Summary Report

GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016

Table with 3 columns: Total Observed U-Turns, AADT Factor. Rows for Northbound, Southbound, Eastbound, Westbound.

Full Study

Main data table for Full Study with columns for GREENBANK RD (Northbound, Southbound) and STRANDHERD DR (Eastbound, Westbound). Includes Grand Total column.

EQ 12Hr 1735 3008 537 5281 2146 2818 1170 6140 11421 1486 6532 1347 9371 1111 6445 1658 9214 18585 30006

Note: These values are calculated by multiplying the totals by the appropriate expansion factor. 1.39

AVG 12Hr 1561 2707 483 4753 1932 2536 1053 5526 10279 1337 5878 1212 8434 1000 5801 1492 8293 16727 27006

Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor. .90

AVG 24Hr 2045 3546 633 6226 2530 3322 1380 7239 13465 1752 7701 1588 11049 1309 7599 1955 10864 21913 35378

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

W.O. 36175

Turning Movement Count - 15 Minute Summary Report

GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016

Table with 2 columns: Total Observed U-Turns. Rows for Northbound, Southbound, Eastbound, Westbound.

Main data table for 15 Minute Summary Report with columns for GREENBANK RD (Northbound, Southbound) and STRANDHERD DR (Eastbound, Westbound). Includes Grand Total column.

NOTE: U-Turns are included in Totals.

Comment:



**Transportation Services - Traffic Services**  
**Turning Movement Count - Cyclist Volume Report**

Work Order  
36175

**GREENBANK RD @ STRANDHERD DR**

Count Date: Tuesday, August 16, 2016

Start Time: 07:00

Time Period	GREENBANK RD			STRANDHERD DR			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 08:00	0	1	1	0	0	0	1
08:00 09:00	0	0	0	0	2	2	2
09:00 10:00	0	0	0	0	1	1	1
11:30 12:30	0	0	0	0	1	1	1
12:30 13:30	0	0	0	0	0	0	0
15:00 16:00	0	0	0	0	0	0	0
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	4	4	5

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 - Heavy Vehicle Report**

W.O.  
36175

**GREENBANK RD @ STRANDHERD DR**

Survey Date: Tuesday, August 16, 2016

Time Period	GREENBANK RD								STRANDHERD DR								Grand Total		
	Northbound				Southbound				Eastbound				Westbound						
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT		W TOT	STR TOT
07:00 08:00	5	1	0	6	0	3	7	10	16	8	22	7	37	3	16	2	21	58	74
08:00 09:00	6	10	3	19	0	3	1	4	23	12	25	7	44	0	26	7	33	77	100
09:00 10:00	6	3	0	9	2	11	4	17	26	12	39	7	58	6	25	4	35	93	119
11:30 12:30	7	2	2	11	3	2	3	8	19	8	34	8	50	1	34	9	44	94	113
12:30 13:30	4	8	1	13	5	7	4	16	29	9	34	7	50	2	19	1	22	72	101
15:00 16:00	4	0	0	4	2	1	1	4	8	1	16	3	20	1	14	0	15	35	43
16:00 17:00	3	3	0	6	0	2	2	4	10	4	10	3	17	0	9	1	10	27	37
17:00 18:00	4	5	1	10	2	3	0	5	15	2	6	3	11	1	6	0	7	18	33
<b>Sub Total</b>	<b>39</b>	<b>32</b>	<b>7</b>	<b>78</b>	<b>14</b>	<b>32</b>	<b>22</b>	<b>68</b>	<b>146</b>	<b>56</b>	<b>186</b>	<b>45</b>	<b>287</b>	<b>14</b>	<b>149</b>	<b>24</b>	<b>187</b>	<b>474</b>	<b>620</b>
<b>U-Turns (Heavy Vehicles)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Total</b>	<b>39</b>	<b>32</b>	<b>7</b>	<b>78</b>	<b>14</b>	<b>32</b>	<b>22</b>	<b>68</b>	<b>146</b>	<b>56</b>	<b>186</b>	<b>45</b>	<b>287</b>	<b>14</b>	<b>149</b>	<b>24</b>	<b>187</b>	<b>474</b>	<b>620</b>

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  
36175

### Turning Movement Count - Pedestrian Volume Report

#### GREENBANK RD @ STRANDHERD DR

Count Date: Tuesday, August 16, 2016

Start Time: 07:00

Time Period	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	Grand Total
07:00 07:15	0	1	1	0	0	0	1
07:15 07:30	2	0	2	0	2	2	4
07:30 07:45	2	2	4	0	1	1	5
07:45 08:00	1	0	1	0	1	1	2
07:00 08:00	5	3	8	0	4	4	12
08:00 08:15	0	2	2	0	0	0	2
08:15 08:30	0	1	1	0	0	0	1
08:30 08:45	0	4	4	2	0	2	6
08:45 09:00	3	5	8	0	0	0	8
08:00 09:00	3	12	15	2	0	2	17
09:00 09:15	6	2	8	0	7	7	15
09:15 09:30	1	5	6	0	8	8	14
09:30 09:45	4	2	6	0	3	3	9
09:45 10:00	3	0	3	2	1	3	6
09:00 10:00	14	9	23	2	19	21	44
11:30 11:45	3	1	4	0	3	3	7
11:45 12:00	2	1	3	1	1	2	5
12:00 12:15	0	2	2	2	1	3	5
12:15 12:30	0	3	3	1	4	5	8
11:30 12:30	5	7	12	4	9	13	25
12:30 12:45	2	2	4	1	2	3	7
12:45 13:00	3	2	5	0	0	0	5
13:00 13:15	1	1	2	1	1	2	4
13:15 13:30	4	2	6	1	0	1	7
12:30 13:30	10	7	17	3	3	6	23
15:00 15:15	0	0	0	0	0	0	0
15:15 15:30	0	1	1	0	0	0	1
15:30 15:45	1	0	1	0	0	0	1
15:45 16:00	0	1	1	0	0	0	1
15:00 16:00	1	2	3	0	0	0	3
16:00 16:15	2	0	2	0	0	0	2
16:15 16:30	0	1	1	1	1	2	3
16:30 16:45	0	0	0	0	1	1	1
16:45 17:00	0	0	0	0	1	1	1
16:00 17:00	2	1	3	1	3	4	7
17:00 17:15	1	0	1	0	0	0	1
17:15 17:30	0	0	0	1	0	1	1
17:30 17:45	0	0	0	0	2	2	2
17:45 18:00	2	0	2	1	0	1	3
17:00 18:00	3	0	3	2	2	4	7
Total .....	43	41	84	14	40	54	138

Comment:



### Transportation Services - Traffic Services

Work Order  
36175

### Turning Movement Count - 15 Min U-Turn Total Report

#### GREENBANK RD @ STRANDHERD DR

Survey Date: Tuesday, August 16, 2016

Time Period	Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00 07:15	0	0	0	0	0
07:15 07:30	0	1	0	0	1
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	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	1	0	1
11:30 11:45	0	0	1	0	1
11:45 12:00	1	0	1	0	2
12:00 12:15	0	0	0	0	0
12:15 12:30	0	0	0	0	0
12:30 12:45	0	1	0	0	1
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	1	0	0	1
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	1	0	1
17:00 17:15	0	0	0	0	0
17:15 17:30	0	0	0	0	0
17:30 17:45	0	0	0	0	0
17:45 18:00	0	0	0	0	0
Total	1	4	5	0	10





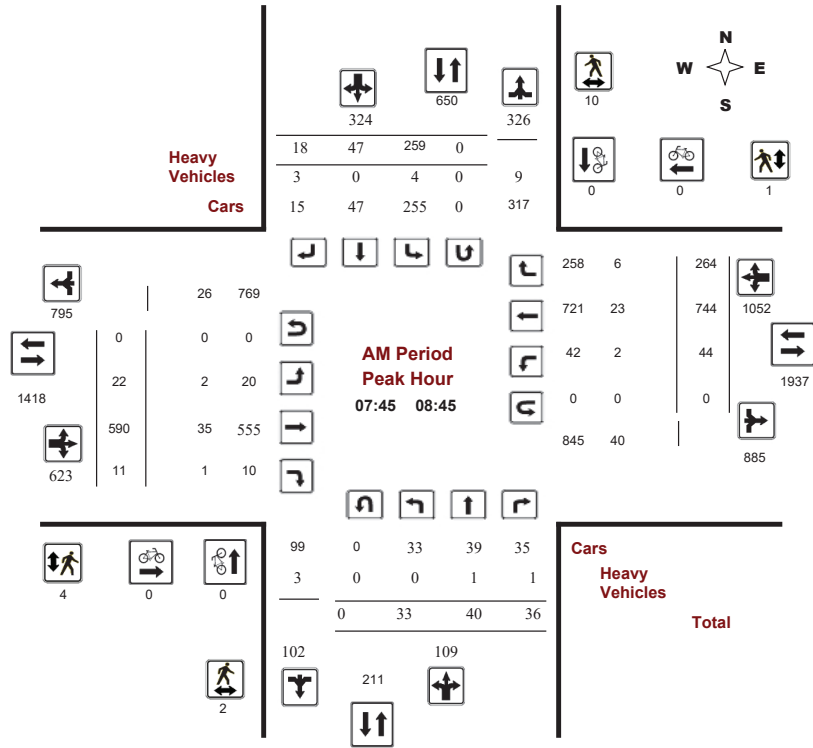
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018  
Start Time: 07:00

WO No: 37499  
Device: Miovision



Comments



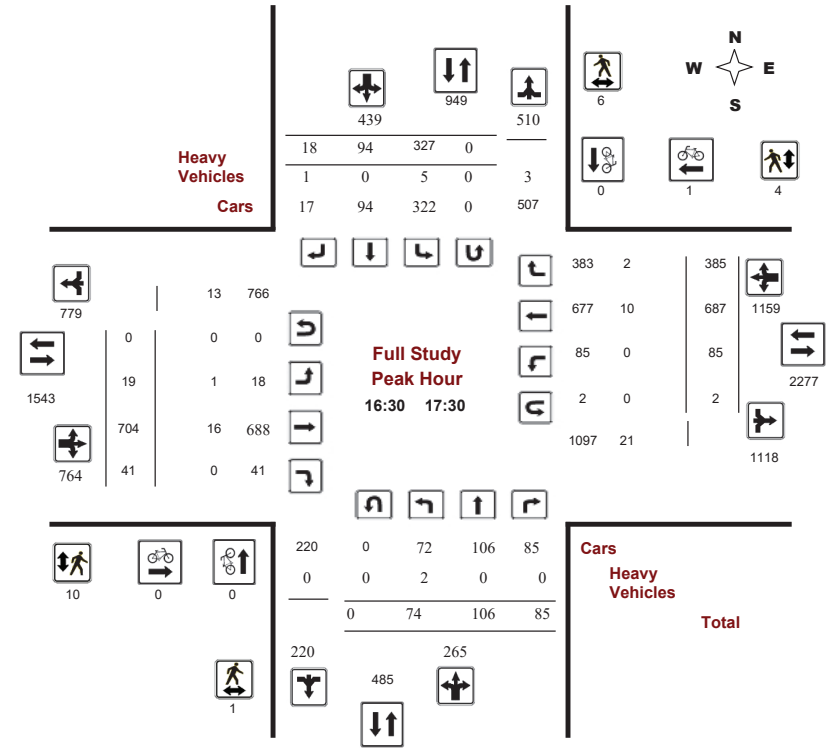
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018  
Start Time: 07:00

WO No: 37499  
Device: Miovision



Comments



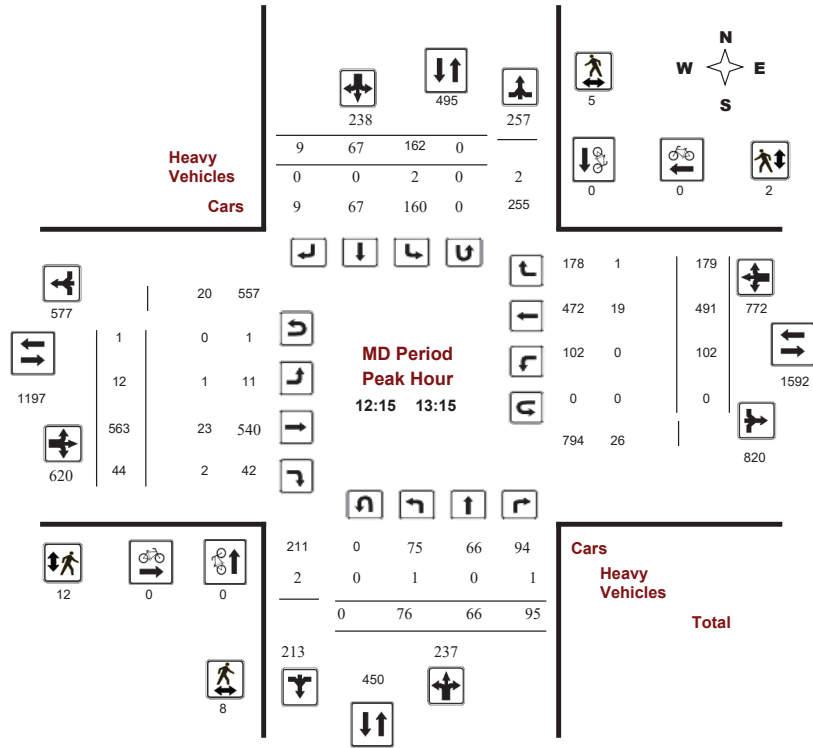
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018  
Start Time: 07:00

WO No: 37499  
Device: Miovision



Comments



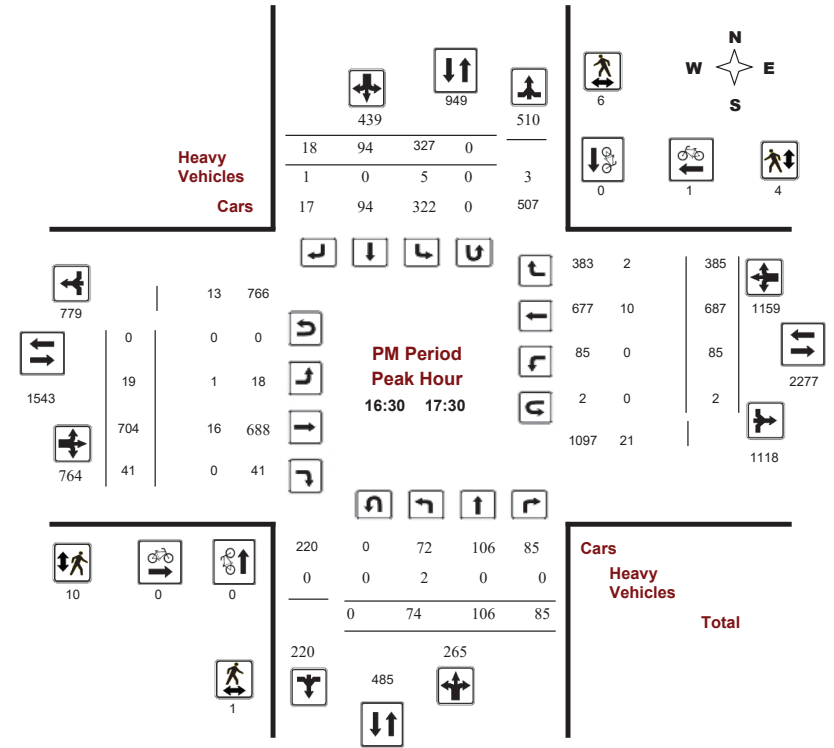
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018  
Start Time: 07:00

WO No: 37499  
Device: Miovision



Comments

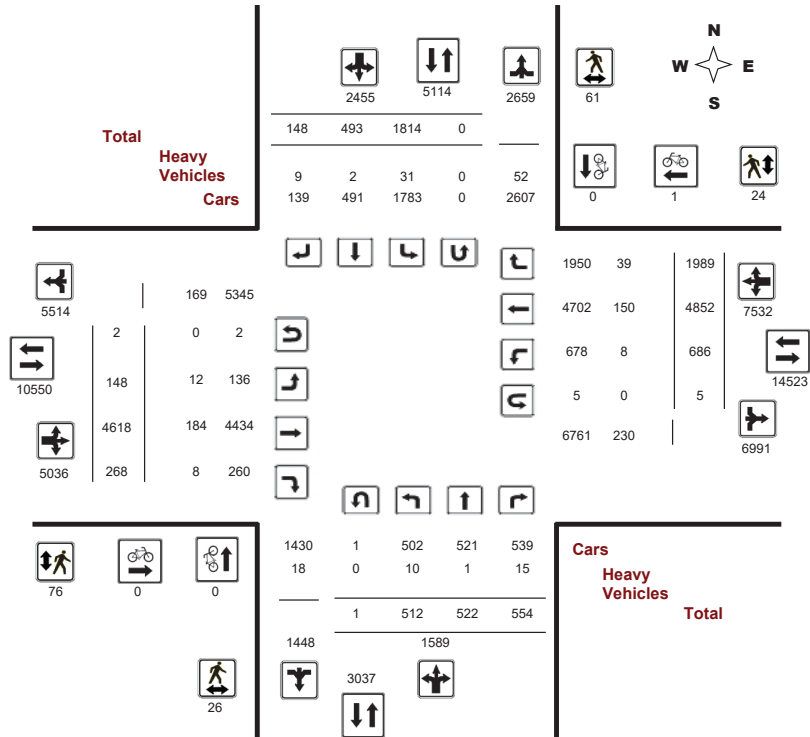


**Transportation Services - Traffic Services**  
**Turning Movement Count - Full Study Diagram**

**JOCKVALE RD @ STRANDHERD DR**

Survey Date: Thursday, January 18, 2018

WO#: 37499  
 Device: Miovision



Comments



**Transportation Services - Traffic Services**

Work Order  
37499

**Turning Movement Count - Full Study Summary Report**

**JOCKVALE RD @ STRANDHERD DR**

Survey Date: Thursday, January 18, 2018

**Total Observed U-Turns**  
 Northbound: 1 Southbound: 0  
 Eastbound: 2 Westbound: 5

**AADT Factor**  
1.00

**Full Study**

Period	Northbound			Southbound			Eastbound			Westbound			WB TOT	STR TOT	Grand Total				
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT				EB TOT			
07:00 08:00	36	18	20	74	251	42	9	302	376	16	504	9	529	33	599	176	808	1337	1713
08:00 09:00	29	44	43	116	234	42	21	297	413	24	551	11	586	49	756	259	1064	1650	2063
09:00 10:00	65	40	52	157	209	38	14	261	418	15	439	26	480	97	557	153	807	1287	1705
11:30 12:30	77	64	83	224	160	51	13	224	448	5	487	52	544	109	473	179	761	1305	1753
12:30 13:30	82	67	98	247	158	75	12	245	492	13	552	39	604	110	472	186	768	1372	1864
15:00 16:00	69	85	81	235	212	68	27	307	542	23	649	34	706	116	643	330	1089	1795	2337
16:00 17:00	81	101	88	270	297	84	26	407	677	29	727	51	807	88	680	356	1124	1931	2608
17:00 18:00	73	103	89	265	293	93	26	412	677	23	709	46	778	84	672	350	1106	1884	2561
<b>Sub Total</b>	512	522	554	1588	1814	493	148	2455	4043	148	4618	268	5034	686	4852	1989	7527	12561	16604
<b>U Turns</b>				1				0	1				2				5	7	8
<b>Total</b>	512	522	554	1589	1814	493	148	2455	4044	148	4618	268	5036	686	4852	1989	7532	12568	16612
<b>EQ 12Hr</b>	712	726	770	2209	2521	685	206	3412	5621	206	6419	373	7000	954	6744	2765	10469	17469	23090
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													1.39						
<b>AVG 12Hr</b>	712	726	770	2209	2521	685	206	3412	5621	206	6419	373	7000	954	6744	2765	10469	17469	23090
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													1.00						
<b>AVG 24Hr</b>	932	951	1009	2893	3303	898	269	4470	7363	269	8409	488	9170	1249	8835	3622	13715	22885	30248
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													1.31						

**Comments:**

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



Turning Movement Count - 15 Minute Summary Report

JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018

Total Observed U-Turns

Northbound: 1 Southbound: 0  
Eastbound: 2 Westbound: 5

Time Period	Northbound			Southbound			Eastbound			Westbound			Grand Total						
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT		E TOT	LT	ST	RT	W TOT	STR TOT
07:00 07:15	4	2	4	10	45	3	2	50	60	1	97	2	100	4	118	23	145	245	305
07:15 07:30	5	7	1	13	66	12	2	80	93	5	128	3	136	4	139	33	176	312	405
07:30 07:45	18	4	11	33	64	8	3	75	108	4	127	1	132	10	181	45	236	368	476
07:45 08:00	9	5	4	18	76	19	2	97	115	6	152	3	161	15	161	75	251	412	527
08:00 08:15	8	13	10	31	56	13	6	75	106	7	165	2	174	5	174	67	246	420	526
08:15 08:30	8	10	10	28	64	7	3	74	102	6	149	2	157	13	199	65	277	434	536
08:30 08:45	8	12	12	32	63	8	7	78	110	3	124	4	131	11	210	57	278	409	519
08:45 09:00	5	9	11	25	51	14	5	70	95	8	113	3	124	20	173	70	263	387	482
09:00 09:15	16	12	9	37	68	11	3	82	119	4	105	5	114	25	151	45	222	336	455
09:15 09:30	11	11	22	44	61	6	4	71	115	2	102	8	112	31	141	35	207	319	434
09:30 09:45	15	7	12	34	34	12	4	50	84	3	112	4	119	17	139	47	203	322	406
09:45 10:00	23	10	9	42	46	9	3	58	100	6	120	9	135	24	126	26	176	311	411
11:30 11:45	17	18	20	55	36	8	2	46	101	2	132	5	139	18	124	46	188	327	428
11:45 12:00	23	16	19	58	46	11	4	61	119	0	110	20	130	30	102	48	181	311	430
12:00 12:15	20	14	20	54	43	21	6	70	124	1	115	14	130	37	124	42	204	334	458
12:15 12:30	17	16	24	57	35	11	1	47	104	2	130	13	146	24	123	43	190	336	440
12:30 12:45	14	8	27	49	47	22	2	71	120	4	135	12	151	33	128	48	209	360	480
12:45 13:00	20	17	27	64	40	18	4	62	126	3	155	10	168	19	118	46	183	351	477
13:00 13:15	25	25	17	67	40	16	2	58	125	3	143	9	155	26	122	42	190	345	470
13:15 13:30	23	17	27	67	31	19	4	54	121	3	119	8	130	32	104	50	186	316	437
15:00 15:15	14	23	27	64	47	14	4	65	129	3	140	9	152	28	165	76	269	421	550
15:15 15:30	21	23	15	59	42	16	6	64	123	5	185	11	201	32	169	77	278	479	602
15:30 15:45	20	27	19	67	67	15	6	88	155	6	171	7	184	21	145	82	248	432	587
15:45 16:00	14	12	20	46	56	23	11	90	136	9	153	7	169	35	164	95	294	463	599
16:00 16:15	26	22	21	69	65	17	6	88	157	9	192	16	218	25	155	86	266	484	641
16:15 16:30	19	22	30	71	70	22	9	101	172	9	187	16	212	20	187	78	285	497	669
16:30 16:45	14	36	21	71	89	25	5	119	190	7	145	7	159	24	162	95	282	441	631
16:45 17:00	22	21	16	59	73	20	6	99	158	4	203	12	219	19	176	97	292	511	669
17:00 17:15	22	23	30	75	83	24	3	110	185	5	154	11	170	20	182	93	296	466	651
17:15 17:30	16	26	18	60	82	25	4	111	171	3	202	11	216	22	167	100	289	505	676
17:30 17:45	20	27	20	67	65	32	9	106	173	3	174	14	191	24	156	83	263	454	627
17:45 18:00	15	27	21	63	63	12	10	85	148	12	179	10	201	18	167	74	259	460	608
<b>TOTAL:</b>	<b>512</b>	<b>522</b>	<b>554</b>	<b>1589</b>	<b>1814</b>	<b>493</b>	<b>148</b>	<b>2455</b>	<b>4044</b>	<b>148</b>	<b>4618</b>	<b>268</b>	<b>5036</b>	<b>686</b>	<b>4852</b>	<b>1989</b>	<b>7532</b>	<b>12568</b>	<b>16612</b>

Note: U-Turns are included in Totals.

Comment:



JOCKVALE RD @ STRANDHERD DR

Count Date: Thursday, January 18, 2018

Start Time: 07:00

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	0	0	0	0	0	0
16:00 17:00	0	0	0	0	1	1	1
17:00 18:00	0	0	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>

Comment:

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



Transportation Services - Traffic Services

W.O. 37499

Turning Movement Count - Heavy Vehicle Report

JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018

Table with columns for Time Period, Northbound (LT, ST, RT, N TOT), Southbound (LT, ST, RT, S TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT), STR TOT, and Grand Total. Includes sub-totals for U-Turns and Total.

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 37499

Turning Movement Count - Pedestrian Volume Report

JOCKVALE RD @ STRANDHERD DR

Count Date: Thursday, January 18, 2018

Start Time: 07:00

Table with columns for 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, and Grand Total. Includes a Total row at the bottom.

Comment:



# Transportation Services - Traffic Services

Work Order  
37499

## Turning Movement Count - 15 Min U-Turn Total Report

### JOCKVALE RD @ STRANDHERD DR

Survey Date: Thursday, January 18, 2018

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	1	1
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	1	1
12:00 12:15	0	0	0	1	1
12:15 12:30	0	0	1	0	1
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	1	0	0	0	1
15:45 16:00	0	0	0	0	0
16:00 16:15	0	0	1	0	1
16:15 16:30	0	0	0	0	0
16:30 16:45	0	0	0	1	1
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	0	0
17:30 17:45	0	0	0	0	0
17:45 18:00	0	0	0	0	0
Total	1	0	2	5	8

# Appendix C

Synchro Intersection Worksheets – Existing Conditions

Lanes, Volumes, Timings  
1: Greenbank & Jockvale

01-28-2019

	↖	→	↘	↙	←	↖	↙	↘	↙	↘	↙	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔		↔		↔	↔	
Traffic Volume (vph)	2	0	4	8	3	169	4	393	6	122	217	6
Future Volume (vph)	2	0	4	8	3	169	4	393	6	122	217	6
Satd. Flow (prot)	0	1563	0	0	1682	1483	0	1742	0	1658	1738	0
Fit Permitted							0.998		0.472			
Satd. Flow (perm)	0	1588	0	0	1745	1483	0	1738	0	824	1738	0
Satd. Flow (RTOR)		102				188		1			3	
Lane Group Flow (vph)	0	6	0	0	12	188	0	448	0	136	248	0
Turn Type	Perm	NA		Perm	NA	pm+ov	Perm	NA		pm+pt	NA	
Protected Phases		4				8		1		2		6
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	1	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	5.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	27.0	27.0		27.0	27.0	20.0	73.0	73.0		20.0	93.0	
Total Split (s)	27.0	27.0		27.0	27.0	20.0	73.0	73.0		20.0	93.0	
Total Split (%)	22.5%	22.5%		22.5%	22.5%	16.7%	60.8%	60.8%		16.7%	77.5%	
Yellow Time (s)	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	3.4	3.4	3.4		3.4	3.4	
Lost Time Adjust (s)		0.0			0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)		6.4			6.4	7.1		7.1		7.1	7.1	
Lead/Lag							Lead	Lag		Lead		
Lead-Lag Optimize?							Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	Max	Max		None	Max	
Act Effct Green (s)		10.0			10.0	9.6		73.0		86.8	92.6	
Actuated g/C Ratio		0.10			0.10	0.10		0.75		0.90	0.96	
v/c Ratio		0.02			0.07	0.59		0.34		0.17	0.15	
Control Delay		0.2			42.5	13.8		5.9		1.6	1.1	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		0.2			42.5	13.8		5.9		1.6	1.1	
LOS		A			D	B		A		A	A	
Approach Delay		0.2			15.5			5.9			1.3	
Approach LOS		A			B			A			A	
Queue Length 50th (m)		0.0			2.1	0.0		18.3		0.4	0.0	
Queue Length 95th (m)		0.0			8.7	18.0		65.4		10.0	17.4	
Internal Link Dist (m)		194.4			396.8			294.1			283.1	
Turn Bay Length (m)												
Base Capacity (vph)		419			372	399		1310		850	1663	
Starvation Cap Reductn		0			0	0		0		0	0	
Spillback Cap Reductn		0			0	0		0		0	0	
Storage Cap Reductn		0			0	0		0		0	0	
Reduced v/c Ratio		0.01			0.03	0.47		0.34		0.16	0.15	

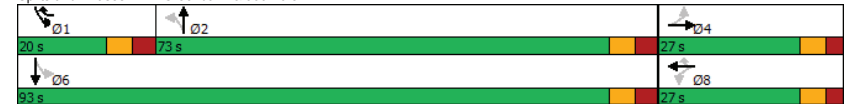
Intersection Summary	
Cycle Length:	120
Actuated Cycle Length:	96.8
Natural Cycle:	120
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.59

Lanes, Volumes, Timings  
1: Greenbank & Jockvale

01-28-2019

Intersection Signal Delay: 6.0	Intersection LOS: A
Intersection Capacity Utilization 60.4%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 1: Greenbank & Jockvale





Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘
Traffic Volume (vph)	12	17	27	56	23	96	98	589	74	41	292	6
Future Volume (vph)	12	17	27	56	23	96	98	589	74	41	292	6
Satd. Flow (prot)	1658	1585	0	1658	1534	0	1658	3259	0	3216	3306	0
Fit Permitted	0.672			0.590			0.950			0.950		
Satd. Flow (perm)	1173	1585	0	1030	1534	0	1658	3259	0	3216	3306	0
Satd. Flow (RTOR)		30			107			14			2	
Lane Group Flow (vph)	13	49	0	62	133	0	109	736	0	46	331	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (%)	10.0%	29.2%		10.0%	29.2%		12.5%	48.3%		12.5%	48.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	15.1	10.6		18.9	17.7		8.7	59.3		6.9	52.4	
Actuated g/C Ratio	0.15	0.11		0.19	0.18		0.09	0.59		0.07	0.52	
v/c Ratio	0.06	0.25		0.27	0.37		0.76	0.38		0.21	0.19	
Control Delay	31.9	25.4		35.6	14.7		77.6	13.2		47.2	13.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	31.9	25.4		35.6	14.7		77.6	13.2		47.2	13.7	
LOS	C	C		D	B		E	B		D	B	
Approach Delay		26.7			21.3			21.5			17.7	
Approach LOS		C			C			C			B	
Queue Length 50th (m)	2.2	3.7		10.5	4.3		22.5	45.6		4.7	18.6	
Queue Length 95th (m)	7.2	15.0		21.9	23.4		#53.7	66.2		10.6	28.8	
Internal Link Dist (m)		102.8			148.8			283.1			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	204	473		229	513		144	1934		279	1730	
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	0.06	0.10		0.27	0.26		0.76	0.38		0.16	0.19	

Intersection Summary

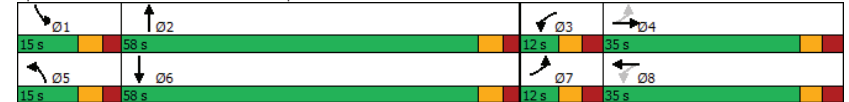
Cycle Length: 120  
 Actuated Cycle Length: 100.2  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.76

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 20.8  
 Intersection Capacity Utilization 49.6%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	↖	→	↘	↙	←	↖	↙	↑	↗	↘	↓	↖
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↖	↖	↖↗	↖	↖↗	↖↗	↖	↖↗	↖↗	↖
Traffic Volume (vph)	114	495	125	67	604	163	130	250	54	175	162	101
Future Volume (vph)	114	495	125	67	604	163	130	250	54	175	162	101
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3226	0	3216	3316	1483
Fit Permitted	0.195			0.382			0.950			0.950		
Satd. Flow (perm)	340	3316	1483	667	3316	1483	3216	3226	0	3216	3316	1483
Satd. Flow (RTOR)			149			181		20				149
Lane Group Flow (vph)	127	550	139	74	671	181	144	338	0	194	180	112
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (%)	15.8%	34.2%	34.2%	15.8%	34.2%	34.2%	20.0%	30.0%		20.0%	30.0%	30.0%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max			None	Max	Max
Act Effct Green (s)	40.6	31.9	31.9	34.8	26.6	26.6	10.1	29.8		11.7	31.4	31.4
Actuated g/C Ratio	0.39	0.30	0.30	0.33	0.25	0.25	0.10	0.28		0.11	0.30	0.30
v/c Ratio	0.48	0.55	0.25	0.25	0.80	0.35	0.46	0.36		0.54	0.18	0.20
Control Delay	25.6	34.0	5.4	21.0	44.6	6.7	51.5	31.3		51.2	30.0	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	25.6	34.0	5.4	21.0	44.6	6.7	51.5	31.3		51.2	30.0	3.1
LOS	C	C	A	C	D	A	D	C		D	C	A
Approach Delay		27.8			35.3			37.3			32.2	
Approach LOS		C			D			D			C	
Queue Length 50th (m)	16.7	53.4	0.0	9.4	71.2	0.0	15.4	28.8		20.7	15.2	0.0
Queue Length 95th (m)	30.7	77.4	12.9	19.5	98.2	17.0	27.7	48.8		34.8	27.8	7.0
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	291	1109	595	366	1101	613	547	930		547	991	547
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.44	0.50	0.23	0.20	0.61	0.30	0.26	0.36		0.35	0.18	0.20

Intersection Summary

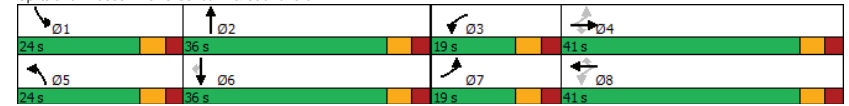
Cycle Length: 120  
 Actuated Cycle Length: 104.9  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.80

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 32.9  
 Intersection Capacity Utilization 60.3%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service B

Splits and Phases: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	22	590	11	44	744	264	33	39	35	259	47	18
Future Volume (vph)	22	590	11	44	744	264	33	39	35	259	47	18
Satd. Flow (prot)	1658	3306	0	1658	3186	0	1658	1745	1483	1658	1672	0
Fit Permitted	0.177			0.330			0.710			0.391		
Satd. Flow (perm)	309	3306	0	576	3186	0	1239	1745	1483	682	1672	0
Satd. Flow (RTOR)		2			50				145		18	
Lane Group Flow (vph)	24	668	0	49	1120	0	37	43	39	288	72	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		2	2		1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	10.8%	46.3%		10.8%	46.3%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	3.7	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	6.9	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None		
Act Effct Green (s)	55.7	51.0		58.4	55.8		10.7	10.7	10.7	27.9	27.9	
Actuated g/C Ratio	0.55	0.50		0.57	0.55		0.11	0.11	0.11	0.27	0.27	
v/c Ratio	0.10	0.40		0.12	0.63		0.29	0.24	0.14	0.88	0.15	
Control Delay	11.0	19.0		10.9	19.6		51.7	48.7	1.0	60.7	22.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	11.0	19.0		10.9	19.6		51.7	48.7	1.0	60.7	22.8	
LOS	B	B		B	B		D	D	A	E	C	
Approach Delay		18.7			19.2			34.0			53.1	
Approach LOS		B			B			C			D	
Queue Length 50th (m)	2.1	50.6		4.4	74.8		7.8	9.0	0.0	54.1	8.7	
Queue Length 95th (m)	6.0	69.2		10.2	132.5		18.7	20.5	0.0	#79.4	19.9	
Internal Link Dist (m)		158.5			396.5			177.6			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	263	1656		405	1769		286	402	453	339	764	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.09	0.40		0.12	0.63		0.13	0.11	0.09	0.85	0.09	

Intersection Summary

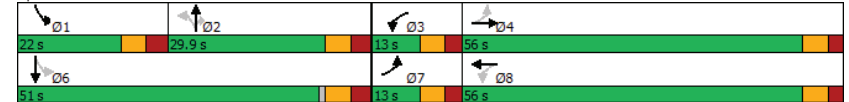
Cycle Length: 120.9  
 Actuated Cycle Length: 101.8  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.88

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 25.0  
 Intersection Capacity Utilization 71.2%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



Lanes, Volumes, Timings  
1: Greenbank & Jockvale

01-28-2019

	↖	→	↘	↙	←	↖	↙	↘	↙	↘	↙	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔		↔		↔	↔	
Traffic Volume (vph)	0	2	5	1	0	154	2	323	7	256	564	0
Future Volume (vph)	0	2	5	1	0	154	2	323	7	256	564	0
Satd. Flow (prot)	0	1569	0	0	1658	1483	0	1740	0	1658	1745	0
Fit Permitted								0.998		0.512		
Satd. Flow (perm)	0	1569	0	0	1745	1483	0	1736	0	893	1745	0
Satd. Flow (RTOR)		6				171		1				
Lane Group Flow (vph)	0	8	0	0	1	171	0	369	0	284	627	0
Turn Type		NA		Perm	NA	pm+ov	Perm	NA		pm+pt	NA	
Protected Phases		4				8		1		2		6
Permitted Phases		4			8		8	2			6	
Detector Phase		4	4		8	8	1	2	2		1	6
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	5.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	27.0	27.0		27.0	27.0	30.0	63.0	63.0		30.0	93.0	
Total Split (s)	27.0	27.0		27.0	27.0	30.0	63.0	63.0		30.0	93.0	
Total Split (%)	22.5%	22.5%		22.5%	22.5%	25.0%	52.5%	52.5%		25.0%	77.5%	
Yellow Time (s)	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	3.4	3.4	3.4		3.4	3.4	
Lost Time Adjust (s)		0.0			0.0	0.0		0.0		0.0	0.0	
Total Lost Time (s)		6.4			6.4	7.1		7.1		7.1	7.1	
Lead/Lag							Lead	Lag		Lag	Lead	
Lead-Lag Optimize?							Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None	None	Max	Max		None	Max	
Act Effct Green (s)		10.0			10.0	10.2		71.8		86.3	92.2	
Actuated g/C Ratio		0.10			0.10	0.11		0.75		0.90	0.96	
v/c Ratio		0.05			0.01	0.55		0.29		0.33	0.38	
Control Delay		29.0			42.0	12.5		6.0		2.2	1.9	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay		29.0			42.0	12.5		6.0		2.2	1.9	
LOS		C			D	B		A		A	A	
Approach Delay		29.0			12.7			6.0			2.0	
Approach LOS		C			B			A			A	
Queue Length 50th (m)		0.3			0.2	0.0		14.3		0.9	0.0	
Queue Length 95th (m)		5.5			1.9	16.5		57.7		20.4	54.7	
Internal Link Dist (m)		194.4			396.8			294.1			283.1	
Turn Bay Length (m)												
Base Capacity (vph)		342			374	524		1294		983	1670	
Starvation Cap Reductn		0			0	0		0		0	0	
Spillback Cap Reductn		0			0	0		0		0	0	
Storage Cap Reductn		0			0	0		0		0	0	
Reduced v/c Ratio		0.02			0.00	0.33		0.29		0.29	0.38	

Intersection Summary	
Cycle Length:	120
Actuated Cycle Length:	96.3
Natural Cycle:	120
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.55

Lanes, Volumes, Timings  
1: Greenbank & Jockvale

01-28-2019

Intersection Signal Delay: 4.4	Intersection LOS: A
Intersection Capacity Utilization 75.3%	ICU Level of Service D
Analysis Period (min) 15	

Split and Phases: 1: Greenbank & Jockvale



Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	44	117	102	163	124	169	149	412	70	191	545	43
Future Volume (vph)	44	117	102	163	124	169	149	412	70	191	545	43
Satd. Flow (prot)	1658	1623	0	1658	1593	0	1658	3243	0	3216	3279	0
Fit Permitted	0.290			0.391			0.950			0.950		
Satd. Flow (perm)	506	1623	0	682	1593	0	1658	3243	0	3216	3279	0
Satd. Flow (RTOR)		34			54			19			8	
Lane Group Flow (vph)	49	243	0	181	326	0	166	536	0	212	654	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (%)	10.8%	29.2%		10.8%	29.2%		16.7%	43.3%		16.7%	43.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	29.6	23.1		31.3	26.0		13.4	47.4		12.0	46.0	
Actuated g/C Ratio	0.26	0.20		0.27	0.23		0.12	0.41		0.10	0.40	
v/c Ratio	0.25	0.69		0.75	0.81		0.86	0.40		0.63	0.50	
Control Delay	30.3	46.5		53.2	52.1		87.5	25.0		58.7	27.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	30.3	46.5		53.2	52.1		87.5	25.0		58.7	27.8	
LOS	C	D		D	D		F	C		E	C	
Approach Delay		43.8			52.5			39.8			35.4	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	8.1	46.2		32.7	64.1		40.2	47.2		25.7	62.3	
Queue Length 95th (m)	17.3	74.5		#57.7	#108.0		#82.2	65.4		39.2	82.9	
Internal Link Dist (m)		102.8			148.8			283.1			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	198	430		242	438		199	1351		386	1320	
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	0.25	0.57		0.75	0.74		0.83	0.40		0.55	0.50	

Intersection Summary

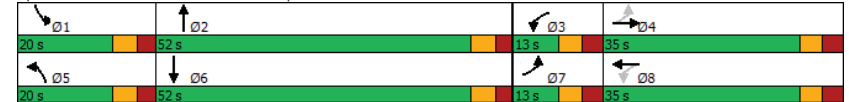
Cycle Length: 120  
 Actuated Cycle Length: 114.6  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.86

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 41.4  
 Intersection Capacity Utilization 69.8%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	145	814	168	160	654	184	201	264	53	251	331	124
Future Volume (vph)	145	814	168	160	654	184	201	264	53	251	331	124
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3233	0	3216	3316	1483
Fit Permitted	0.209			0.116			0.950			0.950		
Satd. Flow (perm)	365	3316	1483	202	3316	1483	3216	3233	0	3216	3316	1483
Satd. Flow (RTOR)			187		204		19					149
Lane Group Flow (vph)	161	904	187	178	727	204	223	352	0	279	368	138
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (%)	15.0%	34.2%	34.2%	15.0%	34.2%	34.2%	20.0%	30.8%		20.0%	30.8%	30.8%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	44.3	33.8	33.8	45.4	34.4	34.4	13.3	30.5		14.9	32.1	32.1
Actuated g/C Ratio	0.38	0.29	0.29	0.39	0.30	0.30	0.11	0.26		0.13	0.28	0.28
v/c Ratio	0.63	0.94	0.33	0.82	0.74	0.35	0.60	0.41		0.68	0.40	0.27
Control Delay	32.5	58.4	6.3	55.3	42.9	6.2	56.3	35.7		57.3	36.6	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
Total Delay	32.5	58.4	6.3	55.3	42.9	6.2	56.3	35.7		57.3	36.6	6.0
LOS	C	E	A	E	D	A	E	D		E	D	A
Approach Delay		47.3			38.2			43.7			38.6	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	23.5	112.2	0.0	27.1	84.0	0.0	27.0	35.3		33.7	38.3	0.0
Queue Length 95th (m)	40.0	#157.7	17.3	#67.7	110.2	18.2	39.5	51.2		48.4	55.5	13.8
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	268	984	571	222	989	585	489	862		489	915	517
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.60	0.92	0.33	0.80	0.74	0.35	0.46	0.41		0.57	0.40	0.27

Intersection Summary

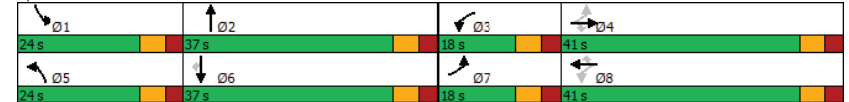
Cycle Length: 120  
 Actuated Cycle Length: 116.3  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.94

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 42.2  
 Intersection Capacity Utilization 71.7%  
 Intersection LOS: D  
 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: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	19	704	41	85	687	385	74	106	85	327	94	18
Future Volume (vph)	19	704	41	85	687	385	74	106	85	327	94	18
Satd. Flow (prot)	1658	3289	0	1658	3137	0	1658	1745	1483	1658	1703	0
Fit Permitted	0.149			0.222			0.677			0.448		
Satd. Flow (perm)	260	3289	0	387	3137	0	1181	1745	1483	782	1703	0
Satd. Flow (RTOR)		6			105				145		9	
Lane Group Flow (vph)	21	828	0	94	1191	0	82	118	94	363	124	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		2	2	2	1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	13.2%	43.8%		13.2%	43.8%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	3.7	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	6.9	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None		
Act Effct Green (s)	53.2	47.0		60.0	56.3		13.6	13.6	13.6	35.6	35.6	
Actuated g/C Ratio	0.48	0.43		0.55	0.51		0.12	0.12	0.12	0.32	0.32	
v/c Ratio	0.10	0.59		0.31	0.72		0.57	0.55	0.30	0.97	0.22	
Control Delay	13.4	26.6		14.9	23.5		60.9	55.4	4.1	75.1	26.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	13.4	26.6		14.9	23.5		60.9	55.4	4.1	75.1	26.2	
LOS	B	C		B	C		E	E	A	E	C	
Approach Delay		26.3			22.9			40.5			62.7	
Approach LOS		C			C			D			E	
Queue Length 50th (m)	2.0	72.1		9.3	84.4		17.7	25.4	0.0	70.6	18.7	
Queue Length 95th (m)	6.4	104.7		19.6	157.8		34.6	44.9	4.0	#137.7	34.1	
Internal Link Dist (m)		158.5			396.5			177.6			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	260	1409		326	1659		247	365	425	373	703	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.08	0.59		0.29	0.72		0.33	0.32	0.22	0.97	0.18	

Intersection Summary

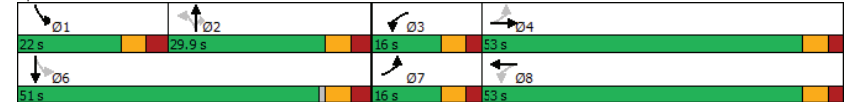
Cycle Length: 120.9  
 Actuated Cycle Length: 109.9  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.97

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 32.3  
 Intersection Capacity Utilization 78.9%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



# Appendix D

Collision Data



Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Traffic Control Condition	Classification Of Accident	Initial Impact Type	Road Surface Condition
2014-08-07	2014	21:46	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	01 - Fatal injury	07 - SMV other	01 - Dry
2014-01-11	2014	8:22	GREENBANK RD @ STRANDHERD DR	04 - Freezing Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	06 - Ice
2014-01-23	2014	17:49	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	06 - Ice
2014-03-12	2014	19:20	GREENBANK RD @ STRANDHERD DR	05 - Drifting Snow	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	03 - Loose snow
2014-05-09	2014	21:00	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	02 - Wet
2014-06-23	2014	13:50	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2014-11-03	2014	8:22	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2014-09-05	2014	11:43	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	07 - SMV other	01 - Dry
2014-12-21	2014	0:13	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	02 - Angle	01 - Dry
2014-01-07	2014	15:45	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	06 - Strong wind	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	03 - Rear end	06 - Ice
2014-01-03	2014	8:58	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	01 - Approaching	06 - Ice
2014-01-07	2014	15:00	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	01 - Dry
2014-01-11	2014	18:30	GREENBANK RD @ JOCKVALE RD	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	07 - SMV other	02 - Wet
2014-01-23	2014	14:19	STRANDHERD DR btwn 215 W OF GREENBANK RD/BARRHAVEN MALL S	01 - Clear	01 - Daylight	10 - No control	04 - At/near private drive	03 - P.D. only	05 - Turning movement	01 - Dry
2014-01-24	2014	18:15	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-01-31	2014	18:41	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-02-11	2014	12:35	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	04 - Sideswipe	02 - Wet
2014-02-01	2014	15:10	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	06 - Ice
2014-02-09	2014	10:01	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-02-21	2014	6:14	GREENBANK RD @ MARKETPLACE AVE	02 - Rain	03 - Dawn	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2014-02-11	2014	8:25	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2014-02-18	2014	7:29	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	03 - Loose snow
2014-02-14	2014	16:44	JOCKVALE RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	03 - Loose snow
2014-03-04	2014	14:07	GREENBANK RD @ MARKETPLACE AVE	03 - Snow	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	02 - Wet
2014-03-26	2014	18:40	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2014-04-03	2014	13:14	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-03-05	2014	21:25	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	02 - Wet
2014-03-28	2014	9:00	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	02 - Wet
2014-04-14	2014	8:35	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-05-03	2014	9:53	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-04-27	2014	15:15	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-06-11	2014	17:27	GREENBANK RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2014-07-03	2014	16:50	JOCKVALE RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2014-07-23	2014	10:47	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	01 - Dry
2014-07-07	2014	14:15	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-07-12	2014	14:19	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-07-28	2014	14:30	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-07-14	2014	7:45	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-07-08	2014	13:54	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-07-18	2014	13:58	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-08-07	2014	21:30	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	01 - Dry
2014-10-14	2014	14:06	STRANDHERD DR btwn 215 W OF GREENBANK RD/BARRHAVEN MALL S	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-11-25	2014	18:29	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-11-08	2014	21:51	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2014-10-14	2014	16:37	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-09-30	2014	10:20	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-11-06	2014	9:12	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-09-17	2014	15:30	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2014-10-29	2014	16:10	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	03 - Rear end	01 - Dry
2014-10-04	2014	1:30	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2014-09-20	2014	16:40	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-10-30	2014	16:16	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2014-12-09	2014	7:48	GREENBANK RD @ STRANDHERD DR	01 - Clear	03 - Dawn	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2014-12-09	2014	16:45	JOCKVALE RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2014-09-13	2014	13:55	GREENBANK RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2014-09-26	2014	19:50	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2014-11-01	2014	16:13	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-03-02	2015	15:28	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2015-05-07	2015	9:20	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-01-16	2015	10:00	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	05 - Packed snow
2015-01-07	2015	15:51	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-04-17	2015	16:50	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	02 - Non-fatal injury	03 - Rear end	01 - Dry
2015-09-01	2015	20:05	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2015-01-30	2015	16:05	STRANDHERD DR btwn JOCKVALE RD & 215 W OF GREENBANK RD/BARRHAVE	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	02 - Non-fatal injury	03 - Rear end	06 - Ice
2015-05-18	2015	13:39	GREENBANK RD @ MARKETPLACE AVE	02 - Rain	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	02 - Angle	02 - Wet

2015-12-06	2015	10:30	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-10-20	2015	19:58	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-10-17	2015	16:15	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2015-03-01	2015	12:49	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2015-02-08	2015	10:20	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	03 - Loose snow
2015-05-12	2015	14:00	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-05-14	2015	10:46	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-05-18	2015	18:34	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2015-07-10	2015	13:20	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-03-17	2015	23:57	GREENBANK RD @ JOCKVALE RD	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	02 - Angle	01 - Dry
2015-10-01	2015	12:39	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-09-19	2015	9:45	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-05-05	2015	14:53	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-04-29	2015	13:06	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	01 - Dry
2015-04-16	2015	20:44	GREENBANK RD @ JOCKVALE RD	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-07-16	2015	21:00	GREENBANK RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-07-26	2015	13:00	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-02-14	2015	11:00	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	03 - Loose snow
2015-03-01	2015	17:17	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	07 - SMV other	01 - Dry
2015-02-21	2015	12:38	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	02 - Intersection related	06 - Ice
2015-03-18	2015	22:11	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-03-21	2015	15:19	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2015-02-26	2015	18:52	STRANDHERD DR btwn 215 W OF GREENBANK RD/BARRHAVEN MALL S	01 - Clear	07 - Dark	10 - No control	01 - Non intersection	03 - P.D. only	03 - Rear end	02 - Wet
2015-02-21	2015	15:00	GREENBANK RD @ JOCKVALE RD	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	03 - Loose snow
2015-05-20	2015	13:15	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-06-05	2015	18:39	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-06-06	2015	16:29	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2015-08-15	2015	12:00	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-07-29	2015	11:01	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	04 - At/near private drive	03 - P.D. only	05 - Turning movement	01 - Dry
2015-08-15	2015	11:40	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	04 - At/near private drive	03 - P.D. only	02 - Angle	01 - Dry
2015-08-01	2015	13:34	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-06-11	2015	18:52	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-10-25	2015	17:44	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-10-17	2015	14:20	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-11-16	2015	16:29	GREENBANK RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2015-10-10	2015	9:38	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	01 - Dry
2015-12-21	2015	9:31	GREENBANK RD @ JOCKVALE RD	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2015-11-27	2015	7:02	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	01 - Clear	03 - Dawn	10 - No control	01 - Non intersection	03 - P.D. only	03 - Rear end	01 - Dry
2015-12-10	2015	11:35	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2015-12-30	2015	14:00	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2015-12-28	2015	19:13	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-05-28	2016	13:29	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2016-03-05	2016	9:00	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-08-11	2016	12:54	GREENBANK RD @ JOCKVALE RD	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2016-11-18	2016	17:42	GREENBANK RD @ JOCKVALE RD	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-05-05	2016	18:31	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	07 - SMV other	01 - Dry
2016-03-18	2016	18:43	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2016-08-23	2016	12:36	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-06-28	2016	23:01	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-12-23	2016	14:09	GREENBANK RD @ MARKETPLACE AVE	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	02 - Angle	02 - Wet
2016-04-12	2016	9:58	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2016-02-17	2016	20:45	GREENBANK RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	99 - Other	05 - Packed snow
2016-08-22	2016	10:28	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-01-26	2016	0:38	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2016-10-25	2016	18:42	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2016-09-11	2016	10:15	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2016-08-10	2016	18:09	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-07-25	2016	17:39	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-06-04	2016	13:10	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-06-20	2016	19:40	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-05-31	2016	13:15	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-09-22	2016	21:17	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2016-07-21	2016	13:18	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-08-25	2016	19:20	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-12-30	2016	16:05	GREENBANK RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	02 - Wet
2016-12-21	2016	18:36	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry

2016-12-03	2016	18:12	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	99 - Other	01 - Dry
2016-06-14	2016	20:53	GREENBANK RD btwn MARKETPLACE AVE & JOCKVALE RD	01 - Clear	05 - Dusk	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-03-24	2016	15:44	GREENBANK RD btwn STRANDHERD DR & MARKETPLACE AVE	04 - Freezing Rain	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	03 - Rear end	06 - Ice
2016-09-07	2016	10:22	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2016-01-13	2016	13:50	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	02 - Wet
2016-08-17	2016	11:32	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2016-07-14	2016	0:05	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2016-10-20	2016	18:50	JOCKVALE RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	07 - SMV other	02 - Wet
2016-05-14	2016	15:03	JOCKVALE RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2016-08-31	2016	16:41	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-01-12	2016	12:22	JOCKVALE RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	03 - Loose snow
2016-08-05	2016	8:40	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-08-05	2016	8:39	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-07-20	2016	7:46	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-10-06	2016	15:52	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-10-06	2016	20:15	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2016-12-14	2016	14:47	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-12-14	2016	18:55	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-11-09	2016	16:45	JOCKVALE RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-11-25	2016	7:30	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2016-12-09	2016	18:41	JOCKVALE RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	06 - Ice
2016-12-10	2016	12:43	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2016-06-23	2016	14:34	STRANDHERD DR btwn 215 W OF GREENBANK RD/BARRHAVEN MALL S	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2016-01-12	2016	15:58	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	03 - Snow	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	07 - SMV other	03 - Loose snow
2016-06-24	2016	10:30	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2016-09-17	2016	20:30	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	02 - Rain	07 - Dark	10 - No control	01 - Non intersection	03 - P.D. only	07 - SMV other	02 - Wet
2017-06-23	2017	8:09	GREENBANK RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2017-06-09	2017	17:50	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-05-17	2017	21:42	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2017-05-13	2017	16:26	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-07-20	2017	12:02	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2017-08-05	2017	15:10	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2017-07-12	2017	9:25	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-08-10	2017	11:39	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	03 - Rear end	01 - Dry
2017-08-25	2017	16:47	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-07-11	2017	5:07	GREENBANK RD @ STRANDHERD DR	01 - Clear	03 - Dawn	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-07-24	2017	22:10	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2017-09-12	2017	16:29	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-09-12	2017	8:17	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-10-28	2017	11:20	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-10-08	2017	10:30	GREENBANK RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2017-11-09	2017	21:44	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	02 - Wet
2017-11-18	2017	15:56	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-11-03	2017	15:29	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-11-18	2017	18:44	GREENBANK RD @ STRANDHERD DR	02 - Rain	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	02 - Wet
2017-12-08	2017	17:58	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-11-30	2017	7:20	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-12-09	2017	16:15	GREENBANK RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-02-14	2017	23:00	GREENBANK RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	03 - Loose snow
2017-01-04	2017	19:05	GREENBANK RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	03 - Loose snow
2017-02-15	2017	18:57	GREENBANK RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	04 - Slush
2017-03-02	2017	12:08	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-03-24	2017	9:00	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	03 - Loose snow
2017-04-08	2017	11:26	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry
2017-02-21	2017	12:50	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-03-24	2017	12:07	GREENBANK RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2017-02-22	2017	18:44	GREENBANK RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2017-03-12	2017	15:12	GREENBANK RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	01 - Dry
2017-12-22	2017	12:35	GREENBANK RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	04 - Sideswipe	03 - Loose snow
2017-05-13	2017	19:15	GREENBANK RD btwn STRANDHERD DR & MARKETPLACE AVE	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	01 - Dry
2017-01-19	2017	17:50	GREENBANK RD btwn STRANDHERD DR & MARKETPLACE AVE	01 - Clear	07 - Dark	10 - No control	01 - Non intersection	02 - Non-fatal injury	04 - Sideswipe	02 - Wet
2017-06-12	2017	17:46	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	01 - Dry
2017-05-11	2017	16:55	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	02 - Non-fatal injury	05 - Turning movement	01 - Dry
2017-05-25	2017	18:40	JOCKVALE RD @ STRANDHERD DR	02 - Rain	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	03 - Rear end	02 - Wet
2017-10-11	2017	8:47	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	03 - Rear end	01 - Dry
2017-11-23	2017	9:18	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	01 - Dry

2017-01-29	2017	15:56	JOCKVALE RD @ STRANDHERD DR	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	02 - Wet
2017-02-03	2017	17:30	JOCKVALE RD @ STRANDHERD DR	01 - Clear	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2017-03-15	2017	19:52	JOCKVALE RD @ STRANDHERD DR	03 - Snow	07 - Dark	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	03 - Loose snow
2017-12-28	2017	13:00	JOCKVALE RD @ STRANDHERD DR	01 - Clear	01 - Daylight	01 - Traffic signal	03 - At intersection	03 - P.D. only	05 - Turning movement	01 - Dry
2017-12-23	2017	22:03	JOCKVALE RD @ STRANDHERD DR	07 - Fog, mist, smoke, dust	07 - Dark	01 - Traffic signal	02 - Intersection related	02 - Non-fatal injury	03 - Rear end	03 - Loose snow
2017-12-30	2017	16:29	JOCKVALE RD @ STRANDHERD DR	01 - Clear	05 - Dusk	01 - Traffic signal	03 - At intersection	03 - P.D. only	03 - Rear end	03 - Loose snow
2017-09-30	2017	12:21	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	01 - Clear	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	05 - Turning movement	01 - Dry
2017-03-14	2017	16:45	STRANDHERD DR @ 215 W OF GREENBANK RD/BARRHAVE	03 - Snow	01 - Daylight	01 - Traffic signal	02 - Intersection related	03 - P.D. only	07 - SMV other	03 - Loose snow
2017-05-25	2017	17:45	STRANDHERD DR btwn 215 W OF GREENBANK RD/BARRHAVEN MALL S	02 - Rain	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	99 - Other	02 - Wet
2017-06-29	2017	14:11	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	02 - Rain	01 - Daylight	10 - No control	01 - Non intersection	02 - Non-fatal injury	07 - SMV other	02 - Wet
2017-03-24	2017	9:07	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	03 - Snow	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	07 - SMV other	04 - Slush
2017-12-19	2017	7:54	STRANDHERD DR btwn ANDORA AVE & JOCKVALE RD	03 - Snow	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	04 - Sideswipe	05 - Packed snow
2017-06-01	2017	9:25	STRANDHERD DR btwn JOCKVALE RD & 215 W OF GREENBANK RD/BAR	01 - Clear	01 - Daylight	10 - No control	01 - Non intersection	03 - P.D. only	99 - Other	01 - Dry
2017-08-12	2017	8:30	STRANDHERD DR btwn JOCKVALE RD & 215 W OF GREENBANK RD/BAR	02 - Rain	01 - Daylight	10 - No control	01 - Non intersection	02 - Non-fatal injury	07 - SMV other	02 - Wet

# Appendix E

Synchro Intersection Worksheets – 2026 Background Conditions

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Traffic Volume (vph)	12	17	27	58	23	106	98	742	74	63	338	6
Future Volume (vph)	12	17	27	58	23	106	98	742	74	63	338	6
Satd. Flow (prot)	1658	1585	0	1658	1530	0	1658	3269	0	3216	3306	0
Fit Permitted	0.674			0.522			0.950			0.950		
Satd. Flow (perm)	1176	1585	0	911	1530	0	1658	3269	0	3216	3306	0
Satd. Flow (RTOR)		27			106			11			2	
Lane Group Flow (vph)	12	44	0	58	129	0	98	816	0	63	344	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (%)	10.0%	29.2%		10.0%	29.2%		12.5%	48.3%		12.5%	48.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	12.9	10.6		16.4	15.2		8.6	56.7		7.2	52.8	
Actuated g/C Ratio	0.13	0.11		0.17	0.16		0.09	0.58		0.07	0.54	
v/c Ratio	0.07	0.23		0.29	0.40		0.67	0.43		0.27	0.19	
Control Delay	32.0	25.5		36.6	15.1		67.9	14.2		46.9	12.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	32.0	25.5		36.6	15.1		67.9	14.2		46.9	12.9	
LOS	C	C		D	B		E	B		D	B	
Approach Delay		26.9			21.8			20.0			18.1	
Approach LOS		C			C			B			B	
Queue Length 50th (m)	2.0	3.3		9.8	3.8		20.1	53.0		6.4	19.5	
Queue Length 95th (m)	6.9	13.9		20.9	22.4		#47.2	75.4		13.4	29.6	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	182	481		202	521		148	1897		286	1782	
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	0.07	0.09		0.29	0.25		0.66	0.43		0.22	0.19	

Intersection Summary

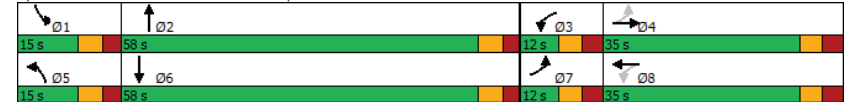
Cycle Length: 120  
 Actuated Cycle Length: 98  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.67

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 20.0  
 Intersection Capacity Utilization 54.7%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	↖	→	↘	↙	←	↖	↙	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↖	↖	↖↗	↖	↖↗	↖↗	↖	↖↗	↖↗	↖
Traffic Volume (vph)	114	526	141	83	642	163	172	308	96	175	188	101
Future Volume (vph)	114	526	141	83	642	163	172	308	96	175	188	101
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3196	0	3216	3316	1483
Fit Permitted	0.213			0.390			0.950			0.950		
Satd. Flow (perm)	372	3316	1483	681	3316	1483	3216	3196	0	3216	3316	1483
Satd. Flow (RTOR)			149			163		33				149
Lane Group Flow (vph)	114	526	141	83	642	163	172	404	0	175	188	101
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (%)	15.8%	34.2%	34.2%	15.8%	34.2%	34.2%	20.0%	30.0%		20.0%	30.0%	30.0%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	38.3	29.9	29.9	33.9	25.4	25.4	10.9	29.8		11.0	29.9	29.9
Actuated g/C Ratio	0.37	0.29	0.29	0.33	0.25	0.25	0.11	0.29		0.11	0.29	0.29
v/c Ratio	0.43	0.54	0.26	0.27	0.78	0.33	0.51	0.42		0.51	0.19	0.19
Control Delay	24.2	34.2	5.7	21.2	43.6	6.9	50.1	30.3		50.0	30.2	2.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	24.2	34.2	5.7	21.2	43.6	6.9	50.1	30.3		50.0	30.2	2.3
LOS	C	C	A	C	D	A	D	C		D	C	A
Approach Delay		27.6			34.7			36.2			31.6	
Approach LOS		C			C			D			C	
Queue Length 50th (m)	14.7	50.4	0.0	10.5	66.0	0.0	17.8	32.9		18.1	15.5	0.0
Queue Length 95th (m)	27.6	73.5	13.4	21.1	92.6	16.0	31.7	56.4		32.0	29.4	4.6
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	300	1131	603	370	1127	611	560	952		560	967	538
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.38	0.47	0.23	0.22	0.57	0.27	0.31	0.42		0.31	0.19	0.19

Intersection Summary

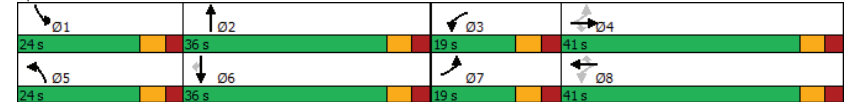
Cycle Length: 120  
 Actuated Cycle Length: 102.5  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 32.5  
 Intersection Capacity Utilization 64.5%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service C

Splits and Phases: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	22	643	11	44	832	264	33	39	35	259	47	18
Future Volume (vph)	22	643	11	44	832	264	33	39	35	259	47	18
Satd. Flow (prot)	1658	3306	0	1658	3196	0	1658	1745	1483	1658	1672	0
Fit Permitted	0.186			0.339			0.715			0.388		
Satd. Flow (perm)	325	3306	0	592	3196	0	1248	1745	1483	677	1672	0
Satd. Flow (RTOR)		2			43				145		18	
Lane Group Flow (vph)	22	654	0	44	1096	0	33	39	35	259	65	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8			2			1	6
Permitted Phases	4			8			2		2		6	
Detector Phase	7	4		3	8		2	2	2		1	6
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	10.8%	46.3%		10.8%	46.3%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	3.7	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	6.9	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None	None	
Act Effct Green (s)	56.1	51.4		58.8	56.2		10.5	10.5	10.5	27.5	27.5	
Actuated g/C Ratio	0.55	0.50		0.58	0.55		0.10	0.10	0.10	0.27	0.27	
v/c Ratio	0.08	0.39		0.11	0.61		0.26	0.22	0.12	0.80	0.14	
Control Delay	10.7	18.6		10.7	19.1		50.8	48.4	0.9	51.8	22.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	10.7	18.6		10.7	19.1		50.8	48.4	0.9	51.8	22.1	
LOS	B	B		B	B		D	D	A	D	C	
Approach Delay		18.4			18.8			33.6			45.8	
Approach LOS		B			B			C			D	
Queue Length 50th (m)	1.9	49.2		3.9	72.6		6.9	8.1	0.0	47.6	7.5	
Queue Length 95th (m)	5.5	66.7		9.2	126.8		17.0	18.9	0.0	#81.7	18.1	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	272	1669		415	1784		287	401	453	337	763	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.08	0.39		0.11	0.61		0.11	0.10	0.08	0.77	0.09	

Intersection Summary

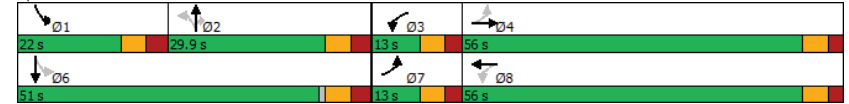
Cycle Length: 120.9  
 Actuated Cycle Length: 101.8  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.80

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 23.3  
 Intersection Capacity Utilization 71.2%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd





Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	117	102	167	124	185	149	517	70	224	703	43
Future Volume (vph)	44	117	102	167	124	185	149	517	70	224	703	43
Satd. Flow (prot)	1658	1623	0	1658	1588	0	1658	3256	0	3216	3286	0
Fit Permitted	0.313			0.431			0.950			0.950		
Satd. Flow (perm)	546	1623	0	752	1588	0	1658	3256	0	3216	3286	0
Satd. Flow (RTOR)		34			59			14			6	
Lane Group Flow (vph)	44	219	0	167	309	0	149	587	0	224	746	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (%)	10.8%	29.2%		10.8%	29.2%		16.7%	43.3%		16.7%	43.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	28.3	21.8		30.0	24.8		12.9	46.8		12.2	46.1	
Actuated g/C Ratio	0.25	0.19		0.27	0.22		0.11	0.41		0.11	0.41	
v/c Ratio	0.22	0.64		0.66	0.78		0.78	0.43		0.65	0.56	
Control Delay	29.8	44.0		45.8	49.1		77.9	25.5		58.6	28.5	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.8	44.0		45.8	49.1		77.9	25.5		58.6	28.5	
LOS	C	D		D	D		E	C		E	C	
Approach Delay		41.6			48.0			36.1			35.5	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	7.3	40.1		29.9	58.0		34.9	51.6		26.5	71.4	
Queue Length 95th (m)	16.0	66.3		48.5	92.2		#71.4	72.8		41.2	97.2	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	203	437		253	446		202	1357		392	1342	
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	0.50		0.66	0.69		0.74	0.43		0.57	0.56	

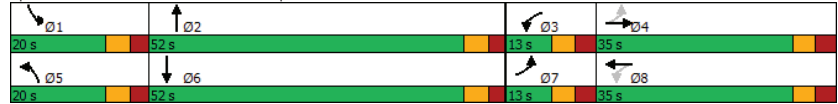
**Intersection Summary**  
 Cycle Length: 120  
 Actuated Cycle Length: 113  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 38.8 Intersection LOS: D  
 Intersection Capacity Utilization 74.9% ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔↔	↔	↔	↔↔	↔	↔↔	↔↔	↔	↔↔	↔↔	↔
Traffic Volume (vph)	145	865	220	212	695	184	232	311	84	251	404	124
Future Volume (vph)	145	865	220	212	695	184	232	311	84	251	404	124
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3210	0	3216	3316	1483
Fit Permitted	0.235			0.117			0.950			0.950		
Satd. Flow (perm)	410	3316	1483	204	3316	1483	3216	3210	0	3216	3316	1483
Satd. Flow (RTOR)			220			184		27				149
Lane Group Flow (vph)	145	865	220	212	695	184	232	395	0	251	404	124
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (%)	15.0%	34.2%	34.2%	15.0%	34.2%	34.2%	20.0%	30.8%		20.0%	30.8%	30.8%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	43.4	33.2	33.2	45.6	34.3	34.3	13.6	30.6		14.1	31.1	31.1
Actuated g/C Ratio	0.38	0.29	0.29	0.40	0.30	0.30	0.12	0.27		0.12	0.27	0.27
v/c Ratio	0.55	0.91	0.38	0.95	0.70	0.32	0.61	0.45		0.64	0.45	0.24
Control Delay	28.4	53.8	6.2	77.6	41.1	6.2	55.8	35.5		56.2	37.7	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	28.4	53.8	6.2	77.6	41.1	6.2	55.8	35.5		56.2	37.7	4.5
LOS	C	D	A	E	D	A	E	D		E	D	A
Approach Delay		42.3			42.3			43.0				38.4
Approach LOS		D			D			D				D
Queue Length 50th (m)	20.6	104.1	0.0	35.7	78.2	0.0	27.7	39.1		30.0	42.7	0.0
Queue Length 95th (m)	36.2	#146.6	18.7	#88.9	104.6	17.2	40.8	56.8		44.0	61.2	10.2
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	282	995	599	224	1004	577	495	871		495	893	508
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.51	0.87	0.37	0.95	0.69	0.32	0.47	0.45		0.51	0.45	0.24

Intersection Summary

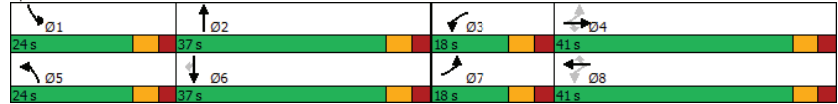
Cycle Length: 120  
 Actuated Cycle Length: 115.2  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.95

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 41.6 Intersection LOS: D  
 Intersection Capacity Utilization 78.7% 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: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↗	↖	↖↗	↗	↖	↖↗	↗	↖	↖↗	↗
Traffic Volume (vph)	19	800	41	85	761	385	74	106	85	327	94	18
Future Volume (vph)	19	800	41	85	761	385	74	106	85	327	94	18
Satd. Flow (prot)	1658	3292	0	1658	3150	0	1658	1745	1483	1658	1703	0
Fit Permitted	0.158			0.227			0.685			0.491		
Satd. Flow (perm)	276	3292	0	396	3150	0	1195	1745	1483	857	1703	0
Satd. Flow (RTOR)		5			86			130			9	
Lane Group Flow (vph)	19	841	0	85	1146	0	74	106	85	327	112	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8		2	2	2	1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	13.2%	43.8%		13.2%	43.8%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	2.0	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	5.2	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None		
Act Effct Green (s)	52.1	47.3		57.2	53.7		12.8	12.8	12.8	35.9	34.2	
Actuated g/C Ratio	0.49	0.45		0.54	0.51		0.12	0.12	0.12	0.34	0.32	
v/c Ratio	0.09	0.57		0.28	0.70		0.51	0.50	0.29	0.79	0.20	
Control Delay	12.7	25.0		14.1	22.7		58.3	53.6	4.6	45.5	25.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	12.7	25.0		14.1	22.7		58.3	53.6	4.6	45.5	25.7	
LOS	B	C		B	C		E	D	A	D	C	
Approach Delay		24.7			22.1			39.2			40.4	
Approach LOS		C			C			D			D	
Queue Length 50th (m)	1.8	72.3		8.2	79.0		15.8	22.6	0.0	60.1	16.6	
Queue Length 95th (m)	5.7	104.8		17.5	146.7		31.8	41.0	4.6	#98.1	31.1	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	273	1474		334	1642		261	382	426	418	735	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.07	0.57		0.25	0.70		0.28	0.28	0.20	0.78	0.15	

Intersection Summary  
 Cycle Length: 120.9  
 Actuated Cycle Length: 105.8  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.79

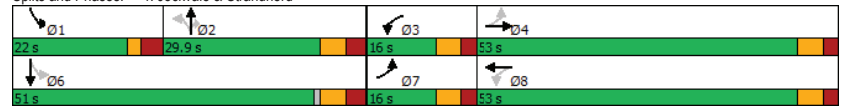
Lanes, Volumes, Timings

4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 27.4 Intersection LOS: C  
 Intersection Capacity Utilization 81.1% 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.

Splits and Phases: 4: Jockvale & Strandherd



# Appendix F

Synchro Intersection Worksheets – 2031 Background Conditions

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	145	898	79	221	722	184	123	327	89	251	426	124
Future Volume (vph)	145	898	79	221	722	184	123	327	89	251	426	124
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3210	0	3216	3316	1483
Fit Permitted	0.244			0.104			0.950			0.950		
Satd. Flow (perm)	426	3316	1483	181	3316	1483	3216	3210	0	3216	3316	1483
Satd. Flow (RTOR)			143			184		26				143
Lane Group Flow (vph)	145	898	79	221	722	184	123	416	0	251	426	124
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	18.0	43.0	43.0	20.0	45.0	45.0	24.0	38.0		24.0	38.0	38.0
Total Split (%)	14.4%	34.4%	34.4%	16.0%	36.0%	36.0%	19.2%	30.4%		19.2%	30.4%	30.4%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	45.6	35.4	35.4	51.7	38.4	38.4	10.0	31.6		14.4	36.0	36.0
Actuated g/C Ratio	0.38	0.29	0.29	0.43	0.32	0.32	0.08	0.26		0.12	0.30	0.30
v/c Ratio	0.54	0.92	0.15	0.92	0.69	0.31	0.46	0.48		0.66	0.43	0.23
Control Delay	28.4	57.4	0.6	71.5	40.3	5.9	58.9	38.1		59.5	36.3	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
Total Delay	28.4	57.4	0.6	71.5	40.3	5.9	58.9	38.1		59.5	36.3	4.7
LOS	C	E	A	E	D	A	E	D		E	D	A
Approach Delay		49.7			40.8			42.8			38.6	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	21.0	114.5	0.0	40.3	83.6	0.0	15.5	44.1		31.5	45.6	0.0
Queue Length 95th (m)	36.5	#159.3	0.0	#93.1	109.8	17.2	25.7	62.4		45.8	63.4	10.9
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	281	1004	548	241	1067	602	472	858		472	988	542
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.52	0.89	0.14	0.92	0.68	0.31	0.26	0.48		0.53	0.43	0.23

Intersection Summary

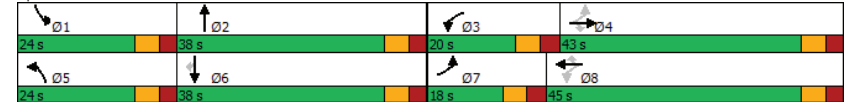
Cycle Length: 125  
Actuated Cycle Length: 120.7  
Natural Cycle: 120  
Control Type: Actuated-Uncoordinated  
Maximum v/c Ratio: 0.92

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

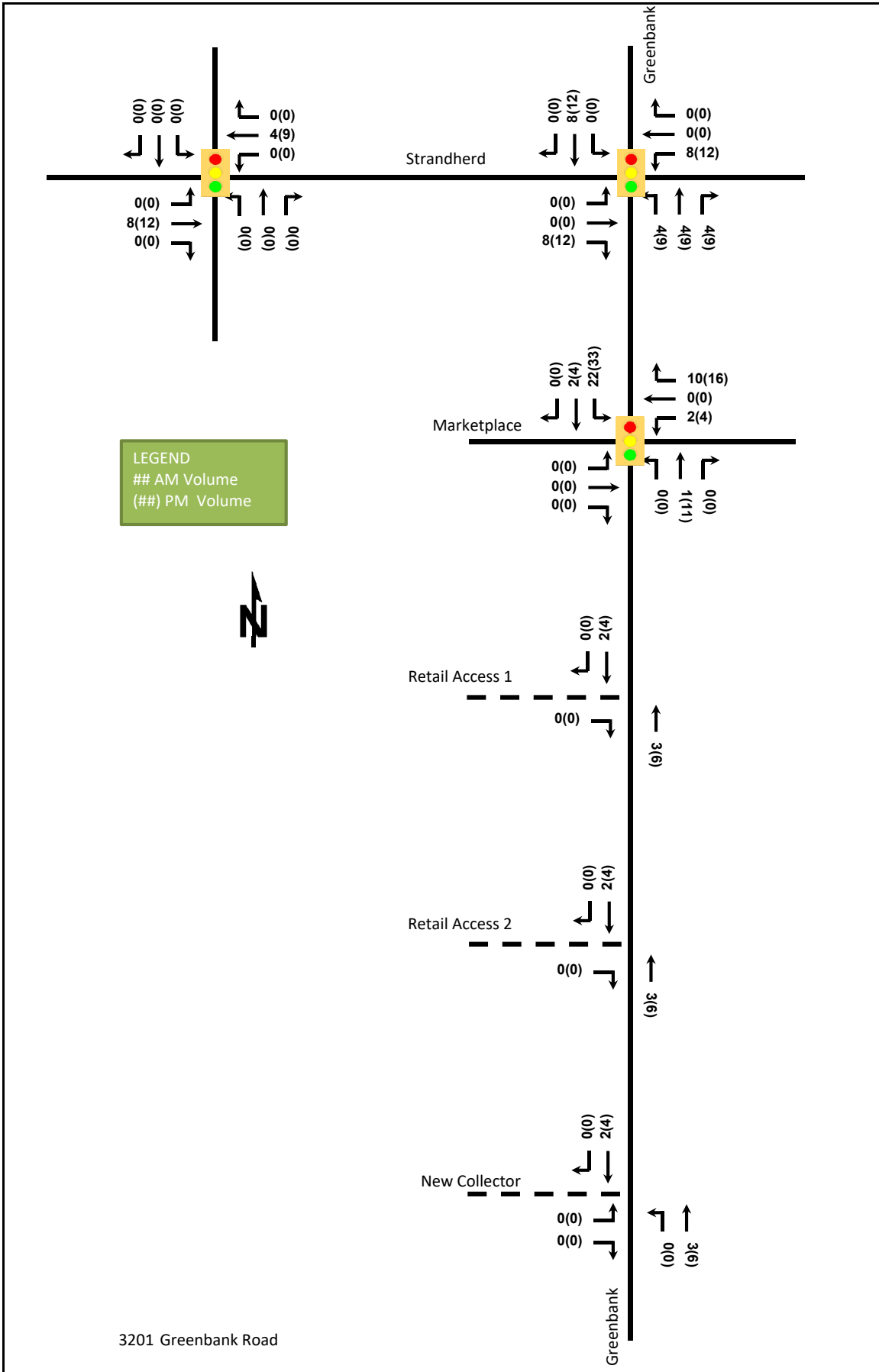
Intersection Signal Delay: 43.4  
Intersection Capacity Utilization 80.8%  
Analysis Period (min) 15  
# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.

Splits and Phases: 3: Greenbank & Strandherd

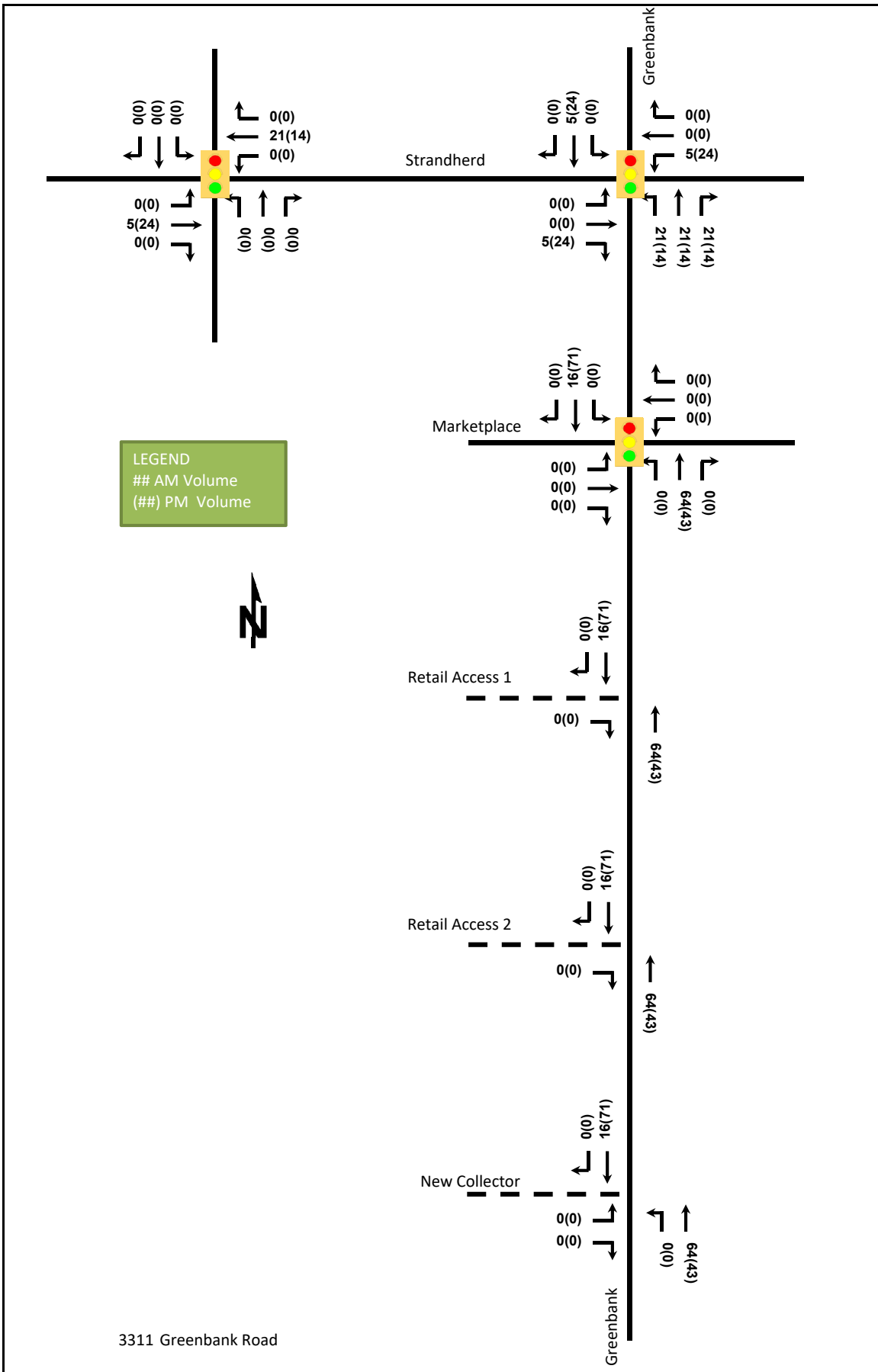


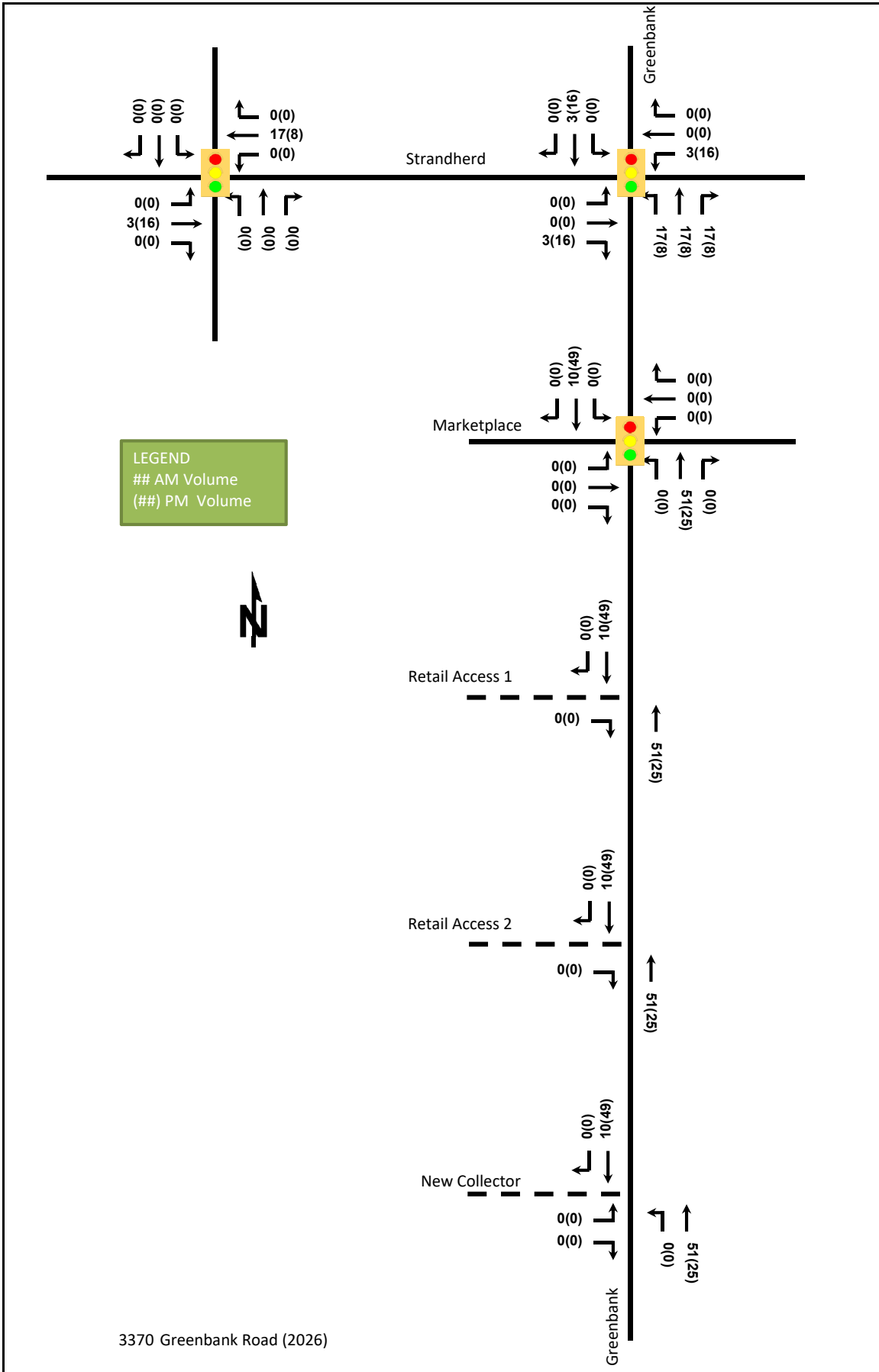
# Appendix G

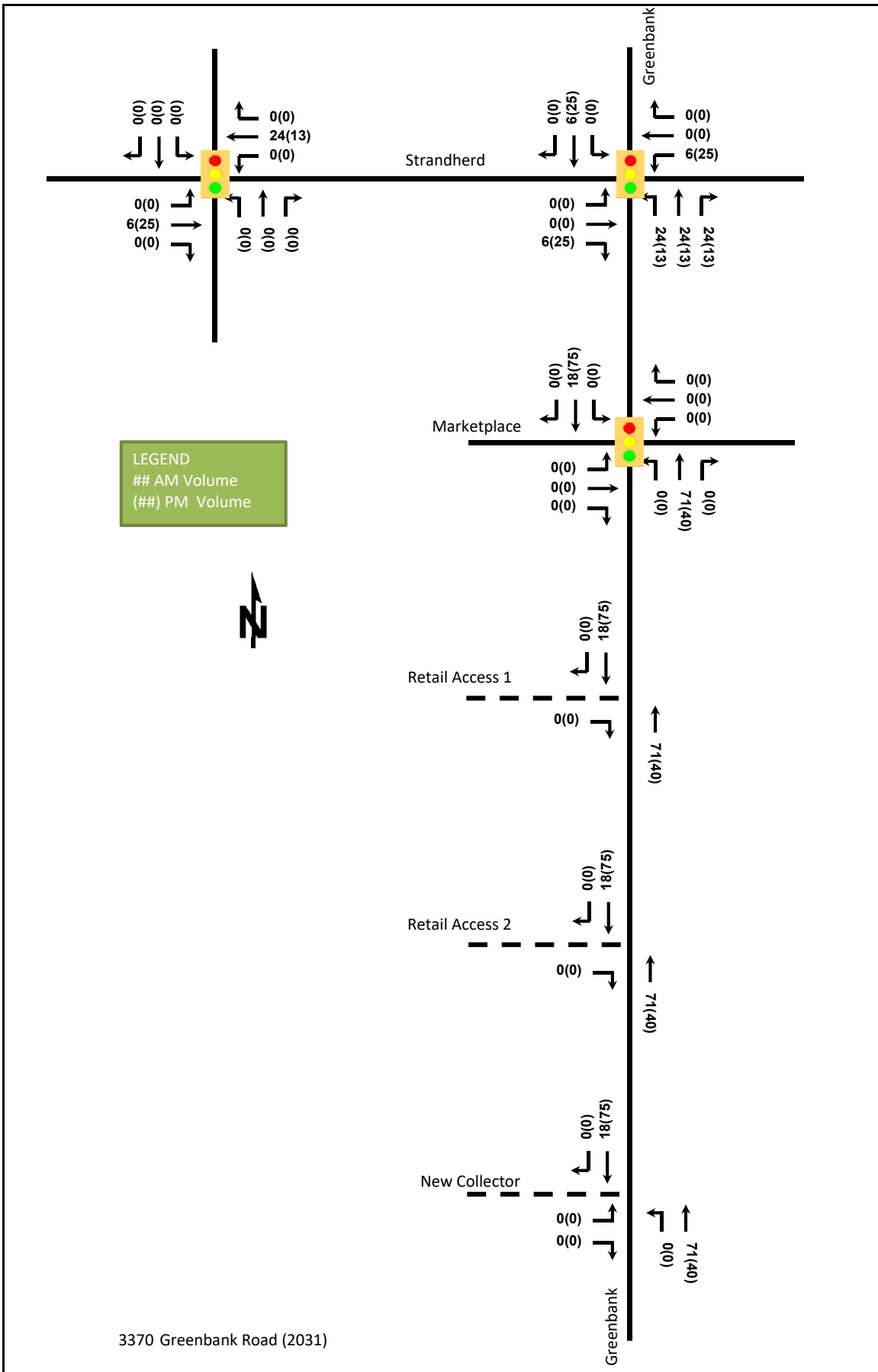
Background Development Volumes











# Appendix H

MMLOS Analysis

**Multi-Modal Level of Service - Intersections Form**

Consultant	CGH Transportation	Project	3194 Jockvale Road
Scenario		Date	Dec. 2018
Comments			

INTERSECTIONS																		
Greenbank Road & Marketplace Avenue																		
Greenbank Road & Strandherd Drive																		
Jockvale Road & Strandherd Drive																		
Greenbank Road & New Collector																		
INTERSECTIONS	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Pedestrian	Lanes	6	5	4	4	7	6	6	4	3	5	5	5	4	5	3	4	
	Median	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	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	Median > 2.4 m	Median > 2.4 m	No Median - 2.4 m		
	Conflicting Left Turns	Permissive	Permissive	Protected	Protected	Permissive	Permissive	Protected	Protected	Protected/ Permissive	Protected/ Permissive	Protected/ Permissive	Permissive	Permissive	No left turn / Prohib.	Permissive		
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	No right turn	Permissive or yield control	Permissive or yield control	
	Right Turns on Red (RTor) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR prohibited	RTOR allowed	RTOR allowed	
	Ped Signal Leading Interval?	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
	Right Turn Channel	No Channel	No Channel	No Channel	No Channel	Smart Channel	No Channel	Smart Channel	Smart Channel	Smart 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	15-25m	15-25m	15-25m	>25m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	10-15m	
	Crosswalk Type	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	Std transverse markings	
	PETSJ Score		25	40	61	61	16	23	37	66	70	37	40	40	63	48	70	
	Ped. Exposure to Traffic LoS		F	E	C	C	F	F	E	C	C	E	E	E	C	D	C	-
	Cycle Length		120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Effective Walk Time		28	28	25	25	27	27	29	29	30	30	23	23	18	18	18	18	
Average Pedestrian Delay		35	35	38	38	36	36	35	35	34	34	39	39	15	15	15	15	
Pedestrian Delay LoS		D	D	D	D	D	D	D	D	D	D	D	D	B	B	B	-	
Level of Service		F	E	D	D	F	F	E	D	D	E	E	E	C	D	C	-	
		F				F				E				D				
Approach From																		
Bicycle	Bicycle Lane Arrangement on Approach	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic	Mixed Traffic	Pocket Bike Lane	Curb Bike Lane, Cycletrack or MUP	Pocket Bike Lane	Pocket Bike Lane	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Mixed Traffic		
	Right Turn Lane Configuration	Not Applicable	Not Applicable	≤ 50 m	≤ 50 m	> 50 m Introduced right turn lane	Not Applicable	Bike lane shifts to the left of right turn	≤ 50 m Introduced right turn lane	Not Applicable	> 50 m	Not Applicable	≤ 50 m	Not Applicable	Not Applicable	≤ 50 m		
	Right Turning Speed	Not Applicable	Not Applicable	≤ 25 km/h	≤ 25 km/h	≤ 25 km/h	Not Applicable	>25 to 30 km/h	>25 to 30 km/h	Not Applicable	≤ 25 km/h	Not Applicable	≤ 25 km/h	Not Applicable	Not Applicable	≤ 25 km/h		
	Cyclist relative to RT motorists	Not Applicable	Not Applicable	D	D	D	Not Applicable	F	C	Not Applicable	F	Not Applicable	D	Not Applicable	Not Applicable	-	D	
	Separated or Mixed Traffic	Separated	Separated	Mixed Traffic	Mixed Traffic	Separated	Separated	Separated	Separated	Separated	Mixed Traffic	Separated	Mixed Traffic	Separated	Separated	-	Mixed Traffic	
	Left Turn Approach	≥ 2 lanes crossed	≥ 2 lanes crossed	No lane crossed	No lane crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	≥ 2 lanes crossed	Other LT config	One lane crossed	Other LT config	One lane crossed	Other LT config	One lane crossed	≥ 2 lanes crossed	One lane crossed	
	Operating Speed	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	≤ 40 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	> 50 to < 60 km/h	> 40 to ≤ 50 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	≥ 60 km/h	> 40 to ≤ 50 km/h	
Left Turning Cyclist		F	F	B	B	F	F	F	F	F	D	F	F	-	F	-	D	
Level of Service		F	F	D	D	F	F	F	F	F	F	F	F	-	F	-	D	
		F				F				F				F				
Transit	Average Signal Delay	≤ 30 sec	≤ 30 sec	> 40 sec	> 40 sec	> 40 sec	> 40 sec	≤ 40 sec	≤ 40 sec	≤ 30 sec	> 40 sec	≤ 30 sec	≤ 30 sec	≤ 10 sec	≤ 10 sec	-	≤ 20 sec	
	Level of Service	D	D	F	F	F	F	E	E	D	F	D	D	B	B	-	C	
		F				F				F				C				
Truck	Effective Corner Radius	10 - 15 m	10 - 15 m	10 - 15 m	10 - 15 m	> 15 m	10 - 15 m	> 15 m	> 15 m	10 - 15 m	10 - 15 m	10 - 15 m	< 10 m	10 - 15 m	10 - 15 m	-	10 - 15 m	
	Number of Receiving Lanes on Departure from Intersection	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	≥ 2	1	≥ 2	1	-	≥ 2	≥ 2	
	Level of Service	B	B	B	B	A	B	A	A	B	B	E	D	E	-	-	B	
		B				B				E				E				
Auto	Volume to Capacity Ratio	0.61 - 0.70				0.71 - 0.80				0.61 - 0.70				0.0 - 0.60				
	Level of Service	B				C				B				A				

# Multi-Modal Level of Service - Segments Form

Consultant	CGH Transportation
Scenario	
Comments	

Project	3194 Jockvale Road
Date	Dec. 2018

SEGMENTS		Greenbank Road	Existing	Future	Section	Section
			1	2	3	4
Pedestrian	Sidewalk Width	E	1.8 m	≥ 2 m		
	Boulevard Width		0.5 - 2 m	0.5 - 2 m		
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000		
	Operating Speed		> 60 km/h	> 60 km/h		
	On-Street Parking		no	no		
	<b>Exposure to Traffic PLoS</b>		<b>E</b>	<b>E</b>	-	-
	Effective Sidewalk Width		1.2 m	2.0 m		
Pedestrian Volume	250 ped/hr	250 ped/hr				
<b>Crowding PLoS</b>	<b>B</b>	<b>B</b>	-	-		
<b>Level of Service</b>	<b>E</b>	<b>E</b>	-	-		
Bicycle	Type of Cycling Facility	F	Mixed Traffic	Curbside Bike Lane		
	Number of Travel Lanes		2-3 lanes total	2 ea. dir. (w median)		
	Operating Speed		≥ 60 km/h	>50 to 70 km/h		
	<b># of Lanes &amp; Operating Speed LoS</b>		<b>F</b>	<b>C</b>	-	-
	Bike Lane (+ Parking Lane) Width			≥ 1.8 m		
	<b>Bike Lane Width LoS</b>		-	<b>A</b>	-	-
	Bike Lane Blockages			Rare		
	<b>Blockage LoS</b>		-	<b>A</b>	-	-
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge	≥ 1.8 m refuge		
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes	≤ 3 lanes		
Sidestreet Operating Speed	>40 to 50 km/h	>40 to 50 km/h				
<b>Unsignalized Crossing - Lowest LoS</b>	<b>B</b>	<b>B</b>	-	-		
<b>Level of Service</b>	<b>F</b>	<b>C</b>	-	-		
Transit	Facility Type	D	Mixed Traffic	Mixed Traffic		
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8		
<b>Level of Service</b>	<b>D</b>	<b>D</b>	-	-		
Truck	Truck Lane Width	A	≤ 3.5 m	≤ 3.5 m		
	Travel Lanes per Direction		> 1	> 1		
<b>Level of Service</b>	<b>A</b>	<b>A</b>	-	-		
Auto	<b>Level of Service</b>	<b>Not Applicable</b>				

# Appendix I

Signal Warrant Analysis

# City of Ottawa Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Greenbank Road	Direction (EW or NS)	NS
Side Street (name)	New Collector Road	Direction (EW or NS)	EW
Quadrant / Int #		Comments	2026 Scenario
	<b>CHECK SHEET</b>		

press 'CHECK SHEET' button to calculate results

Road Authority:	City of Ottawa
City:	Ottawa
Analysis Date:	2018 Dec 19, Wed
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Greenbank Road	NB		1	1					2
Greenbank Road	SB			1		1			2
New Collector Road	WB								
New Collector Road	EB	1					1		

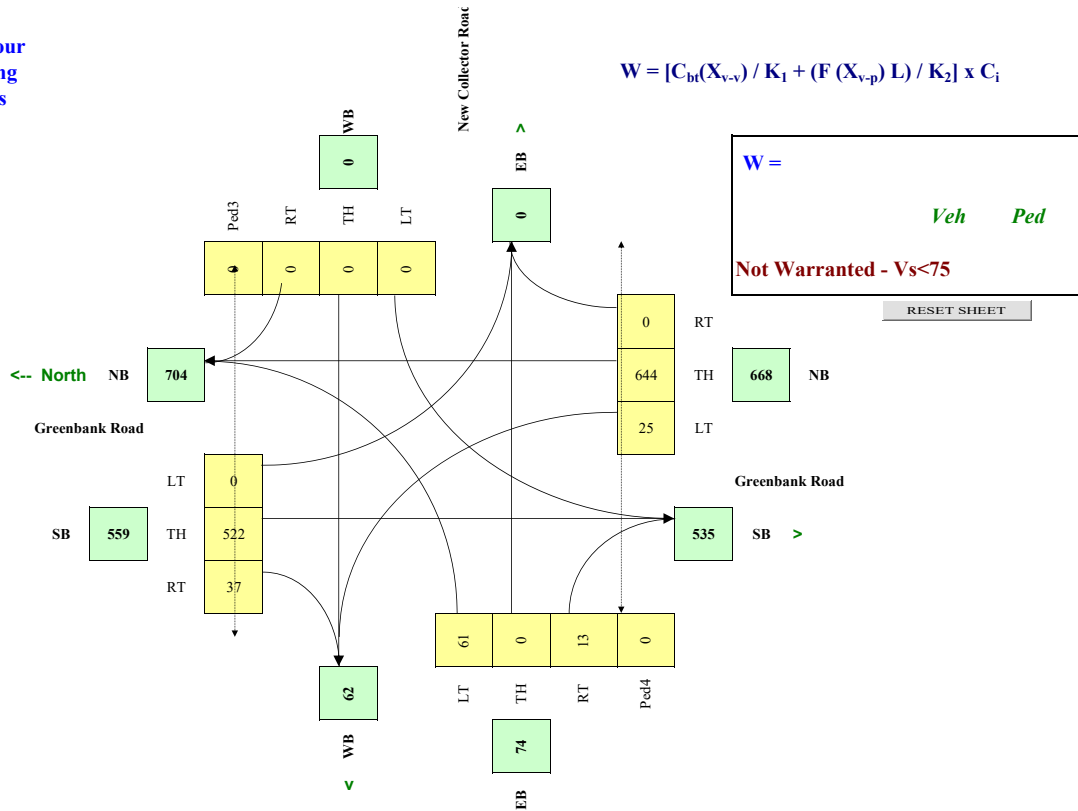
Demographics		
Elem. School/Mobility Impaired	(y/n)	
Senior's Complex	(y/n)	
Pathway to School	(y/n)	
Metro Area Population	(#)	
Central Business District	(y/n)	

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Greenbank Road	NS	60	2.0%	y	5.0
New Collector Road	EW	50	2.0%	y	0.0

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
press 'Set Peak Hours' Button to set the peak hour periods	13	761	0	0	320	24	0	0	0	37	0	6				
	15	879	0	0	370	28	0	0	0	43	0	7				
	9	532	0	0	224	17	0	0	0	26	0	4				
	21	321	0	0	421	29	0	0	0	49	0	12				
	44	663	0	0	871	60	0	0	0	101	0	24				
47	705	0	0	926	64	0	0	0	107	0	26					
<b>Total (6-hour peak)</b>	<b>149</b>	<b>3,861</b>	<b>0</b>	<b>0</b>	<b>3,132</b>	<b>222</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>363</b>	<b>0</b>	<b>79</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>25</b>	<b>644</b>	<b>0</b>	<b>0</b>	<b>522</b>	<b>37</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>61</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

## Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$$





## City of Ottawa Canadian Matrix Traffic Signal Warrant Analysis

Main Street (name)	Greenbank Road	Direction (EW or NS)	NS
Side Street (name)	New Collector Road	Direction (EW or NS)	EW
Quadrant / Int #		Comments	2031 Scenario
<b>CHECK SHEET</b>			

[press 'CHECK SHEET' button to calculate results](#)

Road Authority:	City of Ottawa
City:	Ottawa
Analysis Date:	2018 Dec 19, Wed
Count Date:	
Date Entry Format:	(yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Greenbank Road	NB		1	1					2
Greenbank Road	SB			1		1			2
New Collector Road	WB								
New Collector Road	EB	1					1		

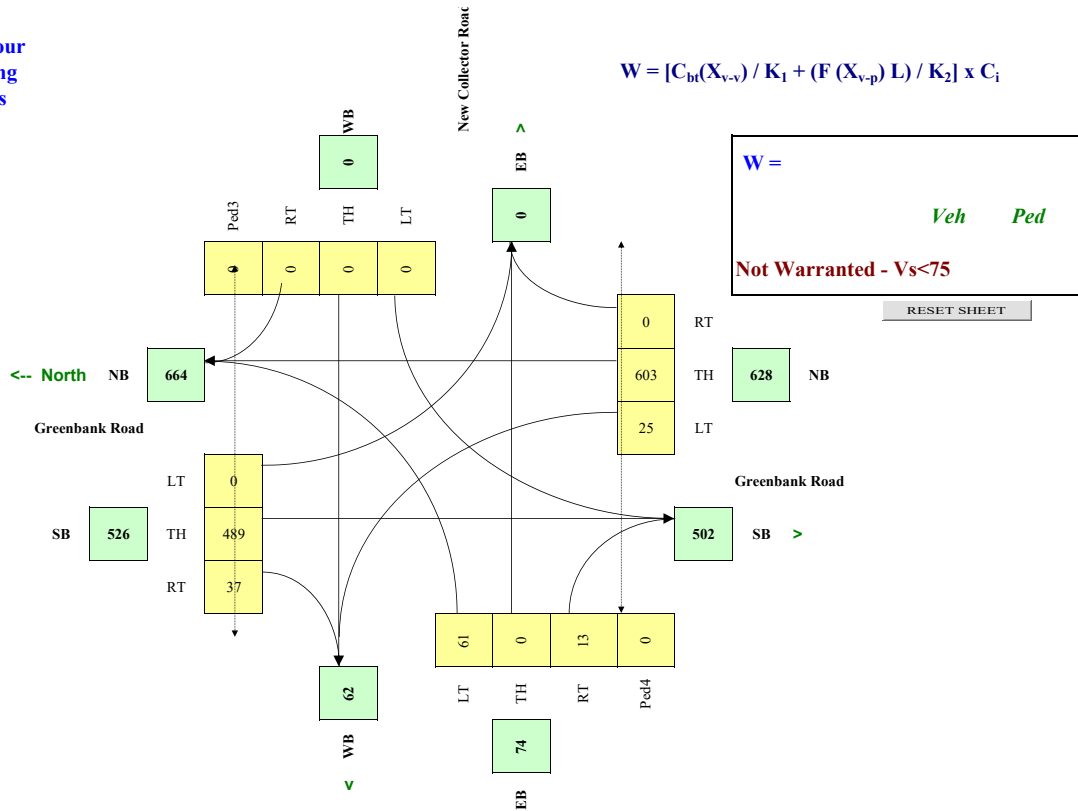
Demographics	
Elem. School/Mobility Impaired	(y/n)
Senior's Complex	(y/n)
Pathway to School	(y/n)
Metro Area Population	(#)
Central Business District	(y/n)

Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Greenbank Road	NS	60	2.0%	y	5.0
New Collector Road	EW	50	2.0%	y	0.0

Set Peak Hours													Ped1	Ped2	Ped3	Ped4
Traffic Input	NB			SB			WB			EB			NS	NS	EW	EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
<a href="#">press 'Set Peak Hours' Button to set the peak hour periods</a>	13	705	0	0	287	24	0	0	0	37	0	6				
	15	815	0	0	332	28	0	0	0	43	0	7				
	9	493	0	0	201	17	0	0	0	26	0	4				
	21	305	0	0	402	29	0	0	0	49	0	12				
	44	631	0	0	830	60	0	0	0	101	0	24				
	47	671	0	0	883	64	0	0	0	107	0	26				
<b>Total (6-hour peak)</b>	<b>149</b>	<b>3,620</b>	<b>0</b>	<b>0</b>	<b>2,935</b>	<b>222</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>363</b>	<b>0</b>	<b>79</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Average (6-hour peak)</b>	<b>25</b>	<b>603</b>	<b>0</b>	<b>0</b>	<b>489</b>	<b>37</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>61</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

### Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p})L) / K_2] \times C_i$$



# Appendix J

Synchro Intersection Worksheets – 2026 Total Conditions

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘
Traffic Volume (vph)	12	17	27	58	23	106	98	785	74	63	378	6
Future Volume (vph)	12	17	27	58	23	106	98	785	74	63	378	6
Satd. Flow (prot)	1658	1585	0	1658	1530	0	1658	3273	0	3216	3309	0
Fit Permitted	0.674			0.522			0.950			0.950		
Satd. Flow (perm)	1176	1585	0	911	1530	0	1658	3273	0	3216	3309	0
Satd. Flow (RTOR)		27			106			10			2	
Lane Group Flow (vph)	12	44	0	58	129	0	98	859	0	63	384	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (%)	10.0%	29.2%		10.0%	29.2%		12.5%	48.3%		12.5%	48.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	12.9	10.6		16.4	15.2		8.6	56.7		7.2	52.8	
Actuated g/C Ratio	0.13	0.11		0.17	0.16		0.09	0.58		0.07	0.54	
v/c Ratio	0.07	0.23		0.29	0.40		0.67	0.45		0.27	0.22	
Control Delay	32.0	25.5		36.6	15.1		67.9	14.6		46.9	13.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	32.0	25.5		36.6	15.1		67.9	14.6		46.9	13.1	
LOS	C	C		D	B		E	B		D	B	
Approach Delay		26.9			21.8			20.0			17.8	
Approach LOS		C			C			C			B	
Queue Length 50th (m)	2.0	3.3		9.8	3.8		20.1	57.0		6.4	22.0	
Queue Length 95th (m)	6.9	13.9		20.9	22.4		#47.2	80.7		13.4	33.1	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	182	481		202	521		148	1899		286	1784	
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	0.07	0.09		0.29	0.25		0.66	0.45		0.22	0.22	

Intersection Summary

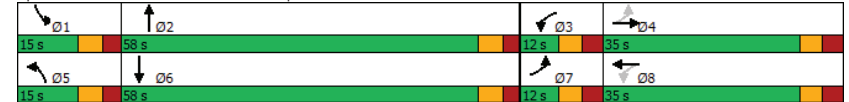
Cycle Length: 120  
 Actuated Cycle Length: 98  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.67

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 19.9  
 Intersection Capacity Utilization 55.9%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	120	537	141	108	657	163	172	325	123	175	205	103
Future Volume (vph)	120	537	141	108	657	163	172	325	123	175	205	103
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3180	0	3216	3316	1483
Fit Permitted	0.256			0.364			0.950			0.950		
Satd. Flow (perm)	447	3316	1483	635	3316	1483	3216	3180	0	3216	3316	1483
Satd. Flow (RTOR)			149			163		43				149
Lane Group Flow (vph)	120	537	141	108	657	163	172	448	0	175	205	103
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (%)	15.8%	34.2%	34.2%	15.8%	34.2%	34.2%	20.0%	30.0%		20.0%	30.0%	30.0%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	Max	Max	None	Max		None	None	None
Act Effct Green (s)	46.1	35.5	35.5	44.0	34.5	34.5	11.3	29.5		11.4	29.7	29.7
Actuated g/C Ratio	0.41	0.32	0.32	0.39	0.31	0.31	0.10	0.26		0.10	0.27	0.27
v/c Ratio	0.40	0.51	0.25	0.32	0.64	0.29	0.53	0.51		0.54	0.23	0.21
Control Delay	22.4	33.9	5.5	20.9	37.5	6.1	54.4	34.6		54.3	33.9	2.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	22.4	33.9	5.5	20.9	37.5	6.1	54.4	34.6		54.3	33.9	2.6
LOS	C	C	A	C	D	A	D	C		D	C	A
Approach Delay		27.1			30.0			40.1			34.6	
Approach LOS		C			C			D			C	
Queue Length 50th (m)	15.6	52.8	0.0	14.0	69.0	0.0	19.8	42.1		20.2	19.6	0.0
Queue Length 95th (m)	28.9	75.8	13.5	26.5	95.0	16.0	31.7	62.1		32.0	31.6	5.0
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	325	1052	572	378	1022	570	508	870		508	877	502
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.37	0.51	0.25	0.29	0.64	0.29	0.34	0.51		0.34	0.23	0.21

Intersection Summary

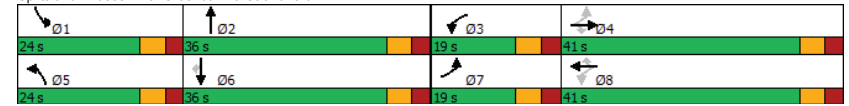
Cycle Length: 120  
 Actuated Cycle Length: 112  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.64

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 32.2  
 Intersection Capacity Utilization 66.7%  
 Analysis Period (min) 15  
 Intersection LOS: C  
 ICU Level of Service C

Splits and Phases: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	22	643	35	61	832	264	61	52	52	259	62	18
Future Volume (vph)	22	643	35	61	832	264	61	52	52	259	62	18
Satd. Flow (prot)	1658	3289	0	1658	3196	0	1658	1745	1483	1658	1686	0
Fit Permitted	0.183			0.323			0.705			0.413		
Satd. Flow (perm)	319	3289	0	564	3196	0	1230	1745	1483	721	1686	0
Satd. Flow (RTOR)		6			43				145		14	
Lane Group Flow (vph)	22	678	0	61	1096	0	61	52	52	259	80	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	10.8%	46.3%		10.8%	46.3%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	3.7	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	6.9	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None	None	
Act Effct Green (s)	56.0	51.2		58.7	56.2		12.0	12.0	12.0	28.9	28.9	
Actuated g/C Ratio	0.54	0.50		0.57	0.55		0.12	0.12	0.12	0.28	0.28	
v/c Ratio	0.09	0.41		0.16	0.62		0.43	0.26	0.17	0.78	0.17	
Control Delay	11.8	19.8		12.0	20.3		55.5	48.2	1.2	48.4	24.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	11.8	19.8		12.0	20.3		55.5	48.2	1.2	48.4	24.1	
LOS	B	B		B	C		E	D	A	D	C	
Approach Delay		19.6			19.9			36.1			42.6	
Approach LOS		B			B			D			D	
Queue Length 50th (m)	2.0	52.1		5.6	74.0		13.1	11.0	0.0	47.7	10.7	
Queue Length 95th (m)	6.1	74.2		12.9	135.8		27.2	23.3	0.0	#74.0	22.4	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	266	1637		396	1761		281	398	450	349	761	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.08	0.41		0.15	0.62		0.22	0.13	0.12	0.74	0.11	

Intersection Summary

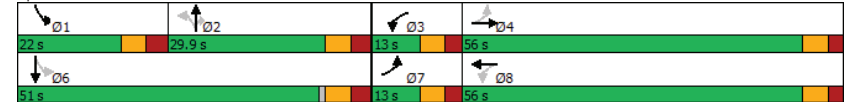
Cycle Length: 120.9  
 Actuated Cycle Length: 103.1  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 24.2  
 Intersection Capacity Utilization 75.1%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↖	↗	↗
Traffic Volume (vph)	43	7	15	879	370	28
Future Volume (vph)	43	7	15	879	370	28
Satd. Flow (prot)	1658	1483	1658	3316	3279	0
Fit Permitted	0.950		0.517			
Satd. Flow (perm)	1658	1483	902	3316	3279	0
Satd. Flow (RTOR)		7			19	
Lane Group Flow (vph)	43	7	15	879	398	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	24.0	24.0	23.2	23.2	23.2	
Total Split (s)	24.0	24.0	36.0	36.0	36.0	
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	
Yellow Time (s)	3.3	3.3	3.7	3.7	3.7	
All-Red Time (s)	2.5	2.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.8	5.8	5.2	5.2	5.2	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	
Act Effct Green (s)	7.0	7.0	47.6	47.6	47.6	
Actuated g/C Ratio	0.13	0.13	0.87	0.87	0.87	
v/c Ratio	0.20	0.04	0.02	0.30	0.14	
Control Delay	24.3	13.9	3.0	2.7	2.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	24.3	13.9	3.0	2.7	2.2	
LOS	C	B	A	A	A	
Approach Delay	22.8			2.7	2.2	
Approach LOS	C			A	A	
Queue Length 50th (m)	3.8	0.0	0.0	0.0	0.0	
Queue Length 95th (m)	11.4	2.9	2.0	28.4	11.4	
Internal Link Dist (m)	164.5			457.8	30.3	
Turn Bay Length (m)	37.5		37.5			
Base Capacity (vph)	556	502	784	2882	2853	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.08	0.01	0.02	0.30	0.14	

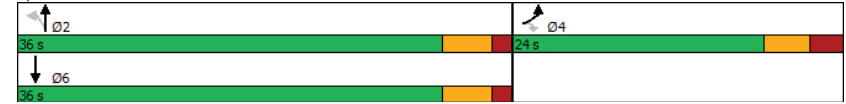
Intersection Summary	
Cycle Length:	60
Actuated Cycle Length:	54.7
Natural Cycle:	50
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.30

Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Intersection Signal Delay: 3.3	Intersection LOS: A
Intersection Capacity Utilization 39.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 5: Greenbank & New Collector



Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	44	117	102	167	124	185	149	624	70	224	810	43
Future Volume (vph)	44	117	102	167	124	185	149	624	70	224	810	43
Satd. Flow (prot)	1658	1623	0	1658	1588	0	1658	3266	0	3216	3289	0
Fit Permitted	0.313			0.431			0.950			0.950		
Satd. Flow (perm)	546	1623	0	752	1588	0	1658	3266	0	3216	3289	0
Satd. Flow (RTOR)		34			59			12			5	
Lane Group Flow (vph)	44	219	0	167	309	0	149	694	0	224	853	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (%)	10.8%	29.2%		10.8%	29.2%		16.7%	43.3%		16.7%	43.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	28.3	21.8		30.0	24.8		12.9	46.8		12.2	46.1	
Actuated g/C Ratio	0.25	0.19		0.27	0.22		0.11	0.41		0.11	0.41	
v/c Ratio	0.22	0.64		0.66	0.78		0.78	0.51		0.65	0.64	
Control Delay	29.8	44.0		45.8	49.1		77.9	27.0		58.6	30.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.8	44.0		45.8	49.1		77.9	27.0		58.6	30.4	
LOS	C	D		D	D		E	C		E	C	
Approach Delay		41.6			48.0			36.0			36.3	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	7.3	40.1		29.9	58.0		34.9	64.1		26.5	85.3	
Queue Length 95th (m)	16.0	66.3		48.5	92.2		#71.4	88.5		41.2	114.6	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	203	437		253	446		202	1360		392	1343	
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	0.50		0.66	0.69		0.74	0.51		0.57	0.64	

Intersection Summary

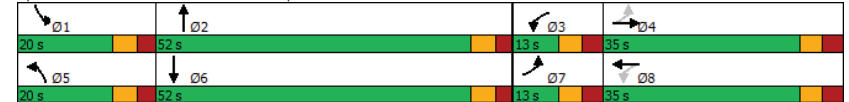
Cycle Length: 120  
 Actuated Cycle Length: 113  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 38.8  
 Intersection Capacity Utilization 78.0%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	159	895	220	274	736	184	232	355	146	251	449	128
Future Volume (vph)	159	895	220	274	736	184	232	355	146	251	449	128
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3170	0	3216	3316	1483
Fit Permitted	0.208			0.116			0.950			0.950		
Satd. Flow (perm)	363	3316	1483	202	3316	1483	3216	3170	0	3216	3316	1483
Satd. Flow (RTOR)			220			184		50				149
Lane Group Flow (vph)	159	895	220	274	736	184	232	501	0	251	449	128
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (%)	15.0%	34.2%	34.2%	15.0%	34.2%	34.2%	20.0%	30.8%		20.0%	30.8%	30.8%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	44.1	33.6	33.6	45.8	34.5	34.5	13.6	30.5		14.1	31.0	31.0
Actuated g/C Ratio	0.38	0.29	0.29	0.40	0.30	0.30	0.12	0.26		0.12	0.27	0.27
v/c Ratio	0.62	0.93	0.37	1.23	0.74	0.32	0.61	0.57		0.64	0.51	0.25
Control Delay	31.8	56.5	6.2	163.8	42.6	6.2	55.9	36.6		56.4	38.8	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	31.8	56.5	6.2	163.8	42.6	6.2	55.9	36.6		56.4	38.8	5.0
LOS	C	E	A	F	D	A	E	D		E	D	A
Approach Delay		44.8			64.8			42.7			38.9	
Approach LOS		D			E			D			D	
Queue Length 50th (m)	22.8	109.1	0.0	-66.7	84.2	0.0	27.7	49.7		30.0	48.3	0.0
Queue Length 95th (m)	39.6	#155.3	18.7	#127.0	111.6	17.2	40.8	70.6		44.0	68.1	11.2
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	269	991	597	223	996	574	493	874		493	889	507
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.59	0.90	0.37	1.23	0.74	0.32	0.47	0.57		0.51	0.51	0.25

Intersection Summary

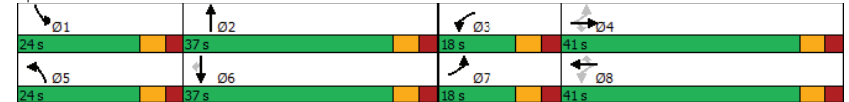
Cycle Length: 120  
Actuated Cycle Length: 115.6  
Natural Cycle: 120  
Control Type: Actuated-Uncoordinated  
Maximum v/c Ratio: 1.23

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 49.1	Intersection LOS: D
Intersection Capacity Utilization 86.6%	ICU Level of Service E
Analysis Period (min) 15	
~ Volume exceeds capacity, queue is theoretically infinite.	
~ Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer.	
~ Queue shown is maximum after two cycles.	

Splits and Phases: 3: Greenbank & Strandherd





Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	19	800	97	130	761	385	129	147	129	327	135	18
Future Volume (vph)	19	800	97	130	761	385	129	147	129	327	135	18
Satd. Flow (prot)	1658	3263	0	1658	3150	0	1658	1745	1483	1658	1714	0
Fit Permitted	0.160			0.184			0.660			0.450		
Satd. Flow (perm)	279	3263	0	321	3150	0	1152	1745	1483	785	1714	0
Satd. Flow (RTOR)		13			86				130			6
Lane Group Flow (vph)	19	897	0	130	1146	0	129	147	129	327	153	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8			2		2	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	13.2%	43.8%		13.2%	43.8%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	2.0	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	5.2	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None	None	
Act Effct Green (s)	53.2	47.0		61.0	57.2		17.3	17.3	17.3	40.7	39.0	
Actuated g/C Ratio	0.47	0.41		0.53	0.50		0.15	0.15	0.15	0.36	0.34	
v/c Ratio	0.09	0.66		0.47	0.71		0.74	0.56	0.39	0.81	0.26	
Control Delay	14.9	30.6		19.8	25.4		71.4	53.3	10.6	46.4	27.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	14.9	30.6		19.8	25.4		71.4	53.3	10.6	46.4	27.1	
LOS	B	C		B	C		E	D	B	D	C	
Approach Delay		30.3			24.8			45.5			40.2	
Approach LOS		C			C			D			D	
Queue Length 50th (m)	2.0	89.8		14.8	90.8		29.7	32.8	0.0	61.8	25.0	
Queue Length 95th (m)	6.2	121.3		27.6	158.0		51.9	54.1	16.8	#96.0	41.8	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	259	1352		287	1621		232	352	403	409	681	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.07	0.66		0.45	0.71		0.56	0.42	0.32	0.80	0.22	

Intersection Summary

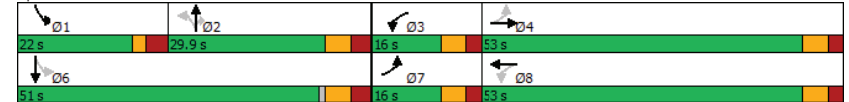
Cycle Length: 120.9  
 Actuated Cycle Length: 114.2  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.81

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 31.6  
 Intersection Capacity Utilization 87.1%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Lane Configurations						
Traffic Volume (vph)	107	26	47	705	926	64
Future Volume (vph)	107	26	47	705	926	64
Satd. Flow (prot)	1658	1483	1658	3316	3283	0
Fit Permitted	0.950		0.261			
Satd. Flow (perm)	1658	1483	455	3316	3283	0
Satd. Flow (RTOR)		26			17	
Lane Group Flow (vph)	107	26	47	705	990	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	24.2	24.2	23.0	23.0	23.0	
Total Split (s)	25.0	25.0	35.0	35.0	35.0	
Total Split (%)	41.7%	41.7%	58.3%	58.3%	58.3%	
Yellow Time (s)	3.7	3.7	3.3	3.3	3.3	
All-Red Time (s)	2.5	2.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.2	6.2	4.8	4.8	4.8	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Min	Min	Min	
Act Effct Green (s)	8.4	8.4	26.4	26.4	26.4	
Actuated g/C Ratio	0.20	0.20	0.64	0.64	0.64	
v/c Ratio	0.32	0.08	0.16	0.33	0.47	
Control Delay	17.5	7.3	7.5	6.1	7.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	17.5	7.3	7.5	6.1	7.0	
LOS	B	A	A	A	A	
Approach Delay	15.5			6.1	7.0	
Approach LOS	B			A	A	
Queue Length 50th (m)	7.4	0.0	1.6	14.0	21.5	
Queue Length 95th (m)	17.8	4.4	6.8	27.0	41.1	
Internal Link Dist (m)	164.5			457.8	30.3	
Turn Bay Length (m)	37.5		37.5			
Base Capacity (vph)	787	717	337	2461	2441	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.14	0.04	0.14	0.29	0.41	

Intersection Summary

Cycle Length: 60  
Actuated Cycle Length: 41.3  
Natural Cycle: 50  
Control Type: Actuated-Uncoordinated  
Maximum v/c Ratio: 0.47

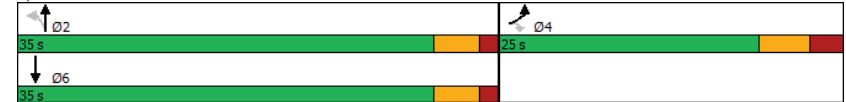
Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Intersection Signal Delay: 7.2  
Intersection Capacity Utilization 52.8%  
Analysis Period (min) 15

Intersection LOS: A  
ICU Level of Service A

Splits and Phases: 5: Greenbank & New Collector



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	↖	→	↘	↙	←	↖	↙	↘	↙	↘	↙	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↖	↖	↖↗	↖	↖↗	↖↗	↖	↖↗	↖↗	↖
Traffic Volume (vph)	159	895	220	274	736	184	232	355	146	251	449	128
Future Volume (vph)	159	895	220	274	736	184	232	355	146	251	449	128
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3170	0	3216	3316	1483
Fit Permitted	0.276			0.094			0.950			0.950		
Satd. Flow (perm)	482	3316	1483	164	3316	1483	3216	3170	0	3216	3316	1483
Satd. Flow (RTOR)			220			184		45				138
Lane Group Flow (vph)	159	895	220	274	736	184	232	501	0	251	449	128
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	19.0	43.0	43.0	25.0	49.0	49.0	24.0	38.0		24.0	38.0	38.0
Total Split (%)	14.6%	33.1%	33.1%	19.2%	37.7%	37.7%	18.5%	29.2%		18.5%	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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max			None	Max	Max
Act Effct Green (s)	47.2	36.1	36.1	60.4	43.0	43.0	14.2	31.5		14.7	32.1	32.1
Actuated g/C Ratio	0.37	0.29	0.29	0.48	0.34	0.34	0.11	0.25		0.12	0.25	0.25
v/c Ratio	0.56	0.95	0.38	0.94	0.65	0.29	0.64	0.61		0.67	0.53	0.27
Control Delay	28.4	63.5	6.5	73.7	39.2	5.6	62.4	42.1		62.9	44.0	6.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	28.4	63.5	6.5	73.7	39.2	5.6	62.4	42.1		62.9	44.0	6.7
LOS	C	E	A	E	D	A	E	D		E	D	A
Approach Delay		49.3			42.0			48.5			44.0	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	23.5	121.8	0.0	56.7	87.4	0.0	30.6	56.6		33.1	54.2	0.0
Queue Length 95th (m)	39.2	#169.1	19.3	#114.7	113.2	16.7	44.4	77.8		47.6	74.3	14.0
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	299	958	585	296	1128	625	450	824		450	841	478
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.53	0.93	0.38	0.93	0.65	0.29	0.52	0.61		0.56	0.53	0.27

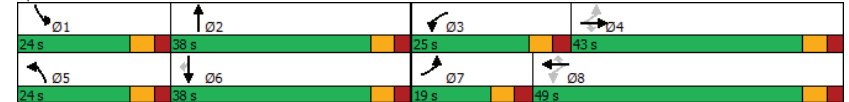
Intersection Summary	
Cycle Length:	130
Actuated Cycle Length:	126.4
Natural Cycle:	120
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.95

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 45.9	Intersection LOS: D
Intersection Capacity Utilization 86.6%	ICU Level of Service E
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 3: Greenbank & Strandherd



# Appendix K

Synchro Intersection Worksheets – 2031 Total Conditions

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗	↘	↖	↗	↘	↖	↗	↘	↖	↗	↘
Traffic Volume (vph)	12	17	27	58	23	106	98	666	74	63	317	6
Future Volume (vph)	12	17	27	58	23	106	98	666	74	63	317	6
Satd. Flow (prot)	1658	1585	0	1658	1530	0	1658	3266	0	3216	3306	0
Fit Permitted	0.674			0.522			0.950			0.950		
Satd. Flow (perm)	1176	1585	0	911	1530	0	1658	3266	0	3216	3306	0
Satd. Flow (RTOR)		27			106			12			2	
Lane Group Flow (vph)	12	44	0	58	129	0	98	740	0	63	323	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (s)	12.0	35.0		12.0	35.0		15.0	58.0		15.0	58.0	
Total Split (%)	10.0%	29.2%		10.0%	29.2%		12.5%	48.3%		12.5%	48.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	12.9	10.6		16.4	15.2		8.6	56.7		7.2	52.8	
Actuated g/C Ratio	0.13	0.11		0.17	0.16		0.09	0.58		0.07	0.54	
v/c Ratio	0.07	0.23		0.29	0.40		0.67	0.39		0.27	0.18	
Control Delay	32.0	25.5		36.6	15.1		67.9	13.7		46.9	12.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	32.0	25.5		36.6	15.1		67.9	13.7		46.9	12.8	
LOS	C	C		D	B		E	B		D	B	
Approach Delay		26.9			21.8			20.0			18.4	
Approach LOS		C			C			C			B	
Queue Length 50th (m)	2.0	3.3		9.8	3.8		20.1	46.6		6.4	18.2	
Queue Length 95th (m)	6.9	13.9		20.9	22.4		#47.2	66.7		13.4	28.0	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	182	481		202	521		148	1896		286	1782	
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	0.07	0.09		0.29	0.25		0.66	0.39		0.22	0.18	

Intersection Summary

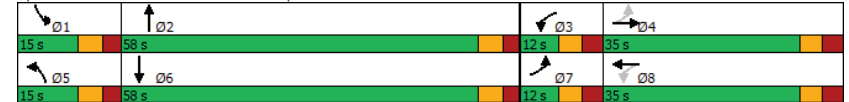
Cycle Length: 120  
 Actuated Cycle Length: 98  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.67

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 20.1  
 Intersection Capacity Utilization 52.4%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	↖	→	↘	↙	←	↖	↙	↘	↙	↘	↙	↘
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↖	↖	↖↗	↖	↖↗	↖↗	↖↗	↖↗	↖↗	↖↗
Traffic Volume (vph)	120	557	63	111	681	163	16	342	130	175	215	103
Future Volume (vph)	120	557	63	111	681	163	16	342	130	175	215	103
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3180	0	3216	3316	1483
Fit Permitted	0.187			0.303			0.950			0.950		
Satd. Flow (perm)	326	3316	1483	529	3316	1483	3216	3180	0	3216	3316	1483
Satd. Flow (RTOR)			149			163		44				149
Lane Group Flow (vph)	120	557	63	111	681	163	16	472	0	175	215	103
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA	Prot	NA	Perm	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (s)	19.0	41.0	41.0	19.0	41.0	41.0	24.0	36.0		24.0	36.0	36.0
Total Split (%)	15.8%	34.2%	34.2%	15.8%	34.2%	34.2%	20.0%	30.0%		20.0%	30.0%	30.0%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	Max			None	Max	Max
Act Effct Green (s)	37.6	27.4	27.4	36.2	26.7	26.7	6.1	29.8		11.1	42.5	42.5
Actuated g/C Ratio	0.36	0.26	0.26	0.35	0.26	0.26	0.06	0.29		0.11	0.41	0.41
v/c Ratio	0.48	0.64	0.13	0.39	0.80	0.32	0.09	0.50		0.51	0.16	0.15
Control Delay	25.8	37.7	0.5	23.0	44.2	6.7	51.4	31.8		50.8	23.1	1.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	25.8	37.7	0.5	23.0	44.2	6.7	51.4	31.8		50.8	23.1	1.9
LOS	C	D	A	C	D	A	D	C		D	C	A
Approach Delay		32.6			35.3			32.4			28.5	
Approach LOS		C			D			C			C	
Queue Length 50th (m)	15.5	54.8	0.0	14.3	71.4	0.0	1.7	40.0		18.5	13.8	0.0
Queue Length 95th (m)	28.9	79.0	0.0	27.0	99.0	16.0	5.7	65.6		32.0	29.9	4.5
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	284	1110	595	335	1110	605	552	941		552	1355	694
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.42	0.50	0.11	0.33	0.61	0.27	0.03	0.50		0.32	0.16	0.15

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 104
Natural Cycle: 120
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.80

3195 Jockvale Road AM Peak Hour 2031 Future Total

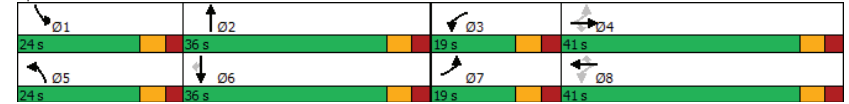
Synchro 10 Light Report  
Page 3

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 32.8	Intersection LOS: C
Intersection Capacity Utilization 68.1%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 3: Greenbank & Strandherd



3195 Jockvale Road AM Peak Hour 2031 Future Total

Synchro 10 Light Report  
Page 4

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	22	589	35	61	707	264	61	52	52	259	62	18
Future Volume (vph)	22	589	35	61	707	264	61	52	52	259	62	18
Satd. Flow (prot)	1658	3289	0	1658	3180	0	1658	1745	1483	1658	1686	0
Fit Permitted	0.229			0.351			0.705			0.413		
Satd. Flow (perm)	400	3289	0	613	3180	0	1230	1745	1483	721	1686	0
Satd. Flow (RTOR)		6			54				145		14	
Lane Group Flow (vph)	22	624	0	61	971	0	61	52	52	259	80	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8			2		2	1	6
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	13.0	56.0		13.0	56.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	10.8%	46.3%		10.8%	46.3%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	3.7	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	6.9	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None	None	
Act Effct Green (s)	56.0	51.2		58.7	56.2		12.0	12.0	12.0	28.9	28.9	
Actuated g/C Ratio	0.54	0.50		0.57	0.55		0.12	0.12	0.12	0.28	0.28	
v/c Ratio	0.08	0.38		0.15	0.55		0.43	0.26	0.17	0.78	0.17	
Control Delay	11.6	19.3		11.9	18.5		55.5	48.2	1.2	48.4	24.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	11.6	19.3		11.9	18.5		55.5	48.2	1.2	48.4	24.1	
LOS	B	B		B	B		E	D	A	D	C	
Approach Delay		19.1			18.1			36.1			42.6	
Approach LOS		B			B			D			D	
Queue Length 50th (m)	2.0	47.0		5.6	60.7		13.1	11.0	0.0	47.7	10.7	
Queue Length 95th (m)	6.1	67.5		12.9	112.8		27.2	23.3	0.0	#74.0	22.4	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	305	1637		420	1757		281	398	450	349	761	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.07	0.38		0.15	0.55		0.22	0.13	0.12	0.74	0.11	

Intersection Summary

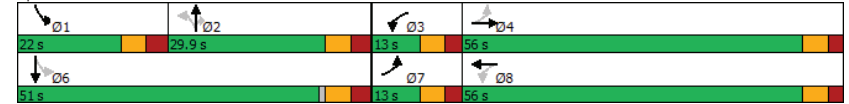
Cycle Length: 120.9  
 Actuated Cycle Length: 103.1  
 Natural Cycle: 125  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 23.6  
 Intersection Capacity Utilization 71.4%  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖	↗	↖	↗	↗	↖
Traffic Volume (vph)	43	7	14	815	332	28
Future Volume (vph)	43	7	14	815	332	28
Satd. Flow (prot)	1658	1483	1658	3316	3276	0
Fit Permitted	0.950		0.537			
Satd. Flow (perm)	1658	1483	937	3316	3276	0
Satd. Flow (RTOR)		7		20		
Lane Group Flow (vph)	43	7	14	815	360	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	24.2	24.2	23.2	23.2	23.2	
Total Split (s)	26.0	26.0	34.0	34.0	34.0	
Total Split (%)	43.3%	43.3%	56.7%	56.7%	56.7%	
Yellow Time (s)	3.3	3.3	3.7	3.7	3.7	
All-Red Time (s)	2.5	2.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.8	5.8	5.2	5.2	5.2	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	
Act Effct Green (s)	6.9	6.9	45.5	45.5	45.5	
Actuated g/C Ratio	0.13	0.13	0.87	0.87	0.87	
v/c Ratio	0.20	0.03	0.02	0.28	0.13	
Control Delay	23.2	13.6	3.1	2.7	2.2	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	23.2	13.6	3.1	2.7	2.2	
LOS	C	B	A	A	A	
Approach Delay	21.8			2.7	2.2	
Approach LOS	C			A	A	
Queue Length 50th (m)	3.6	0.0	0.0	0.0	0.0	
Queue Length 95th (m)	11.0	2.8	1.9	25.7	10.2	
Internal Link Dist (m)	164.5			457.8	30.3	
Turn Bay Length (m)	37.5		37.5			
Base Capacity (vph)	642	579	811	2870	2838	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.07	0.01	0.02	0.28	0.13	

Intersection Summary

Cycle Length: 60  
Actuated Cycle Length: 52.6  
Natural Cycle: 50  
Control Type: Actuated-Uncoordinated  
Maximum v/c Ratio: 0.28

Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Intersection Signal Delay: 3.3  
Intersection Capacity Utilization 37.1%  
Analysis Period (min) 15

Intersection LOS: A  
ICU Level of Service A

Splits and Phases: 5: Greenbank & New Collector





Lanes, Volumes, Timings

7: Greenbank & Retail Access #1

01-28-2019

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	2	0	827	345	6
Future Volume (vph)	0	2	0	827	345	6
Satd. Flow (prot)	0	1510	0	3316	3306	0
Fit Permitted						
Satd. Flow (perm)	0	1510	0	3316	3306	0
Lane Group Flow (vph)	0	2	0	827	351	0
Sign Control	Yield		Free		Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 27.5%                      ICU Level of Service A						
Analysis Period (min) 15						

Lanes, Volumes, Timings

8: Greenbank & Retail Access #2

01-28-2019

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	2	0	827	341	6
Future Volume (vph)	0	2	0	827	341	6
Satd. Flow (prot)	0	1510	0	3316	3306	0
Fit Permitted						
Satd. Flow (perm)	0	1510	0	3316	3306	0
Lane Group Flow (vph)	0	2	0	827	347	0
Sign Control	Yield		Free		Free	
<b>Intersection Summary</b>						
Control Type: Unsignalized						
Intersection Capacity Utilization 27.5%                      ICU Level of Service A						
Analysis Period (min) 15						

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	44	117	102	167	124	185	149	542	70	224	708	42
Future Volume (vph)	44	117	102	167	124	185	149	542	70	224	708	42
Satd. Flow (prot)	1658	1623	0	1658	1588	0	1658	3259	0	3216	3289	0
Fit Permitted	0.313			0.431			0.950			0.950		
Satd. Flow (perm)	546	1623	0	752	1588	0	1658	3259	0	3216	3289	0
Satd. Flow (RTOR)		34			59			13				6
Lane Group Flow (vph)	44	219	0	167	309	0	149	612	0	224	750	0
Turn Type	pm+pt	NA		pm+pt	NA		Prot	NA		Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8								
Detector Phase	7	4		3	8		5	2		1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		5.0	10.0		5.0	10.0	
Minimum Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (s)	13.0	35.0		13.0	35.0		20.0	52.0		20.0	52.0	
Total Split (%)	10.8%	29.2%		10.8%	29.2%		16.7%	43.3%		16.7%	43.3%	
Yellow Time (s)	3.3	3.3		3.3	3.3		3.7	3.7		3.7	3.7	
All-Red Time (s)	3.1	3.2		3.1	3.2		2.6	2.5		2.6	2.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	6.4	6.5		6.4	6.5		6.3	6.2		6.3	6.2	
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes	
Recall Mode	None	None		None	None		None	Max		None	Max	
Act Effct Green (s)	28.3	21.8		30.0	24.8		12.9	46.8		12.2	46.1	
Actuated g/C Ratio	0.25	0.19		0.27	0.22		0.11	0.41		0.11	0.41	
v/c Ratio	0.22	0.64		0.66	0.78		0.78	0.45		0.65	0.56	
Control Delay	29.8	44.0		45.8	49.1		77.9	25.9		58.6	28.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	29.8	44.0		45.8	49.1		77.9	25.9		58.6	28.6	
LOS	C	D		D	D		E	C		E	C	
Approach Delay		41.6			48.0			36.1			35.5	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	7.3	40.1		29.9	58.0		34.9	54.6		26.5	71.8	
Queue Length 95th (m)	16.0	66.3		48.5	92.2		#71.4	76.4		41.2	97.7	
Internal Link Dist (m)		102.8			148.8			92.5			171.8	
Turn Bay Length (m)	25.0			55.0			60.0			56.0		
Base Capacity (vph)	203	437		253	446		202	1358		392	1344	
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	0.50		0.66	0.69		0.74	0.45		0.57	0.56	

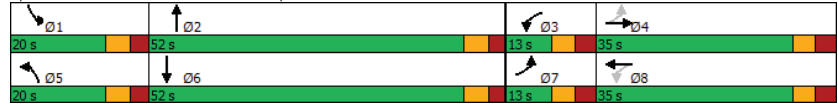
**Intersection Summary**  
 Cycle Length: 120  
 Actuated Cycle Length: 113  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.78

Lanes, Volumes, Timings  
2: Greenbank & Marketplace

01-28-2019

Intersection Signal Delay: 38.7 Intersection LOS: D  
 Intersection Capacity Utilization 75.0% ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Greenbank & Marketplace



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖
Traffic Volume (vph)	159	928	79	283	763	184	123	371	151	251	471	128
Future Volume (vph)	159	928	79	283	763	184	123	371	151	251	471	128
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3173	0	3216	3316	1483
Fit Permitted	0.194			0.114			0.950			0.950		
Satd. Flow (perm)	339	3316	1483	199	3316	1483	3216	3173	0	3216	3316	1483
Satd. Flow (RTOR)			149			184		49				149
Lane Group Flow (vph)	159	928	79	283	763	184	123	522	0	251	471	128
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (%)	15.0%	34.2%	34.2%	15.0%	34.2%	34.2%	20.0%	30.8%		20.0%	30.8%	30.8%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	44.8	34.4	34.4	46.5	35.2	35.2	9.8	30.5		14.1	34.8	34.8
Actuated g/C Ratio	0.39	0.30	0.30	0.40	0.30	0.30	0.08	0.26		0.12	0.30	0.30
v/c Ratio	0.64	0.95	0.15	1.27	0.76	0.32	0.46	0.60		0.64	0.47	0.23
Control Delay	32.8	59.3	0.6	182.3	43.2	6.2	56.3	37.6		56.7	35.4	4.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	32.8	59.3	0.6	182.3	43.2	6.2	56.3	37.6		56.7	35.4	4.4
LOS	C	E	A	F	D	A	E	D		E	D	A
Approach Delay		51.7			69.6			41.2				37.0
Approach LOS		D			E			D				D
Queue Length 50th (m)	22.8	114.7	0.0	~71.8	88.2	0.0	14.7	52.6		30.0	48.5	0.0
Queue Length 95th (m)	39.6	#164.3	0.0	#133.2	116.8	17.2	24.8	74.2		44.0	67.3	10.6
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	262	984	544	222	1004	577	489	868		489	993	548
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.61	0.94	0.15	1.27	0.76	0.32	0.25	0.60		0.51	0.47	0.23

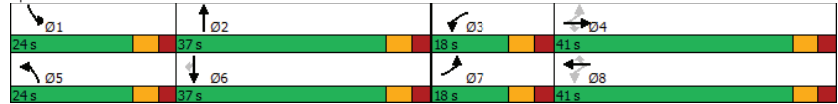
Intersection Summary  
 Cycle Length: 120  
 Actuated Cycle Length: 116.3  
 Natural Cycle: 120  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 1.27

Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 52.4	Intersection LOS: D
Intersection Capacity Utilization 88.7%	ICU Level of Service E
Analysis Period (min) 15	
~ Volume exceeds capacity, queue is theoretically infinite.	
Queue shown is maximum after two cycles.	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 3: Greenbank & Strandherd



Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↖↗	↗	↖	↖↗	↗	↖	↖↗	↗	↖	↖↗	↗
Traffic Volume (vph)	19	688	97	130	680	385	129	147	129	327	135	18
Future Volume (vph)	19	688	97	130	680	385	129	147	129	327	135	18
Satd. Flow (prot)	1658	3253	0	1658	3137	0	1658	1745	1483	1658	1714	0
Fit Permitted	0.190			0.230			0.660			0.450		
Satd. Flow (perm)	332	3253	0	401	3137	0	1152	1745	1483	785	1714	0
Satd. Flow (RTOR)		15			106				130			6
Lane Group Flow (vph)	19	785	0	130	1065	0	129	147	129	327	153	0
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	pm+pt	NA	
Protected Phases	7	4		3	8			2		1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		2	2	2	1	6	
Switch Phase												
Minimum Initial (s)	5.0	10.0		5.0	10.0		10.0	10.0	10.0	5.0	10.0	
Minimum Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (s)	16.0	53.0		16.0	53.0		29.9	29.9	29.9	22.0	51.0	
Total Split (%)	13.2%	43.8%		13.2%	43.8%		24.7%	24.7%	24.7%	18.2%	42.2%	
Yellow Time (s)	3.7	3.7		3.7	3.7		3.7	3.7	3.7	2.0	3.7	
All-Red Time (s)	2.4	2.4		2.4	2.4		3.2	3.2	3.2	3.2	3.2	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.1	6.1		6.1	6.1		6.9	6.9	6.9	5.2	6.9	
Lead/Lag	Lead	Lag		Lead	Lag		Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes		
Recall Mode	None	Max		None	Max		None	None	None	None		
Act Effct Green (s)	53.2	47.0		61.0	57.2		17.3	17.3	17.3	40.7	39.0	
Actuated g/C Ratio	0.47	0.41		0.53	0.50		0.15	0.15	0.15	0.36	0.34	
v/c Ratio	0.08	0.58		0.42	0.66		0.74	0.56	0.39	0.81	0.26	
Control Delay	14.7	28.5		18.2	23.3		71.4	53.3	10.6	46.4	27.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	14.7	28.5		18.2	23.3		71.4	53.3	10.6	46.4	27.1	
LOS	B	C		B	C		E	D	B	D	C	
Approach Delay		28.1			22.7			45.5			40.2	
Approach LOS		C			C			D			D	
Queue Length 50th (m)	2.0	74.7		14.8	78.7		29.7	32.8	0.0	61.8	25.0	
Queue Length 95th (m)	6.2	102.2		27.6	138.4		51.9	54.1	16.8	#96.0	41.8	
Internal Link Dist (m)		158.5			396.5			134.9			123.9	
Turn Bay Length (m)	63.0			115.0			70.0		60.0	45.0		
Base Capacity (vph)	280	1349		323	1624		232	352	403	409	681	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.07	0.58		0.40	0.66		0.56	0.42	0.32	0.80	0.22	

Intersection Summary

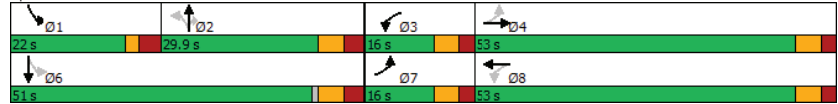
Cycle Length: 120.9
Actuated Cycle Length: 114.2
Natural Cycle: 125
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81

Lanes, Volumes, Timings  
4: Jockvale & Strandherd

01-28-2019

Intersection Signal Delay: 30.3 Intersection LOS: C  
 Intersection Capacity Utilization 84.7% ICU Level of Service E  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 4: Jockvale & Strandherd



Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗	↖ ↗
Traffic Volume (vph)	107	26	47	671	883	64
Future Volume (vph)	107	26	47	671	883	64
Satd. Flow (prot)	1658	1483	1658	3316	3283	0
Fit Permitted	0.950		0.287			
Satd. Flow (perm)	1658	1483	501	3316	3283	0
Satd. Flow (RTOR)		26			18	
Lane Group Flow (vph)	107	26	47	671	947	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Detector Phase	4	4	2	2	6	
Switch Phase						
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	
Minimum Split (s)	23.8	23.8	23.2	23.2	23.2	
Total Split (s)	24.0	24.0	36.0	36.0	36.0	
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	
Yellow Time (s)	3.3	3.3	3.7	3.7	3.7	
All-Red Time (s)	2.5	2.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.8	5.8	5.2	5.2	5.2	
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	None	None	Max	Max	Max	
Act Effct Green (s)	8.9	8.9	39.1	39.1	39.1	
Actuated g/C Ratio	0.16	0.16	0.70	0.70	0.70	
v/c Ratio	0.40	0.10	0.13	0.29	0.41	
Control Delay	24.6	8.8	6.0	4.9	5.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	24.6	8.8	6.0	4.9	5.6	
LOS	C	A	A	A	A	
Approach Delay	21.5			5.0	5.6	
Approach LOS	C			A	A	
Queue Length 50th (m)	10.6	0.0	1.6	13.6	21.1	
Queue Length 95th (m)	20.3	5.0	6.3	25.1	38.0	
Internal Link Dist (m)	164.5			457.8	30.3	
Turn Bay Length (m)	37.5		37.5			
Base Capacity (vph)	547	507	353	2338	2320	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.20	0.05	0.13	0.29	0.41	

Intersection Summary  
 Cycle Length: 60  
 Actuated Cycle Length: 55.5  
 Natural Cycle: 50  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.41

Lanes, Volumes, Timings  
5: Greenbank & New Collector

01-28-2019

Intersection Signal Delay: 6.5	Intersection LOS: A
Intersection Capacity Utilization 51.8%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 5: Greenbank & New Collector



Lanes, Volumes, Timings  
3: Greenbank & Strandherd

01-28-2019

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↕	↔	↔	↕	↔	↔	↕	↔
Traffic Volume (vph)	159	928	79	283	763	184	123	371	151	251	471	128
Future Volume (vph)	159	928	79	283	763	184	123	371	151	251	471	128
Satd. Flow (prot)	1658	3316	1483	1658	3316	1483	3216	3173	0	3216	3316	1483
Fit Permitted	0.279			0.087			0.950			0.950		
Satd. Flow (perm)	487	3316	1483	152	3316	1483	3216	3173	0	3216	3316	1483
Satd. Flow (RTOR)			186			184		42				186
Lane Group Flow (vph)	159	928	79	283	763	184	123	522	0	251	471	128
Turn Type	pm+pt	NA	Perm	pm+pt	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8						6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	5.0	10.0	10.0	5.0	10.0	10.0	5.0	10.0		5.0	10.0	10.0
Minimum Split (s)	18.0	41.0	41.0	18.0	41.0	41.0	24.0	37.0		24.0	37.0	37.0
Total Split (s)	20.0	47.0	47.0	27.0	54.0	54.0	24.0	37.0		24.0	37.0	37.0
Total Split (%)	14.8%	34.8%	34.8%	20.0%	40.0%	40.0%	17.8%	27.4%		17.8%	27.4%	27.4%
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
All-Red Time (s)	2.9	2.8	2.8	2.9	2.8	2.8	2.6	2.8		2.6	2.8	2.8
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	6.6	6.5	6.5	6.6	6.5	6.5	6.3	6.5		6.3	6.5	6.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Max		None	Max	Max
Act Effct Green (s)	50.7	39.2	39.2	65.6	47.5	47.5	10.4	30.6		15.0	35.2	35.2
Actuated g/C Ratio	0.39	0.30	0.30	0.50	0.36	0.36	0.08	0.23		0.11	0.27	0.27
v/c Ratio	0.54	0.93	0.14	0.93	0.63	0.28	0.48	0.67		0.68	0.53	0.24
Control Delay	26.8	61.2	0.5	72.8	37.7	5.2	64.6	47.4		65.7	43.8	2.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	26.8	61.2	0.5	72.8	37.7	5.2	64.6	47.4		65.7	43.8	2.1
LOS	C	E	A	E	D	A	E	D		E	D	A
Approach Delay		52.4			40.9			50.6			44.0	
Approach LOS		D			D			D			D	
Queue Length 50th (m)	23.3	130.3	0.0	61.6	90.8	0.0	17.0	64.4		34.7	58.5	0.0
Queue Length 95th (m)	38.2	#174.9	0.0	#119.5	117.3	16.3	27.4	86.6		49.5	79.2	3.4
Internal Link Dist (m)		396.5			415.8			171.8			236.6	
Turn Bay Length (m)	70.0		100.0	130.0			60.0			85.0		160.0
Base Capacity (vph)	316	1030	589	312	1228	665	436	774		436	894	535
Starvation Cap Reductn	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
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.50	0.90	0.13	0.91	0.62	0.28	0.28	0.67		0.58	0.53	0.24

Intersection Summary

Cycle Length: 135
Actuated Cycle Length: 130.6
Natural Cycle: 120
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93

Lanes, Volumes, Timings  
 3: Greenbank & Strandherd

01-28-2019

Intersection Signal Delay: 46.6      Intersection LOS: D  
 Intersection Capacity Utilization 88.7%      ICU Level of Service E  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Greenbank & Strandherd

