COSTCO

COSTCO DEVELOPMENT TRAFFIC IMPACT STUDY – BARON ROAD SITE

Final

NOVEMBER 10, 2020

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COSTCO DEVELOPMENT

TRANSPORTATION IMPACT ASSESSMENT – BARON ROAD SITE

PROJECT NO.: 17M-02290-01
DATE: NOVEMBER 10, 2020

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November 10, 2020

Costco Wholesale Corporation
45940 Horseshow Drive, Suite 150
Sterling, VA, 20166
USA

Attention: Kim Katz

Dear Kim:

Subject: Costco Wholesale Relocation Traffic Impact Study - Baron Road

A traffic impact study was completed for a proposed relocation of Costco Wholesale from its current location at 2479 Highway 97 N to 2125 and 1901 Baron Road in Kelowna, BC. This final report is based upon previous versions produced in 2019 and 2020 and incorporates additional comments received by the Ministry and City in August and September of 2020.

The new site will consist of a wholesale warehouse and gas station/auxiliary parking site with 12 pumps (24 fueling stations).

The proposed study area is shown in Figure 1 and includes the following intersections and accesses:

- Highway 97 and Banks Road;
- Highway 97 and Leckie Road;
- Highway 97 and Underhill Street;
- Highway 97 and Dilworth Drive;
- Baron Road and Banks Road;
- Baron Road and Leckie Road;
- Baron Road and Durnin Road;
- Baron Road and Underhill Street;
- Baron Road and Dilworth Drive;
- Springfield Road and Leckie Road;
- Springfield Road and Durnin Road;
- Springfield Road and Dilworth Drive;
- Leckie Road and Parkview Crescent access to site;
- Three additional accesses into the warehouse site and three accesses for the gas station.

This TIA compares the performance of the local traffic network with and without the Costco during the PM and Saturday afternoon peak hours in the 2021 and 2031 horizon years.

For the further sake of comparison, two background scenarios are developed:

1. 2021 and 2031 growth of 2% per annum background traffic increases from turning counts taken in 2019

2. 2021 and 2031 growth of 2% p.a. traffic background traffic increases as above plus four currently-planned developments:

    - A proposed 845 residential unit complex and 2,500 ft^2 of commercial floor space available to both residents and non-residents located at the corner of Baron Road and Dilworth Drive at the old School District 23 site. This site is assumed to be phased over the two assessment years (2021 and 2031).

- A commercial development at the corner of Enterprise Way and Dilworth Drive, the old Enterprise Steel site. The development consists of 112,500 ft^2 of small bay flex units, and 38,000 ft^2 of new car sales/service facility.

- A proposed Tim Horton's high turnover restaurant located within the existing Canadian Tire parking lot at 1655 Leckie Road

- The assumed redevelopment of the 'old' Costco site at 2479 Highway 97 into some big-box retail function – assumed trip generation commensurate with that land use and square footage.

These two background scenarios ("2% Growth Rate Only" and "Full Background") were developed to better understand the likely range of actual future traffic performance in the study area, and by contrast, the real impacts of the Costco on the network.

The proposed development consists of a new Costco store, which requires a rezoning, and an adjoining gas station, which may be built as-of-right. To determine the relative impact of the full development on both background traffic scenarios, the effects of this development's components have also been individually compared:

- Costco store only

- Gas station only

- Costco store + gas station

To determine the impact of the relocation of Costco from Highway 33 intersection to the Leckie/Baron Road location, WSP used Synchro and SimTraffic modelling softwares to compare capacity and level of service against thresholds established by the City of Kelowna and Ministry of Transportation and Infrastructure (MoTI) for two time periods and assessment conditions.

The thresholds included:

For signalized intersections:

— Overall intersection Level of Service (LOS) does not exceed LOS D in both AM & PM peak hours;
— Overall intersection Volume to Capacity (v/c) ratio does not exceed 0.85;
— Individual movement LOS does not exceed LOS E;
— Individual movement v/c ratio does not exceed 0.90; and,
— 95th percentile queue lengths do not exceed storage lengths.

For unsignalized intersections:

— Individual movement LOS does not exceed LOS D (unless the movement volume is very low compared to other movements);
— Individual movement v/c ration does not exceed 0.90; and,
— 95th percentile queue lengths do not exceed storage lengths.

When traffic generated by Costco is added to an intersection and the v/c ratio of a specific movement was less than 0.90 under background conditions is now greater than 0.90, then mitigations are identified to allow the intersection to operate at 0.90 or less. If the intersection was already above 0.90 under background conditions, then reasonable mitigation measures are identified if appropriate.

The study periods included a weekday PM peak hour from 16:00 to 17:00 and Saturday peak hour from 12:45 to 13:45 under three assessment conditions:

- 2019 existing conditions;
- 2021 background and 2021 total development conditions;
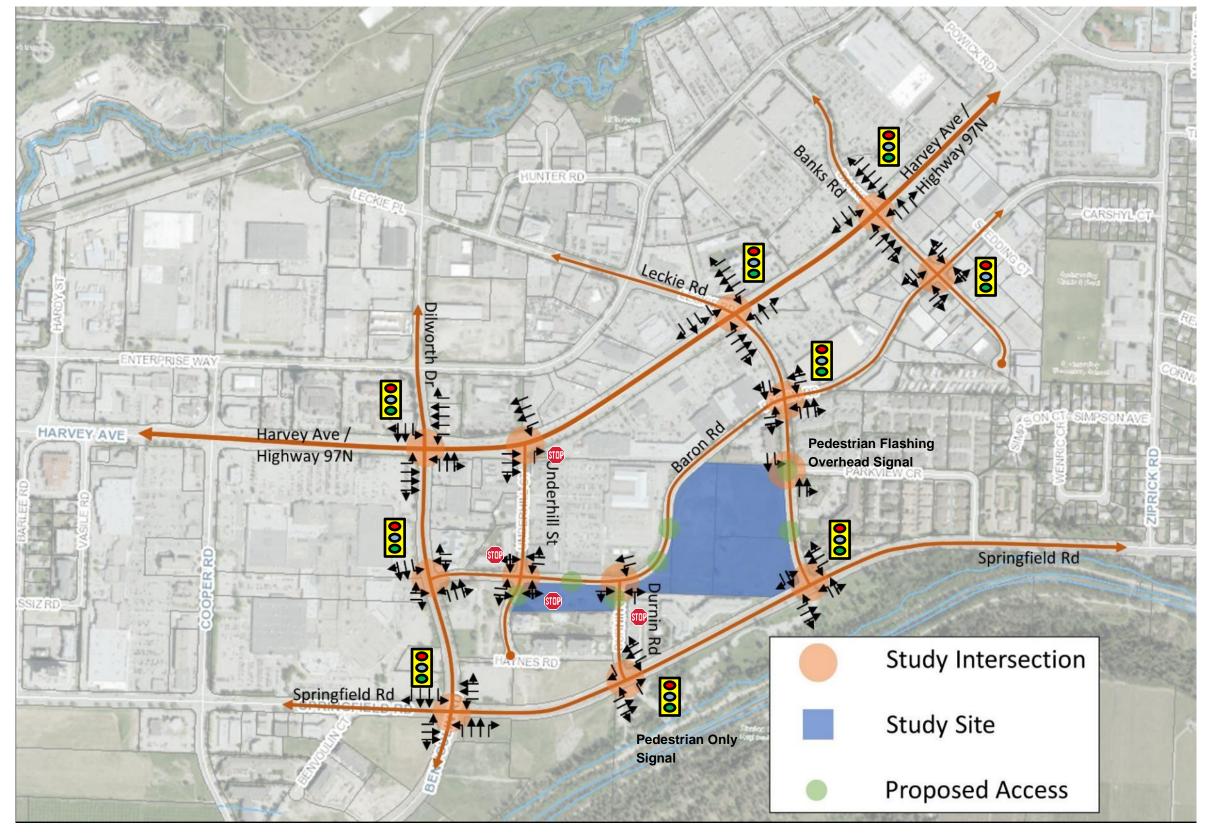- 2031 background and 2031 total development conditions.

Figure 1: Study Area and Intersection Laning

The AM peak hour was not reviewed as the Costco warehouse does not open for members until after the AM peak period. While the Costco Gasoline fuel station will be open during the AM peak, it generates a relatively low number of trips in comparison to the warehouse and fuel station during the PM and Saturday peak hours.

The total development conditions included the Full Background traffic scenario, as described above, plus the relocation of the Costco site and new gas station.

The results of the Do Nothing / No Costco analysis show the following:

i. The study network already experiences some delays and reduced intersection performance during the weekday PM peak and Saturday peak under existing 2019 volumes.

ii. There are existing capacity and LOS issues for left turns from the Highway to the City streets. Left turns from both Dilworth Drive and Leckie Road to the Highway will also perform beyond their design capacities in both the Background and Build conditions in 2021 and 2031. However, lower-performing background intersections are mostly the result of the four major local developments identified above; not the 2% p.a. background growth rate.

iii. The planned relocation of Costco from the existing site on Highway 97 to the proposed site on Baron Road/Leckie Road will generate a net increase of 295 trips in the weekday PM peak and 311 trips in the Saturday peak hour because of the new gas bar and increased size of the store.

iv. Overall, the Costco + Gas Station's net increase produces limited effects on the local network when compared against the Full Background scenario. However, some effects are present, for which mitigation is outlined below.

v. Due to the nature of Costco sales, there are limited opportunities to promote alternate modes of transportation (i.e. transit and active transportation).

vi. Based on sight line analysis, the proposed access locations meet the requirements for all movements except the mid-block access on Baron Road which does not meet the requirements for left turn out of the site. Unless additional sight distance can be cleared, this access should be restricted to right-in/right-out/left-in.

vii. A viable design for a dual southbound left turn from Highway 97 to Leckie Road is feasible and shown in Appendix E.

viii. The internal throat length at the primary access of Leckie Road/Parkview Crescent is approximately 65 metres (or 9 vehicles). The other throat lengths range from 14 to 23 metres which allows for approximately 2 to 3 vehicles waiting at the access location.

ix. The collision records show that over 70% of the collisions at the study intersections over the past 10 years are from rear end collisions. This is common of high-volume, short-block networks with multiple accesses.

x. No overflow issues were seen throughout the study area under total development conditions.

xi. **To mitigate traffic conditions under existing or Full Background development conditions, the following measures were modeled:**

Highway 97/Dilworth Drive	Add a northbound right turn lane
Highway 97/Banks Road	Monitor
Highway 97/Underhill Street	Monitor
Baron/Dilworth/Mall Entrance	Reconfigure the north/south direction to a left turn lane and separate through/right turn lane, optimize

	phasing, and add a westbound right turn lane from Dilworth Drive to Baron Road.
Baron Road/Underhill Street	Signalize, line paint for left turn lanes
Baron Road/Banks Road	Monitor
Springfield/Dilworth/Benvoulin	Extend the westbound right turn lane from Benvoulin Road to Springfield Road.
Springfield Road/Leckie Road	Add a dual left turn lane along Springfield Road in northbound direction, update cycle length and optimize phases within cycle.

xii. **To mitigate traffic conditions as a result of total development conditions, the following measures were modeled:**

Highway 97/Leckie Road	• Converting the second eastbound left turn lane to a second eastbound through lane • Add a double left turn southbound onto Leckie (once aggreged upon triggers by City and MOTI are met)
Leckie Corridor	Change the lane configuration to two through lanes with left turn lanes at Baron Road and Parkview Crescent
Baron Road/Underhill Street	Signalize
Baron Road/Durnin Road	Move pedestrian actuated crossing from Underhill
Baron Road/Leckie Road	Change the lane configuration to two through lanes and left turn lane, change the cycle length and optimize phases within the cycle.
Springfield Road/Durnin Road	Monitor. Should the left turn queues become too long, then the pedestrian signal could be converted to a signalized intersection for left turns.
Springfield Road/Parkview Crescent	Monitor. If it is found that traffic is taking this route to shortcut, the City can either formalize with a signal, traffic calm, or continue to monitor.

A summary of the upgrades by priority is shown in Figure 1 and described in colour code below.

This study investigated the traffic impacts of the proposed relocation of Costco to Baron Road. There is already a Costco Warehouse near the proposed new site, and many of the generated trips are already on the study network which means they will be re-distributed. As a result, the impacts of the proposed Costco relocation on the wider traffic network are minimal and the impacts are localized to the surrounding network within the proposed site. The localized impacts can be reasonably mitigated by implementation of the strategies outlined above.

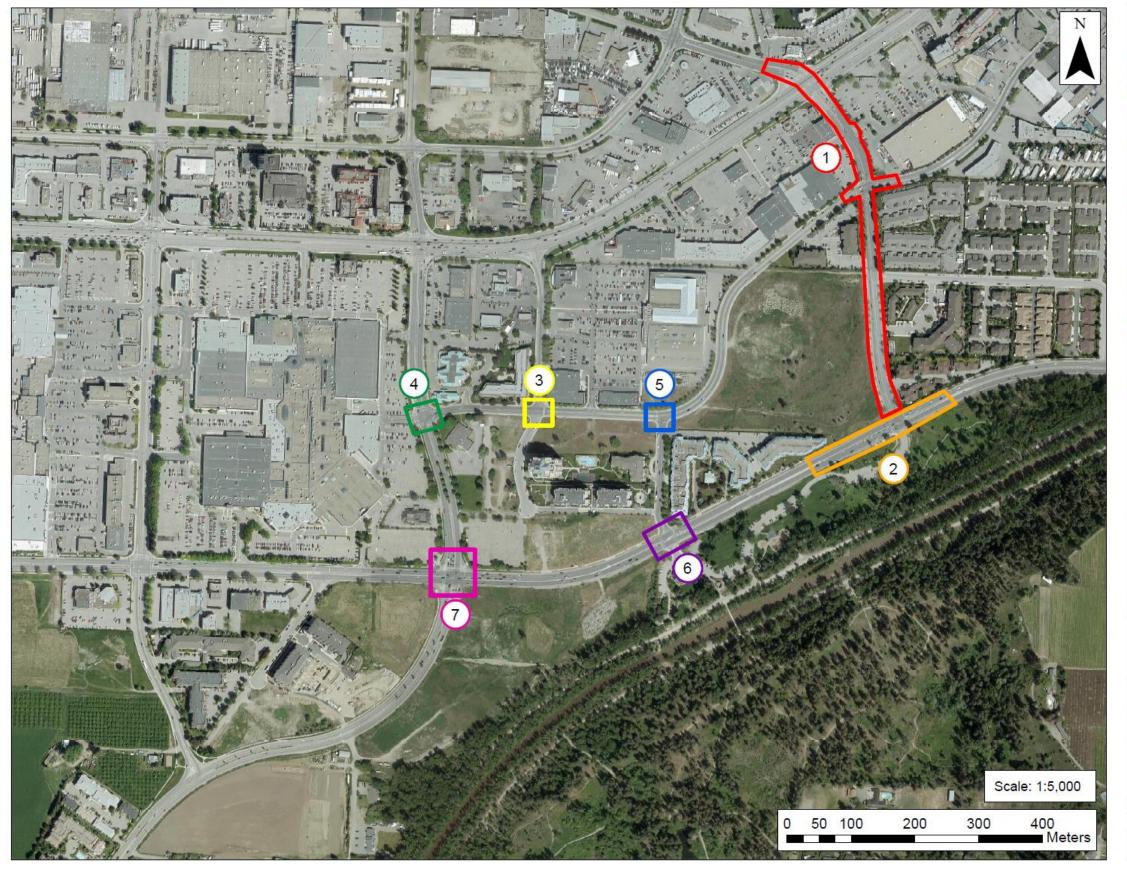Yours sincerely,

Avi Thiessen, P. Eng.
Transportation Engineer

WSP ref.: 17M-02290-01

Table 1 – Summary Table of Improvements Corresponding to Summary Upgrade Map

Priority*	Location	Physical Upgrade Description
1	Leckie Road	Realignment of Leckie Road and Baron Road intersection including but not limited to: - Addition of a dedicated through lane on Leckie Road towards Springfield Road, resulting in two through lanes - Double left southbound from Hwy 97 onto Leckie Road plus conversion of the second eastbound left turn lane to a second eastbound through lane Realignment of Leckie Road and Parkview Crescent Intersection including but not limited to: - Addition of the through/right turn lane on Leckie at Parkview Crescent (to site entrance), resulting in two through lanes towards Springfield - Addition of the left turn at Parkview Crescent on Leckie Road to site entrance
2	Springfield at Leckie Road	Intersection upgrades including but not limited to: - Addition of second left turn lane from Springfield Road onto Leckie Road toward Hwy 97 - Shifting existing bus stop on Springfield Road to the other side of Mission Creek Park entrance as per Figure 2 included in Appendix E - Lane realignment along Springfield Road to account for the additional left turn lane and relocation of the bus stop
3	Baron at Underhill	Addition of fully signalized intersection at Baron Road and Underhill
4	Dilworth at Baron	Intersection upgrades including but not limited to: - Addition of a slip lane for right turn from Dilworth Drive to Baron Road - Reconfigure the north/south direction to a left turn lane and separate through/right turn lane, and optimize phasing.
5	Baron at Durnin	Moving of the existing pedestrian push button crossing at Baron Road/Underhill Street to the crosswalk at Baron Road/Durnin Road
6	Springfield at Durnin	Addition of a vehicle actuated left turn from Springfield Road onto Durnin Road (Optional if warranted by Queue volumes)
7	Springfield at Benvoulin/Dilworth	- Extension of the right turning lane from Benvoulin Road to Springfield Road - Adding a dual left-turn lane either direction for traffic on Springfield onto Dilworth and Benvoulin

*: Colour coordination for priorities corresponds to WSP upgrade summary map

Improvement Priority

1. Leckie Road
2. Springfield Road/ Leckie Road
3. Baron Road/ Underhill Street
4. Dilworth Road/ Baron Road/ Mall Entrance
5. Baron Road/ Durnin Road
6. Springfield Road/ Durnin Road
7. Springfield Road/ Benvoulin Road/ Dilworth Drive

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Costco Wholesale

Costco Barron Road Locati
Transportation Impact Analy

Overall Off-Site Roadworks
Improvement Summary Ma

| project no. 17M-02290-00 | figure no. |
| date: 2019-12-12 | 1 |

Scale: 1:5,000

0 50 100   200   300   400
Meters

REVISION HISTORY

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November 10, 2020			
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2020-11-10

Avi Thiessen, P.Eng.
Transportation Engineer

November 10, 2020

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SUBCONSULTANTS

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DEFINITIONS

EB – Eastbound
WB – Westbound
NB – Northbound
SB – Southbound
L – Left
T – Through
R – Right
LTR – Left/through/right lane grouping
TR – Through/right lane grouping
TTR – 2 through lanes and right lane grouping
LT – Left and through lane grouping
TT – 2 through lane grouping
TTT – 3 through lane grouping
TTTR – 3 through lane and right lane grouping

1 INTRODUCTION

1.1 BACKGROUND

Costco Wholesale has engaged WSP Canada Group Limited (WSP) to prepare a transportation impact assessment (TIA) for the proposed relocation of Costco Wholesale from its' current location at 2479 Highway 97 N to 2125 and 1901 Baron Road, shown in Figure 2. The new site will consist of a wholesale warehouse and gas station/auxiliary parking site with 12 pumps (24 fueling stations). The current site is undeveloped.
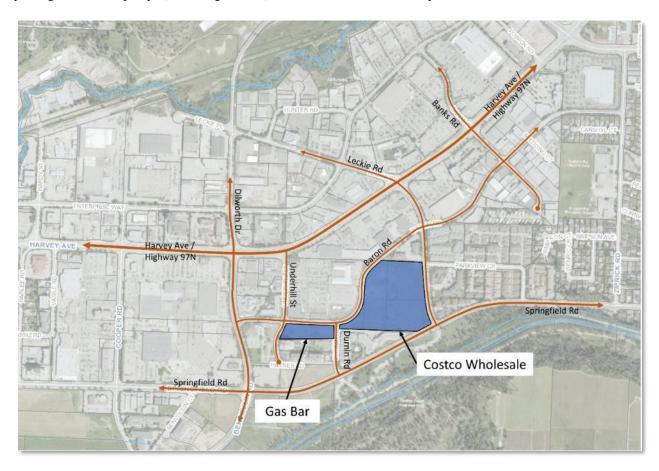

Figure 2: Development Study Site
Source: City of Kelowna MapViewer

For the purposes of this study, Highway 97, Baron Road, and Springfield Road were taken to run North/South and Dilworth Drive/Benvoulin Road, Underhill Street, Durnin Road, Leckie Road, and Banks Road were taken to run East/West.

1.2 DEVELOPMENT INFORMATION

The new wholesale store at 2125 Baron Road will have a GFA of 14,391 m^2 (excluding canopy area) and will consist of the following:

- Wholesale Retail store;
- Tire center;
- Seasonal Garden Centre; and,
- Propane Station.

There is also an auxiliary site proposed at 1901 Baron Road which will include some additional parking spaces and a gas station. The fuel station will provide fuel sales only and there will be no convenience or automotive services are associated with the pad.

The following number of parking stalls is proposed on-site:

- 3m wide stalls: 896
- Accessible stalls: 16
- Total: 921

The preliminary site plan shows four accesses to the Costco Wholesale site including two on Baron Road and two on Leckie Road. The gas station site is shown with two full movement access: One on Baron Road, one on Durnin Road, and an exit only on Underhill Street. The site plan showing the access locations is shown in Appendix A.

1.3 STUDY AREA

The proposed study area includes the following intersections and accesses:

- Highway 97 and Banks Road;
- Highway 97 and Leckie Road;
- Highway 97 and Underhill Street;
- Highway 97 and Dilworth Drive;
- Baron Road and Banks Road;
- Baron Road and Leckie Road;
- Baron Road and Durnin Road;
- Baron Road and Underhill Street;
- Baron Road and Dilworth Drive;
- Springfield Road and Leckie Road;
- Springfield Road and Durnin Road;
- Springfield Road and Dilworth Drive;
- Leckie Road and Parkview Crescent access to site;
- Three accesses into the warehouse site as shown on the site plan in Appendix A; and
- Three accesses for the gas station.

Figure 3 shows the proposed study intersections and laning.

1.4 EXISTING TRAFFIC

Existing traffic counts were obtained from the City of Kelowna and Ministry of Transportation and Infrastructure (MOTI) and adjusted to the current year of 2019. Where traffic counts were not available, WSP collected traffic data for the PM and Saturday Peak hour. Figure 4 and Figure 5 provide a graphical summary of the existing traffic counts at the study intersections.

WSP reviewed the peak hour of the site and adjacent street traffic throughout the study area to determine the Weekday and Saturday peak hours. The daily peak hour of the site was found to be in the morning whereas the adjacent street was in the afternoon. However, in reviewing the trip generation rate for the site, there was little variation found throughout the day and as a result the peak hour of adjacent street traffic would result in the highest network demand. The modelling is based on the following peak hours:

- Weekday: 16:00 – 17:00
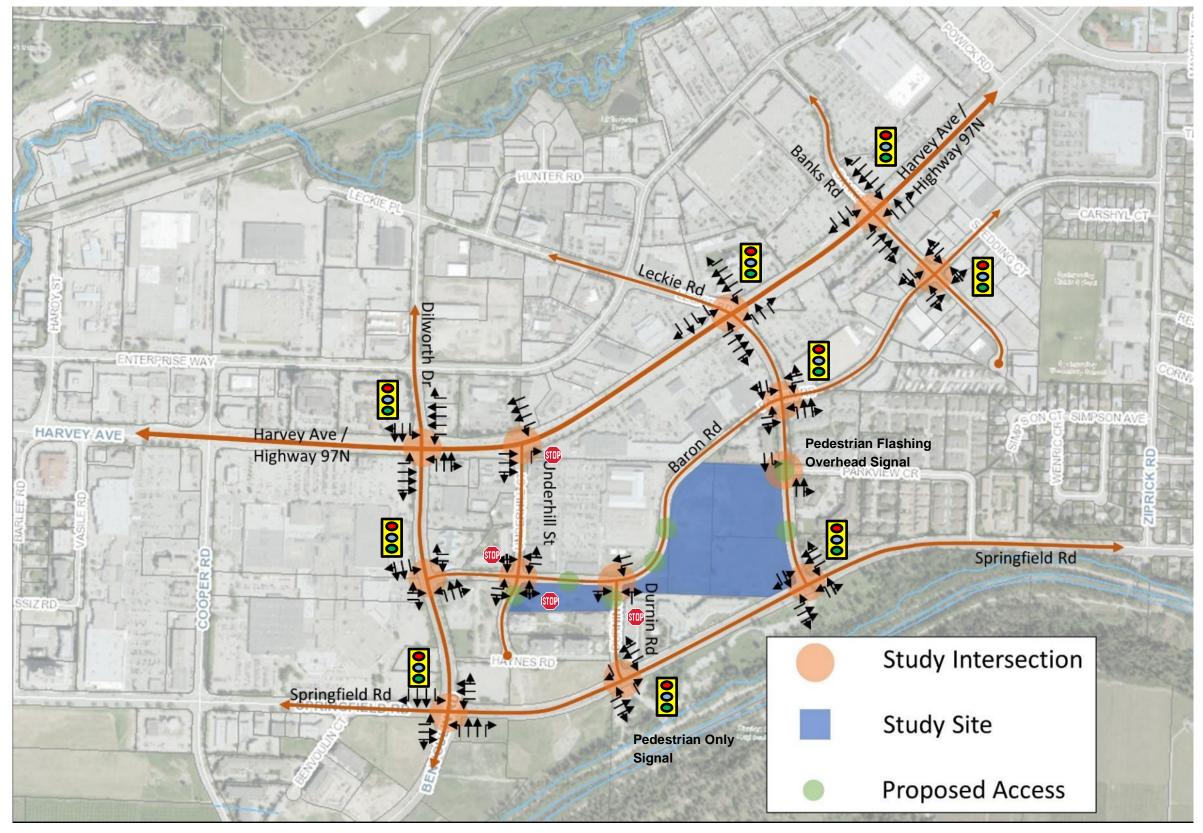
- Saturday: 12:45 – 13:45
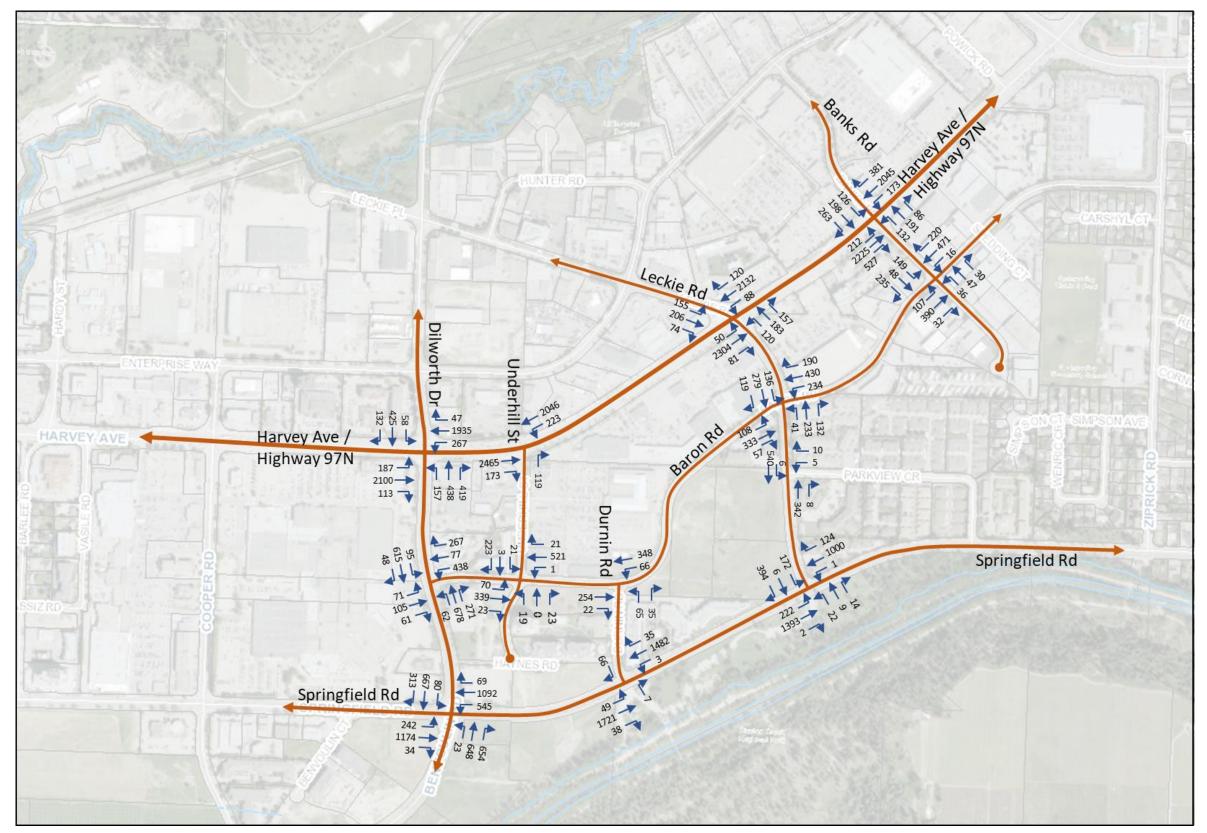
Figure 3: Study Area and Intersection Laning

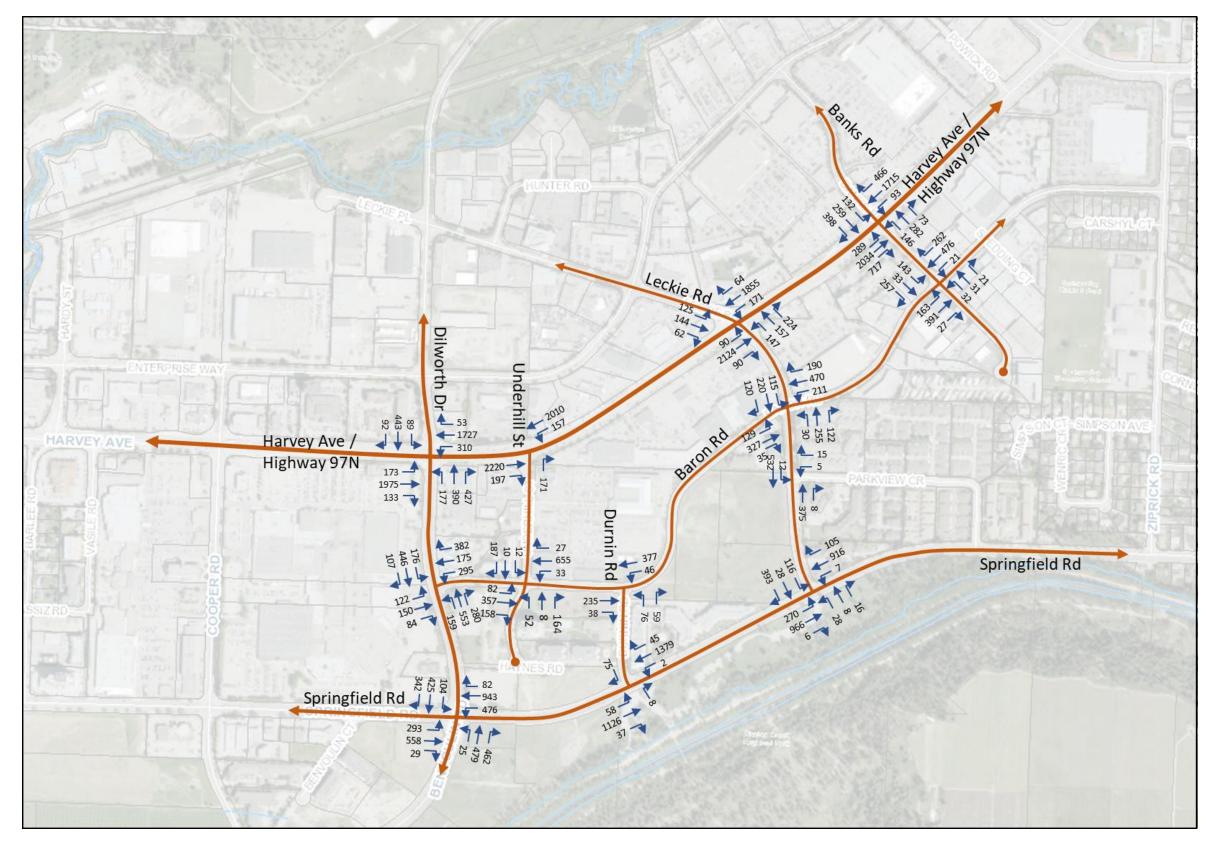**Figure 4: 2019 Weekday PM Peak Hour Volumes**

Figure 5: 2019 Saturday Midday Peak Hour Volumes

1.5 REGIONAL GROWTH AND LOCAL DEVELOPMENT

1.5.1 BACKGROUND GROWTH AND LOCAL DEVELOPMENTS

As discussed in the Terms of Reference (TOR), general background traffic is expected to grow linearly at 2% per year. In addition, four planned developments are also expected to impact background traffic and they have been included in the analysis. The four developments are:

1. A proposed 845 residential unit complex and 2,500 ft^2 of commercial floor space available to both residents and non-residents located at the corner of Baron Road and Dilworth Drive at the old School District 23 site. This site is assumed to be phased over the two assessment years (2021 and 2031).

2. A commercial development at the corner of Enterprise Way and Dilworth Drive, the old Enterprise Steel site. The development consists of 112,500 ft^2 of small bay flex units, and 38,000 ft^2 of new car sales/service facility.

3. A proposed Tim Horton's high turnover restaurant located within the existing Canadian Tire parking lot at 1655 Leckie Road.

4. The assumed redevelopment of the 'old' Costco site at 2479 Highway 97 into some big-box retail function – assumed trip generation commensurate with that land use and square footage.

The growth rate along with the additional developments listed above are added to the existing traffic to generate forecasted background traffic under two assessment years as agreed to in the TOR. The scenarios included in the model are listed in Table 1-1.

Table 1-1: ASSESSMENT YEARS

ASSESSMENT YEAR	ASSESSMENT SCENARIOS
Current Year (2019)	Existing Volumes
Development Completion (2021)	General growth (2% p.a.); General growth (2% p.a.) + 4 Background Developments + Costco
10 Years After Development Completion (2031)	General growth (2% p.a.); General growth (2% p.a.) + 4 Background Developments + Costco

Forecasted traffic volumes for the PM peak and Saturday peak hour for the residential complex at the corner of Baron Road/Dilworth Drive were obtained from Figure 3.2 of the Ward Consulting Group report "*Traffic Impact Assessment for Proposed Residential Development- 1930 Underhill Street*", 2018.

The traffic volumes for the PM peak hour for the commercial development at the corner of Enterprise Way/Dilworth Drive were obtained from Figure 7 of the CTQ report "*1655 Dilworth Drive Commercial Development, Kelowna, BC, Transportation Impact Study*", February 9, 2017. The CTQ study for the commercial development did not include a Saturday scenario and therefore WSP derived Saturday peak hour traffic for this commercial development using ITE Trip Generation rates for the same ITE codes and version described in the CTQ report. The trips were then distributed through the study network using the same distribution as the weekday PM peak hour.

Traffic volumes for Tim Horton's restaurant were obtained from Exhibit 3.2 of the Bunt report "*Tim Hortons, 1655 Leckie Road Transportation Impact Assessment, Final Report*". The Bunt study did not include a Saturday scenario and after discussions with MOTI, the morning peak hour trip forecasts from the Bunt report were used to represent the Saturday peak hour for the Tim Horton's Restaurant. The trips were then distributed through the study network using the same distribution in the Bunt report.

Traffic volumes for the re-development of the existing Costco site were generated using ITE trip generation code 813 (Free-Standing Discount Superstore). The generated trips were distributed through the study network using the same pattern as described in Section 2.2. More discussions on the re-development of the existing Costco site are provided in Section 2.3.

The resulting future background traffic adjusted for growth for the 2021 and 2031 assessment years are shown in Figure 6 through Figure 9.
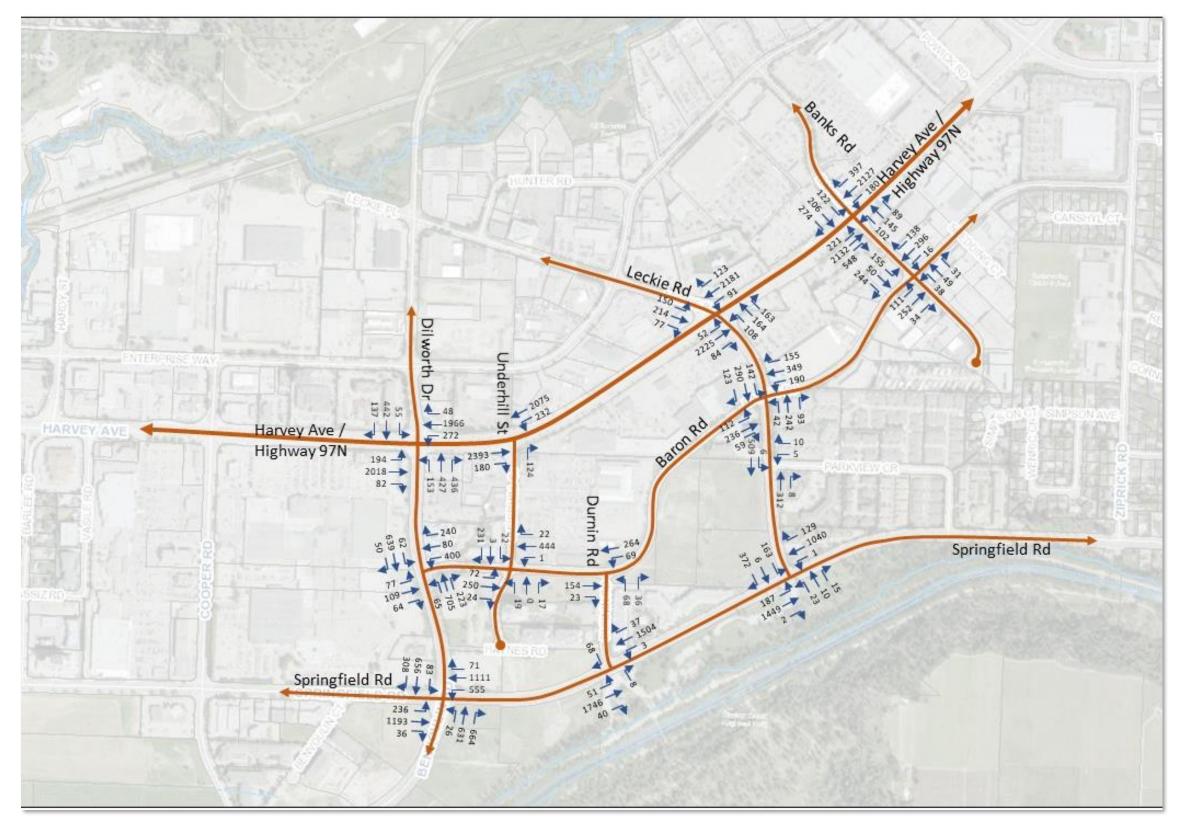
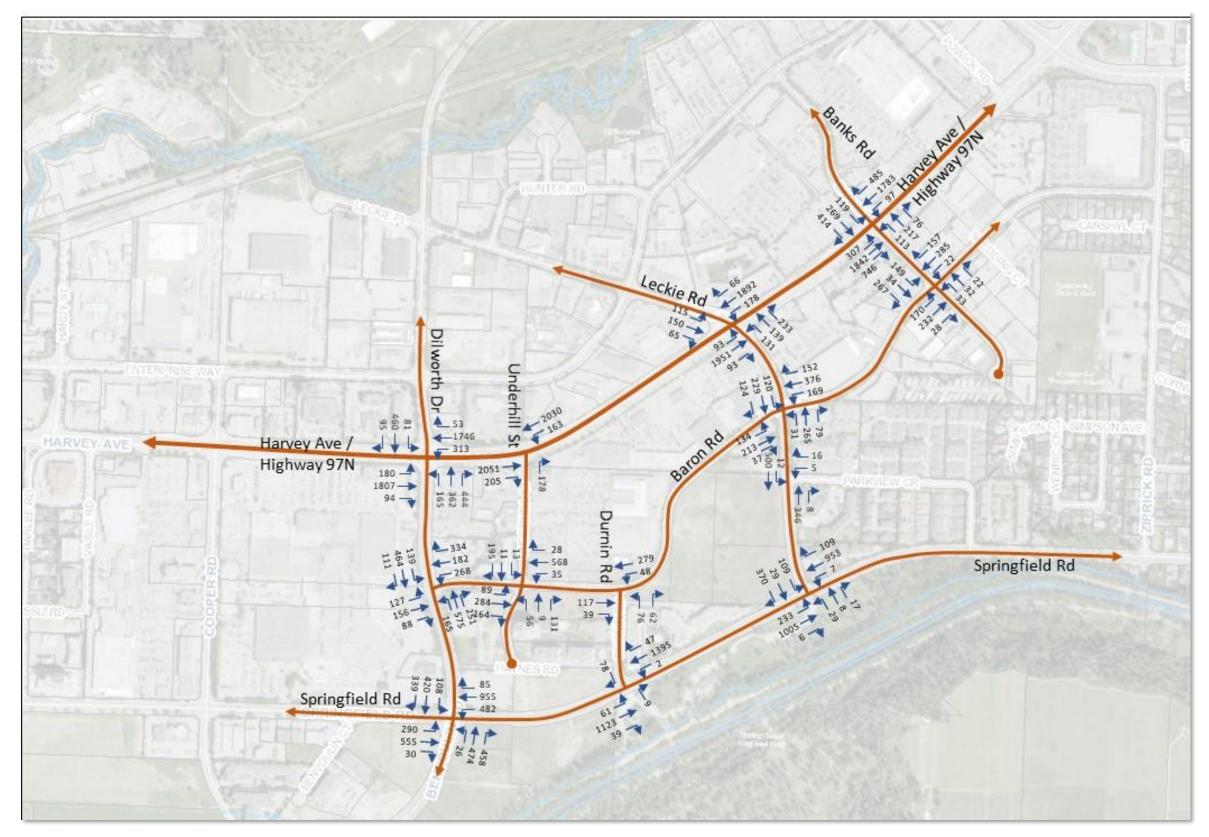Figure 6: 2021 Weekday PM Peak Hour Background Traffic

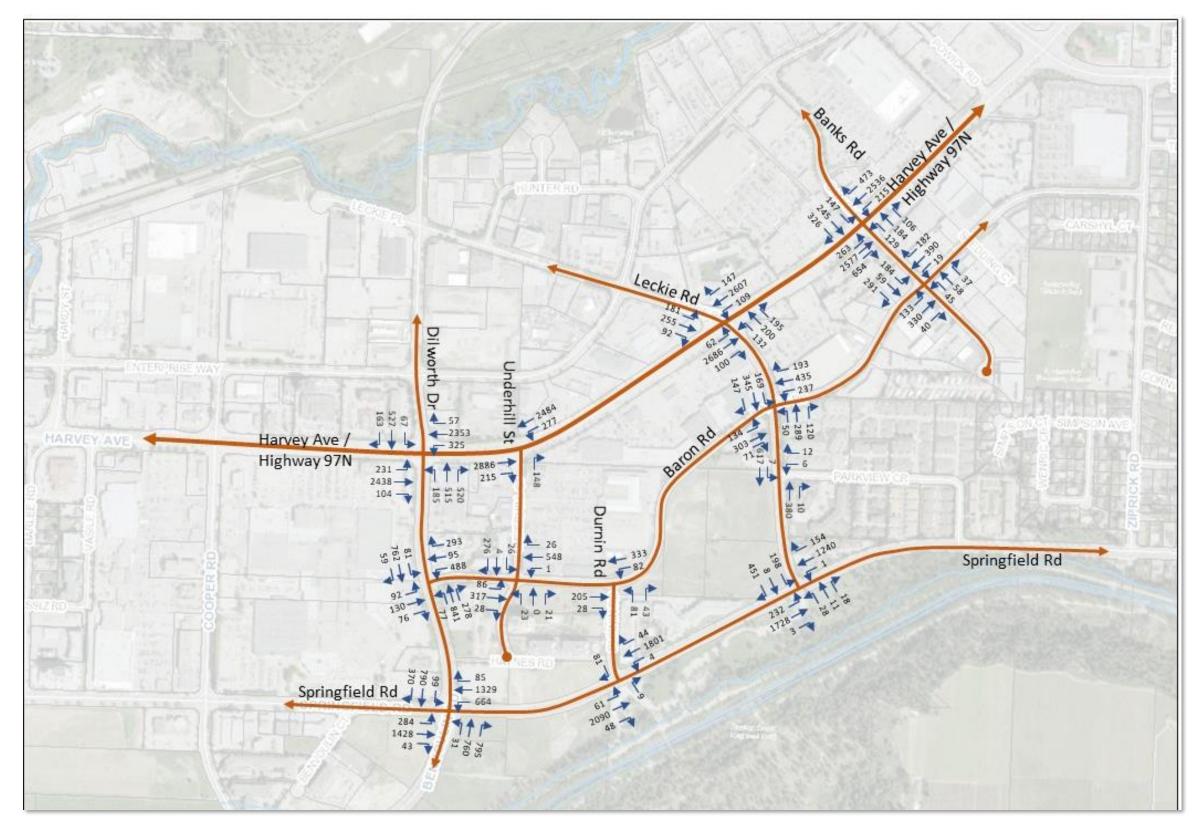**Figure 7: 2021 Saturday Midday Peak Hour Background Traffic**
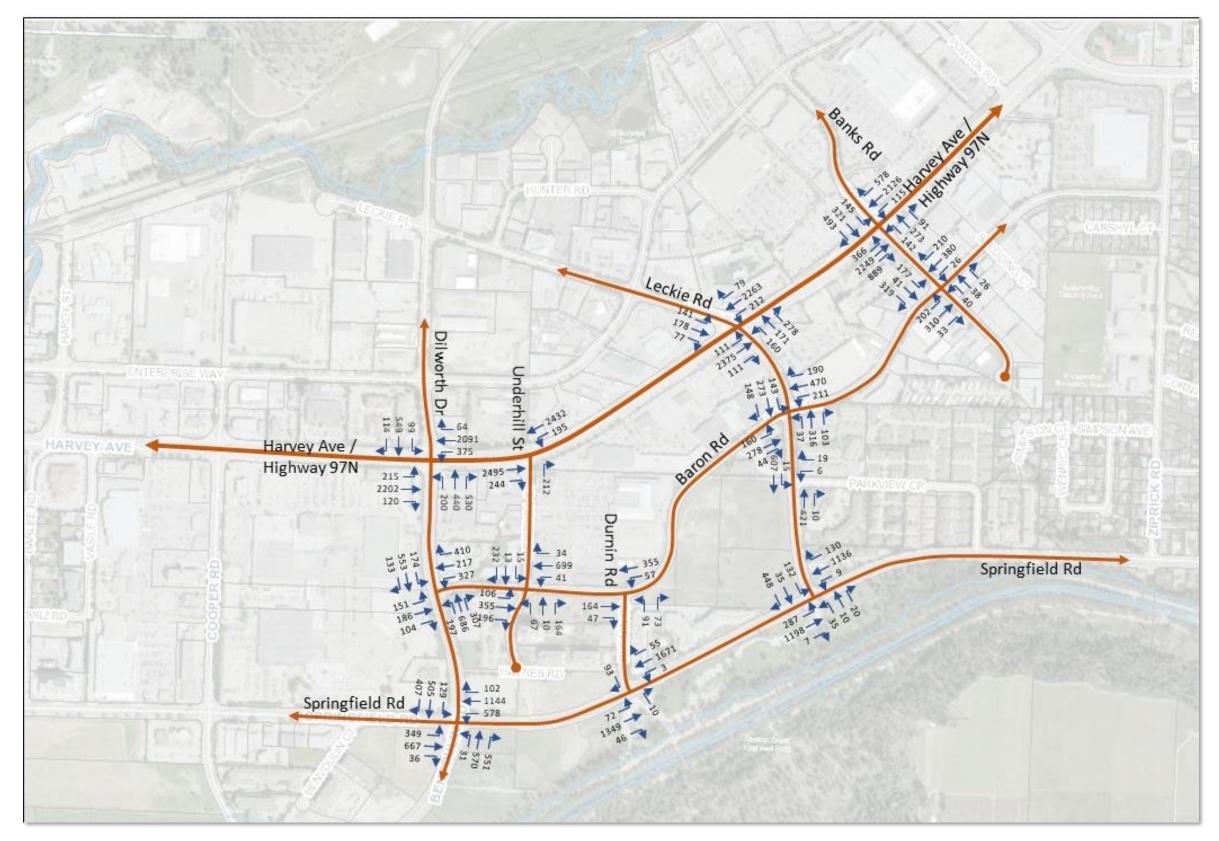
Figure 8: 2031 Weekday PM Peak Hour Background Traffic

Figure 9: 2031 Saturday Midday Peak Hour Background Traffic

2 COSTCO TRIP GENERATION, DISTRIBUTION AND ASSIGNMENT

2.1 TRIP GENERATION

Due to the unique nature of Costco retail warehouse, a trip generation study was completed at the existing location to determine accurate trip generation rates for the proposed new site. The study was completed at the existing site located at 2479 Highway 97 and consisted of counts at each of the five accesses during business hours on a weekday and Saturday. The details of the trip generation, pass-by and diverted trips for both the Costco wholesale store and the gas bar are outlined in the Terms of Reference attached as Appendix B.

The final trip generation rates as determined in the study are shown in Table 2-1 for the Costco Store and Table 2-2 for the Gas Bar with the trip summary shown in Table 2-3.

Table 2-1: Comparison of Trip Generation Rates for Costco Store

PROPOSED LAND USE	PERIOD	PEAK HOUR	TRIP GENERATION RATE FROM STUDY	ITE TRIP GENERATION RATE
Costco Wholesale Club[1]	Weekday	PM Peak hour of Adjacent Street	9.22 trips/ 1,000 ft^2	4.61 trips/ 1,000 ft^2
	Saturday	Peak Hour of Adjacent Street	11.35 trips/ 1,000 ft^2	6.37 trips/ 1,000 ft^2

Table 2-2: Comparison of Trip Generation Rates for Costco Gasoline Fueling Stations

PROPOSED LAND USE	PERIOD	PEAK HOUR	TRIP GENERATION RATE FROM STUDY	ITE TRIP GENERATION RATE
Gas Station	Weekday	PM Peak of Adjacent Street	29.86 trips/FP	15.87
	Saturday	Peak Hour of Adjacent Street	30.41 Trips/FP	19.28

FP: fueling position

Table 2-3: Combined Study Site Trip Summary

PERIOD	SITE	TOTAL SITE TRIPS	RE-ROUTED TRIPS	PASS-BY TRIPS	DIVERTED TRIPS	NET NEW TRIPS
Weekday Peak	Costco Wholesale	1,428	1,269	-	-	159
	Gas Station	538	-	130	122	108
	Combined Trips	-178	-	-	-	-
	Total	**1,788**	**1,269**	**130**	**122**	**267**
Saturday Peak	Costco Wholesale	1,758	1,581	-	-	177
	Gas Station	548	N/A	105	112	133
	Combined Trips	-198				
	Total	**2,108**	**1,581**	**105**	**112**	**310**

*Trip generation was assumed to be 18 fuel stations for the gas bar as per the original trip generation determined in the terms of reference.

2.2 TRIP DISTRIBUTION AND ASSIGNMENT

Trip distribution for the development was described in the Terms of Reference. The distribution was slightly adjusted, at the request of the City, for Leckie Road and is shown in Figure 10 and Figure 11. Trip distribution for the new site was assumed to be similar to the existing patterns found at 2479 Highway 97 Costco site. The assignment of the trips was completed as follows:

Underhill Development: Taken directly from Figure 3.2 of the Ward Consulting Group report "*Traffic Impact Assessment for Proposed Residential Development- 1930 Underhill Street*", 2018.

Commercial Development: Taken directly from Figure 7 of the CTQ report "*1655 Dilworth Drive Commercial Development, Kelowna, BC, Transportation Impact Study*", February 9, 2017 for the PM Peak hour. The Saturday trips generated by WSP for the commercial development were assigned using the same distribution as the weekday PM peak hour.

Tim Horton's restaurant: Taken directly from Exhibit 3.2 of the Bunt report "*Tim Hortons, 1655 Leckie Road Transportation Impact Assessment, Final Report*".

New Costco Trips: Generally, assigned assuming the shortest path with some adjustments to account for drivers preferring to take the local network.

Existing Costco Redevelopment Trips: Assigned to follow the existing distribution patterns and traffic turning movement patterns at the intersections. Redevelopment trips from the North or to the North were assumed to follow the same distribution as existing trips to Costco and therefore not included in the study intersections (i.e. traffic going to Ziprick Place, northbound on Baron or leaving to the north using the Highway 97 access are not part of the study). The regenerated trips using the study network for the existing site is as follows:

- Weekday Inbound - 54%, Weekday Outbound - 58% (*the remaining inbound and outbound trips are not be part of the study*)

- Saturday Inbound – 45%, Saturday Outbound – 42% (*the remaining inbound and outbound trips are not be part of the study*)

The resulting generated trip assignments for Costco and the gas bar are shown in Figure 12 and Figure 13.
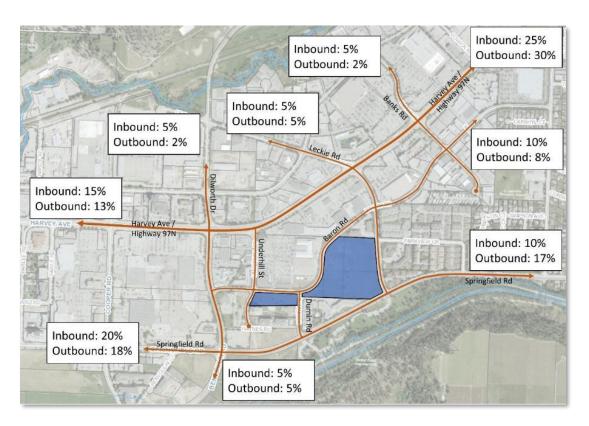
Figure 10: Proposed Site Weekday PM Peak Hour Distribution
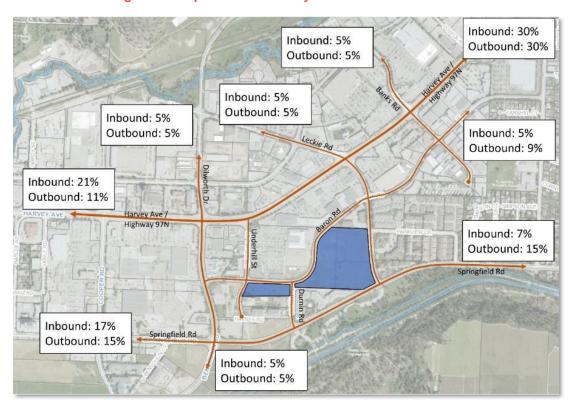

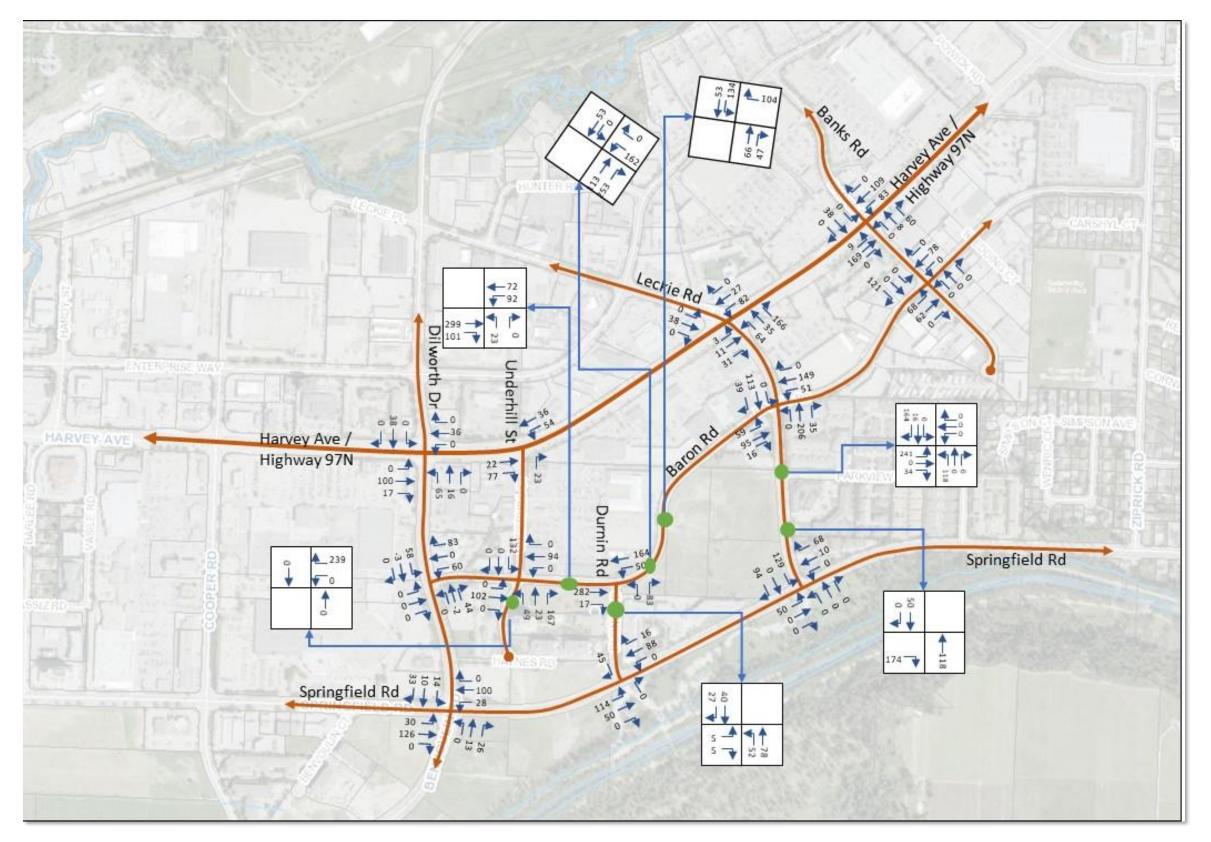**Figure 11: Proposed Site Saturday Midday Peak Hour Distribution**

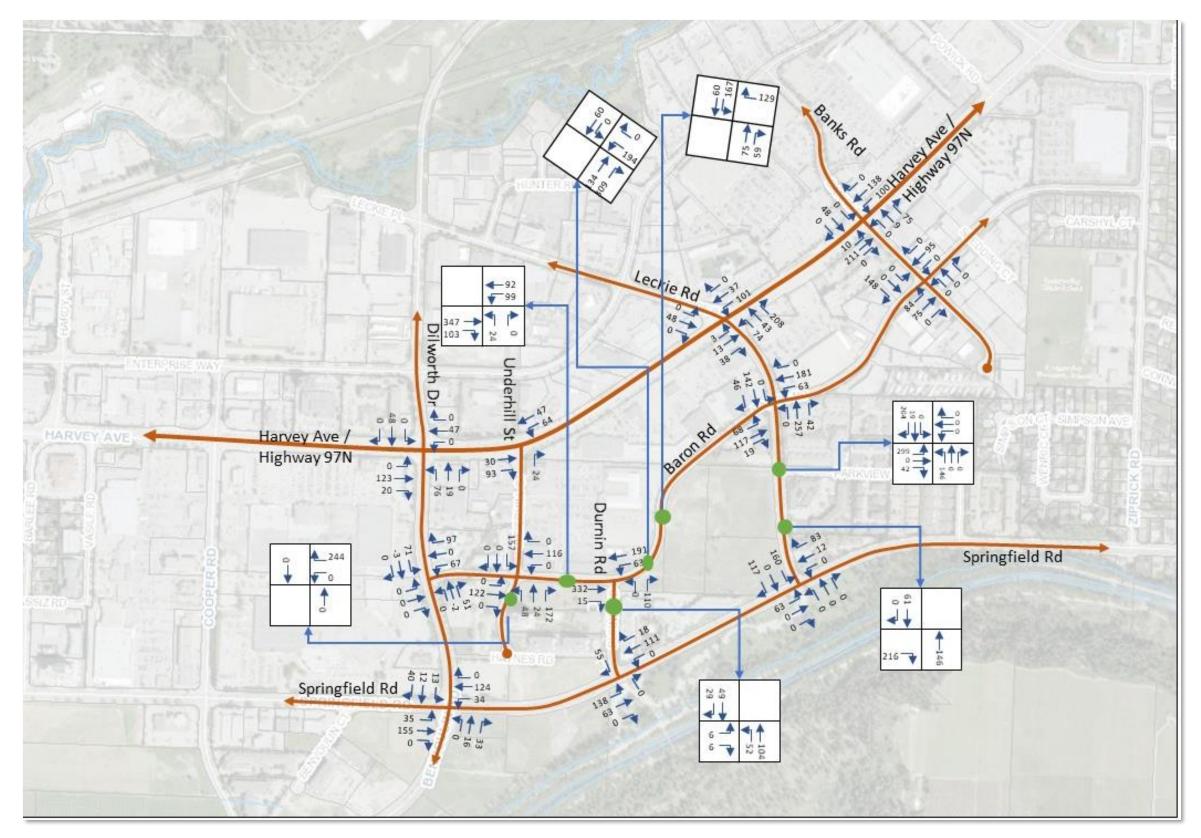Figure 12: Weekday PM Peak Hour Costco and Gas Bar Site Generated Trips

Figure 13: Saturday Midday Peak Hour Costco and Gas Bar Site Generated Trips

2.3 EXISTING WAREHOUSE SITE

In addition to the first three developments listed in Section 1.5, the existing warehouse will have an impact on traffic when it is redeveloped. The existing warehouse site was assumed to continue to be a discount retail store once Costco has relocated, but the details of the specific use are unknown at this time. To assess the impact of the re-development of the existing warehouse site, the net difference in trip generation between the existing use and assumed future use were added to the study network which in this case, the resulting in less trips than existing for the redeveloped site.

The assignment was completed using the following steps:

- The existing warehouse site based on the trip generation study were removed from the network assuming the same distribution as existing;

- The new generated trip for a warehouse retail site using ITE trip generation code 813 (Free-Standing Discount Superstore), shown in Table 2-4 were then added to the network.

Table 2-4: Trip Generation for Re-Development of Existing Site

LAND USE	PEAK HOUR		TRIP GENERATION RATE	PROPOSED SIZE	TOTAL	IN/OUT	IN	OUT
Warehouse Retail	Weekday	PM	4.33/1000 ft^2	139,290 ft^2	603	49/51	294	307
	Saturday	Peak Hour	5.57/1000 ft^2		776	50/50	388	388

The trip distribution was assumed to follow the same pattern as described in Section 2.2. As the trip generation rate for Costco is significantly higher than the ITE rate for Warehouse Retail, there was a net reduction in trips to the network from the re-development of the existing site. The net trips for the re-development of the existing site from a Costco Wholesale to warehouse retail are shown in Figure 14 and Figure 15.
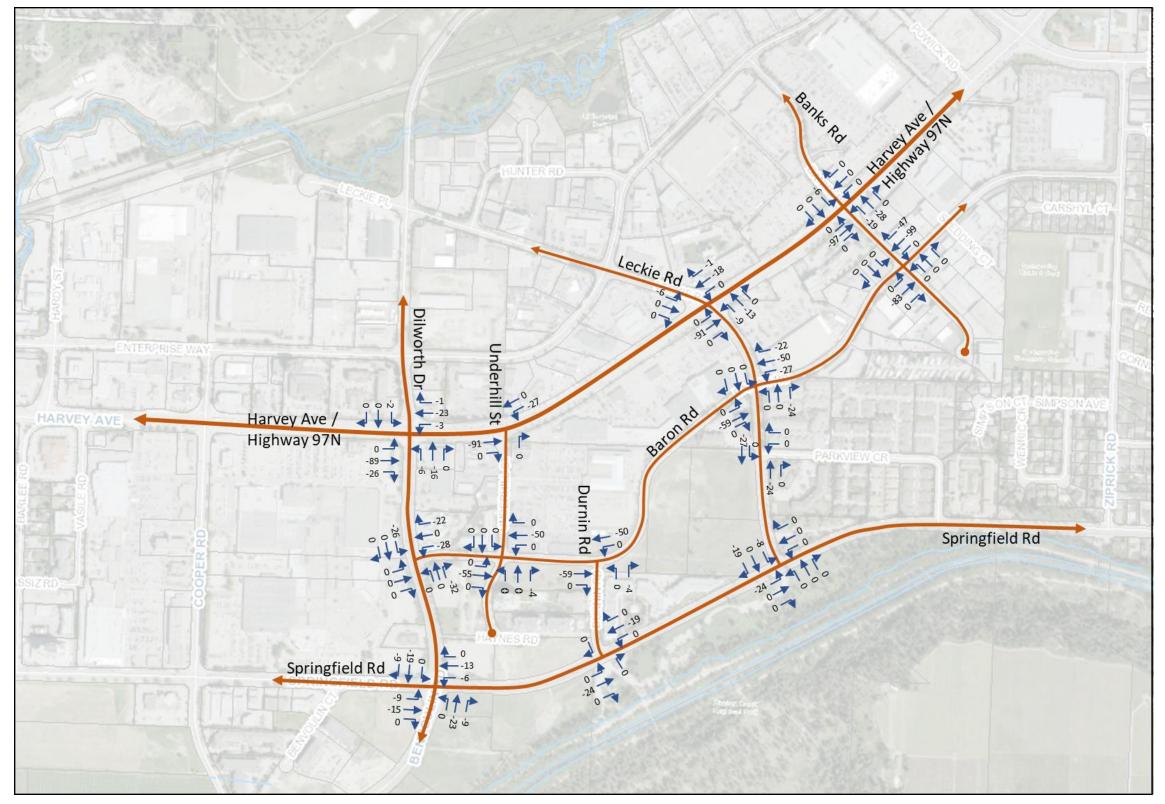
Figure 14: Existing Costco Warehouse Site Re-Development Weekday PM Peak Hour Trips
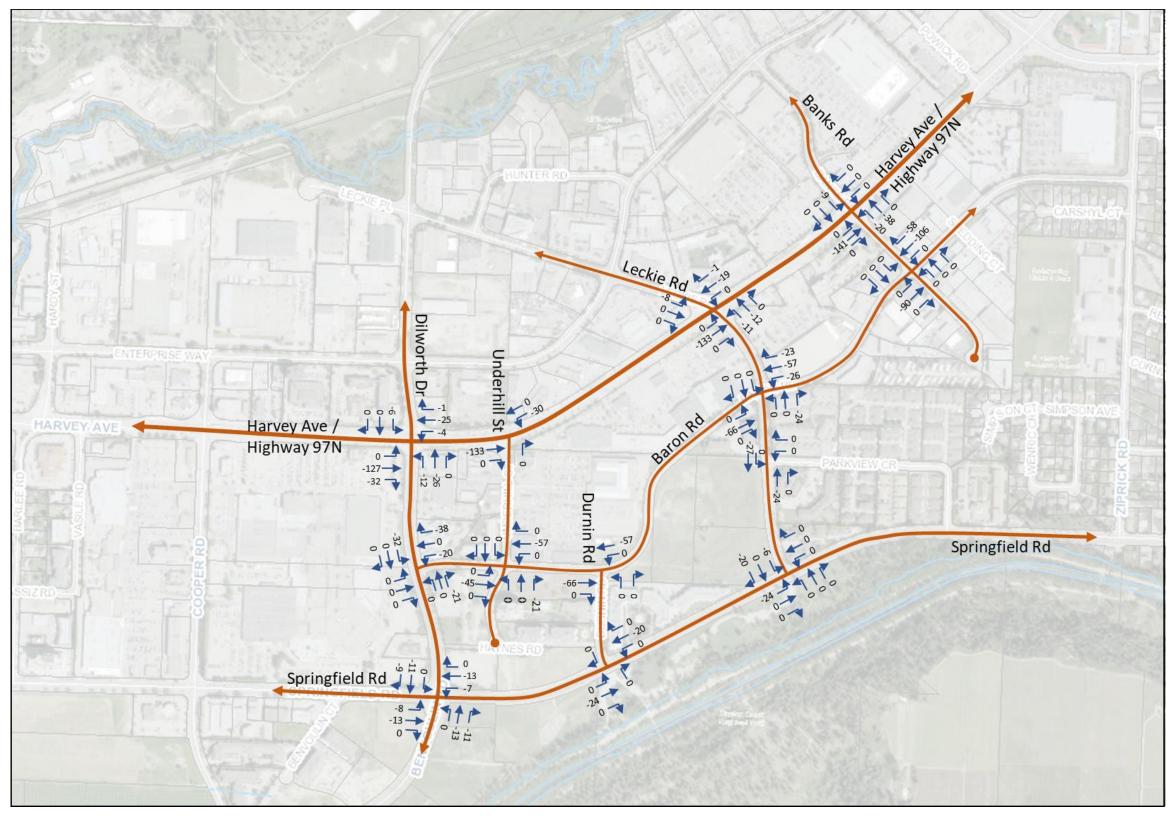
Figure 15: Existing Costco Warehouse Site Re-Development Saturday Midday Peak Hour Trips

2.4 TOTAL TRIPS

Due to the nature of Costco sales with bulk goods and large item purchases, there is limited opportunity for multi-modal reduction in trips. There is opportunity to encourage Costco employees to use non-auto modes to travel to and from work. However, given Costco's shift times, most employees do not arrive or leave work during the peak hour periods. As a result, our modelling scenarios are a worst-case scenario where trip reductions from multi-modal options are not considered.

Figure 16, Figure 17, Figure 18, and Figure 19 show the total trips in 2021 (opening day) and 2031 (10-year horizon). Total trips include the new Costco/Gas Bar trips, existing warehouse re-development net trip reductions, background traffic with a growth rate of 2% and the local development trips which includes the Underhill residential development, Tim Horton's and the Enterprise Development.

Figure 16: 2021 Weekday PM Peak Hour Total Volumes

Figure 17: 2021 Saturday Midday Peak Hour Total Volumes

Figure 18: 2031 Weekday PM Peak Hour Total Volumes
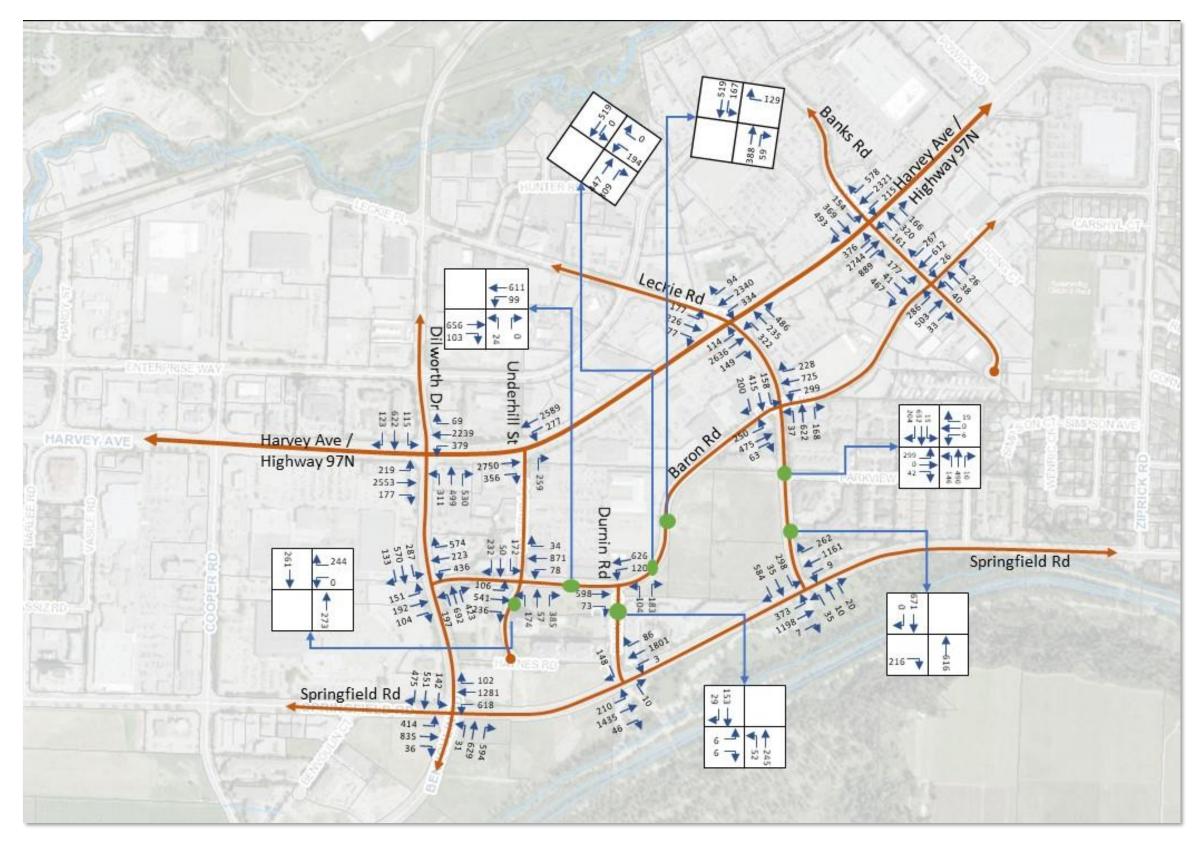
Figure 19: 2031 Saturday Midday Peak Hour Total Volumes

3 MODELLING RESULTS

3.1 PERFORMANCE MEASURES

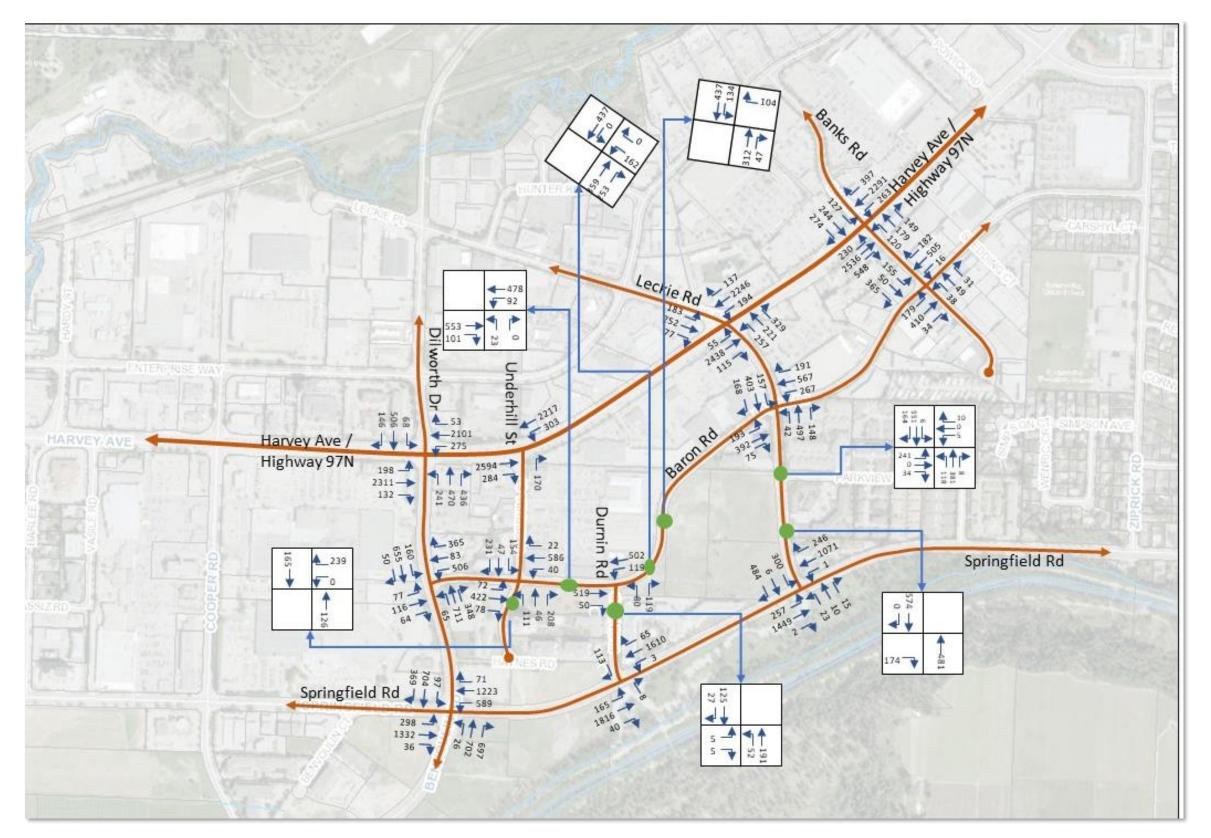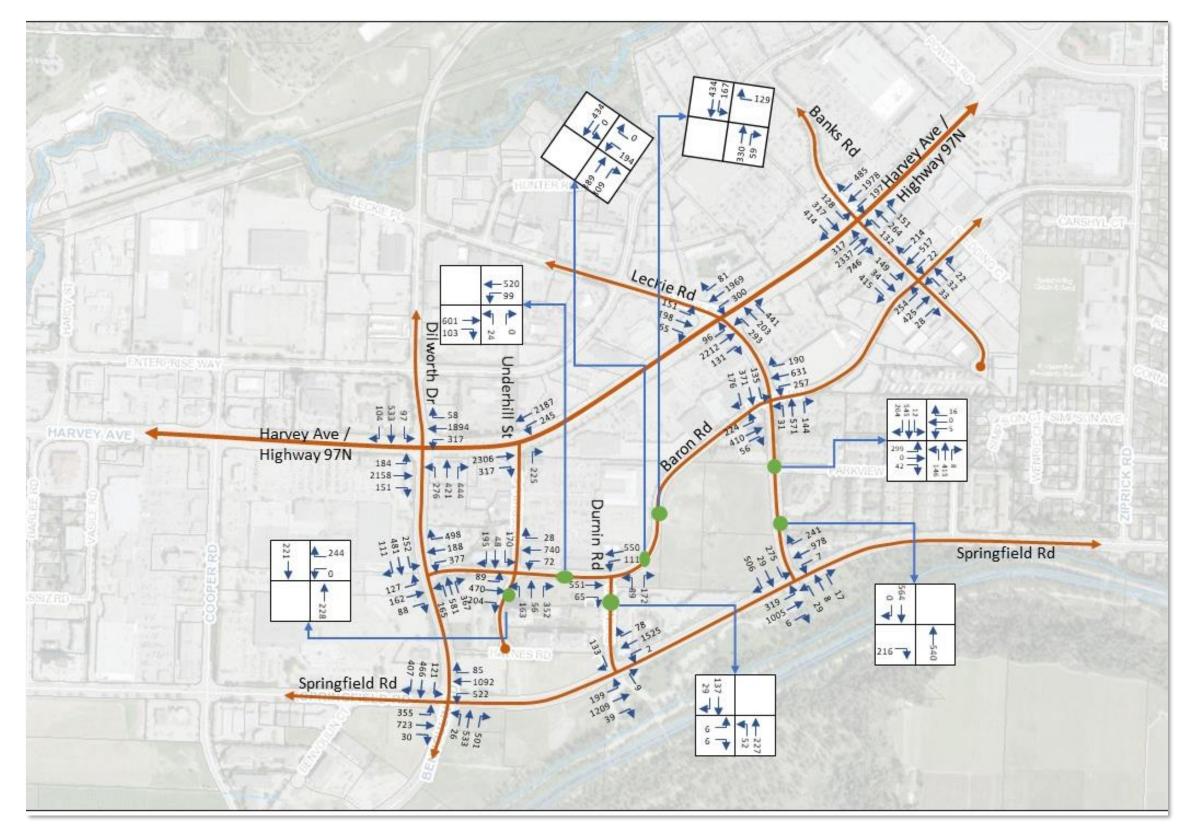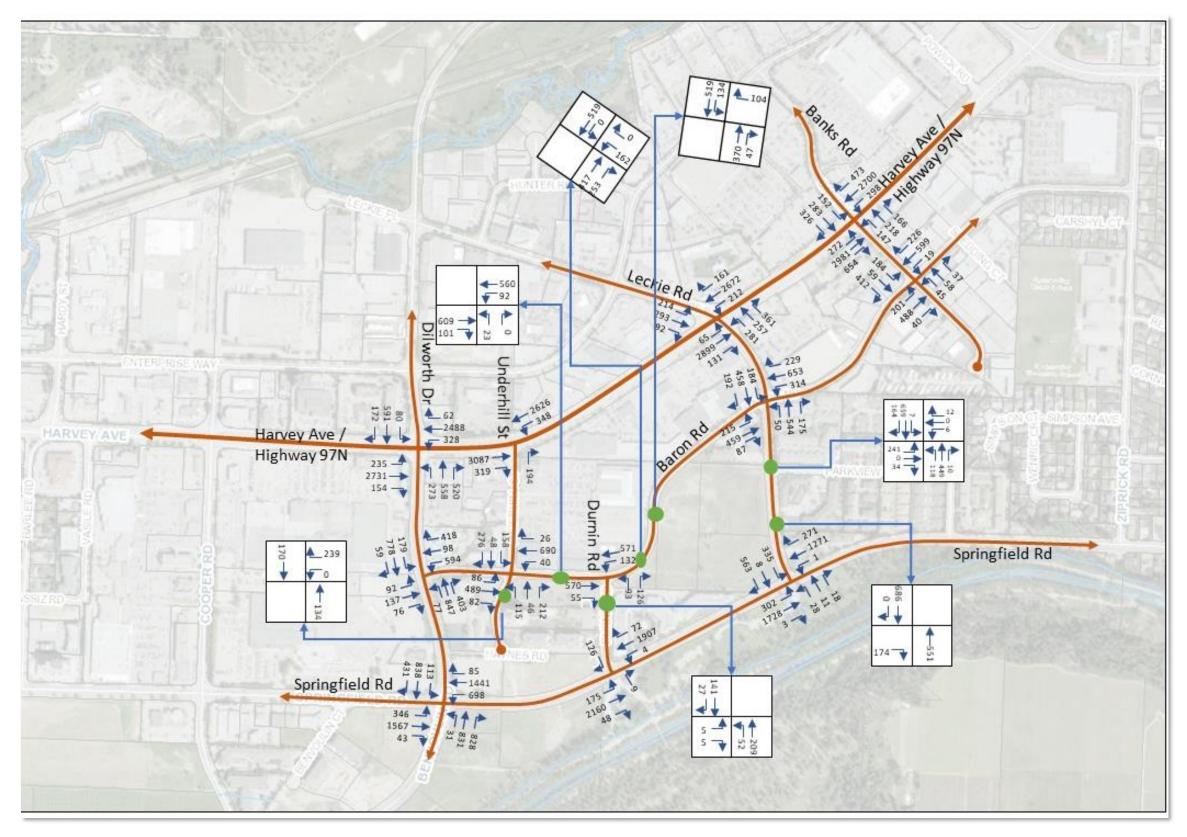The performance of the study intersections is determined using Synchro 10 software. Synchro 10, developed by Trafficware, utilizes the Highway Capacity Manual (HCM) 6th Edition for assessing the Level of Service (LOS) at each approach and overall intersection performance. The HCM criteria for the Two-Way Stop Controlled (TWSC) and Signalized intersections are given below.

Table 3-1 and Table 3-2 show the LOS for each control delay range for un-signalized and signalized intersections, respectively.

Table 3-1: LOS Criteria for Vehicles at Un-Signalized Intersections (HCM)

CONTROL DELAY (SECONDS/VEHICLE)	LOS BY VOLUME-TO-CAPACITY RATIO
0 - 10	A
< 10 - 15	B
< 15 - 25	C
< 25 - 35	D
< 35 - 50	E
>50	F

Table 3-2: LOS Criteria for Vehicles at Signalized Intersections (HCM)

CONTROL DELAY (SECONDS/VEHICLE)	LOS BY VOLUME-TO-CAPACITY RATIO
≤ 10	A
$> 10 \leq 20$	B
$> 20 \leq 35$	C
$> 35 \leq 55$	D
$> 55 \leq 80$	E
> 80	F

The capacity analysis results are reviewed based on the following criteria:

1. For signalized intersections:
    — Overall intersection Level of Service (LOS) does not exceed LOS D in both AM & PM peak hours;
    — Overall intersection Volume to Capacity (v/c) ratio does not exceed 0.85;
    — Individual movement LOS does not exceed LOS E;
    — Individual movement v/c ratio does not exceed 0.90; and,
    — 95th percentile queue lengths do not exceed storage lengths.

2. For unsignalized intersections:

— Individual movement LOS does not exceed LOS D (unless the movement volume is very low compared to other movements);

— Individual movement v/c ration does not exceed 0.90; and,

— 95th percentile queue lengths do not exceed storage lengths.

When traffic generated by Costco is added to an intersection and the v/c ratio of a specific movement was less than 0.90 under background conditions is now greater than 0.90, then mitigations are identified to allow the intersection to operate at 0.90 or less. If the intersection was above 0.90 under background conditions, then improvements are identified if the v/c ratio increases because of the development.

3.2 OVERALL MODELLING RESULTS

The peak movements not meeting the performance thresholds as described in Section 3.1 are summarized in Table 3-3. For this study, Highway 97, Baron Road and Springfield Road are considered North/South routes. The movements that do not meet performance thresholds depending on scenario are highlighted in a different colour:

- Black for movements that do not meet threshold for existing conditions,

- Blue for movements that do not meet thresholds for 2021 or 2031 background, and

- Green for movement that do not meet thresholds for 2021 or 2031 total conditions.

As such, the movements highlighted in green in the table are the movements that are specifically impacted by the proposed Costco development.

Some of the intersection approaches were found to have a volume/capacity ratio near or above 1.0. This means that more vehicles are arriving at the intersection than are clearing the intersection during the PM peak and Saturday peak hours. The result of this, is a highly volatile network that can experience large and unexpected changes to performance with minor network or volume changes. It also means the network is sensitive to delays from collisions, stalls, or construction and if one change is made to improve an approach capacity or level of service, it could affect other approaches within the intersection or network.

Since both peak hours show similar movements not meeting thresholds, the mitigation measures considered and modelled were the same for the PM and Saturday peak hour under total development conditions. The total development scenario was chosen because if the measures were found to show an improvement at this level of development, the improvements would therefore satisfy background development conditions as well.

The mitigated considerations are described in Table 3-4. Note that the cycle lengths used for the Highway 97 intersections are the existing cycle lengths. The overall modelling results of the existing traffic volumes, background development condition in 2021 and 2031 and total development conditions before and after mitigation are shown in Table 3-5, Table 3-6 and Table 3-7. Comments on the results are provided in Table 3-9 by intersection along with the recommended mitigations. Appendix E provides high level conceptual drawings of the improvements.

Table 3-3: PM Peak and Saturday Peak Movements Not Meeting Thresholds

	2019 PM Peak	2021 Background PM Peak	Total 2021 PM Peak (Costco)	2031 Background PM Peak	Total 2031 PM Peak (Costco)		2019 Saturday Peak	2021 Background Saturday Peak	Total 2021 Saturday Peak (Costco)	2031 Background Saturday Peak	Total 2031 Saturday Peak (Costco)
Highway 97/Dilworth Drive	SBL	WBL, NBL, NBTTTR, SBL	WBL, NBL, NBTTTR, SBL	WBL, NBL, NBTTTR, SBL, SBTTR	WBL, NBL, NBTTTR, SBL		SBL	WBL, NBTTTR, SBL	WBL, NBTTTR, SBL	EBL, WBL, NBL, NBTTTR, SBL	EBL, WBL, NBL, NBTTTR, SBL
Highway 97/Underhill Street	WBR, SBL	WBR, SBL	WBR, SBL	WBR, SBL	WBR, SBL		WBR, SBL	WBR, SBL	WBR, SBL	WBR, SBL	WBR, SBL
Highway 97/Leckie Road	WBL, WBT, SBL	EBLL, WBL, WBT, SBL	EBTR, WBL, WBT, SBL	EBLL, EBTR, WBL, WBT, SBL, NBL, NBTTTR, SBL	EBLL, EBTR, WBL, WBT, SBL, NBL, NBTTTR, SBL		WBL	WBL, WBT, NBL, SBL	WBL, WBT, SBL	WBL, WBT, NBL, NBTTTR, SBL	WBL, WBT, NBL, NBTTTR, SBL
Highway 97/Banks Road	NBL	NBL, NBTTT, SBL	NBL, NBTTT, SBL, SBTTT	EBL, WBL, NBL, NBTTT, SBL, SBTTT	EBL, WBL, NBL, NBTTT, SBL, SBTTT		NBL	NBL, NBTTT	NBL, NBTTT, SBTTT	EBL, WBL, NBL, NBTTT, SBTTT	EBL, WBL, NBL, NBTTT, SBTTT
Baron Road /Dilworth/Mall Entrance	SBLT	NBLT, SBLT	NBLT, SBLT	NBLT, SBLT, WBTTR	NBLT, SBLT, WBTTR		NBLT, SBLT	NBLT, SBLT	NBLT, SBLT	WBTTR, NBLT, SBLT	EBL, WBTTR, NBLT, SBLT
Baron Road/Underhill Street		EBLTR, WBLTR	EBLTR, WBLTR	EBLTR, WBLTR	EBLTR, WBLTR		EBLTR, WBLTR	EBLTR, WBLTR	EBLTR, WBLTR	EBLTR, WBLTR	EBLTR, WBLTR
Baron Road/Durnin Road			WBLR		WBLR				WBLR		WBLR
Baron Road/Leckie Road	SBTR	SBTR	EBTR, SBTR	SBTR, EBTR	EBTR, EBL, SBTR		SBTR	SBTR	EBTR, NBL, SBTR	SBTR	EBL, EBTR, NBL, SBTR
Baron Road/Banks Road	SBTR	SBTR	SBTR	SBTR	SBTR		SBTR	SBTR	SBTR	SBTR	EBTR, SBTR
Springfield/Dilworth/ Benvoulin	WBTT, NBTTR, SBL	WBTT, NBTTR, SBL	WBTT, NBTTR, NBL, SBL	EBTT, WBTT, NBL, NBTTR, SBL, SBTTR	EBTT, WBTT, NBL, NBTTR, SBL, SBTTR			SBL	NBL, SBL, SBTTR	NBL, SBL, SBTTR	NBL, NBTTR, SBL, SBTTR
Springfield Road /Durnin Road			NBL		EBR NBL, NBTTR				NBL		NBL
Springfield Road/ Leckie Road	NBL	NBL	NBL, SBTTR	NBL	EBR, NBL, SBL, SBTTR		NBL	NBL, SBTTR	NBL, SBTTR	NBL, SBTTR	NBL, SBTTR
Leckie Road/Parkview Crescent			NBL, SBL		NBL, SBL				NBL, SBL		NBL, SBL

- *Black for movements that do not meet threshold for existing conditions,*

- *Blue for movements that do not meet thresholds for 2021 or 2031 background, and*

- *Green for movement that do not meet thresholds for 2021 or 2031 total conditions.*

Table 3-4: Mitigation Modelled by Intersection

Location	PM/Saturday Peak Hour Mitigation	Cycle Length – PM (seconds)	Cycle Length – Saturday (seconds)
Highway 97/ Dilworth Drive	• Dual southbound left • Northbound right • Optimize phases within cycle length	150	130
Highway 97/ Underhill Street	• Do nothing		
Highway 97/Leckie Road	• Dual southbound left • Convert second eastbound left had turn lane to second eastbound through lane • Optimize phases within cycle length	150	130
Highway 97/Banks Road	• Dual Northbound left • Optimize phases within cycle length	150	130
Baron/Dilworth/ Mall Entrance	• Adjust lane configuration along Baron Road • Add westbound right along Dilworth Drive • Optimize phases within cycle length.	100	100
Baron Road/ Underhill Street	• Signalize • Left turn lane in East and West • Westbound right turn lane	50	50
Baron Road/Durnin Road	• Do nothing – Review pedestrian crossing options		
Baron Road/Leckie Road	• Change lane configuration to two through and left turn lane along Leckie Road. • Add southbound right turn lane along Baron Road • Change cycle length from 85s to 100s on Saturday. Optimized phases within cycle length.	100	100
Baron Road/Banks Road	• Add southbound right turn lane. • Change cycle length from 81s to 100s	100	100
Springfield/Dilworth/ Benvoulin	• Dual southbound left • Increase length of westbound right turn lane	120	110
Springfield Road/ Durnin Road	• Signalize and coordinated between Benvoulin/Dilworth and Leckie Road	120	110
Springfield Road /Leckie Road	• Dual Northbound left • Optimize phases within cycle • Increased cycle length on Weekdays from 110s to 120s and Saturday from 100s to 110s	120	110
Leckie Road/ Parkview Crescent	• Signalize (permissive only phasing) • Add east/west left turn Lane at Parkview Crescent	50	50

Table 3-5: Summary of PM Peak Hour Modelling Results – 1 of 4

Highway 97 and Dilworth Drive

Movement	Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)
EBL	L=58	0.38	61.7	E	57.9*	L=71	0.51	65.8	E	70.9*	L=68	1.61	385.6	F	71.4	L=68	0.71	71.4	E	83.3	L=83	0.83	107.4	F	81.9*	L=80	1.90	500.1	F	85	L=80	0.85	93.6	F	54.2
EBTTR	T=425	0.42	42.6	D	99.4	T=468	0.46	43.0	D	111.4	T=506	0.67	47.8	D	143.9	T=506	1.08	113.1	F	152.7	T=553	0.55	44.5	D	136.1	T=591	0.78	52.4	D	176.7	T=591	1.19	150.2	F	139.3
	R=132					R=146					R=146					R=146					R=172					R=172					R=172				
WBL	L=157	0.74	67.3	E	113.4*	L=180	0.91	87.2	F	139.6*	L=241	2.30	638.0	F	91.5	L=241	1.08	118.9	F	87.5	L=212	1.27	198.0	F	153.3*	L=273	3.90	1348.9	F	86.1	L=273	1.35	217.7	F	93.4
WBTTR	T=438	0.63	46.6	D	319*	T=467	0.66	47.1	D	344*	T=470	0.87	51.0	D	339.2	T=470	0.99	73.2	E	237.5	T=555	0.79	49.7	D	435.5*	T=558	1.03	80.0	E	317.2	T=558	1.18	135.1	F	325.3
	R=419					R=436					R=436					R=436					R=520					R=520					R=520				
NBL	L=187	0.89	53.5	D	83*	L=198	0.90	65.1	E	92.3*	L=198	0.87	73.9	E	86.5	L=198	1.04	137.1	F	103.5	L=235	0.97	98.0	F	121.9*	L=235	0.97	93.4	F	59.1	L=235	1.27	206.3	F	97.3
NBTTR	T=2100	0.87	42.3	D	264.8*	T=2300	0.94	45.3	D	315*	T=2311	1.14	108.4	F	458.2	T=2311	1.04	69.8	E	419.5	T=2720	1.10	92.5	F	423.8*	T=2731	1.35	194.9	F	453.8	T=2731	1.23	143.5	F	421.7
	R=113					R=126					R=132					R=132	0.19	5.5	A	77	R=148					R=154	0.22	7.4	A	81.1	R=154				
SBL	L=267	1.03	110.9	F	146.2*	L=278	1.10	136.1	F	154.8*	L=275	1.12	134.7	F	72.7	L=275	1.02	103.8	F	124.8	L=331	1.34	231.7	F	194.3*	L=328	1.34	212.8	F	99.8	L=328	1.18	143.1	F	159.3
SBTTT	T=1935	0.76	31.4	C	210.3	T=2089	0.81	33.0	C	237.7	T=2101	0.96	49.3	D	105.8	T=2101	1.02	73.8	E	202.6	T=2476	1.02	60.7	F	335.8*	T=2488	1.15	112.1	F	141.7	T=2488	1.19	136.5	F	215
SBR	R=47		0.0		5.1	R=53				6.9	R=53	0.09	5.8	A	19.8	R=53	0.09	4.1	A	31.1	R=62		0.0		9.3	R=62	0.11	7.5	A	9.6	R=62	0.10	5.4	A	32.4
Overall	6278		43.5	D		6812		47.4	D		6937		98.6	F		6937		78.7	E		8067		84.7	F		8192		180.7	F		8192		140.7	F	

Highway 97 and Underhill Street

Movement	Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)
WBR	R=119	0.99	142.5	F	50.25	R=147	1.45	317.0	F	84	R=170	0.30	13.7	B	130.4	R=170	0.31	13.9	B	98.7	R=171	2.50	805.0	F	130.5	R=194	0.34	14.3	B	109.1	R=194	0.35	14.6	B	121.2
NBTTT	T=2465					T=2664					T=2594	0.54	0.0		242.2	T=2594	0.54	0.0		179.6	T=3157					T=3087	0.64	0.0		221.3	T=3087	0.64	0.0		193.8
NBR	R=173					R=207					R=284	0.18	0.0		50.4	R=284	0.18	0.0		30.8	R=242					R=319	0.20	0.0		49.4	R=319	0.20	0.0		14.2
SBL	L=223	4.89	1920.3	F	199.5	L=249	7.28	3042.0	F	235.5	L=303	1.14	136.4	F	114	L=303	1.10	121.9	F	128.4	L=294	17.19	7698.3	F	295.5	L=348	3.01	979.6	F	114.3	L=348	2.93	943.9	F	121.6
SBTTT	T=2046					T=2209					T=2217	0.46	0.0		640.2	T=2217	0.46	0.0		618.6	R=2618					T=2626	0.54	0.0		673.5	T=2626	0.54	0.0		344.6
Overall	5026		88.6			5476		146.9			5568		7.8	A		5568		7.1	A		6482		370.4			6574		52.2			6574		50.4		

Highway 97 and Leckie Road

Movement	Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Ctrl Delay (s)	LoS	Queue (m)
EBLL	L=155	0.86	77.3	E	75.4	L=189	0.89	82.6	F	90.4	L=183	0.61	73.6	E	64.9	L=183	0.87	83.4	F	71.6	L=220	0.90	86.7	F	106.4*	L=214	0.65	73.4	E	30.4	L=214	0.95	91.1	F	62.5
EBTR	T=206	0.87	77.4	E	149.5*	T=214	0.85	75.1	E	159.7*	T=252	1.03	112.2	F	197.1	T=252	0.68	60.6	E	239.9	T=255	0.90	81.9	F	207.7*	T=293	1.22	168.8	F	198.3	T=293	0.66	57.6	E	244.8
	R=74					R=77										R=77					R=92										R=92				
WBL	L=120	0.85	97.2	F	75.2*	L=202	1.31	238.5	F	141.6*	L=257	1.67	366.4	F	72.4	L=257	1.12	135.1	F	86.6	L=226	1.46	301.6	F	161.3*	L=281	1.83	431.4	F	74.4	L=281	1.20	162.7	F	100.8
WBT	T=183	0.95	113.7	F	110.1	T=199	1.07	147.7	F	129.1*	T=221	0.63	63.8	E	170.4	T=221	0.69	66.9	E	206.5	T=235	1.27	216.9	F	157.5*	T=257	0.77	72.4	E	168.4	T=257	0.79	74.8	E	221.8
WBR	R=157		0		0	R=163		0		0	R=329	0.22	0.3	A	210.5	R=329	0.89	63.8	E	228.7	R=195		0		0	R=361	0.24	0.4	A	168.9	R=361	1.05	104	F	215.1
NBL	L=50	0.45	49.3	D	32.3*	L=52	0.54	66.6	E	36.1*	L=55	1.18	219.8	F	33.6	L=55	0.48	29.2	C	30.5	L=62	0.95	167	F	44.6*	L=65	1.39	291.4	F	17.6	L=65	0.62	31.6	C	27.3
NBTTTR	T=2304	0.68	16.7	B	218.4	T=2519	0.77	20.4	B	258.7	T=2438	0.93	35.1	D	610.5	T=2438	1.02	28.4	C	527.4	T=2980	0.93	31.5	C	391.4	T=2899	1.11	83.4	F	534.9	T=2899	1.21	113.3	F	589.2
	R=81					R=84					R=115					R=115					R=100					R=131					R=131				
SBL	L=88	0.96	135.7	F	73.6	L=112	1.52	352.8	F	94.5*	L=194	4.41	1591.9	F	193	L=194	0.77	74.4	E	110.2	L=130	2.62	854.5	F	110.3*	L=212	4.82	1773.7	F	126.9	L=212	1.22	159.5	F	112.3
SBTTT	T=2132	0.64	15.4	B	181.9	T=2238	0.69	17.8	B	198.2	T=2246	0.81	27.3	C	213.8	T=2246	0.80	22.6	C	221.7	T=2664	0.84	24.6	C	275.9	T=2672	0.97	41.8	D	236.4	T=2672	1.02	46.4	D	226.9
SBR	R=120				0	R=138		0.0		0	R=137	0.12	0.2	A	100.1	R=137	0.12	0.1	A	81.6	R=162		0.0		0	R=161	0.14	0.2	A	49.9	R=161	0.14	0.0	A	72.5
Overall	5670		28.2	C		6187		43.1	D		6504		99.0	F		6504		37.7	D		7321		66.1	E		7638		130.3	F		7638		84.3	F	

Table 3-5: Summary of PM Peak Hour Modelling Results – 2 of 4

Highway 97 and Banks Road

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 126	0.63	68.2	E	70.9*	L = 132	0.65	69.1	E	76.5*	L = 127	0.79	86.7	F	71	L = 127	0.77	83.6	F	85.3	L = 157	0.85	95.0	F	97.6*	L = 152	0.80	81.9	F	27.8	L = 152	0.86	93.2	F	82.8
EBT	T = 198	0.48	50.7	D	83.9	T = 206	0.49	50.0	D	87.6	T = 244	0.69	64.6	E	191.9	T = 244	0.68	64.8	E	224.1	T = 245	0.56	50.7	D	103.7	T = 283	0.65	57.9	E	179.4	T = 283	0.68	60.3	E	218.8
EBR	R = 263		0.0		68.5	R = 274		0.0		73.7	R = 274	0.68	33.8	C	78.4	R = 274	0.65	32.2	C	86.3	R = 326		0.0		99.1	R = 326	0.70	37.2	D	82.7	R = 326	0.72	39.6	D	81.5
WBL	L = 135	0.68	70.9	E	79.2*	L = 140	0.70	71.6	E	83.6*	L = 120	1.08	159.9	F	82	L = 120	1.02	144.8	F	95.7	L = 167	0.92	103.1	F	107.5*	L = 147	1.05	140.3	F	88.5	L = 147	1.16	174.9	F	83.9
WBT	T = 191	0.48	50.5	D	82.5	T = 198	0.48	49.7	D	85.9	T = 179	0.52	57.3	E	149.1	T = 179	0.51	58.1	E	183.8	T = 237	0.55	50.2	D	102.6	T = 218	0.51	53.0	D	196	T = 218	0.53	54.7	D	174.1
WBR	R = 86		23.9			R = 89		25.5			R = 149	0.42	29.0	C	22.6	R = 149	0.40	23.6	C	27.3	R = 106		0.0		31.8	R = 166	0.40	31.4	C	8.8	R = 166	0.39	23.8	C	24.9
NBL	L = 212	0.91	76.0	E	123*	L = 221	1.01	109.1	F	129.6*	L = 230	0.84	68.8	E	81.1	L = 230	0.78	85.5	F	48.6	L = 263	1.37	249.7	F	160.8*	L = 272	1.42	251.4	F	20.5	L = 272	1.04	102.4	F	46.1
NBTTT	T = 2225	0.87	31.1	C	283.2	T = 2465	1.00	49.6	D	367	T = 2536	0.98	46.6	D	211.4	T = 2536	1.03	37.1	D	158.5	T = 2910	1.19	125.3	F	483*	T = 2981	1.15	106.5	F	196.3	T = 2981	1.25	131.3	F	78.9
NBR	R = 527		0.0		79.6	R = 548		0.0		91.8	R = 548	0.59	16.0	B	178.1	R = 654		0.0		156.9	R = 654		0.0		156.9	R = 654	0.72	23.5	C	134.2	R = 654	0.78	6.5	A	134.2
SBL	L = 173	0.89	75.5	E	89*	L = 180	0.94	99.0	F	94*	L = 263	0.96	90.7	F	119.6	L = 263	1.01	119.6	F	121.9	L = 215	1.12	155.3	F	122.4*	L = 298	1.56	308.1	F	94.5	L = 298	1.30	211.7	F	122.9
SBTTT	T = 2045	0.76	26.2	C	211.7	T = 2182	0.82	29.5	C	231.3	T = 2291	0.89	35.0	C	562.1	T = 2291	0.83	27.8	C	512.2	T = 2591	0.99	49.1	D	352*	T = 2700	1.05	64.0	E	533.3	T = 2700	1.02	82.1	F	467
SBR	R = 381				39	R = 397		0.0		46.6	R = 397	0.42	6.4	A	104.2	R = 397	0.41	8.4	A	91.9	R = 473		0.0		85.2	R = 473	0.52	12.2	B	56.6	R = 473	0.51	12.2	B	105.1
Overall	6562		35.8	D		7032		46.8	D		7358		43.3	D		7358		38.3	D		8344		95.3	F		8670		86.3	F		8670		92.0	F	

Baron Road and Dilworth Drive/Mall Entrance

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 95	0.43	14.9	B	15.3	L = 113	0.45	15.5	B	18.1	L = 160	0.60	21.6	C	62.3	L = 160	0.72	37.5	D	66.8	L = 132	0.51	17.6	B	23.2	L = 179	0.65	25.1	C	42.2	L = 179	0.85	54.8	D	69.6
EBTTR	T = 615	0.39	12	B	44.1	T = 658	0.40	11.4	B	47.6	T = 655	0.39	11.7	B	181.9	T = 781	0.50	19.7	B	249.4	T = 778	0.47	12	B	58.6	T = 778	0.46	12.5	B	142.9	T = 778	0.59	22.4	C	259.1
	R = 48					R = 50					R = 50					R = 50					R = 59					R = 59					R = 59				
WBL	L = 62	0.26	18.6	B	18.1	L = 65	0.27	19.2	B	19.1	L = 65	0.28	23.2	C	65	L = 65	0.37	33.2	C	42.8	L = 77	0.38	20.6	C	23.5	L = 77	0.38	26.7	C	38.6	L = 77	0.49	40.7	D	60.5
WBTTR	T = 678	0.80	27	C	99.7	T = 713	0.87	31.1	C	126*	T = 711	0.89	33.9	C	277.5	T = 711	0.78	35.9	D	272.4	T = 849	1.04	62.3	E	166.5*	T = 847	1.06	68.1	E	267.7	T = 847	0.91	46.6	D	307.5
	R = 271					R = 335					R = 348					R = 403					R = 390					R = 403					R = 403				
NBLT	L = 74	0.87	52.5	D	71.9*	L = 77	1.66	359.9	F	93*	L = 77					L = 77	0.55	47.9	D	26.9	L = 92	3.89	1365.3	F	112.8*	L = 92					L = 92	0.64	52.7	D	56.2
	T = 105					T = 116					T = 116	2.54	751.6	F	63.9	T = 116	0.62	37.8	D	66.8	T = 137					T = 137	3.89	1362	F	61.4	T = 137	0.67	39.8	D	70.3
NBR	R = 61	0.04	17.2	B	0	R = 64	0.04	19.1	B	0	R = 64	0.11	0.4	A	11.7	R = 76	0.05	19.3	B	0.3	R = 76	0.13	19.3	B	0.3	R = 76	0.13	0.5	A	10.5	R = 76				
SBLT	L = 438	1.35	198.4	F	188.0*	L = 474	1.63	322.8	F	208.7*	L = 506					L = 506	1.00	63	E	86.7	L = 562	2.14	550.5	F	257.1*	L = 594					L = 594	1.23	143.7	F	137.4
	T = 77					T = 83					T = 83	1.75	373.9	F	196.8	T = 83	0.56	10.4	B	99.5	T = 98					T = 98	2.28	607.7	F	183.9	T = 98	0.64	13.4	B	158
SBR	R = 267	0.18	18.2	B	16.7	R = 299	0.23	20.2	C	19.7	R = 365	0.55	9.1	A	151.8	R = 365					R = 352	0.36	21.8	C	34.6	R = 418	0.64	13.3	B	120.3	R = 418				
Overall	2791		55.1	E		3047		38.5	D		3200		130.6	F		3200		30.3	C		3605		215.3	F		3758		223.5	F		3758		48.3	D	

Baron Road and Underhill Street

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLTR	L = 21	0.61	25.8	D	29.25	L = 22	1.01	120.7	F	96	L = 154	5.91	Err	F	274.6	L = 154	0.44	16.1	B	64.2	L = 26	1.65	347.0	F	179.3	L = 158	11.11	Err	F	261.1	L = 158	0.45	16.8	B	59.9
	T = 3					T = 47					T = 47	5.91	Err	F		T = 47	0.52	9.6	A	282.8	T = 48					T = 48	11.11	Err	F		T = 48	0.64	14.4	B	164.7
	R = 223					R = 231					R = 231	5.91	Err	F		R = 231					R = 276					R = 276	11.11	Err	F		R = 276				
WBLTR	L = 19	0.28	37.8	E	8.25	L = 62	1.98	587.4	F	94.5	L = 111	5.64	Err	F	38.2	L = 111	0.41	16.8	B	43.6	L = 66	5.59	2364.0	F	134.3	L = 115	18.26	Err	F	37.4	L = 115	0.53	22.3	C	46.2
	T = 0					T = 23					T = 46	5.64	Err	F		T = 46	0.09	11.2	B	33	T = 23					T = 46	18.26	Err	F		T = 46	0.09	11.5	B	38.1
	R = 23					R = 45					R = 208	5.64	Err	F		R = 49	0.38	4.4	A	44.3	R = 49					R = 212	18.26	Err	F		R = 212	0.38	4.3	A	46.3
NBL	L = 70	0.08	9.0	A	1.5	L = 72	0.08	9.1	A	2.25	L = 72	0.08	9.2	A	11	L = 72	0.32	11.6	B	29.6	L = 86	0.10	9.6	A	2.25	L = 86	0.11	9.8	A	4.9	L = 86	0.50	23.0	C	28.1
NBTR	T = 339					T = 375					T = 422	0.31	0.0		181.7	T = 422	0.61	11.2	B	177.9	T = 442					T = 489	0.35	0.0		156.2	T = 489	0.66	13.3	B	178
	R = 23					R = 78					R = 78	0.31	0.0			R = 78					R = 82					R = 82	0.35	0.0			R = 82				
SBL	L = 1	0.00	8.1	A		L = 40	0.04	8.5	A	0.75	L = 40	0.04	8.7	A	12	L = 40	0.13	7.6	A	18.9	L = 40	0.04	8.8	A	0.75	L = 40	0.04	9.0	A	11.1	L = 40	0.15	8.7	A	18.2
SBTR	T = 521					T = 542					T = 586	0.38	0.0		70.8	T = 586	0.74	15.5	B	62.3	T = 646					T = 690	0.44	0.0		100.8	T = 690	0.82	20.5	C	77.8
	R = 21					R = 22					R = 22	0.38	0.0			R = 22					R = 26					R = 26	0.44	0.0			R = 26				
Overall	1264		6.8	E		1559		72.8			2017		3949.2	F		2017		12.2	B		1810		248.2			2268		3770.6	F		2268		15.8	B	

Table 3-5: Summary of PM Peak Hour Modelling Results – 3 of 4

Intersection	Move	**Background 2019** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**Future Background (2021)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**Future Total (2021)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**MITIGATION – Future Total (2021)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**Future Background (2031)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**Future Total (2031)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	**MITIGATION – Future Total (2031)** Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Baron Road and Durnin Road	WBLR	L=65, R=35	0.26	16.7	C	7.5	L=80, R=36	0.35	20.7	C	11.25	L=80, R=119	0.85	67.4	F	32.4	L=80, R=119	0.85	67.4	F	33.7	L=93, R=43	0.50	29.4	D	18	L=93, R=126	1.18	171.0	F	33.3	L=93, R=126	1.18	171.0	F	34.8
	NBTR	T=254, R=22					T=296, R=33					T=519, R=50	0.35	0.0		109.6	T=519, R=50	0.35	0.0		109.5	T=347, R=38					T=570, R=55	0.39	0.0		107.8	T=570, R=55	0.39	0.0		117.4
	SBL	L=66	0.06	8.0	A	1.5	L=69	0.06	8.2	A	1.5	L=119	0.13	9.3	A	12.1	L=119	0.13	9.3	A	16.1	L=82	0.08	8.4	A	1.5	L=132	0.15	9.6	A	7.2	L=132	0.15	9.6	A	15.9
	SBT	T=348					T=388					T=502	0.31	0.0		20.2	T=502	0.31	0.0		19.1	T=457					T=571	0.35	0.0		68.6	T=571	0.35	0.0		23.8
	Overall	790		2.8			902		3.3			1389		10.4	B		1389		10.4	B		1060		4.4			1547		25.1	D		1547		25.1	D	
Baron Road and Leckie Road	EBL	L=136	0.48	30.1	C	38.9	L=157	0.58	33.6	C	54*	L=157	1.09	132.8	F	182.1	L=157	0.90	76.4	E	58.9	L=184	0.75	45.7	D	72.9*	L=184	1.59	328.0	F	192.3	L=184	1.08	124.2	F	47.7
	EBTR	T=279, R=119	0.79	32.4	C	102.8*	T=290, R=129	0.80	33.2	C	111.5*	T=403, R=168	1.07	85.9	F	182.6	T=403, R=168	0.49	22.4	C	200.5	T=345, R=153	0.93	49.3	D	146.1*	T=458, R=192	1.22	141.2	F	129.7	T=458, R=192	0.52	22.6	C	208.5
	WBL	L=41	0.25	35.5	D	15.2	L=42	0.26	36.2	D	16.2	L=42	0.50	46.9	D	34.8	L=42	0.20	24.9	C	29.8	L=50	0.46	43.7	D	26.4*	L=50	0.60	57.4	E	9	L=50	0.26	25.4	C	34.5
	WBTTR	T=233, R=132	0.38	22.2	C	28.2	T=291, R=137	0.41	22.4	C	38	T=497, R=148	0.62	26.0	C	153.6	T=497, R=148	0.56	24.8	C	148.6	T=338, R=164	0.47	22.8	C	45.5	T=544, R=175	0.70	27.8	C	118.4	T=544, R=175	0.57	25.2	C	132.6
	NBL	L=108	0.45	19.0	B	16.6	L=134	0.59	20.9	C	22.6	L=193	0.71	29.7	C	80.6	L=193	0.82	46.1	D	94.2	L=156	0.68	23.0	C	28.6	L=215	0.78	36.6	D	63.5	L=215	1.04	97.0	F	88.9
	NBTR	T=333, R=57	0.65	23.5	C	86.9	T=356, R=59	0.72	36.8	C	93.5	T=392, R=75	0.77	33.0	C	270.4	T=392, R=75	0.82	41.7	D	276.9	T=423, R=71	0.89	38.4	C	129.3*	T=459, R=87	0.90	44.3	D	249.7	T=459, R=87	1.04	84.0	F	226.5
	SBL	L=234	0.56	16.2	B	34.4	L=243	0.62	18.8	B	35.8	L=267	0.78	29.3	C	106.9	L=267	0.86	42.2	D	99.9	L=290	0.86	37.3	D	76.6*	L=314	1.09	102.4	F	23	L=314	1.10	107.2	F	104.2
	SBTR	T=430, R=190	0.97	49.9	D	179.8*	T=468, R=213	1.09	87.3	F	205.4*	T=567, R=191	1.22	137.9	F	337.3	T=567, R=191	0.90	47.3	D	319.6	T=554, R=229	1.30	172.4	F	256.4*	T=653, R=229	1.41	221.2	F	272.2	T=653, R=229	1.04	78.6	E	233.8
	Overall	2292		31.6	C		2519		42.9	D		3100		71.7	E		3100		35.4	D		2979		73.5	E		3560		122.0	F		3560		59.4	E	
Baron Road and Banks Road	EBL	L=149	0.48	26.7	C	38	L=155	0.50	26.9	C	39.6	L=155	0.60	35.7	D	51.5	L=155	0.54	33.7	C	49.1	L=184	0.60	29.4	C	47.8	L=184	0.64	36.1	D	11.4	L=184	0.64	38.5	D	47.7
	EBTR	T=48, R=235	0.76	29.7	C	26.2	T=50, R=244	0.77	30.3	C	26.7	T=50, R=365	0.69	10.8	B	210.1	T=50, R=365	0.68	11.7	B	187.7	T=59, R=291	0.78	33.0	C	30.5	T=59, R=412	0.75	16.0	B	195.8	T=59, R=412	0.78	19.6	B	101.6
	WBLTR	L=36, T=47, R=30	0.44	23.6	C	27.8	L=38, T=49, R=31	0.46	23.6	C	39.6	L=38, T=49, R=31	1.49	293.6	F	222.6	L=38, T=49, R=31	0.91	84.6	F	219.1	L=45, T=58, R=37	0.54	25.2	C	42.4*	L=45, T=58, R=37	1.41	260.2	F	199.2	L=45, T=58, R=37	1.32	223.5	F	218.5
	NBL	L=107	0.43	16.2	B	14.9	L=111	0.46	16.5	B	16.1	L=179	0.57	17.6	B	63.8	L=179	0.45	10.5	B	84.8	L=133	0.56	18.4	B	22.1	L=201	0.66	24.4	C	85.6	L=201	0.63	20.3	C	88.5
	NBTR	T=390, R=32	0.40	7.8	A	53.1	T=431, R=34	0.45	8.4	A	62.2	T=410, R=34	0.40	8.3	A	126.8	T=410, R=34	0.42	9.0	A	168.5	T=509, R=40	0.56	11.4	B	80.3	T=488, R=40	0.50	11.1	B	145.9	T=488, R=40	0.50	11.8	B	188.5
	SBL	L=16	0.03	12.2	B	5.8	L=16	0.04	12.6	B	5.9	L=16	0.04	15.3	B	11.1	L=16	0.05	16.4	B	15.5	L=19	0.05	16.0	B	6.7	L=19	0.06	17.0	B		L=19	0.06	17.2	B	15
	SBTR	T=471, R=220	0.99	51.3	D	192.9*	T=526, R=229	1.09	82.3	F	220.7*	T=505, R=182	0.96	48.1	D	229.2	T=505, R=182	0.80	31.0	C	287.7	T=620, R=273	1.37	200.1	F	278.7*	T=599, R=226	1.22	134.2	F	225.1	T=599, R=226	0.86 / 0.36	36.1 / 11.4	D / B	266.2 / 44.3
	Overall	1781		31.3	C		1914		43.8	D		2014		42.2	D		2014		21.7	C		2268		91.8	E		2368		72.8	E		2368		34.8	C	

Table 3-5: Summary of PM Peak Hour Modelling Results – 4 of 4

Springfield Road and Dilworth/Benvoulin Road

Move		Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
		Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q
EBL		L=80	0.58	46.9	D	30.9	L=83	0.51	38.6	D	29.1	L=97	0.55	43.5	D	42.9	L=97	0.62	46.1	D	38.5	L=99	0.58	39.4	D	33.6	L=113	0.64	48.9	D	30.4	L=113	0.73	55.2	E	47.1
EBTT		T=667	0.77	50.1	D	111.1	T=713	0.83	44.5	D	106.8	T=704	0.79	44.6	D	250.2	T=704	0.62	36.1	D	159.5	T=847	0.95	56.2	E	145.4*	T=838	0.94	58.0	E	190.6	T=838	0.74	39.6	D	216.8
EBR		R=313		0.0		25.3	R=345		0.0		39.6	R=369	0.62	13.5	B	78.2	R=369	0.53	8.8	A	68.1	R=407		0.0		64.1	R=431	0.73	20.6	C	44.6	R=431	0.62	13.8	B	92.5
WBL		L=25	0.24	60.9	E	16.5	L=26	0.26	52.4	E	15.4	L=26	0.34	56.1	E	31.9	L=26	0.19	41.9	D	41.3	L=31	0.43	58.3	E	21*	L=31	0.35	51.6	D	13.5	L=31	0.35	51.6	D	41.7
WBTT		T=648	1.22	172.9	F	162.6*	T=712	1.53	294.0	F	164.1*	T=702	1.50	268.9	F	239	T=702	0.92	63.3	E	231	T=841	1.73	381.6	F	199.5*	T=831	1.77	386.0	F	211.8	T=831	1.09	103.1	F	227.3
WBR		R=654		0.0		227.1*	R=680		0.0		219.8*	R=697	1.22	229.6	F	62.3	R=697	1.22	136.1	F	172.1	R=811		0.0		293.6*	R=828	1.74	360.6	F	39.8	R=828	1.47	244.4	F	221.4
NBL		L=242	0.69	24.8	C	79*	L=276	0.79	31.0	C	103.7*	L=298	1.04	94.7	F	121.5	L=298	1.20	165.8	F	128.6	L=324	1.04	91.4	F	132.3*	L=346	1.20	149.1	F	113.7	L=346	1.39	237.8	F	113.9
NBTTR		T=1174, R=34	0.90	48.2	E	250.6*	T=1221, R=36	0.98	56.0	E	216.7*	T=1332, R=36	1.15	108.9	F	486.8	T=1332, R=36	1.14	109.9	F	504.1	T=1456, R=43	1.21	137.2	F	281.8*	T=1567, R=43	1.35	192.7	F	485.6	T=1567, R=43	1.31	179.0	F	487.2
SBL		L=545	1.20	148.2	F	259.1*	L=567	1.32	192.6	F	230.4*	L=589	1.38	214.8	F	282.1	L=589	1.16	136.6	F	199	L=676	1.58	308.5	F	290.2*	L=698	1.64	324.3	F	261.9	L=698	1.45	243.8	F	216
SBTTR		T=1092, R=69	0.64	24.8	C	192.4	T=1136, R=71	0.73	25.6	C	159.8	T=1223, R=71	0.88	36.6	D	335.4	T=1223, R=71	1.06	76.1	E	351.4	T=1354, R=85	0.91	37.7	D	229.2*	T=1441, R=85	1.04	66.1	E	351.8	T=1441, R=85	1.25	157.3	F	399.2
Overall		5543		71.8	E		5866		97.3	F		6144		120.8	F		6144		89.9	F		6974		153.4	F		7252		189.4	F		7252		153.8	F	

Springfield Road and Durnin Road

Move		Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
		Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q
EBR		R=66	0.23	28.7	C	16.6	R=68	0.26	29.8	C	16	R=113	0.45	27.6	C	16.3	R=113	0.49	20.8	C	30.6	R=81	0.31	32.8	D	18.8	R=126	0.51	29.5	C	13.1	R=126	0.56	28.3	C	36.7
WBR		R=7	0.00	27.6	C	0.7	R=8	0.00	28.6	C	0.7	R=8	0.03	1.0	A	5.8	R=8	0.03	0.2	A	8.1	R=9	0.01	31.2	C	0.9	R=9	0.03	2.0	A	18.2	R=9	0.04	0.3	A	8.1
NBL		L=49	0.31	4.7	A	17	L=50	0.36	5.1	A	21.1*	L=165	1.32	206.7	F	45.5	L=165	0.69	28.6	C	85.1	L=61	0.70	27.4	C	25.6*	L=175	2.00	502.6	F	48.2	L=175	0.72	37.1	D	76
NBTTR		T=1721, R=38	0.72	6.8	A	198.8	T=1790, R=40	0.75	7.1	A	240.1*	T=1816, R=40	0.73	11.2	B	136.8	T=1816, R=40	0.70	7.1	A	338.3	T=2134, R=48	0.88	11.4	B	320.3*	T=2160, R=48	0.93	19.8	B	228.8	T=2160, R=48	0.84	10.9	B	89.7
SBL		L=3	0.03	2.9	A	1.6	L=3	0.03	2.8	A	1.7	L=3	0.03	7.7	A	2.5	L=3	0.02	7.3	A	14.3	L=4	0.04	3.0	A	2.1	L=4	0.04	8.0	A	1.3	L=4	0.03	6.8	A	35.7
SBTTR		T=1482, R=35	0.62	5.5	A	148.1	T=1541, R=49	0.65	5.6	A	164.1	T=1610, R=65	0.66	9.6	A	122.7	T=1610, R=65	0.75	24.5	C	362.8	T=1838, R=56	0.76	7.6	A	255*	T=1907, R=72	0.83	14.3	B	259.1	T=1907, R=72	0.91	31.6	C	460.8
Overall		3401		6.6	A		3549		6.9	A		3820		19.4	B		3820		16.0	B		4231		10.3	A		4501		36.4	D		4501		21.5	C	

Springfield Road and Leckie Road

Move		Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
		Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q
EBTL		L=172, T=6	0.47	42.4	C	63.2	L=179, T=6	0.45	34.8	D	61.9	L=300, T=6	0.87	59.7	E	65.5	L=300, T=6	0.93	78.2	E	72.7	L=214, T=8	0.48	32.4	D	71.2	L=335, T=8	0.90	63.0	E	63.7	L=335, T=8	1.06	110.2	F	68.2
EBR		R=394	0.68	34.1	C	97.8	R=409	0.73	33.2	C	92.3	R=484	0.75	28.5	C	66.9	R=484	0.85	41.4	D	71	R=488	0.79	34.3	C	118.8	R=563	0.87	38.1	D	60.7	R=563	0.95	55.7	E	80.2
WBL		L=22	0.12	49.5	D	11.2	L=23	0.12	41.0	D	11.2	L=23	0.13	28.5	C	12.1	L=23	0.15	36.7	D	14	L=28	0.14	39.8	D	12.3	L=28	0.16	28.6	C	15	L=28	0.24	41.3	D	16
WBTR		T=9, R=14	0.05	35.4	D	8.5	T=10, R=15	0.06	28.9	C	8.9	T=10, R=15	0.06	15.3	B	63.5	T=10, R=15	0.06	19.5	B	42.2	T=11, R=18	0.06	25.9	C	10.2	T=11, R=18	0.06	18.0	B	73.2	T=11, R=18	0.07	19.2	B	53.7
NBL		L=222	0.99	110.7	F	101.1*	L=231	1.42	267.4	F	98.7*	L=257	1.02	109.3	F	147.4	L=257	0.67	65.4	E	124.3	L=276	1.70	386.3	F	139.0*	L=302	1.40	243.0	F	164.9	L=302	0.67	65.9	E	106.8
NBTTR		T=1393, R=2	0.62	16.1	B	124.5	T=1449, R=2	0.69	18.0	B	138.3	T=1449, R=2	0.71	18.2	B	271.2	T=1449, R=2	0.69	8.6	A	272.2	T=1728, R=3	0.88	30.9	C	214.8	T=1728, R=3	0.88	26.4	C	370.9	T=1728, R=3	0.82	7.4	A	37.7
SBL		L=1	0.01	22.8	C	1.2	L=1	0.01	17.8	C	1.2	L=1	0.01	20.0	B	1.1	L=1	0.01	56.0	E	2	L=1	0.01	40.8	D	1.3	L=1	0.01	21.0	C		L=1	0.01	56.0	E	9.3
SBTTR		T=1000, R=124	0.72	30.8	C	149.4	T=1061, R=178	0.81	32.9	C	193*	T=1071, R=246	1.00	56.2	E	518	T=1071, R=246	0.86	35.0	D	487.2	T=1261, R=203	1.04	80.8	F	253.2*	T=1271, R=271	1.17	114.0	F	497.9	T=1271, R=271	1.04	65.7	E	489.2
Overall		3359		31.1	C		3564		41.9	D		3864		41.8	D		3864		31.3	C		4239		70.7	E		4539		74.7	E		4539		45.2	D	

Leckie Road and Parkview Crescent

Move		Background 2019					Future Background (2021)					Future Total (2021)					Future Total (2021) MITIGATION					Future Background (2031)					Future Total (2031)					Future Total (2031) MITIGATION				
		Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q	Vol	V/C	Delay	LoS	Q
EBL		L=6	0.01	8.0		o	L=6	0.01	8.2	A	o	L=6	0.01	8.2	A	4.2	L=6	0.01	7.0	A	4.4	L=7	0.01	8.4	A	o	L=7	0.01	8.4	A		L=7	0.01	7.1	A	4
EBTR		T=540, R=NA		0.0	A		T=562, R=NA					T=551, R=164	0.44	0.0		3	T=551, R=164	0.39	7.1	A	79.3	T=670, R=NA					T=659, R=164	0.51	0.0		60.4	T=659, R=164	0.45	7.9	A	56.2
WBTTR		L=NA, T=342, R=8					L=NA, T=405, R=8					L=118, T=381, R=8	0.16	10.5	B	32.9	L=118, T=381, R=8	0.36	12.0	B	39.8	L=NA, T=473, R=10					L=118, T=449, R=10	0.19	11.7	B	6.4	L=118, T=449, R=10	0.42	14.5	B	39.9
NBL		L=NA					L=NA					L=241	2.09	575.9	F	23.1	L=241	0.66	24.1	C	23.4	L=NA					L=241	3.37	Err	F	22.7	L=241	0.66	24.1	C	23.9
NBTR		R=NA					R=NA					R=34	0.07	12.2	B	48.5	R=34				54	R=NA					R=34	0.08	14.1	B	41.2	R=34				53
SBL		L=5	0.02	18.4	C	0.75	L=5	0.02	20.3	C	0.75	L=5	0.06	54.3	F	7.7	L=5	0.01	11.0	B	14	L=6	0.04	25.4	D	0.75	L=6	0.14	105.9	F	9.5	L=6	0.02	11.0	B	8.2
SBTR		R=10	0.01	9.4	A	o	R=10	0.01	9.6	A	o	R=10	0.01	9.6	A	46.2	R=10				22.5	R=12	0.02	9.9	A	0.75	R=12	0.02	9.8	A	127.1	R=12	0.02			60.2
Overall		911		0.2	A		996		0.2	A		1518		92.9	F		1518		10.0	A		1178		0.3	A		1700		1419.6	F		1700		10.3	B	

Table 3-6: Summary of Saturday Peak Hour Modelling Results – 1 of 4

Highway 97 and Dilworth Drive

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 89	0.56	56.6	E	74.2*	L = 103	0.71	67.9	E	84.9*	L = 97	1.98	525.3	F	67.2	L = 97	0.88	86.2	F	79.3	L = 121	1.07	156.1	F	85.4*	L = 115	2.35	681.6	F	67.5	L = 115	1.00	111.6	F	87
EBTTR	T = 443	0.45	37.8	D	85.8	T = 485	0.49	38.4	D	95.7	T = 533	0.66	43.0	D	184.6	T = 533	0.90	64.1	E	161.8	T = 574	0.58	40.0	D	116.5	T = 622	0.78	47.3	D	140.4	T = 622	1.02	86.9	F	159.5
	R =92					R = 104					R = 104					R = 104					R = 123					R = 123					R = 123				
WBL	L = 177	0.89	78.2	E	114.7*	L = 208	1.14	147.1	F	144.1*	L = 276	2.55	741.3	F	59.2	L = 276	0.99	85.1	F	78.6	L = 243	1.59	332.2	F	157.3*	L = 311	4.22	1492.0	F	43.5	L = 311	1.08	109.3	F	78.9
WBTTR	T = 390	0.57	39.7	D	262.2*	T = 420	0.61	40.5	D	285.2*	T = 421	1.29dr	165.1	F	243.2	T = 421	1.20dr	128.0	F	206.5	T = 498	0.73	42.6	D	361.8*	T = 499	1.54dr	264.6	F	249	T = 499	1.41dr	205.4	F	137.9
	R = 427					R = 444					R = 444					R = 444					R = 530					R = 530					R = 530				
NBL	L = 173	0.81	40.0	D	73.1*	L = 184	0.89	51.5	D	81.7*	L = 184	0.88	69.0	E	20.6	L = 184	1.08	143.8	F	96.5	L = 219	1.06	114.5	F	107.3*	L = 219	1.01	98.6	F	8.5	L = 219	1.34	231.2	F	93.4
NBTTR	T = 1975	0.88	38.9	D	231.3*	T = 2162	0.93	40.3	D	271*	T = 2158	1.06	71.0	E	419.3	T = 2158	1.12	100.8	F	429	T = 2557	1.08	78.5	F	355.3*	T = 2553	1.25	148.0	F	413.8	T = 2553	1.34	191.6	F	419.7
	R = 133					R = 144					R = 151					R = 151	0.25	6.8	A	98.5	R = 170					R = 177	0.30	9.4	A	95.5	R = 177				
SBL	L = 310	1.08	116.9	F	149.7*	L = 322	1.15	142.9	F	157.8*	L = 317	1.17	142.7	F	70.4	L = 317	1.07	109.3	F	150.9	L = 384	1.42	252.1	F	199.3*	L = 379	1.40	231.4	F	48.5	L = 379	1.40	227.7	F	129.2
SBTTT	T = 1727	0.70	27.0	C	151.5	T=1873	0.73	26.5	C	171	T = 1894	0.80	32.3	C	98	T = 1894	1.03	67.5	E	209.7	T=2218	0.89	33.9	C	227.2*	T = 2239	0.95	43.7	D	22	T = 2239	1.24	148.2	F	204.5
SBR	R = 53		0.0		5.3	R=59				6.6	R = 58	0.10	4.4	A	11.9	R = 58	0.11	4.1	A	35.3	R = 70		0.0		9	R = 69	0.12	6.0	A		R = 69	0.13	4.9	A	41.7
Overall	5989		41.4	D		6508		46.7	D		6637		108.3	F		6637		88.7	F		7707		80.9	F		7836		188.9	F		7836		162.9	F	

Highway 97 and Underhill Street

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBR	R = 171	1.20	195.5	F	78.75	R = 201	1.64	377.0	F	117.8	R = 225	0.38	14.2	B		R = 225	0.35	13.2	B	93.7	R = 235	2.78	901.4	F	180.8	R = 259	0.45	15.6	C		R = 259	0.40	13.9	B	25.7
NBTTT	T =2220					T =2409					T = 2306	0.48	0.0		246.5	T = 2306	0.48	0.0		197	T=2853					T = 2750	0.57	0.0		181.7	T = 2750	0.57	0.0		51.8
NBR	R = 197					R = 224					R = 317	0.20	0.0		35.9	R = 317	0.20	0.0		34	R = 263					R = 356	0.22	0.0		36.9	R = 356	0.22	0.0		13.9
SBL	L = 157	2.62	875.5	F	123.8	L = 181	4.05	1550.9	F	159.8	L = 245	0.64	28.5	D	111.5	L = 245	0.74	40.1	E	128.3	L = 213	8.62	3724.1	F	208.5	L = 277	1.42	257.6	F	111.8	L = 277	1.63	352.7	F	159.6
SBTTT	T = 2010					T=2171					T = 2187	0.45	0.0		705.1	T = 2187	0.45	0.0		392.9	T = 2589					T = 2589	0.53	0.0		592.3	T = 2589	0.53	0.0		548.5
Overall	4755		32.3			5186		61.8			5280		1.9	A		5280		2.4	A		6137		147.1			6231		12.1	B		6231		16.3	C	

Highway 97 and Leckie Road

	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 125	0.82	67.9	E	56.5	L = 159	0.85	66.2	E	67.7	L = 151	0.70	69.2	E	23.3	L = 151	0.95	91.1	F	54.9	L = 185	0.87	69.2	E	76.9	L = 177	0.74	69.1	E	33.5	L = 177	1.16	159.1	F	59.7
EBTR	T = 144	0.83	64	E	78.1	T = 150	0.77	59.8	E	83	T = 198	0.80	63.9	E	254.5	T = 198	0.66	57.6	E	203.8	T = 178	0.81	61.2	E	101.2	T = 226	0.90	75.3	E	225.9	T = 226	0.48	49.2	D	118.8
	R = 62					R = 65					R = 65					R = 65					R = 77					R = 77					R = 77				
WBL	L = 147	0.97	117.7	F	89.9*	L = 230	1.52	317.8	F	148.6*	L = 293	1.93	472.1	F	69	L = 293	1.20	162.7	F	86.1	L = 259	1.72	400.6	F	169.2*	L = 322	2.12	553.3	F	68.2	L = 322	0.98	87.3	F	87
WBT	T = 157	0.80	73.1	E	69.2	T = 172	0.93	96.9	F	91*	T = 203	0.70	64.7	E	171.9	T = 203	0.79	74.8	E	216.3	T = 204	1.10	144.8	F	120.3*	T = 235	0.85	79.1	E	165.4	T = 235	0.78	76.5	E	211.5
WBR	R = 224				o	R = 233				o	R = 441	0.30	0.5	A	229.6	R = 441	1.05	104	F	226.4	R = 278				o	R = 486	0.33	0.6	A	230	R = 486	1.25	163.7	F	212.5
NBL	L = 90	0.72	62.8	E	68.3*	L = 93	0.84	88.2	F	56.2*	L = 96	1.68	396.8	F	13.4	L = 96	0.62	38	D	37.8	L = 111	1.44	303.2	F	77.7*	L = 114	2.11	574.9	F	12.8	L = 114	0.77	61	E	45.6
NBTTTR	T = 2124	0.77	25.7	C	255.3*	T=2332	0.88	31.9	C	297.6	T = 2212	1.08	78.9	E	250.8	T = 2212	1.21	113.9	F	486.5	T=2756	1.07	72.8	F	385.6*	T = 2636	1.28	161.8	F	281.6	T = 2636	1.22	139.4	F	373.8
	R = 90					R = 93					R = 131					R = 131					R = 111					R = 149					R = 149				
SBL	L = 171	0.89	62.8	E	85.6*	L = 199	1.08	127.2	F	104.9*	L = 300	1.60	320.1	F	122.5	L = 300	1.22	159.5	F	108.2	L = 233	1.38	242.4	F	129.8*	L = 334	1.91	452.8	F	19.3	L = 334	1.12	145.3	F	104.5
SBTTT	T = 1855	0.56	12.5	B	137.9	T=1952	0.60	14.0	B	149.3	T = 1969	0.70	22.2	C	233.1	T = 1969	1.02	46.4	D	190.8	T=2323	0.74	18.0	B	200.6	T = 2340	0.84	27.5	C	179.9	T = 2340	0.95	45.9	D	197.3
SBR	R = 64		0.0		o	R = 81		0.0		o	R = 81	0.07	0.1	A	40.1	R = 81	0.14	0.1	A	40.1	R = 94		0.0		o	R = 94	0.08	0.1	A	19.4	R = 94	0.08	0.1	A	78.8
Overall	5253		29.8	C		5759		47.1	D		6140		88.6	F		6140		84.6	F		6809		80.1	F		7190		134.4	F		7190		92.6	F	

Table 3-6: Summary of Saturday Peak Hour Modelling Results – 2 of 4

Note: The 4th group (Future Total 2021) and the 7th group (Future Total 2031) are **MITIGATION** scenarios. Control Delay is in seconds (s); Queue is in metres (m). Values flagged with * on queue and red V/C ratios are as marked in the source.

Highway 97 and Banks Road

Movement	BG19 Vol	BG19 V/C	BG19 Delay	BG19 LoS	BG19 Q	FB21 Vol	FB21 V/C	FB21 Delay	FB21 LoS	FB21 Q	FT21 Vol	FT21 V/C	FT21 Delay	FT21 LoS	FT21 Q	FT21-MIT Vol	FT21-MIT V/C	FT21-MIT Delay	FT21-MIT LoS	FT21-MIT Q	FB31 Vol	FB31 V/C	FB31 Delay	FB31 LoS	FB31 Q	FT31 Vol	FT31 V/C	FT31 Delay	FT31 LoS	FT31 Q	FT31-MIT Vol	FT31-MIT V/C	FT31-MIT Delay	FT31-MIT LoS	FT31-MIT Q
EBL	L=132	0.63	59.8	E	73.5*	L=137	0.68	64.0	E	76.8*	L=128	0.80	76.3	E	19.9	L=128	0.79	77.4	E	82.3	L=163	1.02	136.7	F	103*	L=154	0.98	110.5	F	1.5	L=154	0.95	103.6	F	92.3
EBT	T=259	0.53	39.9	D	94.6	T=269	0.55	40.4	D	98.3	T=317	0.72	52.8	D	188.7	T=317	0.72	53.9	D	225.8	T=321	0.65	43.4	D	119.2	T=369	0.73	51.1	D	178.9	T=369	0.73	50.1	D	184.8
EBR	R=398		0.0		106.3	R=414		0.0		115.3	R=414	0.83	39.2	D	74.1	R=414	0.81	36.8	D	79.5	R=493		0.0		175.3*	R=493	0.91	49.1	D	58.8	R=493	0.90	49.0	D	83
WBL	L=146	0.70	60.5	E	84.6*	L=152	0.76	64.7	E	88.9*	L=132	1.08	146.2	F	75.6	L=132	1.07	145.1	F	78.8	L=181	1.11	125.1	F	116.8*	L=161	1.28	210.6	F	87.5	L=161	1.24	195.8	F	81.7
WBT	T=282	0.56	40.3	D	100.8	T=293	0.58	40.7	D	104.9	T=264	0.61	48.0	D	68.9	T=264	0.61	49.1	D	160.7	T=349	0.69	42.2	D	127.6	T=320	0.65	48.3	D	153.8	T=320	0.64	48.2	D	166
WBR	R=73		0.0		15.6	R=76		0.0		16.3	R=151	0.36	23.8	C	18.4	R=151	0.36	25.3	C	28.8	R=91		0.0		13.7	R=166	0.35	24.6	C	13.5	R=166	0.35	24.2	C	29.2
NBL	L=289	1.11	120.4	F	156.8*	L=307	1.21	161.8	F	164.8*	L=317	1.14	134.2	F	31.8	L=317	0.83	75.7	E	51	L=366	1.62	339.8	F	202.7*	L=376	1.71	363.3	F	5.4	L=376	1.20	150.4	F	83.1
NBTTT	T=2034	0.86	30.0	C	259.7*	T=2267	0.95	38.9	D	313*	T=2337	1.03	60.2	E	201.7	T=2337	1.06	99.9	F	405.6*	T=2674	1.14	99.9	F		T=2744	1.30	169.0	F	198.5	T=2744	1.30	155.8	F	113.9
NBR	R=717		0.0		190.7	R=746		0.0		236.2*	R=746	0.86	31.7	C	135.9	R=746	0.90	15.1	B	77.6	R=889		0.0		350*	R=889	1.11	91.4	F	137.3	R=889	1.12	67.3	E	116.5
SBL	L=93	0.61	31.9	C	27.2	L=97	0.72	37.2	D	28.6	L=197	0.88	70.2	E	122.7	L=197	1.03	128.6	F	126	L=115	0.82	44.4	D	35.8	L=215	0.97	89.6	F	82	L=215	1.33	227.2	F	111.3
SBTTT	T=1715	0.75	29.1	C	162.8	T=1840	0.81	31.1	C	181.6	T=1978	1.03	88.0	F	532.6	T=1978	0.85	32.6	C	474.4	T=2183	0.96	42.7	D	258.4*	T=2321	1.03	59.4	E	397.2	T=2321	1.03	59.8	E	459.9
SBR	R=466		0.0		90.6	R=485		0.0		101.7	R=485	0.59	16.0	B	39.1	R=485	0.60	17.8	B	107.2	R=578		0.0		159.1	R=578	0.73	25.1	C	19.3	R=578	0.73	24.9	C	114.6
Overall	6604		38.0	D		7083		44.8	D		7466		50.4	D		7466		43.7	D		8403		88.6	F		8786		109.6	F		8786		97.0	F	

Baron Road and Dilworth Drive / Mall Entrance

Movement	BG19 Vol	BG19 V/C	BG19 Delay	BG19 LoS	BG19 Q	FB21 Vol	FB21 V/C	FB21 Delay	FB21 LoS	FB21 Q	FT21 Vol	FT21 V/C	FT21 Delay	FT21 LoS	FT21 Q	FT21-MIT Vol	FT21-MIT V/C	FT21-MIT Delay	FT21-MIT LoS	FT21-MIT Q	FB31 Vol	FB31 V/C	FB31 Delay	FB31 LoS	FB31 Q	FT31 Vol	FT31 V/C	FT31 Delay	FT31 LoS	FT31 Q	FT31-MIT Vol	FT31-MIT V/C	FT31-MIT Delay	FT31-MIT LoS	FT31-MIT Q
EBL	L=176	0.60	17	B	31.5	L=194	0.68	20.8	B	44.5*	L=252	0.87	46.7	D	18.8	L=252	1.02	88	F	67.7	L=229	0.81	33.8	C	62.4*	L=287	1.02	80.5	F	22.7	L=287	1.34	204.4	F	67.1
EBTTR	T=446, R=107	0.32	11.2	B	34.8	T=484, R=111	0.34	11	B	38	T=481, R=111	0.34	10.7	B	25.1	T=481, R=111	0.69	35.3	D	271.9	T=573, R=133	0.40	11.3	B	46.5	T=570, R=133	0.39	11.2	B	19.4	T=570, R=133	0.76	36.7	D	307.2
WBL	L=159	0.67	30.2	C	50.4*	L=165	0.69	31.2	C	55.4*	L=165	0.67	37.3	D	38.9	L=165	0.64	31.6	C	56.1	L=197	0.88	55.7	E	74.9*	L=197	0.85	57.4	E	20.8	L=197	0.87	55.5	E	63
WBTT	T=553	0.77	27.9	C	82.7	T=583	0.81	29	C	93.3	T=581	0.82	27.8	C	251.6	T=581	0.73	39.8	D	256.9	T=694	0.94	40.8	D	135.4*	T=692	0.93	37.7	D	254.9	T=692	0.79	40.3	D	269.1
WBR	R=280					R=337					R=367					R=367	0.59	7.2	A	77.7	R=393					R=423					R=423	0.61	6.8	A	78.4
NBL	L=122	1.51	279.2	F	118.1*	L=127	2.52	735.9	F	121*	L=127					L=127	0.78	48.5	D	33.3	L=151	5.73	2191.3	F	164.1*	L=151					L=151	0.93	76.8	C	40.7
NBT	T=150					T=162					T=162	4.07	1428.8	F	60.1	T=162	0.51	30.5	C	69.4	T=192					T=192	5.73	2172.1	F	59	T=192	0.61	33.9	C	71.1
NBR	R=84	0.06	17.9	B	1.6	R=88	0.06	19.2	B	2.3	R=88	0.15	1.3	A	8.2	R=88					R=104	0.07	20	B	4.9	R=104	0.18	2.1	A	2.5	R=104				
SBL	L=295	1.45	245.4	F	178.3*	L=330	1.80	400.1	F	202.5*	L=377					L=377	0.79	31.2	C	125.5	L=389	2.63	773.2	F	216.5*	L=436					L=436	1.04	77.7	E	137.6
SBT	T=175					T=188					T=188	1.95	462.4	F	154.9	T=188	0.99	56	E	167.4	T=223					T=223	2.83	853.2	F	154	T=223	1.19	122.4	F	174.2
SBR	R=382	0.38	20.5	C	37.3	R=427	0.48	22.9	C	50.4	R=498	0.73	16.1	B	116.5	R=498					R=503	0.67	28.2	C	79.8*	R=574	0.87	28.5	C	115.5	R=574				
Overall	2929		81.2	F		3196		148.3	F		3397		216.0	F		3397		40.6	D		3781		347.0	F		3982		353.8	F		3982		70.1	E	

Baron Road and Underhill Street

Movement	BG19 Vol	BG19 V/C	BG19 Delay	BG19 LoS	BG19 Q	FB21 Vol	FB21 V/C	FB21 Delay	FB21 LoS	FB21 Q	FT21 Vol	FT21 V/C	FT21 Delay	FT21 LoS	FT21 Q	FT21-MIT Vol	FT21-MIT V/C	FT21-MIT Delay	FT21-MIT LoS	FT21-MIT Q	FB31 Vol	FB31 V/C	FB31 Delay	FB31 LoS	FB31 Q	FT31 Vol	FT31 V/C	FT31 Delay	FT31 LoS	FT31 Q	FT31-MIT Vol	FT31-MIT V/C	FT31-MIT Delay	FT31-MIT LoS	FT31-MIT Q
EBL (EBLTR)	L=12	0.98	100.1	F	66	L=13	1.22	189.7	F	92.25	L=170	214.00	Err	F		L=170	0.49	17.8	B	63.8	L=15	2.34	1612.7	F	177.8	L=172	Err	Err	F		L=172	0.48	17.1	B	60.5
EBT	T=10					T=11					T=48	214.00	Err	F	255.1	T=48	0.48	10.9	B	228.2	T=13					T=50	Err	Err	F	256.4	T=50	0.57	14.6	B	131.8
EBR	R=187					R=195					R=195	214.00	Err	F		R=195					R=232					R=232	Err	Err	F		R=232				
WBL (WBLTR)	L=52	2.16	616.0	F	153	L=69	4.09	1525.0	F	211.5	L=163	75.68	Err	F		L=163	0.58	22.0	C	51.6	L=80	4.21	>300	F	305.3	L=174	Err	Err	F		L=174	0.68	27.3	C	50.2
WBT	T=8					T=9					T=56	75.68	Err	F	35.7	T=56	0.11	11.7	B	43.6	T=10					T=57	Err	Err	F	36.3	T=57	0.11	11.3	B	45.6
WBR	R=164					R=171					R=352	75.68	Err	F		R=352	0.62	9.9	A	44.5	R=204					R=385	Err	Err	F		R=385	0.70	14.4	B	44
NBL	L=82	0.12	10.4	B	3	L=89	0.13	10.7	B	3	L=89	0.12	10.1	B	4.5	L=89	0.55	27.1	C	40.2	L=106	0.16	11.8	B	4.5	L=106	0.16	11.1	B		L=106	0.67	38.9	D	46.3
NBT (NBTR)	T=357					T=411					T=470	0.42	0.0		2.2	T=470	0.77	17.6	B	182.1	T=482					T=541	0.48	0.0		14.7	T=541	0.89	27.5	C	184.9
NBR	R=158					R=175					R=204	0.42	0.0			R=204					R=207					R=236	0.48	0.0			R=236				
SBL	L=33	0.03	8.6	A	0.75	L=35	0.04	8.9	A	0.75	L=72	0.09	9.6	A	11.8	L=72					L=41	0.09	9.3	A	1.5	L=78	0.11	10.2	B	8.3	L=78	0.49	24.9	C	30.5
SBT (SBTR)	T=655					T=705					T=740	0.48	0.0		82	T=740	0.86	23.7	C	84.4	T=836					T=871	0.56	0.0		78	T=871	1.01	50.6	D	79.5
SBR	R=27					R=28					R=28	0.48	0.0			R=28					R=34					R=34	0.56	0.0			R=34				
Overall	1745		92.2			1911		221.1			2587		3805.7	F		2587		18.1	B		2260		2741.5			2936		Err	Err		2936		31.1	C	

Table 3-6: Summary of Saturday Peak Hour Modelling Results – 3 of 4

Baron Road and Durnin Road

Mvmt	BG2019 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2031 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)
WBLR	L=73 R=59	0.33	16.1	C	9	L=89 R=62	0.40	20.1	C	14.25	L=89 R=172	1.12 1.12	137.7 137.7	F F	32	L=89 R=172	1.12 1.12	137.7 137.7	F F	34.3	L=104 R=73	0.57	29.3	D	24.75	L=104 R=183	1.52 1.52	303.2 303.2	F F	32.7	L=104 R=183	1.52 1.52	303.2 303.2	F F	33.5
NBTR	T=235 R=38					T=284 R=50					T=551 R=65	0.38 0.38	0.0 0.0		55.8	T=551 R=65	0.38 0.38	0.0 0.0		110.6	T=331 R=58					T=598 R=73	0.42 0.42	0.0 0.0		73.4	T=598 R=73	0.42 0.42	0.0 0.0		103.2
SBL / SBT	L=46 T=377	0.04	8.0 8.0	A	0.75	L=48 T=416	0.04	8.2 8.0	A	0.75	L=111 T=550	0.13 0.34	9.4 0.0	A	6.9 73.9	L=111 T=550	0.13 0.34	9.4 0.0	A	19.6 36.1	L=57 T=492	0.05	8.4	A	1.5	L=120 T=626	0.14 0.39	9.8 0.0	A	8.2 69.5	L=120 T=626	0.14 0.39	9.8 0.0	A	21 29.5
Overall	828		3.0	A		949		3.6	A		1538		24.1	C		1538		24.1	C		1115		5.1			1704		51.7	F		1704		51.7	F	

Baron Road and Leckie Road

Mvmt	BG2019 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2031 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)
EBL	L=115	0.43	30.0	C	33	L=135	0.52	32.3	C	45.8*	L=135	1.15	161.4	F	158.6	L=135	0.81	57.8	E	56.8	L=158	0.66	40.6	D	62.6*	L=158	1.75	397.6	F	207.4	L=158	0.93	79.4	E	54.7
EBTR	T=220 R=120	0.00 0.72	0.0 28.7	A C	76.4	T=229 R=130	0.00 0.71	0.0 28.6	A C	82.1	T=371 R=176	1.03	75.0	E	147.9	T=371 R=176	0.56 0.82	28.7 35.5	C	188.8	T=273 R=154	0.00 0.82	0.0 35.5	A C	113.5*	T=415 R=200	1.16	119.0	F	30.6	T=415 R=200	0.62	30.3	C	177.6
WBL	L=30	0.16	32.5	C	11.3	L=31	0.16	32.7	C	12	L=31	0.38	37.6	D	9.1	L=31	0.13	21.9	C	32.9	L=37	0.24	37.3	D	14.6	L=37	0.45	42.6	D	4	L=37	0.17	22.6	C	38.1
WBTTR	T=255 R=122	0.39	22.6	C	32	T=314 R=127	0.44	22.6	C	41.1	T=571 R=144	0.70	28.4	C	128.9	T=571 R=144	0.87	45.9	D	138.8	T=365 R=151	0.49	23.4	C	49.2	T=622 R=168	0.77	30.9	C	113.6	T=622 R=168	0.96	57.8	E	131.3
NBL	L=129	0.55	22.9	B	21.1	L=156	0.67	21.6	C	29.2	L=224	0.80	39.2	D	65.3	L=224	0.96	74.0	E	89.5	L=182	0.75	27.0	C	40*	L=250	0.89	51.5	D	65.4	L=250	1.26	176.3	F	94.4
NBTR	T=327 R=35	0.57	19.0	C	79.8	T=358 R=37	0.65	23.6	C	88.6	T=410 R=56	0.75	32.4	C	255.3	T=410 R=56	0.78	39.2	D	264.5	T=423 R=44	0.81	31.6	C	109.6*	T=475 R=63	0.87	41.5	D	224.4	T=475 R=63	0.93	56.9	E	246.5
SBL	L=211	0.47	20.4	C	31.1	L=220	0.53	16.1	B	32.4	L=257	0.75	26.1	C	28.6	L=257	0.80	34.6	C	76.6	L=262	0.72	23.8	C	48.9*	L=299	1.01	76.4	E		L=299	1.04	91.0	F	100.1
SBTR	T=470 R=190	1.01	59.1	F	196.6*	T=507 R=213	1.14	103.0	F	221.1*	T=631 R=190	1.32	181.8	F	261.4	T=631 R=190	0.97 0.29	59.8 5.1	E A	198 104.4	T=601 R=251	1.38	208.2	F	275.4*	T=725 R=228	1.53	272.7	F	259.5	T=725 R=228	1.05 0.34	79.8 7.9	E A	230.4 116.7
Overall	2224		33.5	C		2457		47.2	D		3196		82.6	F		3196		43.6	D		2901		82.2	E		3640		131.8	F		3640		65.7	E	

Baron Road and Banks Road

Mvmt	BG2019 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2021 Volume	V/C	Delay(s)	LoS	Queue(m)	FB2031 Volume	V/C	Delay(s)	LoS	Queue(m)	FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)	MIT FT2031 Volume	V/C	Delay(s)	LoS	Queue(m)
EBL	L=143	0.53	27.3	C	37.5	L=149	0.56	28.0	C	39.3	L=149	0.54	32.9	C	9.6	L=149	0.50	33.3	C	46.7	L=177	0.70	35.5	D	47.6	L=177	0.59	33.8	C		L=177	0.60	39.0	D	50.6
EBTR	T=33 R=257	0.00 0.80	0.0 33.0	A C	13.7	T=34 R=267	0.00 0.80	0.0 34.1	A C	13.9	T=34 R=415	0.76	14.6	B	192	T=34 R=319	0.76 0.89	17.1 46.8	B D	103.7	T=41 R=334	0.00 0.89	0.0 46.8	A D	16.8	T=41 R=467	0.84	23.0	C	158.8	T=41 R=467	0.87	29.0	C	126.6
WBLTR	L=32 T=31 R=21	0.53	26.9	C	25.2	L=33 T=32 R=22	0.55	27.5	C	26.5	L=33 T=32 R=22	1.08	151.9	F	218.3	L=33 T=32 R=22	1.15	175.9	F	141.8	L=40 T=38 R=26	0.83	56.0	E	46.5*	L=40 T=38 R=26	1.33	238.7	F	192.1	L=40 T=38 R=26	1.56	338.6	F	145.4
NBL	L=163	0.83	28.3	C	29.4	L=170	0.84	31.6	C	31.3	L=254	0.77	31.7	C	11.1	L=254	0.57	13.6	B	91.5	L=202	0.89	47.0	D	46.2*	L=286	0.91	50.9	D	39.3	L=286	0.74	29.5	C	87.7
NBTR	T=391 R=27	0.46	8.9	A	61.8	T=440 R=28	0.52	9.8	A	71.8	T=425 R=28	0.40	8.2	A	16	T=425 R=28	0.45	12.4	B	199.4	T=518 R=33	0.62	12.5	B	90.9	T=503 R=33	0.49	10.6	B	40.3	T=503 R=33	0.52	15.1	B	190.4
SBL	L=21	0.07	13.6	B	6.6	L=22	0.08	14.3	B	6.8	L=22	0.06	15.3	B	5.8	L=22	0.05	8.0	A	17.1	L=26	0.11	18.7	B	7.8	L=26	0.08	16.9	B		L=26	0.06	9.0	A	18.2
SBTR	T=476 R=262	1.18	116.6	F	234.7	T=528 R=272	1.30	168.4	F	260.7*	T=517 R=214	1.03	64.3	E	224.3	T=517 R=214	0.84 0.36	35.9 9.0	D A	302.9 45.1	T=623 R=325	1.64	320.5	F	321*	T=612 R=267	1.28	162.4	F	223	T=612 R=267	0.90 0.42	43.5 12.0	D B	231.4 46.2
Overall	1857		57.3	E		1997		77.8	E		2145		39.1	D		2145		26.9	C		2368		141.4	F		2516		81.8	F		2516		41.0	D	

Table 3-6: Summary of Saturday Peak Hour Modelling Results – 4 of 4

Springfield Road and Dilworth/Benvoulin Road

Movement	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 104	0.47	31.2	C	27.3	L = 108	0.50	30.6	C	28.3	L = 121	0.56	32.3	C	31.9	L = 121	0.71	54.1	D	50.2	L = 129	0.58	30.9	D	34.7*	L = 142	0.71	43.0	D	18.6	L = 142	0.84	70.3	E	47.3
EBTT	T = 425	0.41	27.6	C	47	T = 465	0.43	26.8	C	51.5	T = 466	0.40	25.2	C	78.7	T = 466	0.49	34.7	C	122.8	T = 550	0.46	25.3	C	209.4	T = 551	0.45	25.4	C		T = 551	0.59	37.3	D	101
EBR	R = 342		0.0		18.2	R = 376		0.0		19.1	R = 407	0.54	6.1	A	22.8	R = 407	0.57	6.4	A	50.5	R = 444		0.0		37.3	R = 475	0.62	9.4	A	20.9	R = 475	0.69	12.5	B	63
WBL	L = 25	0.11	34.8	C	11.6	L = 26	0.11	33.8	C	12	L = 26	0.15	33.1	C	20.8	L = 26	0.19	43.6	D	44.7	L = 31	0.13	32.3	D	14.2	L = 31	0.18	33.9	C	12.9	L = 31	0.26	47.1	D	63.3
WBTT	T = 479	0.79	43.3	D	66.3	T = 530	0.81	44.0	D	73.8	T = 533	0.75	43.4	D	224.2	T = 533	0.97	76.8	E	225.2	T = 626	0.86	46.8	E	88.4	T = 629	0.83	47.3	D	211.3	T = 629	1.20	146.1	F	260.6
WBR	R = 462		0.0		28.3	R = 480		0.0		38.2	R = 501	0.75	12.9	B	29.5	R = 501	0.85	22.7	C	157.6	R = 573		0.0		95.8*	R = 594	0.89	27.3	C	21	R = 594	1.08	76.6	E	209.2
NBL	L = 293	0.79	31.9	C	103.4*	L = 328	0.93	54.7	D	120.7*	L = 355	1.06	96.2	F	112.8	L = 355	0.99	87.8	F	131.3	L = 387	1.29	178.5	F	151.2*	L = 414	1.33	193.9	F	112.5	L = 414	1.25	171.9	F	119.5
NBTTR	T = 558	0.55	31.2	C	90.2*	T = 581	0.63	34.8	C	96.5*	T = 723	1.06	88.7	F	546.2	T = 723	0.64	32.9	C	516.5	T = 693	0.89	50.9	D	126.6*	T = 835	1.23	148.6	F	483.4	T = 835	0.76	37.0	D	545.9
	R = 29					R = 30					R = 30					R = 36					R = 36					R = 36									
SBL	L = 476	0.86	28.9	C	155.5*	L = 495	0.91	37.6	D	166.7*	L = 522	1.04	78.1	E	234.4	L = 522	0.81	51.7	D	123.2	L = 591	1.20	134.4	F	214.6*	L = 618	1.29	170.6	F	248.5	L = 618	0.88	56.0	E	144.8
SBTTR	T = 943	0.74	29.4	C	160.6*	T = 981	0.80	32.6	C	171*	T = 1092	1.13	104.1	F	340.7	T = 1092	1.04	73.4	E	206.9	T = 1170	1.05	73.0	F	221.8*	T = 1281	1.33	185.3	F	403.6	T = 1281	1.14	108.2	F	262.5
	R = 82					R = 85					R = 85					R = 85					R = 102					R = 102									
Overall	4218		31.7	C		4485		36.6	D		4861		64.4	E		4861		51.0	D		5332		76.0	E		5708		112.7	F		5708		81.1	F	

Springfield Road and Durnin Road

Movement	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBR	R = 75	0.22	23.1	C	17.7	R = 78	0.28	28.4	C	18.1	R = 133	0.53	30.5	C	14.9	R = 133	0.29	2.8	A	26	R = 93	0.37	32.5	C	21.7	R = 148	0.58	32.7	C	7.4	R = 148	0.34	7.6	A	31.8
WBR	R = 8	0.01	22.2	C	0	R = 9	0.01	27.2	C	0	R = 9	0.03	0.2	A	0	R = 9	0.02	0.1	A	8.3	R = 10	0.01	30.6	C	1.2	R = 10	0.04	2.4	A	11.6	R = 10	0.03	0.1	A	8.1
NBL	L = 58	0.37	5.7	A	19.3	L = 61	0.38	5.0	A	23.2	L = 199	1.57	308.9	F	44.4	L = 199	0.79	43.9	D	100.4	L = 72	0.70	24.4	C	27.5*	L = 210	2.40	684.2	F	73.1	L = 210	0.97	78.0	E	100.9
NBTTR	T = 1126	0.51	5.1	A	95.9	T = 1171	0.50	4.5	A	102.6	T = 1209	0.52	7.6	A	30.6	T = 1209	0.55	9.9	A	414.1	T = 1397	0.58	5.1	A	137.1	T = 1435	0.63	9.2	A	111.7	T = 1435	0.66	11.8	B	383
	R = 37					R = 39					R = 39					R = 39					R = 46					R = 46					R = 46				
SBL	L = 2	0.01	3.3	A	1.1	L = 2	0.01	2.8	A	1.1	L = 2	0.01	6.5	A	1.2	L = 2	0.01	13.5	B	2.3	L = 3	0.02	2.8	A	1.6	L = 3	0.02	7.0	A	1.6	L = 3	0.02	13.0	B	24.4
SBTTR	T = 1379	0.63	6.2	A	132.6	T = 1434	0.62	5.5	A	145.9	T = 1525	0.68	9.9	A	483.7	T = 1525	0.91	31.6	C	391.9	T = 1710	0.72	6.8	A	228.9*	T = 1801	0.80	13.4	B	433.3	T = 1801	1.05	58.1	E	424.9
	R = 45					R = 78					R = 78					R = 78					R = 68					R = 86					R = 86				
Overall	2730		6.2	A		2854		5.8	A		3194		28.5	C		3194		22.6	C		3399		7.2	A		3739		50.1	D		3739		38.7	D	

Springfield Road and Leckie Road

Movement	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBTL	L = 116	0.49	33.6	C	17.3	L = 121	0.51	33.6	D	17.9	L = 275					L = 275					L = 144	0.58	34.4	C	20.5	L = 298					L = 298				
	T = 28					T = 29					T = 29	0.89	62.7	E	69.9	T = 29	0.93	74.0	E	80.3	T = 35					T = 35	0.93	68.7	E	39.2	T = 35	1.02	95.3	F	76.2
EBR	R = 393	0.61	22.7	C	72.3	R = 409	0.62	22.6	C	76.4	R = 506	0.72	22.4	C	87.1	R = 506	0.85	37.6	D	83.9	R = 487	0.70	23.7	C	98.5	R = 584	0.82	28.4	C	60.2	R = 584	0.95	51.5	D	80.3
WBL	L = 28	0.39	42.9	D	9.8	L = 29	0.41	43.6	D	9.9	L = 29	0.18	29.9	C	16.8	L = 29	0.26	35.6	D	15.7	L = 35	0.57	49.4	D	11.5	L = 35	0.22	31.2	C	10	L = 35	0.28	39.7	D	23.7
WBTR	T = 8	0.11	28.5	C	3.9	T = 8	0.12	28.1	C	3.9	T = 8	0.06	14.5	B	69.5	T = 8	0.06	16.7	B	34	T = 10	0.13	26.4	C	4.4	T = 10	0.07	14.6	B	70.1	T = 10	0.07	17.1	B	34.5
	R = 16					R = 17					R = 17					R = 17					R = 20					R = 20					R = 20				
NBL	L = 270	0.91	67.1	E	102.2*	L = 281	0.93	72.4	E	110.5*	L = 319	0.93	73.1	E	158.3	L = 319	0.70	52.8	D	130.4	L = 335	1.11	123.4	F	143.6*	L = 373	1.13	127.5	F	149.1	L = 373	0.74	53.6	D	142.5
NBTTR	T = 966	0.46	11.4	B	72.3	T = 1005	0.48	12.0	B	77.6	T = 1005	0.49	12.0	B	393	T = 1198	0.49	13.0	B	294.8	T = 1198	0.60	15.5	B	103.7	T = 1198	0.60	14.1	B	412.2	T = 1198	0.58	14.4	B	343.2
	R = 6					R = 6					R = 6					R = 6					R = 7					R = 7					R = 7				
SBL	L = 7	0.06	20.2	C	3.4	L = 7	0.06	20.8	C	3.4	L = 7	0.04	23.1	C	13.3	L = 7	0.09	52.7	D	20.2	L = 9	0.09	23.0	C	4	L = 9	0.06	24.0	C	13.3	L = 9	0.11	53.6	D	26.7
SBTTR	T = 916	0.84	38.3	D	158.6*	T = 966	0.97	58.8	E	189.4*	T = 978	1.07	78.0	E	544.3	T = 978	0.85	34.4	C	489.4	T = 1149	1.22	146.1	F	241.7*	T = 1161	1.26	155.3	F	456.2	T = 1161	1.02	60.9	E	517.3
	R = 105					R = 158					R = 241					R = 241					R = 179					R = 262					R = 262				
Overall	2859		29.8	C		3036		36.5	D		3420		47.4	D		3420		33.7	C		3608		77.3	E		3992		81.8	F		3992		47.1	D	

Leckie Road and Parkview Crescent

Movement	Background 2019					Future Background (2021)					Future Total (2021)					MITIGATION Future Total (2021)					Future Background (2031)					Future Total (2031)					MITIGATION Future Total (2031)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 12	0.01	8.2	A	0	L = 12	0.01	8.3	A	0	L = 12	0.01	8.3	A		L = 12	0.03	7.7	A	7.3	L = 15	0.02	8.6	A	0	L = 15	0.02	8.5	A		L = 15	0.04	7.8	A	11.3
EBTR	T = 532					T = 553					T = 545	0.46	0.0		57.5	T = 545	0.54	8.6	A	79	T = 660					T = 652	0.53	0.0		33.6	T = 652	0.58	9.5	A	64.7
	R = NA					R = NA					R = 204	0.46	0.0			R = 204					R = NA					R = 204	0.53	0.0			R = 204				
WBTTR	L = NA					L = NA					L = 146	0.21	6.1	A		L = 146	0.67	27.5	C	53.1	L = NA					L = 146	0.24	6.9	A		L = 146	0.75	38.2	D	59.5
	T = 375					T = 439					T = 415	0.21	6.1	A	163.7	T = 415	0.31	8.5	A	172.5	T = 514					T = 490	0.24	6.9	A	144.2	T = 490	0.34	8.5	A	176.3
	R = 8					R = 8					R = 8	0.13	0.0			R = 8					R = 10					R = 10	0.16	0.0			R = 10				
NBL	L = NA					L = NA					L = 299	3.70	Err	F	20.8	L = 299	0.66	20.0	B		L = NA					L = 299	6.24	Err	F	20.3	L = 299	0.69	22.1	C	25.4
NBTR	R = NA					R = NA					R = 42	0.09	12.8	B	43.3	R = 42				37.9	R = NA					R = 42	0.11	14.9	B	42.8	R = 42				39.3
SBL	L = 5	0.02	19.8	C	0.75	L = 5	0.02	21.3	C	0.75	L = 5	0.09	77.9	F	1.4	L = 5	0.01	10.2	B	7.1	L = 6	0.04	27.3	C	0.75	L = 6	0.22	169.6	F	5.3	L = 6	0.01	10.5	B	7.9
SBTR	R = 15	0.02	9.6	A	0.75	R = 16	0.02	9.8	A	0.75	R = 16	0.02	9.7	A	136.8	R = 16				74.6	R = 19	0.03	10.1	B	0.75	R = 19	0.03	10.0	B	159	R = 19				24.2
Overall	947		0.4			1033		0.4			1692		1769.5	F		1692		11.9	B		1224		0.4			1883		1590.8	F		1883		13.2	B	

Table 3-7: Summary of Costco Access Modelling Results

| | | Weekday PM Peak | | | | | | | | | | Weekend Saturday Peak | | | | | | | | | |
| | | Future Total (2021) | | | | | Future Total (2031) | | | | | Future Total (2021) | | | | | Future Total (2031) | | | | |
Intersection		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Mid Baron/Costco	SEL	L = 134	0.12	8.5		6.7	L = 134	0.13	8.7	A	1.8	L = 167	0.15	8.7	A	3.1	L = 167	0.16	8.9	A	
	SET	T = 437	0.27	0.0			T = 519	0.32	0.0		35	T = 434	0.27	0.0		42.5	T = 519	0.32	0.0		
	NWTR	T = 312	0.22	0.0		120	T = 370	0.26	0.0		121.7	T = 330	0.24			116.3	T = 388	0.28			111
		R = 47	0.22	0.0			R = 47	0.26	0.0			R = 59	0.24				R = 59	0.28			
	SWR	R = 104	0.16	11.2	B	56.2	R = 104	0.17	11.8	B	57.4	R = 129	0.20	11.8	B	56.2	R = 129	0.22	12.5	B	51.7
	Overall	**1034**		**2.2**	**A**		**1174**		**2.0**	**A**		**1119**		**2.7**	**A**		**1262**		**2.5**	**A**	
Underhill Street/Gas	EBTL	T = 165	0.10	0			T = 170	0.11	0			T = 221	0.14	0			T = 261	0.16	0		
	WBTR	T = 126	0.08	0.0		134.0	T = 134	0.08	0.0		104.8	T = 228	0.14	0.0		103.3	T = 273	0.17	0.0		104.6
	SBLR	R = 239	0.28	10.4	B	37.8	R = 239	0.28	10.5	B	34.5	R = 244	0.32	11.6	B	32.9	R = 244	0.34	12.3	B	33.7
	Overall	**530**		**4.7**	**A**		**543**		**4.6**	**A**		**693**		**4.1**	**A**		**778**		**3.8**	**A**	
Leckie Road/Costco (Right in Right Out)	EBTTR	T = 574	0.24	0		4.7	T = 686	0.28	0		81.4	T = 563	0.23	0		116.2	T = 670	0.28	0		65.1
	WBTT	T = 481	0.15	0		99.7	T = 551	0.17	0		90.1	T = 540	0.17	0		97.3	T = 616	0.19	0		78.8
	NBR	R = 174	0.26	12	B	37.4	R = 174	0.29	12.9	B	39.3	L = 216	0.32	12.6	B	55.2	L = 216	0.35	13.6	B	38.5
	Overall	**1229**		**1.7**	**A**		**1411**		**1.6**	**A**		**1319**		**2.1**	**A**		**1502**		**2.0**	**A**	
South Baron/Costco	WBLR	L = 162	0.61	36	E	27	L = 162	0.75	56	F	52.6	L = 194	0.79	55.9	F	55.1	L = 194	0.97	102	F	52.7
	NBTR	T = 359	0.38	0		68.2	T = 417	0.41	0		72.6	T = 389	0.43	0		65.3	T = 447	0.47	0		57.3
		R = 253	0.38	0			R = 253	0.41	0			R = 309	0.43	0			R = 309	0.47	0		
	SBT	T = 437	0.27	0		7.1	T = 519	0.32	0		76.8	T = 434	0.27	0		76.4	T = 519	0.32	0		57.5
	Overall	**1211**		**4.8**	**A**		**1351**		**6.7**	**A**		**1326**		**8.2**	**A**		**1469**		**13.5**	**B**	
Durnin/Gas	EBTR	T = 125	0.09	0			T = 140	0.10	0			T = 137	0.10	0			T = 153	0.11	0		
		R = 27	0.09	0			R = 27	0.10	0			R = 29	0.10	0			R = 29	0.11	0		
	WBLT	L = 52	0.04	1.9	A		L = 52	0.04	1.8	A		L = 52	0.04	1.7	A		L = 52	0.04	1.7	A	
		T = 191	0.04	1.9	A	112	T = 208	0.04	1.8	A	145.2	T = 226	0.04	1.7	A	164.6	T = 244	0.04	1.7	A	166.6
	NBLR	L = 5	0.01	10.4	B	25.4	L = 5	0.02	10.6	B	32.2	L = 6	0.02	10.7	B	34.2	L = 6	0.02	10.9	B	38.5
		R = 5	0.01	10.4	B		R = 5	0.02	10.6	B		R = 6	0.02	10.7	B		R = 6	0.02	10.9	B	
	Overall	**405**		**1.4**	**A**		**437**		**1.3**	**A**		**456**		**1.3**	**A**		**490**		**1.3**	**A**	
Baron Road/Gas	WBLR	L = 23	0.16	33.1	D	14.8	L = 23	0.19	41.2	E	38.8	L = 24	0.19	39.7	E	43.1	L = 24	0.24	51.1	F	42.4
	NBTR	T = 553	0.40	0		98.7	T = 609	0.44	0		88.1	T = 601	0.44	0			T = 656	0.47	0		62.4
		R = 101	0.40	0			R = 101	0.44	0			R = 103	0.44	0			R = 103	0.47	0		
	SBL	L = 92	0.11	9.4	A	11.9	L = 92	0.11	9.7	A	5.9	L = 99	0.12	9.7	A	7	L = 99	0.13	10	B	6.8
	SBT	T = 478	0.30	0		46.7	T = 560	0.35	0		116.3	T = 520	0.32	0		114.6	T = 611	0.38	0		103.2
	Overall	**1247**		**1.3**	**A**		**1385**		**1.3**	**A**		**1347**		**1.4**	**A**		**1493**		**1.5**	**A**	

Signal timing at Highway 97 and Leckie Road was optimized along with two other signalized intersections on Highway 97 for 2021 Future Total scenarios to show the effect to intersection performance by signal timing optimization only. Summary of the modelling results is shown in Table 3-8. This testing was only conducted to the 2021 models as the double southbound left-turn lanes at Highway 97 and Leckie Road are expected to be in place by 2031. Other than the signal timing optimization, the turn type for the southbound left-turn phase at Highway 97 and Leckie Road in 2021 Future Total Weekday scenario was adjusted from Permitted to Protected-permitted. It should be noted that the same protected southbound left-turn phase was already coded for the weekend scenario as of existing. No other changes were made to the intersection for this scenario.

Compared to the corresponding results under Future Total scenarios in Table 3-5 and 3-6, the overall intersection delays and LOS are slightly improved at Leckie Road and Banks Road; however, delays have significantly increased at Dilworth Drive. This is likely caused by corridor offset optimization, with some intersections and movements being improved but others becoming worse. By adding the protected southbound left-turn phase at Highway 97 and Leckie Road in 2021 weekday scenario, delays for westbound left-turn, northbound left-turn and southbound left-turn have been significantly improved. Synchro and SimTraffic reports for the optimized signal timings are included in Appendix C.

It is important to note that the Highway 97 signal optimization in this task, was limited in scope to the three signals within the study area (Dilworth, Banks, and Leckie). This signal optimization review did not include the rest of the signals along the coordinated corridor (Burch, Spall, Cooper, and Highway 33). As such it is not possible to show the impact of optimization on the entire corridor or find a signal timing which is optimal for the entire coordinated corridor. Furthermore, optimizing Leckie with Dilworth and Banks increases the overall delay on Highway 97 and Dilworth. Thus, optimizing Leckie without optimizing the entire coordinated segment is not recommended for opening day and any future signal optimization should include all seven of the coordinated signals (Leckie, Burch, Spall, Cooper, Dilworth, Banks, and Highway 33).

Table 3-8: Modelling Results along Highway 97 with Signal Timing Optimization

		Future Total Weekday (2021) - Signal Timing Optimized					Future Total Weekend (2021) - Signal Timing Optimized				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Highway 97 and Banks Road	EBL	L = 127	0.76	83.0	F	56.2	L = 128	0.77	72.9	E	34.9
	EBT	T = 244	0.68	64.6	E	215.2	T = 317	0.70	52.6	D	205.8
	EBR	R = 274	0.61	23.6	C	64.6	R = 414	0.78	32.6	C	68.8
	WBL	L = 120	1.02	142.5	F	76	L = 132	1.03	133.1	F	86.4
	WBT	T = 179	0.51	58.0	E	120	T = 264	0.60	48.2	D	140.9
	WBR	R = 149	0.42	31.8	C	23.1	R = 151	0.33	15.1	B	18.6
	NBL	L = 230	0.93	79.0	E	66.3	L = 317	0.99	90.8	F	30.4
	NBTTT	T = 2536	0.98	14.8	B	133.5	T = 2337	1.01	28.3	C	186.2
	NBR	R = 548	0.61	3.1	A	133.9	R = 746	0.86	12.9	B	164
	SBL	L = 263	1.01	102.9	F	111.2	L = 197	1.00	98.1	F	81.9
	SBTTT	T = 2291	0.87	32.8	C	546.5	T = 1978	0.93	42.4	D	489.3
	SBR	R = 397	0.43	8.7	A	85.7	R = 485	0.63	19.3	B	54.4
	Overall	**7358**		**31.0**	**C**		**7466**		**38.7**	**D**	
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Highway 97 and Leckie Road	EBLL	L = 183	0.66	77.3	E	52.5	L = 151	0.80	83.5	F	34.1
	EBTR	T = 252	1.09	128.6	F	196.2	T = 198	0.86	72.5	E	258.4
		R = 77					R = 65				
	WBL	L = 257	1.23	186.9	F	70.4	L = 293	1.65	350	F	74.6
	WBT	T = 221	0.56	57.4	E	182.7	T = 203	0.64	58.1	E	181.1
	WBR	R = 329	0.22	0.3	A	207.7	R = 441	0.30	0.5	A	243.7
	NBL	L = 55	1.16	114.9	F	30.3	L = 96	1.68	334	F	12.3
	NBTTTR	T = 2438	1.22	118.8	F	620.2	T = 2212	1.14	78.6	E	581
		R = 115					R = 131				
	SBL	L = 194	1.12	133.2	F	166	L = 300	1.33	195.1	F	135.7
	SBTTT	T = 2246	0.84	28.6	C	248.8	T = 1969	0.70	33.9	C	250.8
	SBR	R = 137	0.12	0.1	A	112.8	R = 81	0.07		A	54.3
	Overall	**6504**		**79.3**	**E**		**6140**		**79.6**	**E**	
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Highway 97 and Dilworth Drive	EBL	L = 68	0.75	80.5	F	79.6	L = 97	1.69	391.8	F	82.4
	EBTTR	T = 506	0.52	35.2	D	153.6	T = 533	0.42	23.4	C	175.6
		R = 146					R = 104				
	WBL	L = 241	1.37	230.3	F	85.2	L = 276	1.10	118.6	F	51.1
	WBTTR	T = 470	0.70	34.9	C	276.7	T = 421	0.86	34.0	C	296.5
		R = 436					R = 444				
	NBL	L = 198	1.28	198.6	F	72.5	L = 184	1.31	206.0	F	49.8
	NBTTTR	T = 2311	1.34	192.9	F	420.5	T = 2158	1.51	263.7	F	428
		R = 132					R = 151				
	SBL	L = 275	1.30	181.6	F	118.1	L = 317	1.54	282.2	F	29.3
	SBTTT	T = 2101	1.05	88.0	F	181.4	T = 1894	1.10	96.5	F	77.3
	SBR	R = 53	0.10	16.4	B	23.3	R = 58	0.13	14.7	B	15.6
	Overall	**6937**		**124.3**	**F**		**6637**		**156.2**	**F**	

Table 3-9: Summary of Modelling Result Comments

Location	Mitigation	Comments
Highway 97/Dilworth Drive	• Dual southbound left • Northbound right • Optimize phases within cycle length	The southbound left turn maneuver has capacity and level of service issues during all time periods and scenarios. The northbound through/right turn lane grouping will also perform poorly in 2021 when traffic is added on the network from the residential development at Dilworth/Baron Road. The model also indicated there could be level of service and capacity issues for the vehicles turning left from Dilworth Drive onto the Highway under background conditions in 2021 and 2031 and when Costco traffic is added to the network. Mitigation modelling results showed that adding a southbound left turn lane will not improve capacity as the signal phase change to a protected only for the Northbound and Southbound left turns and optimization will have impacting consequences for the Highway through movements for both 2021 and 2031 modelling horizons. The overall intersection delay will be worse if dual left turn lanes are added compared to existing conditions. *Due to ROW constraints, the most effective physical measure for this intersection in 2021 is to add a northbound right turn lane.*
Highway 97/Underhill Street	• Do Nothing	Traffic movements at this three-legged intersection are restricted to right in and left in from the highway to Underhill Street and right out onto the highway. Under all conditions and assessment years, the southbound left and westbound right turn movements were found to operate poorly and at higher than acceptable capacity and delay thresholds. Queues lengths were also found to reach beyond the available lane length along Highway 97. It should also be noted that HCM results show intersection performance in isolation of each other which means that available gaps in opposing traffic from the signal at Dilworth Drive/Highway 97 is not considered and field observations indicate there is less queueing and delay than shown in the model at the intersection. *No mitigation was considered in the model for this intersection in this study. Monitoring is recommended.*
Highway 97/Leckie Road	• Dual southbound left • Optimize phases within cycle length • Convert second eastbound left lane to second eastbound through lane	The current protected southbound left turn phase is only functional from 9 am to 3 pm. This movement also was shown to perform poorly under existing conditions during the PM and Saturday peak hours for all horizon years. Southbound left turn queues will also be quite long under total traffic conditions in 2021 and 2031. The trip assignment for the new Costco location assumed that traffic coming from the north would use the shortest route which meant a high trip assignment at Leckie Road. If this intersection capacity is not upgraded or phasing is not updated, then likely traffic will use alternative routes. Modelling a southbound dual left turn lane along the highway and optimizing signal phasing showed overall improvement under total development conditions in 2021 but northbound through movements will be impacted by the protected phase of the southbound dual left turn lane along the Highway. There will continue to be capacity and level of service issues in 2031 after applying the mitigation measures. Converting the second eastbound left turn lane to a second eastbound through lane will improve operations. *Ultimately double left turns southbound onto Leckie is required (once aggreged upon triggers by City and MOTI are met.)*
Highway 97/Banks Road	• Dual Northbound left • Optimize phases within cycle length	The capacity and level of service issues for the northbound left movements stem from existing traffic conditions and background growth. A dual northbound lane will improve the capacity of this movement but will impact some other movements when signal timing is updated to accommodate the protective nature of a dual left turn lane. The 2031 mitigation modelling scenario also show capacity and level of service issues after applying the mitigation measures. *The most effective measure for this intersection in 2021 is to monitor this intersection.*
Baron/Dilworth/Mall Entrance	• Adjust lane configuration along Baron Road • Add westbound right along Dilworth Drive • Optimize phases within cycle length.	Capacity and level of service thresholds do not meet acceptable levels under existing and all other scenarios along Baron Road at the mall/Dilworth Drive intersection. The change in signal timing, lane configuration and addition of the westbound right turn lane from Dilworth Drive to Baron Road improved the overall intersection performance as well as delays from the mall entrance for the 2021 horizon years. East (EBL), westbound (WBR) and southbound directions could continue to experience capacity issues on Saturdays. Although there was some improvement to capacity and level of service in 2031, it will continue to not meet capacity and level of service thresholds in the westbound, southbound and eastbound directions on Saturdays. A lane reconfiguration along Baron Road and the mall entrance will improve the safety of the intersection because through movements would no longer have to merge into a left turning lane to complete the maneuver and it will reduce driver confusing with the protected left turn phase. *The most effective measure for this intersection in 2021 is to reconfigure the north/south direction to a left turn lane and separate through/right turn lane, optimize phasing and add a westbound right turn lane from Dilworth Drive to Baron Road.*
Baron Road/Underhill Street	• Signalize	The Baron Road/Underhill Street intersection is currently un-signalized and operates at acceptable capacity and delay thresholds during the PM peak hour but fails on Saturday under existing conditions. However, preliminary analysis indicates that a signal is not warranted under existing conditions due to the

	• East and westbound left turn lane • Westbound right turn lane	low left turn volume. When regional development trips are added to the network, the intersection fails in 2021 and 2031 background horizon years. The capacity and level of service thresholds are also exceeded when Costco trips are added to the network. Left turn and through movements out of Underhill Street onto or across Baron Road are constrained by the high two-way volumes on Baron Road. Signalization, left turn lanes from Underhill Street onto Baron Road and a westbound right turn lane improved the level of service in 2021 to acceptable thresholds levels. The northbound and southbound direction may still experience some capacity issues by 2031 during the Saturday peak hour. However, no further mitigation is required as the level of service in 2031 on Saturday for the total development conditions is better than the background level of service for the same period when no mitigation measure was in place. *The most effective measure for this intersection in 2021 is to signalize it, line paint for left turn lanes in the east/west direction and add a westbound right turn lane to accommodate the Costco traffic from the gas bar.*
Baron Road/Durnin Road	• None – review pedestrian crossing	The Baron Road/Durnin Street intersection operates at acceptable capacity and level of service thresholds under background conditions for all horizon years. Queue lengths are also acceptable. The Saturday market at Springfield Road/Dilworth Drive does attract other road users to the area and with the addition of Costco gas bar traffic, there will be capacity and level of service issues on Saturdays along Durnin Street. The alignment of the gas pumps will effectively create one-way traffic into the gas bar from Durnin Street and out at Underhill Street and the amount of traffic turning left or right from Durnin Street is relatively low compared to traffic impacts at Underhill Street and Baron Road. Durnin Street is a residential area which has 30 km/h posted speed limits and traffic calming measures in place. The signal at Underhill Street will likely allow for gaps in traffic while the signal phase is red along Baron. No mitigation is recommended for the westbound left movements. *The most effective measure for this intersection is to review pedestrian crossing options.*
Baron Road/Leckie Road	• Change lane configuration to two through and left turn lane along Leckie Road. • Add southbound right turn lane along Baron Road • Change cycle length from 85s to 100s on Saturday. • Optimize phases within cycle length.	The southbound lane from Baron Road onto Leckie Road to get to Highway 97 does not meet acceptable capacity and level of service thresholds under existing and future background conditions. When the new Costco site traffic is added to the network, there will also be capacity and level of services issues on opening day and in the 10-year horizon along Leckie Road in the eastbound direction. Queues lengths along Baron Road are also anticipated to reach beyond the existing lane lengths. The modelling results showed that changing the lane configuration to two through east/west lanes, adding east/west left turn lanes along Leckie Road and a southbound right turn lane along Baron Road will improve this intersection in 2021 horizon years under total development conditions and no anticipated spill back to the Highway is forecasted. Northbound and southbound left turns from Baron Road to Leckie Road as well as the eastbound direction could be impacted by the higher volumes 2031. Signal timing should be reviewed once traffic volumes reach 2031 levels. *Due to property constraints, the southbound right turn lane is likely not feasible. Therefore, the most effective measure in 2021 at this intersection is to change the lane configuration to two through and left turn lane along Leckie Road, update the cycle length and optimize the phases within the cycle length.*
Baron Road/Banks Road	• Add southbound right turn lane. • Change cycle length from 81s to 100s	The Baron Road/Banks Road intersection will generally see an improvement in lane group capacities and the level of service when Costco is relocated towards Leckie Road due to the re-distribution of traffic. However, the southbound direction does experience capacity and LOS issues under existing conditions. The modelling results showed that adding a southbound right turn lane along Baron Road and adjusting signal timing will bring all movements to acceptable threshold levels in 2021 and 2031 under PM peak traffic conditions and 2021 Saturday peak traffic conditions. Signal timing may have to be reviewed for Saturday traffic conditions in 2031. *However, adding a southbound right turn lane is not feasible due to property constraints.*
Springfield/Dilworth/Benvoulin	• Dual southbound left • Increase length of westbound right turn lane	The southbound and westbound capacity and LOS issues stem from existing PM peak traffic conditions. The southbound left turn capacity issues will become an issue on Saturdays under background growth conditions. When Costco traffic is added to the background, then Northbound left turn will also start to experience capacity and LOS issues. Southbound Left turn lane queues often spill back into the through lane during afternoon peak hours. The Left turn volumes in the afternoon under existing conditions are on the order of 545 vehicles per hour (veh/h) and forecast to increase to over 700 veh/h in 2031 under future background and total development conditions. Opposing volumes are also high during the afternoon peak hour. Generally, when left turning volumes are over 300 veh/h and the opposing volume is high, a second left turn lane with fully protected signal phasing should be considered. Other recent studies for the area have recommended converting the single left turn lane to a dual left turn lane from Springfield Road onto Benvoulin Road.

		The modelling results showed adding southbound left turn lane will improve capacity and level of service for the left turn movement and overall intersection LOS but the mitigation measure will not meet the threshold established for other movements that are experiencing capacity and LOS issues. Signal timing would need further review or additional lane capacity added to meet the thresholds established.
		Although, the southbound dual left turn lane does not change intersection performance to meet thresholds under total development conditions, dual left turns should be considered in future transportation capital upgrade plans.
		An effective measure for 2021 would be to extend the westbound right turn lane.
Springfield Road/Durnin Road	• Signalize and coordinate between Benvoulin/Dilworth and Leckie Road	Costco traffic will add northbound left turn movements at Springfield/Durnin Road intersection. The impact of platooning and gaps from the signal at Leckie Road/Springfield Road is not taken into consideration in the model and likely there may be enough gaps to accommodate this movements in 2021.
		Therefore, monitoring is recommended at this time. Should the left turn queues become too long, then the pedestrian signal could be converted to a signalized intersection actuated for left turn movements.
Springfield Road /Leckie Road	• Dual Northbound left • Optimize phases within cycle length • Increase cycle length on Weekdays from 110s to 120s and Saturday from 100s to 110s	The northbound left turn movement is beyond capacity during the PM and Saturday peak hours under 2019 traffic volume conditions and other horizon year. Under 2021and 2031 total conditions a similar issue occurs for the southbound through and right turn lane groupings. The northbound left turn queues lengths may exceed the available storage lane length during the afternoon and Saturday peak hours for 2021 and 2031 background and total development conditions.
		The current phasing at this location includes a protected left turn only phase which limits the vehicles from making additional left turn maneuvers when opposing lanes have adequate gaps in traffic. This was put in place due to the high collision rates at this intersection approximately 8 years ago. As a result, a mitigation strategy of changing this phase as protected/permissive was not considered and a dual left turn lane was modelled.
		The modelling of a northbound dual left turn lane will bring the left turn movement to acceptable capacity and level of service thresholds in 2021 but will not in 2031. The southbound through and right movements will be impacted by the protected phase of the left turns.
		The most effective measure, if protected permissive phasing is not allowed, is to add a left turn lane in the northbound direction, update the cycle lengths and optimize the phases within the cycle. Right of way will be required for a dual left turn lane. To minimize the land requirements, the existing bus stop should be moved to the far side (north) of the intersection.
Leckie Road/Parkview Crescent	• Signalize (permissive phasing only) • Left turn lane in east and west directions	The Leckie Road/Parkview Crescent intersection is proposed to serve as the primary access into and out of the new Costco site. It currently has a pedestrian crossing signal across Leckie Road. A fourth leg would be added to form a four-legged intersection at this location. Due to the high left turn traffic volume both into and out of the site, the northbound left turn maneuver (out of Costco) will be beyond level of service and capacity thresholds. The modelling results showed signalizing the Costco entrance/Leckie Road will bring all movements to acceptable threshold levels.
		The most effective measure for this intersection is to signalize and add left turn lanes in the east and west direction.
Costco Non-Signalized Access Locations - **Mid Baron Road** - **Leckie Road** - **South Baron Road**	• None	Mid Baron Road access is limited to a right-in/right-out with southbound left turn from Baron Road into the site. This access point will operate at acceptable thresholds for all horizons and time periods.
		The Leckie Road access which is limited to a right-in/right-out will also operate at acceptable thresholds for all horizons and time periods.
		The south Baron Road access which is proposed to be an all turns access to and from Baron Road will generally operate at acceptable conditions except for the left turn movements out of the site on Saturdays. The through volumes are high along Baron Road which will cause some delay and queues within the site on Saturdays.
Gas Bar Non-Signalized Access Locations - **Underhill Street** - **Baron Road** - **Durnin Road**	• None	The model results show the accesses for the gas station will operate at acceptable thresholds. Left tun traffic out the gas station and onto Baron Road will experience delays over the acceptable thresholds in 2031 on Saturday but these volumes are forecasted to be low as the majority of gas bar users will use the Underhill Street access to leave the station.

3.3 PERSON DELAY REVIEW

In addition to the HCM results, the total delay per person was calculated for the whole of the study network by adding up the overall delay per vehicle for each of the intersections and multiplying it by the average number of people per vehicle (assumed to be 1.2 person/veh).

The intersection of Baron Road and Underhill Street was not included in the calculation due to very delays when it is an unsignalized intersection under background and total development conditions which skews the results. Table 3-11 and Table 3-12 provide a summary of the PM and Saturday peak hour results of overall delay by intersection and delay within the study network.

The resulting change is overall delay from the proposed relocation of Costco with the proposed mitigation measures for the 2021 and 2031 total network scenarios is shown in Table 3-10.

Table 3-10: Person Delay Improvement (minutes)

TOTAL DEVELOPMENT CONDITIONS PEAK HOUR AND HORIZON YEAR	NO MITIGATION MEASURES (MINUTES)	WITH MITIGATION MEASURES (MINUTES)	CHANGE (MINUTES)
Total Development PM Peak 2021	18.4	8.1	10.3
Total Development PM Peak 2031	33.0	14.8	18.2
Total Development Saturday Peak 2021	19.5	8.1	11.4
Total Development Saturday Peak 2031	32.9	13.9	19.0

Table 3-11: PM Peak Hour Delay by Intersection and Total for Study Area

	Background (2019)	Background (2021)	Future Total (2021)	Mitigation Future Total 2021	Background (2031)	Future Total (2031)	Mitigation Future Total (2031)
	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)
Highway 97 and Dilworth Drive	43.5	47.4	61.2	66.2	84.7	93.6	158.4
Highway 97 and Underhill Street	88.6	146.9	156.9	10.3	370.4	379.5	63.3
Highway 97 and Leckie Road	28.2	43.1	122.0	36.3	66.1	171.9	55.7
Highway 97 and Banks Road	35.8	46.8	52.1	42.7	95.3	118.5	94.1
Baron Road and Dilworth Drive/ Mall Entrance	55.1	38.5	99.4	30.6	215.3	214.1	40.5
Baron Road and Durnin Road	2.8	3.3	11.4	6.5	4.4	23.6	13.3
Baron Road and Leckie Road	31.6	42.9	86.5	39.3	73.5	131.9	52.2
Baron Road and Banks Road	31.3	43.8	38.1	20.1	91.8	77.7	25.7
Springfield Road and Dilworth/ Benvoulin Road	71.8	97.3	105	93.8	153.4	170	156.2
Springfield Road and Durnin Road	6.6	6.9	14.6	14.7	10.3	23.9	22.5
Springfield Road and Leckie Road	31.1	41.9	65.8	33.3	70.7	98.9	51.1
Leckie Road and Parkview Crescent	0.2	0.2	104.8	9.2	0.3	145.7	8.7
Total Delay (minutes)	7.1	9.3	15.3	6.7	20.6	27.5	12.4
Total Person Delay (minutes)	8.5	11.2	18.4	8.1	24.7	33.0	14.8

- *The highlighted yellow value in the table indicate the mitigation measure modelled will not improve the intersection LOS and could have other impacted effects.*

Table 3-12: Saturday Peak Hour Delay by Intersection and Total for Study Area

	Background (2019)	Background (2021)	Future Total (2021)	Mitigation Future Total 2021	Background (2031)	Future Total (2031)	Mitigation Future Total (2031)
	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)	Control Delay (s)
Highway 97 and Dilworth Drive	41.4	46.7	56.6	76.3	80.9	96.7	167.6
Highway 97 and Underhill Street	32.3	61.8	79.5	2.7	147.1	182.0	21.3
Highway 97 and Leckie Road	29.8	47.1	102.5	47.6	80.1	136.7	73.3
Highway 97 and Banks Road	38	44.8	62.3	53.0	88.6	122.8	99.3
Baron Road and Dilworth Drive/ Mall Entrance	81.2	148.3	144.3	41.8	347	338.5	66.1
Baron Road and Durnin Road	3	3.6	23.8	12.8	5.1	51.6	25.2
Baron Road and Leckie Road	33.5	47.2	114.5	41.5	82.2	159.9	55.7
Baron Road and Banks Road	57.3	77.8	44.5	24.2	141.4	93	35.7
Springfield Road and Dilworth/ Benvoulin Road	31.7	36.6	49	48.1	76	104.9	78.1
Springfield Road and Durnin Road	6.2	5.8	13.3	13.7	7.2	25.6	18.1
Springfield Road and Leckie Road	29.8	36.5	51.1	32.1	77.3	84.4	44.5
Leckie Road and Parkview Crescent	0.4	0.4	231.2	9.0	0.4	250	10.2
Total Delay (minutes)	6.4	9.3	16.2	6.7	18.9	27.4	11.6
Total Person Delay (minutes)	7.7	11.1	19.5	8.1	22.7	32.9	13.9

- *The highlighted yellow value in the table indicate the mitigation measure modelled will not improve the intersection LOS and could have other impacted effects.*

4 ALTERNATIVE SCENARIO TESTING

The analyses in Section 3 represent a simple comparison of the existing network in the Full Background and Full Build conditions in 2021 and 2031. However, over the course of this study the Ministry and City requested several rounds of sensitivity analyses be conducted to confirm the potential for minor changes to the network. One of these was to confirm the potential impacts of changes to the intersection of Highway 97 and Underhill Street.

Sections 4.1 and 4.2 are largely unchanged from the previous report and are presented here for completeness. They do not incorporate the refinements in the assignment of Costco traffic.

In addition, they requested more specified analysis to determine the individual effects of the new Costco, new as-of-right gas bar against two comparative background scenarios: 1) without the four major background developments noted in Section 1.5.1 (2% p.a. traffic growth only) and 2) with those four major background developments. The purpose of this is to better determine how much of the 2021 and 2031 peak scenarios is created by the proposed Costco and how much from other major projects.

4.1 POTENTIAL CHANGES TO UNDERHILL LEFT TURN

In response to the Ministry's request regarding further mitigation exploration along the Highway, WSP completed additional modelling of the network focusing on different scenarios for the highway.

These scenarios included the following, both of which were ultimately denied by the Ministry due to their proximity to Dilworth Road and the potential for adverse effects on major movements at that intersection:

1. Left turn signalization of Highway 97 at Underhill Street and reassignment of some Costco traffic to Underhill Street access. The left turn phase would be coordinated with side street movements at Dilworth Drive.

2. Closure of Highway 97 left turn at Underhill Street and reassignment of existing highway left turn traffic to Dilworth Drive. Costco traffic assigned back to Leckie Road.

These two scenarios had two major findings: a) Closing Underhill significantly increased the delay of southbound vehicles turning left off of the Highway at Dilworth and b) adding a signal at Underhill had almost the same effect as a second southbound left turning lane at Leckie. Also, it should be noted that while Costco is adding volume, most of these left turns are either saturated or close to saturated during peak hours in the background condition.

These modelling scenarios were completed for the 2021 opening day horizon for the PM and Saturday peak hour and total traffic conditions. Cycle lengths were kept the same at 150 seconds for the PM peak hour and 130 seconds for Saturday.

The modelling included the following mitigations as shown in Table 4-1:

Table 4-1: Proposed Mitigation Measures

INTERSECTION	PM/SATURDAY MITIGATION
Highway 97/Banks Road	- Dual northbound left turn lanes - Phase optimization
Highway 97/ Underhill Street	- Scenario 1 – Left turn signalization - Scenario 2 – Closure of left turn

Highway 97/ Leckie Road	- Northbound and southbound left turn lanes remain the same as the existing configuration - Protected/permissive phasing for all time periods in the northbound and southbound direction - Laning in east/west direction to include two through lanes and one left turn lane from Leckie Road to highway 97 in both directions - Signal phase optimization
Highway 97/ Dilworth Drive	- Northbound and southbound left turn lanes remain the same as the existing configuration - Right turn lane addition as per previous analysis - Signal phase optimization

The results of additional scenarios are summarized below for the PM peak in Table 4-2 and for the Saturday afternoon peak in Table 4-3.

Table 4-2: Summary of Underhill Street Mitigation PM Peak Hour Modelling Results – 1 of 4

Highway 97 and Dilworth Drive

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 69	0.37	55.3	E	68.9*	L = 69	0.24	39.3	D	45.4*	L = 69	0.38	56.4	E	77.6	L = 69	0.39	57.4	E	76.8
EBTTR	T = 510 / R = 146	0.50	43.7	D	120.8	T = 510 / R = 146	0.37	31.2	C	100.4	T = 510 / R = 146	0.84	66.1	E	164	T = 510 / R = 146	0.83	65.3	E	168.8
WBL	L = 246	1.35	237.6	F	198*	L = 246	0.87	66.1	E	166.2*	L = 246	1.16	144.8	F	65.3	L = 246	1.29	198.7	F	66.1
WBTTR	T = 467 / R = 436	0.46	42.8	D	157	T = 467 / R = 436	0.34	30.6	C	128.4	T = 467 / R = 436	0.46	42.8	D	288.4	T = 467 / R = 436	0.48	44.3	D	293.7
NBL	L = 198	0.90	70.2	E	92.3*	L = 198	1.20	200.7	F	136.4*	L = 198	1.01	113.8	F	88.4	L = 198	0.96	90.2	F	92.2
NBTTR	T=2318	1.01	60.7	F	370.9*	T=2318	1.23	151.3	F	372.7*	T=2318	1.03	67.8	F	418.9	T=2318	1.19	134.3	F	418.8
	R = 117					R = 117		0.0		27.2	R = 117				90	R = 117		0.0		82.8
SBL	L = 275	1.12	144.8	F	152.1*	L = 275	1.17	179.0	F	77.9*	L = 275	1.24	191.4	F	154.2	L = 525	1.52	300.2	F	155.8
SBTTT	T = 2102	0.88	36.8	D	284.9*	T = 2102	1.19	138.8	F	326.3*	T = 2102	0.90	64.0	E	155.2	T = 2102	0.88	38.1	D	178.6
SBR	R = 52	0.00	0.0	A	6.5	R = 52	0.00	0.0	A	4.9	R = 52		0.0		37.7	R = 52	0.00	0.0	A	40.4
Overall			61.2	E				126.1	F				74.6	E				105.0	F	

Highway 97 and Underhill Street

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBR	R=190	1.80	460.4	F	119.3	R=190	1.80	460.4	F	119.3	R=190				6.6	R=190	1.77	445.5	F	17.7
NBTTT	T=2630					T=2630					T=2602	0.68	6.5	B	66.6	T=2602				23.0
NBR	R = 257					R = 257					R = 286				26.6	R = 286				
SBL	L = 249	7.49	3142.0	F	236.3	L = 249	7.49	3142.0	F	236.3	L =306	0.91	69.0	E	79.1	L =0				
SBTTT	T=2218					T=2218					T=2218	0.48	0.5	A	64.2	T=2468				641.3
Overall			156.9					156.9					7.6	A				15.3		

Highway 97 and Leckie Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 183	0.76	72.8	E	43.1	L = 183	0.80	80.2	F	103.6*	L = 183	0.78	75.5	E	63.5	L = 183	0.80	80.2	F	61.6
EBTR	T = 256 / R = 77	0.90	82.4	F	192.9*	T = 256 / R = 77	0.28	43	D	62.4	T = 256 / R = 77	0.28	42.2	C	139.4	T = 256 / R = 77	0.28	43	D	138
WBL	L = 229	1.48	305.1	F	163.9*	L = 229	0.87	79.6	F	146.2	L = 229	0.84	73.3	D	77.7	L = 229	0.87	77.6	E	76.7
WBT	T = 221	0.69	61.5	E	102.8	T = 221	0.46	45.8	D	90.3	T = 221	0.45	44.9	D	169.9	T = 221	0.46	45.8	D	170.2
WBR	R = 378				0	R = 378				0	R = 342		0		130.3	R = 342				129.3
NBL	L = 58	0.65	88.6	F	41.4*	L = 58	0.79	112.2	F	20.1	L = 58	0.47	31.9	C	32.8	L = 58	0.46	30.8	C	30
NBTTR	T=2465	0.83	24.7	C	308.0	T=2465	1.01	57.0	C	225.8*	T=2465	1.01	56.2	F	236.0	T=2465	1.04	66.3	F	123.1
	R = 141					R = 141					R = 113					R = 113				
SBL	L = 291	4.35	1609.7	F	244.1*	L = 291	0.90	92	F	70.1*	L = 198	1.01	117.5	F	103.1	L = 253	1.10	139.4	F	159.6
SBTTT	T=2220	0.75	21.0	C	220.8	T=2220	0.82	27.7	B	89.5	T=2277	0.83	28.3	C	201.3	T=2277	0.82	27.3	C	340.9
SBR	R = 137				0	R = 137				0	R = 137		0.0		37	R = 137				154.9
Overall			122.0	F				49.0	D				47.6	D				53.4	E	

Table 4-2: Summary of Underhill Street Mitigation PM Peak Hour Modelling Results – 2 of 4

		BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
		Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Highway 97 and Banks Road	EBL	L = 126	0.56	63	E	64	L = 126	0.72	79.3	E	74.7*	L = 126	0.60	65.4	E	85.7	L = 126	0.60	68.9	E	95.4
	EBT	T = 248	0.57	51	D	105.2	T = 248	0.68	59.1	E	111.1	T = 248	0.90	87.6	E	225.4	T = 248	0.90	87.6	E	203.9
	EBR	R = 274		0		74.4	R = 274		0		76.6	R = 274		0		87.3	R = 274		0		89.9
	WBL	L = 121	0.68	72	E	80.9*	L = 121	0.93	125.4	F	87*	L = 121	0.92	107.4	E	80.8	L = 121	0.92	109	E	65.5
	WBT	T = 184	0.43	48	D	79.5	T = 184	0.51	53.4	D	84	T = 184	0.47	40.5	D	139.8	T = 184	0.47	50.9	D	87.2
	WBR	R = 89		0		25.5	R = 89		0		26.9	R = 125				29.1	R = 125				27.9
	NBL	L = 223	1.09	139	F	129*	L = 223	0.84	84.6	F	40.5	L = 221	0.92	83.3	F	73.4	L = 221	0.92	83.3	F	68.0
	NBTTT	T=2618	1.00	51.5	F	358.7*	T=2618	1.00	50.8	F	121.7	T=2582	1.00	49.9	F	106.3	T=2582	1.00	49.9	F	131.1
	NBR	R = 548		0		108.8	R = 548		0		41.1	R = 548		0		31.7	R = 548		0		201.3
	SBL	L=209	1.09	145.4	F	117.8*	L=209	0.99	123.2	F	127*	L=245	1.04	121.4	F	105.2	L=245	1.04	121.4	F	107.3
	SBTTT	T=2361	0.90	35.2	D	275.5	T=2361	0.84	26.9	C	249.0	T=2325	0.89	33.9	C	357.0	T=2325	0.89	33.9	C	429.2
	SBR	R = 397		0		42.7	R = 397		0		52.5	R = 397		0		127.5	R = 397		0		131.5
	Overall			52.1	D				47.8	D				50.6	D				51.1	D	
Baron Road and Dilworth Drive/ Mall Entrance	EBL	L = 146	0.55	17.3	B	26.8	L = 146	0.65	30.3	C	41.8*	L = 146	0.70	32.5	C	60.1	L = 271	0.88	32	C	62.7
	EBTTR	T = 658 R = 50	0.39	11.3	B	47.6	T = 658 R = 50	0.53	22.3	C	75.2	T = 658 R = 50	0.55	27.1	C	96.2	T = 783 R = 50	0.56	25.2	C	136.2
	WBL	L = 65	0.28	19.5	B	19.1	L = 65	0.28	30.6	C	24.7	L = 65	0.31	37.5	D	109.7	L = 65	0.31	37.5	D	78.2
	WBTTR	T = 713	0.88	32.9	C	128*	T = 713	0.85	41.1	C	104.5*	T = 713	0.84	40	D	76	T = 713	0.84	43.2	D	298.7
		R = 347					R = 347	0.96	70.6	E	28.9	R = 347	0.95	47.3	D	289.2	R = 347	0.94	49.6	D	80.1
	NBLT	L = 77	1.72	385.3	F	93.5*	L = 77	0.31	32.7	C	24.1	L = 77	0.26	32.5	D	57.9	L = 77	0.31	40.3	D	61
		T = 116					T = 116	0.54	34	C	47.1	T = 116	0.40	33.3	C	53.1	T = 116	0.43	38.5	C	60.2
	NBR	R = 64	0.04	19.3	B	0	R = 64					R = 64					R = 64				
	SBLT	L = 473	1.64	330	F	208.8*	L = 473	0.84	30.9	C	105.6*	L = 473	0.79	27.5	D	134.8	L = 348	0.71	30.3	D	132.5
		T = 83					T = 83	0.60	17.7	B	47.8	T = 83	0.56	20.2	B	164.7	T = 83	0.65	29.3	B	167.9
	SBR	R = 365	0.36	22	C	35.4	R = 365					R = 365					R = 365				
	Overall			99.4	F				33.9	C				32.3	C				34.7	C	
Baron Road and Underhill Street	EBLTR	L = 72	3.44	>300	F	264	L = 72	0.15	10.9	B	11.5	L = 158	0.39	17.2	B	57.6	L = 158	0.48	23.1	C	46.7
		T = 47					T = 47	0.54	12.2	B	21.6	T = 47	0.60	17	B	188	T = 47	0.41	19.9	B	101.6
		R = 231					R = 231					R = 231					R = 106				
	WBLTR	L = 106	4.44	1642.9	F	315.75	L = 106	0.30	15.9	B	16.9	L = 106	0.38	23	B	40	L = 106	0.36	24.2	C	37.8
		T = 66					T = 66	0.11	9.7	A	10.2	T = 66	0.12	13.8	A	21.3	T = 66	0.15	18.1	B	22.8
		R = 212					R = 212	0.43	11.4	B	10.6	R = 212	0.47	16.2	B	35.3	R = 212	0.60	21.8	B	30.5
	NBL	L = 72	0.08	9	A	2.25	L = 72	0.24	16.3	B	11.7	L = 72	0.23	17	B	26.9	L = 197	0.54	19.4	B	38
	NBTR	T = 423					T = 423	0.65	10.4	B	55.1	T = 423	0.58	10.3	B	96.2	T = 423	0.53	9	A	101.9
		R = 78					R = 78					R = 78					R = 78				
	SBL	L = 40	0.04	8.7	A	0.75	L = 40	0.12	13.6	B	6.3	L = 40	0.11	14.7	B	21.5	L = 40	0.10	13.1	B	22
	SBTR	T = 563					T = 563	0.74	12.3	B	75.1*	T = 563	0.66	13.8	B	72.7	T = 563	0.60	11.7	B	74.6
		R = 22					R = 22					R = 22					R = 22				
	Overall			541.5					11.9	B				14.6	B				15.2	B	

		BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
		Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Baron Road and Durnin Road	WBLR	L = 80	0.87	65.3	F	55.5	L = 80	0.87	65.3	F	55.5	L = 80	0.65	73.2	F	29.1	L = 80	0.65	73.2	F	28.7
		R = 147					R = 147					R = 147	0.34	16.9	C	27.1	R = 147	0.34	16.9	C	26.8
	NBTR	T = 523					T = 523					T = 609				45.7	T = 609				45.5
		R = 33					R = 33					R = 33					R = 33				
	SBL	L = 105	0.11	9.2	A	3	L = 105	0.11	9.2	A	3	L = 105	0.12	9.5	A	19.8	L = 105	0.12	9.5	A	22.2
	SBT	T = 498					T = 498					T = 498				13.7	T = 498				28.4
	Overall			11.4					11.4					15.9					15.9		
		Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Baron Road and Leckie Road	EBL	L = 157	0.87	69.4	E	73.5*	L = 157	0.68	45.7	D	72.2*	L = 157	0.64	33.6	D	58.5	L = 157	0.64	33.6	D	51.3
	EBTR	T = 526	1.30	176.3	F	231.1*	T = 526	0.55	24.1	C	76.4	T = 441	0.45	29.3	C	87.3	T = 441	0.50	30.0	C	98.6
		R = 171					R = 171					R = 135					R = 135				
	WBL	L = 42	0.50	46.9	D	21.5*	L = 42	0.19	31.6	C	15.5	L = 42	0.17	36	C	50.3	L = 42	0.18	37.6	C	52
	WBTTR	T = 527	0.65	26.8	C	71.7	T = 527	0.53	23.8	C	75.1	T = 527	0.78	49.9	D	135.8	T = 527	0.78	49.9	D	145.8
		R = 156					R = 156					R = 156					R = 156				
	NBL	L = 184	0.65	27.3	C	41*	L = 184	0.77	37.3	D	60.6*	L = 148	0.71	38.7	C	83.4	L = 148	0.71	38.7	C	77.8
	NBTR	T = 335	0.76	26.8	C	92.9	T = 335	0.74	33.0	C	108.7	T = 371	0.80	43.0	C	258.8	T = 371	0.80	43.0	C	263.0
		R = 79					R = 79					R = 79					R = 79				
	SBL	L = 234	0.60	18.5	B	34.4	L = 234	0.71	28.2	C	50.6*	L = 234	0.77	37.5	C	116.0	L = 234	0.77	37.5	C	112.5
	SBTR	T = 554	1.20	132	F	232.1*	T = 554	0.90	43.2	D	168*	T = 590	0.92	52.7	D	213.4	T = 590	0.92	52.7	D	287.9
		R = 191					R = 191	0.38	24.1	C	23.1	R = 191	0.36	28.6	C	121.2	R = 191	0.36	28.6	C	133.0
	Overall			86.5	F				30.8	C				41.7	D				41.6	D	
		Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
Baron Road and Banks Road	EBL	L = 155	0.53	27.1	C	39.6	L = 155	0.48	24	C	46	L = 155	0.43	31.5	C	34.6	L = 155	0.33	25.9	C	53
	EBTR	T = 50	0.87	40.1	D	29.7	T = 50	0.82	29.1	C	37.8	T = 50	0.76	35.5	D	93.8	T = 50	0.59	27	C	147.4
		R = 315					R = 315					R = 351					R = 315				
	WBLTR	L = 38	0.55	24.4	C	41.4*	L = 38	0.46	21.3	C	36.1	L = 38	0.43	23.4	C	38	L = 38	0.28	24.9	C	118
		T = 49					T = 49					T = 49					T = 49				
		R = 31					R = 31					R = 31					R = 31				
	NBL	L = 125	0.52	17.6	B	19.8	L = 125	0.38	14.1	B	18.1	L = 161	0.57	19.1	B	46.5	L = 161	0.70	33.4	C	47.5
	NBTR	T = 415	0.45	9.5	A	59.5	T = 415	0.47	10.1	A	64.5	T = 415	0.51	13	B	65.8	T = 415	0.56	24.1	C	86.4
		R = 34					R = 34					R = 34					R = 34				
	SBL	L = 16	0.04	13.7	B	5.8	L = 16	0.04	14.6	B	5.9	L = 16	0.04	17.4	B	22.5	L = 16	0.05	32.4	C	20.2
	SBTR	T = 510	1.03	64.7	F	197.1*	T = 510	0.79	22.1	C	115.9	T = 510	0.88	36.6	D	178.6	T = 510	0.87	46.6	D	240.8
		R = 182					R = 182	0.35	16.7	B	22.9	R = 182	0.39	20	C	48.0	R = 182	0.39	31.5	C	48.7
	Overall			38.1	D				19.6	B				26.8	C				32.1	C	

Springfield Road and Dilworth/Benvoulin Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 83	0.51	38.6	D	29.1	L = 83	0.51	36.2	D	28.1	L = 83	0.53	36.1	D	43.6	L = 83	0.53	37.6	D	41.6
EBTT	T = 700	0.81	43.6	D	104.5	T = 700	0.64	35.2	D	102.7	T = 700	0.63	34.6	D	153.8	T = 700	0.63	47.2	D	88.6
EBR	R = 357		0		45.1	R = 357		0		29.5	R = 357		0		90.3	R = 357		0		46.4
WBL	L = 26	0.25	51.7	E	15.3	L = 26	0.16	45.5	E	14.7	L = 26	0.16	44.9	E	41.2	L = 26	0.17	47.5	E	45.9
WBTT	T = 692	1.48	275.3	F	158.6*	T = 692	0.94	65.1	E	132.3*	T = 692	0.92	61.3	E	245.7	T = 692	0.92	61.3	E	225.3
WBR	R = 710		0		236.5*	R = 710		0		233.4*	R = 710		0		195	R = 710		0		174.7
NBL	L = 308	0.92	51.4	D	121.5*	L = 308	1.11	134.9	F	150.5*	L = 308	1.17	157.7	F	196.7	L = 308	1.17	157.7	F	200.5
NBTTR	T = 1332 / R = 36	1.07	82.3	F	246.5*	T = 1332 / R = 36	1.09	93	F	265.5*	T = 1332 / R = 36	1.08	88.7	F	501.5	T = 1332 / R = 36	1.08	88.7	F	487.5
SBL	L = 597	1.40	227.2	F	246.7*	L = 597	1.11	120.7	F	133.3*	L = 597	1.17	144.2	F	181.0	L = 597	1.17	144.2	F	195.7
SBTTR	T = 1252 / R = 71	0.82	29.7	C	198.1*	T = 1252 / R = 71	1.03	70.9	F	248.1*	T = 1252 / R = 71	1.02	67.6	F	385.4	T = 1252 / R = 71	1.02	67.6	F	309.6
Overall			105	F				80.2	F				81.8	F				83.6	F	

Springfield Road and Durnin Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBR	R = 104	0.43	32.7	C	24.2	R = 104	0.55	49.7	D	18.1	R = 104	0.54	50.8	D	33.6	R = 104	0.54	50.8	D	27.2
WBR	R = 8	0.01	30.5	C	0.7	R = 8	0.04	45.6	D	0	R = 8	0.04	45.5	D	8.2	R = 8	0.04	45.5	D	8.5
NBL	L = 141	1.30	194.7	F	65.1*	L = 141	0.65	24.1	C	21.7	L = 141	0.66	24.6	C	53.1	L = 141	0.66	24.6	C	70.5
NBTTR	T = 1841 / R = 40	0.76	7.5	A	251.7*	T = 1841 / R = 40	0.74	13.4	B	165	T = 1841 / R = 40	0.70	9.5	B	264.4	T = 1841 / R = 40	0.70	9.5	B	258
SBL	L = 3	0.03	2.9	A	1.7	L = 3	0.03	10.6	B	0.4	L = 3	0.02	14.8	B	26.1	L = 3	0.02	14.9	B	26.0
SBTTR	T = 1651 / R = 97	0.71	6.6	A	222*	T = 1651 / R = 97	0.73	13.7	B	279.4*	T = 1651 / R = 97	0.74	14.2	B	382.8	T = 1651 / R = 97	0.74	15.8	B	182.0
Overall			14.6	B				14.6	B				13.3	B				14	B	

Springfield Road and Leckie Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBTL	L = 312 / T = 6	0.66	36.4	D	109.9*	L = 312 / T = 6	0.68	41.3	D	121*	L = 312 / T = 6	0.83	58.1	E	73.2	L = 312 / T = 6	0.83	58.1	E	78.5
EBR	R = 519	0.82	35.5	C	134*	R = 519	0.83	39	D	146.3*	R = 519	0.95	61.1	E	77.8	R = 519	0.95	61.1	E	68.2
WBL	L = 23	0.15	45.8	D	10.4	L = 23	0.17	51.4	D	11.3	L = 23	0.36	63	E	15	L = 23	0.36	63	E	15.6
WBTR	T = 10 / R = 15	0.05	24.9	C	8	T = 10 / R = 15	0.05	27.9	C	8.8	T = 10 / R = 15	0.06	32.9	C	10.3	T = 10 / R = 15	0.06	32.9	C	27.8
NBL	L = 282	1.73	401.5	F	154.5*	L = 282	0.85	68.9	E	62.5*	L = 282	0.81	56.9	E	51.1	L = 282	0.81	56.9	E	119.2
NBTTR	T = 1449 / R = 2	0.75	23.7	C	165.5	T = 1449 / R = 2	0.78	28.4	C	101.4	T = 1449 / R = 2	0.70	20.6	C	111.1	T = 1449 / R = 2	0.70	20.6	C	305.8
SBL	L = 1	0.01	32	C	1.3	L = 1	0.41	144.4	F	2.2	L = 1	0.41	144.4	F	2.6	L = 1	0.41	144.4	F	
SBTTR	T = 1109 / R = 214	0.97	59	E	215.3*	T = 1109 / R = 214	0.93	51.4	D	224*	T = 1109 / R = 214	0.84	37.1	C	306.1	T = 1109 / R = 214	0.84	37.1	C	523.3
Overall			65.8	E				41.9	D				37.4	D				37.4	D	

Leckie Road and Parkview Crescent

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 6	0.01	8.2	A	0	L = 6	0.01	6.2	A	1.8	L = 6	0.01	19.1	A	6.5	L = 6	0.01	18.1	A	5
EBTR	T = 555 / R = 254		0	A		T = 555 / R = 254	0.44	6.6	A	32.5	T = 555 / R = 169	0.52	22.4	A	56.4	T = 555 / R = 224	0.53	21.9	A	65.3
WBTTR	L = 140 / T = 381 / R = 8	0.15	10.4 / 0.7	B / A	3.75	L = 140 / T = 381 / R = 8	0.28 / 0.20	12.1 / 5.9	B / A	20.3 / 18.3	L = 111 / T = 381 / R = 8	0.43 / 0.27	23.1 / 11.6	B / A	58.2 / 174	L = 111 / T = 381 / R = 8	0.43 / 0.25	23 / 10.6	B / A	61 / 166.9
NBL	L = 279	2.19	613.7	F	183.75	L = 279	0.59	18.7	B	42.3	L = 279	0.62	22.7	B	24.3	L = 279	0.63	22.85	B	24.7
NBTR	R = 50	0.12	14.6	B	3	R = 50	0.13	14.3	B	0	R = 50	0.13	17.4	B	79.8	R = 50	0.13	17.4	B	83.2
SBL	L = 5	0.07	52.5	F	1.5	L = 5	0.01	14.7	B	1.9	L = 5	0.01	17.9	B	5.1	L = 5	0.01	18	B	5.8
SBTR	R = 10	0.01	9.5	A	0	R = 10	0.03	13.8	B	0	R = 10	0.03	16.8	B	9.1	R = 10	0.03	16.8	B	16.6
Overall			104.8					9.2	A				19.6	B				19.3	B	

Highway 97 and Dilworth Drive

	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 97	0.65	64.8	E	82.6*	L = 97	0.48	45.9	D	45*	L = 97	0.52	52.5	D	57	L = 97	0.52	52.5	D	69.2
EBTTR	T = 535 / R = 104	0.54	39.3	D	104.7	T = 535 / R = 104	0.86	59.9	E	127.9*	T = 535 / R = 104	0.65	44.8	D	101.1	T = 535 / R = 104	0.65	44.8	D	109
WBL	L = 279	1.61	346.0	F	170.2*	L = 279	0.92	57.7	E	128.4*	L = 279	1.32	209.9	F	65.4	L = 279	1.32	210.4	F	66.6
WBTTR	T = 444 / R = 444	0.65	41.2	D	295.9*	T = 444 / R = 444	0.66	41.8	D	284.3*	T = 444 / R = 444	0.57	36.3	D	262.9	T = 444 / R = 444	0.57	36.4	D	305
NBL	L = 184	0.82	40.7	D	79.9*	L = 184	1.12	162.2	F	112.1*	L = 184	1.12	134.6	F	91.7	L = 184	1.06	113.4	F	87.1
NBTTTR	T=2220 / R = 138	0.94	41.5	D	281.8*	T=2220 / R = 138	1.04	69.9	F	276* / 14.4	T=2220 / R = 138	0.97	48.5	D	420.2 / 97.5	T=2220 / R = 138	0.97	48.5	D	438.5 / 100.1
SBL	L = 318	1.14	140.3	F	154.9*	L = 318	1.17	165.3	F	80.7*	L = 318	1.63	343.5	F	148.5	L = 498	2.55	752.1	F	155.9
SBTTT	T = 1874	0.79	25.0	C	171.2	T = 1874	0.93	44.9	D	223.9*	T = 1874	0.78	50.1	D	176.1	T = 1874	0.78	30.6	D	177.9
SBR	R = 58	0.71	0.0		5.9	R = 58		0.0		2.4	R = 58		0.0		39.7	R = 58		0.0		40.7
Overall			56.6	E				66.1	E				74.3	E				109.1	F	

Highway 97 and Underhill Street

	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBR	R = 250	1.91	494	F	154.5	R = 250	1.92	494	F	154.5	R = 250				19.1	R = 250	1.88	475.5	F	10.8
NBTTT	T=2373					T=2373					T=2338	0.59	0.1	A	51.0	T=2338				137.2
NBR	R = 312					R = 312					R = 347				43.2	R = 347				31.8
SBL	L = 181	4.23	1638.0	F	161.3	L = 181	4.23	1638.0	F	161.3	L = 251	0.86	36.6	D	34.4	0				
SBTTT	T = 2167					T = 2167					T = 2167	0.48	0.6	A	173.8	T = 2367				464.8
Overall			79.5					79.5					2.2	A				22.4		

Highway 97 and Leckie Road

	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 151	0.84	66.5	E	65	L = 151	0.93	103.2	F	200.6*	L = 151	0.90	95.4	F	55.7	L = 151	0.90	95.4	F	52
EBTR	T = 200 / R = 65	0.85	64.4	E	116.4*	T = 200 / R = 65	0.20	33.9	D	40.1	T = 200 / R = 65	0.20	33.2	C	55.1	T = 200 / R = 65	0.20	33.2	C	56.6
WBL	L = 245	1.60	344.7	F	157.5*	L = 245	0.74	51	F	1221*	L = 245	0.72	49.8	D	87.2	L = 245	0.72	49.8	D	83.4
WBT	T = 204	1.00	102.3	F	108.8*	T = 204	0.39	36.2	E	70.7	T = 204	0.38	35.5	D	184.2	T = 204	0.38	35.5	D	175.4
WBR	R = 497		0		0	R = 497		0		0	R = 409		0		104.9	R = 409		0		98.4
NBL	L = 99	0.74	71.8	E	62.7*	L = 99	0.82	83.4	F	28.1	L = 99	0.57	29.1	C	37	L = 99	0.57	29.1	C	33.8
NBTTTR	T=2242 / R = 190	0.85	30.8	C	296.8*	T=2242 / R = 190	1.02	59.9	F	225.5*	T=2242 / R = 155	1.07	81.1	F	206.2	T=2242 / R = 155	1.07	81.1	F	111.0
SBL	L = 463	2.42	690.2	F	290.4*	L = 463	1.12	137	F	103.3*	L = 304	1.06	111.6	F	102.2	L = 304	1.31	202.8	F	150.8
SBTTT	T=1933	0.60	14.3	B	146.9	T=1933	0.76	27.6	D	129.1*	T=2003	0.77	27.1	C	220.1	T=2003	0.77	27.1	C	273.2
SBR	R = 80		0.0		0	R = 80		0.0		0	R = 80		0.0		36.2	R = 80		0.0		25.3
Overall			102.5	F				54.8	D				57.7	E				64.9	E	

Highway 97 and Banks Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 128	0.67	64.3	E	74.7*	L = 128	0.86	95.8	F	79.6	L = 128	0.70	67.4	E	92.2	L = 128	0.70	67.4	E	90.2
EBT	T = 319	0.63	42.8	D	115.5	T = 319	0.72	49.3	D	120.8	T = 319	0.92	77.8	E	187.6	T = 319	0.92	77.8	E	185
EBR	R = 414		0		111.3	R = 414		0		144*	R = 414		0		82.5	R = 414		0		88.4
WBL	L = 132	0.73	65.3	E	81*	L = 132	0.95	100.9	F	85.5*	L = 132	0.85	73.1	E	91.2	L = 132	0.85	73.1	E	87.8
WBT	L = 299	0.61	41.2	D	110.2	L = 299	0.69	46	D	115.2	L = 299	0.62	42.3	D	167.3	L = 299	0.62	42.3	D	167.6
WBR	R = 76		0		15.6	R = 76				16.3	R = 164				26.9	R = 164				28.8
NBL	L = 313	1.35	224.5	F	168.8*	L = 313	0.90	82.4	F	46.8*	L = 313	1.01	95.7	F	72.5	L = 313	1.01	95.7	F	72.2
NBTTT	T=2427	1.06	67.8	F	349.5*	T=2427	1.02	54.4	F	57.1	T=2339	1.07	73.2	F	69.1	T=2339	1.07	73.2	F	66.7
NBR	R = 746		0		234.2*	R = 746		0		20.1	R = 746		0		114.7	R = 746		0		91.0
SBL	L = 134	0.84	53.5	D	43.4	L = 134	1.00	135.3	F	84.0	L = 222	1.06	118.8	F	95.3	L = 222	1.06	118.8	F	103.5
SBTTT	T=2104	0.92	38.3	C	227.2	T=2104	0.87	32	C	212.3	T=2015	0.97	49.5	D	455.0	T=2015	0.97	49.5	D	434.9
SBR	R = 485		0		101.0	R = 485		0		102.8	R = 485		0		126.7	R = 485		0		120.4
Overall			62.3	E				51.3	D				66.4	E				66.4	E	

Baron Road and Dilworth Drive/Mall Entrance

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 238	0.82	34	C	64.7*	L = 238	0.91	61.9	E	78.6*	L = 238	0.87	53.9	E	63.9	L = 328	1.07	67.1	E	68.6
EBTTR	T = 484	0.33	11	B	37.6	T = 484	0.65	35.1	D	76.6	T = 484	0.65	35.5	D	110.3	T = 574	0.70	32.2	D	150.6
	R = 111					R = 111					R = 111					R = 111				
WBL	L = 165	0.67	29.5	C	52.7*	L = 165	0.55	26.7	C	37.9	L = 165	0.55	27.3	C	88.6	L = 165	0.56	25.5	C	85.6
WBTTR	T = 583	0.81	29	C	93.1	T = 583	0.65	34.3	C	78	T = 583	0.68	35.7	C	271.6	T = 583	0.68	33.8	C	291.9
	R = 363					R = 363	0.94	66	E	23.1	R = 363	0.98	77.6	E	82.1	R = 363	0.98	46.8	E	86.1
NBLT	L = 127	2.56	755	F	122*	L = 127	0.82	55.9	E	41.5*	L = 127	0.82	56	E	64.7	L = 127	0.83	58.2	E	56.2
	T = 162					T = 162	0.52	30.4	C	64.7	T = 162	0.52	30.4	C	61.7	T = 162	0.52	30.4	C	57.5
NBR	R = 88	0.06	19	C	2.3	R = 88					R = 88					R = 88				
SBLT	L = 334	1.78	391.4	F	203.5*	L = 334	0.72	26.8	C	67.8	L = 334	0.72	26.7	C	155.4	L = 244	0.57	22.1	C	165
	T = 188					T = 188	1.19	129.5	F	215.5*	T = 188	1.18	128.4	F	152.8	T = 188	1.24	152.1	F	152.5
SBR	R = 522	0.66	26.8	C	81.3*	R = 522					R = 522					R = 522				
Overall			144.3	F				59.3	E				60.0	E				61.7	E	

Baron Road and Underhill Street

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLTR	L = 101	35.90	>300	F	315.75	L = 101	0.25	13.4	B	15.4	L =206	0.61	26.5	C	69.4	L =206	0.87	69.4	E	67
	T = 11					T = 11	0.45	13.4	B	19.8	T = 11	0.49	21.1	C	149.5	T = 11	0.37	34.5	C	282.4
	R = 195					R = 195					R = 195					R = 105				
WBLTR	L = 112	7.43	3005.0	F	452.3	L = 112	0.31	16.9	B	17.4	L = 112	0.40	27.1	C	39.5	L = 112	0.47	41.9	D	36.3
	T = 58					T = 58	0.11	11.4	B	9.5	T = 58	0.12	18.1	B	17.9	T = 58	0.15	32.4	C	5.4
	R = 331					R = 331	0.74	17.2	B	23.8	R = 331	0.80	30.7	C	45.5	R = 331	1.08	112.2	F	14.7
NBL	L = 89	0.11	10.2	B	3	L = 89	0.43	22.9	C	27.2*	L = 89	0.35	23.2	C	33.7	L = 89	0.50	21.4	C	36.8
NBTR	T = 489					T = 489	0.80	14.8	B	110.9*	T = 489	0.68	10.7	B	76.4	T = 489	0.57	7.8	A	97.3
	R = 175					R = 175					R = 175					R = 175				
SBL	L = 35	0.04	9.2	A	0.75	L = 35	0.13	16.8	B	6.8	L = 35	0.11	17	B	25	L = 35	0.08	13.4	B	24.1
SBTR	T = 762					T = 762	0.90	22.5	C	143.8*	T = 762	0.77	12.7	B	73.8	T = 762	0.64	10.6	B	78.9
	R = 28					R = 28					R = 28					R = 28				
Overall			35.9					17.9	B				17.6	B				32.1	C	

Baron Road and Durnin Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBLR	L = 89	1.15	163.2	F	85.5	L = 89	1.16	163.2	F	85.5	L = 88	1.09	187.8	F	32.3	L = 88	1.09	187.8	F	32.3
	R = 128					R = 128					R = 128	0.33	17.8	C	27.5	R = 128	0.33	17.8	C	23.6
NBTR	T = 566					T = 566					T = 671				8.4	T = 671				8
	R = 50					R = 50					R = 50					R = 50				
SBL	L = 136	0.15	9.4	A	3.75	L = 136	0.16	9.6	A	3.75	L = 136	0.17	10.1	B	36	L = 136	0.17	10.1	B	27.1
SBT	T = 574					T = 574					T = 574				66.2	T = 574				57.7
Overall			23.8					23.8					12.2					12.2		

Baron Road and Leckie Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 135	0.83	66.7	E	64.6*	L = 135	0.68	36.7	D	46*	L = 135	0.68	35.5	D	44.2	L = 135	0.68	33.1	C	44.8
EBTR	T = 546	0.00	0	A	260.9*	T = 546	0.86	48.0	D	113.4*	T = 440	0.49	29.3	C	78.1	T = 440	0.54	29.5	C	94.7
	R = 224	1.49	261.1	F		R = 224	0.86	49.4	D		R = 136	0.49	29.5	C		R = 136	0.55	29.6	C	
WBL	L = 31	0.38	46	D	14.4	L = 31	0.20	28.4	C	10.8	L = 31	0.14	35.2	D	37	L = 31	0.15	37.2	D	32.3
WBTTR	T = 542	0.69	29.3	C	74.6	T = 542	0.86	50.5	D	102.4*	T = 542	0.83	50.1	D	127.5	T = 542	0.83	50.0	D	129.7
	R = 165					R = 165	0.87	51.7	D		R = 165	0.83	51.0	D		R = 165	0.83	50.9	D	
NBL	L = 262	0.93	54.8	D	78.6*	L = 262	0.89	45.4	D	90.8*	L = 174	0.81	44.9	D	80.8	L = 174	0.81	44.9	D	66.6
NBTR	T = 365	0.67	24.9	C	95.2	T = 365	0.65	27.1	C	105.7	T = 453	0.80	38.1	D	179.6	T = 453	0.80	38.1	D	136.7
	R = 55					R = 55					R = 55					R = 55				
SBL	L = 216	0.54	17	B	31.7	L = 216	0.59	22.6	C	39.2	L = 216	0.69	29.0	C	107.7	L = 216	0.69	29.0	C	92.8
SBTR	T = 565	1.26	154.4	F	236.8*	T = 565	0.93	50.4	D	184.6	T = 653	0.94	52.6	D	201.2	T = 653	0.94	52.6	D	170.9
	R = 190					R = 190	0.38	24.6	C	15.2	R = 190	0.33	23.9	C	50.7	R = 190	0.33	23.9	C	22.3
Overall			114.5	F				42.7	D				41.0	D				40.7	D	

Baron Road and Banks Road

Movement	BEFORE MITIGATION — Future Total (2021)					MITIGATION - December 2019 — Future Total (2021)					MITIGATION - Underhill Signal and Reassignment — Future Total (2021)					MITIGATION - Underhill Closure — Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L =149	0.48	26	C	37.5	L =149	0.42	22.5	C	44.6	L =149	0.42	24.5	C	48	L =149	0.42	24.5	C	44.3
EBTR	T = 34	0.00	0	A	27.9	T = 34	0.00	0	A	34.4	T = 34	0.00	0	A	135	T = 34	0.00	0	A	105.8
	R = 354	0.89	45	C		R = 354	0.84	31.1	C		R = 442	0.87	32.4	D		R = 442	0.87	32.4	D	
WBLTR	L = 33	0.47	23.8	C	36.8*	L = 33	0.39	20.8	C	38*	L = 33	0.44	29.4	C	36.8	L = 33	0.44	29.4	C	28.8
	T = 32					T = 32					T = 32					T = 32				
	R = 22					R = 22					R = 22					R = 22				
NBL	L = 214	0.84	31.9	B	47.7*	L = 214	0.62	16.2	B	27.6	L = 302	0.87	36.4	D	80.4	L = 302	0.87	36.4	D	78.1
NBTR	T = 441	0.47	10.3	A	59.2	T = 441	0.59	15.6	B	84.6	T = 441	0.61	20.4	C	153.8	T = 441	0.61	20.4	C	125.1
	R = 28					R = 28					R = 28					R = 28				
SBL	L = 22	0.05	15.1	B	7.0	L = 22	0.09	15	B	4.2	L = 22	0.07	21.1	C	24.6	L = 22	0.07	21.1	C	27.5
SBTR	T = 472	1.07	79	F	188.1*	T = 472	0.78	23.4	C	109.0	T = 472	0.88	43	D	278.2	T = 472	0.88	43	D	248.3
	R = 214					R = 214	0.44	18.9	B	24.2	R = 214	0.49	26.7	C	48.1	R = 214	0.49	26.7	C	48.5
Overall			44.5	D				21.6	C				31.3	C				31.3	C	

Table 4-3: Summary of Underhill Street Mitigation Saturday Peak Hour Modelling Results – 4 of 4

Springfield Road and Dilworth/Benvoulin Road

	BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
	Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 108	0.50	30.7	D	28.3	L = 108	0.64	40.3	D	39.5*	L = 108	0.64	40.4	D	41.3	L = 108	0.64	40.4	D	42.8
EBTT	T = 460	0.43	27	D	51	T = 460	0.50	33.8	C	65.2	T = 460	0.50	33.8	C	88.8	T = 460	0.50	33.8	C	98.2
EBR	R = 385		0		21.8	R = 385		0		24.5	R = 385		0		58.9	R = 385		0		61.7
WBL	L = 26	0.11	34	D	12	L = 26	0.13	41	C	14.3	L = 26	0.13	41	C	53.4	L = 26	0.13	41	C	48.8
WBTT	T = 520	0.81	43.8	D	72.2	T = 520	1.01	87.2	D	104.1*	T = 520	1.01	87.2	D	192.9	T = 520	1.01	87.2	D	183.2
WBR	R = 516		0		5008	R = 516		0		89.3*	R = 516		0		214.7	R = 516		0		123.1
NBL	L = 364	1.12	109.7	D	139.3*	L = 364	1.02	96.2	F	152.8*	L = 364	1.02	96.2	F	126.1	L = 364	1.02	96.2	F	142.9
NBTTR	T = 694, R = 30	0.78	40.5	E	125.7*	T = 694, R = 30	0.55	28.6	C	98.4	T = 694, R = 30	0.55	28.6	C	618.2	T = 694, R = 30	0.55	28.6	C	533.2
SBL	L = 532	1.02	68.8	E	185.6*	L = 532	0.86	50.8	D	79.4	L = 532	0.86	50.8	D	137.6	L = 532	0.86	50.8	D	66.3
SBTTR	T = 1100, R = 85	0.90	38.5	C	200.5*	T = 1100, R = 85	0.92	45.3	D	198.8*	T = 1100, R = 85	0.92	46.5	D	233.6	T = 1100, R = 85	0.92	46.5	D	241.1
Overall			49	D				52	D				52.4	D				52.4	D	

Springfield Road and Durnin Road

	BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
	Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBR	R = 166	0.59	33.4	D	39	R = 166	0.51	31	C	19.3	R = 166	0.63	42.4	D	39.5	R = 166	0.63	42.4	D	33.8
WBR	R = 8	0.01	28	C	0	R = 8	0.02	27.3	C	0	R = 8	0.03	37.1	D	8.2	R = 8	0.03	37.1	D	9
NBL	L = 142	1.10	119.9	F	56.5*	L = 142	0.64	21.9	C	43.9*	L = 142	0.61	19.8	B	96.6	L = 142	0.61	19.8	B	67.3
NBTTR	T = 1239, R = 39	0.54	6	A	111.7	T = 1239, R = 39	0.56	8.8	A	109.1	T = 1239, R = 39	0.52	8.3	A	256	T = 1239, R = 39	0.52	8.3	A	240.8
SBL	L = 2	0.01	3.6	A	1.1	L = 2	0.01	13.4	B	1.6	L = 2	0.01	17.7	B	17.9	L = 2	0.01	17.7	B	4.0
SBTTR	T = 1502, R = 69	0.67	7.4	A	160.2	T = 1502, R = 69	0.83	22	C	232.1*	T = 1502, R = 69	0.73	17.8	B	453.2	T = 1502, R = 69	0.73	17.8	B	288.1
Overall			13.3	B				17.1	B				15.4	B				15.4	B	

Springfield Road and Leckie Road

	BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
	Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBTL	L = 265, T = 29	0.69	38.3	D	102.4*	L = 265, T = 29	0.75	47	D	111.8*	L = 265, T = 29	0.75	47	D	74	L = 265, T = 29	0.75	47	D	70.1
EBR	R = 477	0.69	23.5	C	93.7	R = 477	0.83	39.7	D	115.8	R = 477	0.83	39.7	D	66.9	R = 477	0.83	39.7	D	69.6
WBL	L = 29	0.24	46.3	D	12.6	L = 29	0.31	54.5	D	13.8	L = 29	0.31	54.5	D	15	L = 29	0.31	54.5	D	20.9
WBTR	T = 8, R = 17	0.06	26.2	C	7.5	T = 8, R = 17	0.06	30.4	C	8.2	T = 8, R = 17	0.06	30.4	C	9.8	T = 8, R = 17	0.06	30.4	C	12.1
NBL	L = 349	1.11	122.3	F	143.2*	L = 349	0.83	54.9	D	58.9*	L = 349	0.83	54.9	D	56.3	L = 349	0.83	54.9	D	57.8
NBTTR	T=1005, R = 6	0.49	13.1	B	78.6	T=1005, R = 6	0.45	15.6	B	101.7	T=1005, R = 6	0.45	15.6	B	81.6	T=1005, R = 6	0.45	15.6	B	88.4
SBL	L = 7	0.03	21.7	C	4.2	L = 7	0.81	73.1	E	6.5	L = 7	0.81	73.1	E	18.8	L = 7	0.81	73.1	E	29.6
SBTTR	T = 975, R = 220	1.03	76.5	F	190.7*	T = 975, R = 220	0.81	32.7	C	168.5*	T = 975, R = 220	0.81	35.7	C	325.4	T = 975, R = 220	0.81	35.7	C	263.2
Overall			51.1	D				32.4	C				33.3	C				33.3	C	

Leckie Road and Parkview Crescent

	BEFORE MITIGATION					MITIGATION - December 2019					MITIGATION - Underhill Signal and Reassignment					MITIGATION - Underhill Closure				
	Future Total (2021)					Future Total (2021)					Future Total (2021)					Future Total (2021)				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 12	0.01	8.3	A	0	L = 12	0.02	6.8	A	2.8	L = 12	0.02	15.4	B	9.6	L = 12	0.02	15.1	B	6.9
EBTR	T = 544					T = 544	0.54	7.6	A	29.5	T = 544	0.48	18.2	B	37.3	T = 544	0.52	18.6	B	38.1
	R = 339					R = 339	0.54	7.6	A		R = 233	0.48	18.3	B	62.3	R = 303	0.52	18.8	B	62.3
WBTTR	L = 154	0.22	11.3	B	6	L = 154	0.45	14.2	B	41.2*	L = 154	0.51	20.4	C	41	L = 154	0.55	22.4	C	41
	T = 415		0	A		T = 415	0.24	6	A	19.9	T = 415	0.25	8.3	A	45.1	T = 415	0.24	8	A	48.8
	R = 8					R = 8	0.24	6	A		R = 8	0.25	8.3	A	38.9	R = 8	0.25	8	A	42.1
NBL	L = 290	3.28	1123.7	F	227.3	L = 290	0.55	15.3	B	44.3	L = 290	0.62	20.9	B	25.3	L = 290	0.62	20.9	B	24.3
NBTR	R = 44	0.11	14.9	B	3	R = 44	0.10	11.4	B		R = 44	0.11	15.4	B	73.3	R = 44	0.11	15.4	B	76
SBL	L = 5	0.09	75.8	F	2.25	L = 5	0.01	11.7	B	1.9	L = 5	0.01	15.8	B	4.7	L = 5	0.01	15.8	B	5.4
SBTR	R = 16	0.02	9.7	A	0.75	R = 16	0.04	11.2	B	0	R = 16	0.04	15.1	B	11.2	R = 16	0.04	15.1	B	8
Overall			231.2					9.1	A				16.3	B				16.7	B	

4.1.1 SCENARIO 1 – LEFT TURN LANE SIGNALIZATION AT HIGHWAY 97/UNDERHILL STREET

The idea behind adding a coordinated left turn signal at Underhill Street/Highway 97 is to encourage travellers to disperse their left turns from the Highway and onto the local network over several intersections instead of at Dilworth Drive and Leckie Road which are already overloaded and not meeting thresholds.

The modelling results showed that moving some traffic from Leckie Road to Underhill Street along Highway 97 and providing protected/permissive phasing for all time periods at Leckie Road will have similar mitigation results to adding a southbound dual left turn lane along Highway 97. The signal will also not impact Dilworth Drive if coordinated correctly.

Despite these potential benefits, this scenario option was not approved by the Ministry due to Underhill Street's proximity to Dilworth Avenue. It is retained in this final version as a record of the analysis and for future consideration.

4.1.2 SCENARIO 2 – CLOSURE OF LEFT TURN AT UNDERHILL STREET

The closure of the left turn lane along Highway 97 at Underhill street will force all background left turn traffic to Dilworth Drive and Costco traffic moved to Underhill Street in the Scenario 1 back to Leckie Road. The resulting impacts of this closure at Dilworth Drive and Highway 97 are very long left turn delays and high V/C ratios that do not meet the thresholds.

The PM peak hour V/C ratios would change from 1.38 to 2.62 and delays in excess of 795 seconds or 550 seconds more than if Underhill Street remained open. Similarly, the Saturday V/C ratios would change from 1.40 to 1.80 and changes in delays by approximately 180 seconds. Further mitigation at Dilworth Drive and Highway 97 would be required with this closure such as a dual southbound left turn lane.

The local street network would also see an increase in through and left turn traffic along Dilworth Drive to Baron Road but at the same time there would be a decrease in left turn traffic from Baron Road onto Dilworth Drive. Leckie Road modelling results with a single left turn lane and optimized with protected/permitted phasing would also not meet acceptable thresholds with a closure of Underhill Street.

Earlier versions of this report recommended a northbound southbound left turn signal at Underhill be added for the following reasons:

1. Based on the additional modeling, adding a signal at Underhill and moving highway left turn traffic from Leckie Road to Underhill Street has a similar capacity effect as adding a second southbound left turning lane at Dilworth or Highway 97/Leckie Road.

2. The addition of a signal at Underhill provides additional left turning capacity without stealing green time for a protected phase at either Dilworth of Leckie. Thus, it increases the volume of left turns without decreasing the LOS of the other phases at Dilworth or Leckie.

3. Does not affect overall travel time through the corridor as the Underhill delay would be coordinated with Dilworth and Leckie. The signal timing can be coordinated such that any vehicles that is delayed at Underhill can be at Leckie before the signal at Leckie transitions to green phase.

Despite these potential benefits, this scenario option was not approved by the Ministry due to Underhill Street's proximity to Dilworth Avenue. It is retained in this final version as a record of the analysis and for future consideration.

4.2 SENSITIVITY ANALYSES AND MITIGATION

After the first iteration of this report in December 2019, the Ministry and City requested additional sensitivity analyses to test various distribution, assignment, and network performance assumptions. Our team applied these distribution and assignment changes to the 2021 total development scenario only. Costco development traffic was also redistributed and reassigned within the network. In the updated scenario models, the signal timings were optimized and SimTraffic was used to determine the queues instead of the Synchro queue results.

4.2.1 LECKIE / BARON DISTRIBUTION

These updates incorporate small changes to the assignment of Costco development traffic from the north and south as well as optimized signal timing and offsets for the network using the existing cycles lengths along the highway. In order to ensure there was no spill back onto the Highway from Leckie Road, more mitigation measures were added to the network in the modelling scenarios:

1. Addition of a protected/permissive westbound left turn arrow at Highway 97/Banks Road since queues propagated back upstream from one intersection to the next.

2. Right turn slip lane at Baron Road / Durnin Road, again since queues propagated back upstream from one intersection to the next.

3. Addition of a protected/permissive westbound left turn arrow at Highway 97/Dilworth Drive (this was not needed to mitigate Leckie queues but added due to the heavy left turn volumes along Dilworth Drive), again since queues propagated back upstream from one intersection to the next.

The updated model results are also shown in Table 4-4 above. The resulting eastbound 95th percentile queues from SimTraffic with the above mitigation measures at Baron Road/Leckie Road and Baron Road/Bank Road are summarized in Table 4-4 below.

Table 4-4: Queue Length Summary

Location	Direction	Weekday with Re-assignment	Saturday with Re-assignment
Leckie Road/Baron Road	Eastbound left	58.5 m	44.2 m
	Eastbound Through/right	87.3 m	78.1 m
Banks Road/Baron Road	Eastbound left	34.6 m	48 m
	Eastbound Through/right	93.8 m	135 m

the longest queue of a lane is shown if there are more than two lanes in the lane grouping.
The SimTraffic results were completed with 30-minute seeding, 60-minute time interval and three runs.

4.2.2 UNDERHILL / HWY 97 LEFT TURN

Based on instructions from the Ministry, this report's original volume distribution and assignments were adjusted to test alternative network performance outcomes. For the inbound traffic from the north, it was originally assumed that 25% of the total traffic to the new Costco would travel from the northeast and use Highway 97 via the Leckie Road left turn lane. For the reassignment scenario, 8% of this traffic was rerouted to Underhill Street and another 5% was rerouted to Banks Road – reducing the distribution of Costco-bound traffic via Leckie Road to 12%.

A similar process was used for the Saturday peak hour, which originally had a 30% share of Costco-bound traffic utilizing w/b Leckie Road left turn. In this scenario, 8% of this was rerouted to Underhill Street and 10% to Banks

Road – reducing the distribution of Saturday Costco-bound traffic to 12%. Gas bar traffic was already distributed to different routes and no significant volumes were assigned via Leckie Road.

The model network was also adjusted to create this scenario, including the assumed signalization of the Highway 97 / Underhill Street intersection. A short protected phase for the southbound left turn at Underhill Street was introduced. Intersection cycle lengths remained the same along the corridor as existing so a newly-signalized Underhill Street could be coordinated with only minor adjustments. If this signalized scenario does eventually receive Ministry approval, these coordination elements will be refined.

For the Saturday scenario, the background left turn volume was increased from 181 v/h to 251 v/h, resulting in an increased V/C of 0.86. For the weekday scenario, the background left turn volume was increased from 249 v/h to 306 v/h, resulting in a V/C of 0.91.

The northbound queues at the nearby Underhill / Baron Road would be approximately 96m during the PM peak hour and approximately 76m in the Saturday peak if Underhill Street remains open to left turn traffic from the Highway. If Underhill street is closed to left turn traffic from the highway, the northbound PM peak queues are approximately 102m and 97m in the Saturday peak. Both scenarios will accommodate these queues along Baron Road between Underhill Street and Dilworth Drive.

The list of mitigation measures and updates that were applied to the network are shown in Table 4-5. Note that the cycle lengths at the Highway 97 intersections are the same as the existing cycle lengths.

Table 4-5: Mitigation Measures and Network Sensitivity Updates

Location	PM/Saturday Peak Hour Mitigation	Cycle Length – PM (seconds)	Cycle Length – Saturday (seconds)
Highway 97/ Dilworth Drive	• Single left turn lane with protected/permissive left turn phase westbound • Northbound right turn lane • Optimize phases within cycle length	150	130
Highway 97/ Underhill Street	• Signalized left turn as scenario 1	150	130
Highway 97/Leckie Road	• Single left turn lane with protected permissive left turn phase for all **time periods** • An alternative is a double southbound left turn lane • Adjust laning in East/West direction to two through lanes and one left turn lane from Leckie to Highway in both directions • Optimize phases within cycle length	150	130
Highway 97/Banks Road	• Single left turn lane with protected permissive left turn phase for all time periods • Westbound left protected/permissive phase • Optimize phases within cycle length	150	130
Baron/Dilworth/ Mall Entrance	• Adjust lane configuration along Baron Road • Add westbound right along Dilworth Drive • Optimize phases within cycle length.	Scenario 1 110	Scenario 1 100

		Scenario 1 55	Scenario 1 80
Baron Road/ Underhill Street	• Signalize • Left turn lane in East and West • Westbound right turn lane		
Baron Road/Durnin Road	• Westbound right turn slip lane • Review pedestrian crossing options		
Baron Road/Leckie Road	• Change lane configuration to two through and left turn lane along Leckie Road. • Add southbound right turn lane along Baron Road • Optimized phases within cycle length.	120	110
Baron Road/Banks Road	• Add southbound right turn lane. • Optimized phases within cycle length.	75	100
Springfield/Dilworth/ Benvoulin	• Dual southbound left • Increase length of westbound right turn lane and northbound right turn lane	120	110
Springfield Road/ Durnin Road	• Signalize and coordinate between Benvoulin/Dilworth and Leckie Road	120	110
Springfield Road /Leckie Road	• Dual Northbound left • Optimize phases within cycle	120	110
Leckie Road/ Parkview Crescent	• Signalize (permissive only phasing) • Add east/west left turn Lane at Parkview Crescent	60	55

4.3 EFFECT OF COSTCO STORE

The Ministry and City further requested the impacts of the Costco store be assessed independently of the Gas Bar, which as was noted earlier in this report, is an as-of-right land use and could proceed without rezoning approval. The effects of the Costco store alone (without Gas Bar) was were isolated to determine how a phased development could affect local network performance triggers.

The gas bar generates 360 p.m. peak hour trips and 350 Saturday peak hour trips. Assigned network trips for this scenario for 2021 PM peak are shown in Figure 20, 2021 Saturday peak is shown in Figure 21, 2031 PM peak is shown in Figure 22, and 2031 Saturday peak is in Figure 23 below.

These trips have been excluded in the analysis and performance results shown for the PM peak in Table 4-6 and for the Saturday peak in Table 4-7.

The results indicate:

1. There are minor network improvements without the Gas Bar.

2. The Gas Bar has relatively little cumulative effect on overall network performance.
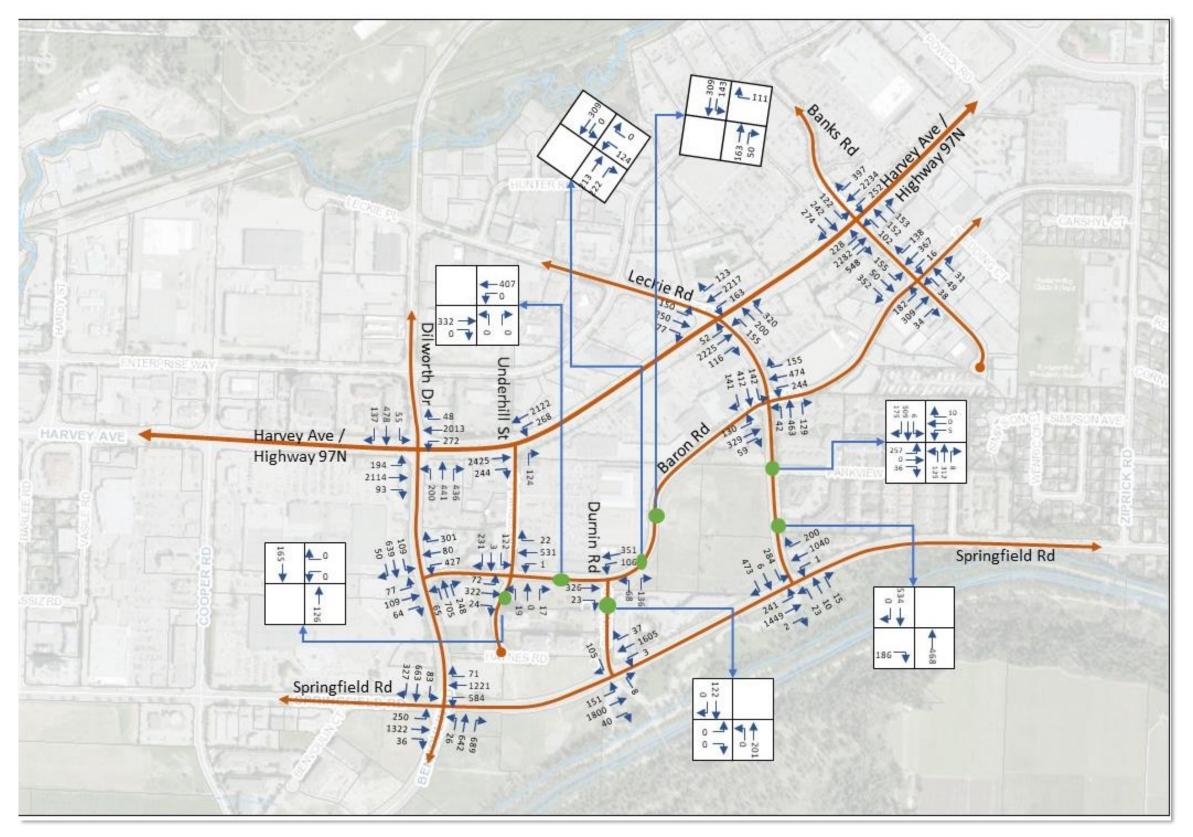
Figure 20: 2021 Costco Trips only (no Gas Bar) PM peak
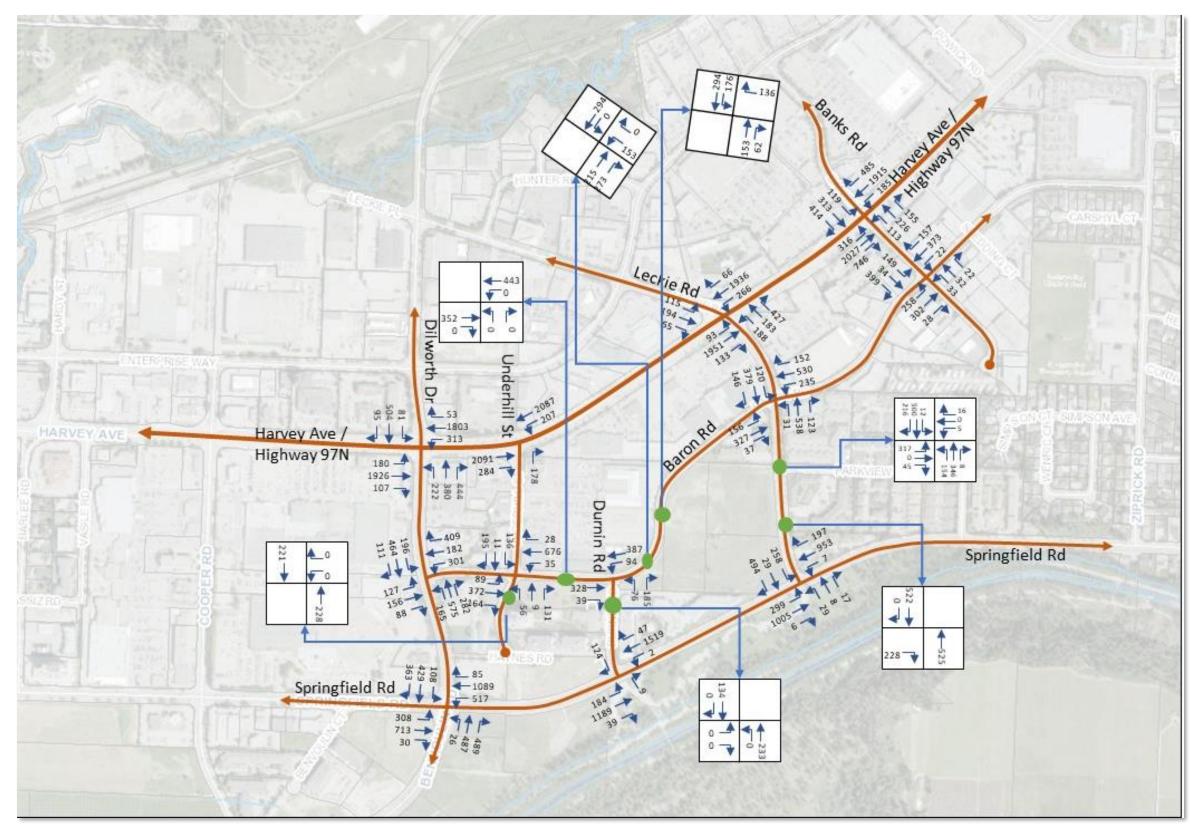
Figure 21: 2021 Costco Trips only (no Gas Bar) Saturday peak
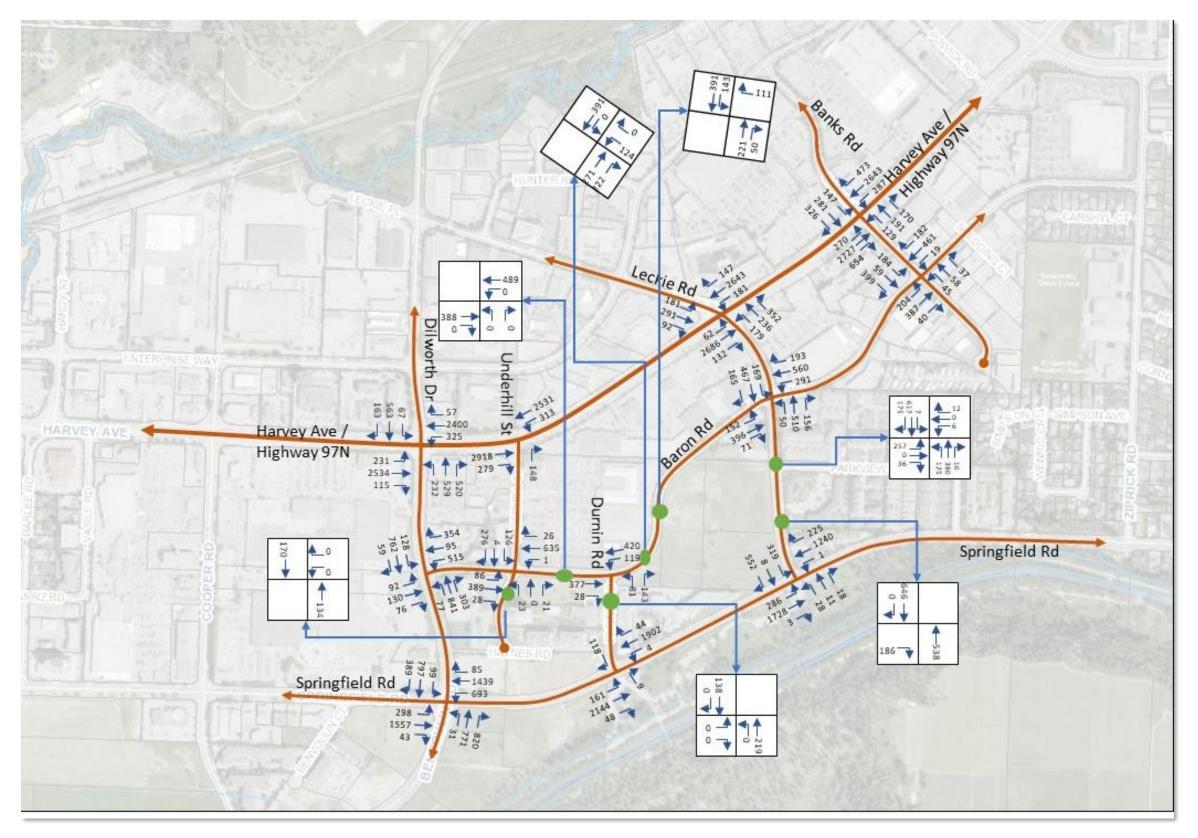
Figure 22: 2031 Costco Trips only (no Gas Bar) PM peak
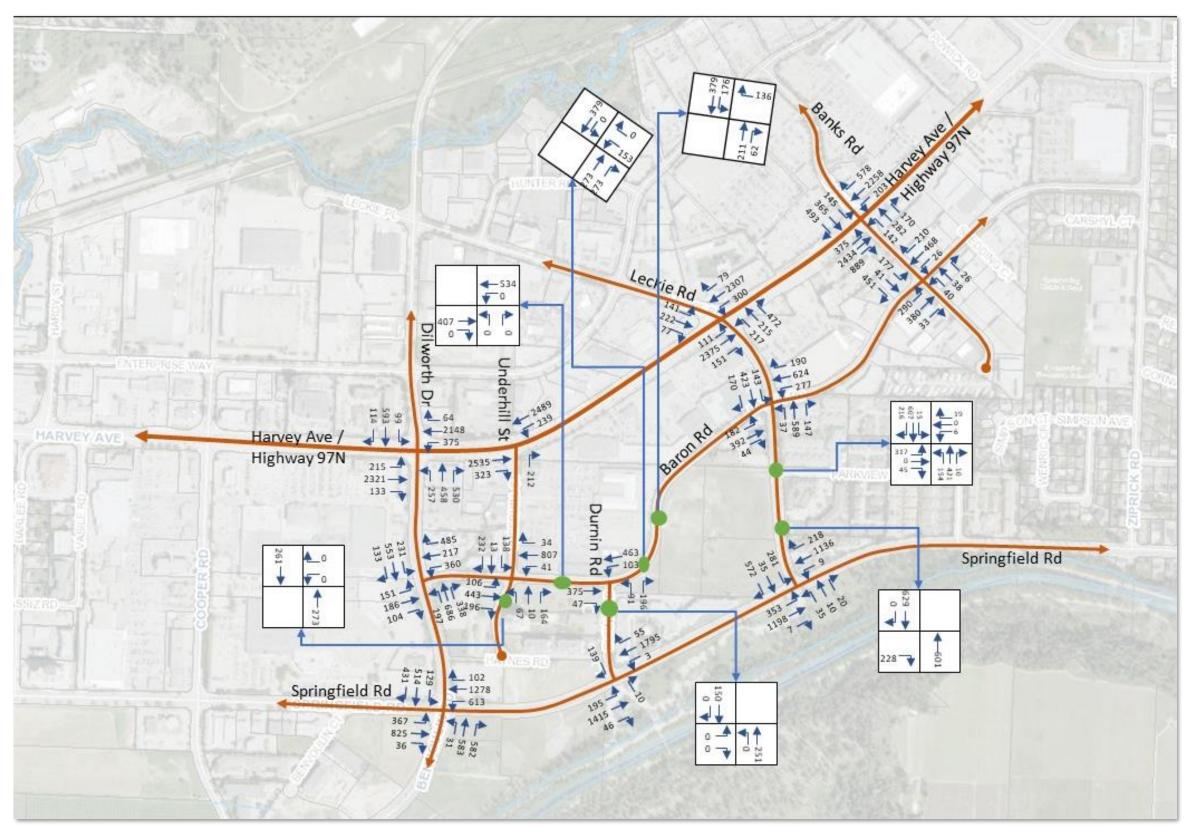
Figure 23: 2031 Costco Trips only (no Gas Bar) Saturday peak

Table 4-6: Summary of Costco Impact Weekday Peak

Highway 97 and Dilworth Drive

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 69	1.11	195.4	F	80.1	L = 69	1.12	201.0	F	83.8
EBTTR	T = 504 / R = 146	0.91	73.2	E	168.8	T = 510 / R = 146	0.92	74.4	E	168
WBL	L = 231	1.19	159.3	F	66.3	L = 246	1.27	187.8	F	65.5
WBTTR	T = 465 / R = 436	0.78	41.9	D	285.1	T = 467 / R = 436	0.79	42.2	D	278.2
NBL	L = 198	0.99	102.2	F	90	L = 198	0.99	102.2	F	89.6
NBTTTR	T = 2303	1.05	75.8	E	419.3	T = 2318	1.06	78.1	E	418.4
	R = 115	0.16	6.9	A	79.3	R = 117	0.17	7.2	A	93
SBL	L = 275	1.16	143.3	F	152.5	L = 275	1.16	143.4	F	141.7
SBTTT	T = 2102	0.92	33.5	C	179.5	T = 2102	0.92	33.8	C	156.5
SBR	R = 52	0.07	1.3	A	28.8	R = 52	0.07	1.4	A	34.5
Overall			63.9	E				66.2	E	

Highway 97 and Underhill Street

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBR	R = 149	0.25	12.8	B	20.3	R = 190	0.32	13.6	B	26.2
NBTTT	T = 2602	0.54	0.0	A	14.3	T = 2602	0.54	0.0	A	25.7
NBR	R = 271	0.14	9.3	A	12.4	R = 286	0.18	0.0	A	12.4
SBL	L = 298	1.89	470.1	F	133.6	L = 306	1.25	179.9	F	94.1
SBTTT	T = 2218	0.46	0.0	A	461.3	T = 2218	0.46	0.0	A	84.8
Overall			25.7	D				10.3	B	

Highway 97 and Leckie Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 183	0.87	103	F	63.3	L = 183	0.87	103	F	62.3
EBTR	T = 250 / R = 77	0.54	55.2	E	176.3	T = 256 / R = 77	0.55	55.7	E	151.3
WBL	L = 229	0.88	75.5	E	85.4	L = 229	0.88	76	E	86.2
WBT	T = 221	0.64	64.4	E	198.3	T = 221	0.64	64.2	E	194
WBR	R = 342	0.95	81.1	F	188.5	R = 342	0.95	80.5	F	180.9
NBL	L = 52	0.43	23.4	C	35	L = 58	0.50	29.3	C	36.6
NBTTTR	T = 2430 / R = 113	0.94	31.8	C	140.8	T = 2465 / R = 113	0.97	33.9	C	118.5
SBL	L = 186	0.85	97.5	F	60.2	L = 198	0.85	93.4	F	59.8
SBTTT	T = 2269	0.79	12.5	B	112.6	T = 2277	0.79	14.7	B	95.7
SBR	R = 137	0.09	0.1	A	34.5	R = 137	0.09	0.1	A	20.9
Overall			34.6	C				36.3	D	

Highway 97 and Banks Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 126	0.71	79.8	E	88	L = 126	0.70	79.1	E	90.9
EBT	T = 242	0.86	87.6	F	223.2	T = 248	0.87	89.1	F	214.9
EBR	R = 274	0.67	31.6	C	89	R = 274	0.71	31.4	C	88.5
WBL	L = 121	0.95	108.6	F	75.2	L = 121	0.96	112.5	F	85
WBT	T = 182	0.46	48.3	D	109.5	T = 184	0.46	48.2	D	140.7
WBR	R = 125	0.32	22.5	C	29.6	R = 125	0.32	22.4	C	29.7
NBL	L = 221	0.92	72.0	E	84.0	L = 221	0.93	73.5	E	87.6
NBTTT	T = 2547	1.01	40.2	D	114.3	T = 2582	1.03	45.3	D	106.4
NBR	R = 548	0.60	13.0	B	72.6	R = 548	0.60	11.9	B	69.6
SBL	L = 236	0.93	85.1	F	93.7	L = 245	0.95	89.4	F	88.4
SBTTT	T = 2305	0.90	36.1	D	471.1	T = 2325	0.91	36.9	D	470.3
SBR	R = 397	0.42	6.8	A	129.9	R = 397	0.42	7	A	132.8
Overall			40.4	D				42.7	D	

Baron Road and Dilworth Drive/ Mall Entrance

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 138	0.74	48	D	56.3	L = 146	0.79	53.9	D	57.9
EBTTR	T = 658 / R = 50	0.57	28.7	C	108.9	T = 658 / R = 50	0.57	29.3	C	110.2
WBL	L = 65	0.40	42.1	D	67.4	L = 65	0.41	43.2	D	77.1
WBTTR	T = 713	0.85	49.9	D	242.8	T = 713	0.87	52	D	292.6
	R = 332	0.57	9.9	A	81.7	R = 347	0.59	10.7	B	82.3
NBL	L = 77	0.31	36.4	D	31.8	L = 77	0.31	36.1	D	43.7
NBTR	T = 116 / R = 64	0.37	30.8	C	49.9	T = 116 / R = 64	0.37	30.3	C	53.6
SBL	L = 446	0.75	24.4	C	113.3	L = 473	0.79	26.1	C	126.5
SBTR	T = 83 / R = 348	0.48	7.9	A	136	T = 83 / R = 365	0.49	8.3	A	152.7
Overall			29.5	C				30.6	C	

Baron Road and Underhill Street

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLTR	L = 135	0.52	25.4	C	33.8	L = 158	0.57	25.8	C	41.6
	T = 47	0.58	10.2	B	47.2	T = 47	0.54	9.0	A	89.7
	R = 231					R = 231				
WBLTR	L = 62	0.46	28.6	C	25.8	L = 106	0.67	37.7	D	33.1
	T = 25	0.07	15.8	B	15.7	T = 66	0.17	16.2	B	31
	R = 39	0.12	6.6	A	16.9	R = 212	0.43	5.5	A	33
NBL	L = 72	0.18	5.1	A	24.7	L = 72	0.19	5.9	A	26.2
NBTR	T = 400 / R = 78	0.44	5.2	A	47.2	T = 423 / R = 78	0.47	6.2	A	48.4
SBL	L = 40	0.08	5.8	A	21.1	L = 40	0.09	6.7	A	22.4
SBTR	T = 563 / R = 22	0.53	8.6	A	66.5	T = 563 / R = 22	0.54	9.7	A	67.9
Overall			9.8	A				11	B	

Baron Road and Durnin Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBLR	L = 80	0.44	37.4	E	22	L = 80	0.66	75.6	F	23.5
	R = 147	0.27	13.5	B	21.4	R = 147	0.34	16.8	C	24.0
NBTR	T = 436 / R = 33	0.29	0.0	A	5.4	T = 609 / R = 33	0.40	0	A	7.1
SBL	L = 105	0.11	8.8	A	18.7	L = 105	0.12	9.6	A	18.8
SBT	T = 417	0.26	0.0	A	9.7	T = 498	0.31	0	A	6.1
Overall			4.8	A				6.5	A	

Baron Road and Leckie Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 157	0.60	32.3	C	49.7	L = 157	0.63	35.2	D	53.3
EBTR	T = 441 / R = 117	0.40	24.4	C	86	T = 441 / R = 135	0.43	25.4	C	98.1
WBL	L = 42	0.19	38.5	D	42.1	L = 42	0.20	37.4	D	45.5
WBTTR	T = 527 / R = 156	0.70	42.8	D	132.1	T = 527 / R = 156	0.73	41.6	D	131.3
NBL	L = 148	0.79	49.8	D	85.5	L = 148	0.81	54.5	D	86.8
NBTR	T = 360 / R = 59	0.73	42.1	D	203.9	T = 371 / R = 79	0.77	44.2	D	207.3
SBL	L = 234	0.80	39.9	D	106.7	L = 234	0.80	39.6	D	109.5
SBTR	T = 563	0.90	55	E	182.3	T = 590	0.91	55.1	E	201.5
	R = 191	0.30	4.6	A	104.9	R = 191	0.30	4.4	A	111.3
Overall			38.6	D				39.3	D	

Baron Road and Banks Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 155	0.35	17.5	B	35.4	L = 155	0.36	17.4	B	40.2
EBTR	T = 50 / R = 336	0.52	5.6	A	84.9	T = 50 / R = 351	0.55	6.1	A	100.6
WBLTR	L = 38 / T = 49 / R = 31	0.27	16.9	B	39	L = 38 / T = 49 / R = 31	0.28	17.3	B	49.1
NBL	L = 159	0.62	21.6	C	46.6	L = 161	0.64	23.0	C	57.3
NBTR	T = 406 / R = 34	0.50	13.9	B	70.1	T = 415 / R = 34	0.51	13.9	B	101.1
SBL	L = 16	0.06	16.9	B	20.9	L = 16	0.06	16.9	B	23.1
SBTR	T = 498	0.87	40.4	D	144.2	T = 510	0.88	41.4	D	193.3
	R = 182	0.33	8.2	A	48.0	R = 182	0.33	8.1	A	48.8
Overall			19.6	B				20.1	C	

Springfield Road and Dilworth/Benvoulin Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 83	0.53	40.3	D	44.1	L = 83	0.53	40.3	D	44.5
EBTT	T = 694 / R = 336	0.61	35.9	D	112.1	T = 700 / R = 357	0.62	36	D	163.5
EBR	R = 336	0.48	6.9	A	80.1	R = 357	0.50	7.4	A	87.9
WBL	L = 26	0.19	41.7	D	41	L = 26	0.19	41.8	D	48.8
WBTT	T = 689	0.90	61.0	E	177.9	T = 692	0.91	61.5	E	254.3
WBR	R = 707	1.23	139.2	F	164.6	R = 710	1.21	133.4	F	193.9
NBL	L = 296	1.20	163.2	F	185.9	L = 308	1.18	155.6	F	176.7
NBTTR	T = 1320 / R = 36	1.13	105.9	F	553.9	T = 1332 / R = 36	1.14	109.9	F	492.5
SBL	L = 597	1.18	141.8	F	181.5	L = 597	1.18	142.8	F	174.2
SBTTR	T = 1252 / R = 71	1.08	85.7	F	360.1	T = 1252 / R = 71	1.11	72	F	367.2
Overall			92.0	F				93.8	F	

Springfield Road and Durnin Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBR	R = 104	0.40	8.8	A	34	R = 104	0.38	6.7	A	35.4
WBR	R = 8	0.04	0.2	A	9.3	R = 8	0.04	0.2	A	8.7
NBL	L = 126	0.62	26.6	C	48	L = 141	0.67	27.7	C	42.3
NBTTR	T = 1841 / R = 40	0.70	5.8	A	163.9	T = 1841 / R = 40	0.70	7	A	135.9
SBL	L = 3	0.03	13.0	B	24.9	L = 3	0.03	13.7	B	35.6
SBTTR	T = 1651 / R = 85	0.75	20.6	C	232.9	T = 1651 / R = 97	0.77	22.5	C	430.6
Overall			13.2	B				14.7	B	

Springfield Road and Leckie Road

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBTL	L = 292 / T = 6	0.94	70.8	E	75	L = 312 / T = 6	0.97	78	E	73.2
EBR	R = 519	0.89	46.6	D	77.3	R = 519	0.88	43.7	D	78.8
WBL	L = 23	0.16	37.6	D	14.1	L = 23	0.16	37.2	D	39.6
WBTR	T = 10 / R = 15	0.06	20.0	B	11.5	T = 10 / R = 15	0.06	19.5	B	14.1
NBL	L = 282	0.65	63.5	E	60.0	L = 282	0.66	61.1	E	44.6
NBTTR	T = 1449 / R = 2	0.68	9.3	A	106.3	T = 1449 / R = 2	0.69	9.9	A	74.9
SBL	L = 1	0.01	56.0	E	10.0	L = 1	0.01	56	E	1.1
SBTTR	T = 1097 / R = 214	0.86	36.3	D	168.3	T = 1109 / R = 214	0.89	38.4	D	286.5
Overall			32.2	C				33.3	C	

Leckie Road and Parkview Crescent

Movement	2021 No Gas Bar					2021 Total				
	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL	L = 6	0.01	5.3	A	8.2	L = 6	0.01	5.2	A	8.7
EBTR	T = 535 / R = 169	0.38	4.4	A	51.8	T = 555 / R = 169	0.39	4.6	A	51.8
WBL	L = 111	0.33	6.8	A	37.7	L = 111	0.34	9.3	A	36.4
WBTR	T = 381 / R = 8	0.21	3.4	A	82.0	T = 381 / R = 8	0.21	4.6	A	62.6
NBLTR	L = 279 / R = 50	0.73	29.4	C	25.1 / 75.0	L = 279 / R = 50	0.73	29.7	C	25.5 / 76.7
SBLTR	L = 5 / R = 10	0.01	12.4	B	5.8 / 6.9	L = 5 / R = 10	0.01	12.6	B	5.7 / 7.6
Overall			8.7	A				9.2	A	

Table 4-7: Summary of Costco Impact Saturday Peak

Highway 97 and Dilworth Drive

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 97	1.12	176.7	F	83.7	L = 97	1.15	185.2	F	81.7
EBTTR		T = 529	0.82	55.7	E	161.1	T = 535	0.83	56.2	E	167.3
		R = 104					R = 104				
WBL		L = 266	1.24	169.4	F	65.6	L = 279	1.31	197.8	F	65.6
WBTTR		T = 438	0.72	32.0	C	291.4	T = 444	0.73	32.5	C	283.4
		R = 444					R = 444				
NBL		L = 184	0.93	80.5	F	91.5	L = 184	0.96	86.3	F	88.9
NBTTTR		T = 2197	1.11	94.8	F	420.6	T = 2220	1.12	99.3	F	418.5
		R = 135	0.21	7.9	A	94.6	R = 138	0.21	8.1	A	97.4
SBL		L = 318	1.29	188.3	F	155.6	L = 318	1.29	188.2	F	146.1
SBTTT		T = 1874	0.89	41.1	D	197.8	T = 1874	0.88	40.4	D	196.5
SBR		R = 58	0.08	0.3	A	48.6	R = 58	0.08	0.3	A	35.9
Overall				73.3	E				76.3	E	

Highway 97 and Underhill Street

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBR		R = 201	0.32	12.9	B	18.7	R = 250	0.40	13.9	B	28.2
NBTTT		T = 2338	0.48	0.0	A	33.7	T = 2338	0.48	0.0	A	20.0
NBR		R = 324	0.20	0.0	A	13.4	R = 347	0.21	0.0	A	17.9
SBL		L = 242	1.21	178.3	F	91.1	L = 251	0.77	43.5	E	80.7
SBTTT		T = 2167	0.45	0.0	A	113.9	T = 2167	0.45	0.0	A	131.1
Overall				8.7	A				2.7	A	

Highway 97 and Leckie Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL		L = 151	0.85	105.3	F	60.3	L = 151	0.85	105.3	F	60.2
EBTR		T = 194	0.42	50.2	D	71.6	T = 200	0.44	51.8	D	93.6
		R = 65					R = 65				
WBL		L = 245	0.81	64.5	E	84.7	L = 245	0.83	67.7	E	85.2
WBT		T = 204	0.55	58.2	E	192.7	T = 204	0.56	59.3	E	183.5
WBR		R = 409	0.96	71.4	E	167.3	R = 409	0.97	73.3	E	158.9
NBL		L = 93	0.60	40.6	D	36.9	L = 99	0.63	43	D	44.3
NBTTTR		T = 2199	0.94	44.3	D	171.5	T = 2242	0.96	46.9	D	172.9
		R = 155					R = 155				
SBL		L = 291	0.90	95.8	F	92.8	L = 304	0.90	94.2	F	89.7
SBTTT		T = 1994	0.75	29.9	C	159.2	T = 2003	0.75	29.7	C	149.9
SBR		R = 80	0.05	0.1	A	49.5	R = 80	0.05	0.1	A	27.8
Overall				46.3	D				47.6	D	

Highway 97 and Banks Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 128	0.76	76.6	E	91.9	L = 128	0.75	75.4	E	87.7
EBT		T = 313	0.92	81.6	F	185.3	T = 319	0.93	83.8	F	186.1
EBR		R = 414	0.93	55.5	E	88.3	R = 414	0.93	53.9	D	87.8
WBL		L = 132	0.94	99.0	F	89.5	L = 132	0.96	104.9	F	92.6
WBT		T = 299	0.61	46.7	D	165.4	T = 299	0.61	46.5	D	165.4
WBR		R = 164	0.33	15.5	B	27.4	R = 164	0.33	15.4	B	27
NBL		L = 307	0.99	87.3	F	111.2	L = 313	1.01	90.9	F	113.6
NBTTT		T = 2302	0.99	47.8	D	147.2	T = 2339	1.02	55.8	E	149.8
NBR		R = 746	0.86	29.7	C	110.7	R = 746	0.87	31.6	C	107.7
SBL		L = 207	0.95	84.0	F	107.6	L = 222	0.97	90.1	F	107.5
SBTTT		T = 1993	0.96	47.3	D	332.5	T = 2015	0.97	49.9	D	464.5
SBR		R = 485	0.63	19.6	B	116.1	R = 485	0.63	19.8	B	118.7
Overall				49.1	D				53	D	

Baron Road and Dilworth Drive/ Mall Entrance

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 229	1.04	99.7	F	67.2	L = 238	1.01	87.8	F	64.7
EBTTR		T = 484	0.75	39.7	D	126.8	T = 484	0.71	37.5	D	112.1
		R = 111					R = 111				
WBL		L = 165	0.69	36.7	D	80.8	L = 165	0.67	34.3	C	80.3
WBTTR		T = 583	0.75	41.8	D	295.3	T = 583	0.75	41.8	D	280.9
		R = 351	0.58	7.3	A	81.1	R = 363	0.59	7.3	A	80.2
NBL		L = 127	0.68	36.9	D	64.2	L = 127	0.68	37.3	D	68.2
NBTR		T = 162	0.45	27.4	C	63	T = 162	0.47	28.7	C	64
		R = 88					R = 88				
SBL		L = 310	0.62	21.2	C	153.3	L = 334	0.69	24.4	C	153.7
SBTR		T = 188	0.97	52	D	168.6	T = 188	1.02	63.2	E	177.4
		R = 503					R = 522				
Overall				40.4	D				41.8	D	

Baron Road and Underhill Street

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLTR		L = 174	0.68	41.8	D	66.1	L = 206	0.72	40.6	D	71.4
		T = 48	0.52	10.9	B	161.6	T = 48	0.48	11.0	B	229.4
		R = 195					R = 195				
WBLTR		L = 115	0.86	76.3	E	46.6	L = 158	0.88	69.4	E	50.3
		T = 32	0.09	24.0	C	46.2	T = 81	0.19	23.2	C	46.9
		R = 179	0.42	6.9	A	34.4	R = 360	0.61	8.8	A	48.4
NBL		L = 89	0.29	9.2	A	36	L = 89	0.33	12.2	B	38
NBTR		T = 450	0.57	9.6	A	92.1	T = 471	0.62	12.4	B	99.9
		R = 204					R = 204				
SBL		L = 72	0.19	7.3	A	32.3	L = 72	0.22	9.5	A	31.5
SBTR		T = 738	0.64	11.0	B	79.3	T = 738	0.67	13.7	B	75.7
		R = 28					R = 28				
Overall				15.8	B				18	B	

Baron Road and Durnin Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
WBLR		L = 89	0.67	71.8	F	30.8	L = 89	1.05	194.8	F	34.1
		R = 128	0.25	14.1	B	22.6	R = 128	0.33	17.8	C	28.5
NBTR		T = 490	0.33	0.0		9.1	T = 671	0.45	0		6.6
		R = 50	0.33	0.0			R = 50	0.45	0		
SBL		L = 136	0.14	9.2	A	28.2	L = 136	0.17	10.2	B	32.9
SBT		T = 481	0.30	0.0		40.6	T = 574	0.36	0		62.5
Overall				6.9	A				12.8	B	

Baron Road and Leckie Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 135	0.68	41.4	D	47.3	L = 135	0.74	49.7	D	48
EBTR		T = 440	0.45	25.5	C	96.5	T = 440	0.48	26.5	C	97.5
		R = 117					R = 136				
WBL		L = 31	0.15	35.3	D	41.4	L = 31	0.16	34.6	C	35.8
WBTTR		T = 542	0.79	46.1	D	140.9	T = 542	0.81	46.4	D	146.6
		R = 165					R = 165				
NBL		L = 174	0.89	66	E	86.6	L = 174	0.89	65.5	E	85.8
NBTR		T = 442	0.78	40.7	D	188.7	T = 453	0.80	41.1	D	176.7
		R = 37					R = 55				
SBL		L = 216	0.74	31.6	C	100.7	L = 216	0.76	32.8	C	101.3
SBTR		T = 626	0.94	55.4	E	176.8	T = 653	0.95	55.9	E	177.3
		R = 190	0.29	4.2	A	104.7	R = 190	0.28	4.1	A	110.5
Overall				40.7	D				41.5	D	

Baron Road and Banks Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 149	0.34	26.7	C	45.8	L = 149	0.34	26.4	C	47.1
EBTR		T = 34	0.61	9.7	A	110.4	T = 34	0.64	11.0	B	113
		R = 421					R = 442				
WBLTR		L = 33	0.29	22.6	C	35.3	L = 33	0.32	22.9	C	34.2
		T = 32					T = 32				
		R = 22					R = 22				
NBL		L = 302	0.78	29.0	C	81.2	L = 302	0.79	30.4	C	83.7
NBTR		T = 430	0.53	17.9	B	156.7	T = 441	0.54	18.5	B	167.9
		R = 28					R = 28				
SBL		L = 22	0.06	9.6	A	25.7	L = 22	0.06	9.9	A	26.3
SBTR		T = 466	0.86	44.8	D	217.2	T = 472	0.87	46.2	D	271.2
		R = 214	0.39	8.9	A	49.1	R = 214	0.39	9.1	A	48.3
Overall				23.3	C				24.2	C	

Springfield Road and Dilworth/ Benvoulin Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 108	0.64	48.7	D	42.6	L = 108	0.64	49.4	D	41
EBTT		T = 454	0.48	34.8	C	63.6	T = 460	0.50	35.8	D	73.6
		R = 367	0.54	6.3	A	59	R = 385	0.56	6.5	A	58.4
WBL		L = 26	0.19	44.0	D	45.6	L = 26	0.20	45.1	D	44.1
WBTT		T = 517	0.96	75.8	E	188.1	T = 520	1.01	88.8	F	180.5
WBR		R = 513	0.86	24.1	C	135.3	R = 516	0.89	27.8	C	130.1
NBL		L = 355	0.99	87.8	F	134.9	L = 364	1.03	98.7	F	130.4
NBTTR		T = 682	0.60	32.0	C	579.7	T = 694	0.60	31.4	C	557.5
		R = 30					R = 30				
SBL		L = 532	0.81	51.1	D	197.3	L = 532	0.81	48.1	D	106.6
SBTTR		T = 1100	1.04	57.0	E	359.0	T = 1100	1.01	51.9	D	202.7
		R = 85					R = 85				
Overall				47.1	D				48.1	D	

Springfield Road and Durnin Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBR		R = 166	0.41	12.5	B	54.2	R = 166	0.40	10.3	B	37.5
WBR		R = 9	0.02	0.1	A	8.3	R = 9	0.02	0.1	A	7.4
NBL		L = 127	0.65	23.2	C	52.5	L = 142	0.69	25.8	C	86.9
NBTTR		T = 1239	0.54	13.4	B	224.5	T = 1239	0.54	9.2	A	293.5
		R = 39					R = 39				
SBL		L = 2	0.01	12.0	B	14.3	L = 2	0.01	12	B	3.5
SBTTR		T = 1502	0.80	15.9	B	286.3	T = 1502	0.82	16.7	B	393.6
		R = 60					R = 69				
Overall				15.0	B				13.7	B	

Springfield Road and Leckie Road

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBTL		L = 247					L = 265				
		T = 29	0.89	65.2	E	70.6	T = 29	0.92	67.5	E	71.7
EBR		R = 477	0.81	32.6	C	71.4	R = 477	0.80	31	C	70.8
WBL		L = 29	0.19	35.3	D	16.3	L = 29	0.20	35.6	D	15.2
WBTR		T = 8	0.06	16.8	B	11.5	T = 8	0.06	16.7	B	10.7
		R = 17					R = 17				
NBL		L = 349	0.73	56.4	E	62.1	L = 349	0.75	56.9	E	63.2
NBTTR		T = 1005	0.48	13.3	B	88.7	T = 1005	0.48	13	B	88.7
		R = 6					R = 6				
SBL		L = 7	0.08	52.6	D	21.0	L = 7	0.08	52.6	D	18.8
SBTTR		T = 966	0.81	32.1	C	130.8	T = 975	0.82	32.9	C	328.5
		R = 220					R = 220				
Overall				31.7	C				32.1	C	

Leckie Road and Parkview Crescent

		2021 No Gas Bar					2021 Total				
		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBL		L = 12	0.03	4.4	A	6.5	L = 12	0.03	4.7	A	6.1
EBTR		T = 526	0.41	3.7	A	67.2	T = 544	0.42	3.9	A	60.6
		R = 233					R = 233				
WBL		L = 154	0.51	30.6	C	46.2	L = 154	0.52	12.5	B	49.4
WBTR		T = 415	0.23	3.5	A	91.9	T = 415	0.23	3.4	A	106.3
		R = 8					R = 8				
NBLTR		L = 290	0.76	30.6	C	25.2 / 74.3	L = 290	0.76	31.0	C	24.9 / 84.0
		R = 44					R = 44				
SBLTR		L = 5	0.01	12.4	B	4.7 / 9.6	L = 5	0.01	12.4	B	4.4 / 8.9
		R = 16					R = 16				
Overall				8.9	A				9	A	

4.4   HIGHWAY 97 AND LECKIE ROAD

This intersection was identified as one of the most heavily-affected within the study area, requiring additional analyses to determine the trigger points for the proposed mitigation of a southbound dual left turn from the highway onto Leckie Road. The full build scenario shows a significant deterioration of overall intersection performance in both the 2021 and 2031 horizon years, largely as a result of sensitivity to the increases in the southbound left turn demand. In an optimized signal scenario, added volumes to the existing single southbound left turn lane draws green time away the also-heavy eastbound and westbound movements on Leckie Road, adding to delays and queues.

The forecast performance and mitigation measures noted above and in Table 3-4 were modeled to try and isolate just the network effects of the Costco separately from background and as-of-right Gast Bar impacts. The purpose of this is to establish the level of responsibility the new Costco store may hold for overall future network performance and how much is the result of surrounding developments.

To isolate these contingencies, the following scenarios were developed for the intersection with and without the mitigation measures:

- Scenario A1 (2021) / A2 (2031) – Background traffic growth rate of 2% only, no additional developments
- Scenario B1 (2021) / B2 (2031) – Costco only without Full Background Development (+2% p.a. only)
- Scenario C1 (2021) / C2 (2031) – Gas Bar only without Full Background Development (+2% p.a. only)
- Scenario D1 (2021) / D2 (2031) – Costco + Gas Bar without Full Background Development (+2% p.a. only)
- Scenario E1 (2021) / E2 (2031) – Costco only (No Gas Bar) with Full Background Development
- Scenario F1 (2021) / F2 (2031) – Gas Bar only (No Costco) with Full Background Development
- Scenario G1 (2021) / G2 (2031) – Costco + Gas Bar with Full Background Development

Comparisons of scenarios B1/B2 with E1/E2, C1/C2 with F1/F2, and D1/D2 with G1/G2 demonstrate that while the effects of the Costco + Gas Bar bring the intersection to the brink of established performance thresholds in the 2031 horizon year, it is the traffic generated by the suite of background developments introduced in Section 1.5.1 that push the intersection well beyond its design capacity and in need of mitigation.

Comparative network trip assignments showing the Costco + Gas Bar without the Full Background build and with the Full Background Build are shown in the figures below:

- 2021 PM Peak – Costco + Gas Bar without Full Background Development (Scenario D1) in Figure 24 and **with** Full Background Development (Scenario G1) in Figure 25
- 2021 Saturday Peak – Costco + Gas Bar without Full Background Development (Scenario D1) in Figure 26 and with Full Background Development (Scenario G1) in Figure 27
- 2031 PM Peak – Costco + Gas Bar without Full Background Development (Scenario D2) in Figure 28 and **with** Full Background Development (Scenario G2) in Figure 29
- 2031 Saturday Peak – Costco + Gas Bar without Full Background Development (Scenario D2) in Figure 30 and with Full Background Development (Scenario G2) in Figure 31

The PM peak results are summarized in Table 4-8 and Saturday peak results in Table 4-9 below. This model assumes a linear progression of annual volume increases with no change to existing mode shares or motorist diversion as a result of encountering an over-capacity local network. The mitigation shows to be reasonably effective in all scenarios and horizon years.
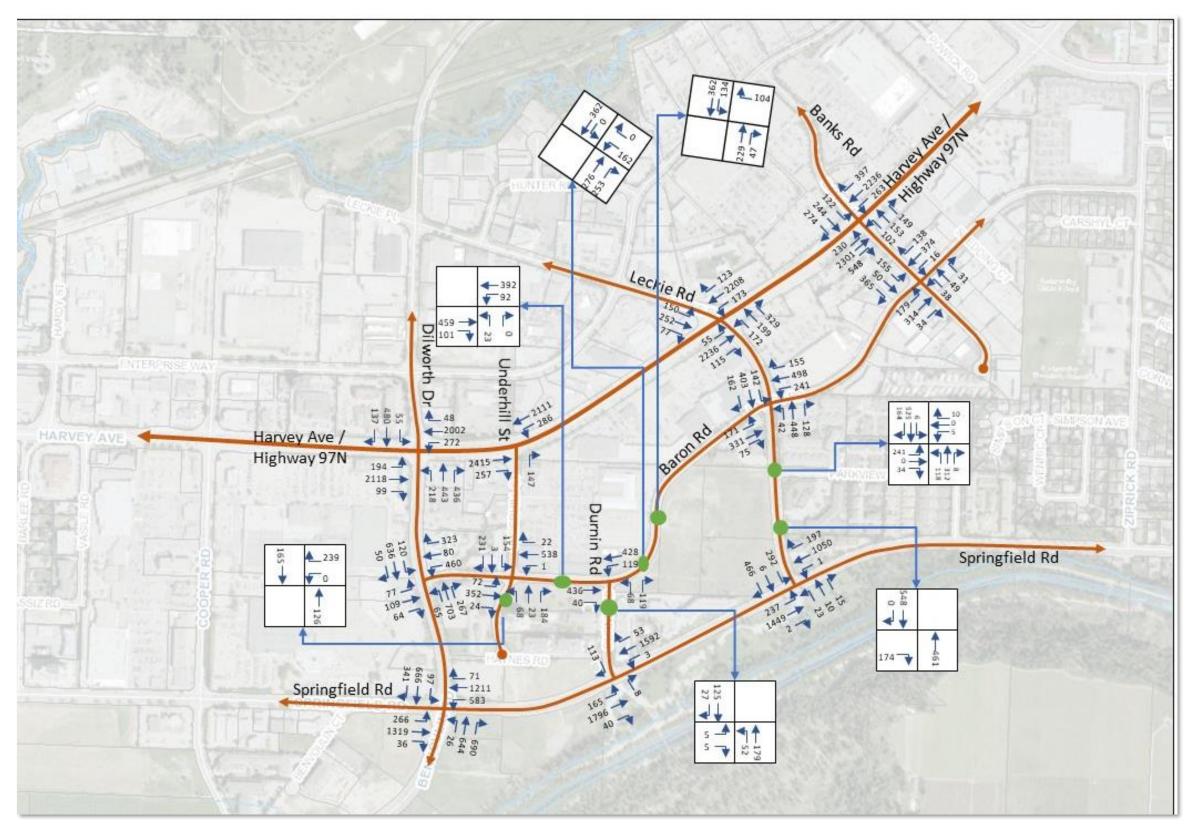
Figure 24: Scenario D1 – 2021 Costco + Gas Bar without Full Background Development PM peak
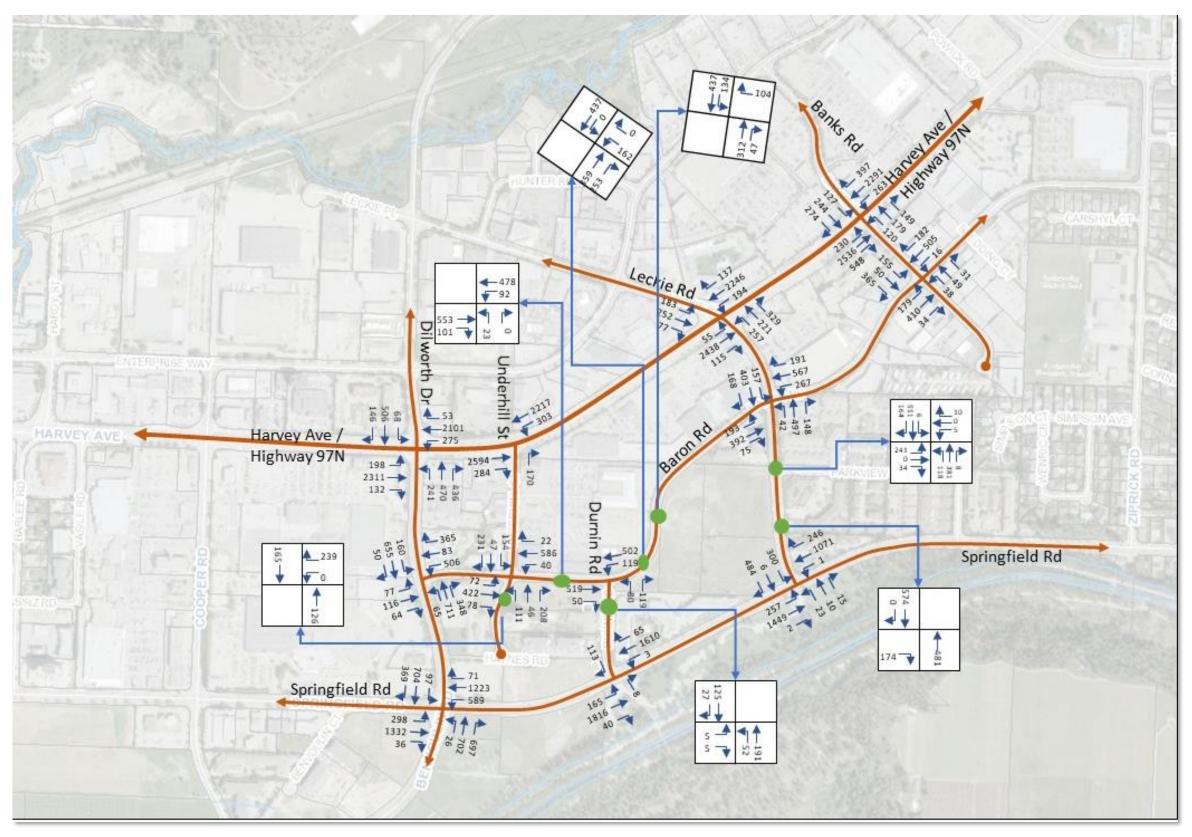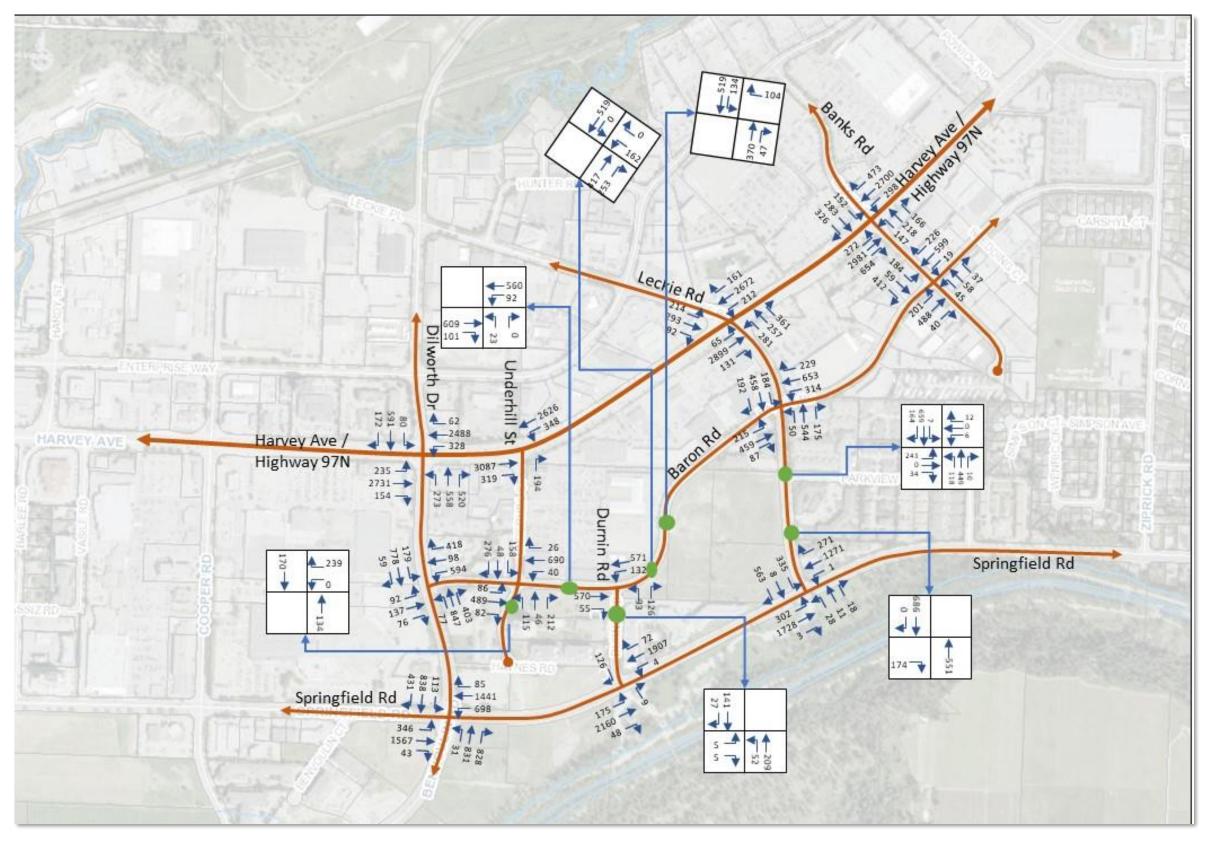
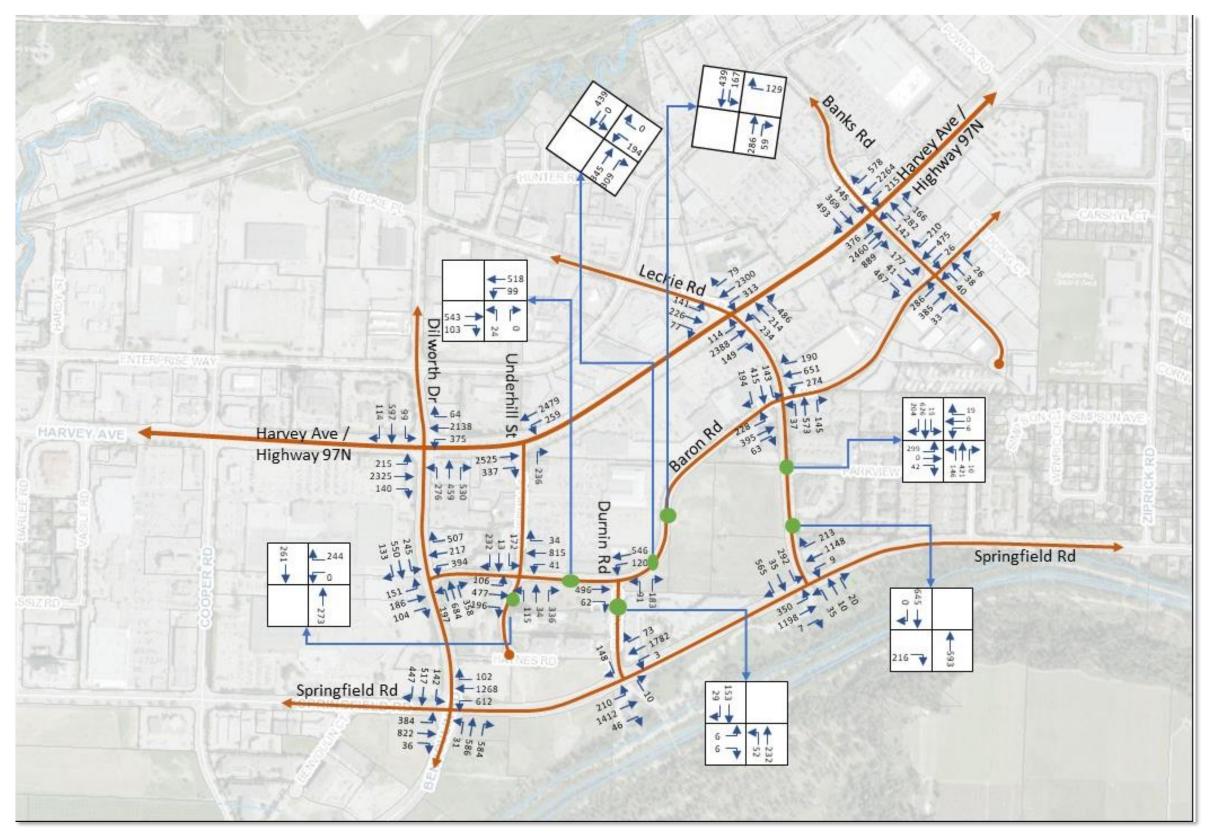Figure 25: Scenario G1 – 2021 Costco + Gas Bar with Full Background Development PM peak
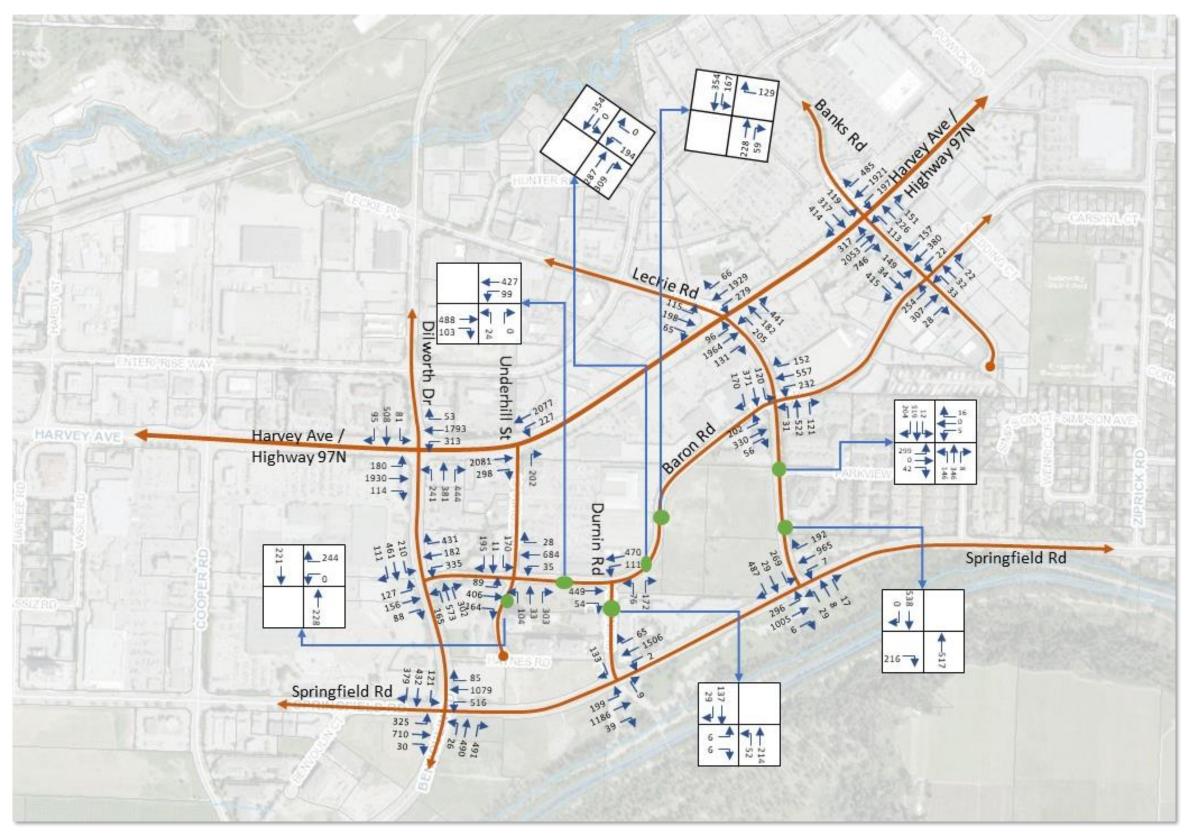
Figure 26: Scenario D1 – 2021 Costco + Gas Bar without Full Background Development Saturday peak
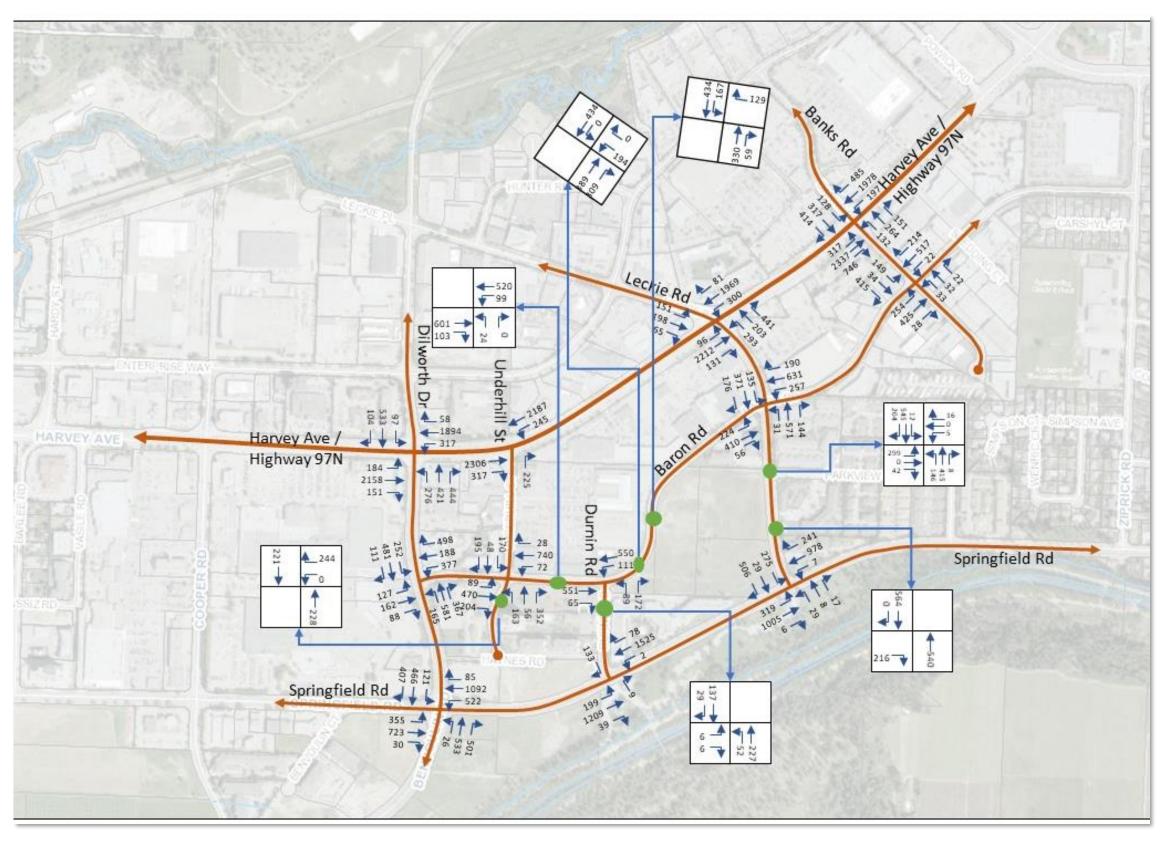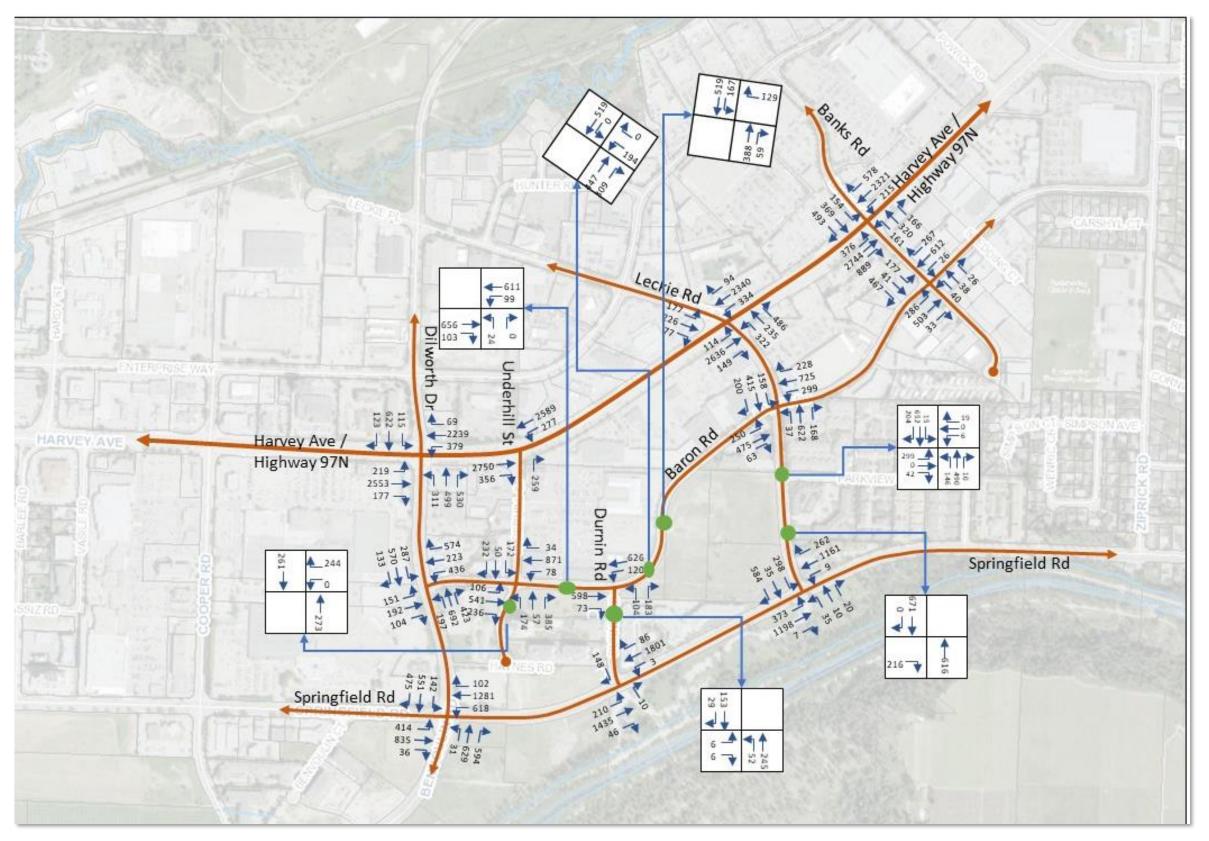
Figure 27: Scenario G1 – 2021 Costco + Gas Bar with Full Background Development Saturday peak
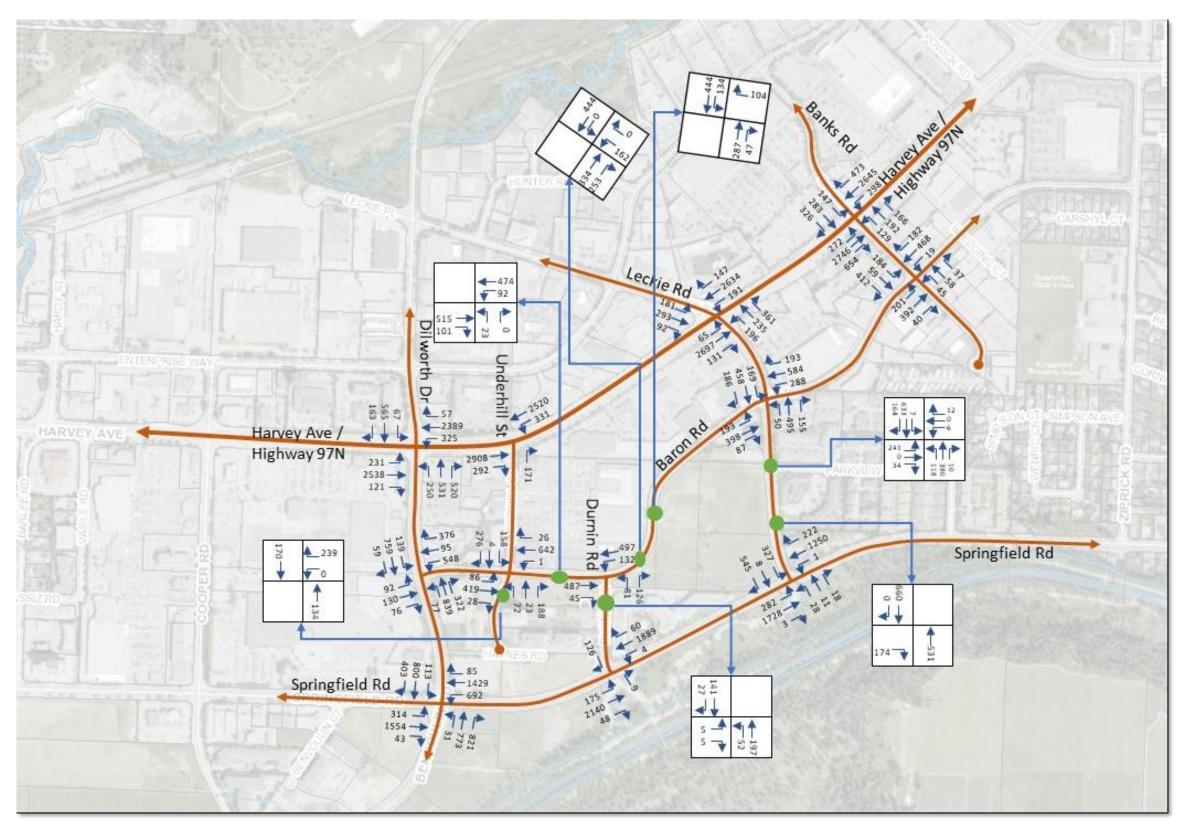
Figure 28: Scenario D2 – 2031 Costco + Gas Bar without Full Background Development PM peak

Figure 29: Scenario G2 – 2031 Costco + Gas Bar with Full Background Development PM peak

Figure 30: Scenario D2 – 2031 Costco + Gas Bar without Full Background Development Saturday peak

Figure 31: Scenario G2 – 2031 Costco + Gas Bar with Full Background Development Saturday peak

Table 4-8: Summary of Leckie and Hwy 97 Scenarios PM Peak

Intersection: Highway 97 and Leckie Road

Scenario A1 – 2021 2% Growth Only / Scenario A2 – 2031 2% Growth Only (Mitigation: N/A)

Movement	A1 Volume	A1 V/C	A1 Delay(s)	A1 LoS	A1 Queue(m)	A1 Mitig.	A2 Volume	A2 V/C	A2 Delay(s)	A2 LoS	A2 Queue(m)	A2 Mitig.
EBLL	L=150	0.56	73.7	E	67.2	N/A	L=181	0.61	73.6	E	59.9	N/A
EBTR	T=214 / R=77	0.90	85.3	F	238.4		T=255 / R=92	0.98	99.7	F	198.1	
WBL	L=108	0.75	94.6	F	66.1		L=132	0.86	108.4	F	82.3	
WBT	T=164	0.49	58.8	E	75.2		T=200	0.56	60.9	E	210.3	
WBR	R=163	0.11	0.1	A	31.9		R=195	0.13	0.2	A	236.5	
NBL	L=52	1.08	185.8	F	41.5		L=62	1.33	269.1	F	39.7	
NBTTTR	T=2225 / R=84	0.75	23.4	C	229.1		T=2686 / R=100	0.94	35.7	D	529.5	
SBL	L=91	1.92	505.6	F	135.9		L=109	2.35	684.7	F	167	
SBTTT	T=2181	0.72	22.3	C	167		T=2607	0.89	31.8	C	246.7	
SBR	R=123	0.08	0.1	A	71.9		R=147	0.10	0.1	A	136.8	
Overall	**5632**		**38.1**	**D**			**6766**		**51.5**	**D**		

Scenario B1 – 2021 Costco only without Background Development (base / mitigation); Scenario B2 – 2031 Costco only without Background Development (base / mitigation)

Movement	B1 Vol	B1 V/C	B1 Delay	B1 LoS	B1 Queue	B1mit V/C	B1mit Delay	B1mit LoS	B1mit Queue	B2 V/C	B2 Delay	B2 LoS	B2 Queue	B2mit V/C	B2mit Delay	B2mit LoS	B2mit Queue
EBLL	L=150	0.56	73.7	E	69.1	0.76	70	E	#63.4	0.61	73.6	E	39.6	0.91	89.2	F	#76.9
EBTR	T=250/R=77	1.01	106.7	F	199.1	0.63	57.6	E	69.2	1.19	158.7	F	196.8	0.66	57.5	E	82.1
WBL	L=155	1.01	138.6	F	97	0.81	75.2	E	#72.5	1.16	177.4	F	78.2	0.95	100.1	F	#99.9
WBT	T=200	0.54	59.1	E	196.4	0.67	68.4	E	91.4	0.67	65.5	E	207.7	0.77	75.3	E	#116.5
WBR	R=320	0.21	0.3	A	134	0.92	68.7	E	#123.2	0.24	0.4	A	223.4	1.07	111.2	F	#173.4
NBL	L=52	1.12	200.3	F	37.9	0.47	29.5	C	m5.7	1.33	269.1	F	21.2	0.60	30.2	C	m5.4
NBTTTR	T=2225/R=116	0.85	29.2	C	465.3	0.88	12.2	B	m73.8	1.03	54.7	D	220.6	1.08	51.3	D	m64.2
SBL	L=163	3.69	1274.8	F	159.9	0.74	80.7	F	m38.9	4.10	1455.8	F	87.7	0.95	109.3	F	m35.9
SBTTT	T=2217	0.80	26.8	C	182	0.77	15.0	B	m110.2	0.96	39.6	D	241.1	0.94	13.1	B	m132.6
SBR	R=123	0.11	0.1	A	58.1	0.11	0.1	A	m0.0	0.13	0.2	A	49.9	0.13	0.0	A	m0.0
Overall	**6048**		**71.8**	**E**			**25.5**	**C**			**93.5**	**F**			**43.7**	**D**	

Scenario C1 – 2021 Gas Bar only without Background Development (base / mitigation); Scenario C2 – 2031 Gas Bar only without Background Development (base / mitigation)

Movement	C1 Vol	C1 V/C	C1 Delay	C1 LoS	C1 Queue	C1mit V/C	C1mit Delay	C1mit LoS	C1mit Queue	C2 V/C	C2 Delay	C2 LoS	C2 Queue	C2mit V/C	C2mit Delay	C2mit LoS	C2mit Queue
EBLL	L=150	0.56	73.7	E	70.9	0.72	67.2	E	60.5	0.61	73.6	E	65.8	0.96	104.8	F	#80.6
EBTR	T=221/R=77	0.95	92.6	F	208.6	0.66	59.3	E	62.2	1.11	130.8	F	198.9	0.68	58.5	E	74.7
WBL	L=128	0.86	107.6	F	88.9	0.70	67.7	E	53.8	0.99	133.1	F	74.9	0.95	107.4	F	#83.2
WBT	T=166	0.46	57.1	E	206.4	0.74	79.9	E	78.2	0.58	61.5	E	199.9	0.82	86.2	F	#96.0
WBR	R=193	0.13	0.2	A	206	0.69	40.8	D	56.3	0.15	0.2	A	225.9	0.80	59.2	E	79.8
NBL	L=57	1.20	227.7	F	46.4	0.45	33.1	C	m9.0	1.45	314.4	F	41	0.59	32.5	C	m8.3
NBTTTR	T=2240/R=84	0.84	28.0	C	317.3	0.83	10.0	A	64.9	1.02	52.6	D	507.7	1.01	18.3	B	m66.7
SBL	L=110	2.44	732.6	F	176.1	0.55	75.6	E	m28.1	2.90	924.1	F	143.1	0.72	82.9	F	m26.7
SBTTT	T=2179	0.78	25.5	C	226.9	0.74	13.7	B	103.1	0.94	37.4	D	218.2	0.91	14.4	B	m124.5
SBR	R=123	0.11	0.1	A	146.3	0.11	0.1	A	0	0.13	0.2	A	149.5	0.13	0.1	A	m0.0
Overall	**5728**		**48.8**	**D**			**21.2**	**C**			**70.1**	**E**			**27.6**	**C**	

Scenario D1 – 2021 Costco and Gas Bar Combined without Background Development (base / mitigation); Scenario D2 – 2031 Costco and Gas Bar Combined without Background Development (base / mitigation) — MITIGATION

Movement	D1 Vol	D1 V/C	D1 Delay	D1 LoS	D1 Queue	D1mit V/C	D1mit Delay	D1mit LoS	D1mit Queue	D2 V/C	D2 Delay	D2 LoS	D2 Queue	D2mit V/C	D2mit Delay	D2mit LoS	D2mit Queue
EBLL	L=150	0.56	73.6	E	60.2	0.68	61.3	E	59.4	0.90	86.9	F	50.5	0.66	57.6	F	#94.0
EBTR	T=252/R=77	1.02	108.7	F	197.9	0.63	57.4	E	70	1.20	163.3	F	196.6	0.66	57.6	E	82.5
WBL	L=172	1.12	165	F	96.1	0.79	69.1	E	#77.8	1.28	215	F	77.9	1.02	115.3	F	#89.7
WBT	T=199	0.54	59	E	208.9	0.61	63.1	E	89.4	0.67	65.4	E	219.5	0.73	71	E	108.5
WBR	R=329	0.22	0.3	A	230.9	0.93	73.6	E	#136.0	0.24	0.4	A	239.9	1.05	106.5	F	#176.2
NBL	L=55	1.18	219.8	F	35.3	0.47	31.7	C	m6.7	1.39	291.4	F	18.8	0.62	31.5	C	m6.4
NBTTTR	T=2236/R=115	0.86	29.4	C	478.4	0.92	14.3	B	98.5	1.03	55.8	F	385.5	1.09	56.4	F	m65.0
SBL	L=173	3.92	1374.2	F	195.6	0.77	83.5	F	m#41.5	4.33	1555.6	F	133.8	1.00	119.8	F	m#40.0
SBTTT	T=2208	0.80	26.7	C	225.2	0.79	16.8	B	m115.5	0.95	39.1	D	258	0.96	15.2	B	m140.6
SBR	R=123	0.11	0.1	A	72.4	0.11	0.1	A	m0.0	0.13	0.2	A	62	0.13	0.0	A	m0.0
Overall	**6089**		**78.0**	**E**			**27.0**	**C**			**100.1**	**F**			**47.0**	**D**	

Scenario E1 – 2021 Costco only with Background Development (base / mitigation); Scenario E2 – 2031 Costco only with Background Development (base / mitigation)

Movement	E1 Vol	E1 V/C	E1 Delay	E1 LoS	E1 Queue	E1mit V/C	E1mit Delay	E1mit LoS	E1mit Queue	E2 V/C	E2 Delay	E2 LoS	E2 Queue	E2mit V/C	E2mit Delay	E2mit LoS	E2mit Queue
EBLL	L=183	0.61	73.6	E	54.6	0.90	88	F	#84.5	0.65	73.4	E	36.2	0.95	92.2	F	#94.1
EBTR	T=250/R=77	1.02	110.1	F	197.5	0.68	60.2	E	69.2	1.21	166.9	F	194	0.66	57.5	E	82.1
WBL	L=240	1.56	322.4	F	88.5	1.07	122.7	F	#105.5	1.72	386.2	F	75.7	1.13	138.3	F	#128.8
WBT	T=222	0.63	63.9	E	225.5	0.72	69.7	E	99.3	0.79	72.6	E	200.7	0.79	74.5	E	#125.7
WBR	R=320	0.21	0.3	A	240.9	0.89	63.5	E	#115.1	0.24	0.4	A	226.3	1.01	95.7	F	#167.4
NBL	L=52	1.22	200.3	F	40.2	0.46	27.3	C	m3.7	1.33	269.1	F	17	0.60	30.7	C	m3.7
NBTTTR	T=2427/R=116	0.93	34.7	C	487.1	1.00	23.3	C	m#240.5	1.10	81.8	F	534.5	1.21	111.2	F	m#175.0
SBL	L=184	4.16	1483	F	174.8	0.76	74.6	E	m#45.9	4.57	1664.6	F	135.5	1.15	137.2	F	m#44.4
SBTTT	T=2255	0.82	27.4	C	247	0.80	21.6	C	m145.9	0.97	42.5	D	216.3	1.00	40.7	D	m#224.7
SBR	R=137	0.12	0.2	A	75.5	0.12	0.1	A	m0.0	0.14	0.2	A	34.2	0.14	0.1	A	m6.0
Overall	**6463**		**90.6**	**F**			**34.7**	**C**			**122.0**	**F**			**79.3**	**E**	

Scenario F1 – 2021 Gas Bar only with Background Development (base / mitigation); Scenario F2 – 2031 Gas Bar only with Background Development (base / mitigation)

Movement	F1 Vol	F1 V/C	F1 Delay	F1 LoS	F1 Queue	F1mit V/C	F1mit Delay	F1mit LoS	F1mit Queue	F2 V/C	F2 Delay	F2 LoS	F2 Queue	F2mit V/C	F2mit Delay	F2mit LoS	F2mit Queue
EBLL	L=183	0.61	73.4	E	69.6	0.83	75.5	E	#79.9	0.65	73.4	E	56.5	1.01	109.4	F	#102.5
EBTR	T=221/R=77	0.96	94.6	F	198	0.64	57.8	E	62.2	1.12	137.8	F	196.3	0.65	57	E	74.7
WBL	L=213	1.39	254.4	F	73.9	1.00	108.4	F	#80.0	1.55	315.2	F	81.7	1.18	162.8	F	#143.8
WBT	T=188	0.55	60.7	E	183	0.77	81	F	87.6	0.67	66.7	E	208.9	0.86	88.8	F	#114.4
WBR	R=193	0.13	0.2	A	227.9	0.69	47	D	63	0.15	0.2	A	235.8	0.77	55.2	E	79.6
NBL	L=57	1.22	231.5	F	40.2	0.48	31.6	C	m6.7	1.45	314.4	F	27.3	0.61	32.8	C	m7.1
NBTTTR	T=2442/R=84	0.91	33.3	C	473.7	0.94	14.6	B	m78.3	1.09	78.6	E	546	1.13	73.0	E	m66.8
SBL	L=131	2.98	954.3	F	188.9	0.63	74.6	E	m#34.2	3.39	1139.4	F	177.8	0.86	76.9	E	m#35.1
SBTTT	T=2217	0.80	26.4	C	233.4	0.77	16.4	B	120.2	0.96	39.6	D	242.4	0.96	32.0	C	m#214.1
SBR	R=137	0.12	0.2	A	115.9	0.12	0.1	A	m0.0	0.14	0.2	A	84.5	0.14	0.1	A	m0.0
Overall	**6143**		**64.1**	**E**			**26.7**	**C**			**95.1**	**F**			**59.1**	**E**	

Scenario G1 – 2021 Costco and Gas Bar Combined with Background Development (base / mitigation); Scenario G2 – 2031 Costco and Gas Bar Combined with Background Development (base / mitigation)

Movement	G1 Vol	G1 V/C	G1 Delay	G1 LoS	G1 Queue	G1mit V/C	G1mit Delay	G1mit LoS	G1mit Queue	G2 V/C	G2 Delay	G2 LoS	G2 Queue	G2mit V/C	G2mit Delay	G2mit LoS	G2mit Queue
EBLL	L=183	0.61	73.6	E	64.9	0.87	83.4	F	71.6	0.65	73.4	E	30.4	0.95	91.1	F	62.5
EBTR	T=252/R=77	1.03	112.2	F	197.1	0.68	60.6	E	239.9	1.22	168.8	F	198.3	0.66	57.6	E	244.8
WBL	L=257	1.67	366.4	F	72.4	1.12	135.1	F	86.6	1.83	431.4	F	74.4	1.20	162.7	F	100.8
WBT	T=257	0.63	63.8	E	170.4	0.69	66.9	E	206.5	0.77	72.4	E	168.4	0.79	74.8	E	221.8
WBR	R=329	0.22	0.3	A	210.5	0.89	63.8	E	228.7	0.24	0.4	A	168.9	1.05	104	F	215.1
NBL	L=55	1.18	219.8	F	33.6	0.48	29.2	C	30.5	1.39	291.4	F	17.6	0.62	31.6	C	27.3
NBTTTR	T=2438/R=115	0.93	35.1	D	610.5	1.02	28.4	C	527.4	1.11	83.4	F	534.9	1.21	113.3	F	589.2
SBL	L=194	4.41	1591.9	F	193	0.77	74.4	F	110.2	4.82	1773.7	F	126.9	1.22	159.5	F	112.3
SBTTT	T=2246	0.81	27.3	C	213.8	0.80	22.6	C	221.7	0.97	41.8	D	236.4	1.02	46.4	D	226.9
SBR	R=137	0.12	0.2	A	100.1	0.12	0.1	A	81.6	0.14	0.2	A	49.9	0.14	0.0	A	72.5
Overall	**6504**		**99.0**	**F**			**37.7**	**D**			**130.3**	**F**			**84.3**	**F**	

Table 4-9: Summary of Leckie and Hwy 97 Scenarios Saturday Peak

Highway 97 and Leckie Road

Scenario A1 - 2021 2% Growth Only | MITIGATION: N/A

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 115	0.46	62.5	E	58.9
EBTR	T = 150, R = 65	0.76	64.8	E	222.2
WBL	L = 131	0.86	99.3	F	86.1
WBT	T = 139	0.45	51.9	D	222.5
WBR	R = 233	0.15	0.2	A	227.9
NBL	L = 93	1.15	180.5	F	56.6
NBTTTR	T = 1951, R = 93	0.88	37.5	D	455.3
SBL	L = 178	0.76	49.3	D	125.2
SBTT	T = 1892	0.62	17.3	B	209.3
SBR	R = 66	0.04	0.0	A	115.8
Overall	5106		34.6	C	

Scenario A2 - 2031 2% Growth Only | MITIGATION: N/A

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 141	0.51	62.7	E	34.6
EBTR	T = 178, R = 77	0.82	67.9	E	254.3
WBL	L = 160	1.03	135.6	F	74.4
WBT	T = 171	0.52	53.1	D	192.4
WBR	R = 278	0.19	0.3	A	208.5
NBL	L = 111	2.05	552.6	F	20.7
NBTTTR	T = 2375, R = 111	1.14	103.1	F	78.8
SBL	L = 212	0.85	60.8	E	36
SBTT	T = 2263	0.76	22.2	C	247.8
SBR	R = 79	0.05	0.1	A	45.3
Overall	6156		71.1	E	

Scenario B1 - 2021 Costco only without Background Development

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 115	0.64	69.3	E	44.4		L = 115	0.75	69.7	E	#123.9
EBTR	T = 194, R = 65	0.85	70.1	E	281.4		T = 194, R = 65	0.45	48.8	D	53.2
WBL	L = 188	1.24	196.5	F	71.2		L = 188	0.58	45.1	D	69.9
WBT	T = 183	0.63	59.9	E	192.4		T = 183	0.55	60.2	E	82.4
WBR	R = 427	0.29	0.5	A	216.3		R = 427	0.96	65.5	E	#152.7
NBL	L = 93	1.40	277.6	F	28.9		L = 93	0.63	43.8	D	34.2
NBTTTR	T = 1951, R = 133	0.96	46.9	D	365.4		T = 1951, R = 133	0.89	41.8	D	235.9
SBL	L = 266	1.22	163.6	F	112.6		L = 266	0.84	86.7	F	#71.8
SBTT	T = 1936	0.66	20.2	C	212.4		T = 1936	0.76	32.1	C	198.6
SBR	R = 66	0.06	0.1	A	62.1		R = 66	0.06	0.1	A	0
Overall	5617		50.2	D			5617		43.5	D	

Scenario B2 - 2031 Costco only without Background Development

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 141	0.68	69.3	E	20.5		L = 141	0.98	112.2	F	#150.6
EBTR	T = 222, R = 77	0.88	71.6	E	235.2		T = 222, R = 77	0.48	49.2	D	61.3
WBL	L = 217	1.43	266.1	F	69.2		L = 217	0.71	52.8	D	81.5
WBT	T = 215	0.69	62.1	E	163.2		T = 215	0.64	64.7	E	97.9
WBR	R = 472	0.32	0.5	A	174.6		R = 472	1.13	116.4	F	#209.3
NBL	L = 111	2.05	552.6	F	14.4		L = 111	0.84	74	E	#57.8
NBTTTR	T = 2375, R = 151	1.16	112.0	F	340.5		T = 2375, R = 151	1.07	79.5	E	#338.4
SBL	L = 300	1.72	368.7	F	71.8		L = 300	1.00	114.9	F	#88.6
SBTT	T = 2307	0.83	27.0	C	182.1		T = 2307	0.89	37.9	D	250
SBR	R = 79	0.07	0.1	A	40.2		R = 79	0.07	0.1	A	0
Overall	6667		93.2	F			6667		66.1	E	

Scenario C1 - 2021 Gas Bar only without Background Development

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 115	0.64	69.3	E	49.6		L = 115	0.77	73.5	E	#114.1
EBTR	T = 158, R = 65	0.81	66.4	E	283.9		T = 158, R = 65	0.43	45.1	D	42.7
WBL	L = 151	0.99	127.3	F	85		L = 151	0.57	50.3	D	58
WBT	T = 141	0.54	58.1	E	218.7		T = 141	0.72	82.9	F	70.2
WBR	R = 269	0.18	0.2	A	238.8		R = 269	0.75	27.1	C	50.2
NBL	L = 99	1.30	233.8	F	43.6		L = 99	0.58	33.2	C	31.9
NBTTTR	T = 1968, R = 93	0.95	45.1	D	372.2		T = 1968, R = 93	0.78	32.5	C	219.4
SBL	L = 199	0.81	55.6	E	109.2		L = 199	0.72	79.8	E	50.4
SBTT	T = 1893	0.63	18.5	B	210.1		T = 1893	0.69	27.5	C	192.7
SBR	R = 66	0.06	0.1	A	84.5		R = 66	0.06	0.1	A	0
Overall	5217		40.7	D			5217		35.2	D	

Scenario C2 - 2031 Gas Bar only without Background Development

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 141	0.68	69.3	E	24.6		L = 141	0.99	115.7	F	#166.4
EBTR	T = 186, R = 77	0.86	71.9	E	249.7		T = 186, R = 77	0.45	46.2	D	52.1
WBL	L = 180	1.19	180.2	F	70.9		L = 180	0.72	60.6	E	71.1
WBT	T = 173	0.63	61.8	E	169.6		T = 173	0.79	86.4	F	#91.7
WBR	R = 314	0.21	0.3	A	238.6		R = 314	0.96	69.7	E	#116.0
NBL	L = 117	2.16	597.2	F	14.9		L = 117	0.75	58.2	E	#50.6
NBTTTR	T = 2392, R = 111	1.15	107.0	F	364.2		T = 2392, R = 111	0.96	45.1	D	#298.6
SBL	L = 233	1.11	123.9	F	28		L = 233	0.88	97	F	#68.5
SBTT	T = 2264	0.78	23.9	C	174.8		T = 2264	0.84	33.1	C	236.6
SBR	R = 79	0.07	0.1	A	39.9		R = 79	0.07	0.1	A	0
Overall	6267		78.4	E			6267		46.8	D	

Scenario D1 - 2021 Costco and Gas Bar Combined without Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 115, R = 65	0.68	68.4	E	21.1		L = 115, R = 65	0.74	69.3	E	#123.3
EBTR	T = 198	0.86	70.9	E	257.8		T = 198	0.45	49.6	D	54.5
WBL	L = 205	1.35	235.9	F	69.4		L = 205	0.62	46.4	D	76.1
WBT	T = 182	0.61	59.1	E	164.5		T = 182	0.52	58	E	81.3
WBR	R = 441	0.30	0.5	A	164.6		R = 441	0.97	67.1	E	#162.8
NBL	L = 96	1.44	293.9	F	20		L = 96	0.69	50.9	D	#40.9
NBTTTR	T = 1964, R = 131	0.96	47.6	D	557.5		T = 1964, R = 131	0.90	43.1	D	238.1
SBL	L = 279	1.30	194.5	F	34.6		L = 279	0.88	91.7	F	#76.8
SBTT	T = 1929	0.66	20.4	C	175.2		T = 1929	0.75	31.6	C	192.3
SBR	R = 66	0.06	0.1	A	45.2		R = 66	0.06	0.1	A	0
Overall	5671		54.5	D			5671		44.5	D	

Scenario D2 - 2031 Costco and Gas Bar Combined without Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 141, R = 77	0.69	69.3	E			L = 141, R = 77	0.97	111.1	F	#148.1
EBTR	T = 226	0.89	74.2	E	218.5		T = 226	0.50	50.4	D	62.5
WBL	L = 234	1.55	312	F	71.4		L = 234	0.76	56.2	E	#92.5
WBT	T = 214	0.69	62.1	E	163.6		T = 214	0.62	63.5	E	97.1
WBR	R = 486	0.33	0.6	A	163.4		R = 486	1.13	116.6	F	#213.2
NBL	L = 114	2.11	574.9	F	7.3		L = 114	0.75	58.9	E	#51.4
NBTTTR	T = 2388, R = 149	1.17	114.2	F	84.7		T = 2388, R = 149	1.09	85.7	F	#344.0
SBL	L = 313	1.78	397.8	F			L = 313	1.00	115	F	#91.7
SBTT	T = 2300	0.83	26.8	C	173.3		T = 2300	0.91	40.6	D	257
SBR	R = 79	0.07	0.1	A	0		R = 79	0.07	0.1	A	0
Overall	6721		98.6	F			6721		69.4	E	

Scenario E1 - 2021 Costco only with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 151, R = 65	0.70	69.2	E	30.8		L = 151, R = 65	0.96	102.7	F	#161.8
EBTR	T = 194	0.78	62.7	E	246		T = 194	0.44	48.9	D	53.8
WBL	L = 276	1.82	425.5	F	68.8		L = 276	0.80	58.1	E	#111.7
WBT	T = 204	0.70	64.6	E	164.2		T = 204	0.65	67.2	E	94.3
WBR	R = 427	0.29	0.5	A	245.3		R = 427	1.04	88.7	F	#174.6
NBL	L = 93	1.69	401.1	F	19.1		L = 93	0.66	47.4	D	#36.9
NBTTTR	T = 2199, R = 133	1.07	77.2	E	195.9		T = 2199, R = 133	1.01	60.8	E	#299.6
SBL	L = 287	1.55	295.6	F	65.1		L = 287	0.95	104.1	F	#83.2
SBTT	T = 1976	0.70	22.3	C	184.1		T = 1976	0.79	33.4	C	199.9
SBR	R = 81	0.07	0.1	A	40.2		R = 81	0.07	0.1	A	0
Overall	6086		83.1	F			6086		55.4	E	

Scenario E2 - 2031 Costco only with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 177, R = 77	0.68	69.1	E			L = 177, R = 77	1.20	173	F	#229.3
EBTR	T = 222	0.89	73.8	E	216.9		T = 222	0.47	48.7	D	61
WBL	L = 305	2.01	506	F	68.8		L = 305	0.96	83.5	F	#110.6
WBT	T = 236	0.82	79.6	E	81		T = 236	0.82	81	F	#122.1
WBR	R = 472	0.32	0.5	A	163.5		R = 472	1.25	165.5	F	#225.3
NBL	L = 111	2.05	552.6	F	19.8		L = 111	0.75	58.9	E	#51.4
NBTTTR	T = 2623, R = 151	1.20	160.1	F	436.6		T = 2623, R = 151	1.20	130.1	F	#400.0
SBL	L = 321	1.84	421.7	F	119.1		L = 321	1.08	133.5	F	#97.7
SBTT	T = 2347	0.84	27.7	C	251.2		T = 2347	0.94	44.0	D	269.3
SBR	R = 94	0.08	0.1	A	27.8		R = 94	0.08	0.1	A	0
Overall	7136		128.2	F			7136		95.1	F	

Scenario F1 - 2021 Gas Bar only with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 151, R = 65	0.70	69.2	E	55.1		L = 151, R = 65	0.93	97.4	F	#178.5
EBTR	T = 158	0.79	66.1	E	289.4		T = 158	0.39	44	D	43.8
WBL	L = 239	1.58	324.4	F	72.9		L = 239	0.89	76.9	E	#112.7
WBT	T = 162	0.68	67.2	E	164.2		T = 162	0.85	99.3	F	#94.6
WBR	R = 269	0.18	0.2	A	216.4		R = 269	0.81	37.9	D	#70.5
NBL	L = 99	1.42	284.7	F	44.9		L = 99	0.62	41.2	D	34.8
NBTTTR	T = 2216, R = 93	1.06	72.5	E	610.7		T = 2216, R = 93	0.91	40.0	D	255.2
SBL	L = 220	0.94	78.5	E	128.9		L = 220	0.85	93.7	F	#63.5
SBTT	T = 1933	0.65	19.4	B	233.3		T = 1933	0.74	30.3	C	192.9
SBR	R = 81	0.07	0.1	A	111.8		R = 81	0.07	0.1	A	0
Overall	5686		64.0	E			5686		43.0	D	

Scenario F2 - 2031 Gas Bar only with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 177, R = 77	0.74	67.4	E			L = 177, R = 77	1.13	152.3	F	#233.1
EBTR	T = 186	0.83	67.4	E	254.9		T = 186	0.45	46.5	D	52.6
WBL	L = 268	1.77	402.5	F	70.8		L = 268	1.07	119.6	F	#119.8
WBT	T = 194	0.75	70.6	E	166		T = 194	1.05	139.9	F	#125.3
WBR	R = 314	0.21	0.3	A	185.5		R = 314	1.11	117.2	F	#140.7
NBL	L = 99	2.16	597.2	F	34.8		L = 117	0.68	68.7	E	#58.4
NBTTTR	T = 2640, R = 111	1.26	154.3	F	515.4		T = 2640, R = 111	1.06	72.4	E	#362.0
SBL	L = 254	1.34	208.9	F	88.6		L = 254	1.07	139	F	#81.4
SBTT	T = 2304	0.81	25.8	C	252.3		T = 2304	0.86	34.2	C	239.2
SBR	R = 94	0.08	0.1	A	90		R = 94	0.08	0.1	A	0
Overall	6736		112.3	F			6736		67.6	E	

Scenario G1 - 2021 Costco and Gas Bar Combined with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 151, R = 65	0.70	69.2	E	23.3		L = 151, R = 65	0.95	91.1	F	54.9
EBTR	T = 198	0.80	63.9	E	254.5		T = 198	0.66	57.6	E	203.8
WBL	L = 293	1.93	472.1	F	69		L = 293	1.20	162.7	F	86.1
WBT	T = 203	0.70	64.7	E	171.9		T = 203	0.79	74.8	E	216.3
WBR	R = 441	0.30	0.5	A	229.6		R = 441	1.05	104	F	226.4
NBL	L = 96	1.68	396.8	F	13.4		L = 96	0.62	38	D	37.8
NBTTTR	T = 2212, R = 131	1.08	78.9	E	250.8		T = 2212, R = 131	1.21	113.9	F	486.5
SBL	L = 300	1.60	320.1	F	122.5		L = 300	1.22	159.5	F	108.2
SBTT	T = 1969	0.70	22.2	C	233.1		T = 1969	1.02	46.4	D	190.8
SBR	R = 81	0.07	0.1	A	40.1		R = 81	0.14	0.1	A	40.1
Overall	6140		88.6	F			6140		84.6	F	

Scenario G2 - 2031 Costco and Gas Bar Combined with Background Development (right: MITIGATION)

	Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)		Volume	V/C Ratio	Control Delay (s)	LoS	Queue (m)
EBLL	L = 177, R = 77	0.74	69.1	E	33.5		L = 177, R = 77	1.16	159.1	F	59.7
EBTR	T = 226	0.90	75.3	E	225.9		T = 226	0.48	49.2	D	118.8
WBL	L = 322	2.12	553.3	F	68.2		L = 322	0.98	87.3	F	87
WBT	T = 235	0.85	76.5	E	165.4		T = 235	0.78	76.5	E	211.5
WBR	R = 486	0.33	0.6	A	230		R = 486	1.25	163.7	F	212.5
NBL	L = 114	2.11	574.9	F	12.8		L = 114	0.77	61	E	45.6
NBTTTR	T = 2636, R = 149	1.28	161.8	F	281.6		T = 2636, R = 149	1.22	139.4	F	373.8
SBL	L = 334	1.91	452.8	F	19.3		L = 334	1.12	145.3	F	104.5
SBTT	T = 2340	0.84	27.5	C	179.9		T = 2340	0.95	45.9	D	197.3
SBR	R = 94	0.08	0.1	A	19.4		R = 94	0.08	0.1	A	78.8
Overall	7190		134.4	F			7190		92.6	F	

5 MULTI MODAL NETWORK

5.1 TRANSIT NETWORK

There are existing transit routes 8 and 11 along Baron Road and Springfield Road. Figure 32 shows the bus routes (in brown) and transit stops within the vicinity of the new development. Transit stops exist along Baron Road just east of Underhill Street and west of Leckie Road. Along Springfield Road, transit stops are available near Durnin Road and Leckie Road. There are no shelters available at Stops 103156, 103130 and 103138.

Figure 32: Bus Route and Stops within Vicinity of New Development

As discussed in Section 2.3, the nature of Costco limits opportunities for reduction in trips from alternate travel modes. There is opportunity to encourage Costco employees to use non-auto modes or transit to travel to and from work. To this end, secured bicycle parking has been incorporated into the development. The current bus stop locations will also provide adequate access to the site for Costco employees and customers.

To accommodate and minimize land acquisition for a dual left turn lane at Springfield/Leckie Road intersection, Bus stop ID 103158 will have to move to the far side of the intersection.

5.2 PEDESTRIAN ACCESSIBILITY

Existing aerial photos (see Figure 33) of the undeveloped site, indicate pedestrians use the site as a cut through route between Baron Road and Leckie Road. The un-official east/west pedestrian route located at the North end of the lot has been incorporated into the site plan. The south route will not be added within the Costco site due to safety concerns related to site circulation and privacy concerns for adjacent residents. There are other options within the site to travel across from Baron Road to Leckie near the south side.

Figure 33: Existing Pedestrian Routes

Off-site pedestrian infrastructure is also provided along all the roads within the study area.

5.3 CYCLING FACILITIES

Dilworth Drive and Leckie Road both have existing on-street cycle lanes. Both roads are designated as future cycling corridors connecting the Rail Trail with the Mission Creek trail facility along Springfield Road. Both are also planned for future upgrades including:

Leckie Road

- Cycle track, sidewalks, boulevards and intersection upgrades.

Dilworth Drive/Benvoulin Rd

- Cycle track, sidewalks, boulevards and intersection upgrades.

The impact on traffic and infrastructure because of these upgrades is currently being reviewed by the City. Costco access locations along Leckie Road for the new site is to incorporate unimpeded sight line design elements to reduce conflict with cyclist/pedestrians.

6 ROAD SAFETY CONSIDERATIONS

6.1 ACCESSES

6.1.1 SIGHT LINES

The sight lines of the access locations connected to Baron Road and Leckie Road were reviewed and compared with TAC guidelines for 50 km/h posted speed limit and are summarized in Table 6-1.

Table 6-1: Summary of Sight Line Analysis

Movement	TAC Guideline (m)	GAS BAR	COSTCO			
		Baron	Baron South End	Baron Mid Block of Lot	Parkview	Leckie between Springfield and Parkview
Left turn from minor road	105	ok	ok	Does not meet criteria	ok	ok
Left turn from major road	80	ok	ok	ok	ok	ok
Right turn from minor road	95	ok	ok	ok	ok	ok
Crossing major road from minor road	95	ok	ok	Does not meet criteria	ok	ok
Stopping sight distance on Major road	65	ok	ok	ok	ok	ok

As shown in Table 6-1, the mid block access along Baron Road into the Costco Wholesale store does not meet the criteria for all turns. As a result, this access has been designed to limit left turns out from the site to account for the sight line issues at this location.

6.1.2 THROAT LENGTHS

The primary access to the site is located along Leckie Road. The site plan has assumed Parkview/Leckie Road intersection would be the primary access. The design incorporates the following throat lengths shown in Table 6-2.

Table 6-2: Throat Lengths

LOCATION	LENGTH (M)	APROX. VEHICLE QUEUE STORAGE
Baron South End	23 m	3
Baron Mid Block of Lot	14 m	2
Parkview Crescent Primary Access	64 m	9
Leckie Between Springfield and Parkview Crescent	14 m	2

6.2 COLLISION REVIEW

The collision review provides a general overview of the collision history of the study network. A full collision analysis is beyond the scope of this TIA as it has already recently been completed by the City. For this review, ICBC collision data from 2007 through 2017 for the study area was reviewed and a general summary provided. Some of the recommended improvements identified from a capacity and level of service perspective in Section 3 also improves the safety of the intersections and they are further described in this section. From a general perspective, adequate bike lanes and pedestrian crossing control throughout the study network will further reduce pedestrian/vehicle/cycling conflicts.

There is a total of 3,109 recorded collisions at the study intersections over the 10-year study period. Figure 34 shows the total collisions at each of the study intersections by severity.
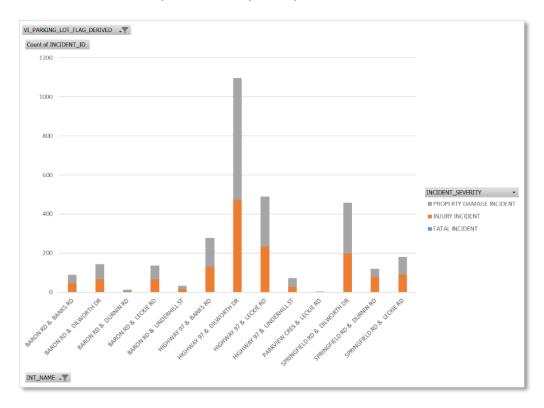

Figure 34: Total Collisions in Study Network by Intersection and Severity

The intersection of Highway 97/Dilworth Drive has the highest number of collisions followed by Highway 97/ Leckie Road, Springfield Road/Dilworth Drive/Benvoulin Road and Highway 97/Banks Road. These four intersections are also listed in the City's top 40 list as requiring improvements from a collision perspective in a recent safety study completed by the City.

As shown in Figure 35, rear end collisions make up approximately 70% of all collisions. Rear end collisions are caused by following too closely or unexpected stopping mid-block. A summary of the collision types for each of the study intersections is included in Appendix D.
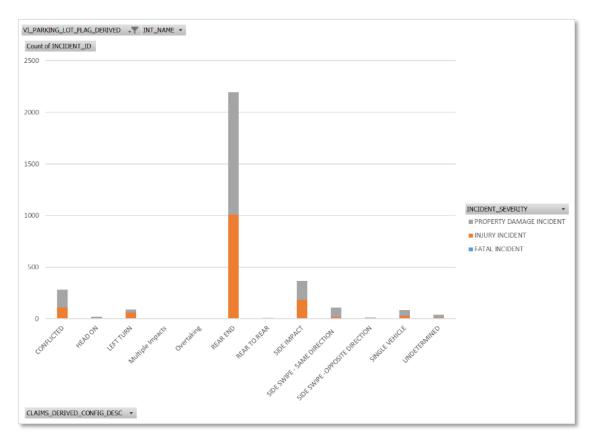

Figure 35: Total Collisions in Study Network by Type and Severity

6.2.1 LECKIE ROAD

As discussed in Section 3, the section of Leckie Road between Highway 97 and Parkview Crescent should be reviewed irrespective of the proposed Costco relocation. The laning configuration for the mid-block accesses causes some drive confusion which may be contributing to rear end collisions through the corridor. Mitigation measures could include:

- Extending the centre median from Highway 97 through to Baron Road to reduce driver confusion and conflicts.

- Having a consistent cross section along Leckie Road from Highway 97 to Springfield road such as two through lanes in each direction with left turn auxiliary lanes at intersections.

- Maintaining adequate cycling facilities along Leckie Road.

6.2.2 BARON ROAD/DILWORTH DRIVE INTERSECTION

The Baron Road/Dilworth Drive intersection will benefit from both a capacity and safety perspective by reconfiguring the laning at the intersection in the north/south direction to a through/right lane and separate left turn lane as well as adding a westbound right turn lane along Dilworth Drive.

6.2.3 SPRINGFIELD ROAD/LECKIE ROAD INTERSECTION

The current signal phasing of the Springfield Road/Leckie Road intersection includes a protected left turn only phase which limits the vehicles from making additional left turn maneuvers when opposing lanes have adequate gaps in traffic. Although there are adequate sight lines for northbound left turning traffic, the protected left turn phase was put in place due to the high collision rates at this intersection approximately 8 years ago. Changing this phase back to a protected/permissive phase is not an option, however, more traffic is anticipated at this intersection. A dual left turn lane will therefore mitigate the added future traffic volumes allow for this maneuver to remain as a protected only phase.

6.2.4 BARON ROAD/DURNIN ROAD INTERSECTION

Durnin road will receive more traffic when Costco and the gas bar is located along Baron Road. This road already has traffic calming measures in place. These should remain in place as a measure to control speeds. It is also anticipated there will be more pedestrian traffic due to the overflow parking spaces made available at the Gas station for the Costco development. Adequate lighting will be required in addition to improved pedestrian control measures such as the flashing beacons above pedestrian signs for crossing of Baron Road.

7 SUMMARY AND RECOMMENDATIONS

7.1 SUMMARY

The results of the analysis indicated the following:

i.   The study network experiences some delays and queues during the weekday PM peak and Saturday peak under existing 2019 volumes.

ii. There are existing capacity and LOS issues for left turns from the Highway to the City streets. There will be left turning traffic capacity and LOS issues from Dilworth Drive and Leckie Road to the Highway under background and total conditions in 2021 and 2031.

iii. The planned relocation of Costco from the existing site on Highway 97 to the proposed site on Baron Road/Leckie Road will generate a net increase of 267 trips in the weekday PM peak and 310 trips in the Saturday peak hour because of the new gas bar and increased size of the store.

iv. The Costco + Gas Bar will affect the overall performance of the Leckie Road / Highway 97 intersection, but not as significantly as the identified suite of background developments identified in Section 1.5.1 of this report.

v.   Due to the nature of Costco sales, there are limited opportunities to promote alternate modes of transportation (i.e. transit and active transportation).

vi. Based on sight line analysis, the proposed access locations meet the requirements for all movements except the mid-block access on Baron Road which does not meet the requirements for left turn out of the site, so it should be restricted to right-in/right-out/left-in.

vii. A viable design for a dual southbound left turn from Highway 97 to Leckie Road is feasible and shown in Appendix E.

viii. The internal throat length at the primary access of Leckie Road/Parkview Crescent is approximately 65 metres (or 9 vehicles). The other throat lengths range from 14 to 23 metres which allows for approximately 2 to 3 vehicles waiting at the access location.

ix. The collisions analysis indicates that over 70% of the collisions at the study intersections over the past 10 years are from rear end collisions.

This study investigated the traffic impacts of the proposed relocation of Costco to Baron Road. There is already a Costco Warehouse near the proposed new site, and many of the generated trips are already on the study network which means they will be re-distributed. As a result, the impact of the proposed Costco relocation on the wider traffic network are minimal and the impacts are localized to the surrounding network within the proposed site.

7.2 MITIGATION SUMMARY

To mitigate traffic conditions under existing or background development conditions:

Highway 97/Dilworth Drive	Add a northbound right turn lane
Highway 97/Banks Road	Monitor
Highway 97/Underhill Street	Monitor

Baron/Dilworth/Mall Entrance	Reconfigure the north/south direction to a left turn lane and separate through/right turn lane, optimize phasing, and add a westbound right turn lane from Dilworth Drive to Baron Road.
Baron Road/Underhill Street	Signalize, line paint for left turn lanes
Baron Road/Bank Road	Monitor
Springfield/Dilworth/Benvoulin	Extend the westbound right turn lane from Benvoulin Road to Springfield Road.
Springfield Road/Leckie Road	Add a dual left turn lane along Springfield Road in northbound direction, update cycle length and optimize phases within cycle.

To mitigate traffic conditions as a result of total development conditions:

Highway 97/Leckie Road	• Converting the second eastbound left turn lane to a second eastbound through lane • Add a double left turn southbound onto Leckie (once aggregated upon triggers by City and MOTI are met)
Leckie Corridor	Change the lane configuration to two through lanes with left turn lanes at Baron Road and Parkview Crescent
Baron Road/Underhill Street	Signalize
Baron Road/Durnin Road	Move pedestrian actuated crossing from Underhill
Baron Road/Leckie Road	Change the lane configuration to two through lanes and left turn lane, change the cycle length and optimize phases within the cycle.
Springfield Road/Durnin Road	Monitor. Should the left turn queues become too long, then the pedestrian signal could be converted to a signalized intersection for left turns.
Springfield Road/Parkview Crescent	Monitor. If it is found that traffic is taking this route to shortcut, the City can either formalize with a signal, traffic calm, or continue to monitor.

APPENDIX

A SITE PLAN

APPENDIX

APPENDIX

B TERMS OF REFERENCE

APPENDIX

APPENDIX

C SYNCHRO REPORTS

APPENDIX

APPENDIX

D COLLISION SUMMARY TABLES

APPENDIX

APPENDIX

E CONCEPT DRAWINGS