

# 30-48 Chamberlain Avenue

## Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report - ZBA

Step 4 Strategy Report - SPA

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## 1 Screening

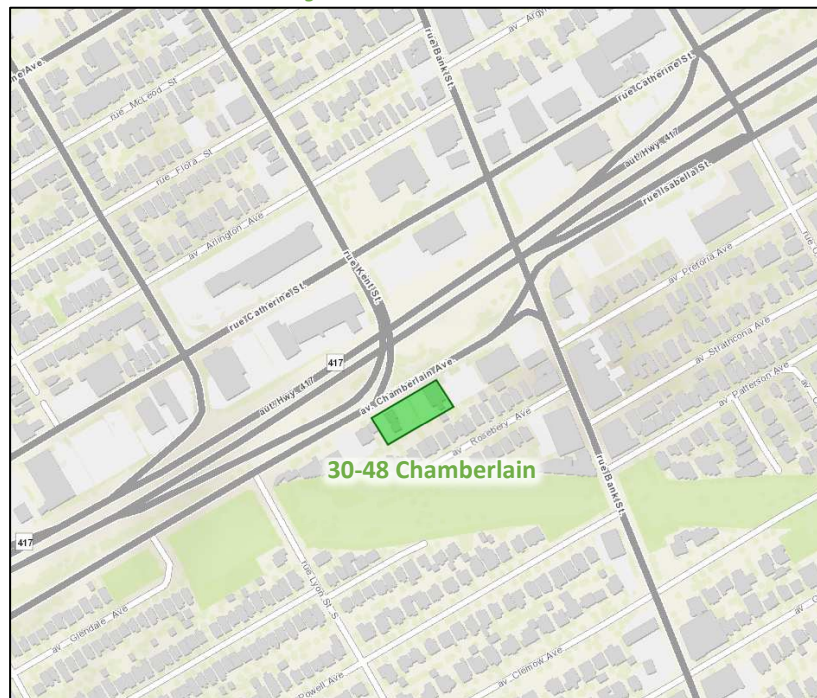
This study has been prepared according to the City of Ottawa’s 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for TIA Study PM. As shown in the Screening Form, a TIA is required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

## 2 Existing and Planned Conditions

### 2.1 Proposed Development

The proposed development, located at 30-48 Chamberlain Avenue and zoned as General Mixed-Use (GM4[2735]S448), is planned to include a total of 160 apartment units, and approximately 3,355 sq. ft. of ground floor retail space. The proposed vehicle parking consists of 78 vehicle spaces. The existing site contains a dental clinic and an electrician’s office, including approximately 54 parking stalls, both defined and undefined on a paved surface lot. The site will be accessed by a two-way access and outbound drop-off loop between the existing access location and crosswalk. The anticipated full build-out and occupancy horizon is 2024. Figure 1 illustrates the Study Area Context. Figure 2 illustrates the proposed concept plan.

Figure 1: Area Context Plan



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: January 19, 2023





## 2.2 Existing Conditions

### 2.2.1 Area Road Network

**Bank Street:** Bank Street is a City of Ottawa arterial road with a four-lane urban cross-section, sidewalks on both sides of the road, and on-street parking permitted on the east side of the road south of Pretoria Avenue and on both sides of the road south of Strathcona Avenue (no stopping peak hours in peak directions). The posted speed limit transitions at Chamberlain Avenue/Isabella Street from 40km/h to the south, to 50km/h to the north. The City-protected right-of-way is 20.0 metres and Bank Street is a truck route.

**Kent Street:** Kent Street is a City of Ottawa one-way arterial road (northbound) with a three-lane urban cross-section, sidewalks on both sides of the road, and on-street parking permitted on the east side south of Arlington Avenue in a layby and on the west side in laybys and on the east side in the travel lane (no stopping during AM peak) north of Flora Street. The unposted speed limit is 50 km/h and the City-protected right-of-way is 20.0 metres. Kent Street is a truck route.

**Lyon Street:** Lyon Street is a City of Ottawa one-way arterial road (southbound) with a two-lane urban cross-section, sidewalks on both sides of the road, a bike lane on the west side of the road, and on-street parking permitted on the east side north of Arlington Avenue in the travel lane (no stopping during PM peak). The unposted speed limit is 50 km/h and the City-protected right-of-way is 20.0 metres.

**Catherine Street:** Catherine Street is a City of Ottawa arterial road with a three-lane urban cross-section, sidewalks on both sides of the road, and on-street parking permitted on the north side of the road west of Lyon Street. The posted speed limit is 50 km/h and the City-protected right-of-way is 23.0 metres. Catherine Street is a truck route.

**Chamberlain Avenue:** Chamberlain Avenue is a City of Ottawa arterial road with a two-lane urban cross section, and a bike lane and sidewalk on the south side of the road. The posted speed limit is 50 km/h and the City-protected right-of-way is 23.0 metres. Chamberlain Avenue is a truck route.

**Isabella Street:** Isabella Street is a City of Ottawa arterial road with a two-lane urban cross section, and a bike lane and sidewalk on the south side of the road. The posted speed limit is 50 km/h and the City-protected right-of-way is 23.0 metres. Isabella Street is a truck route.

### 2.2.2 Existing Intersections

The key existing signalized intersections within 400 metres of the site have been summarized below:

***Lyon Street/Highway 417 On-Ramp & Catherine Street***

The intersection of Lyon Street and Bank Street is a signalized intersection. The southbound approach consists of a through lane and a right-turn lane, and the westbound approach consists of a shared left-turn/through lane and two through lanes. As both streets are one-way roadways, the west and south legs are inbound only. It is noted that the south leg of the intersection is an on-ramp to westbound Highway 417. No turn restrictions are noted.

***Kent Street & Catherine Street***

The intersection of Kent Street and Catherine Street is a signalized intersection. The northbound approach consists of a shared left-turn/through lane, a through lane, and an additional through lane separated by a concrete median. The westbound approach consists of a through lane, a shared through/right-turn lane, and a right-turn lane. Northbound left or right turns are prohibited in the east lane and westbound right turns on red are restricted.

*Kent Street & Chamberlain Avenue*

The intersection of Kent Street and Chamberlain Avenue is a pedestrian crossing location with a half-signal. The signal only stops eastbound through movements when triggered by a pedestrian crossing. No turn restrictions are noted.

*Bank Street & Catherine Street*

The intersection of Bank Street and Catherine Street is a signalized intersection. The northbound approach consists of a shared left-turn/through lane and a through lane and the southbound approach consists of a through lane and a shared through/right-turn lane. The westbound approach consists of a shared left-turn/through lane, a through lane, and a shared through/right-turn lane. As Catherine Street is a one-way roadway, the west leg is inbound only. No turn restrictions are noted.

*Bank Street & Chamberlain Avenue/Isabella Street*

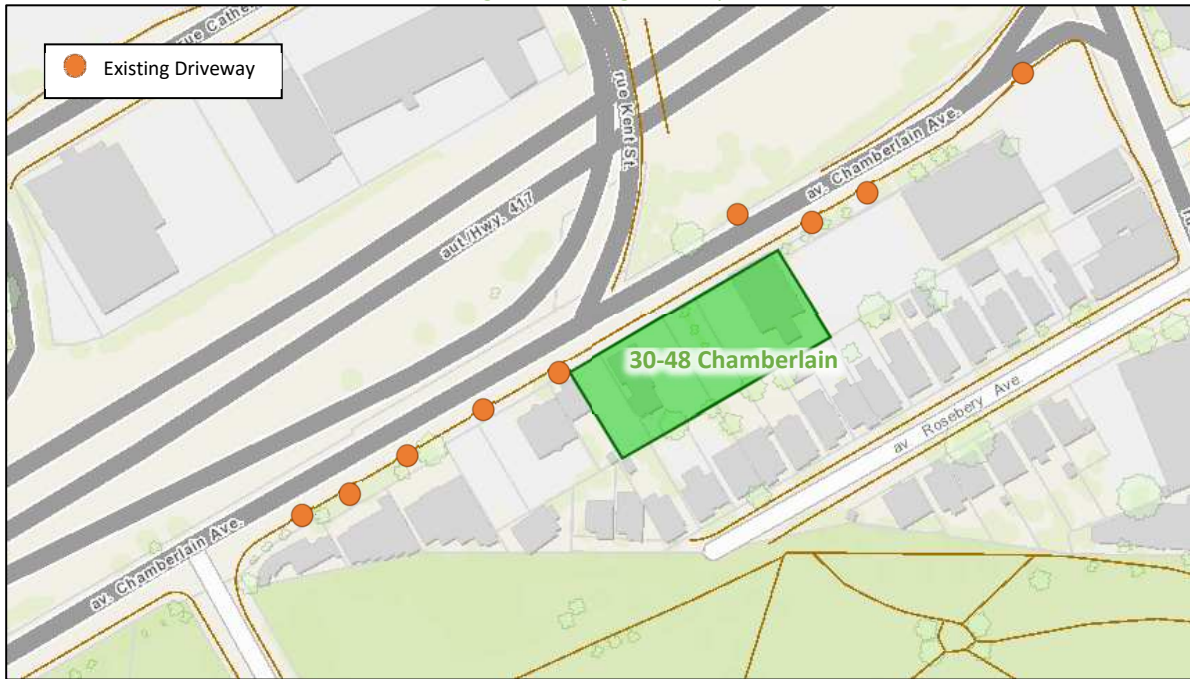
The intersection of Bank Street and Chamberlain Avenue/Isabella Street is a signalized intersection. The northbound approach consists of a through lane and a shared through/right-turn lane, and the southbound approach consists of a shared left-turn/through lane and a through lane. The eastbound approach consists of a shared left-turn/through lane, a through lane, and an auxiliary channelized right-turn lane. Functionally, driver behaviour results in the southbound approach operating as a left-turn lane and a through lane with drivers shifting to the curb lane in expectation of vehicles queuing for a left turn. No turn restrictions are noted.

2.2.3 Existing Driveways

Within 200 metres of the proposed site access, eight driveways exist on the south side of Chamberlain Avenue providing access to various commercial land uses. Additionally, a service entrance is present on the north side of Chamberlain Avenue to the east of the proposed site. Figure 3 illustrates the boundary street driveways within 200 metres of the proposed site accesses.



Figure 3: Existing Driveways

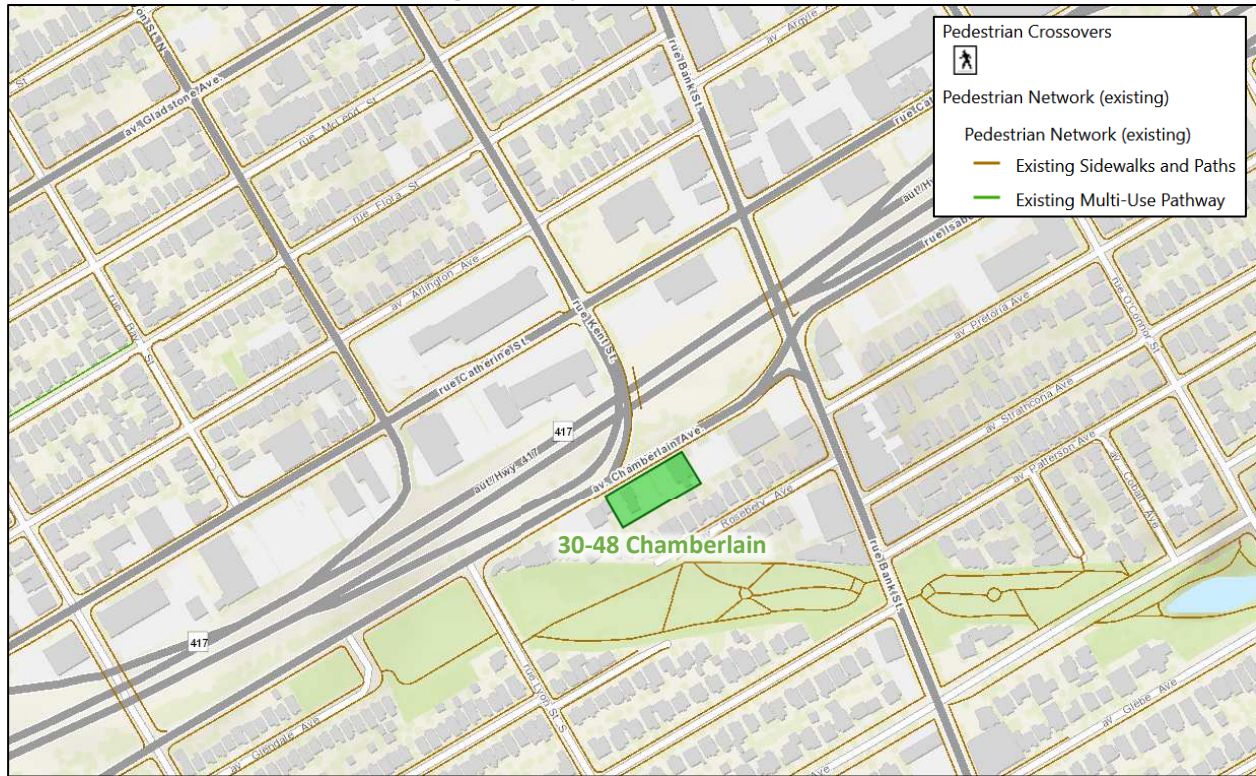


#### 2.2.4 Cycling and Pedestrian Facilities

Figure 4 illustrates the pedestrian facilities in the study area and Figure 5 illustrates the cycling facilities.

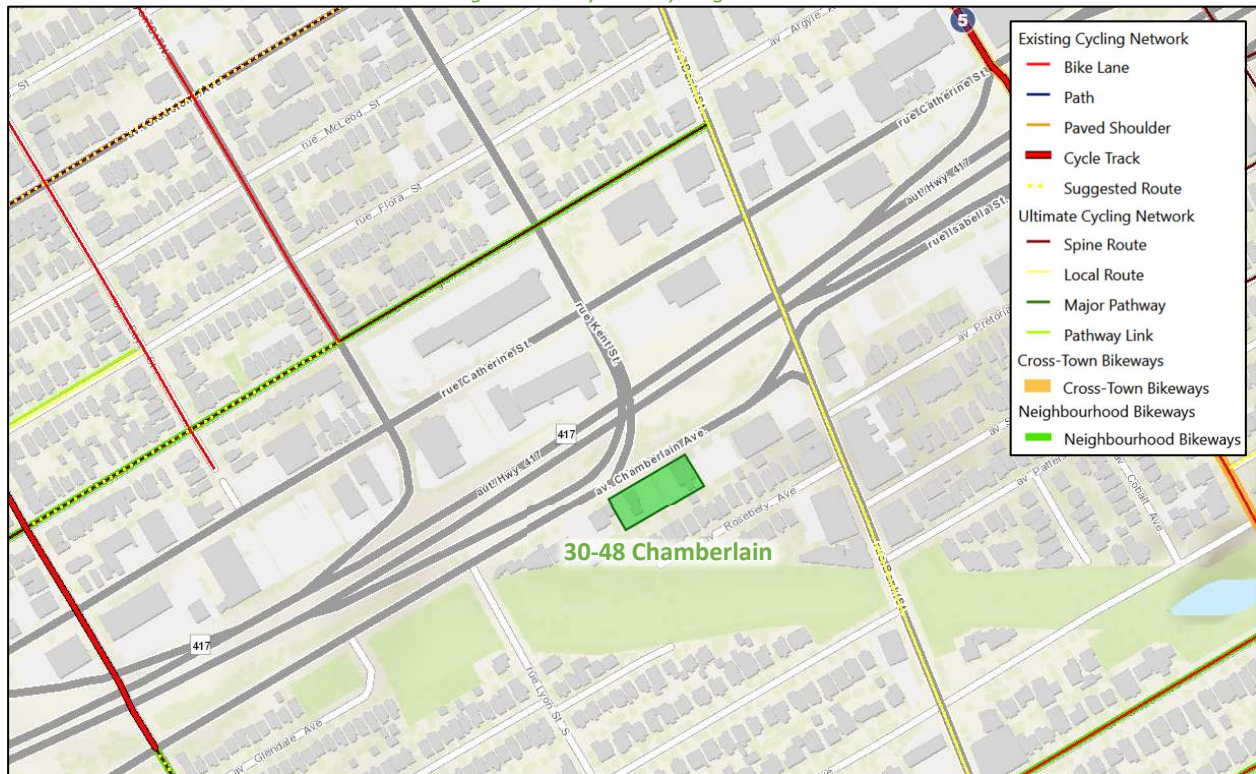
Sidewalks are provided along the south side of Chamberlain Street, the east side of Kent Street between Catherine Street and Chamberlain Street, and along both sides of all other study area roads. A southbound curbside bike lane is provided on the Lyon Street, which is a spine route (with a northbound bike lane found one block to the west along Bay Street, also a spine route). Catherine Street is a spine route, and Bank Street is a local cycling route.

Figure 4: Study Area Pedestrian Facilities



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: January 19, 2023

Figure 5: Study Area Cycling Facilities



Source: <http://maps.ottawa.ca/geoOttawa/> Accessed: January 19, 2023



Pedestrian and cyclist volumes included in study area intersection counts, presented in Section 2.2.7, have been compiled and are illustrated in Figure 6 and Figure 7, respectively.

Figure 6: Existing Pedestrian Volumes

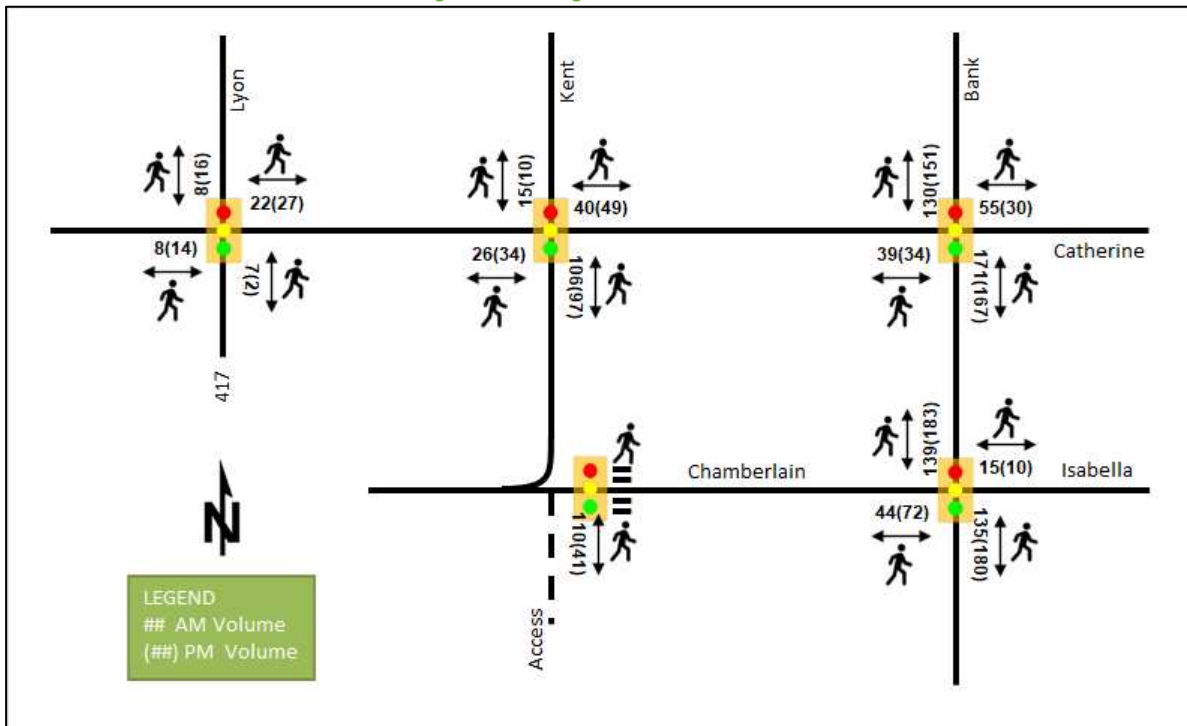
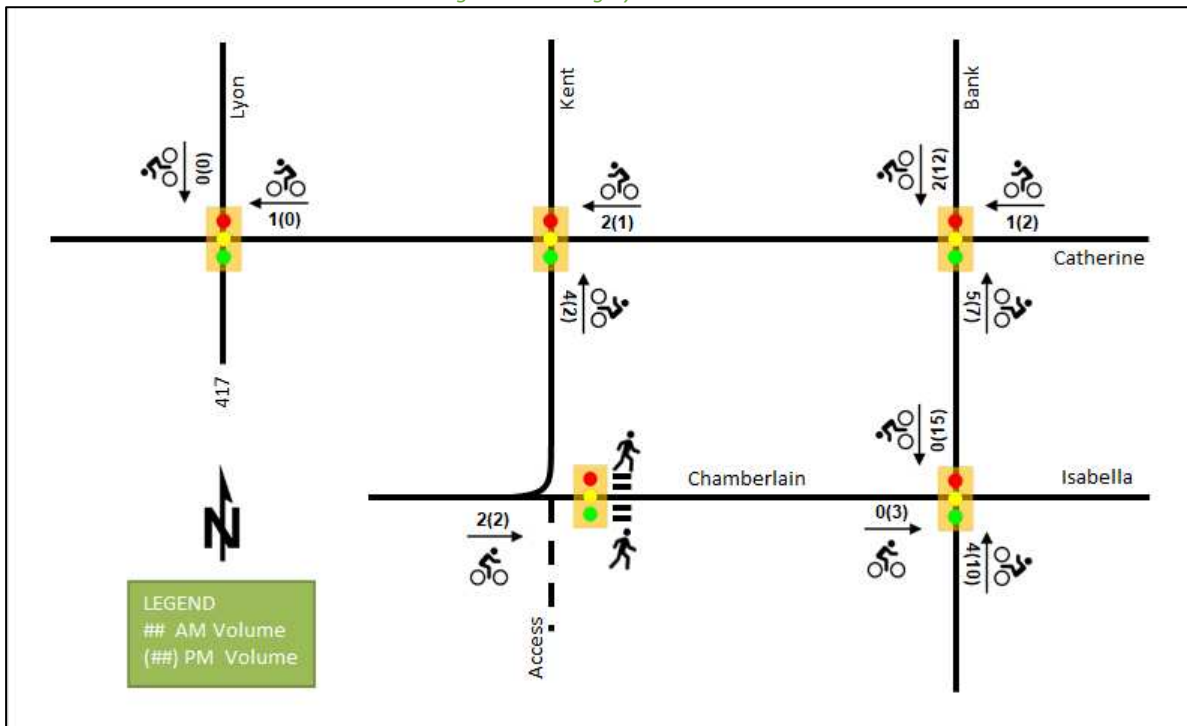


Figure 7: Existing Cyclist Volumes

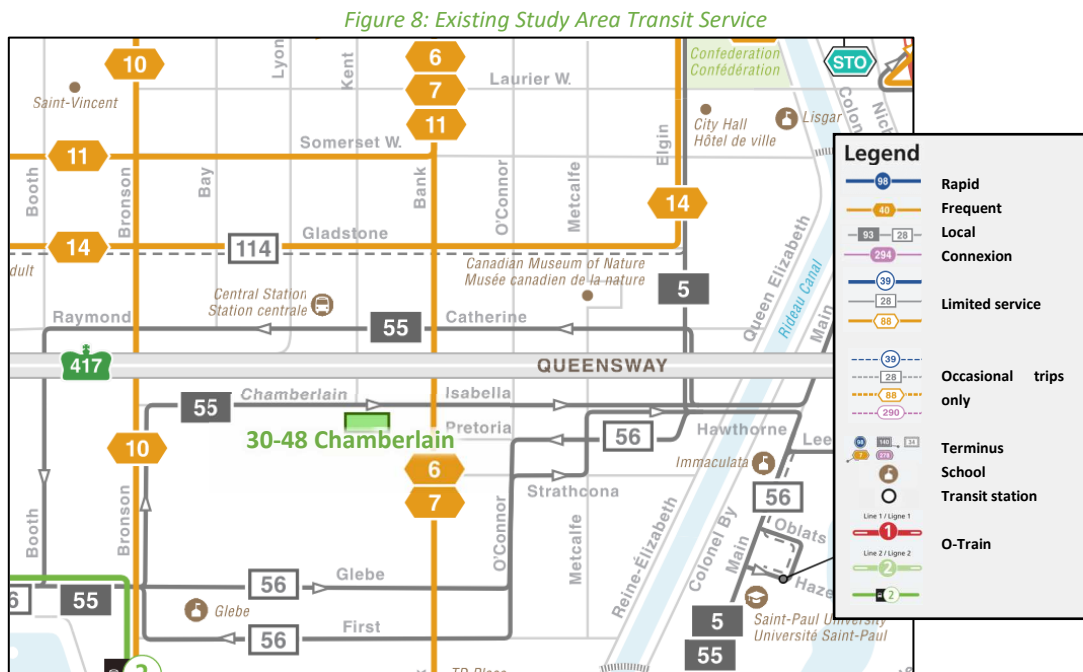


2.2.5 Existing Transit

Figure 8 illustrates the transit system map in the study area and Figure 9 illustrates nearby transit stops, including bus stop #6850 is located on the site frontage. All transit information is from March 15, 2023 and is included for general information purposes and context to the surrounding area.

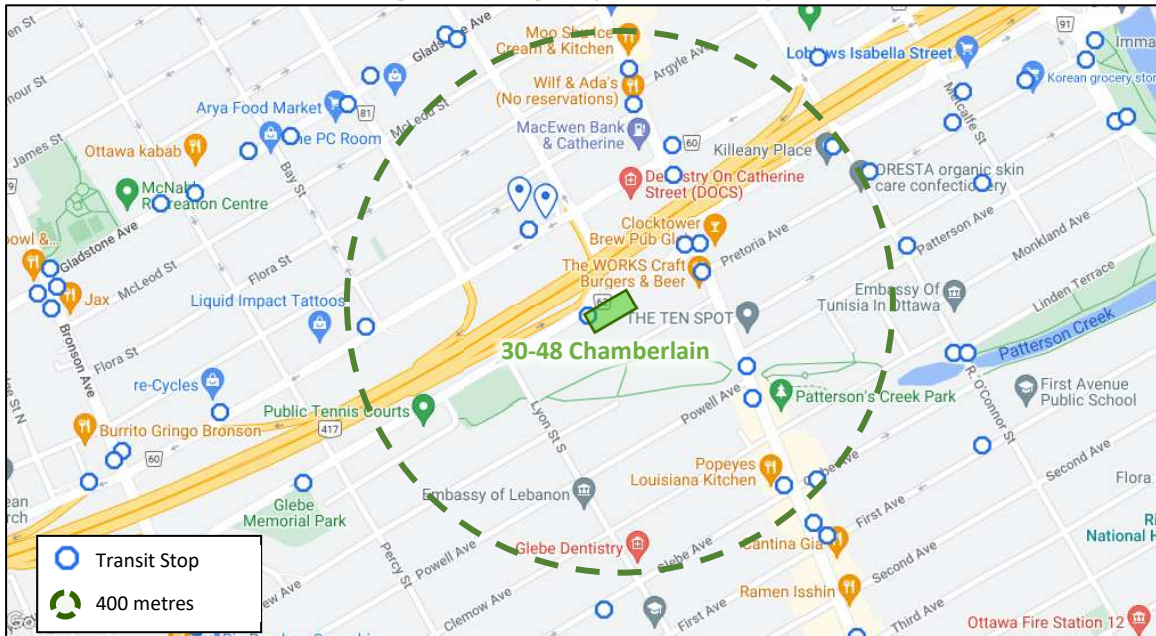
Within the study area, the routes #6 and #7 travel along Bank Street, #55 travels eastbound along Chamberlain Avenue and westbound along Catherine Street. Stops are located at the intersection of Kent Street and Chamberlain Street, and Bank Street and Chamberlain Avenue/Isabella Street. The frequency of these routes within proximity of the proposed site based on March 15, 2023 service levels are:

- Route #6 – 5-minute service all day, 10-minute nighttime service
- Route #7 – 15-minute service all day, 30-minute service during the evening/nighttime
- Route #55 – 15-minute service all day, 30-minute service during the evening



Source: <http://www.octranspo.com/> Accessed: March 15, 2023

Figure 9: Existing Study Area Transit Stops



Source: <http://www.octranspo.com/> Accessed: March 15, 2023

### 2.2.6 Existing Area Traffic Management Measures

The study area traffic calming measures consist of narrowings of local roads where they intersect arterials, speed humps along Lyon Street, Flora Street, Arlington Avenue, and on-street parking and bulb-outs/planters to delineate the start and end of the parking areas on local roads and Kent Street.

### 2.2.7 Existing Peak Hour Travel Demand

Existing turning movement counts were acquired from City counts for the existing Study Area intersections. Table 1 summarizes the intersection count dates. The counts are all from 2018 and considered acceptable for this area of the City. Typical growth central and downtown Ottawa are limited and it is not expected to have increased in any significant degree since 2018 beyond the application of typical background growth presented in Section 6.

Table 1: Intersection Count Date

Intersection	Count Date
Lyon Street/Highway 417 On-Ramp & Catherine Street	Wednesday, April 18, 2018
Kent Street & Catherine Street	Wednesday, April 18, 2018
Kent Street & Chamberlain Avenue	Wednesday, April 18, 2018
Bank Street & Catherine Street	Wednesday, April 18, 2018
Bank Street & Chamberlain Avenue/Isabella Street	Wednesday, April 18, 2018

Figure 10 illustrates the existing traffic counts and Table 2 summarizes the existing intersection operations. The level of service for signalized intersections is based on the TIA Guidelines for the lane movements and HCM average delay for the overall intersection. The southbound approach has been modeled as a left-turn lane and a through lane during the AM peak hour at all study horizons, in line with the in-situ operation. Detailed turning movement count data is included in Appendix B and the Synchro worksheets are provided in Appendix C.

Figure 10: Existing Traffic Volumes

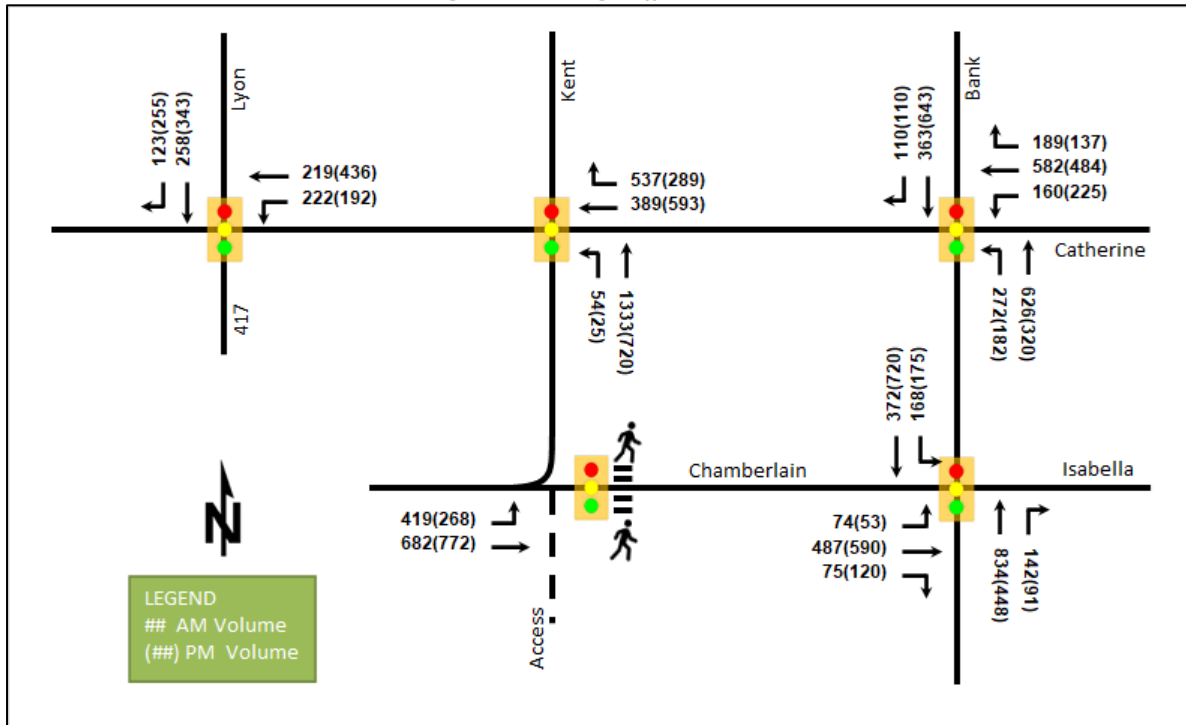


Table 2: Existing Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
Lyon St/Highway 417 On-Ramp & Catherine St <i>Signalized</i>	WBL/T	A	0.22	10.0	m25.8	A	0.46	15.4	11.3
	SBT	A	0.42	18.7	47.7	A	0.39	11.0	45.5
	SBR	A	0.21	3.9	9.5	A	0.33	6.8	24.7
	<b>Overall</b>	<b>A</b>	<b>0.28</b>	<b>11.8</b>	-	<b>A</b>	<b>0.40</b>	<b>12.4</b>	-
Kent St & Catherine St <i>Signalized</i>	WBT/R	B	0.69	26.9	m61.0	A	0.51	14.1	m42.9
	WBR	C	0.73	31.7	m57.3	A	0.54	16.6	m38.9
	NB	C	0.74	19.7	77.9	A	0.49	18.5	40.6
	<b>Overall</b>	<b>B</b>	<b>0.70</b>	<b>23.2</b>	-	<b>A</b>	<b>0.48</b>	<b>16.5</b>	-
Kent St & Chamberlain Ave <i>Pedestrian Signal</i>	EBL	A	0.38	1.7	9.1	A	0.21	1.2	7.4
	EBT	A	0.35	7.1	31.1	A	0.31	4.1	35.9
	<b>Overall</b>	<b>A</b>	<b>0.27</b>	<b>5.0</b>	-	<b>A</b>	<b>0.32</b>	<b>3.4</b>	-
Bank St & Catherine St <i>Signalized</i>	WB	D	0.86	33.3	#69.1	D	0.83	33.0	#60.2
	NBL/T	E	0.91	18.0	m#34.1	A	0.54	12.0	19.1
	SBT/R	B	0.64	26.4	46.7	E	0.92	88.3	#92.8
	<b>Overall</b>	<b>D</b>	<b>0.86</b>	<b>25.9</b>	-	<b>C</b>	<b>0.74</b>	<b>47.8</b>	-
Bank St & Chamberlain Ave /Isabella St <i>Signalized</i>	EBL/T	C	0.74	30.9	55.7	C	0.76	29.6	62.4
	EBR	A	0.19	2.3	3.4	A	0.28	5.3	10.5
	NBT/R	D	0.90	34.6	#122.9	A	0.35	10.2	34.8
	SBL(/T)	A	0.60	27.1	m31.4	C	0.79	26.8	m92.5
	(SBT)	A	0.41	9.5	m28.4				
	<b>Overall</b>	<b>C</b>	<b>0.80</b>	<b>27.6</b>	-	<b>D</b>	<b>0.87</b>	<b>22.4</b>	-

Notes: Saturation flow rate of 1800 veh/h/lane  
Queue is measured in metres  
Peak Hour Factor = 0.90

Delay = average vehicle delay in seconds  
m = metered queue  
# = volume for the 95th %ile cycle exceeds capacity

The existing intersections operate adequately during both peak hours.



At the intersection of Bank Street and Catherine Street during the AM peak hour the westbound movement and northbound shared left-turn/through movement may exhibit extended queues. During the PM peak hour at this intersection, the southbound through/right movement may be subject to high delays and extended queues, and the westbound movement may exhibit extended queues.

At the intersection of Bank Street at Chamberlain Avenue/Isabella Street during the AM peak hour, the northbound through/right movement may exhibit extended queues.

### 2.2.8 Collision Analysis

Collision data has been acquired from the City of Ottawa open data website ([data.ottawa.ca](http://data.ottawa.ca)) for five years prior to the commencement of this TIA for the surrounding study area road network. Table 3 summarizes the collisions types and conditions in the study area, Figure 11 illustrates the intersections and segments analyzed, and Table 4 summarizes the total collisions for each of these locations. Collision data is included in Appendix D.

*Table 3: Study Area Collision Summary, 2016-2020*

<b>Total Collisions</b>		<b>Number</b>	<b>%</b>
		<b>62</b>	<b>100%</b>
<b>Classification</b>	<b>Fatality</b>	0	0%
	<b>Non-Fatal Injury</b>	10	16%
	<b>Property Damage Only</b>	52	84%
<b>Initial Impact Type</b>	<b>Angle</b>	17	27%
	<b>Rear end</b>	15	24%
	<b>Sideswipe</b>	19	31%
	<b>Turning Movement</b>	8	13%
	<b>SMV Other</b>	3	5%
<b>Road Surface Condition</b>	<b>Dry</b>	48	77%
	<b>Wet</b>	9	15%
	<b>Loose Snow</b>	3	5%
	<b>Slush</b>	1	2%
	<b>Packed Snow</b>	1	2%
<b>Pedestrian Involved</b>		1	2%
<b>Cyclists Involved</b>		1	2%

Figure 11: Study Area Collision Records



Table 4: Summary of Collision Locations, 2016-2020

Intersections / Segments	Number	%
<b>Intersections / Segments</b>	<b>62</b>	<b>100%</b>
Bank Street at Chamberlain Avenue N/Isabella Street	54	87%
Chamberlain Avenue at Kent Street	3	5%
Chamberlain Avenue btwn Kent Street & Bank Street	3	5%
Chamberlain Avenue btwn Lyon Street S & Kent Street	2	3%

Within the study area, the intersection of Bank Street at Chamberlain Avenue/Isabella is noted to show higher collision incidences relative to other area locations. Table 5 summarize the collision types and conditions for the Bank Street at Chamberlain Avenue/Isabella Street intersection.

Table 5: Bank Street at Chamberlain Avenue/Isabella Street Collision Summary

Total Collisions		Number	%
Total Collisions		54	100%
Classification	Fatality	0	0%
	Non-Fatal Injury	9	17%
	Property Damage Only	45	83%
Initial Impact Type	Angle	17	31%
	Rear end	13	24%
	Sideswipe	15	28%
	Turning Movement	8	15%
	SMV Other	1	2%
Road Surface Condition	Dry	42	78%
	Wet	8	15%
	Loose Snow	2	4%

	Number	%
<b>Total Collisions</b>	<b>54</b>	<b>100%</b>
<b>Slush</b>	1	2%
<b>Packed Snow</b>	1	2%
<b>Pedestrian Involved</b>	1	2%
<b>Cyclists Involved</b>	1	2%

The intersection of Bank Street and Chamberlain Avenue/Isabella Street had a total of 54 collisions during the 2016-2020 time period, with 45 involving property damage only, and the remaining nine having non-fatal injuries. The collision types are most represented by angle, with 17 collisions, followed by sideswipe with 15 collisions, rear end with 13, turning movement with eight, and SMV (other) with one.

Historically at this intersection, angle collisions have been primarily represented by southbound through vehicles failing to comply with traffic control colliding with eastbound through vehicles. The lagging left-turn phase in the southbound direction may contribute to this trend as drivers are habituated to continue to drive through after the protected left-turn phase terminates. Sideswipe collisions may partially be a result of southbound traffic switching lanes to get around left-turning vehicles in queue and have historically been mostly due to eastbound drivers making improper lane changes possibly due to the skewed crossing of Bank Street. Turning movement collisions have historically been due to the eastbound drivers turning left into eastbound drivers continuing through. Overall, it is recommended that the City explore the possible addition of “chicken tracking” through the intersection to ensure proper lane use and potentially reduce collisions in the eastbound direction.

Weather conditions do not impact collisions at this location and no mitigation or further review of collisions is required as part of this study.

## 2.3 Planned Conditions

### 2.3.1 Changes to the Area Transportation Network

No roadway improvements are included within the Ottawa TMP for the study area road network. Isolated transit priority measures are identified as part of the Affordable Network along Bank Street.

The Chamberlain Avenue, Catherine Street, and Isabella Street Functional Design Study, conducted in 2019, is currently planned for implementation. The plan recommends several improvements on the subject streets including:

- Wider sidewalks and boulevards where feasible
- Cycling connections between the Rideau Canal and the O’Connor Bikeway
- Increased pedestrian queueing area at traffic signals
- Transit priority lane on part of Catherine Street
- Narrower vehicle lane widths
- Reduction in the number of vehicle lanes, where appropriate, including

This Functional Design is currently in the MTO Construction phase through 2027 seeing associated Highway 417 infrastructure under construction, where the design and construction of the plan recommendations will follow. As such, the implementation of these treatments will occur beyond the horizons considered within this TIA.

From the Draft Transportation Master Plan, anticipated for release in 2025, the Glebe Avenue to Percy Street to Chamberlain Avenue, splitting out to Isabella Street, Pretoria Avenue corridor and the O’Connor Street corridor are presently considered for future crosstown bikeways. Also from this draft document, a feasibility study is planned for cycling facilities within the Bank Street corridor south of Highway 417.

### 2.3.2 Other Study Area Developments

#### *443-447 Kent Street & 423-425 McLeod Street*

The proposed development includes a site plan for a four-storey residential building, with 31 apartment units. This application has been approved. A TIA is not available as part of the submission package for this site.

#### *488, 500 Bank Street*

The application includes a site plan for a nine-storey mixed use building, which includes 151 residential units and approximately 4350 sq. ft. of ground floor commercial. The development is expected to generate 24 new two-way AM peak hour auto trips and 25 new two-way PM peak hour auto trips (Parsons, 2014).

#### *143-153 Arlington Avenue*

The application includes a site plan for four-storey residential building, demolishing a previous building, representing a net increase of four units. A TIA is not available as part of the submission package for this site.

#### *170 Pretoria Avenue*

The application includes a site plan for a four-storey, six-unit residential building. A TIA is not available as part of the submission package for this site.

#### *667 Bank Street*

The application includes a site plan for a five-storey mixed-use building with 14 residential units, ground floor retail, and eight parking spaces. A TIA is not available as part of the submission package for this site.

## 3 Study Area and Time Periods

### 3.1 Study Area

The study area will include the intersections of:

- Lyon Street/Highway 417 On-Ramp & Catherine Street
- Kent Street at:
  - Catherine Street
  - Chamberlain Avenue (pedestrian signal)/Site Access (future conditions)
- Bank Street at:
  - Catherine Street
  - Chamberlain Avenue/Isabella Street

The boundary road is Chamberlain Avenue. No screenlines are present near the development site and none will be reviewed as part of this study.

### 3.2 Time Periods

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

### 3.3 Horizon Years

The anticipated build-out year is 2024. As a result, the full build-out plus five years horizon year is 2029.

## 4 Exemption Review

Table 6 summarizes the exemptions for this TIA.

Table 6: Exemption Review

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

## 5 Development-Generated Travel Demand

### 5.1 Mode Shares

Examining the mode shares recommended in the TRANS Trip Generation Manual (2020) for the subject district, derived from the most recent National Capital Region Origin-Destination survey (OD Survey), the existing average district mode shares by land use for Ottawa Inner Area have been summarized in Table 7.

Table 7: TRANS Trip Generation Manual Recommended Mode Shares – Ottawa Inner Area

Travel Mode	Multi-Unit (High-Rise)		Commercial Generator	
	AM	PM	AM	PM
<b>Auto Driver</b>	26%	25%	45%	45%
<b>Auto Passenger</b>	6%	8%	7%	7%
<b>Transit</b>	28%	21%	29%	29%
<b>Cycling</b>	5%	6%	8%	8%
<b>Walking</b>	35%	40%	11%	11%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### 5.2 Trip Generation

This TIA has been prepared using the vehicle and person trip rates for the residential dwellings using the TRANS Trip Generation Manual (2020) and the vehicle trip rates and derived person trip rates for the retail component from the ITE Trip Generation Manual 11th Edition (2021) using the City-prescribed conversion factor of 1.28. Table 8 summarizes the person trip rates for the proposed residential land use for each peak period and the person trip rates for the retail land use by peak hour.

Table 8: Trip Generation Person Trip Rates by Peak Period

Land Use	Land Use Code	Peak	Peak Period		Peak Hour	
			Vehicle Trip Rate	Person Trip Rates	Vehicle Trip Rate	Person Trip Rates
Multi-Unit High-Rise	221 & 222 (TRANS)	AM	-	0.80	-	-
		PM	-	0.90	-	-
Retail <40k sq. ft.	822 (ITE)	AM	-	-	2.36	3.02
		PM	-	-	6.59	8.44

Using the above person trip rates, the total person trip generation has been estimated. Table 9 summarizes the total person trip generation for the residential land use and for the retail land use.

Table 9: Total Residential Person Trip Generation by Peak Period

Land Use	Units	AM Peak Period			PM Peak Period		
		In	Out	Total	In	Out	Total
Multi-Unit High-Rise	160	40	88	128	84	60	144

Land Use	GFA	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Retail <40k sq. ft.	3,355	6	4	10	14	14	28

Internal capture rates from the ITE Trip Generation Handbook 3<sup>rd</sup> Edition have been assigned to the development’s retail component for mixed-use developments. The rates summarized in Table 10 represent the percentage of trips to/from the retail use based on the residential component.

Table 10: Internal Capture Rates

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

Pass-by reductions applied to the retail trip generation at a rate of 40% have been included using the recommended value presented in the ITE Trip Generation Manual 11th Edition (2021) for the most similar land use with a recommended rate, “Retail (40k – 150k sq. ft.)”.

Using the above mode share targets, the internal capture and pass-by rates, and the person trip rates, the person trips by mode have been projected. Trip generation by peak hour has been forecasted using the prescribed peak period conversion factors presented in the TRANS Trip Generation Manual (2020) for the residential component. Table 11 summarizes the residential trip generation and the retail trip generation by mode and peak hour.



Table 11: Trip Generation by Mode

Travel Mode		AM Peak Hour				PM Peak Hour			
		Mode Share	In	Out	Total	Mode Share	In	Out	Total
Multi-Unit (High-Rise)	Auto Driver	26%	5	11	16	25%	9	7	16
	Auto Passenger	6%	1	2	3	8%	3	2	5
	Transit	28%	6	14	20	21%	8	6	14
	Cycling	5%	1	2	3	6%	2	2	4
	Walking	35%	8	18	26	40%	18	12	30
	<b>Total</b>	<b>100%</b>	<b>21</b>	<b>47</b>	<b>68</b>	<b>100%</b>	<b>40</b>	<b>29</b>	<b>69</b>
Shopping Centre	Auto Driver	45%	0	0	0	45%	0	0	0
	Auto Passenger	7%	0	0	0	7%	1	1	2
	Transit	29%	1	1	2	29%	4	3	7
	Cycling	8%	0	0	0	8%	1	1	2
	Walking	11%	1	0	1	11%	1	1	2
	Pass-by	40%	-2	-2	-4	40%	-6	-6	-12
	Internal Capture	varies	-1	0	-1	varies	-1	-2	-3
	<b>Total</b>	<b>100%</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>100%</b>	<b>7</b>	<b>6</b>	<b>13</b>
Total	Auto Driver	-	5	11	16	-	9	7	16
	Auto Passenger	-	1	2	3	-	4	3	7
	Transit	-	7	15	22	-	12	9	21
	Cycling	-	1	2	3	-	3	3	6
	Walking	-	9	18	27	-	19	13	32
	<b>Total</b>	<b>-</b>	<b>23</b>	<b>48</b>	<b>71</b>	<b>-</b>	<b>47</b>	<b>35</b>	<b>82</b>

As shown above, a total of 16 AM and 16 PM new peak hour two-way vehicle trips are projected as a result of the proposed development.

### 5.3 Trip Distribution

To understand the travel patterns of the subject development the OD Survey has been reviewed to determine the travel for the residential component patterns were applied based on the build-out of Ottawa Inner. Table 12 below summarizes the distributions.

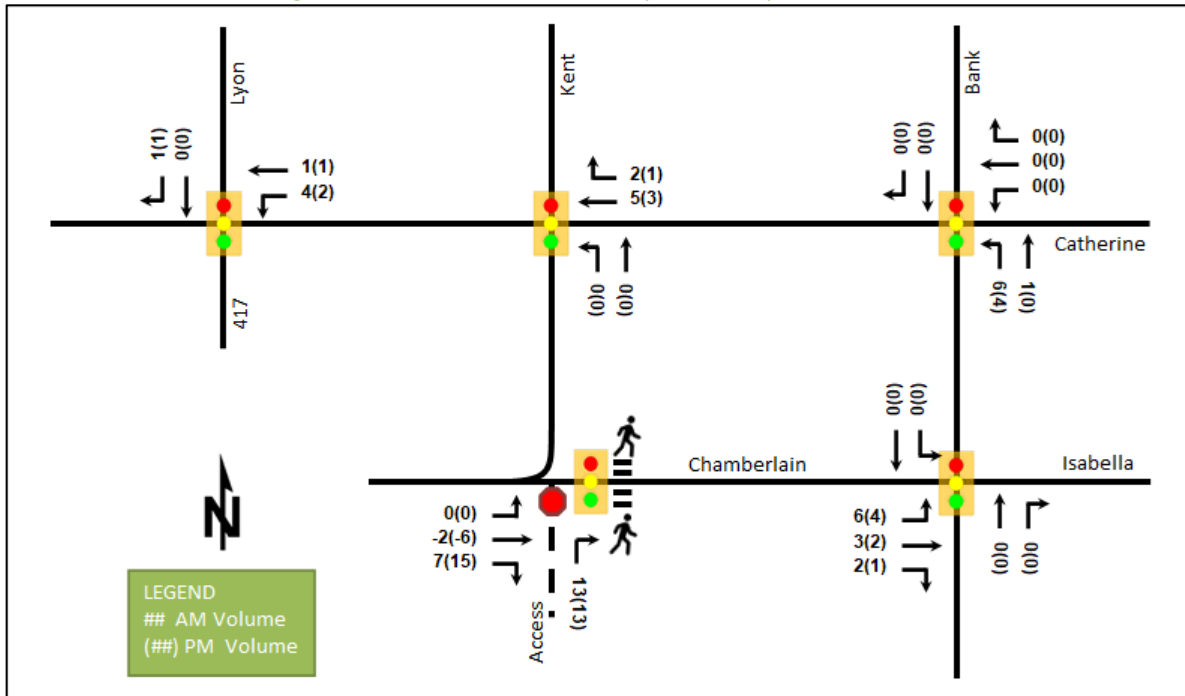
Table 12: OD Survey Distribution – Ottawa Inner

To/From	% of Trips	Via (Outbound/Inbound)
North	25%	15% Kent St/Lyon St, 5 % Bank St, 5% Metcalfe St/O’Connor St
South	35%	15% 417 W, 20% Bank St
East	20%	417 E
West	20%	417 W
Total	100%	-

### 5.4 Trip Assignment

Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the study area road network. Figure 12 illustrates the new site generated volumes.

Figure 12: New Site-Generated Primary and Pass-by Auto Volumes



## 6 Background Network Travel Demands

### 6.1 Transportation Network Plans

The transportation network plans were discussed in Section 2.3. No substantial changes are planned for the study area within the study horizons of this TIA.

### 6.2 Background Growth

A review of the background projections from the City’s TRANS Regional Model for the 2011 and 2031 horizons was completed to determine the background growth for each of the study area roadways. Table 13 summarizes the results of the model, and the projections are provided in Appendix E.

Table 13: TRANS Regional Model Projections – Study Area Growth Rates

Street	Direction Growth Percentage	
	Eastbound	Westbound
Catherine (E of Bank)	N/A	-0.04%
Catherine (W of Bank)	N/A	-0.22%
Chamberlain	1.43%	N/A
Isabella	2.16%	N/A
	Northbound	Southbound
Lyon	N/A	0.56%
Hwy 417 Ramp	2.19%	-0.16%
Kent	0.54%	-
Bank	-0.02%	0.88%

In general, the TRANS projections identify a growth rate range of -0.22% and 2.19%. Appropriate growth rates rounded to the nearest 0.25% will be peak-directionally applied to the identified links with negative growth rates being applied at zero. In the case of one-way streets, the peak direction reversal will be applied to the

corresponding opposite-direction one-way street (e.g. the Lyon Street AM growth rate will be applied as the Kent Street PM growth rate). The resultant growth rates applied to the study area roads are summarized in Table 14.

*Table 14: Applied Study Area Annual Growth Rates*

Street	AM Peak Hour		PM Peak Hour	
	Eastbound	Westbound	Eastbound	Westbound
Catherine (E of Bank)	N/A	-	N/A	2.25%
Catherine (W of Bank)	N/A	-	N/A	1.50%
Chamberlain	1.50%	N/A	-	N/A
Isabella	2.25%	N/A	-	N/A
	Northbound	Southbound	Northbound	Southbound
Lyon	N/A	0.50%	N/A	0.50%
Hwy 417 Ramp	N/A	-	N/A	2.25%
Kent	0.50%	N/A	0.50%	N/A
Bank	-	1.00%	1.00%	-

### 6.3 Other Developments

The background developments were discussed in Section 6.2. The 488, 500 Bank Street development’s 2014 Transportation Memo concluded that the development-generated traffic would be insignificant and thus it will be assumed to be accounted for by the background traffic growth, along with the other study area developments for which there were no traffic studies.

## 7 Demand Rationalization

### 7.1 2024 Future Background Operations

Figure 13 illustrates the 2024 background volumes and Table 15 summarizes the 2024 background intersection operations. The level of service for signalized intersections is based on v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection, and average delay for unsignalized intersections. The synchro worksheets for the 2024 future background horizon are provided in Appendix F.

Figure 13: 2024 Future Background Volumes

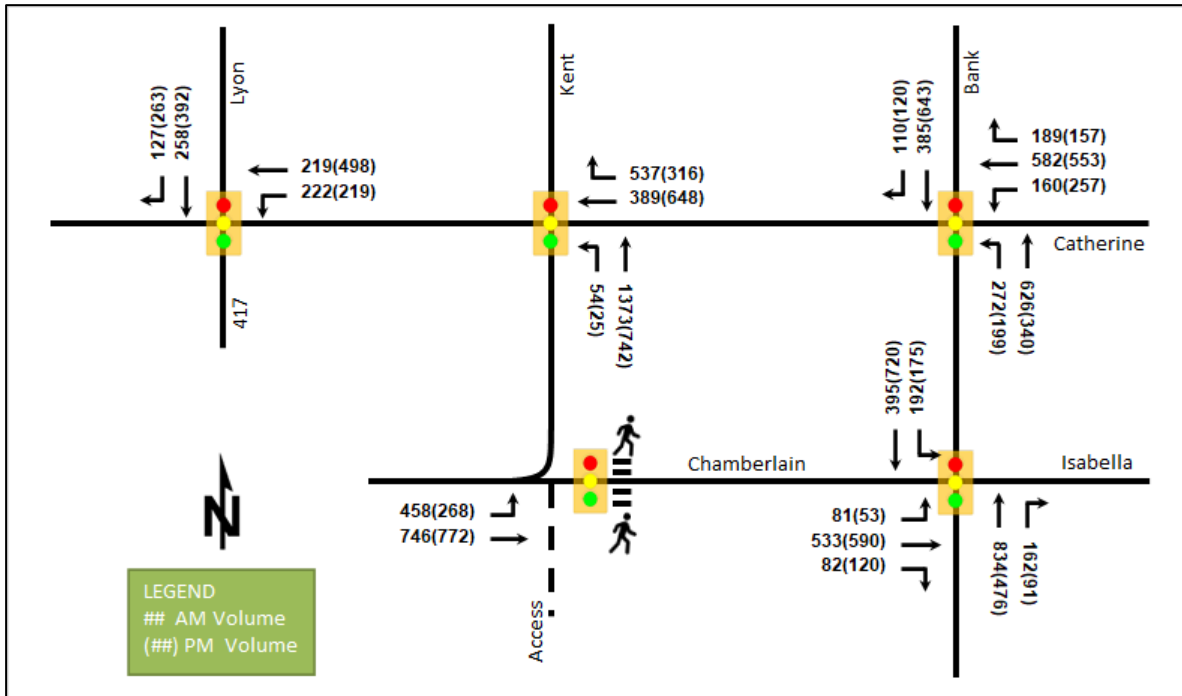


Table 15: 2024 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
Lyon St/Highway 417 On-Ramp & Catherine St <i>Signalized</i>	WBL/T	A	0.20	10.5	26.1	A	0.47	16.1	12.0
	SBT	A	0.37	18.1	42.7	A	0.40	11.1	47.0
	SBR	A	0.19	3.9	9.2	A	0.31	6.5	22.7
	<b>Overall</b>	<b>A</b>	<b>0.25</b>	<b>11.9</b>	-	<b>A</b>	<b>0.41</b>	<b>12.8</b>	-
Kent St & Catherine St <i>Signalized</i>	WBT/R	B	0.62	26.3	m60.6	A	0.50	14.3	m41.1
	WBR	B	0.66	30.1	m57.1	A	0.53	16.6	m37.1
	NB	B	0.69	18.5	69.8	A	0.45	18.0	37.2
	<b>Overall</b>	<b>B</b>	<b>0.64</b>	<b>22.0</b>	-	<b>A</b>	<b>0.46</b>	<b>16.3</b>	-
Kent St & Chamberlain Ave <i>Pedestrian Signal</i>	EBL	A	0.37	1.7	9.1	A	0.19	1.3	7.2
	EBT	A	0.35	7.1	30.5	A	0.28	4.2	31.8
	<b>Overall</b>	<b>A</b>	<b>0.27</b>	<b>5.0</b>	-	<b>A</b>	<b>0.29</b>	<b>3.4</b>	-
Bank St & Catherine St <i>Signalized</i>	WB	C	0.77	28.6	54.9	D	0.85	34.4	#66.1
	NBL/T	D	0.81	12.0	m28.8	A	0.53	12.2	18.9
	SBT/R	A	0.60	25.6	43.9	D	0.84	37.4	#80.1
	<b>Overall</b>	<b>C</b>	<b>0.77</b>	<b>21.5</b>	-	<b>C</b>	<b>0.71</b>	<b>30.1</b>	-
Bank St & Chamberlain Ave /Isabella St <i>Signalized</i>	EBL/T	C	0.73	30.7	54.8	C	0.71	29.0	55.3
	EBR	A	0.19	2.2	3.3	A	0.26	4.7	8.7
	NBT/R	D	0.82	28.8	#107.6	A	0.32	9.4	32.7
	SBL(/T)	A	0.57	24.6	m33.3	B	0.68	16.2	m88.0
	(SBT)	A	0.39	9.1	m27.6				
<b>Overall</b>	<b>C</b>	<b>0.75</b>	<b>24.6</b>	-	<b>C</b>	<b>0.77</b>	<b>17.6</b>	-	

Notes: Saturation flow rate of 1800 veh/h/lane  
Queue is measured in metres  
Peak Hour Factor = 1.00

Delay = average vehicle delay in seconds  
m = metered queue  
# = volume for the 95th %ile cycle exceeds capacity

During both the AM and PM peak hours, the study area intersections operate well at the 2024 future background conditions with operational improvements from existing at all intersections due to the peak hour factor moving from 0.90 to 1.00 for forecasted conditions. No new capacity issues are noted.

### 7.2 2029 Future Background Operations

Figure 14 illustrates the 2029 background volumes and Table 16 summarizes the 2029 background intersection operations. The level of service for signalized intersections is based on v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection, and average delay for unsignalized intersections. The synchro worksheets for the 2029 future background horizon are provided in Appendix G.

Figure 14: 2029 Future Background Volumes

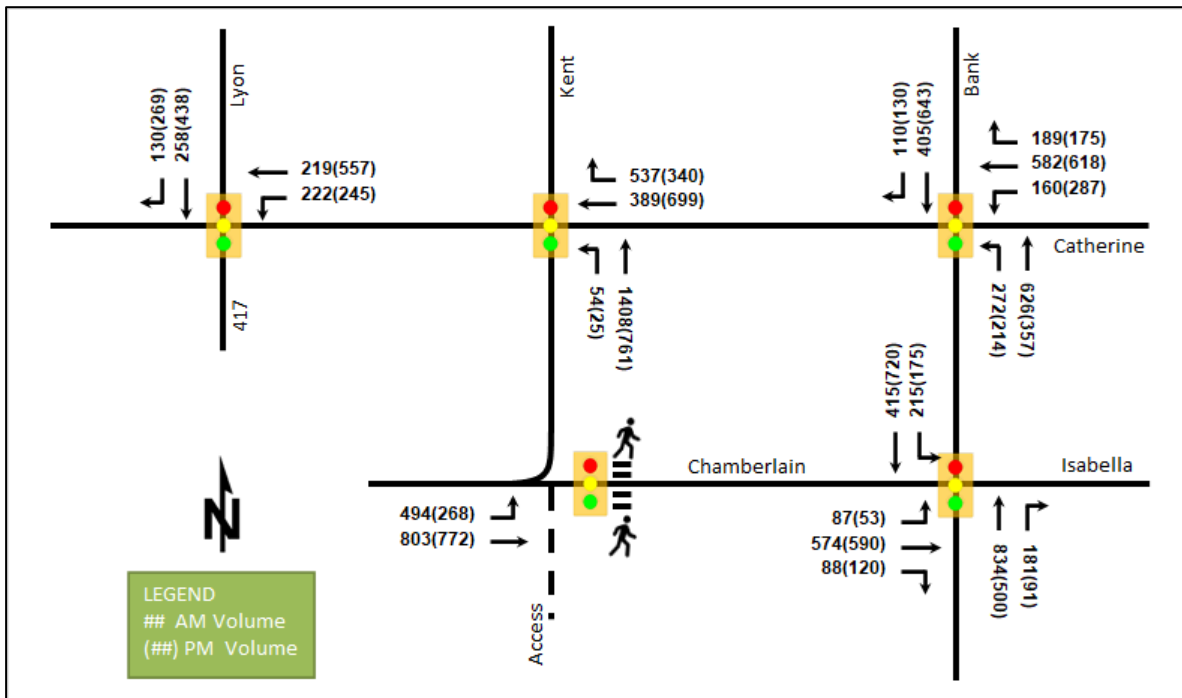


Table 16: 2029 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
Lyon St/Highway 417 On-Ramp & Catherine St <i>Signalized</i>	WBL/T	A	0.20	10.5	26.1	A	0.53	16.7	15.2
	SBT	A	0.37	18.1	42.7	A	0.45	11.8	53.9
	SBR	A	0.20	3.9	9.3	A	0.32	7.6	25.7
	<b>Overall</b>	<b>A</b>	<b>0.25</b>	<b>11.8</b>	-	<b>A</b>	<b>0.47</b>	<b>13.6</b>	-
Kent St & Catherine St <i>Signalized</i>	WBT/R	B	0.62	26.2	m60.3	A	0.54	15.4	m40.3
	WBR	B	0.66	30.0	m56.8	A	0.57	17.8	m36.9
	NB	B	0.70	18.8	72.3	A	0.46	18.2	38.3
	<b>Overall</b>	<b>B</b>	<b>0.65</b>	<b>22.1</b>	-	<b>A</b>	<b>0.49</b>	<b>17.0</b>	-
Kent St & Chamberlain Ave <i>Pedestrian Signal</i>	EBL	A	0.39	1.7	9.1	A	0.19	1.3	7.2
	EBT	A	0.37	7.1	33.2	A	0.28	4.2	31.8
	<b>Overall</b>	<b>A</b>	<b>0.29</b>	<b>5.0</b>	-	<b>A</b>	<b>0.29</b>	<b>3.4</b>	-

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
<b>Bank St &amp; Catherine St Signalized</b>	WB	C	0.77	28.6	54.9	E	0.95	45.5	#79.9
	NBL/T	D	0.82	12.0	m24.2	A	0.57	12.6	20.0
	SBT/R	B	0.63	26.4	46.2	D	0.86	39.1	#81.8
	<b>Overall</b>	<b>C</b>	<b>0.77</b>	<b>21.7</b>	-	<b>C</b>	<b>0.76</b>	<b>35.7</b>	-
<b>Bank St &amp; Chamberlain Ave /Isabella St Signalized</b>	EBL/T	C	0.76	31.1	59.6	C	0.71	29.0	55.3
	EBR	A	0.19	2.5	4.2	A	0.26	4.7	8.7
	NBT/R	D	0.86	31.9	#110.8	A	0.33	9.6	34.4
	SBL(/T)	B	0.66	30.0	m#41.0	B	0.69	16.7	m84.2
	(SBT)	A	0.42	9.9	m28.6				
<b>Overall</b>	<b>C</b>	<b>0.80</b>	<b>26.6</b>	-	<b>B</b>	-	<b>17.7</b>	-	

Notes: Saturation flow rate of 1800 veh/h/lane  
Queue is measured in metres  
Peak Hour Factor = 1.00

Delay = average vehicle delay in seconds  
m = metered queue  
# = volume for the 95th %ile cycle exceeds capacity

During both the AM and PM peak hours, the study area intersections operate well at the 2029 future background conditions and similarly to the 2024 background conditions.

At the intersection of Bank Street at Chamberlain Avenue/Isabella Street, the southbound left lane may exhibit extended queues.

### 7.3 2024 Future Total Operations

Figure 15 illustrates the 2024 total volumes and Table 17 summarizes the 2024 total intersection operations. The level of service for signalized intersections is based on v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2024 total horizon are provided in Appendix H.

Figure 15: 2024 Future Total Volumes

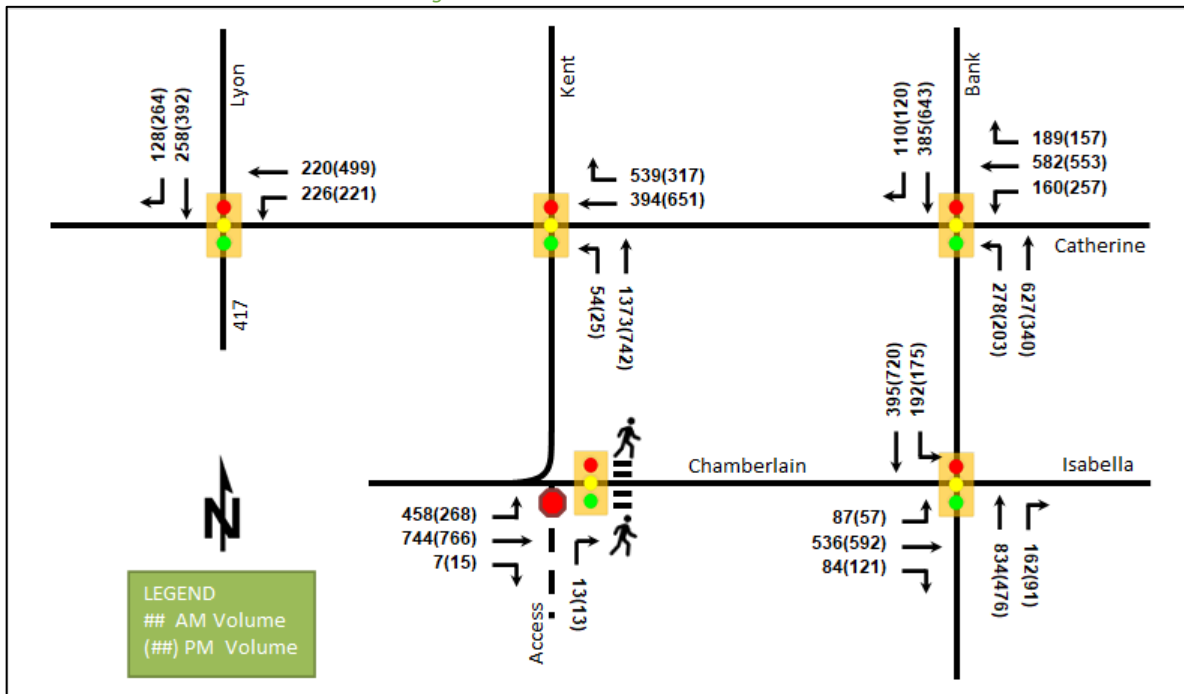




Table 17: 2024 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
<b>Lyon St/Highway 417 On-Ramp &amp; Catherine St Signalized</b>	WBL/T	A	0.20	10.5	26.4	A	0.47	16.0	11.9
	SBT	A	0.37	18.1	42.7	A	0.40	11.1	47.0
	SBR	A	0.20	3.9	9.2	A	0.31	6.6	22.8
	<b>Overall</b>	<b>A</b>	<b>0.25</b>	<b>11.8</b>	-	<b>A</b>	<b>0.41</b>	<b>12.8</b>	-
<b>Kent St &amp; Catherine St Signalized</b>	WBT/R	B	0.63	26.2	m60.7	A	0.51	14.4	m41.5
	WBR	B	0.66	30.0	m56.8	A	0.53	16.7	m37.4
	NB	B	0.69	18.5	69.8	A	0.45	18.0	37.2
	<b>Overall</b>	<b>B</b>	<b>0.64</b>	<b>22.0</b>	-	<b>A</b>	<b>0.46</b>	<b>16.4</b>	-
<b>Kent St/Site Access &amp; Chamberlain Ave Pedestrian Signal</b>	EBL	A	0.37	1.7	9.1	A	0.19	1.3	7.2
	EBT	A	0.35	7.1	30.7	A	0.28	4.1	32.1
	NBR	A	0.01	0.0	0.0	A	0.01	0.0	0.0
	<b>Overall</b>	<b>A</b>	<b>0.27</b>	<b>5.0</b>	-	<b>A</b>	<b>0.29</b>	<b>3.4</b>	-
<b>Bank St &amp; Catherine St Signalized</b>	WB	C	0.77	28.6	54.9	D	0.85	34.4	#66.1
	NBL/T	D	0.82	12.3	m29.3	A	0.54	12.2	19.2
	SBT/R	A	0.60	25.6	43.9	D	0.84	37.4	#80.1
	<b>Overall</b>	<b>C</b>	<b>0.77</b>	<b>21.6</b>	-	<b>C</b>	<b>0.71</b>	<b>30.1</b>	-
<b>Bank St &amp; Chamberlain Ave /Isabella St Signalized</b>	EBL/T	C	0.74	30.9	55.7	C	0.72	29.1	55.7
	EBR	A	0.19	2.3	3.5	A	0.26	4.7	8.7
	NBT/R	D	0.83	29.0	#107.6	A	0.32	9.5	32.7
	SBL(/T)	A	0.57	24.8	m33.4	B	0.69	16.3	m88.0
	(SBT)	A	0.39	9.2	m27.6				
	<b>Overall</b>	<b>C</b>	<b>0.76</b>	<b>24.8</b>	-	<b>C</b>	<b>0.77</b>	<b>17.7</b>	-

Notes: Saturation flow rate of 1800 veh/h/lane  
Queue is measured in metres  
Peak Hour Factor = 1.00

Delay = average vehicle delay in seconds  
m = metered queue  
# = volume for the 95th %ile cycle exceeds capacity

The network intersection operations for the 2024 future total horizon operate similarly to the 2024 future background conditions. No capacity issues are noted, and no mitigation measures are required.

### 7.4 2029 Future Total Operations

Figure 16 illustrates the 2029 total volumes and Table 18 summarizes the 2029 total intersection operations. The level of service for signalized intersections is based on v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2029 future total horizon are provided in Appendix I.

Figure 16: 2029 Future Total Volumes

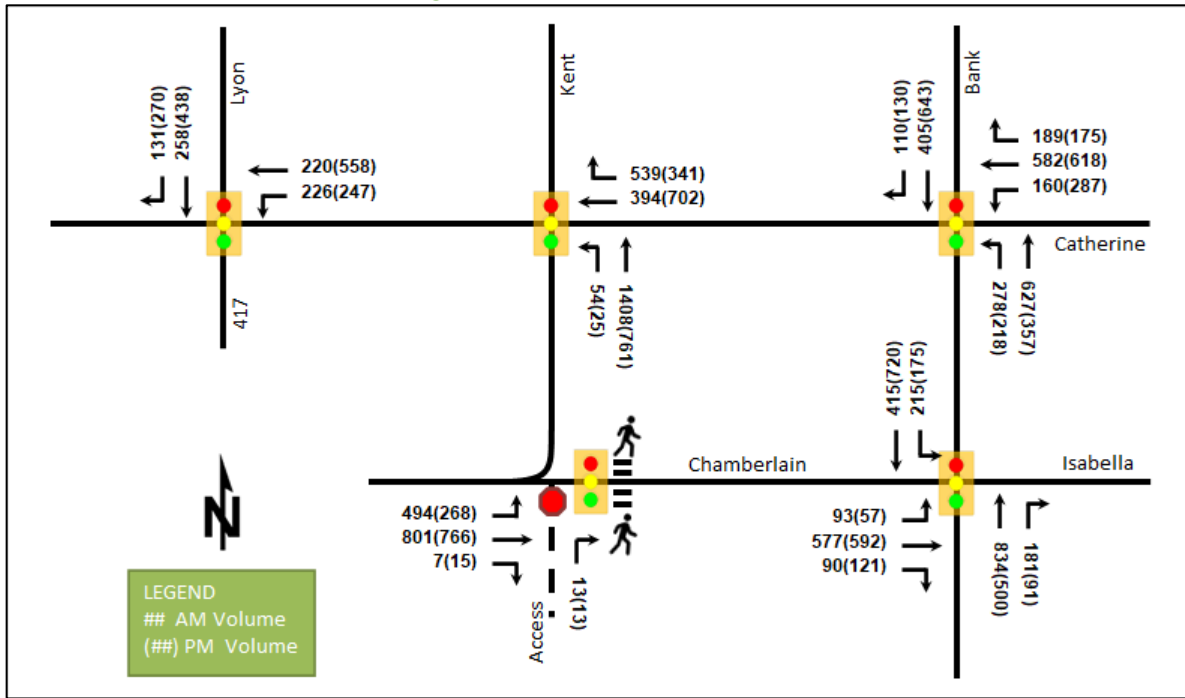


Table 18: 2029 Future Total Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95 <sup>th</sup> )	LOS	V/C	Delay	Q (95 <sup>th</sup> )
Lyon St/Highway 417 On-Ramp & Catherine St Signalized	WBL/T	A	0.20	10.5	26.4	A	0.53	16.6	15.1
	SBT	A	0.37	18.1	42.7	A	0.45	11.8	53.9
	SBR	A	0.20	3.9	9.3	A	0.32	7.6	25.8
	<b>Overall</b>	<b>A</b>	<b>0.25</b>	<b>11.8</b>	-	<b>A</b>	<b>0.47</b>	<b>13.6</b>	-
Kent St & Catherine St Signalized	WBT/R	B	0.63	26.1	m60.7	A	0.55	15.5	m40.7
	WBR	B	0.66	29.9	m56.7	A	0.57	17.8	m37.1
	NB	B	0.70	18.8	72.3	A	0.46	18.2	38.3
	<b>Overall</b>	<b>B</b>	<b>0.65</b>	<b>22.1</b>	-	<b>A</b>	<b>0.49</b>	<b>17.0</b>	-
Kent St/Site Access & Chamberlain Ave Pedestrian Signal	EBL	A	0.39	1.7	9.1	A	0.19	1.3	7.2
	EBT	A	0.37	7.1	33.3	A	0.28	4.1	32.1
	NBR	A	0.01	0.0	0.0	A	0.01	0.0	0.0
	<b>Overall</b>	<b>A</b>	<b>0.29</b>	<b>5.0</b>	-	<b>A</b>	<b>0.29</b>	<b>3.4</b>	-
Bank St & Catherine St Signalized	WB	C	0.77	28.6	54.9	E	0.95	45.5	#79.9
	NBL/T	D	0.82	12.2	m24.6	A	0.57	12.6	20.3
	SBT/R	B	0.63	26.4	46.2	D	0.86	39.1	#81.8
	<b>Overall</b>	<b>C</b>	<b>0.78</b>	<b>21.8</b>	-	<b>C</b>	<b>0.76</b>	<b>35.7</b>	-
Bank St & Chamberlain Ave /Isabella St Signalized	EBL/T	C	0.76	31.3	60.6	C	0.72	29.1	55.7
	EBR	A	0.20	2.6	4.4	A	0.26	4.7	8.7
	NBT/R	D	0.87	32.3	#110.8	A	0.34	9.6	34.4
	SBL(T)	B	0.66	30.2	m#41.1	B	0.69	16.7	m84.2
	(SBT)	A	0.42	9.9	m28.6				
<b>Overall</b>	<b>C</b>	<b>0.80</b>	<b>26.8</b>	-	<b>C</b>	<b>0.78</b>	<b>17.8</b>	-	

Notes: Saturation flow rate of 1800 veh/h/lane  
 Queue is measured in metres  
 Peak Hour Factor = 1.00

Delay = average vehicle delay in seconds  
 m = metered queue  
 # = volume for the 95th %ile cycle exceeds capacity

The network intersection operations for the 2029 future total horizon operate similarly to the 2029 future background conditions. No capacity issues are noted, and no mitigation measures are required.

### 7.5 Modal Share Sensitivity and Demand Rationalization Conclusions

No capacity issues have been noted at the study area intersections. Given this residual capacity, no rationalization for network demand is required.

With respect to site travel demand, negligible impacts are forecast from the low number of auto trips using the unmodified district mode shares. Thus, no rationalization for site-generated travel is required.

## 8 Development Design

### 8.1 Design for Sustainable Modes

Bicycle parking within secure rooms and auto parking are both located within the underground parking garage, and hard surface connections are provided from the building entrance to existing area pedestrian facilities. Bicycle parking is also provided via surface racks at the rear of the building and surface vehicle parking accesses the drive aisle.

All area transit stops for routes discussed in Section 2.2.5 are within 400 metres walk of the building entrance. The existing bus stop, partially located within the site driveway, is envisioned to shift approximately three metres to the west at the stop bar. Alternatively, the stop may relocate to the east to the far side of the pedestrian signal where no frontage conflicts exist. The site plan can accommodate both options and will be a decision from OC Transpo on their preferred location. Any upgrades to the existing stop facilities will be the responsibility of the City once Catherine Avenue is upgraded to ensure it is completed in a holistic manner consistent with the future detailed design exercise.

The infrastructure TDM checklist is provided in Appendix J.

### 8.2 Circulation and Access

Vehicular and cycling access is provided via a right-in-right-out access and a right-out-only drop off loop outlet, both onto Chamberlain Avenue within the intersection of Chamberlain Avenue and Kent Street. Access directly to Kent Street is to be restricted via a No Straight Through sign (Rb-10) located on each private approach.

Emergency and services are anticipated to access the site along the Chamberlain Avenue frontage and garbage collection is anticipated to take place within the drive aisle with the garbage truck entering the site in a forward direction and exiting the site in reverse.

## 9 Parking

### 9.1 Parking Supply

The site proposes 163 bicycle parking spaces, and 78 vehicle parking spaces total, with eight vehicle spaces within the surface lot and the remaining 70 spaces underground.

The parking requirements from the zoning by-law indicate that 80 bicycle and 55 vehicle spaces are required for tenants, 15 vehicle spaces are required for visitors, and a minimum of seven vehicle spaces are required for the commercial space based upon the assumption of a retail store.

The total vehicle parking requirement of 77 spaces is therefore proposed as being met by the development, and the minimum bicycle parking provision is proposed as being exceeded by a factor of two.

## 10 Boundary Street Design

Table 19 summarizes the MMLOS analysis for the boundary street of Chamberlain Avenue. The existing and future conditions for the segment will be considered in separate rows. The boundary street analysis is based on the policy area of “Within 200m of a school”. The MMLOS worksheets has been provided in Appendix K.

*Table 19: Boundary Street MMLOS Analysis*

Segment	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target
<b>Chamberlain Avenue (Existing)</b>	<b>F</b>	A	<b>E</b>	D	D	D	A	E
<b>Chamberlain Avenue (Future)</b>	<b>D</b>	A	A	D	D	D	A	E

Chamberlain Avenue along the site frontage does not meet the pedestrian and cycling MMLOS targets. Pedestrian LOS is not met due to the lack of boulevard, the sidewalk width, and high operating speeds and volumes on the arterial road. If the sidewalk were increased from 1.8 metres to 2.0 metres with a 0.5 metre boulevard or more, the segment would score PLOS D, due to the nature of arterial roads. A curbside bike lane along Chamberlain Avenue currently ends at its intersection with Kent Street, in advance of its intersection with Bank Street where the existing pavement width would preclude its continuation. If the Chamberlain Avenue were widened at its intersection with Bank Street and the bike lane were to be extended, the segment would score BLOS A, however any such treatment would be beyond the scope of this report. Mixed traffic conditions limit transit LOS.

Per the Chamberlain Avenue, Catherine Street and Isabella Street Functional Design Study, the currently planned future conditions for Chamberlain Avenue include a MUP to replace the sidewalk on the south side of the road separated from the road’s edge by a 1.5 metre boulevard. This treatment will improve bicycle LOS to a score of A, meeting targets, and improve pedestrian LOS to a score of D, still failing to meet targets. This treatment is due to occur outside of the time horizons considered by this report.

## 11 Access Intersections Design

### 11.1 Location and Design of Access

The proposed site accesses intersect Chamberlain Avenue just east of Kent Street between the stop line of the half-signal, which controls through-movements to permit pedestrian crossings, and its crosswalk.

The right-in/right-out access is proposed as being 6.0 metres-wide and right-in/right-out with a throat length of 5.6 metres and a distance between the roadway edge and first point of conflict of 7.6 metres. In the ultimate conditions with the proposed Chamberlain Avenue, Catherine Street, and Isabella Street Functional Design Study geometry, the throat length is 7.6 metres and the distance between the roadway edge and first point of conflict is 10.7 metres.

The right-out-only access is proposed as being 3.6 metres-wide and right-out only with a throat length of 5.4 metres and a distance between the roadway edge and first point of conflict of 8.6 metres. In the ultimate conditions with the proposed Chamberlain Avenue, Catherine Street, and Isabella Street Functional Design Study geometry, the throat length is 8.6 metres and the distance between the roadway edge and first point of conflict is 11.8 metres.

The clear throat lengths for the accesses are below the suggested minimum value from Table 8.9.3 of the Geometric Design Guide for Canadian Roadways (Transportation Association of Canada (TAC), 2017) for a residential development of between 100-200 units accessing an arterial road. It is notable that the parcel is only 30.6 metres deep, and the referenced suggestion could not be met in any condition given required setbacks and

aisle widths. Additionally, the existing properties includes three two-way accesses on Chamberlain Avenue, each with no clear throat length. Ultimately, during the PM peak hour when the highest number of trips are forecast, the inbound trips are anticipated to be 15 vehicles and outbound trips are anticipated to be 13 vehicles across two accesses. These volumes average out to one vehicle entering or exiting every four-to-five minutes. Overall, spillback is not anticipated from the site, space is provided for a vehicle to queue within the driveway without conflict.

A 6.4-metre-wide median separates the outbound lane of the right-in/right-out access and the outbound lane from the drop-off loop outlet. No visibility issues are present at the site accesses, with clear lines of site between each and from each to both the oncoming eastbound traffic and the pedestrian crossing. An exemption from the minimum 9.0-metre spacing between site accesses would be required for the proposed development.

### 11.2 Intersection Control

Given the accesses are private approach driveways, minor stop control is proposed on each site access approach. Additionally, No Straight Through signs (Rb-10) are proposed at each private approach to restricted movements through onto Kent Street.

### 11.3 Access Intersection Design

#### 11.3.1 2024 & 2029 Future Total Access Intersection Operations

The operations for the access intersection of Kent Street at Chamberlain Avenue are noted in Section 7.4 and both 2024 and 2029 future total access intersections operate well with all movements and the overall intersection operating at LOS A.

#### 11.3.2 Access Intersection MMLOS

Table 20 summarizes the MMLOS analysis for the site access intersection of Kent Street and Chamberlain Avenue. The existing and future scores for the access intersection will be the same and both horizons are considered in one row. The intersection analysis is based on the policy area of “Within 200m of a school”. The MMLOS worksheets has been provided in Appendix K.

Table 20: Access Intersection MMLOS Analysis

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TkLOS	Target	ALOS	Target
<b>Kent Street &amp; Chamberlain Avenue (Existing/Future)</b>	A	A	<b>E</b>	D	B	D	-	-	A	E

Given the nominal intersection is controlled by a half-signal facilitating the pedestrian crossing of the two-lane arterial, the intersection scores a PLOS of A. Bicycle LOS was limited by the left-turn approach where cyclists are required to cross two lanes to merge into the exiting left-turn lane. No standard left-turn treatments would be applicable at this intersection due to its geometric and functional characteristics.

#### 11.3.3 Recommended Design Elements

The private approach driveways will require a depressed curb and sidewalk through the accesses, the relocation of the existing bus stop, and reinstatement of any accesses removed to full curb height.

## 12 Transportation Demand Management

### 12.1 Context for TDM

The existing area modal shares have been applied without modification, with the district of Ottawa Inner already relying heavily on active modes and transit. As such, modal shares are likely to be achieved. However additional TDM measures could be employed to help ensure this outcome, and to support a further shift from auto mode selection.

Total bedrooms across the 150 proposed units within the development is subject to the final unit count and layout selections by purchasers. No age restrictions are noted.

### 12.2 Need and Opportunity

As stated previously, existing area modal shares have been applied to site generated trips, and therefore, modal share targets should be achieved. Additionally, given the capacity of the study area intersections, deviation from target modal shares will not unduly impact network operations.

### 12.3 TDM Program

The “suite of post occupancy TDM measures” has been summarized in the TDM checklists for the residential land uses. The checklist is provided in Appendix J. The key TDM measures recommended include:

- Display relevant transit schedules and route maps at entrances
- Provide a multimodal travel option information package to new employees/residents
- Inclusion of a 1-month Presto card for first time new townhome purchase and apartment rental, with a set time frame for this offer (e.g. 6-months) from the initial opening of the site
- Unbundle parking cost from purchase or rental costs

## 13 Transit

### 13.1 Route Capacity

In Section 5.1 the trip generation by mode was estimated, including an estimate of the number of transit trips that will be generated by the proposed development. Table 21 summarizes the transit trip generation.

*Table 21: Trip Generation by Transit Mode*

Travel Mode	Mode Share	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Transit	varies	7	15	22	12	9	21

The proposed development is anticipated to generate an additional 22 two-way AM peak hour transit trips and 21 two-way PM peak hour transit trips. From the trip distribution found in section 5.2, these values can be further broken down. Table 22 summarizes forecasted site-generated transit ridership trips by direction, the routes that are impacted, and the equivalent bus loads.

*Table 22: Forecasted Site-Generated Transit Ridership*

Direction	AM Peak Hour		PM Peak Hour		Service Type	Approximate Equivalent Peak Hour/Direction Bus Loads
	In	Out	In	Out		
North	2	4	3	2	Bus	Negligible
South	2	5	4	3	Bus	Negligible
East	1	3	2	2	Bus	Negligible
West	1	3	2	2	Bus	Negligible

### 13.2 Transit Priority

Negligible impacts on area transit are forecast due to site-generated vehicle traffic or site-generated transit ridership. No change in transit LOS is forecast on any approach between the future background and the future total conditions.

## 14 Network Intersection Design

### 14.1 Network Intersection Control

No change to the existing signalized control is recommended for the network intersections.

### 14.2 Network Intersection Design

#### 14.2.1 Future Total Network Intersection Operations

The operations are noted in Section 7.4 and the network intersections at both the 2024 and 2029 future total are anticipated to operate similarly to the background conditions. Negligible impacts from site auto volumes are anticipated.

#### 14.2.2 Network Intersection MMLOS

Table 23 summarizes the MMLOS analysis for the network intersections of Lyon Street/Highway 417 On-Ramp at Catherine Street, Kent Street at Catherine Street, Bank Street at Catherine Street, and Bank Street at Chamberlain Avenue/Isabella Street. The future conditions include the improvements from the Chamberlain Avenue, Catherine Street and Isabella Street Functional Design Study and where the intersections score differently from the existing conditions, they are considered in separate rows. The intersection analysis is based on the policy area of “Within 300m of a school”. The MMLOS worksheets have been provided in Appendix K.

Table 23: Study Area Intersection MMLOS Analysis

Intersection		Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
		PLOS	Target	BLOS	Target	TLOS	Target	TkLOS	Target	ALOS	Target
Lyon St & Catherine St	Ex.	<b>B</b>	A	A	D	C	D	-	-	A	E
	Fut.	A	A	A	D	C	D	-	-	A	E
Kent St & Catherine St	Ex.	<b>D</b>	A	<b>F</b>	D	D	D	D	D	B	E
	Fut.	<b>B</b>	A	<b>F</b>	D	D	D	D	D	B	E
Kent St & Chamberlain Ave	Ex.	A	A	<b>F</b>	D	B	D	-	-	A	E
	Fut.	A	A	<b>E</b>	D	B	D	-	-	A	E
Bank St & Catherine St	Ex.	<b>C</b>	A	<b>E</b>	B	<b>F</b>	D	D	D	D	E
	Fut.	<b>C</b>	A	<b>E</b>	B	<b>F</b>	D	D	D	C	E
Bank St & Chamberlain Ave/Isabella St	Ex.	<b>C</b>	A	<b>D</b>	B	<b>E</b>	D	D	D	D	E
	Fut.	<b>C</b>	A	B	B	<b>E</b>	D	D	D	C	E

The MMLOS targets will only be met for pedestrian LOS at Kent Street at Chamberlain Avenue for both the existing and future upgrade conditions and at Lyon Street at Catherine Street once the future upgrades are complete. The bicycle LOS targets will only be met at the intersections of Lyon Street at Catherine Street for both the existing and future upgrade conditions, and Bank Street at Chamberlain Avenue/Isabella Street once future upgrades are in place. Transit LOS targets will not be met at the intersection of Bank Street at Catherine Street and Bank Street and Chamberlain Avenue/Isabella Street for both the existing and future upgrade conditions.

Given the functional design study, the ultimate pedestrian and bicycle LOS at the study area intersections are assumed to be in line with City objectives and balancing of objectives to achieve the overall MMLOS goals of the



area. To meet transit LOS, all movements associated with transit routes would require a delay of less than 30 seconds. No changes to network intersections are proposed as part of this study.

#### 14.2.3 Recommended Design Elements

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

## 15 Summary of Improvements Indicated and Modifications Options

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

### Proposed Site and Screening

- The proposed site includes 160 apartment units and 3,355 sq. ft. of ground floor retail
- A two-way access and a drop-off loop outlet will both be provided onto Chamberlain Avenue
- The development is proposed to be completed as a single phase by 2024
- The Trip Generation, Location, and Safety triggers were met for the TIA Screening
- This report supports a site plan application

### Existing Conditions

- Bank Street, Kent Street, Lyon Street, Catherine Street, Chamberlain Avenue, and Isabella Street are arterial roads in the study area
- Sidewalks are generally provided on both sides of the study area roadways, and on-street bike lanes on Lyon Street and Chamberlain Avenue until Kent Street, Lyon Street and Catherine Street are spine routes, and Bank Street is a local route
- The high volumes roadways have produced a high number of collisions at the study area intersections, primarily at the Bank Street at Chamberlain Avenue/Isabella Street intersection
- The collisions are predominantly angled and sideswipe collisions and have historically been the result of failure to comply with traffic control for angled collisions, and improper lane changes for sideswipe collisions
- Some extended queuing is noted in the peak north-south direction at the Bank Street and Catherine Street intersection in the AM peak hour and Bank Street and Chamberlain Avenue intersection in the PM peak hour, but generally the intersections operate adequately

### Development Generated Travel Demand

- The proposed development is forecasted produce 71 two-way people trips during the AM peak hour and 82 two-way people trips during the PM peak hour
- Of the forecasted people trips, 16 two-way trips will be vehicle trips during the AM peak hour and 16 two-way trips will be vehicle trips during the PM peak hour based on a 25-26% residential auto mode share target
- Of the forecasted trips, 25% are anticipated to travel north, 35% to travel south, and 20% to travel each east and west

### Background Conditions

- No background developments were explicitly included in the background conditions due to insignificant traffic generation, and volumes were grown along mainline and major turning movements commensurate with growth shown on the appropriate links from the TRANS model projections

- The operations at all study area intersections are expected to be similar to the existing conditions at both future background horizons

#### **Development Design**

- Parking for bicycles and autos are each proposed within an underground garage, with limited spaces also present on the surface
- Pedestrian connections will be made from the building entrance to the sidewalk along the site frontage via a hard surface treatment and all area transit routes are within 400 m walk of the building entrance
- A bus stop on the site frontage is recommended to be relocated approximately 3 metres to the east of the stop bar on Chamberlain Avenue at the pedestrian crossing at Kent Street
- Access to Kent Street at the right-in/right-out site access and the right-out-only access are proposed to have the through movement restricted via signage
- Garbage collection is anticipated via the site drive aisle with the garbage truck entering in a forward manner and exiting in a reverse manner, and emergency services are anticipated to access the site via the public road frontage

#### **Parking**

- The proposed vehicle parking provision is 78 spaces, and the proposed bicycle parking provision is 163 spaces
- The minimum parking provision from the zoning by-law for the site is 77 vehicle spaces and 80 bicycle spaces, and these minimums are each being met

#### **Boundary Street Design**

- The boundary street does not currently meet pedestrian MMLOS targets due to sidewalk and boulevard widths along Chamberlain Avenue as well as auto volumes and posted speed limits
- Bicycle MMLOS does not currently meet targets due to the termination of the curbside bike lane on Chamberlain Avenue at Kent Street due to current limitations from downstream roadway constriction
- Improvements from the Chamberlain Avenue, Catherine Street and Isabella Street Functional Design Study will not meet pedestrian LOS target but will meet bicycle LOS

#### **Access Intersections Design**

- A two-way right-in/right-out access and an outbound right-out-only access at the pedestrian signal on Chamberlain Avenue east of the pedestrian signal stop bar at Kent Street
- The accesses are assumed to be stop controlled on their approaches, with the half-signal continuing to mediate through traffic for the pedestrian crossing
- The accesses are considered to have adequate throat length with spillback not anticipated onto Chamberlain Avenue
- While no sightline issues are present, an exemption to the private approach by-law will be required for the site driveway separation of 6.4 metres
- Intersection operations at the site access perform well
- The bicycle LOS targets cannot be met at the site access intersection due to the left-turn mixed traffic configuration requiring two lanes to be crossed at urban traffic speeds

## TDM

- Supportive TDM measures to be included within the proposed development should include:
  - Display relevant transit schedules and route maps at entrances
  - Provide a multimodal travel option information package to new employees/residents
  - Inclusion of a 1-month Presto card for first time new townhome purchase and apartment rental, with a set time frame for this offer (e.g. 6-months) from the initial opening of the site
  - Unbundle parking cost from purchase or rental costs

## Transit

- Negligible impacts are forecast on the area transit routes from site-generated ridership increases or site-generated auto traffic delays

## Network Intersection Design

- Generally, the network intersections at both future total horizons will operate similarly to the network intersections at the future background horizons
- Pedestrian LOS targets will only be met at Kent Street at Chamberlain Avenue for both the existing and future upgrade conditions and at Lyon Street at Catherine Street once the future upgrades are complete
- Bicycle LOS targets will only be met at the intersections of Lyon Street at Catherine Street for both the existing and future upgrade conditions, and Bank Street at Chamberlain Avenue/Isabella Street once future upgrades are in place
- Transit LOS targets will not be met at the intersection of Bank Street at Catherine Street and Bank Street and Chamberlain Avenue/Isabella Street for both the existing and future upgrade conditions
- Given the functional design study for the network intersections, it is assumed that the future conditions will meet the City's desired balance of MMLOS trade-offs

## 16 Conclusion

It is recommended that, from a transportation perspective, the proposed development application proceed.

Prepared By:



John Kingsley, EIT  
Transportation Engineering-Intern

Reviewed By:



Andrew Harte, P.Eng.  
Senior Transportation Engineer

# Appendix A

TIA Screening Form and PM Certification Form

City of Ottawa 2017 TIA Guidelines  
Step 1 - Screening Form

Date: 29-Apr-20  
Project Number: 2020-40  
Project Reference: 30-48 Chamberlain Avenue

1.1 Description of Proposed Development	
Municipal Address	30-48 Chamberlain Avenue
Description of Location	Existing medical and business buildings, predominantly parking lot area (>60% of surface)
Land Use Classification	General Mixed-Use - GM4
Development Size	148 residential units, 4,184 sq.ft. commercial/resident, 96 parking spaces
Accesses	Two access loop, existing locations
Phase of Development	Single phase
Buildout Year	2024
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger	
Land Use Type	Townhomes or apartments
Development Size	148 Units
Trip Generation Trigger	Yes

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

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



## **TIA Plan Reports**

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

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

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

### **CERTIFICATION**

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

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

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

Name: Andrew Harte  
(Please Print)

Professional Title: Professional Engineer

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

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# Appendix B

Turning Movement Counts



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### BANK ST @ CATHERINE ST

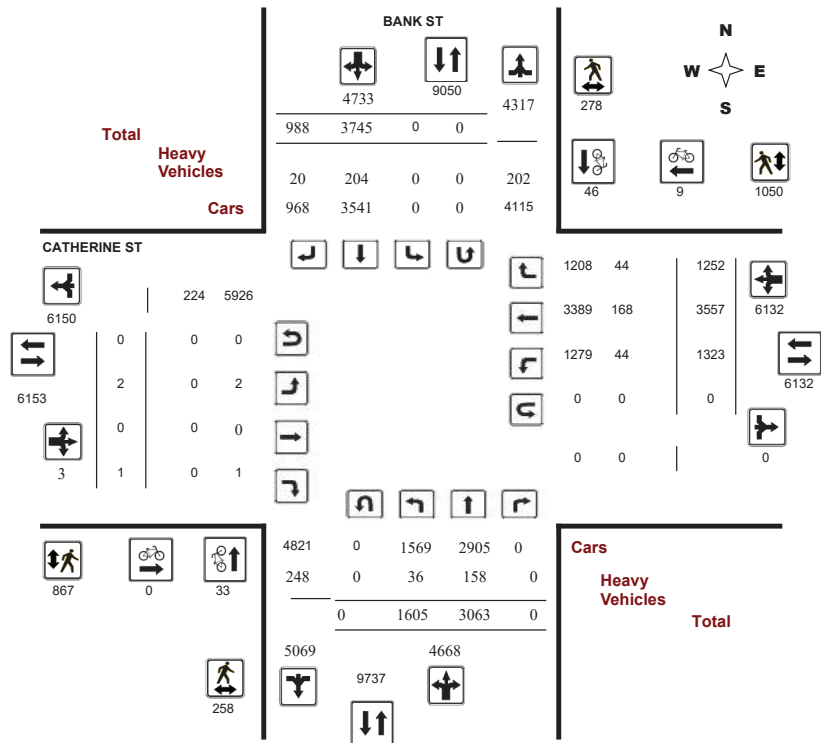
Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

#### Full Study Diagram



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### BANK ST @ CATHERINE ST

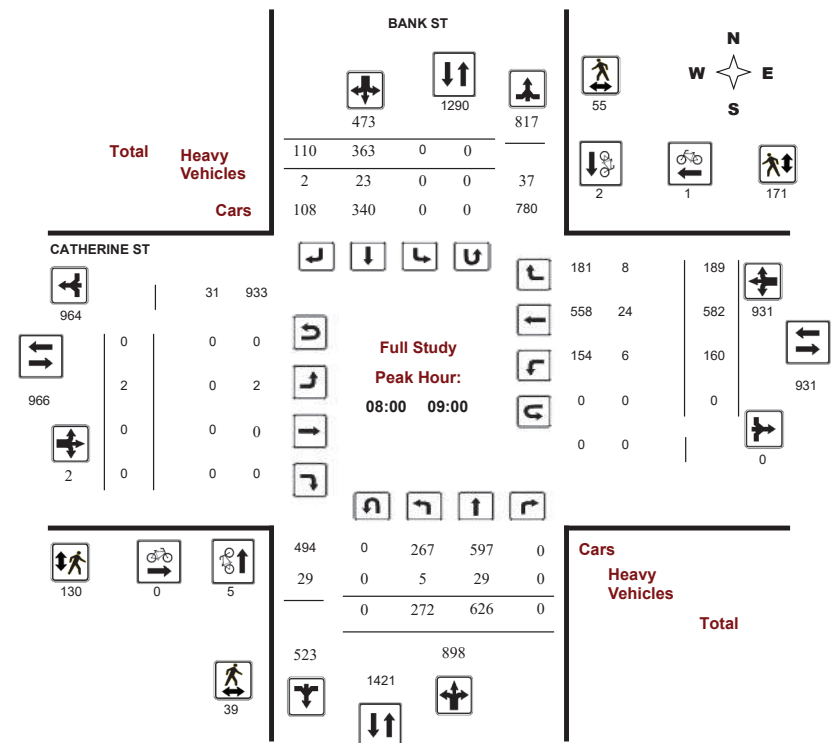
Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

#### Full Study Peak Hour Diagram





# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

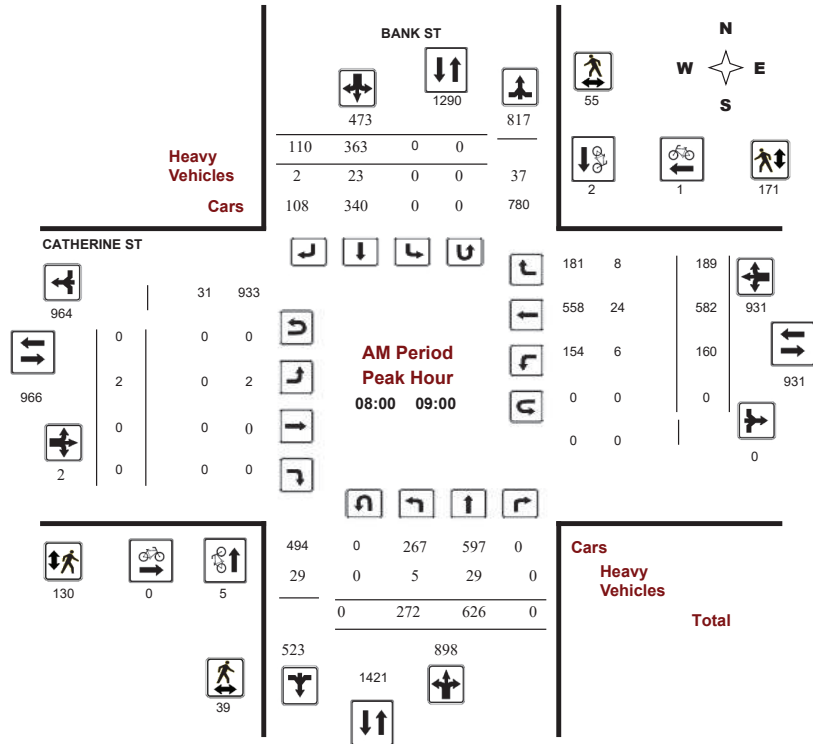
### BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40743

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

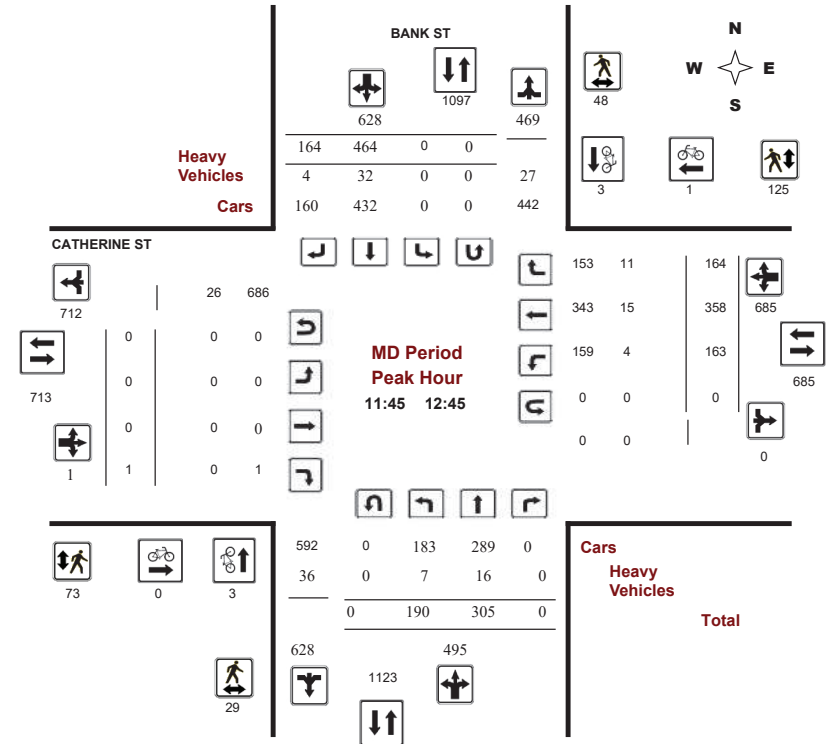
### BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40743

Device: Miovision



Comments



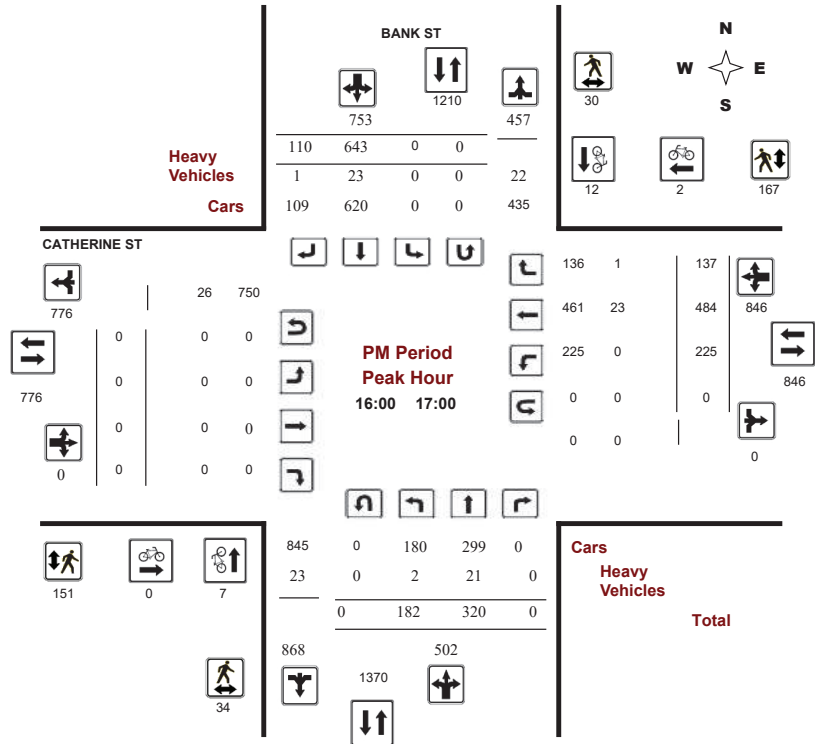
# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

### BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018  
Start Time: 07:00

WO No: 40743  
Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018  
Start Time: 07:00

WO No: 40743  
Device: Miovision

## Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 18, 2018

Total Observed U-Turns  
Northbound: 0 Southbound: 0  
Eastbound: 0 Westbound: 0

AADT Factor  
.90

Period	BANK ST				CATHERINE ST								WB TOT	STR TOT	Grand Total					
	Northbound		Southbound		Eastbound		Westbound		WB	STR	Grand									
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB	STR	Total	
07:00-08:00	215	508	0	723	0	270	82	352	1075	0	0	0	0	96	544	162	802	802	1877	
08:00-09:00	272	626	0	898	0	363	110	473	1371	2	0	0	2	160	582	189	931	933	2304	
09:00-10:00	207	341	0	548	0	387	127	514	1062	0	0	0	0	154	441	176	771	771	1833	
11:30-12:30	190	316	0	506	0	474	129	603	1109	0	0	1	1	179	343	149	671	672	1781	
12:30-13:30	185	305	0	490	0	433	179	612	1102	0	0	0	0	124	306	176	606	606	1708	
15:00-16:00	181	321	0	502	0	523	132	655	1157	0	0	0	0	166	509	126	801	801	1958	
16:00-17:00	182	320	0	502	0	643	110	753	1255	0	0	0	0	225	484	137	846	846	2101	
17:00-18:00	173	326	0	499	0	652	119	771	1270	0	0	0	0	219	348	137	704	704	1974	
<b>Sub Total</b>	<b>1605</b>	<b>3063</b>	<b>0</b>	<b>4668</b>	<b>0</b>	<b>3745</b>	<b>988</b>	<b>4733</b>	<b>9401</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1323</b>	<b>3557</b>	<b>1252</b>	<b>6132</b>	<b>6135</b>	<b>15536</b>	
<b>U Turns</b>				<b>0</b>				<b>0</b>	<b>0</b>				<b>0</b>				<b>0</b>	<b>0</b>	<b>0</b>	
<b>Total</b>	<b>1605</b>	<b>3063</b>	<b>0</b>	<b>4668</b>	<b>0</b>	<b>3745</b>	<b>988</b>	<b>4733</b>	<b>9401</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>1323</b>	<b>3557</b>	<b>1252</b>	<b>6132</b>	<b>6135</b>	<b>15536</b>	
<b>EQ 12Hr</b>	<b>2231</b>	<b>4258</b>	<b>0</b>	<b>6489</b>	<b>0</b>	<b>5206</b>	<b>1373</b>	<b>6579</b>	<b>13067</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>1839</b>	<b>4944</b>	<b>1740</b>	<b>8523</b>	<b>8528</b>	<b>21595</b>	
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.																				
<b>AVG 12Hr</b>	<b>2008</b>	<b>3832</b>	<b>0</b>	<b>5840</b>	<b>0</b>	<b>6137</b>	<b>1619</b>	<b>5921</b>	<b>11760</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>4</b>	<b>1655</b>	<b>4450</b>	<b>1566</b>	<b>7671</b>	<b>7675</b>	<b>19436</b>	
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.																				
<b>AVG 24Hr</b>	<b>2630</b>	<b>5020</b>	<b>0</b>	<b>7650</b>	<b>0</b>	<b>8039</b>	<b>2121</b>	<b>7757</b>	<b>15406</b>	<b>4</b>	<b>0</b>	<b>1</b>	<b>5</b>	<b>2168</b>	<b>5830</b>	<b>2051</b>	<b>10049</b>	<b>10054</b>	<b>25461</b>	
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.																				
Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.																				



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

Full Study 15 Minute Increments

Table with columns for Time Period, Northbound (LT, ST, RT, N TOT, STR TOT), Southbound (LT, ST, RT, S TOT, STR TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT, STR TOT), and Grand Total. Rows represent 15-minute intervals from 07:00 to 18:00.

Note: U-Turns are included in Totals.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

Full Study Cyclist Volume

Table with columns for Time Period, Northbound (Street Total), Southbound (Street Total), Eastbound (Street Total), Westbound (Street Total), and Grand Total. Rows represent 15-minute intervals from 07:00 to 18:00.





Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

Full Study Pedestrian Volume

Table with columns: Time Period, NB Approach, SB Approach, Total, EB Approach, WB Approach, Grand Total. Rows show pedestrian volume data for various time intervals from 07:00 to 17:45.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

Full Study Heavy Vehicles

Table with columns: Time Period, Northbound (LT, ST, RT, N TOT), Southbound (LT, ST, RT, S TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT), Grand Total. Rows show heavy vehicle volume data for various time intervals from 07:00 to 17:45.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CATHERINE ST

Survey Date: Wednesday, April 18, 2018

WO No: 40743

Start Time: 07:00

Device: Miovision

Full Study 15 Minute U-Turn Total

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



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

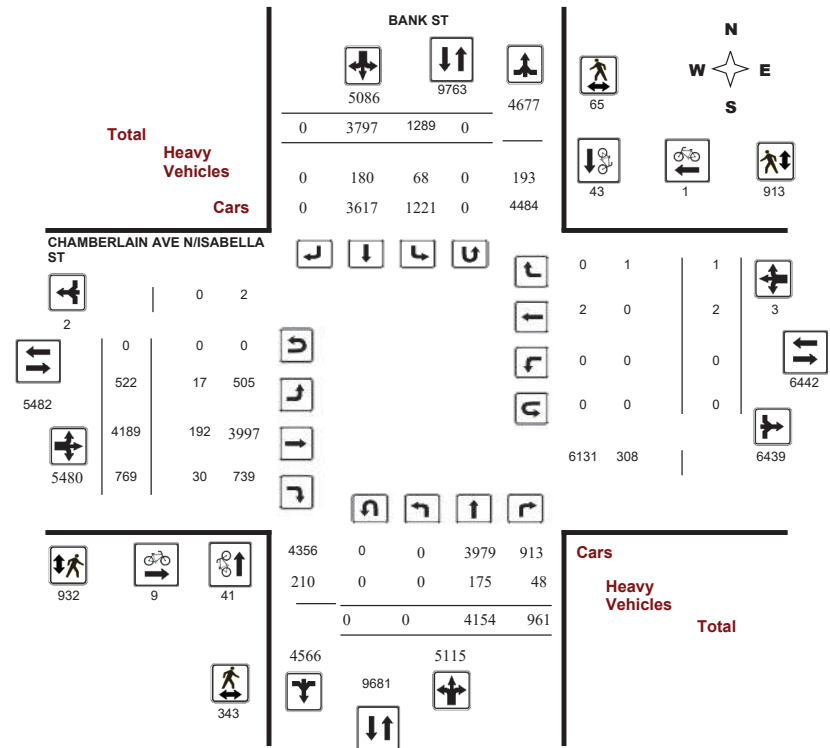
Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study Diagram



W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

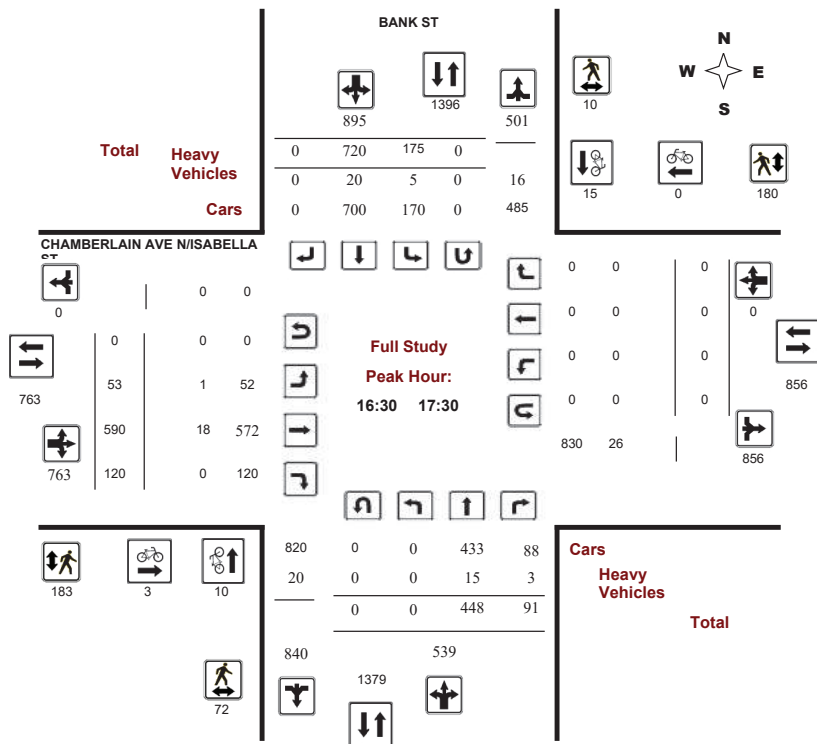
Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

### Full Study Peak Hour Diagram



W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

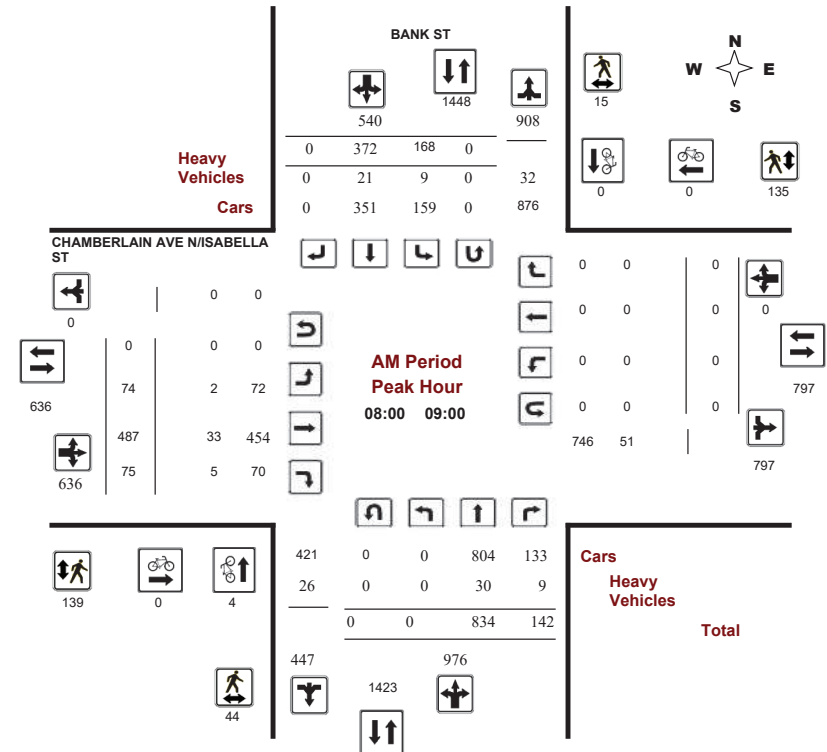
### BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision



Comments W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)

Turning Movement Count - Peak Hour Diagram

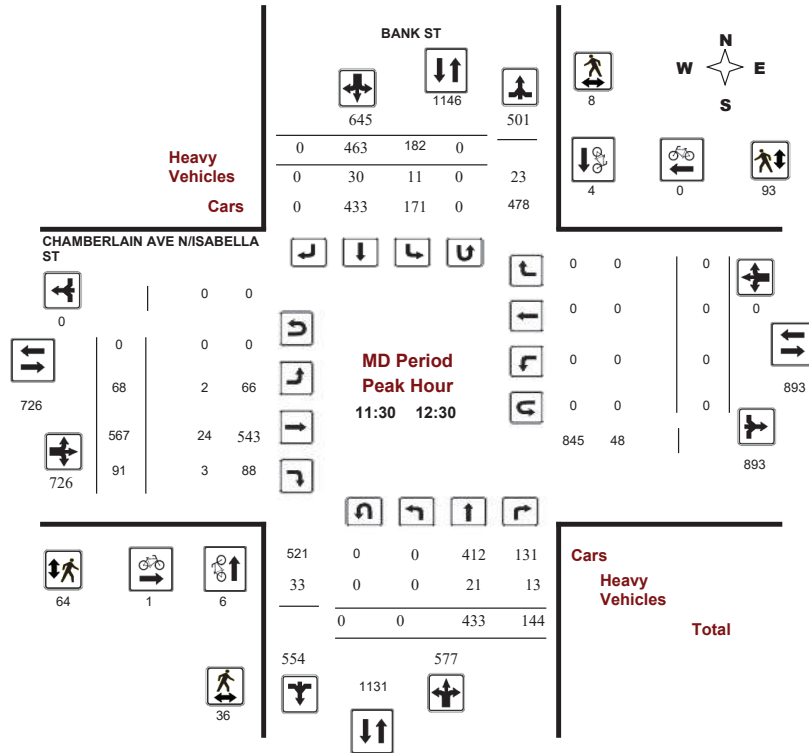
BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision



Comments W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)

Turning Movement Count - Peak Hour Diagram

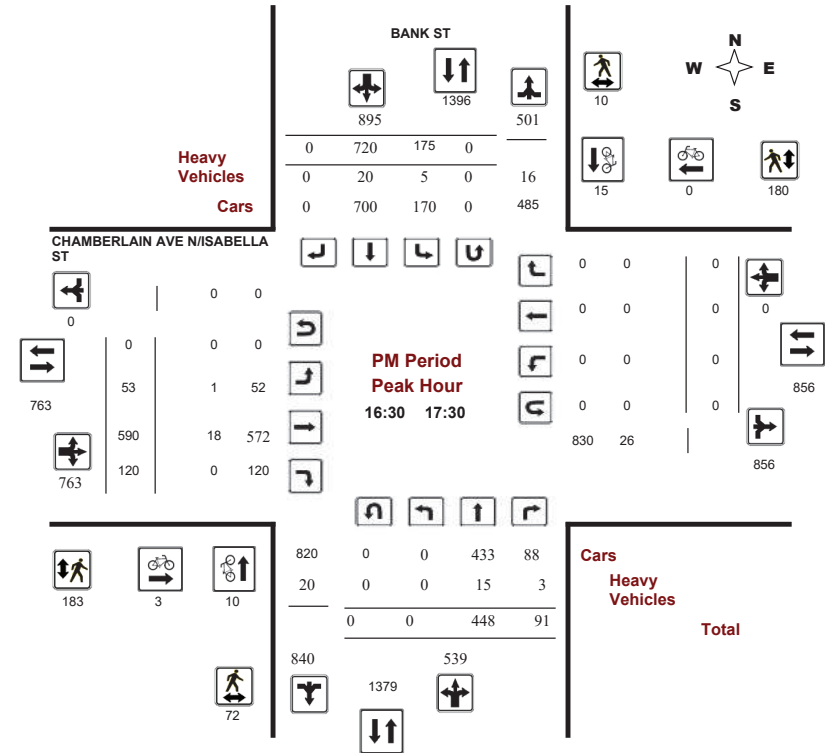
BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision



Comments W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 18, 2018

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

Table with columns for Period, Bank St (Northbound, Southbound), Chamberlain Ave N/Isabella St (Eastbound, Westbound), and Grand Total. Includes sub-totals for U-Turns, EQ 12Hr, and AVG 24Hr.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study 15 Minute Increments

Table with columns for Time Period, Bank St (Northbound, Southbound), Chamberlain Ave N/Isabella St (Eastbound, Westbound), and Grand Total. Shows 15-minute increments from 07:00 to 18:00.

Note: U-Turns are included in Totals.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study Cyclist Volume

Table with columns: Time Period, Northbound, Southbound, Street Total, Eastbound, Westbound, Street Total, Grand Total. Rows show cyclist counts from 07:00 to 18:00.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study Pedestrian Volume

Table with columns: Time Period, NB Approach, SB Approach, Total, EB Approach, WB Approach, Total, Grand Total. Rows show pedestrian counts from 07:00 to 18:00.

W.O. 5365004 - WED APR 18TH - CONSULTANT - (8HR REIMPORT)





Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study Heavy Vehicles

Time Period	BANK ST									CHAMBERLAIN AVE N/ISABELLA S									Grand Total						
	Northbound			Southbound			Eastbound			Westbound			Northbound			Southbound				Eastbound			Westbound		
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT	E TOT	LT	ST	RT	W TOT	STR TOT							
07:00	07:15	0	7	0	7	0	9	0	9	16	0	5	1	6	0	0	0	0	6	22					
07:15	07:30	0	9	1	10	1	7	0	8	18	0	6	1	7	0	0	0	0	7	25					
07:30	07:45	0	6	0	6	1	4	0	5	11	1	4	1	6	0	0	0	0	6	17					
07:45	08:00	0	6	3	9	3	3	0	6	15	0	2	0	2	0	0	0	0	2	17					
08:00	08:15	0	8	1	9	4	5	0	9	18	0	8	1	9	0	0	0	0	9	27					
08:15	08:30	0	6	3	9	0	7	0	7	16	0	4	0	4	0	0	0	0	4	20					
08:30	08:45	0	6	1	7	4	4	0	8	15	1	8	3	12	0	0	0	0	12	27					
08:45	09:00	0	10	4	14	1	5	0	6	20	1	13	1	15	0	0	0	0	15	35					
09:00	09:15	0	5	6	11	5	6	0	11	22	2	7	1	10	0	0	0	0	10	32					
09:15	09:30	0	8	3	11	1	8	0	9	20	3	11	0	14	0	0	1	1	15	35					
09:30	09:45	0	6	1	7	6	9	0	15	22	1	7	3	11	0	0	0	0	11	33					
09:45	10:00	0	4	1	5	5	10	0	15	20	0	3	3	6	0	0	0	0	6	26					
11:30	11:45	0	2	6	8	1	10	0	11	19	1	7	1	9	0	0	0	0	9	28					
11:45	12:00	0	6	2	8	1	7	0	8	16	0	5	0	5	0	0	0	0	5	21					
12:00	12:15	0	9	1	10	4	5	0	9	19	0	4	0	4	0	0	0	0	4	23					
12:15	12:30	0	4	4	8	5	8	0	13	21	1	8	2	11	0	0	0	0	11	32					
12:30	12:45	0	3	2	5	1	6	0	7	12	0	4	1	5	0	0	0	0	5	17					
12:45	13:00	0	6	1	7	2	5	0	7	14	0	5	3	8	0	0	0	0	8	22					
13:00	13:15	0	4	1	5	3	4	0	7	12	1	9	0	10	0	0	0	0	10	22					
13:15	13:30	0	7	1	8	2	5	0	7	15	0	7	2	9	0	0	0	0	9	24					
15:00	15:15	0	6	0	6	0	6	0	6	12	0	8	0	8	0	0	0	0	8	20					
15:15	15:30	0	3	1	4	1	9	0	10	14	1	4	1	6	0	0	0	0	6	20					
15:30	15:45	0	5	0	3	2	1	0	3	6	0	4	1	5	0	0	0	0	5	11					
15:45	16:00	0	6	0	6	3	4	0	7	13	1	4	1	6	0	0	0	0	6	19					
16:00	16:15	0	5	1	6	0	4	0	4	10	1	8	2	11	0	0	0	0	11	21					
16:15	16:30	0	5	0	5	5	2	0	7	12	1	6	0	7	0	0	0	0	7	19					
16:30	16:45	0	6	1	7	2	6	0	8	15	1	1	0	2	0	0	0	0	2	17					
16:45	17:00	0	4	1	5	2	2	0	4	9	0	5	0	5	0	0	0	0	5	14					
17:00	17:15	0	4	0	4	0	6	0	6	10	0	6	0	6	0	0	0	0	6	16					
17:15	17:30	0	1	1	2	1	6	0	7	9	0	6	0	6	0	0	0	0	6	15					
17:30	17:45	0	5	1	6	1	5	0	6	12	0	6	1	7	0	0	0	0	7	19					
17:45	18:00	0	5	0	5	1	2	0	3	8	0	7	0	7	0	0	0	0	7	15					
Total:	None	0	175	48	223	68	180	0	248	471	17	192	30	239	0	0	1	1	240	711					



Transportation Services - Traffic Services

Turning Movement Count - Study Results

BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

Survey Date: Wednesday, April 18, 2018

WO No: 39632

Start Time: 07:00

Device: Miovision

Full Study 15 Minute U-Turn Total

Time Period	BANK ST					CHAMBERLAIN AVE N/ISABELLA S				
	Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total	Northbound U-Turn Total	Southbound U-Turn Total	Eastbound U-Turn Total	Westbound U-Turn Total	Total
07:00	07:15	0	0	0	0	0	0	0	0	0
07:15	07:30	0	0	0	0	0	0	0	0	0
07:30	07:45	0	0	0	0	0	0	0	0	0
07:45	08:00	0	0	0	0	0	0	0	0	0
08:00	08:15	0	0	0	0	0	0	0	0	0
08:15	08:30	0	0	0	0	0	0	0	0	0
08:30	08:45	0	0	0	0	0	0	0	0	0
08:45	09:00	0	0	0	0	0	0	0	0	0
09:00	09:15	0	0	0	0	0	0	0	0	0
09:15	09:30	0	0	0	0	0	0	0	0	0
09:30	09:45	0	0	0	0	0	0	0	0	0
09:45	10:00	0	0	0	0	0	0	0	0	0
11:30	11:45	0	0	0	0	0	0	0	0	0
11:45	12:00	0	0	0	0	0	0	0	0	0
12:00	12:15	0	0	0	0	0	0	0	0	0
12:15	12:30	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0
12:45	13:00	0	0	0	0	0	0	0	0	0
13:00	13:15	0	0	0	0	0	0	0	0	0
13:15	13:30	0	0	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0	0	0	0
15:15	15:30	0	0	0	0	0	0	0	0	0
15:30	15:45	0	0	0	0	0	0	0	0	0
15:45	16:00	0	0	0	0	0	0	0	0	0
16:00	16:15	0	0	0	0	0	0	0	0	0
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	0	0	0	0
17:15	17:30	0	0	0	0	0	0	0	0	0
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
Total	Total	0	0	0	0	0	0	0	0	0





# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

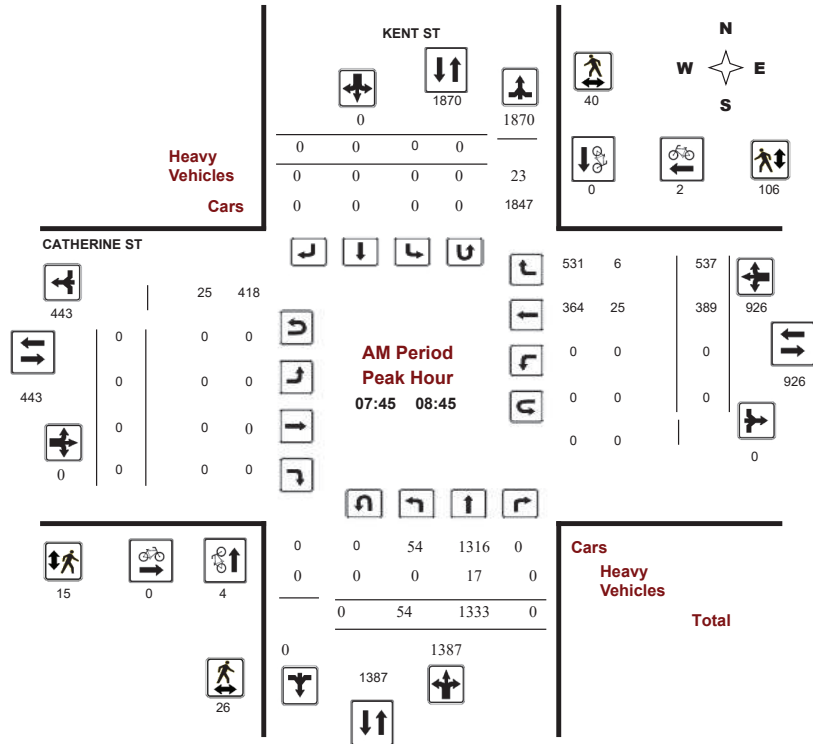
### CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40741

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

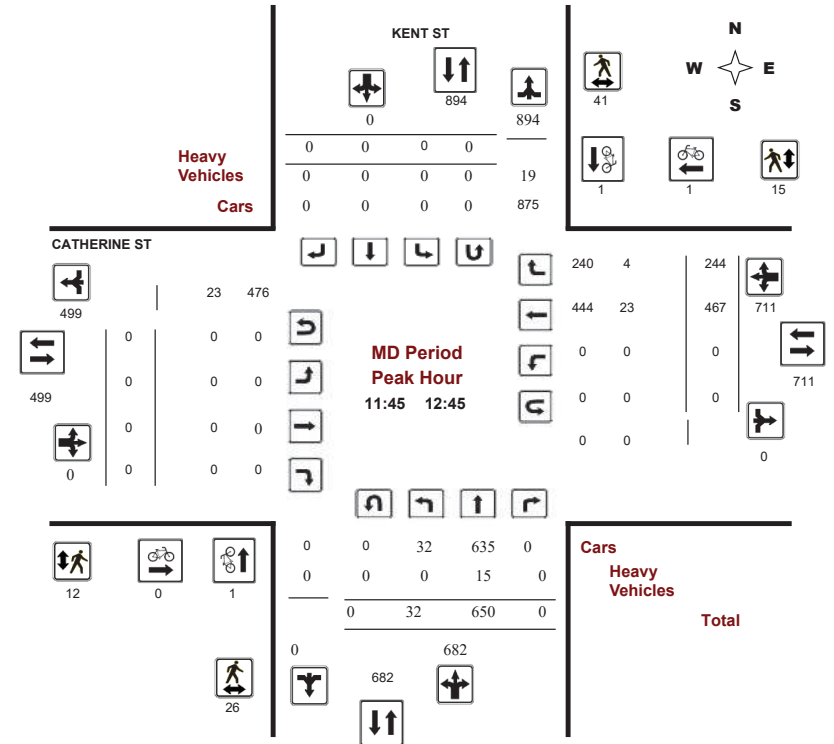
### CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40741

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

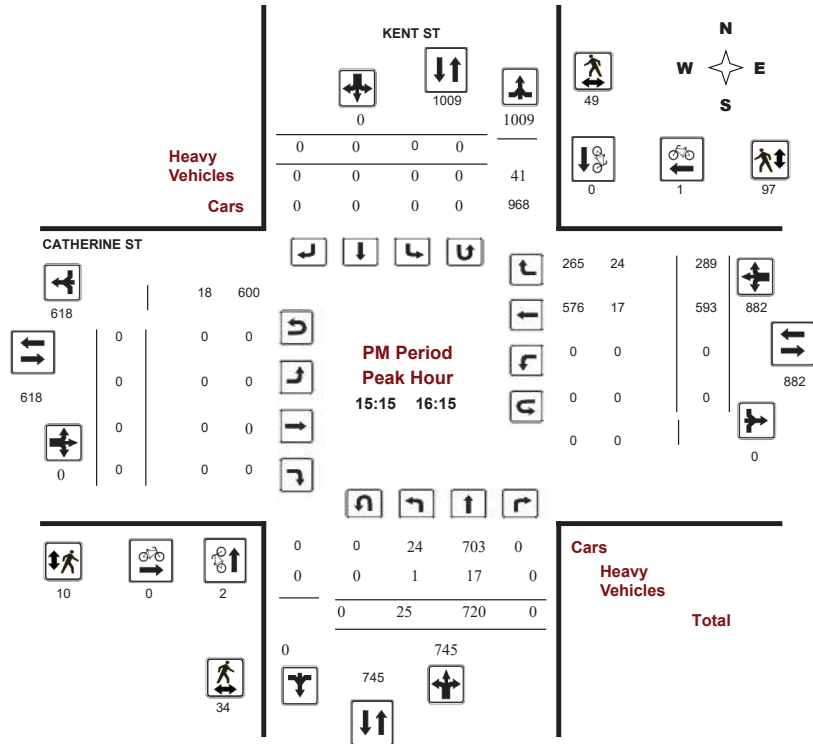
### CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40741

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40741

Device: Miovision

## Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 18, 2018

Total Observed U-Turns

AADT Factor

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

.90

Period	KENT ST							CATHERINE ST							WB TOT	STR TOT	Grand Total		
	Northbound			Southbound				Eastbound			Westbound								
	LT	ST	RT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST				RT	
07:00-08:00	36	1225	0	1261	0	0	0	0	1261	0	0	0	0	0	304	504	808	808	2069
08:00-09:00	54	1326	0	1380	0	0	0	0	1380	0	0	0	0	0	392	530	922	922	2302
09:00-10:00	41	968	0	1009	0	0	0	0	1009	0	0	0	0	0	411	342	753	753	1762
11:30-12:30	36	626	0	662	0	0	0	0	662	0	0	0	0	0	452	231	683	683	1345
12:30-13:30	40	631	0	671	0	0	0	0	671	0	0	0	0	0	477	174	651	651	1322
15:00-16:00	29	652	0	681	0	0	0	0	681	0	0	0	0	0	556	302	858	858	1539
16:00-17:00	18	590	0	608	0	0	0	0	608	0	0	0	0	0	479	311	790	790	1398
17:00-18:00	11	730	0	741	0	0	0	0	741	0	0	0	0	0	366	306	672	672	1413
<b>Sub Total</b>	<b>265</b>	<b>6748</b>	<b>0</b>	<b>7013</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7013</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3437</b>	<b>2700</b>	<b>6137</b>	<b>6137</b>	<b>13150</b>
<b>U Turns</b>				<b>0</b>					<b>0</b>									<b>0</b>	<b>0</b>
<b>Total</b>	<b>265</b>	<b>6748</b>	<b>0</b>	<b>7013</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7013</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3437</b>	<b>2700</b>	<b>6137</b>	<b>6137</b>	<b>13150</b>
<b>EQ 12Hr</b>	<b>368</b>	<b>9380</b>	<b>0</b>	<b>9748</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9748</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4777</b>	<b>3753</b>	<b>8530</b>	<b>8530</b>	<b>18278</b>
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													<b>1.39</b>						
<b>AVG 12Hr</b>	<b>331</b>	<b>8442</b>	<b>0</b>	<b>8773</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>8773</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4299</b>	<b>3378</b>	<b>7677</b>	<b>7677</b>	<b>16450</b>
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													<b>.90</b>						
<b>AVG 24Hr</b>	<b>434</b>	<b>11059</b>	<b>0</b>	<b>11493</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>11493</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>5632</b>	<b>4425</b>	<b>10057</b>	<b>10057</b>	<b>21550</b>
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													<b>1.31</b>						
Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.																			



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40741

Start Time: 07:00

Device: Miovision

Full Study 15 Minute Increments

Table with columns for Time Period, Northbound, Southbound, Eastbound, Westbound, and Grand Total. Rows show 15-minute intervals from 07:00 to 17:45.

Note: U-Turns are included in Totals.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40741

Start Time: 07:00

Device: Miovision

Full Study Cyclist Volume

Table with columns for Time Period, Northbound, Southbound, Street Total, Eastbound, Westbound, Street Total, and Grand Total. Rows show 15-minute intervals from 07:00 to 17:45.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40741

Start Time: 07:00

Device: Miovision

Full Study Pedestrian Volume

KENT ST CATHERINE ST

Table with columns: Time Period, NB Approach (E or W Crossing), SB Approach (E or W Crossing), Total, EB Approach (N or S Crossing), WB Approach (N or S Crossing), Total, Grand Total. Rows show pedestrian counts for various time intervals from 07:00 to 17:45.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40741

Start Time: 07:00

Device: Miovision

Full Study Heavy Vehicles

KENT ST CATHERINE ST

Table with columns: Time Period, Northbound (LT, ST, RT, N TOT), Southbound (LT, ST, RT, S TOT, STR TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT, STR TOT), Grand Total. Rows show heavy vehicle counts for various time intervals from 07:00 to 17:45.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40741

Start Time: 07:00

Device: Miovision

Full Study 15 Minute U-Turn Total

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



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

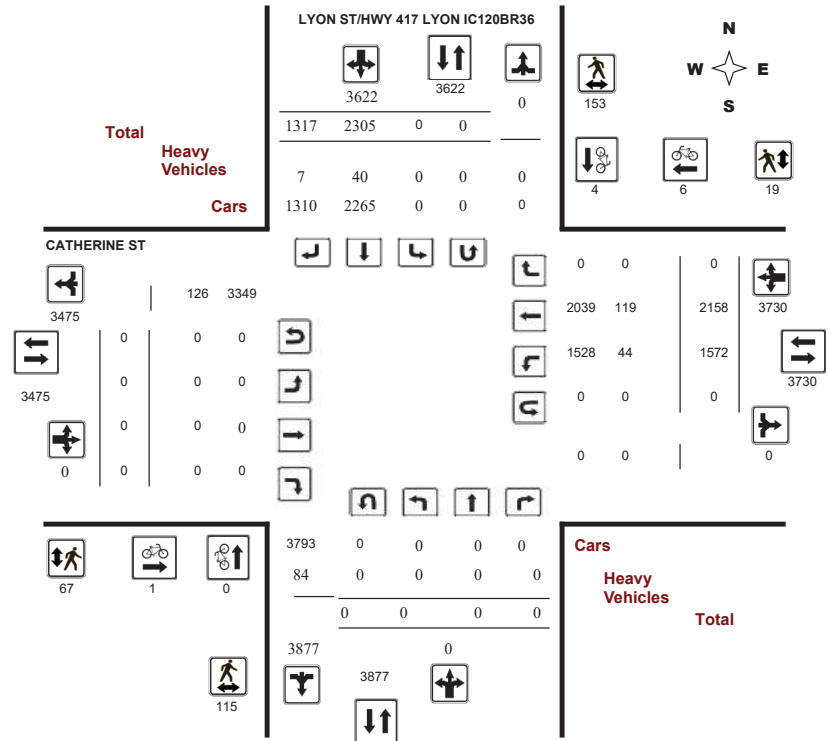
Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study Diagram







# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

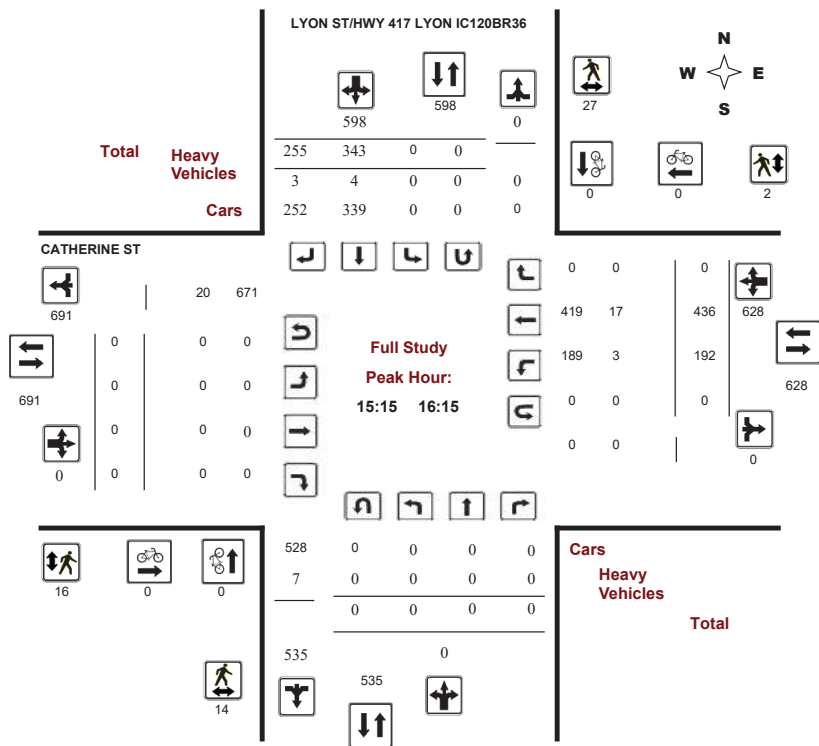
Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

#### Full Study Peak Hour Diagram



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

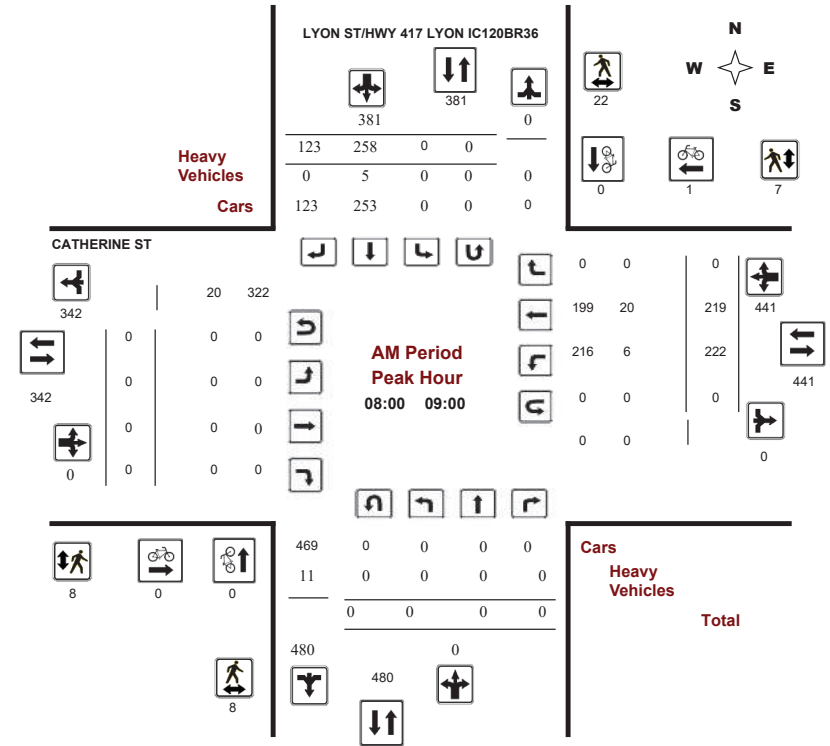
### CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

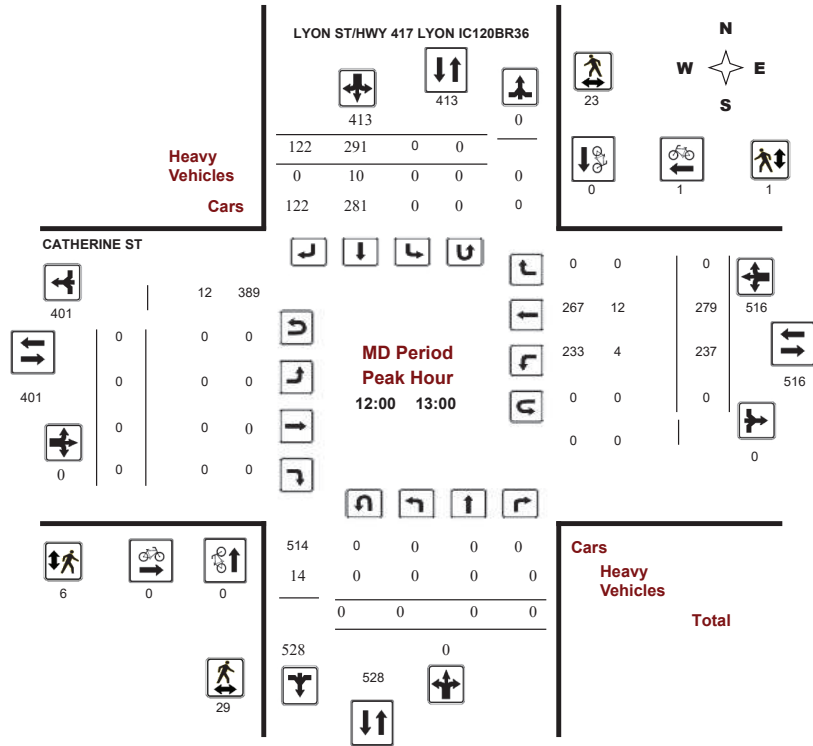
### CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40740

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

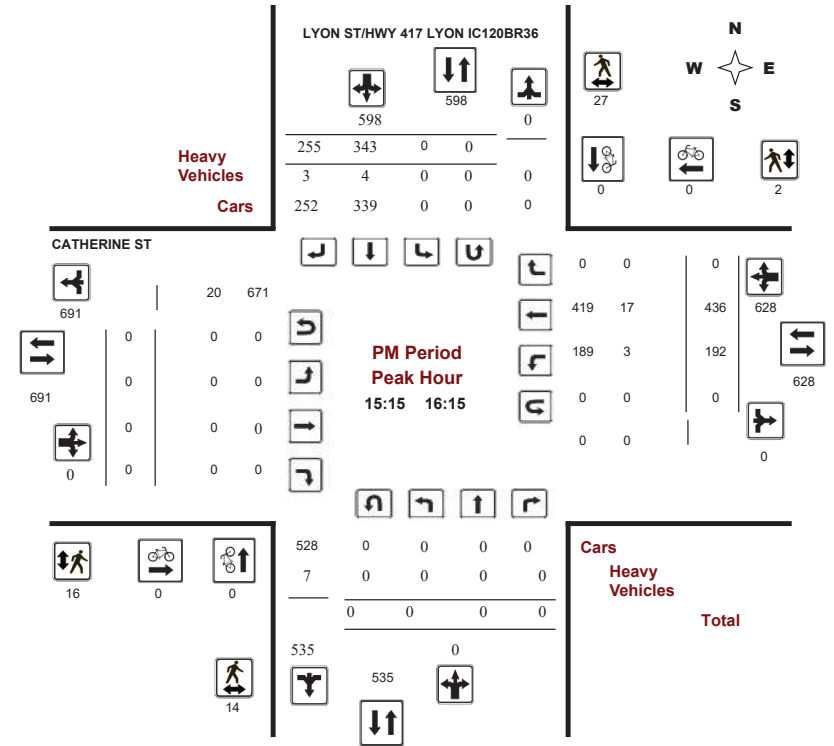
### CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40740

Device: Miovision



Comments



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 18, 2018

Total Observed U-Turns

AADT Factor

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

Table with columns for Period, Northbound (LT, ST, RT, NB TOT), Southbound (LT, ST, RT, SB TOT), Eastbound (LT, ST, RT, EB TOT), Westbound (LT, ST, RT, WB TOT), STR TOT, Grand Total. Includes sub-totals for U Turns, EQ 12Hr, AVG 12Hr, and AVG 24Hr.

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

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

Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor. 1.31

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



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study 15 Minute Increments

LYON ST/HWY 417 LYON IC120BR36

CATHERINE ST

Table with columns for Time Period, Northbound (LT, ST, RT, N TOT), Southbound (LT, ST, RT, S TOT), Eastbound (LT, ST, RT, E TOT), Westbound (LT, ST, RT, W TOT), STR TOT, Grand Total. Shows 15-minute increments from 07:00 to 17:45.

Note: U-Turns are included in Totals.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study Cyclist Volume

Time Period	LYON ST/HWY 417 LYON IC120BR36			CATHERINE ST			Grand Total
	Northbound	Southbound	Street Total	Eastbound	Westbound	Street Total	
07:00 07:15	0	0	0	0	0	0	0
07:15 07:30	0	0	0	0	0	0	0
07:30 07:45	0	0	0	0	0	0	0
07:45 08:00	0	0	0	0	0	0	0
08:00 08:15	0	0	0	0	0	0	0
08:15 08:30	0	0	0	0	1	1	1
08:30 08:45	0	0	0	0	0	0	0
08:45 09:00	0	0	0	0	0	0	0
09:00 09:15	0	0	0	0	0	0	0
09:15 09:30	0	0	0	0	1	1	1
09:30 09:45	0	0	0	0	0	0	0
09:45 10:00	0	0	0	0	0	0	0
11:30 11:45	0	1	1	0	0	0	1
11:45 12:00	0	1	1	0	0	0	1
12:00 12:15	0	0	0	0	0	0	0
12:15 12:30	0	0	0	0	1	1	1
12:30 12:45	0	0	0	0	0	0	0
12:45 13:00	0	0	0	0	0	0	0
13:00 13:15	0	0	0	0	0	0	0
13:15 13:30	0	0	0	0	0	0	0
15:00 15:15	0	0	0	0	0	0	0
15:15 15:30	0	0	0	0	0	0	0
15:30 15:45	0	0	0	0	0	0	0
15:45 16:00	0	0	0	0	0	0	0
16:00 16:15	0	0	0	0	0	0	0
16:15 16:30	0	0	0	0	2	2	2
16:30 16:45	0	0	0	0	1	1	1
16:45 17:00	0	0	0	1	0	1	1
17:00 17:15	0	0	0	0	0	0	0
17:15 17:30	0	0	0	0	0	0	0
17:30 17:45	0	1	1	0	0	0	1
17:45 18:00	0	1	1	0	0	0	1
Total	0	4	4	1	6	7	11



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study Pedestrian Volume

Time Period	LYON ST/HWY 417 LYON IC120BR36			CATHERINE ST			Grand Total
	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)	Total	EB Approach (N or S Crossing)	WB Approach (N or S Crossing)	Total	
07:00 07:15	1	4	5	0	0	0	5
07:15 07:30	0	0	0	1	0	1	1
07:30 07:45	1	3	4	0	0	0	4
07:45 08:00	1	3	4	0	0	0	4
08:00 08:15	1	8	9	0	3	3	12
08:15 08:30	2	5	7	3	1	4	11
08:30 08:45	4	2	6	4	1	5	11
08:45 09:00	1	7	8	1	2	3	11
09:00 09:15	3	6	9	1	1	2	11
09:15 09:30	1	1	2	0	0	0	2
09:30 09:45	7	2	9	5	0	5	14
09:45 10:00	8	2	10	2	0	2	12
11:30 11:45	6	2	8	0	2	2	10
11:45 12:00	5	7	12	0	1	1	13
12:00 12:15	14	7	21	3	0	3	24
12:15 12:30	5	6	11	1	1	2	13
12:30 12:45	7	5	12	1	0	1	13
12:45 13:00	3	5	8	1	0	1	9
13:00 13:15	1	4	5	4	1	5	10
13:15 13:30	7	7	14	3	2	5	19
15:00 15:15	9	11	20	6	0	6	26
15:15 15:30	4	6	10	5	1	6	16
15:30 15:45	0	11	11	6	1	7	18
15:45 16:00	7	5	12	3	0	3	15
16:00 16:15	3	5	8	2	0	2	10
16:15 16:30	4	6	10	5	2	7	17
16:30 16:45	1	1	2	1	0	1	3
16:45 17:00	3	3	6	3	0	3	9
17:00 17:15	3	9	12	4	0	4	16
17:15 17:30	1	7	8	2	0	2	10
17:30 17:45	1	2	3	0	0	0	3
17:45 18:00	1	1	2	0	0	0	2
Total	115	153	268	67	19	86	354



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study Heavy Vehicles

Time Period		Northbound				Southbound				Eastbound				Westbound				Grand Total	
		N		S		STR		E		W		STR		Grand Total					
LT	RT	LT	RT	LT	RT	LT	RT	LT	RT	LT	RT	LT	RT						
07:00	07:15	0	0	0	8	0	4	12	0	0	9	4	9	0	13	22	17		
07:15	07:30	0	0	0	7	0	5	5	12	0	0	3	2	3	0	5	8	10	
07:30	07:45	0	0	0	3	0	2	2	5	0	0	3	1	3	0	4	7	6	
07:45	08:00	0	0	0	0	0	0	0	0	0	0	5	0	5	0	5	10	5	
08:00	08:15	0	0	0	4	0	0	0	4	0	0	7	4	7	0	11	18	11	
08:15	08:30	0	0	0	2	0	1	1	3	0	0	5	1	5	0	6	11	7	
08:30	08:45	0	0	0	3	0	2	2	5	0	0	4	1	4	0	5	9	7	
08:45	09:00	0	0	0	2	0	2	2	4	0	0	4	0	4	0	4	8	6	
09:00	09:15	0	0	0	1	0	0	0	1	0	0	3	1	3	0	4	7	4	
09:15	09:30	0	0	0	5	0	0	0	5	0	0	4	5	4	0	9	13	9	
09:30	09:45	0	0	0	5	0	3	3	8	0	0	2	2	2	0	4	6	7	
09:45	10:00	0	0	0	1	0	1	1	2	0	0	6	0	6	0	6	12	7	
11:30	11:45	0	0	0	1	0	0	2	2	3	0	0	4	1	2	0	3	7	5
11:45	12:00	0	0	0	6	0	3	1	4	10	0	0	6	3	5	0	8	14	12
12:00	12:15	0	0	0	2	0	2	0	2	4	0	0	4	0	4	0	4	8	6
12:15	12:30	0	0	0	5	0	4	0	4	9	0	0	4	1	4	0	5	9	9
12:30	12:45	0	0	0	3	0	1	0	1	4	0	0	4	2	4	0	6	10	7
12:45	13:00	0	0	0	4	0	3	0	3	7	0	0	0	1	0	0	1	1	4
13:00	13:15	0	0	0	3	0	1	0	1	4	0	0	3	2	3	0	5	8	6
13:15	13:30	0	0	0	1	0	0	1	1	2	0	0	3	1	2	0	3	6	4
15:00	15:15	0	0	0	5	0	1	0	1	6	0	0	6	4	6	0	10	16	11
15:15	15:30	0	0	0	2	0	1	0	1	3	0	0	2	1	2	0	3	5	4
15:30	15:45	0	0	0	3	0	1	1	2	5	0	0	6	2	5	0	7	13	9
15:45	16:00	0	0	0	0	0	0	0	0	0	0	0	4	0	4	0	4	8	4
16:00	16:15	0	0	0	2	0	2	2	4	6	0	0	8	0	6	0	6	14	10
16:15	16:30	0	0	0	2	0	0	0	2	0	0	6	2	6	0	8	14	8	
16:30	16:45	0	0	0	1	0	0	0	1	0	0	2	1	2	0	3	5	3	
16:45	17:00	0	0	0	1	0	1	0	1	2	0	0	4	0	4	0	4	8	5
17:00	17:15	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	4	2	
17:15	17:30	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	2	1	
17:30	17:45	0	0	0	2	0	0	0	2	0	0	2	2	2	0	4	6	4	
17:45	18:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total:	None	0	0	0	84	0	40	7	47	131	0	0	126	44	119	0	163	289	210



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CATHERINE ST @ LYON ST/HWY 417 LYON IC120BR36

Survey Date: Wednesday, April 18, 2018

WO No: 40740

Start Time: 07:00

Device: Miovision

Full Study 15 Minute U-Turn Total

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



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### CHAMBERLAIN AVE @ KENT ST

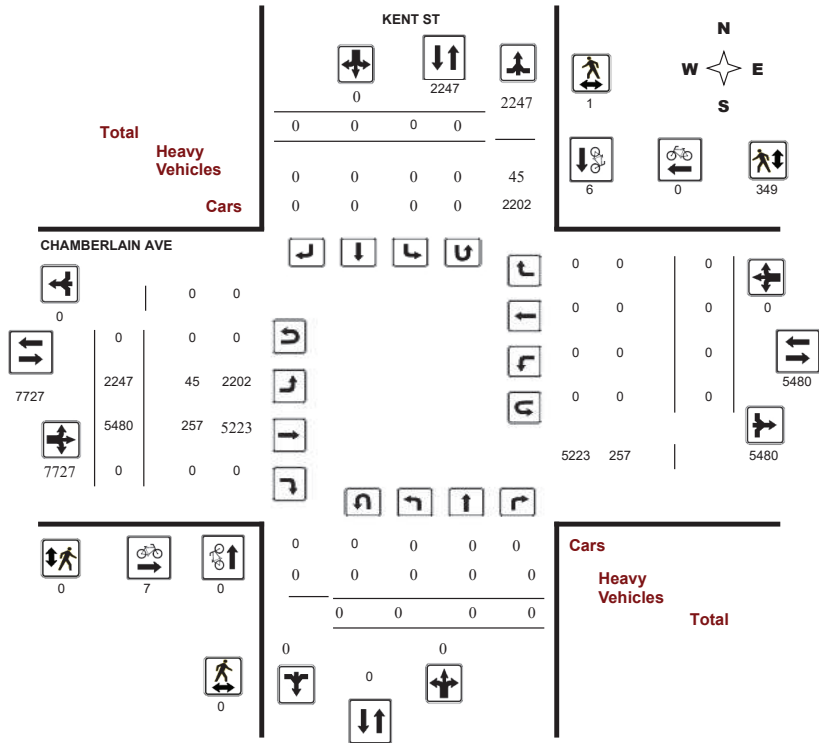
Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

#### Full Study Diagram



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### CHAMBERLAIN AVE @ KENT ST

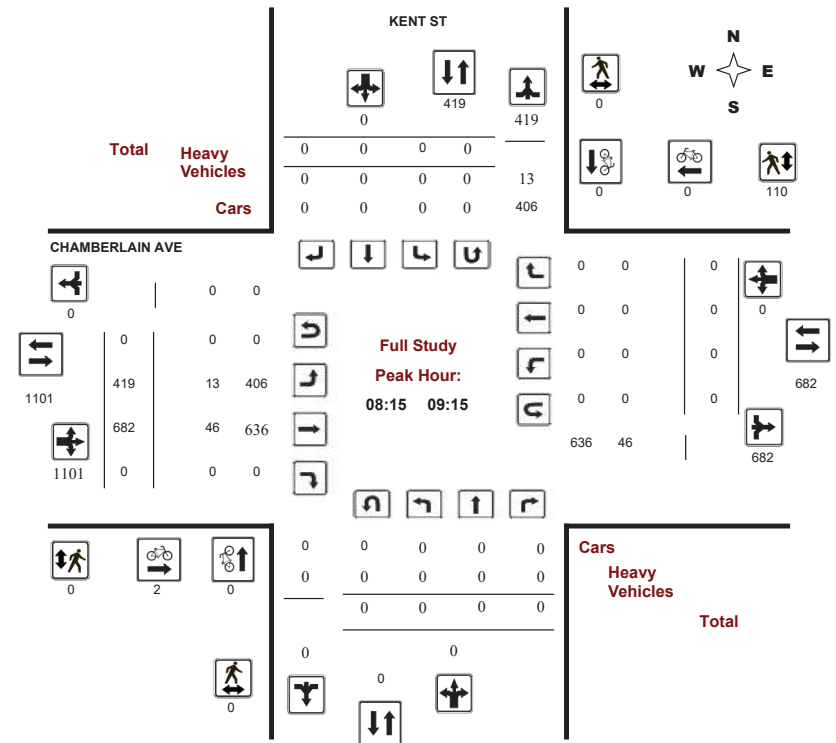
Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

#### Full Study Peak Hour Diagram





# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

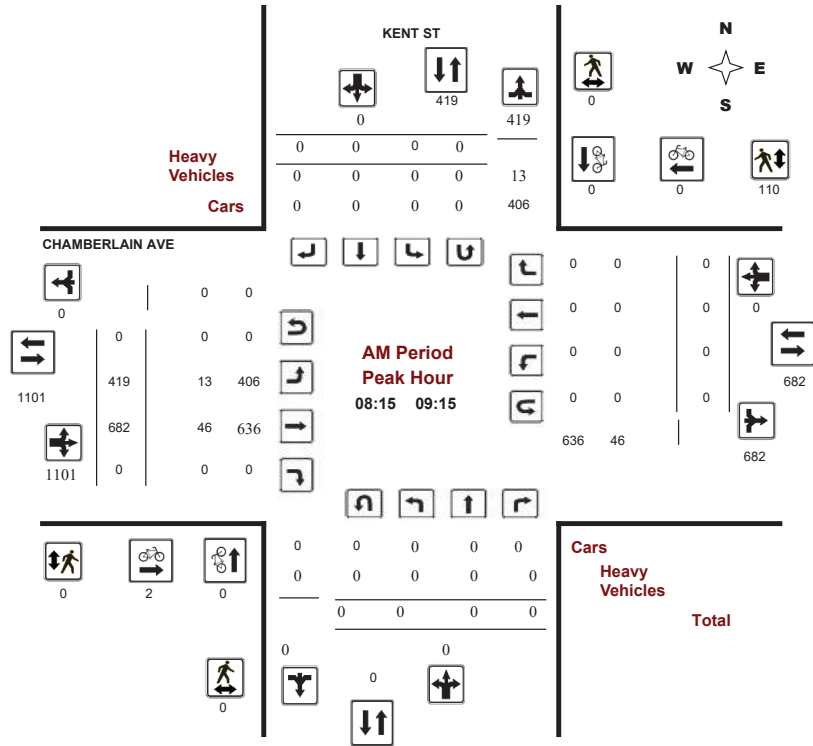
### CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40742

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

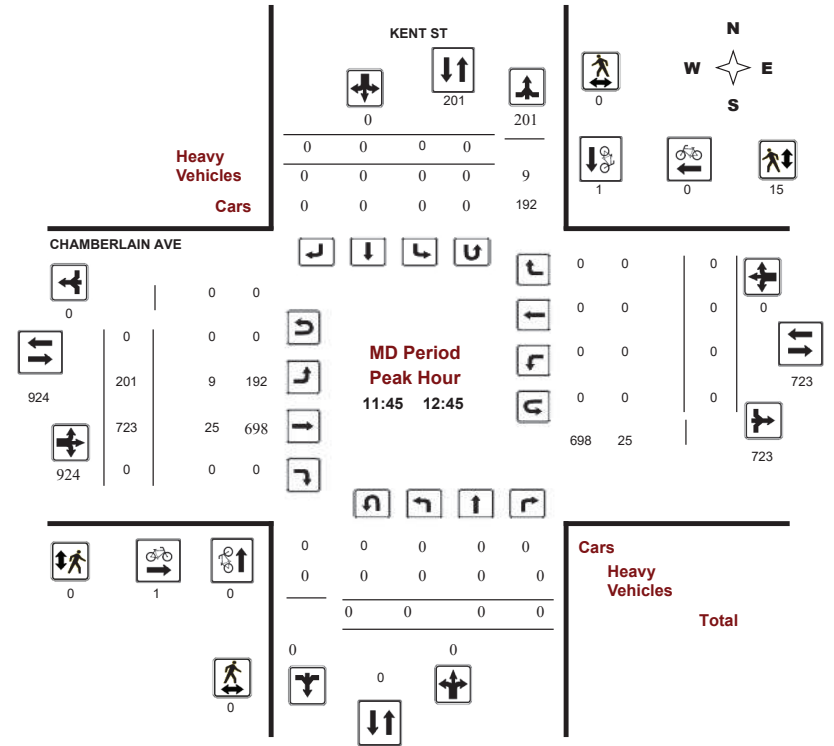
### CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40742

Device: Miovision



Comments





# Transportation Services - Traffic Services

## Turning Movement Count - Peak Hour Diagram

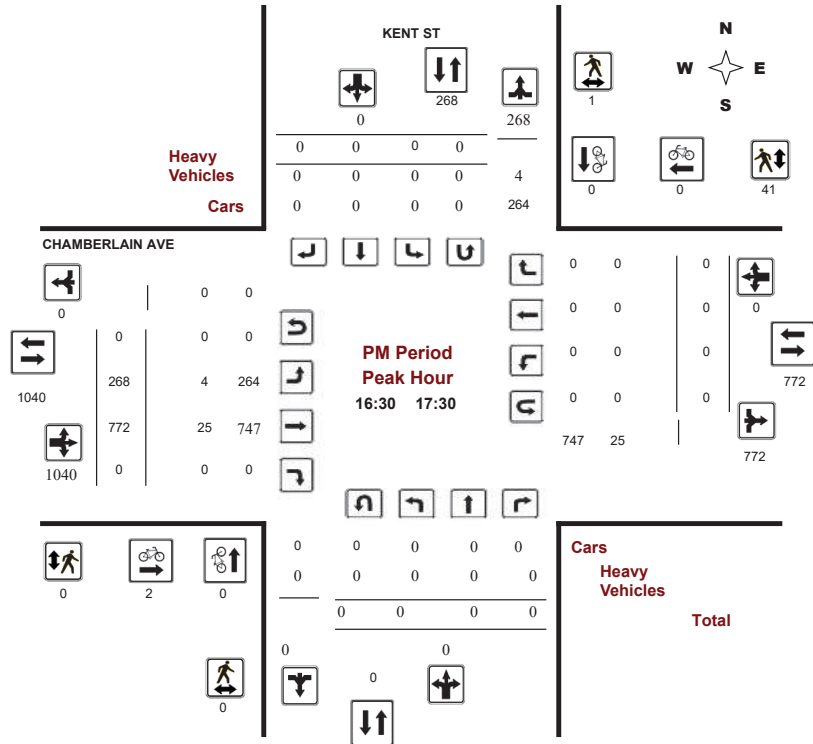
### CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40742

Device: Miovision



Comments



# Transportation Services - Traffic Services

## Turning Movement Count - Study Results

### CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

Start Time: 07:00

WO No: 40742

Device: Miovision

## Full Study Summary (8 HR Standard)

Survey Date: Wednesday, April 18, 2018

**Total Observed U-Turns**

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

**ADT Factor**

.90

Period	KENT ST					CHAMBERLAIN AVE					WB TOT	STR TOT	Grand Total						
	Northbound		Southbound			Eastbound		Westbound											
	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT				ST	RT	EB TOT			
07:00-08:00	0	0	0	0	0	0	0	0	0	346	537	0	883	0	0	0	0	883	883
08:00-09:00	0	0	0	0	0	0	0	0	0	438	652	0	1090	0	0	0	0	1090	1090
09:00-10:00	0	0	0	0	0	0	0	0	0	291	656	0	947	0	0	0	0	947	947
11:30-12:30	0	0	0	0	0	0	0	0	0	196	716	0	912	0	0	0	0	912	912
12:30-13:30	0	0	0	0	0	0	0	0	0	197	714	0	911	0	0	0	0	911	911
15:00-16:00	0	0	0	0	0	0	0	0	0	255	761	0	1016	0	0	0	0	1016	1016
16:00-17:00	0	0	0	0	0	0	0	0	0	265	686	0	951	0	0	0	0	951	951
17:00-18:00	0	0	0	0	0	0	0	0	0	259	758	0	1017	0	0	0	0	1017	1017
<b>Sub Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2247</b>	<b>5480</b>	<b>0</b>	<b>7727</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7727</b>	<b>7727</b>
<b>U Turns</b>				<b>0</b>				<b>0</b>	<b>0</b>				<b>0</b>					<b>0</b>	<b>0</b>
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2247</b>	<b>5480</b>	<b>0</b>	<b>7727</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>7727</b>	<b>7727</b>
<b>EQ 12Hr</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3123</b>	<b>7617</b>	<b>0</b>	<b>10741</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10741</b>	<b>10741</b>
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													<b>1.39</b>						
<b>AVG 12Hr</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2811</b>	<b>6855</b>	<b>0</b>	<b>9667</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9667</b>	<b>9667</b>
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the ADT factor.													<b>.90</b>						
<b>AVG 24Hr</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3682</b>	<b>8980</b>	<b>0</b>	<b>12664</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>12664</b>	<b>12664</b>
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													<b>1.31</b>						
Note: U-Turns provided for approach totals. Refer to 'U-Turn' Report for specific breakdown.																			



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

Full Study 15 Minute Increments

Table with columns for Time Period, Northbound, Southbound, Eastbound, Westbound, and Grand Total. Rows show 15-minute intervals from 07:00 to 18:00.

Note: U-Turns are included in Totals.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

Full Study Cyclist Volume

Table with columns for Time Period, Northbound, Southbound, Street Total, Eastbound, Westbound, Street Total, and Grand Total. Rows show 15-minute intervals from 07:00 to 18:00.



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

Full Study Pedestrian Volume

Time Period	KENT ST		Total	CHAMBERLAIN AVE		Total	Grand Total
	NB Approach (E or W Crossing)	SB Approach (E or W Crossing)		EB Approach (N or S Crossing)	WB Approach (N or S Crossing)		
07:00 07:15	0	0	0	0	4	4	4
07:15 07:30	0	0	0	0	3	3	3
07:30 07:45	0	0	0	0	9	9	9
07:45 08:00	0	0	0	0	12	12	12
08:00 08:15	0	0	0	0	12	12	12
08:15 08:30	0	0	0	0	21	21	21
08:30 08:45	0	0	0	0	65	65	65
08:45 09:00	0	0	0	0	16	16	16
09:00 09:15	0	0	0	0	8	8	8
09:15 09:30	0	0	0	0	3	3	3
09:30 09:45	0	0	0	0	4	4	4
09:45 10:00	0	0	0	0	4	4	4
11:30 11:45	0	0	0	0	5	5	5
11:45 12:00	0	0	0	0	1	1	1
12:00 12:15	0	0	0	0	8	8	8
12:15 12:30	0	0	0	0	4	4	4
12:30 12:45	0	0	0	0	2	2	2
12:45 13:00	0	0	0	0	2	2	2
13:00 13:15	0	0	0	0	4	4	4
13:15 13:30	0	0	0	0	4	4	4
15:00 15:15	0	0	0	0	6	6	6
15:15 15:30	0	0	0	0	58	58	58
15:30 15:45	0	0	0	0	11	11	11
15:45 16:00	0	0	0	0	4	4	4
16:00 16:15	0	0	0	0	14	14	14
16:15 16:30	0	0	0	0	7	7	7
16:30 16:45	0	0	0	0	8	8	8
16:45 17:00	0	0	0	0	10	10	10
17:00 17:15	0	1	1	0	9	9	10
17:15 17:30	0	0	0	0	14	14	14
17:30 17:45	0	0	0	0	8	8	8
17:45 18:00	0	0	0	0	9	9	9
Total .....	0	1	1	0	349	349	350



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

Full Study Heavy Vehicles

Time Period	KENT ST						CHAMBERLAIN AVE						Grand Total						
	Northbound			Southbound			Eastbound			Westbound									
	LT	ST	RT	N TOT	LT	ST	RT	S TOT	STR TOT	LT	ST	RT		E TOT	LT	ST	RT	W TOT	STR TOT
07:00 07:15	0	0	0	0	0	0	0	1	1	1	6	0	7	0	0	0	6	13	7
07:15 07:30	0	0	0	0	0	0	0	0	0	0	7	0	7	0	0	0	7	14	7
07:30 07:45	0	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	6	12	6
07:45 08:00	0	0	0	0	0	0	0	0	0	0	5	0	5	0	0	0	5	10	5
08:00 08:15	0	0	0	0	0	0	0	1	1	1	8	0	9	0	0	0	8	17	9
08:15 08:30	0	0	0	0	0	0	0	1	1	1	5	0	6	0	0	0	5	11	6
08:30 08:45	0	0	0	0	0	0	0	5	5	5	14	0	19	0	0	0	14	33	19
08:45 09:00	0	0	0	0	0	0	0	3	3	3	16	0	19	0	0	0	16	35	19
09:00 09:15	0	0	0	0	0	0	0	4	4	4	11	0	15	0	0	0	11	26	15
09:15 09:30	0	0	0	0	0	0	0	3	3	3	12	0	15	0	0	0	12	27	15
09:30 09:45	0	0	0	0	0	0	0	0	0	0	13	0	13	0	0	0	13	26	13
09:45 10:00	0	0	0	0	0	0	0	2	2	2	8	0	10	0	0	0	8	18	10
11:30 11:45	0	0	0	0	0	0	0	1	1	1	8	0	9	0	0	0	8	17	9
11:45 12:00	0	0	0	0	0	0	0	2	2	2	3	0	5	0	0	0	3	8	5
12:00 12:15	0	0	0	0	0	0	0	0	0	0	5	0	5	0	0	0	5	10	5
12:15 12:30	0	0	0	0	0	0	0	4	4	4	11	0	15	0	0	0	11	26	15
12:30 12:45	0	0	0	0	0	0	0	3	3	3	6	0	9	0	0	0	6	15	9
12:45 13:00	0	0	0	0	0	0	0	1	1	1	8	0	9	0	0	0	8	17	9
13:00 13:15	0	0	0	0	0	0	0	0	0	0	12	0	12	0	0	0	12	24	12
13:15 13:30	0	0	0	0	0	0	0	1	1	1	9	0	10	0	0	0	9	19	10
15:00 15:15	0	0	0	0	0	0	0	2	2	2	6	0	8	0	0	0	6	14	8
15:15 15:30	0	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	6	12	6
15:30 15:45	0	0	0	0	0	0	0	1	1	1	6	0	7	0	0	0	6	13	7
15:45 16:00	0	0	0	0	0	0	0	2	2	2	4	0	6	0	0	0	4	10	6
16:00 16:15	0	0	0	0	0	0	0	1	1	1	13	0	14	0	0	0	13	27	14
16:15 16:30	0	0	0	0	0	0	0	2	2	2	8	0	10	0	0	0	8	18	10
16:30 16:45	0	0	0	0	0	0	0	1	1	1	2	0	3	0	0	0	2	5	3
16:45 17:00	0	0	0	0	0	0	0	1	1	1	5	0	6	0	0	0	5	11	6
17:00 17:15	0	0	0	0	0	0	0	1	1	1	12	0	13	0	0	0	12	25	13
17:15 17:30	0	0	0	0	0	0	0	1	1	1	6	0	7	0	0	0	6	13	7
17:30 17:45	0	0	0	0	0	0	0	0	0	0	7	0	7	0	0	0	7	14	7
17:45 18:00	0	0	0	0	0	0	0	1	1	1	9	0	10	0	0	0	9	19	10
Total: None	0	0	0	0	0	0	0	45	45	45	257	0	302	0	0	0	257	559	302



Transportation Services - Traffic Services

Turning Movement Count - Study Results

CHAMBERLAIN AVE @ KENT ST

Survey Date: Wednesday, April 18, 2018

WO No: 40742

Start Time: 07:00

Device: Miovision

Full Study 15 Minute U-Turn Total

KENT ST

CHAMBERLAIN AVE

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

# Appendix C

Synchro Intersection Worksheets – Existing Conditions

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

Existing  
05-05-2023

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↑↑↑	↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	123
Future Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	123
Satd. Flow (prot)	0	0	0	0	4645	0	0	0	0	0	1745	1483
Fit Permitted					0.975							
Satd. Flow (perm)	0	0	0	0	4612	0	0	0	0	0	1745	1454
Satd. Flow (RTOR)					247							137
Lane Group Flow (vph)	0	0	0	0	490	0	0	0	0	0	287	137
Turn Type				Perm	NA						NA	Perm
Protected Phases					6						4	
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				40.0	40.0						35.0	35.0
Total Split (%)				53.3%	53.3%						46.7%	46.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					34.8						29.7	29.7
Actuated g/C Ratio					0.46						0.40	0.40
v/c Ratio					0.22						0.42	0.21
Control Delay					10.0						18.7	3.9
Queue Delay					0.0						0.0	0.0
Total Delay					10.0						18.7	3.9
LOS					B						B	A
Approach Delay					10.0						13.9	
Approach LOS					B						B	
Queue Length 50th (m)					19.1						28.5	0.0
Queue Length 95th (m)					m25.8						47.7	9.5
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					2272						691	658
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.22						0.42	0.21

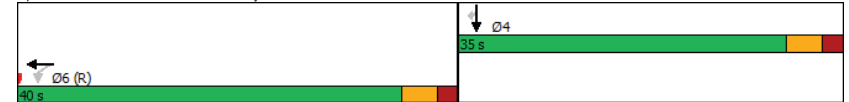
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	48 (64%), Referenced to phase 2: and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.42	Intersection LOS: B
Intersection Signal Delay: 11.8	ICU Level of Service A
Intersection Capacity Utilization 47.6%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	389	537	54	1333	0	0	0	0
Future Volume (vph)	0	0	0	0	389	537	54	1333	0	0	0	0
Satd. Flow (prot)	0	0	0	0	2916	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	2916	1262	0	4749	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	707	322	0	1541	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					32.0	32.0	38.0	38.0				
Total Split (%)					42.7%	42.7%	50.7%	50.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					26.2	26.2		32.2				
Actuated g/C Ratio					0.35	0.35		0.43				
v/c Ratio					0.69	0.73		0.74				
Control Delay					26.9	31.7		19.7				
Queue Delay					0.0	0.0		0.0				
Total Delay					26.9	31.7		19.7				
LOS					C	C		B				
Approach Delay					28.4			19.7				
Approach LOS					C			B				
Queue Length 50th (m)					49.8	45.9		61.5				
Queue Length 95th (m)					m61.0	m57.3		77.9				
Internal Link Dist (m)		157.8			130.6			47.0			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1018	440		2078				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.69	0.73		0.74				

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	15 (20%), Referenced to phase 2: and 6:WBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
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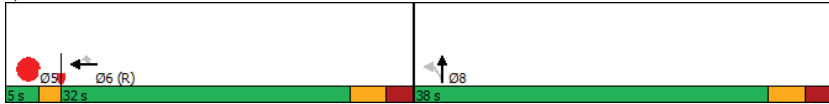
Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.74	Intersection LOS: C
Intersection Signal Delay: 23.2	ICU Level of Service C
Intersection Capacity Utilization 64.8%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

Existing  
05-05-2023

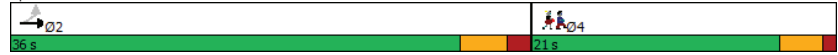
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕	↔	↕	↔	↕	
Traffic Volume (vph)	419	682	0	0	0	0	
Future Volume (vph)	419	682	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	466						
Lane Group Flow (vph)	466	758	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	35.1	35.1					
Actuated g/C Ratio	0.65	0.65					
v/c Ratio	0.38	0.35					
Control Delay	1.7	7.1					
Queue Delay	0.0	0.0					
Total Delay	1.7	7.1					
LOS	A	A					
Approach Delay		5.0					
Approach LOS		A					
Queue Length 50th (m)	0.0	21.9					
Queue Length 95th (m)	9.1	31.1					
Internal Link Dist (m)		270.2	176.4		31.3		
Turn Bay Length (m)							
Base Capacity (vph)	1249	2178					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.37	0.35					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 53.9							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.38							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

Existing  
05-05-2023

Intersection Signal Delay: 5.0	Intersection LOS: A
Intersection Capacity Utilization 28.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

Existing  
05-05-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	160	582	189	272	626	0	0	363	110
Future Volume (vph)	0	0	0	160	582	189	272	626	0	0	363	110
Satd. Flow (prot)	0	0	0	0	4481	0	0	3266	0	0	2996	0
Fit Permitted					0.991			0.633				
Satd. Flow (perm)	0	0	0	0	4429	0	0	2035	0	0	2996	0
Satd. Flow (RTOR)					80			51				
Lane Group Flow (vph)	0	0	0	0	1035	0	0	998	0	0	525	0
Turn Type				Perm	NA	pm+pt	NA	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				25.0	25.0		15.0	40.0			25.0	
Total Split (%)				33.3%	33.3%		20.0%	53.3%			33.3%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag		Lag				Lag	
Lead-Lag Optimize?					Yes		Yes				Yes	
Recall Mode					Max		Max	C-Max			C-Max	
Act Effct Green (s)					19.4			34.6			19.6	
Actuated g/C Ratio					0.26			0.46			0.26	
v/c Ratio					0.86			0.91			0.64	
Control Delay					33.3			18.0			26.3	
Queue Delay					0.0			0.0			0.2	
Total Delay					33.3			18.0			26.4	
LOS					C			B			C	
Approach Delay					33.3			18.0			26.4	
Approach LOS					C			B			C	
Queue Length 50th (m)					47.3			15.1			31.1	
Queue Length 95th (m)					#69.1			m#34.1			46.7	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1204			1096			820	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			29	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.86			0.91			0.66	

Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 70 (93%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings  
4: Bank & Catherine

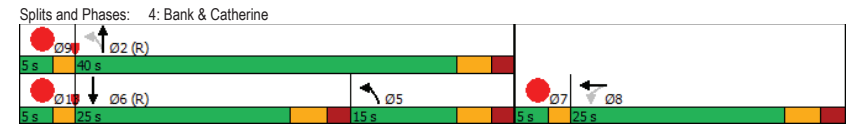
Existing  
05-05-2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?	Yes		Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.91  
 Intersection Signal Delay: 25.9 Intersection LOS: C  
 Intersection Capacity Utilization 79.0% ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

Existing  
05-05-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕		↕	↕	
Traffic Volume (vph)	74	487	75	0	0	0	0	834	142	168	372	0
Future Volume (vph)	74	487	75	0	0	0	0	834	142	168	372	0
Satd. Flow (prot)	0	3292	1483	0	0	0	0	3154	0	1658	1745	0
Fit Permitted		0.993								0.145		
Satd. Flow (perm)	0	3285	1334	0	0	0	0	3154	0	253	1745	0
Satd. Flow (RTOR)			134					27				
Lane Group Flow (vph)	0	623	83	0	0	0	0	1085	0	187	413	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	29.0	29.0	29.0					31.0		15.0	46.0	
Total Split (%)	38.7%	38.7%	38.7%					41.3%		20.0%	61.3%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		19.3	19.3					28.4		43.4	43.4	
Actuated g/C Ratio		0.26	0.26					0.38		0.58	0.58	
v/c Ratio		0.74	0.19					0.90		0.60	0.41	
Control Delay		30.9	2.3					34.6		27.1	8.2	
Queue Delay		0.0	0.0					0.0		0.0	1.3	
Total Delay		30.9	2.3					34.6		27.1	9.5	
LOS		C	A					C		C	A	
Approach Delay		27.5						34.6			15.0	
Approach LOS		C						C			B	
Queue Length 50th (m)		41.8	0.0					73.7		14.1	21.3	
Queue Length 95th (m)		55.7	3.4					#122.9		m31.4	m28.4	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		998	498					1211		313	1009	
Starvation Cap Reductn		0	0					0		0	389	
Spillback Cap Reductn		0	0					0		0	0	
Storage Cap Reductn		0	0					0		0	0	
Reduced v/c Ratio		0.62	0.17					0.90		0.60	0.67	

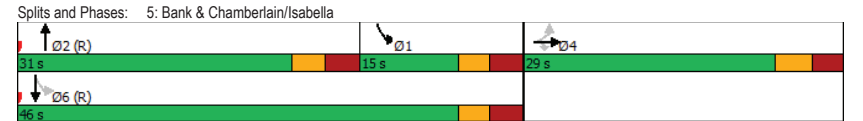
Intersection Summary

Cycle Length: 75
Actuated Cycle Length: 75
Offset: 1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

Existing  
05-05-2023

Maximum v/c Ratio: 0.90	Intersection LOS: C
Intersection Signal Delay: 27.6	ICU Level of Service D
Intersection Capacity Utilization 75.1%	
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

Existing  
05-05-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	192	436	0	0	0	0	0	343	255
Future Volume (vph)	0	0	0	192	436	0	0	0	0	0	343	255
Satd. Flow (prot)	0	0	0	0	4693	0	0	0	0	0	1745	1483
Fit Permitted					0.985							
Satd. Flow (perm)	0	0	0	0	4657	0	0	0	0	0	1745	1443
Satd. Flow (RTOR)					153							104
Lane Group Flow (vph)	0	0	0	0	697	0	0	0	0	0	381	283
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				28.0	28.0						47.0	47.0
Total Split (%)				37.3%	37.3%						62.7%	62.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					22.8						41.7	41.7
Actuated g/C Ratio					0.30						0.56	0.56
v/c Ratio					0.46						0.39	0.33
Control Delay					15.4						11.0	6.8
Queue Delay					0.0						0.0	0.0
Total Delay					15.4						11.0	6.8
LOS					B						B	A
Approach Delay					15.4						9.2	
Approach LOS					B						A	
Queue Length 50th (m)					9.1						28.1	11.8
Queue Length 95th (m)					11.3						45.5	24.7
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					1522						970	848
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.46						0.39	0.33

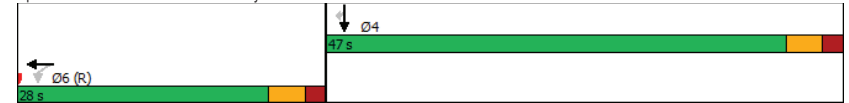
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	24 (32%), Referenced to phase 2: and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.46	Intersection LOS: B
Intersection Signal Delay: 12.4	ICU Level of Service A
Intersection Capacity Utilization 45.8%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	593	289	25	720	0	0	0	0
Future Volume (vph)	0	0	0	0	593	289	25	720	0	0	0	0
Satd. Flow (prot)	0	0	0	0	3143	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	3143	1247	0	4752	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	691	289	0	828	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					38.0	38.0	32.0	32.0				
Total Split (%)					50.7%	50.7%	42.7%	42.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					32.2	32.2		26.2				
Actuated g/C Ratio					0.43	0.43		0.35				
v/c Ratio					0.51	0.54		0.49				
Control Delay					14.1	16.6		18.5				
Queue Delay					0.0	0.0		0.0				
Total Delay					14.1	16.6		18.5				
LOS					B	B		B				
Approach Delay					14.8			18.5				
Approach LOS					B			B				
Queue Length 50th (m)					30.2	25.3		30.0				
Queue Length 95th (m)					m42.9	m38.9		40.6				
Internal Link Dist (m)		157.8			130.6			43.8			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1349	535		1705				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.51	0.54		0.49				

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	

Lanes, Volumes, Timings  
2: Kent & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.54	Intersection LOS: B
Intersection Signal Delay: 16.5	ICU Level of Service A
Intersection Capacity Utilization 48.2%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

Existing  
05-05-2023

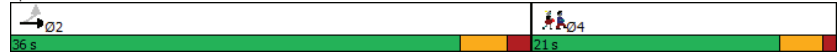
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕	↔	↕	↔	↕	
Traffic Volume (vph)	268	772	0	0	0	0	
Future Volume (vph)	268	772	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	298						
Lane Group Flow (vph)	298	858	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	37.2	37.2					
Actuated g/C Ratio	0.84	0.84					
v/c Ratio	0.21	0.31					
Control Delay	1.2	4.1					
Queue Delay	0.0	0.0					
Total Delay	1.2	4.1					
LOS	A	A					
Approach Delay		3.4					
Approach LOS		A					
Queue Length 50th (m)	0.0	0.0					
Queue Length 95th (m)	7.4	35.9					
Internal Link Dist (m)		270.2	176.4		23.7		
Turn Bay Length (m)							
Base Capacity (vph)	1436	2776					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.21	0.31					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 44.3							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.31							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

Existing  
05-05-2023

Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 26.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

Existing  
05-05-2023

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	225	484	137	182	320	0	0	643	110
Future Volume (vph)	0	0	0	225	484	137	182	320	0	0	643	110
Satd. Flow (prot)	0	0	0	0	4536	0	0	3256	0	0	3095	0
Fit Permitted					0.987			0.547				
Satd. Flow (perm)	0	0	0	0	4474	0	0	1814	0	0	3095	0
Satd. Flow (RTOR)					50			26				
Lane Group Flow (vph)	0	0	0	0	940	0	0	558	0	0	836	0
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				24.0	24.0		14.0	41.0			27.0	
Total Split (%)				32.0%	32.0%		18.7%	54.7%			36.0%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag	Lag					Lag	
Lead-Lag Optimize?											Yes	
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					18.4			35.6			21.6	
Actuated g/C Ratio					0.25			0.47			0.29	
v/c Ratio					0.83			0.54			0.92	
Control Delay					33.0			12.0			42.4	
Queue Delay					0.0			0.0			46.0	
Total Delay					33.0			12.0			88.3	
LOS					C			B			F	
Approach Delay					33.0			12.0			88.3	
Approach LOS					C			B			F	
Queue Length 50th (m)					43.8			15.1			58.2	
Queue Length 95th (m)					#60.2			19.1			#92.8	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1135			1026			909	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					2			0			151	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.83			0.54			1.10	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	50 (67%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated



Lanes, Volumes, Timings  
4: Bank & Catherine

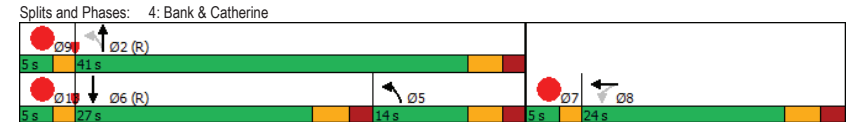
Existing  
05-05-2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?			Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

Existing  
05-05-2023

Maximum v/c Ratio: 0.92
Intersection Signal Delay: 47.8
Intersection Capacity Utilization 72.7%
Analysis Period (min) 15
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

Existing  
05-05-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕			↕↕	
Traffic Volume (vph)	53	590	120	0	0	0	0	448	91	175	720	0
Future Volume (vph)	53	590	120	0	0	0	0	448	91	175	720	0
Satd. Flow (prot)	0	3302	1483	0	0	0	0	3097	0	0	3283	0
Fit Permitted		0.996									0.701	
Satd. Flow (perm)	0	3299	1345	0	0	0	0	3097	0	0	2284	0
Satd. Flow (RTOR)			134					33				
Lane Group Flow (vph)	0	715	133	0	0	0	0	599	0	0	994	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	31.0	31.0	31.0					30.0		14.0	44.0	
Total Split (%)	41.3%	41.3%	41.3%					40.0%		18.7%	58.7%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		21.5	21.5					41.2			41.2	
Actuated g/C Ratio		0.29	0.29					0.55			0.55	
v/c Ratio		0.76	0.28					0.35			0.79	
Control Delay		29.6	5.3					10.2			16.4	
Queue Delay		0.0	0.0					0.0			10.4	
Total Delay		29.6	5.3					10.2			26.8	
LOS		C	A					B			C	
Approach Delay		25.8						10.2			26.8	
Approach LOS		C						B			C	
Queue Length 50th (m)		47.6	0.0					21.8			81.8	
Queue Length 95th (m)		62.4	10.5					34.8			m92.5	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		1090	534					1714			1253	
Starvation Cap Reductn		0	0					0			242	
Spillback Cap Reductn		0	0					0			0	
Storage Cap Reductn		0	0					0			0	
Reduced v/c Ratio		0.66	0.25					0.35			0.98	

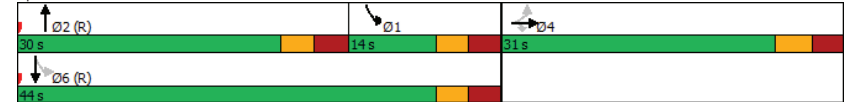
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	60 (80%), Referenced to phase 2:NBT and 6:SBLT, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

Existing  
05-05-2023

Maximum v/c Ratio: 0.79	Intersection LOS: C
Intersection Signal Delay: 22.4	ICU Level of Service D
Intersection Capacity Utilization 81.3%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 5: Bank & Chamberlain/Isabella



# Appendix D

Collision Data





## Transportation Services - Traffic Services Collision Details Report - Public Version

From: January 1, 2014 To: December 31, 2018

**Location:** BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

**Traffic Control:** Traffic signal

**Total Collisions:** 56

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Mar-13, Thu,01:00	Snow	Angle	P.D. only	Loose snow	South	Unknown	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Jul-18, Fri,22:25	Clear	SMV other	P.D. only	Dry	South	Turning left	Automobile, station wagon	Pedestrian	1
2014-Jul-19, Sat,21:01	Clear	Rear end	P.D. only	Dry	South	Going ahead	Passenger van	Other motor vehicle	0
					South	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
2014-Jul-31, Thu,11:45	Clear	Sideswipe	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Aug-10, Sun,21:41	Clear	Rear end	Non-fatal injury	Dry	South	Unknown	Unknown	Cyclist	0
					South	Turning left	Bicycle	Other motor vehicle	
2014-Oct-08, Wed,13:59	Clear	Sideswipe	P.D. only	Dry	South	Changing lanes	Automobile, station wagon	Other motor vehicle	0
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Oct-11, Sat,06:51	Clear	Turning movement	Non-fatal injury	Dry	South	Turning left	Automobile, station wagon	Other motor vehicle	0
					North	Going ahead	Motorcycle	Other motor vehicle	
2014-Oct-14, Tue,06:30	Clear	Angle	Non-fatal injury	Dry	East	Slowing or stopping	Truck - dump	Other motor vehicle	0
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Oct-23, Thu,20:20	Clear	SMV other	Non-fatal injury	Dry	South	Turning left	Automobile, station wagon	Pedestrian	1
2015-Feb-08, Sun,08:48	Snow	Rear end	P.D. only	Loose snow	East	Slowing or stopping	Automobile, station wagon	Other motor vehicle	0
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2015-Apr-29, Wed,10:54	Clear	Angle	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-May-09, Sat,20:05	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2015-Aug-06, Thu,20:59	Clear	SMV other	P.D. only	Dry	North	Turning left	Automobile, station wagon	Ran off road	0

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## Transportation Services - Traffic Services Collision Details Report - Public Version

From: January 1, 2014 To: December 31, 2018

**Location:** BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

**Traffic Control:** Traffic signal

**Total Collisions:** 56

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Sep-08, Tue,19:37	Clear	Angle	P.D. only	Dry	South	Turning left	Bicycle	Other motor vehicle	0
					East	Turning left	Automobile, station wagon	Cyclist	
2015-Sep-12, Sat,16:42	Rain	Turning movement	P.D. only	Wet	East	Turning left	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Passenger van	Other motor vehicle	
2015-Sep-13, Sun,15:43	Clear	Turning movement	P.D. only	Wet	East	Turning left	Delivery van	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2015-Oct-12, Mon,14:45	Clear	Turning movement	P.D. only	Dry	East	Turning left	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Oct-12, Mon,17:00	Clear	Sideswipe	P.D. only	Dry	East	Unknown	Unknown	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Oct-14, Wed,17:01	Clear	Turning movement	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
					South	Stopped	Automobile, station wagon	Other motor vehicle	
2015-Oct-27, Tue,15:22	Clear	Sideswipe	P.D. only	Dry	South	Changing lanes	Pick-up truck	Other motor vehicle	0
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Dec-18, Fri,15:42	Clear	Sideswipe	P.D. only	Dry	South	Stopped	Automobile, station wagon	Other motor vehicle	0
					South	Going ahead	Truck - dump	Other motor vehicle	
2016-Jan-03, Sun,22:14	Clear	Angle	P.D. only	Wet	South	Going ahead	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2016-Jan-11, Mon,01:39	Snow	Angle	P.D. only	Loose snow	East	Turning right	Pick-up truck	Other motor vehicle	0
					South	Going ahead	Municipal transit bus	Other motor vehicle	
2016-Jan-11, Mon,21:08	Clear	SMV other	Non-fatal injury	Wet	North	Turning right	Automobile, station wagon	Pedestrian	1
2016-Mar-04, Fri,14:55	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Turning left	Pick-up truck	Other motor vehicle	

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## Transportation Services - Traffic Services Collision Details Report - Public Version

From: January 1, 2014 To: December 31, 2018

**Location:** BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

**Traffic Control:** Traffic signal

**Total Collisions:** 56

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Mar-21, Mon,11:12	Clear	Turning movement	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2016-Apr-21, Thu,15:40	Clear	Rear end	P.D. only	Dry	East	Going ahead	Police vehicle	Other motor vehicle	0
					East	Slowing or stopping	Passenger van	Other motor vehicle	
2016-May-31, Tue,08:32	Clear	Sideswipe	P.D. only	Dry	North	Unknown	Bicycle	Other motor vehicle	0
2016-Jun-20, Mon,02:12	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2016-Jun-25, Sat,10:38	Clear	Angle	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Jul-04, Mon,00:24	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	0
					South	Going ahead	Pick-up truck	Other motor vehicle	
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Aug-26, Fri,13:33	Clear	Rear end	P.D. only	Dry	North	Slowing or stopping	Pick-up truck	Other motor vehicle	0
					North	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
2016-Sep-20, Tue,18:46	Clear	Sideswipe	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2016-Oct-10, Mon,19:17	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Oct-13, Thu,10:56	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2016-Oct-30, Sun,15:08	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	

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## Transportation Services - Traffic Services Collision Details Report - Public Version

From: January 1, 2014 To: December 31, 2018

**Location:** BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

**Traffic Control:** Traffic signal

**Total Collisions:** 56

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Nov-05, Sat,13:49	Clear	Angle	P.D. only	Dry	South	Going ahead	Pick-up truck	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2016-Dec-31, Sat,15:23	Snow	Rear end	P.D. only	Loose snow	North	Slowing or stopping	Automobile, station wagon	Other motor vehicle	0
					North	Stopped	Pick-up truck	Other motor vehicle	
2017-Feb-27, Mon,14:49	Clear	Angle	P.D. only	Dry	North	Turning right	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Apr-08, Sat,15:02	Clear	Turning movement	P.D. only	Dry	East	Turning left	Pick-up truck	Other motor vehicle	0
2017-Apr-29, Sat,13:25	Clear	Sideswipe	P.D. only	Dry	South	Changing lanes	Automobile, station wagon	Other motor vehicle	0
					South	Changing lanes	Automobile, station wagon	Other motor vehicle	
2017-Jul-11, Tue,17:16	Rain	Rear end	P.D. only	Wet	East	Slowing or stopping	Automobile, station wagon	Other motor vehicle	0
					East	Stopped	Pick-up truck	Other motor vehicle	
2017-Jul-16, Sun,08:49	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Jul-16, Sun,10:56	Clear	Angle	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Other motor vehicle	0
					South	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Aug-24, Thu,20:58	Clear	Sideswipe	P.D. only	Dry	East	Changing lanes	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Sep-13, Wed,05:30	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Pick-up truck	Other motor vehicle	
2017-Sep-23, Sat,14:50	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2017-Dec-15, Fri,16:39	Snow	Sideswipe	P.D. only	Wet	East	Changing lanes	Pick-up truck	Other motor vehicle	0
					East	Turning left	Truck and trailer	Other motor vehicle	

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## Transportation Services - Traffic Services

### Collision Details Report - Public Version

From: January 1, 2014 To: December 31, 2018

**Location:** BANK ST @ CHAMBERLAIN AVE N/ISABELLA ST

**Traffic Control:** Traffic signal

**Total Collisions:** 56

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2018-Jan-16, Tue,20:05	Clear	Turning movement	P.D. only	Slush	South	Turning left	Pick-up truck	Other motor vehicle	0
					North	Going ahead	Pick-up truck	Other motor vehicle	
2018-Feb-06, Tue,20:50	Clear	Turning movement	P.D. only	Wet	South	Turning left	Automobile, station wagon	Other motor vehicle	0
					North	Going ahead	Automobile, station wagon	Other motor vehicle	
2018-May-11, Fri,15:08	Clear	Sideswipe	P.D. only	Dry	East	Overtaking	Automobile, station wagon	Other motor vehicle	0
					East	Slowing or stopping	Automobile, station wagon	Other motor vehicle	
					East	Stopped	Automobile, station wagon	Other motor vehicle	
2018-May-14, Mon,10:32	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2018-May-26, Sat,11:40	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	0
					East	Going ahead	Automobile, station wagon	Other motor vehicle	
2018-Jul-27, Fri,14:15	Clear	Rear end	P.D. only	Dry	North	Unknown	Unknown	Other motor vehicle	0
					North	Stopped	Automobile, station wagon	Other motor vehicle	
2018-Aug-30, Thu,13:20	Clear	Turning movement	P.D. only	Dry	East	Turning left	Delivery van	Other motor vehicle	0
					East	Turning left	Passenger van	Other motor vehicle	
2018-Oct-18, Thu,14:13	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle	0
					East	Stopped	Automobile, station wagon	Other motor vehicle	

# Appendix E

TRANS Model Plots



# TRANS Regional Model

Version 2.15 - Assigned April 21, 2020

**AM Peak Hour Total Traffic Volume**

**Kent/Chamberlain**

2011 Model - Basecase

N/A

User Initials: TIMW

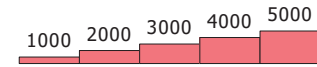
Plot Prepared: June 08, 2020

EMME Scenario: 21711



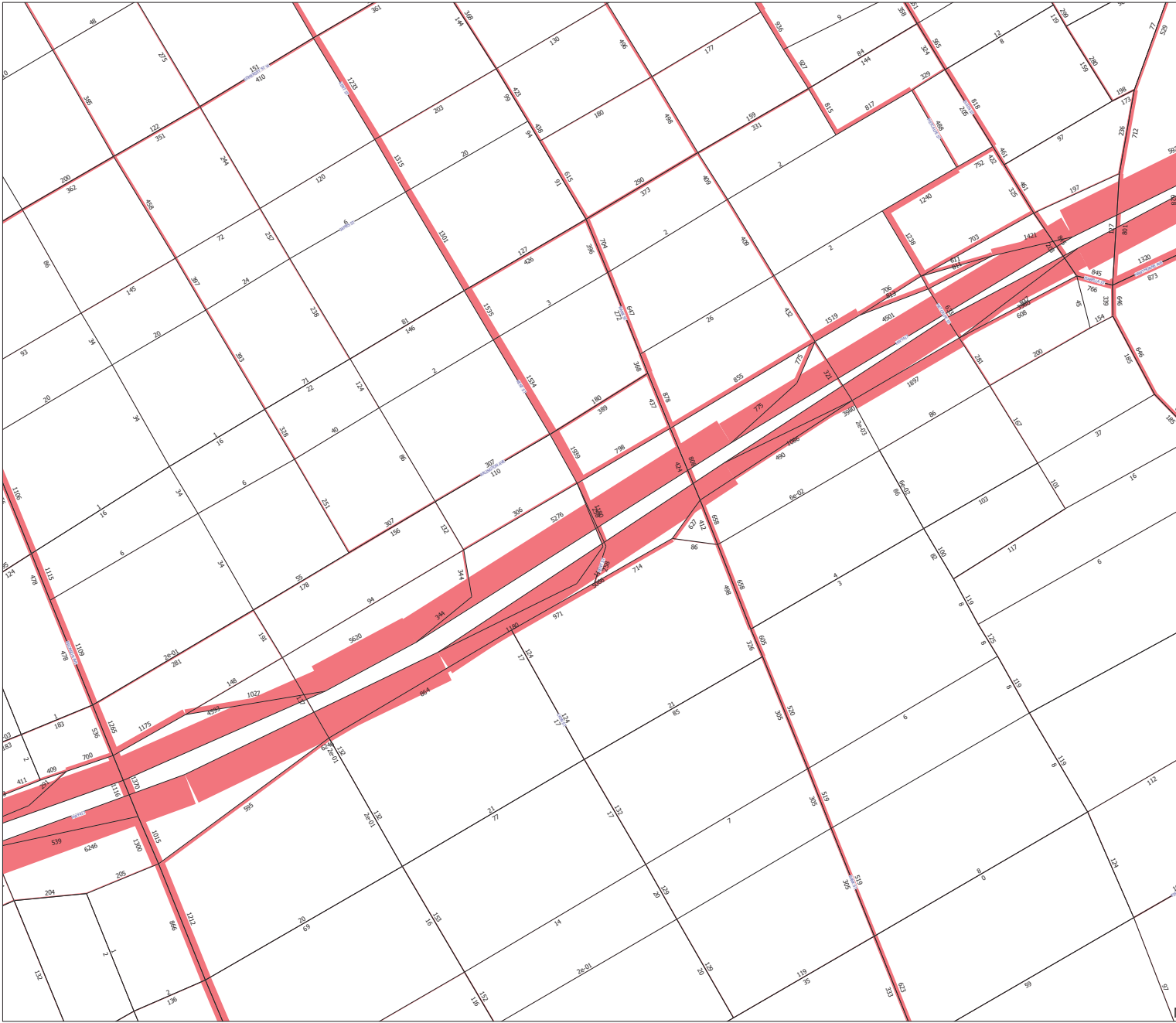
## Legend

AM Peak Hour Total Traffic Volume



Distance (m)

50 100 150 200 250



The TRANS model is continuously refined & maintained, and all information is provided in good faith. However, model outputs are provided "as is", and no warranty or guarantee is provided as to the accuracy, reliability or reasonableness of the results. In using this data, you agree to accept any and all risks arising from any incorrect, incomplete, or misleading information.

Recipients are required to use caution and professional judgement in using and interpreting model outputs. In particular, caution should be used when focusing on a geographically limited area (such as a single road or intersection), as the model is primarily designed to simulate regional-scale phenomena and has been calibrated at a regional level.

As a general good practice, it is recommended that the user confirm the network coding within the area of interest, and compare base year forecasts against traffic count data to assess the extent to which the model may be over- or under-estimating the travel demand.

# TRANS Regional Model

Version 2.15 - Assigned May 27, 2020

**AM Peak Hour Total Traffic Volume  
Kent/Chamberlain**

2031 Model - Basecase

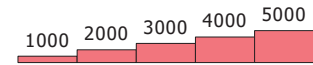
N/A

User Initials: TIMW  
Plot Prepared: June 08, 2020  
EMME Scenario: 21711

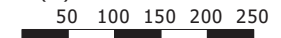


## Legend

AM Peak Hour Total Traffic Volume



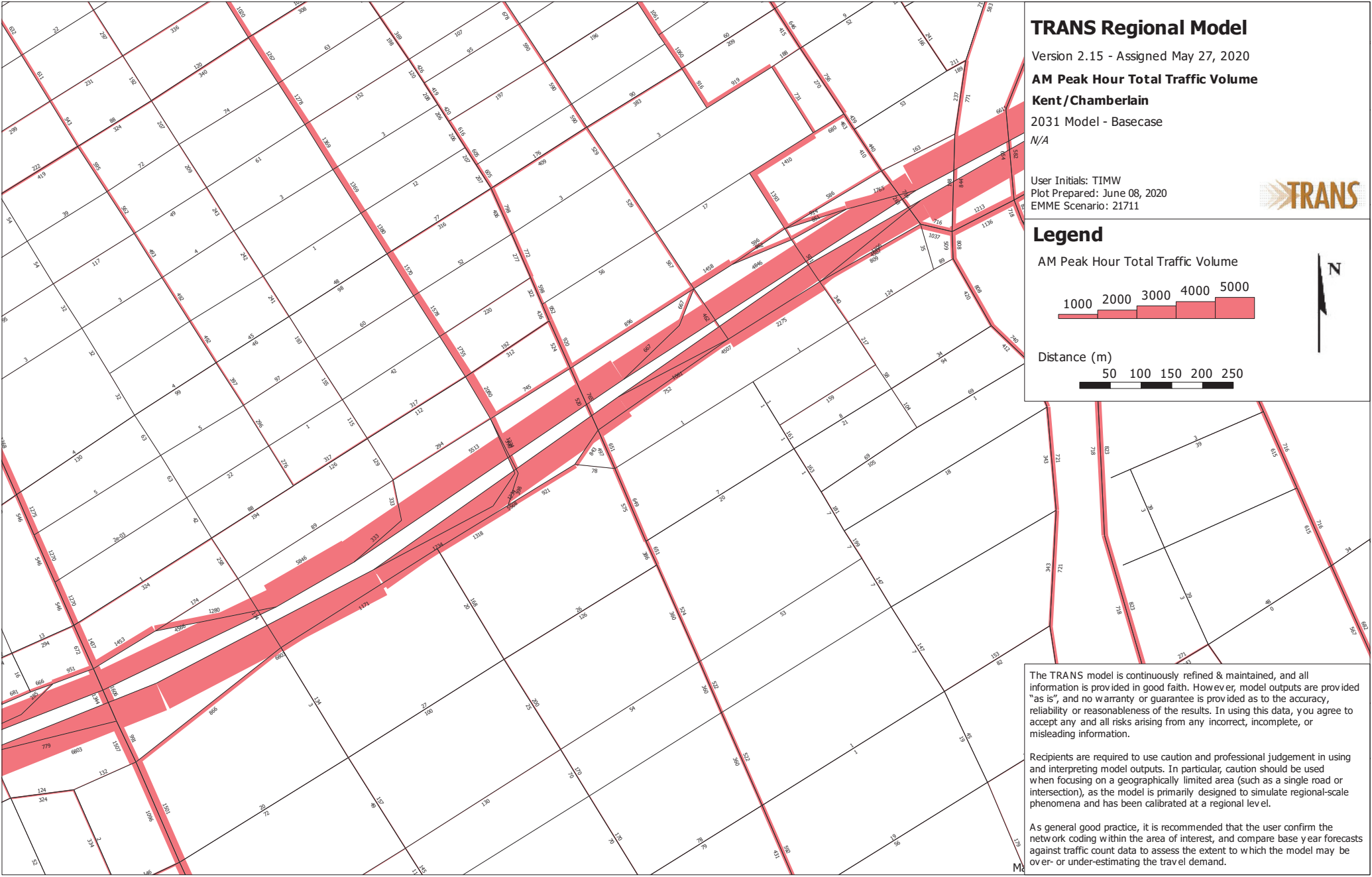
Distance (m)



The TRANS model is continuously refined & maintained, and all information is provided in good faith. However, model outputs are provided "as is", and no warranty or guarantee is provided as to the accuracy, reliability or reasonableness of the results. In using this data, you agree to accept any and all risks arising from any incorrect, incomplete, or misleading information.

Recipients are required to use caution and professional judgement in using and interpreting model outputs. In particular, caution should be used when focusing on a geographically limited area (such as a single road or intersection), as the model is primarily designed to simulate regional-scale phenomena and has been calibrated at a regional level.

As general good practice, it is recommended that the user confirm the network coding within the area of interest, and compare base year forecasts against traffic count data to assess the extent to which the model may be over- or under-estimating the travel demand.



# Appendix F

Synchro Intersection Worksheets – 2024 Future Background Conditions

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Background  
04-28-2023

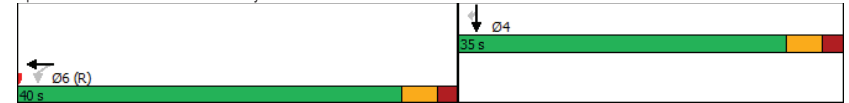
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	127
Future Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	127
Satd. Flow (prot)	0	0	0	0	4645	0	0	0	0	0	1745	1483
Fit Permitted					0.975							
Satd. Flow (perm)	0	0	0	0	4612	0	0	0	0	0	1745	1454
Satd. Flow (RTOR)					222							127
Lane Group Flow (vph)	0	0	0	0	441	0	0	0	0	0	258	127
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				40.0	40.0						35.0	35.0
Total Split (%)				53.3%	53.3%						46.7%	46.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					34.8						29.7	29.7
Actuated g/C Ratio					0.46						0.40	0.40
v/c Ratio					0.20						0.37	0.19
Control Delay					10.5						18.1	3.9
Queue Delay					0.0						0.0	0.0
Total Delay					10.5						18.1	3.9
LOS					B						B	A
Approach Delay					10.5						13.4	
Approach LOS					B						B	
Queue Length 50th (m)					17.3						25.1	0.0
Queue Length 95th (m)					26.1						42.7	9.2
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					2258						691	652
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.20						0.37	0.19
<b>Intersection Summary</b>												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 48 (64%), Referenced to phase 2: and 6:WBTL, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Background  
04-28-2023

Maximum v/c Ratio: 0.37	Intersection LOS: B
Intersection Signal Delay: 11.9	ICU Level of Service A
Intersection Capacity Utilization 47.6%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04-28-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	389	537	54	1373	0	0	0	0
Future Volume (vph)	0	0	0	0	389	537	54	1373	0	0	0	0
Satd. Flow (prot)	0	0	0	0	2916	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	2916	1262	0	4750	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	636	290	0	1427	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					32.0	32.0	38.0	38.0				
Total Split (%)					42.7%	42.7%	50.7%	50.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					26.2	26.2		32.2				
Actuated g/C Ratio					0.35	0.35		0.43				
v/c Ratio					0.62	0.66		0.69				
Control Delay					26.3	30.1		18.5				
Queue Delay					0.0	0.0		0.0				
Total Delay					26.3	30.1		18.5				
LOS					C	C		B				
Approach Delay					27.5			18.5				
Approach LOS					C			B				
Queue Length 50th (m)					43.3	40.0		54.6				
Queue Length 95th (m)					m60.6	m57.1		69.8				
Internal Link Dist (m)		157.8			130.6			47.0			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1018	440		2079				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.62	0.66		0.69				

Intersection Summary  
 Cycle Length: 75  
 Actuated Cycle Length: 75  
 Offset: 15 (20%), Referenced to phase 2: and 6:WBT, Start of Green  
 Natural Cycle: 60  
 Control Type: Actuated-Coordinated

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04-28-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary

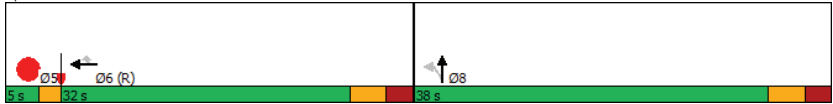
Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04-28-2023

Maximum v/c Ratio: 0.69	Intersection LOS: C
Intersection Signal Delay: 22.0	ICU Level of Service C
Intersection Capacity Utilization 65.6%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

2024 Future Background  
04-28-2023

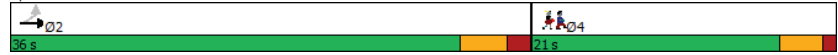
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕					
Traffic Volume (vph)	458	746	0	0	0	0	
Future Volume (vph)	458	746	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	458						
Lane Group Flow (vph)	458	746	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	34.9	34.9					
Actuated g/C Ratio	0.65	0.65					
v/c Ratio	0.37	0.35					
Control Delay	1.7	7.1					
Queue Delay	0.0	0.0					
Total Delay	1.7	7.1					
LOS	A	A					
Approach Delay		5.0					
Approach LOS		A					
Queue Length 50th (m)	0.0	21.4					
Queue Length 95th (m)	9.1	30.5					
Internal Link Dist (m)		270.2	176.4		31.3		
Turn Bay Length (m)							
Base Capacity (vph)	1245	2176					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.37	0.34					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 53.7							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.37							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

2024 Future Background  
04-28-2023

Intersection Signal Delay: 5.0	Intersection LOS: A
Intersection Capacity Utilization 31.0%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Background  
04-28-2023

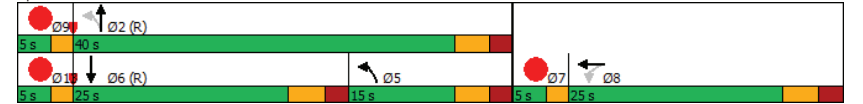
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	160	582	189	272	626	0	0	385	110
Future Volume (vph)	0	0	0	160	582	189	272	626	0	0	385	110
Satd. Flow (prot)	0	0	0	0	4481	0	0	3266	0	0	3011	0
Fit Permitted					0.991			0.648				
Satd. Flow (perm)	0	0	0	0	4429	0	0	2077	0	0	3011	0
Satd. Flow (RTOR)					81			47				
Lane Group Flow (vph)	0	0	0	0	931	0	0	898	0	0	495	0
Turn Type				Perm	NA	pm+pt	NA	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				25.0	25.0		15.0	40.0			25.0	
Total Split (%)				33.3%	33.3%		20.0%	53.3%			33.3%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag		Lag				Lag	
Lead-Lag Optimize?					Yes		Yes				Yes	
Recall Mode					Max		Max	C-Max			C-Max	
Act Effct Green (s)					19.4			34.6			19.6	
Actuated g/C Ratio					0.26			0.46			0.26	
v/c Ratio					0.77			0.81			0.60	
Control Delay					28.6			12.0			25.5	
Queue Delay					0.0			0.0			0.1	
Total Delay					28.6			12.0			25.6	
LOS					C			B			C	
Approach Delay					28.6			12.0			25.6	
Approach LOS					C			B			C	
Queue Length 50th (m)					40.8			10.3			29.0	
Queue Length 95th (m)					54.9			m28.8			43.9	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1205			1110			821	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			27	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.77			0.81			0.62	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	70 (93%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?	Yes		Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 21.5	Intersection LOS: C
Intersection Capacity Utilization 79.5%	ICU Level of Service D
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 4: Bank & Catherine





Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Background  
04-28-2023

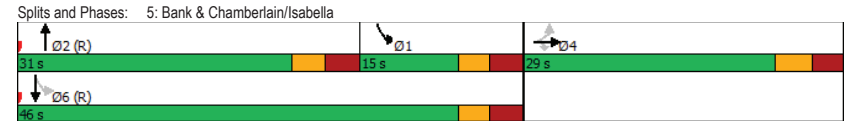
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕		↕	↕	
Traffic Volume (vph)	81	533	82	0	0	0	0	834	162	192	395	0
Future Volume (vph)	81	533	82	0	0	0	0	834	162	192	395	0
Satd. Flow (prot)	0	3292	1483	0	0	0	0	3137	0	1658	1745	0
Fit Permitted		0.993								0.180		
Satd. Flow (perm)	0	3285	1334	0	0	0	0	3137	0	306	1745	0
Satd. Flow (RTOR)			134					32				
Lane Group Flow (vph)	0	614	82	0	0	0	0	996	0	192	395	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	29.0	29.0	29.0					31.0		15.0	46.0	
Total Split (%)	38.7%	38.7%	38.7%					41.3%		20.0%	61.3%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)	0.0	0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		19.2	19.2					28.5		43.5	43.5	
Actuated g/C Ratio		0.26	0.26					0.38		0.58	0.58	
v/c Ratio		0.73	0.19					0.82		0.57	0.39	
Control Delay		30.7	2.2					28.8		24.6	8.0	
Queue Delay		0.0	0.0					0.0		0.0	1.1	
Total Delay		30.7	2.2					28.8		24.6	9.1	
LOS		C	A					C		C	A	
Approach Delay		27.3						28.8			14.1	
Approach LOS		C						C			B	
Queue Length 50th (m)		41.1	0.0					64.5		11.9	19.7	
Queue Length 95th (m)		54.8	3.3					#107.6		m33.3	m27.6	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		998	498					1210		337	1011	
Starvation Cap Reductn		0	0					0		0	385	
Spillback Cap Reductn		0	0					0		0	0	
Storage Cap Reductn		0	0					0		0	0	
Reduced v/c Ratio		0.62	0.16					0.82		0.57	0.63	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Background  
04-28-2023

Maximum v/c Ratio: 0.82	Intersection LOS: C
Intersection Signal Delay: 24.6	ICU Level of Service D
Intersection Capacity Utilization 78.8%	
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	219	498	0	0	0	0	0	392	263
Future Volume (vph)	0	0	0	219	498	0	0	0	0	0	392	263
Satd. Flow (prot)	0	0	0	0	4693	0	0	0	0	0	1745	1483
Fit Permitted					0.985							
Satd. Flow (perm)	0	0	0	0	4657	0	0	0	0	0	1745	1443
Satd. Flow (RTOR)					153							98
Lane Group Flow (vph)	0	0	0	0	717	0	0	0	0	0	392	263
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				28.0	28.0						47.0	47.0
Total Split (%)				37.3%	37.3%						62.7%	62.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					22.8						41.7	41.7
Actuated g/C Ratio					0.30						0.56	0.56
v/c Ratio					0.47						0.40	0.31
Control Delay					16.1						11.1	6.5
Queue Delay					0.0						0.0	0.0
Total Delay					16.1						11.1	6.5
LOS					B						B	A
Approach Delay					16.1						9.3	
Approach LOS					B						A	
Queue Length 50th (m)					9.3						29.2	10.8
Queue Length 95th (m)					12.0						47.0	22.7
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					1522						970	845
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.47						0.40	0.31

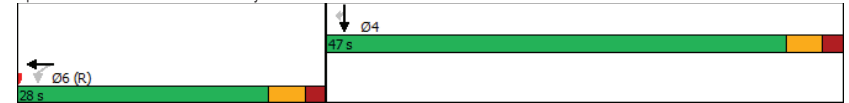
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	24 (32%), Referenced to phase 2: and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Background  
04/12/2023

Maximum v/c Ratio: 0.47	Intersection LOS: B
Intersection Signal Delay: 12.8	ICU Level of Service A
Intersection Capacity Utilization 50.0%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04/12/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	648	316	25	742	0	0	0	0
Future Volume (vph)	0	0	0	0	648	316	25	742	0	0	0	0
Satd. Flow (prot)	0	0	0	0	3143	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	3143	1247	0	4752	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	680	284	0	767	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					38.0	38.0	32.0	32.0				
Total Split (%)					50.7%	50.7%	42.7%	42.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					32.2	32.2		26.2				
Actuated g/C Ratio					0.43	0.43		0.35				
v/c Ratio					0.50	0.53		0.45				
Control Delay					14.3	16.6		18.0				
Queue Delay					0.0	0.0		0.0				
Total Delay					14.3	16.6		18.0				
LOS					B	B		B				
Approach Delay					15.0			18.0				
Approach LOS					B			B				
Queue Length 50th (m)					29.8	25.0		27.1				
Queue Length 95th (m)					m41.1	m37.1		37.2				
Internal Link Dist (m)		157.8			130.6			43.8			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1349	535		1705				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.50	0.53		0.45				

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04/12/2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Background  
04/12/2023

Maximum v/c Ratio: 0.53	Intersection LOS: B
Intersection Signal Delay: 16.3	ICU Level of Service A
Intersection Capacity Utilization 50.5%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

2024 Future Background  
04/12/2023

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕					
Traffic Volume (vph)	268	772	0	0	0	0	
Future Volume (vph)	268	772	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	268						
Lane Group Flow (vph)	268	772	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	35.7	35.7					
Actuated g/C Ratio	0.83	0.83					
v/c Ratio	0.19	0.28					
Control Delay	1.3	4.2					
Queue Delay	0.0	0.0					
Total Delay	1.3	4.2					
LOS	A	A					
Approach Delay		3.4					
Approach LOS		A					
Queue Length 50th (m)	0.0	0.0					
Queue Length 95th (m)	7.2	31.8					
Internal Link Dist (m)		270.2	176.4		23.7		
Turn Bay Length (m)							
Base Capacity (vph)	1425	2761					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.19	0.28					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 42.9							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.28							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

2024 Future Background  
04/12/2023

Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 26.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	257	553	157	199	340	0	0	643	120
Future Volume (vph)	0	0	0	257	553	157	199	340	0	0	643	120
Satd. Flow (prot)	0	0	0	0	4536	0	0	3256	0	0	3077	0
Fit Permitted					0.987			0.544				
Satd. Flow (perm)	0	0	0	0	4474	0	0	1764	0	0	3077	0
Satd. Flow (RTOR)					51			29				
Lane Group Flow (vph)	0	0	0	0	967	0	0	539	0	0	763	0
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				24.0	24.0		14.0	41.0			27.0	
Total Split (%)				32.0%	32.0%		18.7%	54.7%			36.0%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag		Lag				Lag	
Lead-Lag Optimize?												Yes
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					18.4			35.6			21.6	
Actuated g/C Ratio					0.25			0.47			0.29	
v/c Ratio					0.85			0.53			0.84	
Control Delay					34.4			12.2			34.5	
Queue Delay					0.0			0.0			2.9	
Total Delay					34.4			12.2			37.4	
LOS					C			B			D	
Approach Delay					34.4			12.2			37.4	
Approach LOS					C			B			D	
Queue Length 50th (m)					45.4			14.9			51.2	
Queue Length 95th (m)					#66.1			18.9			#80.1	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1136			1008			906	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					1			0			71	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.85			0.53			0.91	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	50 (67%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
4: Bank & Catherine

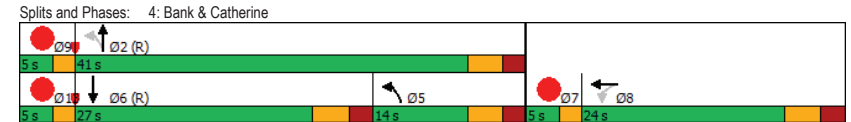
2024 Future Background  
04/12/2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	
Lead-Lag Optimize?		Yes	
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Background  
04/12/2023

Maximum v/c Ratio: 0.85
Intersection Signal Delay: 30.1
Intersection Capacity Utilization 76.8%
Analysis Period (min) 15
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕			↕↕	
Traffic Volume (vph)	53	590	120	0	0	0	0	476	91	175	720	0
Future Volume (vph)	53	590	120	0	0	0	0	476	91	175	720	0
Satd. Flow (prot)	0	3302	1483	0	0	0	0	3106	0	0	3283	0
Fit Permitted		0.996									0.715	
Satd. Flow (perm)	0	3299	1345	0	0	0	0	3106	0	0	2326	0
Satd. Flow (RTOR)			134					31				
Lane Group Flow (vph)	0	643	120	0	0	0	0	567	0	0	895	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	31.0	31.0	31.0					30.0		14.0	44.0	
Total Split (%)	41.3%	41.3%	41.3%					40.0%		18.7%	58.7%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		20.5	20.5					42.2			42.2	
Actuated g/C Ratio		0.27	0.27					0.56			0.56	
v/c Ratio		0.71	0.26					0.32			0.68	
Control Delay		29.0	4.7					9.4			13.2	
Queue Delay		0.0	0.0					0.0			3.0	
Total Delay		29.0	4.7					9.4			16.2	
LOS		C	A					A			B	
Approach Delay		25.2						9.4			16.2	
Approach LOS		C						A			B	
Queue Length 50th (m)		43.2	0.0					19.2			71.1	
Queue Length 95th (m)		55.3	8.7					32.7			m88.0	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		1090	534					1761			1308	
Starvation Cap Reductn		0	0					0			300	
Spillback Cap Reductn		0	0					0			0	
Storage Cap Reductn		0	0					0			0	
Reduced v/c Ratio		0.59	0.22					0.32			0.89	

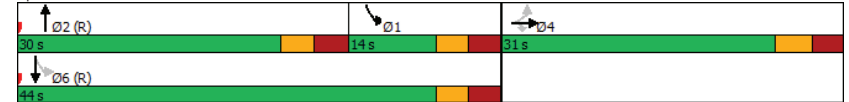
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	60 (80%), Referenced to phase 2:NBT and 6:SBLT, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Background  
04/12/2023

Maximum v/c Ratio: 0.71	Intersection LOS: B
Intersection Signal Delay: 17.6	ICU Level of Service E
Intersection Capacity Utilization 82.0%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 5: Bank & Chamberlain/Isabella



# Appendix G

Synchro Intersection Worksheets – 2029 Future Background Conditions



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Background  
04-28-2023

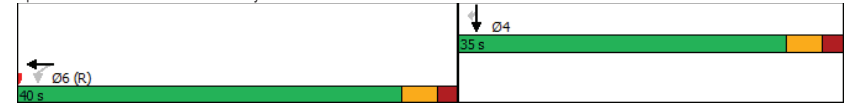
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	130
Future Volume (vph)	0	0	0	222	219	0	0	0	0	0	258	130
Satd. Flow (prot)	0	0	0	0	4645	0	0	0	0	0	1745	1483
Fit Permitted					0.975							
Satd. Flow (perm)	0	0	0	0	4612	0	0	0	0	0	1745	1454
Satd. Flow (RTOR)					222							130
Lane Group Flow (vph)	0	0	0	0	441	0	0	0	0	0	258	130
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				40.0	40.0						35.0	35.0
Total Split (%)				53.3%	53.3%						46.7%	46.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					34.8						29.7	29.7
Actuated g/C Ratio					0.46						0.40	0.40
v/c Ratio					0.20						0.37	0.20
Control Delay					10.5						18.1	3.9
Queue Delay					0.0						0.0	0.0
Total Delay					10.5						18.1	3.9
LOS					B						B	A
Approach Delay					10.5						13.3	
Approach LOS					B						B	
Queue Length 50th (m)					17.2						25.1	0.0
Queue Length 95th (m)					26.1						42.7	9.3
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					2258						691	654
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.20						0.37	0.20
<b>Intersection Summary</b>												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 48 (64%), Referenced to phase 2: and 6:WBTL, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Background  
04-28-2023

Maximum v/c Ratio: 0.37	Intersection LOS: B
Intersection Signal Delay: 11.8	ICU Level of Service A
Intersection Capacity Utilization 47.6%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04-28-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	389	537	54	1408	0	0	0	0
Future Volume (vph)	0	0	0	0	389	537	54	1408	0	0	0	0
Satd. Flow (prot)	0	0	0	0	2916	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	2916	1262	0	4750	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	636	290	0	1462	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					32.0	32.0	38.0	38.0				
Total Split (%)					42.7%	42.7%	50.7%	50.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					26.2	26.2		32.2				
Actuated g/C Ratio					0.35	0.35		0.43				
v/c Ratio					0.62	0.66		0.70				
Control Delay					26.2	30.0		18.8				
Queue Delay					0.0	0.0		0.0				
Total Delay					26.2	30.0		18.8				
LOS					C	C		B				
Approach Delay					27.4			18.8				
Approach LOS					C			B				
Queue Length 50th (m)					42.9	39.6		56.7				
Queue Length 95th (m)					m60.3	m56.8		72.3				
Internal Link Dist (m)		157.8			130.6			47.0			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1018	440		2079				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.62	0.66		0.70				

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	15 (20%), Referenced to phase 2: and 6:WBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04-28-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length:	
Actuated Cycle Length:	
Offset:	
Natural Cycle:	
Control Type:	

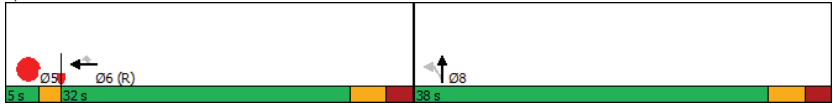
Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04-28-2023

Maximum v/c Ratio: 0.70	Intersection LOS: C
Intersection Signal Delay: 22.1	ICU Level of Service C
Intersection Capacity Utilization 66.3%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

2029 Future Background  
04-28-2023

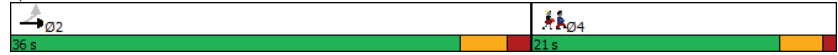
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕	↔	↕	↔	↕	
Traffic Volume (vph)	494	803	0	0	0	0	
Future Volume (vph)	494	803	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	494						
Lane Group Flow (vph)	494	803	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	36.1	36.1					
Actuated g/C Ratio	0.66	0.66					
v/c Ratio	0.39	0.37					
Control Delay	1.7	7.1					
Queue Delay	0.0	0.0					
Total Delay	1.7	7.1					
LOS	A	A					
Approach Delay		5.0					
Approach LOS		A					
Queue Length 50th (m)	0.0	23.5					
Queue Length 95th (m)	9.1	33.2					
Internal Link Dist (m)		270.2	176.4		31.3		
Turn Bay Length (m)							
Base Capacity (vph)	1264	2194					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.39	0.37					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 54.9							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.39							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

2029 Future Background  
04-28-2023

Intersection Signal Delay: 5.0	Intersection LOS: A
Intersection Capacity Utilization 33.1%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04-28-2023

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	160	582	189	272	626	0	0	405	110
Future Volume (vph)	0	0	0	160	582	189	272	626	0	0	405	110
Satd. Flow (prot)	0	0	0	0	4481	0	0	3266	0	0	3022	0
Fit Permitted					0.991			0.638				
Satd. Flow (perm)	0	0	0	0	4429	0	0	2049	0	0	3022	0
Satd. Flow (RTOR)					81						44	
Lane Group Flow (vph)	0	0	0	0	931	0	0	898	0	0	515	0
Turn Type				Perm	NA	pm+pt	NA	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				25.0	25.0		15.0	40.0			25.0	
Total Split (%)				33.3%	33.3%		20.0%	53.3%			33.3%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag		Lag				Lag	
Lead-Lag Optimize?					Yes		Yes				Yes	
Recall Mode					Max		Max	C-Max			C-Max	
Act Effct Green (s)					19.4			34.6			19.6	
Actuated g/C Ratio					0.26			0.46			0.26	
v/c Ratio					0.77			0.82			0.63	
Control Delay					28.6			12.0			26.2	
Queue Delay					0.0			0.0			0.2	
Total Delay					28.6			12.0			26.4	
LOS					C			B			C	
Approach Delay					28.6			12.0			26.4	
Approach LOS					C			B			C	
Queue Length 50th (m)					40.8			10.3			30.8	
Queue Length 95th (m)					54.9			m24.2			46.2	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1205			1101			822	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			29	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.77			0.82			0.65	

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 70 (93%), Referenced to phase 2:NBT and 6:SBT, Start of Green												
Natural Cycle: 70												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04-28-2023

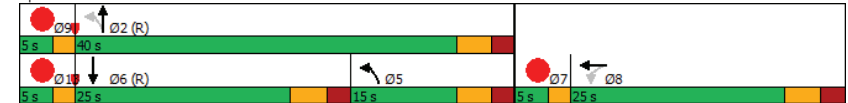
Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?	Yes		Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04-28-2023

Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 21.7	Intersection LOS: C
Intersection Capacity Utilization 80.1%	ICU Level of Service D
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 4: Bank & Catherine



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Background  
04-28-2023

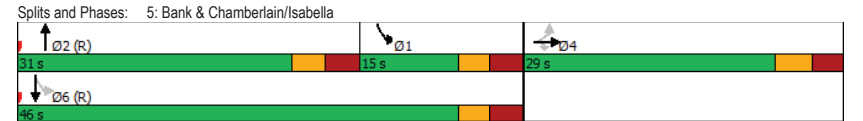
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕		↕	↕	
Traffic Volume (vph)	87	574	88	0	0	0	0	834	181	215	415	0
Future Volume (vph)	87	574	88	0	0	0	0	834	181	215	415	0
Satd. Flow (prot)	0	3292	1483	0	0	0	0	3117	0	1658	1745	0
Fit Permitted		0.993								0.167		
Satd. Flow (perm)	0	3285	1334	0	0	0	0	3117	0	284	1745	0
Satd. Flow (RTOR)			134					37				
Lane Group Flow (vph)	0	661	88	0	0	0	0	1015	0	215	415	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	29.0	29.0	29.0					31.0		15.0	46.0	
Total Split (%)	38.7%	38.7%	38.7%					41.3%		20.0%	61.3%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)	0.0	0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		19.9	19.9					27.8		42.8	42.8	
Actuated g/C Ratio		0.27	0.27					0.37		0.57	0.57	
v/c Ratio		0.76	0.19					0.86		0.66	0.42	
Control Delay		31.1	2.5					31.9		30.0	8.4	
Queue Delay		0.0	0.0					0.0		0.0	1.4	
Total Delay		31.1	2.5					31.9		30.0	9.9	
LOS		C	A					C		C	A	
Approach Delay		27.8						31.9			16.7	
Approach LOS		C						C			B	
Queue Length 50th (m)		44.2	0.0					67.6		18.8	20.5	
Queue Length 95th (m)		59.6	4.2					#110.8		m#41.0	m28.6	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		998	498					1176		325	994	
Starvation Cap Reductn		0	0					0		0	380	
Spillback Cap Reductn		0	0					0		0	0	
Storage Cap Reductn		0	0					0		0	0	
Reduced v/c Ratio		0.66	0.18					0.86		0.66	0.68	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle:	75
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Background  
04-28-2023

Maximum v/c Ratio: 0.86	Intersection LOS: C
Intersection Signal Delay: 26.6	ICU Level of Service E
Intersection Capacity Utilization 82.3%	
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	245	557	0	0	0	0	0	438	269
Future Volume (vph)	0	0	0	245	557	0	0	0	0	0	438	269
Satd. Flow (prot)	0	0	0	0	4693	0	0	0	0	0	1745	1483
Fit Permitted					0.985							
Satd. Flow (perm)	0	0	0	0	4657	0	0	0	0	0	1745	1443
Satd. Flow (RTOR)					152							75
Lane Group Flow (vph)	0	0	0	0	802	0	0	0	0	0	438	269
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				28.0	28.0						47.0	47.0
Total Split (%)				37.3%	37.3%						62.7%	62.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					22.8						41.7	41.7
Actuated g/C Ratio					0.30						0.56	0.56
v/c Ratio					0.53						0.45	0.32
Control Delay					16.7						11.8	7.6
Queue Delay					0.0						0.0	0.0
Total Delay					16.7						11.8	7.6
LOS					B						B	A
Approach Delay					16.7						10.2	
Approach LOS					B						B	
Queue Length 50th (m)					9.4						33.7	13.0
Queue Length 95th (m)					15.2						53.9	25.7
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					1521						970	835
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.53						0.45	0.32

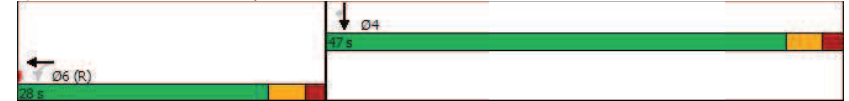
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	24 (32%), Referenced to phase 2: and 6:WBT, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Background  
04/12/2023

Maximum v/c Ratio: 0.53	Intersection LOS: B
Intersection Signal Delay: 13.6	ICU Level of Service A
Intersection Capacity Utilization 54.1%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04/12/2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	699	340	25	761	0	0	0	0
Future Volume (vph)	0	0	0	0	699	340	25	761	0	0	0	0
Satd. Flow (prot)	0	0	0	0	3143	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	3143	1247	0	4752	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	733	306	0	786	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					38.0	38.0	32.0	32.0				
Total Split (%)					50.7%	50.7%	42.7%	42.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					32.2	32.2		26.2				
Actuated g/C Ratio					0.43	0.43		0.35				
v/c Ratio					0.54	0.57		0.46				
Control Delay					15.4	17.8		18.2				
Queue Delay					0.0	0.0		0.0				
Total Delay					15.4	17.8		18.2				
LOS					B	B		B				
Approach Delay					16.1			18.2				
Approach LOS					B			B				
Queue Length 50th (m)					35.0	29.3		28.0				
Queue Length 95th (m)					m40.3	m36.9		38.3				
Internal Link Dist (m)		157.8			130.6			43.8			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1349	535		1705				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.54	0.57		0.46				

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04/12/2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle: 55	
Control Type: Actuated-Coordinated	



Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Background  
04/12/2023

Maximum v/c Ratio: 0.57	Intersection LOS: B
Intersection Signal Delay: 17.0	ICU Level of Service A
Intersection Capacity Utilization 52.7%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Chamberlain & Kent

2029 Future Background  
04/12/2023

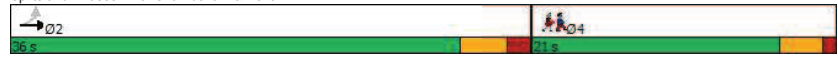
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR	Ø4
Lane Configurations	↔	↕	↔	↕	↔	↕	
Traffic Volume (vph)	268	772	0	0	0	0	
Future Volume (vph)	268	772	0	0	0	0	
Satd. Flow (prot)	1658	3316	0	0	0	0	
Fit Permitted	0.950						
Satd. Flow (perm)	1658	3316	0	0	0	0	
Satd. Flow (RTOR)	268						
Lane Group Flow (vph)	268	772	0	0	0	0	
Turn Type	Perm	NA					
Protected Phases		2					4
Permitted Phases	2						
Detector Phase	2	2					
Switch Phase							
Minimum Initial (s)	10.0	10.0					10.0
Minimum Split (s)	36.0	36.0					21.0
Total Split (s)	36.0	36.0					21.0
Total Split (%)	63.2%	63.2%					37%
Yellow Time (s)	3.3	3.3					3.0
All-Red Time (s)	1.7	1.7					1.0
Lost Time Adjust (s)	0.0	0.0					
Total Lost Time (s)	5.0	5.0					
Lead/Lag							
Lead-Lag Optimize?							
Recall Mode	Min	Min					None
Act Effct Green (s)	35.7	35.7					
Actuated g/C Ratio	0.83	0.83					
v/c Ratio	0.19	0.28					
Control Delay	1.3	4.2					
Queue Delay	0.0	0.0					
Total Delay	1.3	4.2					
LOS	A	A					
Approach Delay		3.4					
Approach LOS		A					
Queue Length 50th (m)	0.0	0.0					
Queue Length 95th (m)	7.2	31.8					
Internal Link Dist (m)		270.2	176.4		23.7		
Turn Bay Length (m)							
Base Capacity (vph)	1425	2761					
Starvation Cap Reductn	0	0					
Spillback Cap Reductn	0	0					
Storage Cap Reductn	0	0					
Reduced v/c Ratio	0.19	0.28					
<b>Intersection Summary</b>							
Cycle Length: 57							
Actuated Cycle Length: 42.9							
Natural Cycle: 60							
Control Type: Semi Act-Uncoord							
Maximum v/c Ratio: 0.28							

Lanes, Volumes, Timings  
3: Chamberlain & Kent

2029 Future Background  
04/12/2023

Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 26.7%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Chamberlain & Kent



Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					←←←			←←←			←←←	
Traffic Volume (vph)	0	0	0	287	618	175	214	357	0	0	643	130
Future Volume (vph)	0	0	0	287	618	175	214	357	0	0	643	130
Satd. Flow (prot)	0	0	0	0	4536	0	0	3256	0	0	3063	0
Fit Permitted					0.987			0.545				
Satd. Flow (perm)	0	0	0	0	4474	0	0	1768	0	0	3063	0
Satd. Flow (RTOR)					50			32				
Lane Group Flow (vph)	0	0	0	0	1080	0	0	571	0	0	773	0
Turn Type				Perm	NA		pm+pt	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				24.0	24.0		14.0	41.0			27.0	
Total Split (%)				32.0%	32.0%		18.7%	54.7%			36.0%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag					Lag		Lag				Lag	
Lead-Lag Optimize?												Yes
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					18.4			35.6			21.6	
Actuated g/C Ratio					0.25			0.47			0.29	
v/c Ratio					0.95			0.57			0.86	
Control Delay					45.4			12.6			35.4	
Queue Delay					0.1			0.0			3.7	
Total Delay					45.5			12.6			39.1	
LOS					D			B			D	
Approach Delay					45.5			12.6			39.1	
Approach LOS					D			B			D	
Queue Length 50th (m)					52.8			15.8			51.8	
Queue Length 95th (m)					#79.9			20.0			#81.8	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1135			1009			904	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					1			0			73	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.95			0.57			0.93	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	50 (67%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04/12/2023

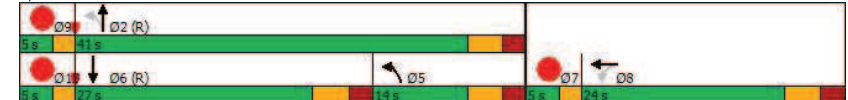
Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?			Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Background  
04/12/2023

Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 35.7	Intersection LOS: D
Intersection Capacity Utilization 80.5%	ICU Level of Service D
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 4: Bank & Catherine



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Background  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕			↕↕	
Traffic Volume (vph)	53	590	120	0	0	0	0	500	91	175	720	0
Future Volume (vph)	53	590	120	0	0	0	0	500	91	175	720	0
Satd. Flow (prot)	0	3302	1483	0	0	0	0	3115	0	0	3283	0
Fit Permitted		0.996									0.705	
Satd. Flow (perm)	0	3299	1345	0	0	0	0	3115	0	0	2296	0
Satd. Flow (RTOR)			134					29				
Lane Group Flow (vph)	0	643	120	0	0	0	0	591	0	0	895	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	31.0	31.0	31.0					30.0		14.0	44.0	
Total Split (%)	41.3%	41.3%	41.3%					40.0%		18.7%	58.7%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		20.5	20.5					42.2			42.2	
Actuated g/C Ratio		0.27	0.27					0.56			0.56	
v/c Ratio		0.71	0.26					0.33			0.69	
Control Delay		29.0	4.7					9.6			13.7	
Queue Delay		0.0	0.0					0.0			3.0	
Total Delay		29.0	4.7					9.6			16.7	
LOS		C	A					A			B	
Approach Delay		25.2						9.6			16.7	
Approach LOS		C						A			B	
Queue Length 50th (m)		43.2	0.0					20.3			71.5	
Queue Length 95th (m)		55.3	8.7					34.4			m84.2	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		1090	534					1765			1291	
Starvation Cap Reductn		0	0					0			283	
Spillback Cap Reductn		0	0					0			0	
Storage Cap Reductn		0	0					0			0	
Reduced v/c Ratio		0.59	0.22					0.33			0.89	

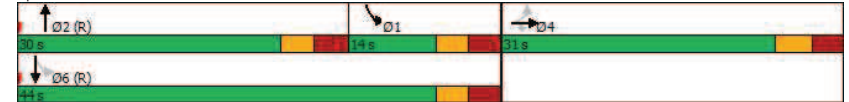
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	60 (80%), Referenced to phase 2:NBT and 6:SBLT, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Background  
04/12/2023

Maximum v/c Ratio: 0.71	Intersection LOS: B
Intersection Signal Delay: 17.7	ICU Level of Service E
Intersection Capacity Utilization 82.7%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 5: Bank & Chamberlain/Isabella



# Appendix H

2024 Future Total Conditions

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Total  
04-28-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	226	220	0	0	0	0	0	258	128
Future Volume (vph)	0	0	0	226	220	0	0	0	0	0	258	128
Satd. Flow (prot)	0	0	0	0	4645	0	0	0	0	0	1745	1483
Fit Permitted					0.975							
Satd. Flow (perm)	0	0	0	0	4611	0	0	0	0	0	1745	1454
Satd. Flow (RTOR)					226							128
Lane Group Flow (vph)	0	0	0	0	446	0	0	0	0	0	258	128
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				40.0	40.0						35.0	35.0
Total Split (%)				53.3%	53.3%						46.7%	46.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					34.8						29.7	29.7
Actuated g/C Ratio					0.46						0.40	0.40
v/c Ratio					0.20						0.37	0.20
Control Delay					10.5						18.1	3.9
Queue Delay					0.0						0.0	0.0
Total Delay					10.5						18.1	3.9
LOS					B						B	A
Approach Delay					10.5						13.4	
Approach LOS					B						B	
Queue Length 50th (m)					17.6						25.1	0.0
Queue Length 95th (m)					26.4						42.7	9.2
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					2260						691	653
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.20						0.37	0.20

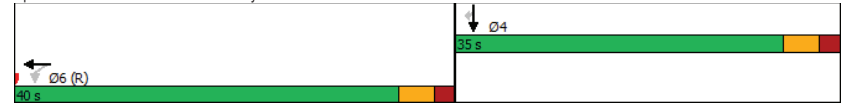
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	48 (64%), Referenced to phase 2: and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Total  
04-28-2023

Maximum v/c Ratio: 0.37	Intersection LOS: B
Intersection Signal Delay: 11.8	ICU Level of Service A
Intersection Capacity Utilization 47.8%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04-28-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	394	539	54	1373	0	0	0	0
Future Volume (vph)	0	0	0	0	394	539	54	1373	0	0	0	0
Satd. Flow (prot)	0	0	0	0	2917	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	2917	1262	0	4750	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	642	291	0	1427	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6		8				
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					32.0	32.0	38.0	38.0				
Total Split (%)					42.7%	42.7%	50.7%	50.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					26.2	26.2		32.2				
Actuated g/C Ratio					0.35	0.35		0.43				
v/c Ratio					0.63	0.66		0.69				
Control Delay					26.2	30.0		18.5				
Queue Delay					0.0	0.0		0.0				
Total Delay					26.2	30.0		18.5				
LOS					C	C		B				
Approach Delay					27.4			18.5				
Approach LOS					C			B				
Queue Length 50th (m)					43.7	40.0		54.6				
Queue Length 95th (m)					m60.7	m56.8		69.8				
Internal Link Dist (m)		157.8			130.6			47.0			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1019	440		2079				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.63	0.66		0.69				

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	15 (20%), Referenced to phase 2: and 6:WBT, Start of Green
Natural Cycle:	60
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04-28-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length:	
Actuated Cycle Length:	
Offset:	
Natural Cycle:	
Control Type:	

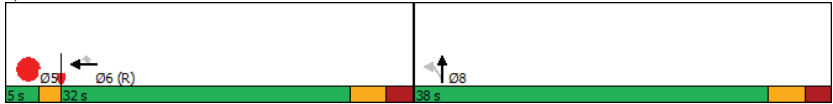
Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04-28-2023

Maximum v/c Ratio: 0.69	Intersection LOS: C
Intersection Signal Delay: 22.0	ICU Level of Service C
Intersection Capacity Utilization 65.7%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04-28-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↕	↔	↔	↔	↔	↔	↔	↕	↔	↔	↔
Traffic Volume (vph)	458	744	7	0	0	0	0	0	13	0	0	0
Future Volume (vph)	458	744	7	0	0	0	0	0	13	0	0	0
Satd. Flow (prot)	1658	3312	0	0	0	0	0	0	1510	0	0	0
Fit Permitted	0.950											
Satd. Flow (perm)	1658	3312	0	0	0	0	0	0	1510	0	0	0
Satd. Flow (RTOR)	458	2							1091			
Lane Group Flow (vph)	458	751	0	0	0	0	0	0	13	0	0	0
Turn Type	Perm	NA							Perm			
Protected Phases	2											
Permitted Phases	2		6									
Detector Phase	2		6									
Switch Phase												
Minimum Initial (s)	10.0	10.0										
Minimum Split (s)	36.0	36.0	15.0									
Total Split (s)	36.0	36.0	36.0									
Total Split (%)	63.2%	63.2%	63.2%									
Yellow Time (s)	3.3	3.3	3.3									
All-Red Time (s)	1.7	1.7	1.7									
Lost Time Adjust (s)	0.0	0.0	0.0									
Total Lost Time (s)	5.0	5.0	5.0									
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min	None									
Act Effct Green (s)	35.0	35.0	35.0									
Actuated g/C Ratio	0.65	0.65	0.65									
v/c Ratio	0.37	0.35	0.01									
Control Delay	1.7	7.1	0.0									
Queue Delay	0.0	0.0	0.0									
Total Delay	1.7	7.1	0.0									
LOS	A	A	A									
Approach Delay	5.0											
Approach LOS	A											
Queue Length 50th (m)	0.0	21.5	0.0									
Queue Length 95th (m)	9.1	30.7	0.0									
Internal Link Dist (m)	270.2		176.4			29.2			31.3			
Turn Bay Length (m)												
Base Capacity (vph)	1246	2176	1366									
Starvation Cap Reductn	0	0	0									
Spillback Cap Reductn	0	0	0									
Storage Cap Reductn	0	0	0									
Reduced v/c Ratio	0.37	0.35	0.01									

Intersection Summary	
Cycle Length:	57
Actuated Cycle Length:	53.8
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.37



Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04-28-2023

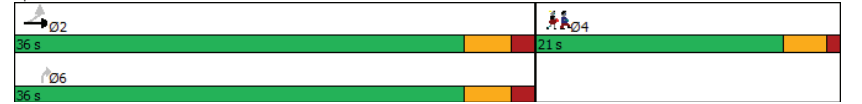
Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	21.0
Total Split (s)	21.0
Total Split (%)	37%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04-28-2023

Intersection Signal Delay: 5.0	Intersection LOS: A
Intersection Capacity Utilization 38.6%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Site Access/Kent & Chamberlain



Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Total  
04-28-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	160	582	189	278	627	0	0	385	110
Future Volume (vph)	0	0	0	160	582	189	278	627	0	0	385	110
Satd. Flow (prot)	0	0	0	0	4481	0	0	3266	0	0	3011	0
Fit Permitted					0.991			0.646				
Satd. Flow (perm)	0	0	0	0	4429	0	0	2070	0	0	3011	0
Satd. Flow (RTOR)					81			47				
Lane Group Flow (vph)	0	0	0	0	931	0	0	905	0	0	495	0
Turn Type				Perm	NA	pm+pt	NA	NA				
Protected Phases					8			5	2			6
Permitted Phases					8			2				
Detector Phase					8	8		5	2			6
Switch Phase												
Minimum Initial (s)					10.0	10.0		5.0	10.0			10.0
Minimum Split (s)					23.6	23.6		10.4	21.4			21.4
Total Split (s)					25.0	25.0		15.0	40.0			25.0
Total Split (%)					33.3%	33.3%		20.0%	53.3%			33.3%
Yellow Time (s)					3.3	3.3		3.3	3.3			3.3
All-Red Time (s)					2.3	2.3		2.1	2.1			2.1
Lost Time Adjust (s)						0.0			0.0			0.0
Total Lost Time (s)						5.6			5.4			5.4
Lead/Lag					Lag	Lag					Lag	
Lead-Lag Optimize?					Yes	Yes					Yes	
Recall Mode					Max	Max		Max	C-Max		C-Max	
Act Effct Green (s)						19.4			34.6			19.6
Actuated g/C Ratio						0.26			0.46			0.26
v/c Ratio						0.77			0.82			0.60
Control Delay						28.6			12.3			25.5
Queue Delay						0.0			0.0			0.1
Total Delay						28.6			12.3			25.6
LOS						C			B			C
Approach Delay						28.6			12.3			25.6
Approach LOS						C			B			C
Queue Length 50th (m)						40.8			10.7			29.0
Queue Length 95th (m)						54.9			m29.3			43.9
Internal Link Dist (m)			130.6			383.3			80.8			138.4
Turn Bay Length (m)												
Base Capacity (vph)						1205			1108			821
Starvation Cap Reductn						0			0			0
Spillback Cap Reductn						0			0			27
Storage Cap Reductn						0			0			0
Reduced v/c Ratio						0.77			0.82			0.62

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	70 (93%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Total  
04-28-2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	70 (93%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

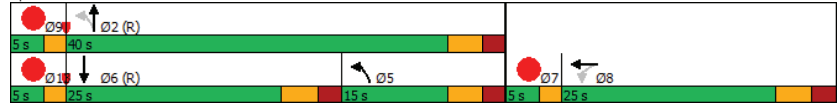
Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Total  
04-28-2023

Maximum v/c Ratio: 0.82	Intersection LOS: C
Intersection Signal Delay: 21.6	ICU Level of Service D
Intersection Capacity Utilization 79.7%	
Analysis Period (min) 15	

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

Splits and Phases: 4: Bank & Catherine



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Total  
04-28-2023

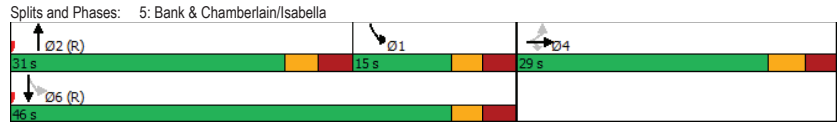
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕		↕	↕	↕
Traffic Volume (vph)	87	536	84	0	0	0	0	834	162	192	395	0
Future Volume (vph)	87	536	84	0	0	0	0	834	162	192	395	0
Satd. Flow (prot)	0	3292	1483	0	0	0	0	3137	0	1658	1745	0
Fit Permitted		0.993								0.179		
Satd. Flow (perm)	0	3285	1334	0	0	0	0	3137	0	304	1745	0
Satd. Flow (RTOR)			134					32				
Lane Group Flow (vph)	0	623	84	0	0	0	0	996	0	192	395	0
Turn Type	Perm	NA	Perm					NA		pm+pt	NA	
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	29.0	29.0	29.0					31.0		15.0	46.0	
Total Split (%)	38.7%	38.7%	38.7%					41.3%		20.0%	61.3%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		19.3	19.3					28.4		43.4	43.4	
Actuated g/C Ratio		0.26	0.26					0.38		0.58	0.58	
v/c Ratio		0.74	0.19					0.83		0.57	0.39	
Control Delay		30.9	2.3					29.0		24.8	8.0	
Queue Delay		0.0	0.0					0.0		0.0	1.1	
Total Delay		30.9	2.3					29.0		24.8	9.2	
LOS		C	A					C		C	A	
Approach Delay		27.5						29.0			14.3	
Approach LOS		C						C			B	
Queue Length 50th (m)		41.8	0.0					64.5		12.0	19.7	
Queue Length 95th (m)		55.7	3.5					#107.6		m33.4	m27.6	
Internal Link Dist (m)		176.4				219.4		129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		998	498					1207		336	1009	
Starvation Cap Reductn		0	0					0		0	385	
Spillback Cap Reductn		0	0					0		0	0	
Storage Cap Reductn		0	0					0		0	0	
Reduced v/c Ratio		0.62	0.17					0.83		0.57	0.63	

Intersection Summary		
Cycle Length:	75	
Actuated Cycle Length:	75	
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle:	70	
Control Type:	Actuated-Coordinated	

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Total  
04-28-2023

Maximum v/c Ratio: 0.83	Intersection LOS: C
Intersection Signal Delay: 24.8	ICU Level of Service D
Intersection Capacity Utilization 79.1%	
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	221	499	0	0	0	0	0	392	264
Future Volume (vph)	0	0	0	221	499	0	0	0	0	0	392	264
Satd. Flow (prot)	0	0	0	0	4693	0	0	0	0	0	1745	1483
Fit Permitted					0.985							
Satd. Flow (perm)	0	0	0	0	4657	0	0	0	0	0	1745	1443
Satd. Flow (RTOR)					154							98
Lane Group Flow (vph)	0	0	0	0	720	0	0	0	0	0	392	264
Turn Type				Perm	NA						NA	Perm
Protected Phases					6						4	
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				28.0	28.0						47.0	47.0
Total Split (%)				37.3%	37.3%						62.7%	62.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					22.8						41.7	41.7
Actuated g/C Ratio					0.30						0.56	0.56
v/c Ratio					0.47						0.40	0.31
Control Delay					16.0						11.1	6.6
Queue Delay					0.0						0.0	0.0
Total Delay					16.0						11.1	6.6
LOS					B						B	A
Approach Delay					16.0						9.3	
Approach LOS					B						A	
Queue Length 50th (m)					9.3						29.2	10.8
Queue Length 95th (m)					11.9						47.0	22.8
Internal Link Dist (m)						117.8			120.4			277.6
Turn Bay Length (m)												
Base Capacity (vph)					1522						970	845
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.47						0.40	0.31

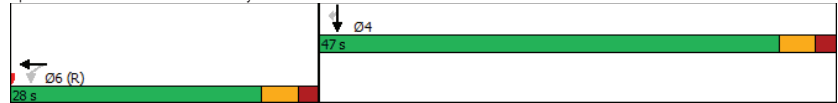
<b>Intersection Summary</b>		
Cycle Length:	75	
Actuated Cycle Length:	75	
Offset:	24 (32%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle:	55	
Control Type:	Actuated-Coordinated	

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2024 Future Total  
04/12/2023

Maximum v/c Ratio: 0.47	Intersection LOS: B
Intersection Signal Delay: 12.8	ICU Level of Service A
Intersection Capacity Utilization 50.1%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕↕	↕		↕↕↕				
Traffic Volume (vph)	0	0	0	0	651	317	25	742	0	0	0	0
Future Volume (vph)	0	0	0	0	651	317	25	742	0	0	0	0
Satd. Flow (prot)	0	0	0	0	3143	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	3143	1247	0	4752	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	683	285	0	767	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6	8					
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					38.0	38.0	32.0	32.0				
Total Split (%)					50.7%	50.7%	42.7%	42.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					32.2	32.2		26.2				
Actuated g/C Ratio					0.43	0.43		0.35				
v/c Ratio					0.51	0.53		0.45				
Control Delay					14.4	16.7		18.0				
Queue Delay					0.0	0.0		0.0				
Total Delay					14.4	16.7		18.0				
LOS					B	B		B				
Approach Delay					15.0			18.0				
Approach LOS					B			B				
Queue Length 50th (m)					30.1	25.1		27.1				
Queue Length 95th (m)					m41.5	m37.4		37.2				
Internal Link Dist (m)						157.8		130.6				56.6
Turn Bay Length (m)												
Base Capacity (vph)					1349	535		1705				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.51	0.53		0.45				

<b>Intersection Summary</b>												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04/12/2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings  
2: Kent & Catherine

2024 Future Total  
04/12/2023

Maximum v/c Ratio: 0.53	
Intersection Signal Delay: 16.4	Intersection LOS: B
Intersection Capacity Utilization 50.6%	ICU Level of Service A
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗							↖			
Traffic Volume (vph)	268	766	15	0	0	0	0	0	13	0	0	0
Future Volume (vph)	268	766	15	0	0	0	0	0	13	0	0	0
Satd. Flow (prot)	1658	3306	0	0	0	0	0	0	1510	0	0	0
Fit Permitted	0.950											
Satd. Flow (perm)	1658	3306	0	0	0	0	0	0	1510	0	0	0
Satd. Flow (RTOR)	268	5							1091			
Lane Group Flow (vph)	268	781	0	0	0	0	0	0	13	0	0	0
Turn Type	Perm	NA							Perm			
Protected Phases	2											
Permitted Phases	2		6									
Detector Phase	2	2	6									
Switch Phase												
Minimum Initial (s)	10.0	10.0										10.0
Minimum Split (s)	36.0	36.0										15.0
Total Split (s)	36.0	36.0										36.0
Total Split (%)	63.2%	63.2%										63.2%
Yellow Time (s)	3.3	3.3										3.3
All-Red Time (s)	1.7	1.7										1.7
Lost Time Adjust (s)	0.0	0.0										0.0
Total Lost Time (s)	5.0	5.0										5.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min										None
Act Effct Green (s)	35.8	35.8										35.8
Actuated g/C Ratio	0.83	0.83										0.83
v/c Ratio	0.19	0.28										0.01
Control Delay	1.3	4.1										0.0
Queue Delay	0.0	0.0										0.0
Total Delay	1.3	4.1										0.0
LOS	A	A										A
Approach Delay	3.4											
Approach LOS	A											
Queue Length 50th (m)	0.0	0.0										0.0
Queue Length 95th (m)	7.2	32.1										0.0
Internal Link Dist (m)	270.2		176.4			27.5			23.7			
Turn Bay Length (m)												
Base Capacity (vph)	1426	2755										1440
Starvation Cap Reductn	0	0										0
Spillback Cap Reductn	0	0										0
Storage Cap Reductn	0	0										0
Reduced v/c Ratio	0.19	0.28										0.01

Intersection Summary	
Cycle Length:	57
Actuated Cycle Length:	43
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.28

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04/12/2023

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	21.0
Total Split (s)	21.0
Total Split (%)	37%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length:	
Actuated Cycle Length:	
Natural Cycle:	
Control Type:	
Maximum v/c Ratio:	

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2024 Future Total  
04/12/2023

Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 39.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Site Access/Kent & Chamberlain



Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	257	553	157	203	340	0	0	643	120
Future Volume (vph)	0	0	0	257	553	157	203	340	0	0	643	120
Satd. Flow (prot)	0	0	0	0	4536	0	0	3256	0	0	3077	0
Fit Permitted					0.987			0.544				
Satd. Flow (perm)	0	0	0	0	4474	0	0	1765	0	0	3077	0
Satd. Flow (RTOR)					51			29				
Lane Group Flow (vph)	0	0	0	0	967	0	0	543	0	0	763	0
Turn Type				Perm	NA	pm+pt	NA	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				24.0	24.0		14.0	41.0			27.0	
Total Split (%)				32.0%	32.0%		18.7%	54.7%			36.0%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag				Lag	Lag						Lag	
Lead-Lag Optimize?											Yes	
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					18.4			35.6			21.6	
Actuated g/C Ratio					0.25			0.47			0.29	
v/c Ratio					0.85			0.54			0.84	
Control Delay					34.4			12.2			34.5	
Queue Delay					0.0			0.0			2.9	
Total Delay					34.4			12.2			37.4	
LOS					C			B			D	
Approach Delay					34.4			12.2			37.4	
Approach LOS					C			B			D	
Queue Length 50th (m)					45.4			15.2			51.2	
Queue Length 95th (m)					#66.1			19.2			#80.1	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1136			1008			906	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					1			0			71	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.85			0.54			0.91	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	50 (67%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated



Lanes, Volumes, Timings  
4: Bank & Catherine

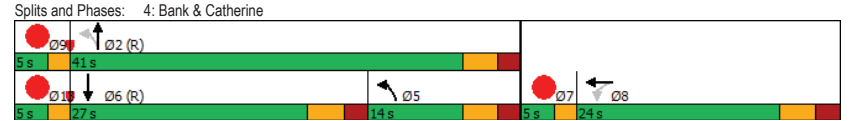
2024 Future Total  
04/12/2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?			Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

2024 Future Total  
04/12/2023

Maximum v/c Ratio: 0.85
Intersection Signal Delay: 30.1
Intersection Capacity Utilization 76.9%
Analysis Period (min) 15
# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕			↕↕	
Traffic Volume (vph)	57	592	121	0	0	0	0	476	91	175	720	0
Future Volume (vph)	57	592	121	0	0	0	0	476	91	175	720	0
Satd. Flow (prot)	0	3302	1483	0	0	0	0	3106	0	0	3283	0
Fit Permitted		0.996									0.714	
Satd. Flow (perm)	0	3299	1345	0	0	0	0	3106	0	0	2323	0
Satd. Flow (RTOR)			134					31				
Lane Group Flow (vph)	0	649	121	0	0	0	0	567	0	0	895	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	31.0	31.0	31.0					30.0		14.0	44.0	
Total Split (%)	41.3%	41.3%	41.3%					40.0%		18.7%	58.7%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		20.6	20.6					42.1			42.1	
Actuated g/C Ratio		0.27	0.27					0.56			0.56	
v/c Ratio		0.72	0.26					0.32			0.69	
Control Delay		29.1	4.7					9.5			13.3	
Queue Delay		0.0	0.0					0.0			3.0	
Total Delay		29.1	4.7					9.5			16.3	
LOS		C	A					A			B	
Approach Delay		25.3						9.5			16.3	
Approach LOS		C						A			B	
Queue Length 50th (m)		43.5	0.0					19.3			71.3	
Queue Length 95th (m)		55.7	8.7					32.7			m88.0	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		1090	534					1758			1305	
Starvation Cap Reductn		0	0					0			297	
Spillback Cap Reductn		0	0					0			0	
Storage Cap Reductn		0	0					0			0	
Reduced v/c Ratio		0.60	0.23					0.32			0.89	

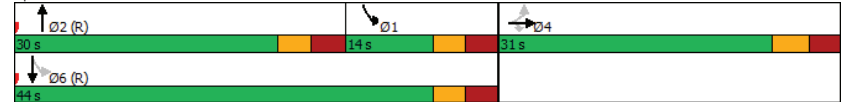
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	60 (80%), Referenced to phase 2:NBT and 6:SBLT, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2024 Future Total  
04/12/2023

Maximum v/c Ratio: 0.72	Intersection LOS: B
Intersection Signal Delay: 17.7	ICU Level of Service E
Intersection Capacity Utilization 82.2%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 5: Bank & Chamberlain/Isabella



# Appendix I

2029 Future Total Conditions

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Total  
04-28-2023

	↖	→	↘	↙	←	↖	↙	↑	↘	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↕↕↕						↕	↕
Traffic Volume (vph)	0	0	0	226	220	0	0	0	0	0	258	131
Future Volume (vph)	0	0	0	226	220	0	0	0	0	0	258	131
Satd. Flow (prot)	0	0	0	0	4645	0	0	0	0	0	1745	1483
Fit Permitted					0.975							
Satd. Flow (perm)	0	0	0	0	4611	0	0	0	0	0	1745	1454
Satd. Flow (RTOR)					226							131
Lane Group Flow (vph)	0	0	0	0	446	0	0	0	0	0	258	131
Turn Type				Perm	NA						NA	Perm
Protected Phases					6							4
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				40.0	40.0						35.0	35.0
Total Split (%)				53.3%	53.3%						46.7%	46.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					34.8						29.7	29.7
Actuated g/C Ratio					0.46						0.40	0.40
v/c Ratio					0.20						0.37	0.20
Control Delay					10.5						18.1	3.9
Queue Delay					0.0						0.0	0.0
Total Delay					10.5						18.1	3.9
LOS					B						B	A
Approach Delay					10.5						13.3	
Approach LOS					B						B	
Queue Length 50th (m)					17.3						25.1	0.0
Queue Length 95th (m)					26.4						42.7	9.3
Internal Link Dist (m)		117.8			157.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					2260						691	654
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.20						0.37	0.20

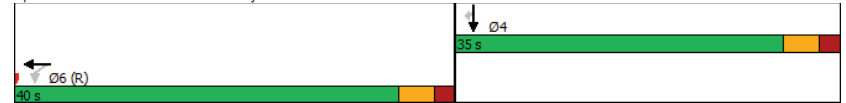
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	48 (64%), Referenced to phase 2: and 6:WBTL, Start of Green
Natural Cycle:	55
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Total  
04-28-2023

Maximum v/c Ratio: 0.37	Intersection LOS: B
Intersection Signal Delay: 11.8	ICU Level of Service A
Intersection Capacity Utilization 47.8%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04-28-2023



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	394	539	54	1408	0	0	0	0
Future Volume (vph)	0	0	0	0	394	539	54	1408	0	0	0	0
Satd. Flow (prot)	0	0	0	0	2917	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	2917	1262	0	4750	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	642	291	0	1462	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6	8					
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					32.0	32.0	38.0	38.0				
Total Split (%)					42.7%	42.7%	50.7%	50.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					26.2	26.2		32.2				
Actuated g/C Ratio					0.35	0.35		0.43				
v/c Ratio					0.63	0.66		0.70				
Control Delay					26.1	29.9		18.8				
Queue Delay					0.0	0.0		0.0				
Total Delay					26.1	29.9		18.8				
LOS					C	C		B				
Approach Delay					27.3			18.8				
Approach LOS					C			B				
Queue Length 50th (m)					43.1	39.6		56.7				
Queue Length 95th (m)					m60.7	m56.7		72.3				
Internal Link Dist (m)		157.8			130.6			47.0			56.6	
Turn Bay Length (m)												
Base Capacity (vph)					1019	440		2079				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.63	0.66		0.70				

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 15 (20%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 60												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04-28-2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length: 75	
Actuated Cycle Length: 75	
Offset: 15 (20%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	

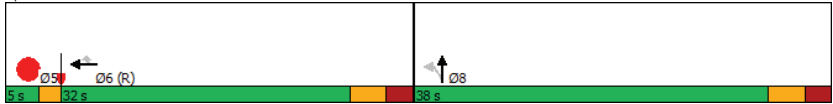
Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04-28-2023

Maximum v/c Ratio: 0.70	Intersection LOS: C
Intersection Signal Delay: 22.1	ICU Level of Service C
Intersection Capacity Utilization 66.4%	
Analysis Period (min) 15	

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

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04-28-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR				
Lane Configurations	↔	↕	↔	↔	↔	↔	↔	↕	↕	↔	↔	↔				
Traffic Volume (vph)	494	801	7	0	0	0	0	0	13	0	0	0				
Future Volume (vph)	494	801	7	0	0	0	0	0	13	0	0	0				
Satd. Flow (prot)	1658	3312	0	0	0	0	0	0	1510	0	0	0				
Fit Permitted	0.950															
Satd. Flow (perm)	1658	3312	0	0	0	0	0	0	1510	0	0	0				
Satd. Flow (RTOR)	494	2							1091							
Lane Group Flow (vph)	494	808	0	0	0	0	0	0	13	0	0	0				
Turn Type	Perm	NA							Perm							
Protected Phases	2															
Permitted Phases	2										6					
Detector Phase	2		2										6			
Switch Phase																
Minimum Initial (s)	10.0		10.0										10.0			
Minimum Split (s)	36.0		36.0										15.0			
Total Split (s)	36.0		36.0										36.0			
Total Split (%)	63.2%		63.2%										63.2%			
Yellow Time (s)	3.3		3.3										3.3			
All-Red Time (s)	1.7		1.7										1.7			
Lost Time Adjust (s)	0.0		0.0										0.0			
Total Lost Time (s)	5.0		5.0										5.0			
Lead/Lag																
Lead-Lag Optimize?																
Recall Mode	Min		Min										None			
Act Effct Green (s)	36.1		36.1										36.1			
Actuated g/C Ratio	0.66		0.66										0.66			
v/c Ratio	0.39		0.37										0.01			
Control Delay	1.7		7.1										0.0			
Queue Delay	0.0		0.0										0.0			
Total Delay	1.7		7.1										0.0			
LOS	A		A										A			
Approach Delay	5.0															
Approach LOS	A															
Queue Length 50th (m)	0.0		23.6										0.0			
Queue Length 95th (m)	9.1		33.3										0.0			
Internal Link Dist (m)			270.2						176.4				29.2		31.3	
Turn Bay Length (m)																
Base Capacity (vph)	1264		2193										1368			
Starvation Cap Reductn	0		0										0			
Spillback Cap Reductn	0		0										0			
Storage Cap Reductn	0		0										0			
Reduced v/c Ratio	0.39		0.37										0.01			
<b>Intersection Summary</b>																
Cycle Length: 57																
Actuated Cycle Length: 54.9																
Natural Cycle: 60																
Control Type: Semi Act-Uncoord																
Maximum v/c Ratio: 0.39																

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04-28-2023

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	21.0
Total Split (s)	21.0
Total Split (%)	37%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04-28-2023

Intersection Signal Delay: 5.0	Intersection LOS: A
Intersection Capacity Utilization 40.3%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Site Access/Kent & Chamberlain



Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Total  
04-28-2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	160	582	189	278	627	0	0	405	110
Future Volume (vph)	0	0	0	160	582	189	278	627	0	0	405	110
Satd. Flow (prot)	0	0	0	0	4481	0	0	3266	0	0	3022	0
Fit Permitted					0.991			0.637				
Satd. Flow (perm)	0	0	0	0	4429	0	0	2045	0	0	3022	0
Satd. Flow (RTOR)					81			44				
Lane Group Flow (vph)	0	0	0	0	931	0	0	905	0	0	515	0
Turn Type				Perm	NA	pm+pt	NA	NA				
Protected Phases					8			5	2			6
Permitted Phases					8			2				
Detector Phase					8	8		5	2			6
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				25.0	25.0		15.0	40.0			25.0	
Total Split (%)				33.3%	33.3%		20.0%	53.3%			33.3%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag				Lag	Lag			Lag			Lag	
Lead-Lag Optimize?				Yes	Yes			Yes			Yes	
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					19.4			34.6			19.6	
Actuated g/C Ratio					0.26			0.46			0.26	
v/c Ratio					0.77			0.82			0.63	
Control Delay					28.6			12.2			26.2	
Queue Delay					0.0			0.0			0.2	
Total Delay					28.6			12.2			26.4	
LOS					C			B			C	
Approach Delay					28.6			12.2			26.4	
Approach LOS					C			B			C	
Queue Length 50th (m)					40.8			10.7			30.8	
Queue Length 95th (m)					54.9			m24.6			46.2	
Internal Link Dist (m)		130.6			383.3			80.8			138.4	
Turn Bay Length (m)												
Base Capacity (vph)					1205			1099			822	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					0			0			29	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.77			0.82			0.65	

Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	70 (93%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle:	70
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Total  
04-28-2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead	Lead	Lead
Lead-Lag Optimize?	Yes	Yes	Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			

Intersection Summary	
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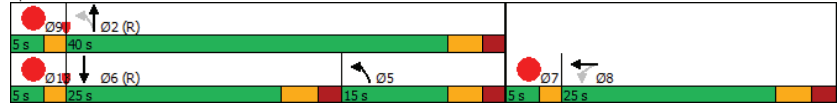
Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Total  
04-28-2023

Maximum v/c Ratio: 0.82	Intersection LOS: C
Intersection Signal Delay: 21.8	ICU Level of Service D
Intersection Capacity Utilization 80.3%	
Analysis Period (min) 15	

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

Splits and Phases: 4: Bank & Catherine



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Total  
04-28-2023

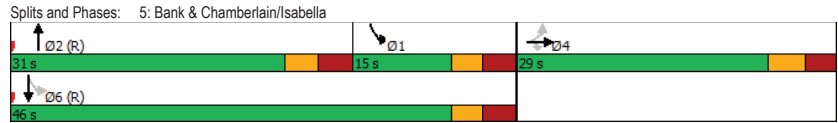
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕		↕	↕	↕
Traffic Volume (vph)	93	577	90	0	0	0	0	834	181	215	415	0
Future Volume (vph)	93	577	90	0	0	0	0	834	181	215	415	0
Satd. Flow (prot)	0	3292	1483	0	0	0	0	3117	0	1658	1745	0
Fit Permitted		0.993								0.166		
Satd. Flow (perm)	0	3285	1334	0	0	0	0	3117	0	283	1745	0
Satd. Flow (RTOR)			134					37				
Lane Group Flow (vph)	0	670	90	0	0	0	0	1015	0	215	415	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	29.0	29.0	29.0					31.0		15.0	46.0	
Total Split (%)	38.7%	38.7%	38.7%					41.3%		20.0%	61.3%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		20.1	20.1					27.6		42.6	42.6	
Actuated g/C Ratio		0.27	0.27					0.37		0.57	0.57	
v/c Ratio		0.76	0.20					0.87		0.66	0.42	
Control Delay		31.3	2.6					32.3		30.2	8.5	
Queue Delay		0.0	0.0					0.0		0.0	1.4	
Total Delay		31.3	2.6					32.3		30.2	9.9	
LOS		C	A					C		C	A	
Approach Delay		27.9						32.3			16.9	
Approach LOS		C						C			B	
Queue Length 50th (m)		44.8	0.0					68.0		19.6	20.5	
Queue Length 95th (m)		60.6	4.4					#110.8		m#41.1	m28.6	
Internal Link Dist (m)		176.4				219.4		129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		998	498					1172		324	992	
Starvation Cap Reductn		0	0					0		0	380	
Spillback Cap Reductn		0	0					0		0	0	
Storage Cap Reductn		0	0					0		0	0	
Reduced v/c Ratio		0.67	0.18					0.87		0.66	0.68	

Intersection Summary		
Cycle Length:	75	
Actuated Cycle Length:	75	
Offset:	1 (1%), Referenced to phase 2:NBT and 6:SBTL, Start of Green	
Natural Cycle:	75	
Control Type:	Actuated-Coordinated	

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Total  
04-28-2023

Maximum v/c Ratio: 0.87	Intersection LOS: C
Intersection Signal Delay: 26.8	ICU Level of Service E
Intersection Capacity Utilization 82.5%	
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	
m Volume for 95th percentile queue is metered by upstream signal.	



Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑						↑	↑
Traffic Volume (vph)	0	0	0	247	558	0	0	0	0	0	438	270
Future Volume (vph)	0	0	0	247	558	0	0	0	0	0	438	270
Satd. Flow (prot)	0	0	0	0	4693	0	0	0	0	0	1745	1483
Fit Permitted					0.985							
Satd. Flow (perm)	0	0	0	0	4657	0	0	0	0	0	1745	1443
Satd. Flow (RTOR)					153							75
Lane Group Flow (vph)	0	0	0	0	805	0	0	0	0	0	438	270
Turn Type				Perm	NA						NA	Perm
Protected Phases					6						4	
Permitted Phases				6								4
Detector Phase				6	6						4	4
Switch Phase												
Minimum Initial (s)				10.0	10.0						10.0	10.0
Minimum Split (s)				26.2	26.2						28.3	28.3
Total Split (s)				28.0	28.0						47.0	47.0
Total Split (%)				37.3%	37.3%						62.7%	62.7%
Yellow Time (s)				3.3	3.3						3.3	3.3
All-Red Time (s)				1.9	1.9						2.0	2.0
Lost Time Adjust (s)					0.0						0.0	0.0
Total Lost Time (s)					5.2						5.3	5.3
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode				C-Max	C-Max						Max	Max
Act Effct Green (s)					22.8						41.7	41.7
Actuated g/C Ratio					0.30						0.56	0.56
v/c Ratio					0.53						0.45	0.32
Control Delay					16.6						11.8	7.6
Queue Delay					0.0						0.0	0.0
Total Delay					16.6						11.8	7.6
LOS					B						B	A
Approach Delay					16.6						10.2	
Approach LOS					B						B	
Queue Length 50th (m)					9.4						33.7	13.0
Queue Length 95th (m)					15.1						53.9	25.8
Internal Link Dist (m)					117.8			120.4			277.6	
Turn Bay Length (m)												
Base Capacity (vph)					1522						970	835
Starvation Cap Reductn					0						0	0
Spillback Cap Reductn					0						0	0
Storage Cap Reductn					0						0	0
Reduced v/c Ratio					0.53						0.45	0.32

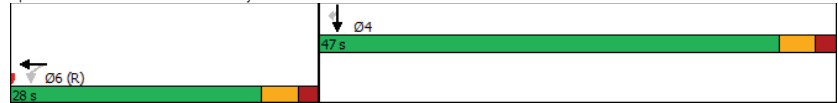
<b>Intersection Summary</b>		
Cycle Length:	75	
Actuated Cycle Length:	75	
Offset:	24 (32%), Referenced to phase 2: and 6:WBT, Start of Green	
Natural Cycle:	55	
Control Type:	Actuated-Coordinated	

Lanes, Volumes, Timings  
1: HWY 417 OR/Lyon & Catherine

2029 Future Total  
04/12/2023

Maximum v/c Ratio: 0.53	Intersection LOS: B
Intersection Signal Delay: 13.6	ICU Level of Service A
Intersection Capacity Utilization 54.2%	
Analysis Period (min) 15	

Splits and Phases: 1: HWY 417 OR/Lyon & Catherine



Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑	↑		↑↑↑				
Traffic Volume (vph)	0	0	0	0	702	341	25	761	0	0	0	0
Future Volume (vph)	0	0	0	0	702	341	25	761	0	0	0	0
Satd. Flow (prot)	0	0	0	0	3143	1350	0	4755	0	0	0	0
Fit Permitted								0.998				
Satd. Flow (perm)	0	0	0	0	3143	1247	0	4752	0	0	0	0
Satd. Flow (RTOR)								70				
Lane Group Flow (vph)	0	0	0	0	736	307	0	786	0	0	0	0
Turn Type					NA	Perm	Perm	NA				
Protected Phases					6			8				
Permitted Phases						6	8					
Detector Phase					6	6	8	8				
Switch Phase												
Minimum Initial (s)					10.0	10.0	10.0	10.0				
Minimum Split (s)					27.8	27.8	17.8	17.8				
Total Split (s)					38.0	38.0	32.0	32.0				
Total Split (%)					50.7%	50.7%	42.7%	42.7%				
Yellow Time (s)					3.3	3.3	3.3	3.3				
All-Red Time (s)					2.5	2.5	2.5	2.5				
Lost Time Adjust (s)					0.0	0.0		0.0				
Total Lost Time (s)					5.8	5.8		5.8				
Lead/Lag					Lag	Lag						
Lead-Lag Optimize?												
Recall Mode					C-Max	C-Max	Max	Max				
Act Effct Green (s)					32.2	32.2		26.2				
Actuated g/C Ratio					0.43	0.43		0.35				
v/c Ratio					0.55	0.57		0.46				
Control Delay					15.5	17.8		18.2				
Queue Delay					0.0	0.0		0.0				
Total Delay					15.5	17.8		18.2				
LOS					B	B		B				
Approach Delay					16.2			18.2				
Approach LOS					B			B				
Queue Length 50th (m)					35.3	29.5		28.0				
Queue Length 95th (m)					m40.7	m37.1		38.3				
Internal Link Dist (m)						157.8		130.6				56.6
Turn Bay Length (m)												
Base Capacity (vph)					1349	535		1705				
Starvation Cap Reductn					0	0		0				
Spillback Cap Reductn					0	0		0				
Storage Cap Reductn					0	0		0				
Reduced v/c Ratio					0.55	0.57		0.46				

Intersection Summary												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 12 (16%), Referenced to phase 2: and 6:WBT, Start of Green												
Natural Cycle: 55												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04/12/2023

Lane Group	Ø5
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	5
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	1.0
Minimum Split (s)	5.0
Total Split (s)	5.0
Total Split (%)	7%
Yellow Time (s)	2.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	Lead
Lead-Lag Optimize?	
Recall Mode	Max
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	
Intersection Summary	

Lanes, Volumes, Timings  
2: Kent & Catherine

2029 Future Total  
04/12/2023

Maximum v/c Ratio: 0.57	Intersection LOS: B
Intersection Signal Delay: 17.0	ICU Level of Service A
Intersection Capacity Utilization 52.8%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 2: Kent & Catherine



Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖	↗							↖			
Traffic Volume (vph)	268	766	15	0	0	0	0	0	13	0	0	0
Future Volume (vph)	268	766	15	0	0	0	0	0	13	0	0	0
Satd. Flow (prot)	1658	3306	0	0	0	0	0	0	1510	0	0	0
Fit Permitted	0.950											
Satd. Flow (perm)	1658	3306	0	0	0	0	0	0	1510	0	0	0
Satd. Flow (RTOR)	268	5							1091			
Lane Group Flow (vph)	268	781	0	0	0	0	0	0	13	0	0	0
Turn Type	Perm	NA							Perm			
Protected Phases	2											
Permitted Phases	2		6									
Detector Phase	2	2	6									
Switch Phase												
Minimum Initial (s)	10.0	10.0										10.0
Minimum Split (s)	36.0	36.0										15.0
Total Split (s)	36.0	36.0										36.0
Total Split (%)	63.2%	63.2%										63.2%
Yellow Time (s)	3.3	3.3										3.3
All-Red Time (s)	1.7	1.7										1.7
Lost Time Adjust (s)	0.0	0.0										0.0
Total Lost Time (s)	5.0	5.0										5.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	Min	Min										None
Act Effct Green (s)	35.8	35.8										35.8
Actuated g/C Ratio	0.83	0.83										0.83
v/c Ratio	0.19	0.28										0.01
Control Delay	1.3	4.1										0.0
Queue Delay	0.0	0.0										0.0
Total Delay	1.3	4.1										0.0
LOS	A	A										A
Approach Delay	3.4											
Approach LOS	A											
Queue Length 50th (m)	0.0	0.0										0.0
Queue Length 95th (m)	7.2	32.1										0.0
Internal Link Dist (m)	270.2		176.4			27.5			23.7			
Turn Bay Length (m)												
Base Capacity (vph)	1426	2755										1440
Starvation Cap Reductn	0	0										0
Spillback Cap Reductn	0	0										0
Storage Cap Reductn	0	0										0
Reduced v/c Ratio	0.19	0.28										0.01

Intersection Summary	
Cycle Length:	57
Actuated Cycle Length:	43
Natural Cycle:	60
Control Type:	Semi Act-Uncoord
Maximum v/c Ratio:	0.28

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04/12/2023

Lane Group	Ø4
Lane Configurations	
Traffic Volume (vph)	
Future Volume (vph)	
Satd. Flow (prot)	
Fit Permitted	
Satd. Flow (perm)	
Satd. Flow (RTOR)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	4
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	10.0
Minimum Split (s)	21.0
Total Split (s)	21.0
Total Split (%)	37%
Yellow Time (s)	3.0
All-Red Time (s)	1.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (m)	
Queue Length 95th (m)	
Internal Link Dist (m)	
Turn Bay Length (m)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary	
Cycle Length:	
Actuated Cycle Length:	
Natural Cycle:	
Control Type:	
Maximum v/c Ratio:	

Lanes, Volumes, Timings  
3: Site Access/Kent & Chamberlain

2029 Future Total  
04/12/2023

Intersection Signal Delay: 3.4	Intersection LOS: A
Intersection Capacity Utilization 39.5%	ICU Level of Service A
Analysis Period (min) 15	

Splits and Phases: 3: Site Access/Kent & Chamberlain


Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations					↑↑↑			↑↑			↑↑	
Traffic Volume (vph)	0	0	0	287	618	175	218	357	0	0	643	130
Future Volume (vph)	0	0	0	287	618	175	218	357	0	0	643	130
Satd. Flow (prot)	0	0	0	0	4536	0	0	3253	0	0	3063	0
Fit Permitted					0.987			0.545				
Satd. Flow (perm)	0	0	0	0	4474	0	0	1768	0	0	3063	0
Satd. Flow (RTOR)					50			32				
Lane Group Flow (vph)	0	0	0	0	1080	0	0	575	0	0	773	0
Turn Type				Perm	NA	pm+pt	NA	NA			NA	
Protected Phases					8		5	2			6	
Permitted Phases					8		2					
Detector Phase					8	8	5	2			6	
Switch Phase												
Minimum Initial (s)				10.0	10.0		5.0	10.0			10.0	
Minimum Split (s)				23.6	23.6		10.4	21.4			21.4	
Total Split (s)				24.0	24.0		14.0	41.0			27.0	
Total Split (%)				32.0%	32.0%		18.7%	54.7%			36.0%	
Yellow Time (s)				3.3	3.3		3.3	3.3			3.3	
All-Red Time (s)				2.3	2.3		2.1	2.1			2.1	
Lost Time Adjust (s)					0.0			0.0			0.0	
Total Lost Time (s)					5.6			5.4			5.4	
Lead/Lag				Lag	Lag						Lag	
Lead-Lag Optimize?											Yes	
Recall Mode				Max	Max		Max	C-Max			C-Max	
Act Effct Green (s)					18.4			35.6			21.6	
Actuated g/C Ratio					0.25			0.47			0.29	
v/c Ratio					0.95			0.57			0.86	
Control Delay					45.4			12.6			35.4	
Queue Delay					0.1			0.0			3.7	
Total Delay					45.5			12.6			39.1	
LOS					D			B			D	
Approach Delay					45.5			12.6			39.1	
Approach LOS					D			B			D	
Queue Length 50th (m)					52.8			16.1			51.8	
Queue Length 95th (m)					#79.9			20.3			#81.8	
Internal Link Dist (m)					130.6			383.3			80.8	
Turn Bay Length (m)												
Base Capacity (vph)					1135			1009			904	
Starvation Cap Reductn					0			0			0	
Spillback Cap Reductn					1			0			73	
Storage Cap Reductn					0			0			0	
Reduced v/c Ratio					0.95			0.57			0.93	

<b>Intersection Summary</b>												
Cycle Length: 75												
Actuated Cycle Length: 75												
Offset: 50 (67%), Referenced to phase 2:NBT and 6:SBT, Start of Green												
Natural Cycle: 70												
Control Type: Actuated-Coordinated												

Lanes, Volumes, Timings  
4: Bank & Catherine

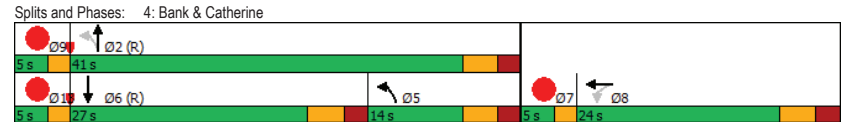
2029 Future Total  
04/12/2023

Lane Group	Ø7	Ø9	Ø13
Lane Configurations			
Traffic Volume (vph)			
Future Volume (vph)			
Satd. Flow (prot)			
Fit Permitted			
Satd. Flow (perm)			
Satd. Flow (RTOR)			
Lane Group Flow (vph)			
Turn Type			
Protected Phases	7	9	13
Permitted Phases			
Detector Phase			
Switch Phase			
Minimum Initial (s)	1.0	1.0	1.0
Minimum Split (s)	5.0	5.0	5.0
Total Split (s)	5.0	5.0	5.0
Total Split (%)	7%	7%	7%
Yellow Time (s)	2.0	2.0	2.0
All-Red Time (s)	0.0	0.0	0.0
Lost Time Adjust (s)			
Total Lost Time (s)			
Lead/Lag	Lead		Lead
Lead-Lag Optimize?			Yes
Recall Mode	Max	Max	Max
Act Effct Green (s)			
Actuated g/C Ratio			
v/c Ratio			
Control Delay			
Queue Delay			
Total Delay			
LOS			
Approach Delay			
Approach LOS			
Queue Length 50th (m)			
Queue Length 95th (m)			
Internal Link Dist (m)			
Turn Bay Length (m)			
Base Capacity (vph)			
Starvation Cap Reductn			
Spillback Cap Reductn			
Storage Cap Reductn			
Reduced v/c Ratio			
Intersection Summary			

Lanes, Volumes, Timings  
4: Bank & Catherine

2029 Future Total  
04/12/2023

Maximum v/c Ratio: 0.95	
Intersection Signal Delay: 35.7	Intersection LOS: D
Intersection Capacity Utilization 80.7%	ICU Level of Service D
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	



Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Total  
04/12/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕	↕					↕↕			↕↕	
Traffic Volume (vph)	57	592	121	0	0	0	0	500	91	175	720	0
Future Volume (vph)	57	592	121	0	0	0	0	500	91	175	720	0
Satd. Flow (prot)	0	3302	1483	0	0	0	0	3115	0	0	3283	0
Fit Permitted		0.996									0.705	
Satd. Flow (perm)	0	3299	1345	0	0	0	0	3115	0	0	2296	0
Satd. Flow (RTOR)			134					29				
Lane Group Flow (vph)	0	649	121	0	0	0	0	591	0	0	895	0
Turn Type	Perm	NA	Perm					NA	pm+pt	NA		
Protected Phases		4						2		1	6	
Permitted Phases	4		4							6		
Detector Phase	4	4	4					2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0					10.0		5.0	10.0	
Minimum Split (s)	26.2	26.2	26.2					23.1		11.1	23.1	
Total Split (s)	31.0	31.0	31.0					30.0		14.0	44.0	
Total Split (%)	41.3%	41.3%	41.3%					40.0%		18.7%	58.7%	
Yellow Time (s)	3.3	3.3	3.3					3.0		3.0	3.0	
All-Red Time (s)	2.9	2.9	2.9					3.1		3.1	3.1	
Lost Time Adjust (s)		0.0	0.0					0.0		0.0	0.0	
Total Lost Time (s)		6.2	6.2					6.1		6.1	6.1	
Lead/Lag								Lead		Lag		
Lead-Lag Optimize?								Yes		Yes		
Recall Mode	None	None	None					C-Max		None	C-Max	
Act Effct Green (s)		20.6	20.6					42.1			42.1	
Actuated g/C Ratio		0.27	0.27					0.56			0.56	
v/c Ratio		0.72	0.26					0.34			0.69	
Control Delay		29.1	4.7					9.6			13.8	
Queue Delay		0.0	0.0					0.0			3.0	
Total Delay		29.1	4.7					9.6			16.7	
LOS		C	A					A			B	
Approach Delay		25.3						9.6			16.7	
Approach LOS		C						A			B	
Queue Length 50th (m)		43.5	0.0					20.4			71.6	
Queue Length 95th (m)		55.7	8.7					34.4			m84.2	
Internal Link Dist (m)		176.4			219.4			129.7			80.8	
Turn Bay Length (m)			30.0									
Base Capacity (vph)		1090	534					1762			1290	
Starvation Cap Reductn		0	0					0			281	
Spillback Cap Reductn		0	0					0			0	
Storage Cap Reductn		0	0					0			0	
Reduced v/c Ratio		0.60	0.23					0.34			0.89	

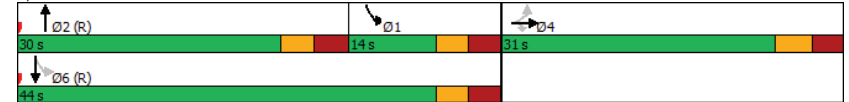
Intersection Summary	
Cycle Length:	75
Actuated Cycle Length:	75
Offset:	60 (80%), Referenced to phase 2:NBT and 6:SBL, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated

Lanes, Volumes, Timings  
5: Bank & Chamberlain/Isabella

2029 Future Total  
04/12/2023

Maximum v/c Ratio: 0.72	Intersection LOS: B
Intersection Signal Delay: 17.8	ICU Level of Service E
Intersection Capacity Utilization 82.9%	
Analysis Period (min) 15	
m Volume for 95th percentile queue is metered by upstream signal.	

Splits and Phases: 5: Bank & Chamberlain/Isabella





# Appendix J

TDM Checklist

# Multi-Modal Level of Service - Segments Form

Consultant  
Scenario  
Comments

<b>CGH Transportation</b>
<b>Present/Future</b>

Project  
Date

<b>2022-117</b>
<b>2023-04-28</b>

SEGMENTS		Street A	Chamberlain	Chamberlain	
			EB (Existing)	EB (Future)	
<b>Pedestrian</b>	Sidewalk Width	<b>F</b>	1.8 m	≥ 2 m	
	Boulevard Width		< 0.5 m	0.5 - 2 m	
	Avg Daily Curb Lane Traffic Volume		> 3000	> 3000	
	Operating Speed		> 50 to 60 km/h	> 50 to 60 km/h	
	On-Street Parking		no	no	
	<b>Exposure to Traffic PLoS</b>		<b>F</b>	<b>D</b>	-
	Effective Sidewalk Width		1.5 m	3.0 m	
Pedestrian Volume	250 ped/hr	250 ped/hr			
<b>Crowding PLoS</b>	<b>B</b>	<b>A</b>	-		
<b>Level of Service</b>	<b>F</b>	<b>D</b>	-		
<b>Bicycle</b>	Type of Cycling Facility	<b>E</b>	Mixed Traffic	Physically Separated	
	Number of Travel Lanes		2-3 lanes total		
	Operating Speed		≥ 50 to 60 km/h		
	<b># of Lanes &amp; Operating Speed LoS</b>		<b>E</b>	-	-
	Bike Lane (+ Parking Lane) Width				
	<b>Bike Lane Width LoS</b>		-	-	-
	Bike Lane Blockages				
	<b>Blockage LoS</b>		-	-	-
	Median Refuge Width (no median = < 1.8 m)		< 1.8 m refuge		
	No. of Lanes at Unsignalized Crossing		≤ 3 lanes		
Sidestreet Operating Speed	≤ 40 km/h				
<b>Unsignalized Crossing - Lowest LoS</b>	<b>A</b>	<b>A</b>	-		
<b>Level of Service</b>	<b>E</b>	<b>A</b>	-		
<b>Transit</b>	Facility Type	<b>D</b>	Mixed Traffic	Mixed Traffic	
	Friction or Ratio Transit:Posted Speed		Vt/Vp ≥ 0.8	Vt/Vp ≥ 0.8	
	<b>Level of Service</b>		<b>D</b>	<b>D</b>	-
<b>Truck</b>	Truck Lane Width	<b>A</b>	> 3.7 m	> 3.7 m	
	Travel Lanes per Direction		> 1	> 1	
	<b>Level of Service</b>		<b>A</b>	<b>A</b>	-
<b>Auto</b>	<b>Level of Service</b>	<b>Not Applicable</b>			

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

Consultant	CGH Transportation	Project	2022-117
Scenario	Existing	Date	2023-04-28
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Chamberlain/Kent				Lyon/Ramp/Catherine				Kent/Catherine				Bank/Catherine				Bank/Chamberlain/Isabella				
Crossing Side		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Pedestrian	Lanes	3				0 - 2				5				4				4				
	Median	No Median - 2.4 m				No Median - 2.4 m				No Median - 2.4 m				No Median - 2.4 m				No Median - 2.4 m				
	Conflicting Left Turns	No left turn / Prohib.				No left turn / Prohib.				No left turn / Prohib.				No left turn / Prohib.				No left turn / Prohib.				
	Conflicting Right Turns	No right turn				Permissive or yield control				No right turn				No right turn				Permissive or yield control				
	Right Turns on Red (RTor) ?	RTOR prohibited				RTOR allowed				RTOR prohibited				RTOR allowed				RTOR prohibited				
	Ped Signal Leading Interval?	No				No				Yes				Yes				No				
	Right Turn Channel	No Right Turn				No Channel				No Right Turn				No Right Turn				No Channel				
	Corner Radius	No Right Turn				0-3m				3-5m				3-5m				No Right Turn				
	Crosswalk Type	Zebra stripe hi-vis markings				Std transverse markings				Zebra stripe hi-vis markings				Textured/coloured pavement				Std transverse markings				
	PETSI Score	99				96				55				65				71				
Ped. Exposure to Traffic LoS	-	-	A	-	A	B	B	A	D	B	A	A	C	C	A	C	C	B	C	A		
Cycle Length																						
Effective Walk Time																						
Average Pedestrian Delay																						
Pedestrian Delay LoS	-	-	-	-	A	B	B	A	D	B	A	A	C	C	A	C	C	B	C	A		
Level of Service	A				B				D				C				C					
Approach From		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Bicycle	Bicycle Lane Arrangement on Approach									Mixed Traffic								Mixed Traffic				
	Right Turn Lane Configuration									> 50 m								≤ 50 m				
	Right Turning Speed									>25 km/h								≤ 25 km/h				
	Cyclist relative to RT motorists	-	-	-	A	-	-	-	-	-	-	F	-	-	-	A	-	-	A	-	-	D
	Separated or Mixed Traffic	-	-	-	-	-	-	-	-	-	-	Mixed Traffic	-	-	-	-	-	-	-	-	-	Mixed Traffic
	Left Turn Approach					≥ 2 lanes crossed								One lane crossed				One lane crossed				
Operating Speed					> 50 to < 60 km/h								> 50 to < 60 km/h				> 40 to ≤ 50 km/h					
Left Turning Cyclist	-	-	-	F	-	-	-	-	-	-	A	-	A	-	E	-	-	D	A	-	A	
Level of Service	F				A				F				E				D					
Transit	Average Signal Delay	≤ 10 sec				≤ 20 sec				≤ 30 sec				> 40 sec				≤ 30 sec				
	Level of Service	-	-	-	B	-	-	C	-	-	-	D	-	F	D	E	-	D	E	-	E	
Truck	Effective Corner Radius									< 10 m				< 10 m				10 - 15 m				
	Number of Receiving Lanes on Departure from Intersection									≥ 2				≥ 2				≥ 2				
Level of Service	-				-				D				D				B					
Auto	Volume to Capacity Ratio	0.0 - 0.60				0.0 - 0.60				0.61 - 0.70				0.81 - 0.90				0.81 - 0.90				
	Level of Service	A				A				B				D				D				

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

Consultant	CGH Transportation	Project	2022-117
Scenario	Future	Date	2023-04-28
Comments			

Unlocked Rows for Replicating

INTERSECTIONS		Chamberlain/Kent/Site Access				Lyon/Ramp/Catherine				Kent/Catherine				Bank/Catherine				Bank/Chamberlain/Isabella				
Crossing Side		NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	
Pedestrian	Lanes			3		0 - 2	3	3	3	3	4	4	0 - 2	4	4	3	3	4	4	0 - 2	3	
	Median			No Median - 2.4 m		No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	No Median - 2.4 m	
	Conflicting Left Turns			No left turn / Prohib.		No left turn / Prohib.	Permissive	No left turn / Prohib.	No left turn / Prohib.	No left turn / Prohib.	No left turn / Prohib.	No left turn / Prohib.	Permissive	No left turn / Prohib.	Permissive	No left turn / Prohib.	Protected/ Permissive	Permissive	No left turn / Prohib.	Protected/ Permissive	No left turn / Prohib.	
	Conflicting Right Turns			No right turn		Permissive or yield control	No right turn	No right turn	Permissive or yield control	Permissive or yield control	No right turn	No right turn	No right turn	Permissive or yield control	No right turn	No right turn	No right turn	Permissive or yield control	No right turn	No right turn	Permissive or yield control	No right turn
	Right Turns on Red (RTOR) ?			RTOR prohibited		RTOR allowed	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR allowed	RTOR prohibited	RTOR allowed	RTOR prohibited	RTOR prohibited	RTOR allowed	RTOR prohibited	RTOR allowed
	Ped Signal Leading Interval?			No		No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	No	No
	Right Turn Channel			No Right Turn		No Channel	No Right Turn	No Right Turn	No Right Turn	No Right Turn	No Channel	No Right Turn	No Right Turn	No Right Turn	No Channel	No Right Turn	No Right Turn	No Channel	No Right Turn	No Right Turn	No Channel	Smart Channel
	Corner Radius			No Right Turn		0-3m	No Right Turn	No Right Turn	No Right Turn	No Right Turn	3-5m	No Right Turn	No Right Turn	No Right Turn	3-5m	No Right Turn	No Right Turn	3-5m	No Right Turn	No Right Turn	5-10m	5-10m
	Crosswalk Type			Zebra stripe hi-vis markings		Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Std transverse markings	Std transverse markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings
	PETSI Score			99		99	91	96	91	88	84	82	106	68	76	98	80	74	79	92	93	
Ped. Exposure to Traffic LoS			A		A	A	A	A	B	B	B	A	C	B	A	B	C	B	A	A		
Cycle Length																						
Effective Walk Time																						
Average Pedestrian Delay																						
Pedestrian Delay LoS																						
Level of Service			A		A	A	A	A	B	B	B	A	C	B	A	B	C	B	A	A		
Approach From																						
Bicycle	Bicycle Lane Arrangement on Approach																				Curb Bike Lane, Cycletrack or MUP	
	Right Turn Lane Configuration																				Not Applicable	
	Right Turning Speed																				Not Applicable	
	Cyclist relative to RT motorists				A							F				A		A			Not Applicable	
	Separated or Mixed Traffic											Mixed Traffic									Separated	
	Left Turn Approach				One lane crossed												One lane crossed		No lane crossed			2-stage, LT box
Operating Speed				> 50 to < 60 km/h												> 50 to < 60 km/h		> 40 to ≤ 50 km/h			> 50 to < 60 km/h	
Left Turning Cyclist				E							A		A		E		B	A			A	
Level of Service				E							F				E		B				A	
Transit	Average Signal Delay				≤ 10 sec				≤ 20 sec				≤ 30 sec	≤ 40 sec	≤ 20 sec	> 40 sec		≤ 20 sec	≤ 20 sec		≤ 40 sec	
	Level of Service				B				C				D	E	C	F		C	C		E	
Truck	Effective Corner Radius												< 10 m	< 10 m		< 10 m		10 - 15 m			< 10 m	
	Number of Receiving Lanes on Departure from Intersection												≥ 2	≥ 2		≥ 2		≥ 2			≥ 2	
Level of Service													D		D			B			D	
Auto	Volume to Capacity Ratio				0.0 - 0.60				0.0 - 0.60				0.61 - 0.70			0.71 - 0.80					0.71 - 0.80	
	Level of Service				A				A				B			C					C	

# Appendix K

MMLOS Analysis

**TDM Measures Checklist:**  
*Non-Residential Developments (office, institutional, retail or industrial)*

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

TDM measures: <i>Non-residential developments</i>		Check if proposed & add descriptions
<b>1. TDM PROGRAM MANAGEMENT</b>		
<b>1.1 Program coordinator</b>		
BASIC	★	1.1.1 Designate an internal coordinator, or contract with an external coordinator <input type="checkbox"/>
<b>1.2 Travel surveys</b>		
BETTER		1.2.1 Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress <input type="checkbox"/>
<b>2. WALKING AND CYCLING</b>		
<b>2.1 Information on walking/cycling routes &amp; destinations</b>		
BASIC		2.1.1 Display local area maps with walking/cycling access routes and key destinations at major entrances <input checked="" type="checkbox"/>
<b>2.2 Bicycle skills training</b>		
<i>Commuter travel</i>		
BETTER	★	2.2.1 Offer on-site cycling courses for commuters, or subsidize off-site courses <input type="checkbox"/>
<b>2.3 Valet bike parking</b>		
<i>Visitor travel</i>		
BETTER		2.3.1 Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games) <input type="checkbox"/>

TDM measures: <i>Non-residential developments</i>		Check if proposed & add descriptions
<b>3. TRANSIT</b>		
<b>3.1 Transit information</b>		
BASIC		3.1.1 Display relevant transit schedules and route maps at entrances <input checked="" type="checkbox"/>
BASIC		3.1.2 Provide online links to OC Transpo and STO information <input type="checkbox"/>
BETTER		3.1.3 Provide real-time arrival information display at entrances <input type="checkbox"/>
<b>3.2 Transit fare incentives</b>		
<i>Commuter travel</i>		
BETTER		3.2.1 Offer preloaded PRESTO cards to encourage commuters to use transit <input type="checkbox"/>
BETTER	★	3.2.2 Subsidize or reimburse monthly transit pass purchases by employees <input type="checkbox"/>
<i>Visitor travel</i>		
BETTER		3.2.3 Arrange inclusion of same-day transit fare in price of tickets (e.g. for festivals, concerts, games) <input type="checkbox"/>
<b>3.3 Enhanced public transit service</b>		
<i>Commuter travel</i>		
BETTER		3.3.1 Contract with OC Transpo to provide enhanced transit services (e.g. for shift changes, weekends) <input type="checkbox"/>
<i>Visitor travel</i>		
BETTER		3.3.2 Contract with OC Transpo to provide enhanced transit services (e.g. for festivals, concerts, games) <input type="checkbox"/>
<b>3.4 Private transit service</b>		
<i>Commuter travel</i>		
BETTER		3.4.1 Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for shift changes, weekends) <input type="checkbox"/>
<i>Visitor travel</i>		
BETTER		3.4.2 Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for festivals, concerts, games) <input type="checkbox"/>

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

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

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

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

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

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



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

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

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

TDM-supportive design & infrastructure measures: Non-residential developments		Check if completed & add descriptions, explanations or plan/drawing references
<b>1. WALKING &amp; CYCLING: ROUTES</b>		
<b>1.1 Building location &amp; access points</b>		
BASIC	1.1.1 Locate building close to the street, and do not locate parking areas between the street and building entrances	<input checked="" type="checkbox"/>
BASIC	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	<input checked="" type="checkbox"/>
BASIC	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	<input type="checkbox"/>
<b>1.2 Facilities for walking &amp; cycling</b>		
REQUIRED	1.2.1 Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations (see <i>Official Plan policy 4.3.3</i> )	<input type="checkbox"/>
REQUIRED	1.2.2 Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible (see <i>Official Plan policy 4.3.12</i> )	<input checked="" type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Non-residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3 Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks (see <i>Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/>
REQUIRED	1.2.4 Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps (see <i>Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/>
REQUIRED	1.2.5 Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians (see <i>Official Plan policy 4.3.11</i> )	<input type="checkbox"/>
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	<input checked="" type="checkbox"/>
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	<input type="checkbox"/>
BASIC	1.2.8 Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	<input type="checkbox"/>
<b>1.3 Amenities for walking &amp; cycling</b>		
BASIC	1.3.1 Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	<input type="checkbox"/>
BASIC	1.3.2 Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	<input type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Non-residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>2. WALKING &amp; CYCLING: END-OF-TRIP FACILITIES</b>		
<b>2.1 Bicycle parking</b>		
REQUIRED	2.1.1 Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible (see <i>Official Plan policy 4.3.6</i> )	<input checked="" type="checkbox"/>
REQUIRED	2.1.2 Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas (see <i>Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
REQUIRED	2.1.3 Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored (see <i>Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
BASIC	2.1.4 Provide bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	<input type="checkbox"/>
BETTER	2.1.5 Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	<input type="checkbox"/>
<b>2.2 Secure bicycle parking</b>		
REQUIRED	2.2.1 Where more than 50 bicycle parking spaces are provided for a single office building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers (see <i>Zoning By-law Section 111</i> )	<input type="checkbox"/>
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met)	<input type="checkbox"/>
<b>2.3 Shower &amp; change facilities</b>		
BASIC	2.3.1 Provide shower and change facilities for the use of active commuters	<input type="checkbox"/>
BETTER	2.3.2 In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	<input type="checkbox"/>
<b>2.4 Bicycle repair station</b>		
BETTER	2.4.1 Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	<input type="checkbox"/>

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

TDM-supportive design & infrastructure measures: <i>Non-residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>6. PARKING</b>		
<b>6.1 Number of parking spaces</b>		
REQUIRED	6.1.1 Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	<input checked="" type="checkbox"/>
BASIC	6.1.2 Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	<input type="checkbox"/>
BASIC	6.1.3 Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly ( <i>see Zoning By-law Section 104</i> )	<input type="checkbox"/>
BETTER	6.1.4 Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking ( <i>see Zoning By-law Section 111</i> )	<input type="checkbox"/>
<b>6.2 Separate long-term &amp; short-term parking areas</b>		
BETTER	6.2.1 Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	<input type="checkbox"/>
<b>7. OTHER</b>		
<b>7.1 On-site amenities to minimize off-site trips</b>		
BETTER	7.1.1 Provide on-site amenities to minimize mid-day or mid-commute errands	<input type="checkbox"/>

**TDM-Supportive Development Design and Infrastructure Checklist:**  
*Residential Developments (multi-family or condominium)*

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

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>1. WALKING &amp; CYCLING: ROUTES</b>		
<b>1.1 Building location &amp; access points</b>		
BASIC	1.1.1 Locate building close to the street, and do not locate parking areas between the street and building entrances	<input checked="" type="checkbox"/>
BASIC	1.1.2 Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	<input checked="" type="checkbox"/>
BASIC	1.1.3 Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	<input type="checkbox"/>
<b>1.2 Facilities for walking &amp; cycling</b>		
REQUIRED	1.2.1 Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations (see <i>Official Plan policy 4.3.3</i> )	<input type="checkbox"/>
REQUIRED	1.2.2 Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible (see <i>Official Plan policy 4.3.12</i> )	<input checked="" type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3 Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks (see <i>Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/>
REQUIRED	1.2.4 Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps (see <i>Official Plan policy 4.3.10</i> )	<input checked="" type="checkbox"/>
REQUIRED	1.2.5 Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians (see <i>Official Plan policy 4.3.11</i> )	<input type="checkbox"/>
BASIC	1.2.6 Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	<input checked="" type="checkbox"/>
BASIC	1.2.7 Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	<input type="checkbox"/>
BASIC	1.2.8 Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	<input type="checkbox"/>
<b>1.3 Amenities for walking &amp; cycling</b>		
BASIC	1.3.1 Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	<input type="checkbox"/>
BASIC	1.3.2 Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	<input type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>2. WALKING &amp; CYCLING: END-OF-TRIP FACILITIES</b>		
<b>2.1 Bicycle parking</b>		
REQUIRED	2.1.1 Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible (see <i>Official Plan policy 4.3.6</i> )	<input checked="" type="checkbox"/>
REQUIRED	2.1.2 Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas (see <i>Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
REQUIRED	2.1.3 Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored (see <i>Zoning By-law Section 111</i> )	<input checked="" type="checkbox"/>
BASIC	2.1.4 Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	<input type="checkbox"/>
<b>2.2 Secure bicycle parking</b>		
REQUIRED	2.2.1 Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers (see <i>Zoning By-law Section 111</i> )	<input type="checkbox"/>
BETTER	2.2.2 Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	<input type="checkbox"/>
<b>2.3 Bicycle repair station</b>		
BETTER	2.3.1 Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	<input type="checkbox"/>
<b>3. TRANSIT</b>		
<b>3.1 Customer amenities</b>		
BASIC	3.1.1 Provide shelters, lighting and benches at any on-site transit stops	<input type="checkbox"/>
BASIC	3.1.2 Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	<input type="checkbox"/>
BETTER	3.1.3 Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	<input type="checkbox"/>

TDM-supportive design & infrastructure measures: <i>Residential developments</i>		Check if completed & add descriptions, explanations or plan/drawing references
<b>4. RIDESHARING</b>		
<b>4.1 Pick-up &amp; drop-off facilities</b>		
BASIC	4.1.1 Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	<input checked="" type="checkbox"/>
<b>5. CARSHARING &amp; BIKESHARING</b>		
<b>5.1 Carshare parking spaces</b>		
BETTER	5.1.1 Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses (see <i>Zoning By-law Section 94</i> )	<input type="checkbox"/>
<b>5.2 Bikeshare station location</b>		
BETTER	5.2.1 Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	<input type="checkbox"/>
<b>6. PARKING</b>		
<b>6.1 Number of parking spaces</b>		
REQUIRED	6.1.1 Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	<input checked="" type="checkbox"/>
BASIC	6.1.2 Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	<input type="checkbox"/>
BASIC	6.1.3 Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly (see <i>Zoning By-law Section 104</i> )	<input type="checkbox"/>
BETTER	6.1.4 Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking (see <i>Zoning By-law Section 111</i> )	<input type="checkbox"/>
<b>6.2 Separate long-term &amp; short-term parking areas</b>		
BETTER	6.2.1 Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	<input type="checkbox"/>