1400 Bank Street

Transportation Impact Assessment

Step 1 Screening Report

Step 2 Scoping Report

Step 3 Forecasting Report

Step 4 Strategy Report

Prepared for:

SerCo Realty Group
9 Capella Court, Unit 200
Ottawa, ON K2E 8A7

Prepared by:

CGH TRANSPORTATION
13 Markham Avenue
Ottawa, ON K2G 3Z1

November 2021

PN: 2021-093

Table of Contents

List of Figures

Table of Tables

List of Appendices

1 Screening

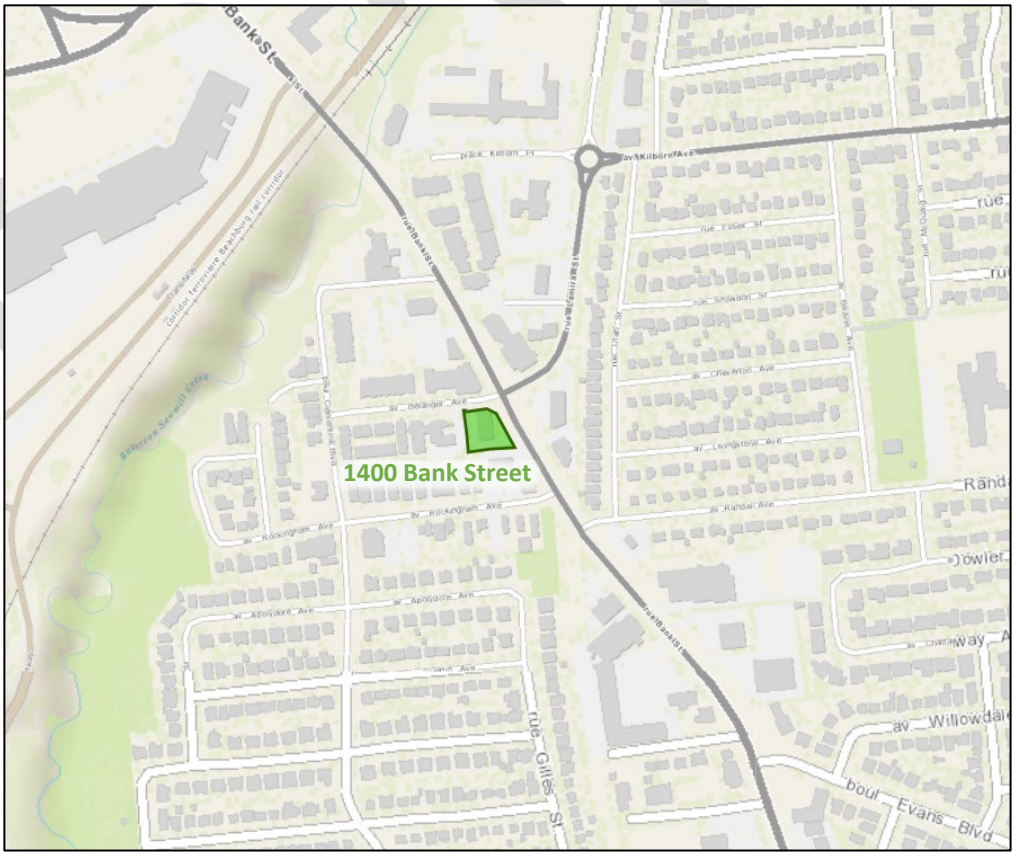
This study has been prepared according to the City of Ottawa's 2017 Transportation Impact Assessment (TIA) Guidelines. Accordingly, a Step 1 Screening Form has been prepared and is included as Appendix A, along with the Certification Form for the TIA Study PM. As shown in the Screening Form, a TIA is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

2 Existing and Planned Conditions

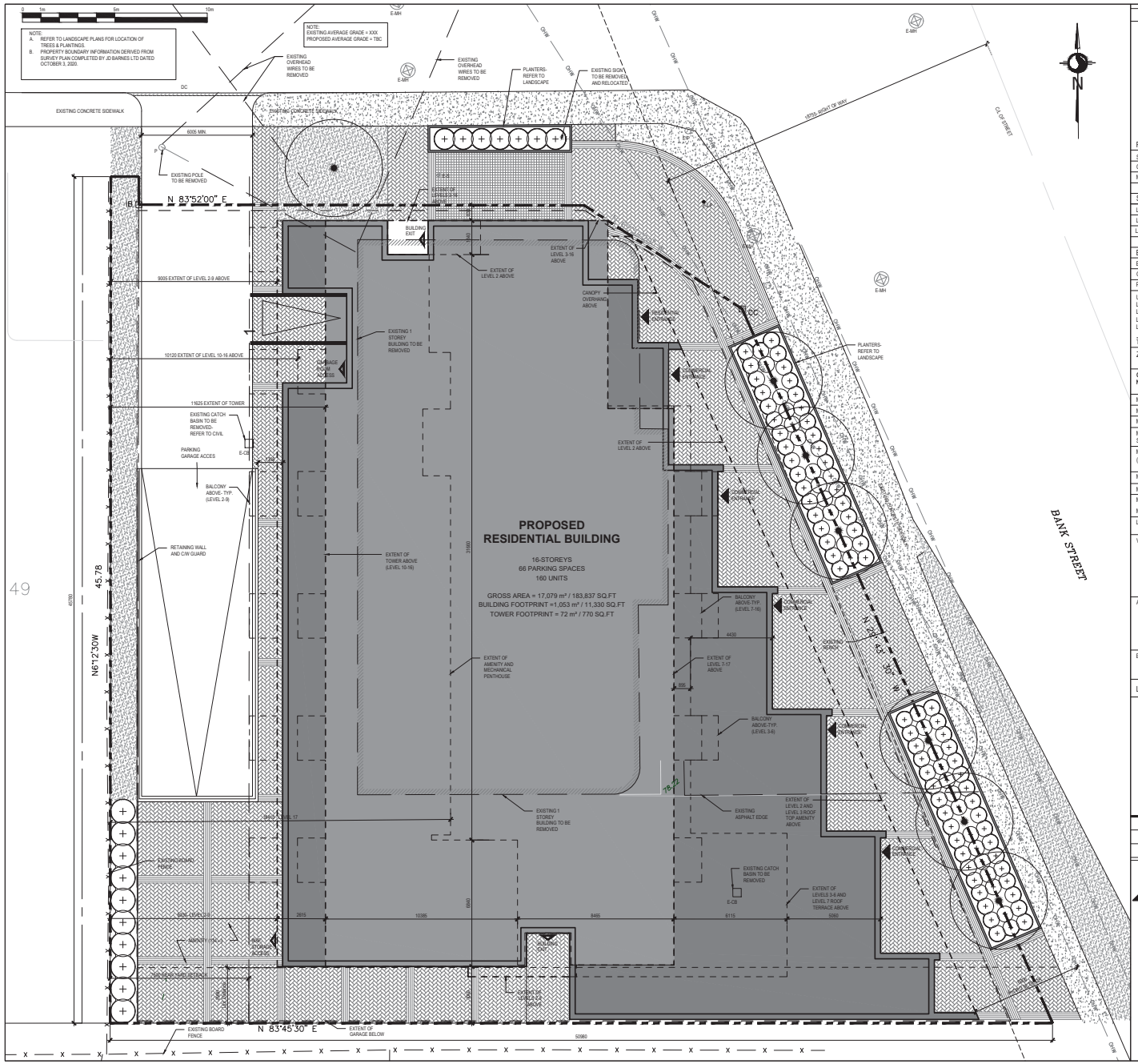
2.1 Proposed Development

The existing site, located at 1400 Bank Street, is zoned as Arterial Mainstreet Zone (AM1 (1913)). The existing site includes a commercial/retail building with a flower shop, a cash advance business, and a surface parking lot that loops behind the building between Belanger Avenue and Bank Street. The proposed redevelopment consists of a 16-storey mixed-use building with a total of 3,791 sq. ft. of commercial space, 5,365 sq. ft. of office space, a total of 160 apartment units, and 66 underground parking spaces. The anticipated full build-out and occupancy horizon is 2026 with construction occurring in a single phase. Along with the removal of one existing driveway access, the concept plan proposes the relocation of an existing full-movements access onto Belanger Avenue as an underground parking access, and the main entrance will be located at the corner at Bank Street. The site is located within the Bank Street Secondary Plan and intersects the Bank Arterial Mainstreet design priority area. 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: August 12, 2021



KEY PLAN

PROPERTY DESCRIPTION

SIXTEEN STOREY MIXED-USE RESIDENTIAL BUILDING	
CITY OF OTTAWA PIN NUMBER	
MUNICIPAL ADDRESS	1400 BANK STREET

SITE INFORMATION

LOT AREA:	1460m²
LOT FRONTAGE:	42m (BANK STREET), 25.6m (BELANGER AVE.)
LOT DEPTH:	25.6m (NORTH) & 51m (SOUTH)

BUILDING INFORMATION

BUILDING AREA:	1,053 m²
GROSS AREA:	17,079 m²
PROPOSED USE:	MIXED-USE RESIDENTIAL

UNIT BREAKDOWN:

LEVEL 2:	6 UNITS
LEVEL 3-6:	12 UNITS EA.
LEVEL 7-9:	12 UNITS EA.
LEVEL 10-16:	10 UNITS EA.
TOTAL:	160 UNITS

RETAIL/OFFICE USE:

LEVEL 1:	352 m²
LEVEL 2:	500 m²

ZONING TABLE

AM1 [1913] - ARTERIAL MAINSTREET, SUBZONE 1, EXCEPTION 1913

CITY OF OTTAWA ZONING BY-LAW No. 2008-250	REQUIRED	PROPOSED
MINIMUM LOT AREA	NO MINIMUM	1,459m²
MINIMUM LOT WIDTH	NO MINIMUM	N/A
MINIMUM FRONT YARD SETBACK	0 m	VARIES
MINIMUM INTERIOR SIDE YARD SETBACK	7.5m (ABUTTING RESIDENTIAL ZONE)	N/A
MINIMUM REAR YARD SETBACK (south)	7.5 m (REAR LOT LINE ABUTTING RESIDENTIAL ZONE)	9.3m- GROUND FLOOR 9m- LEVEL 2-9 11.6m- LEVEL 10-16
MINIMUM CORNER SIDEYARD SETBACK	0 m	0.8 m
MAXIMUM BUILDING HEIGHT	25 m	50 m
MAXIMUM FLOOR SPACE INDEX	3.5	5
MAX # of RESIDENTIAL UNITS	N/A	
LANDSCAPED AREA	N/A	N/A
VEHICLE PARKING REQUIREMENTS AREA Y Table 101-Residences: 0.5 per unit Table 102- Visitors: 0.1 per unit, less the first 12 units Table 101- 1 parking per 100m2 office area	RESIDENTIAL: 80 SPACES VISITORS: 14.8 SPACES RETAIL: N/A OFFICE: 5	66 SPACES
AMENITY AREA REQUIREMENTS Table 137 – (6) 6m2 per dwelling unit, and 10% of the gross floor area of each rooming unit A minimum of 50% of the required total amenity area needs to be communal. Can be divided into areas up to 54 m2 , and where more than one aggregated area is provided, at least one must be a minimum of 54 m2	960 m² 481 m² COMMUNAL	BALCONIES: 696 m² ROOF AMENITY: 379 m² EXTERIOR: 134 m²
BICYCLE PARKING SPACES AREA Y TABLE 111A	0.5 per dwelling unit = 80 1 PER 250m² GFA= 3.4	186 SPACES

LEGEND

GRASS
UNIT PAVERS REFER TO LANDSCAPE
ASPHALT PAVING
CONCRETE
RIVER STONES. REFER TO LANDSCAPE
FIRE ROUTE
EXISTING FENCE
NEW SCREEN FENCE
NEW SOUND FENCE
LOT LINE
SETBACK LINE
DESIGNATED BUILDING ENTRANCE / EXIT
NEW FIRE HYDRANT. REFER TO CIVIL
CATCH BASIN
MANHOLE
FLOOR DRAIN
ELECTRICAL POST
LIGHT STANDARD
DEPRESSED CURB

EXISTING TREE TO REMAIN. (REFER TO LANDSCAPE DRAWINGS)
NEW TREE (REFER TO LANDSCAPE DRAWINGS)
NEW SHRUBS (REFER TO LANDSCAPE DRAWINGS)
NEW EVERGREEN SHRUB (REFER TO LANDSCAPE DRAWINGS)
EXISTING GROUND ELEVATION (TO DETERMINE EXISTING AVERAGE GRADE)
PROPOSED GROUND ELEVATION. REFER TO CIVIL

NOTE: 'X-E INDICATES EXISTING TO REMAIN

No.	Date	Emis pour / Object
1	2021-09-29	FOR COORD.
2	2021-10-13	FOR COORD.
3	2021-10-21	FOR COORD.
4	2021-10-26	OFFICIAL PLAN AMENDMENT AND ZONING BY-LAW AMENDMENT

Planneur / Planner
NOVATECH ENGINEERING CONSULTANTS LTD

Ingénieur / Engineer (Mécanique & Électricité / Mechanical & Electrical)

Ingénieur / Engineer (Structure / Structure)

Architecte/ Architect (paysagiste / Landscape)

Ingénieur / Engineer (Civil / Civil)
LRJ

Client / Client
SERCO REALTY GROUP

Architecte / Architect — Collectif d'architectes / Architects Collective
fig. 1
3550, Saint-Antoine O.
Montréal QC H4C 1A9
T. 514 861-5122
fig. 2
150 Somerset St W #206
Ottawa ON K2P 0J4
T. 613 656-5122
figurr architects collective
www.figurr.ca

Droit d'auteur / Copyright
Ce dessin est sujet au droit d'auteur. Il ne peut être reproduit pour quelques intentions ou usages que ce soit, il ne peut être utilisé uniquement avec l'approbation de la signature et de l'estampe originale.
This drawing is subject to copyright. It is not to be reproduced for any purpose or by any means, and may only be used if it bears an original stamp and signature.

Sceau / Seal

Note:
L'entrepreneur doit vérifier toutes les dimensions et informations sur le site et aviser immédiatement l'architecte de toutes erreurs ou omissions.
Contractor shall verify all information and dimensions on site and immediately report any errors or omissions to the architect.

Projet / Project
16-STOREY MIXED-USE RESIDENTIAL BUILDING
1400 BANK ST.
OTTAWA, ON

Titre / Title
SITE PLAN

Dessiné par / Drawn by: RC
No. projet / Project number: 2144
Vérifié par / Verified by: RC
No. dessin / Drawing number: A-105
Révision / Revision: 4
Échelle / Scale: AS SHOWN
Date de création du dessin / Drawing creation date: 2021-09-29

2.2 Existing Conditions

2.2.1 Area Road Network

Bank Street: Bank Street is a City of Ottawa arterial road. The roadway has a divided four-lane urban cross-section north of Randall Avenue and has a five-lane urban cross-section including a two-way left-turn lane south of Randall Avenue. Sidewalks are provided on both sides of the road. The posted limit is 40 km/h north of Riverdale Avenue and 50 km/h south of Riverdale Avenue. North of Ohio Street, a southbound bike lane is provided and a northbound bike lane begins approximately 110 metres to the north. The City-protected right of way is 37.5 metres. Bank Street is designated as a truck route.

Lamira Street: Lamira Street is a collector road with a two-lane urban cross-section. A sidewalk is provided on north side of the road. The unposted speed limit is assumed to be 50 km/h and the existing right of way provided is 27.0 metres.

Transitway Access: The Transitway access is a roadway that is restricted to buses only. The road is between Bank Street and Data Centre Road and serves as a bus connection to the Transitway.

Ohio Street: Ohio Street is a local road with a two-lane urban cross-section. Sidewalks are present on the north side of the road for 65.0 metres, and along the south side of the road. The unposted speed limit is assumed to be 50 km/h and the existing right of way provided is 3.0 metres.

Belanger Avenue: Belanger Avenue is a local road with an undivided two-lane urban cross-section. Sidewalks are present on both sides of the road. The unposted speed limit is assumed to be 50 km/h and the existing right of way provided is 18.5 metres.

Rockingham Avenue: Rockingham Avenue is a local road with a two-lane urban cross-section. Sidewalks are present on both sides of the road. The unposted speed limit is assumed to be 50 km/h and the existing right of way provided is 18.5 metres.

Randall Avenue: Randall Avenue is a local road with a two-lane urban cross-section. The unposted speed limit is assumed to be 50 km/h and the existing right of way provided is 20.0 metres.

Clementine Boulevard: Clementine Boulevard is a local road with a two-lane urban cross-section. Sidewalks are present on east side of the road. The posted limit is 40 km/h and the existing right of way provided is 12.0 metres

2.2.2 Existing Intersections

The existing signalized area intersections within 400 metre of the site have been summarized below:

Bank Street at Belanger Avenue/ Lamira Street	The intersection of Bank Street and Belanger Avenue/ Lamira Street is a signalized intersection. The northbound and southbound approaches each consist of an auxiliary left-turn lane, a through lane, and a shared through/right-turn lane. The westbound approach consists of a shared left-turn/through lane and an auxiliary, channelized right-turn lane, and the eastbound approach consists of a shared all-movement lane. Vehicles are prohibited from making westbound through movements during weekdays between 7:00–9:00 AM and eastbound through movements during weekdays between 3:30-5:30 PM. Bicycles are permitted to make these movements.

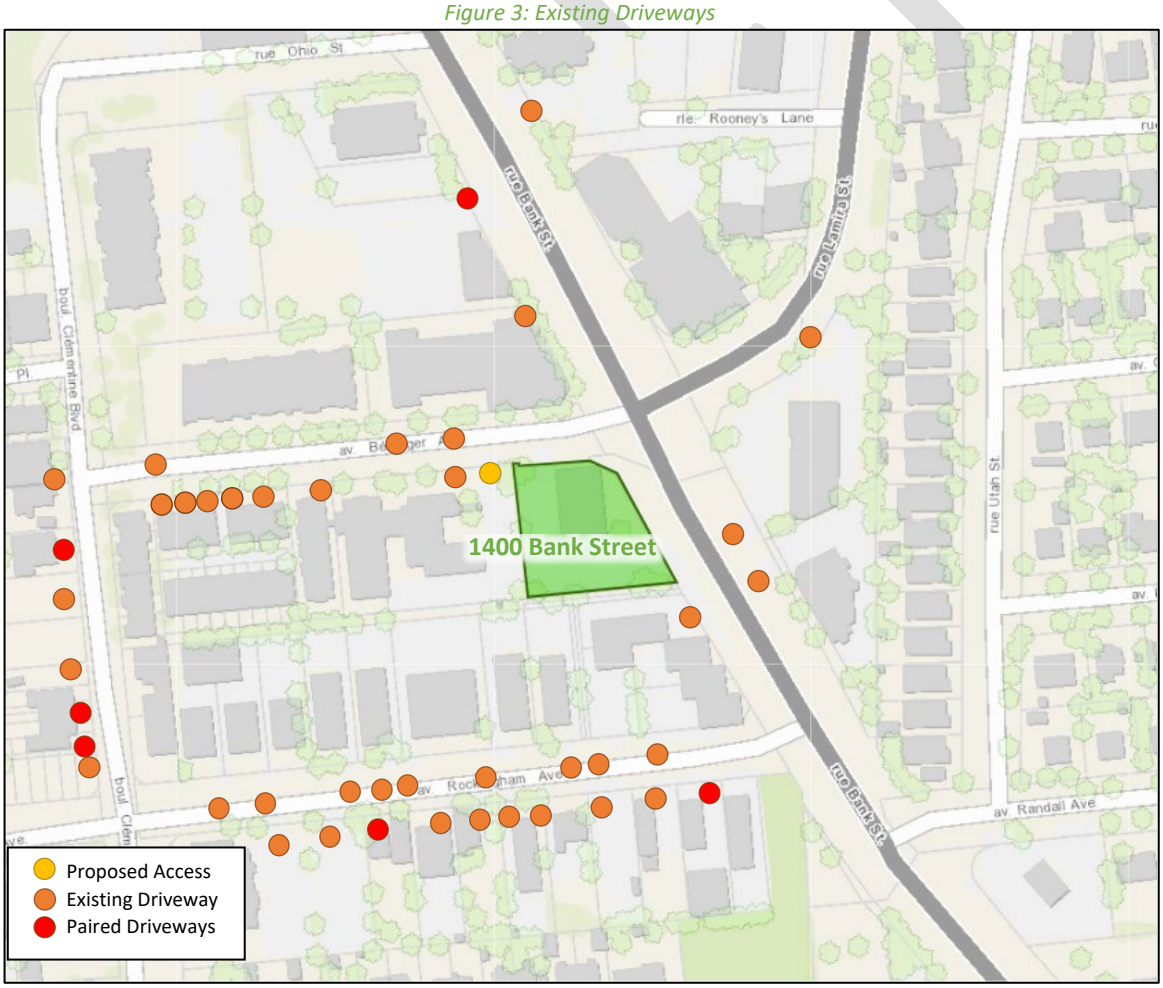
Bank Street at Randall Avenue

The intersection of Bank Street and Randall Avenue 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 an auxiliary left-turn lane and two through lanes. The westbound approach consists of a right-turn lane. Northbound and southbound U-turn movements, and westbound left-turn movements are prohibited.

2.2.3 Existing Driveways

Within 200 metres of the site access, driveways to four low-rise buildings and five semi-detached dwellings are located on Belanger Avenue, and a driveway to a parking lot is present on Lamira Street. Driveways to two mid-rise buildings, a commercial building, a clinic building, a mixed-use building, and a church are present on Bank Street. Driveways to three commercial buildings, eight low-rise building, one mid-rise building, and four detached dwellings are also present on Rockingham Avenue, and driveways to three semi-detached dwellings, one low-rise building, two detached dwellings are located on Clementine Boulevard. Figure 3 illustrates the existing driveways.

Figure 3: Existing Driveways



Source: http://maps.ottawa.ca/geoOttawa/ Accessed: August 12, 2021

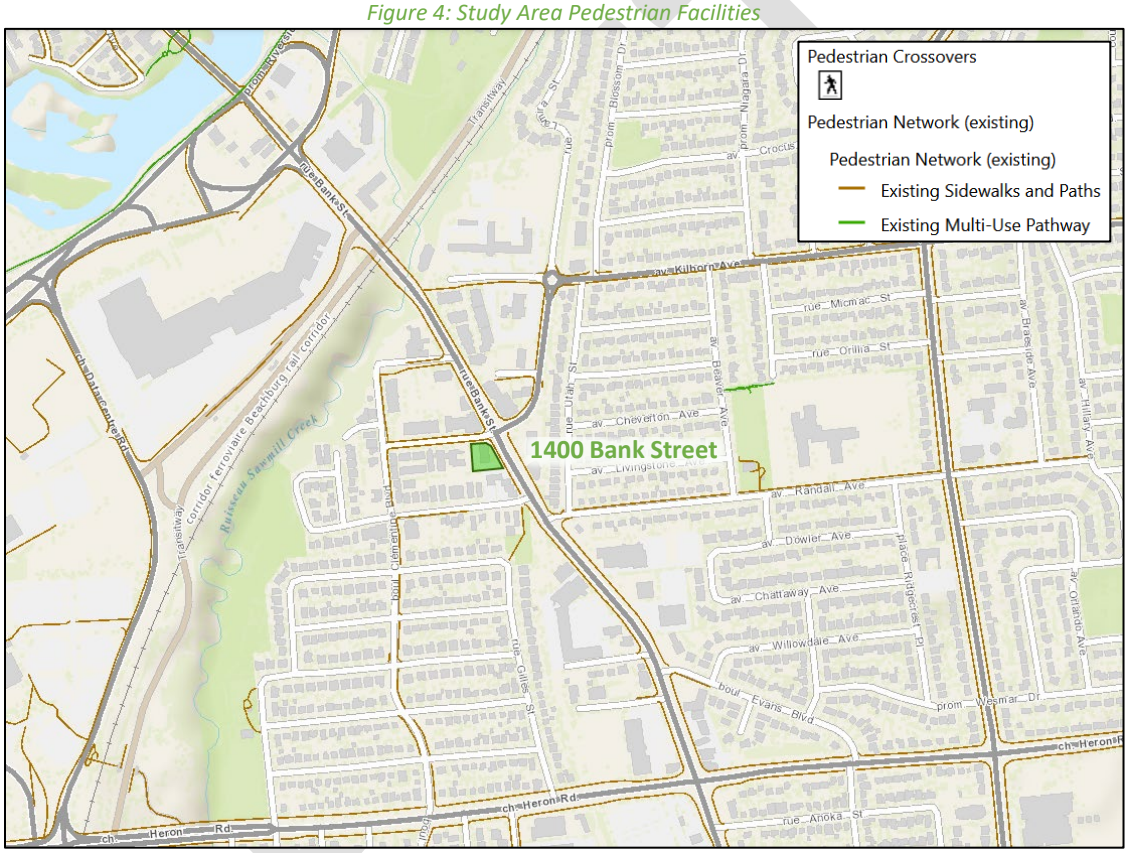
2.2.4 Cycling and Pedestrian Facilities

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

Sidewalks are provided along both sides of Bank Street, Belanger Avenue, and Ohio Street. Sidewalks are also provided along the north side of Randall Avenue and the Transitway access, on the east side of Clementine Boulevard, on the west side of Lamira Street, and on part of the south side of Rockingham Avenue east of Clementine Boulevard.

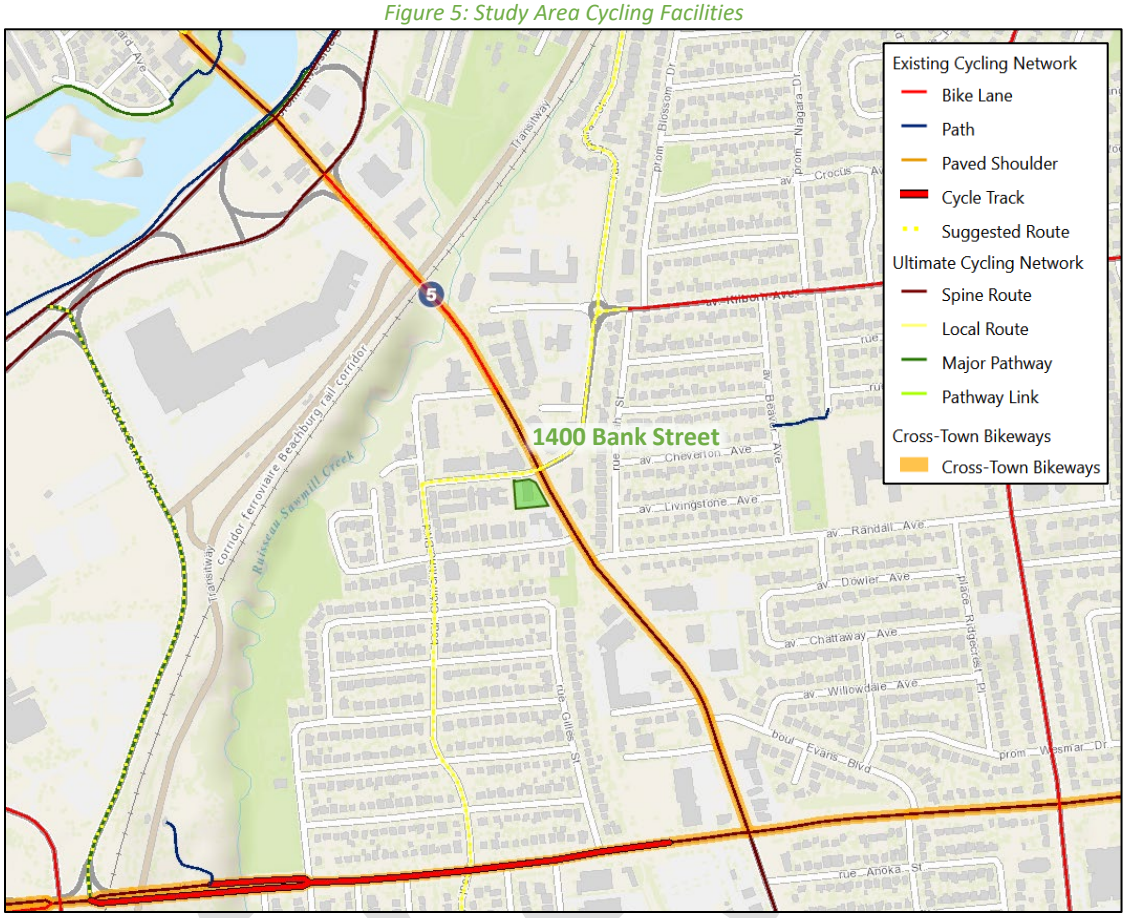
Cycling facilities include a bike lane along Bank Street north of Ohio Street to Riverside Drive, and a cycletrack along Heron Road. A multi-use pathway runs along the north side of Riverside Drive westbound. Bank Street and Heron Road are spine routes, and Data Centre Road and the MUP north of Riverside Drive are major pathways. Lamira Street, Belanger Avenue, and Clementine Boulevard south of Belanger Avenue are identified as local cycling routes. Bank Street north of Heron Road and Heron Road are designated as cross-town bikeways.

Figure 4: Study Area Pedestrian Facilities



Source: http://maps.ottawa.ca/geoOttawa/ Accessed: August 12, 2021

Figure 5: Study Area Cycling Facilities



Source: http://maps.ottawa.ca/geoOttawa/ Accessed: August 12, 2021

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

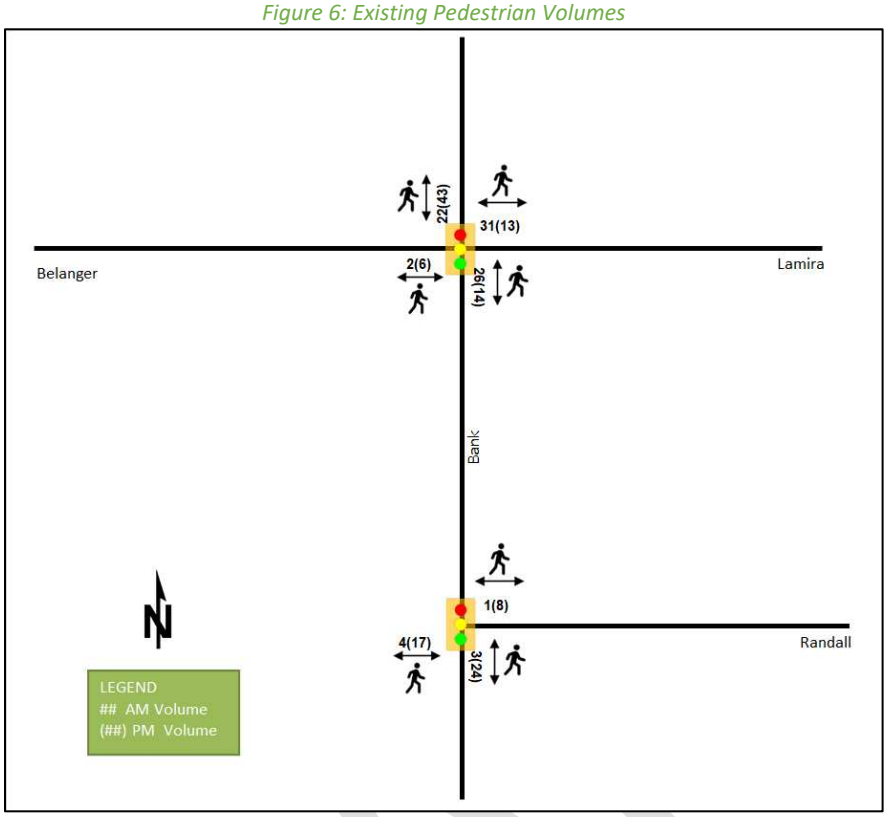
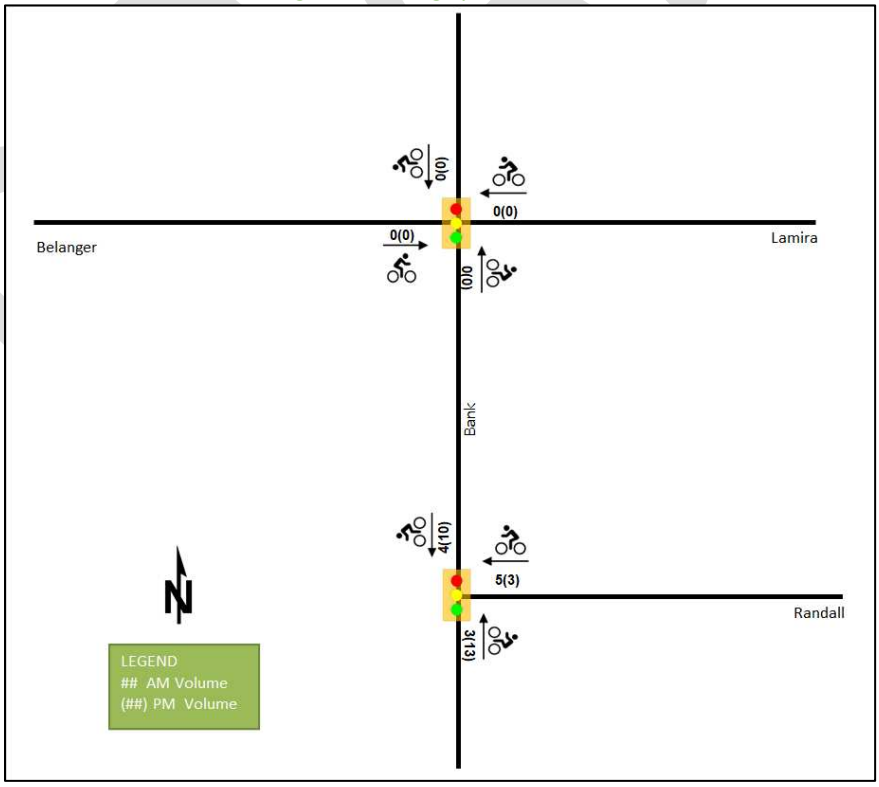


Figure 7: Existing Cyclist Volumes



2.2.5 Existing Transit

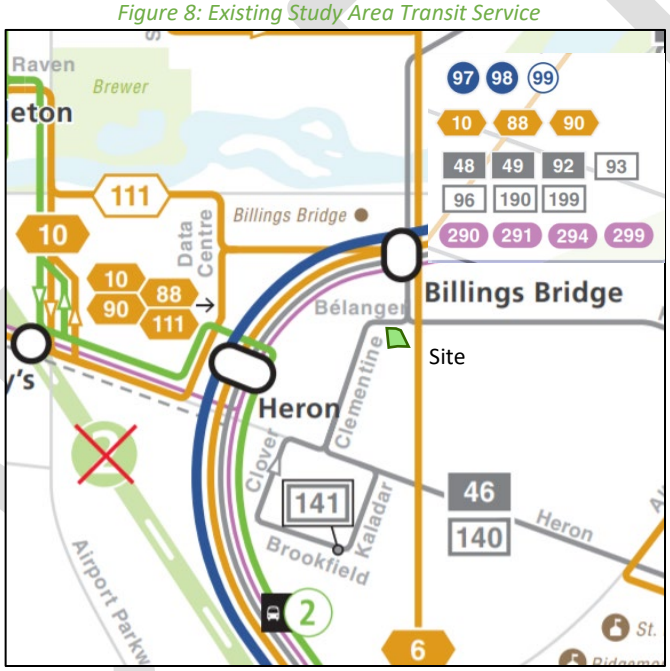
Within the study area, the route #6 travels along Bank Street, the routes #46, #140, and #141 travels along Bank Street, Belanger Avenue, and Clementine Boulevard, and the route #48 travels along Bank Street and Lamira Street.

Primary stops are located at the intersections of Bank Street at Ohio Street, Bank Street at Belanger Avenue, Bank Street at Lamira Street, and Bank Street at Clementine Boulevard. The frequency of these routes within proximity of the proposed site currently are:

- Route # 6 – 15-minute service all day, 30-minute service after 8:00 PM
- Route # 46 – 15-minute service in peak direction/period, 30-minute service all day
- Route # 48 – 30-minute service all day
- Route #140 –30-minute service in peak direction/period
- Route # 141 – 1-hr service in peak direction/period

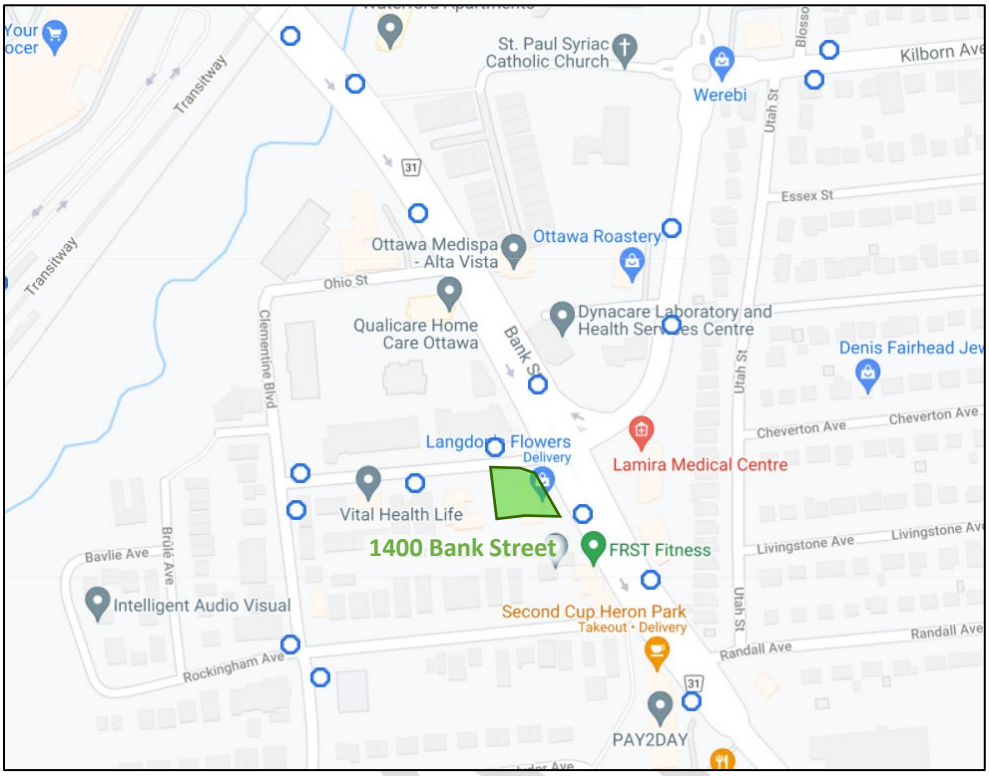
Figure 8 illustrates the transit system map in the study area and Figure 9 illustrates nearby transit stops.

Figure 8: Existing Study Area Transit Service



Source: http://www.octranspo.com/ Accessed: August 12, 2021

Figure 9: Existing Study Area Transit Stops



Source: http://www.octranspo.com/ Accessed: August 12, 2021

2.2.6 Existing Area Traffic Management Measures

There are no existing area traffic management measures within the study area.

2.2.7 Existing Peak Hour Travel Demand

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

Table 1: Intersection Count Date

Intersection	Count Date
Bank Street at Belanger Avenue/Lamira Street	Wednesday, 28 January 2015
Bank Street at Randall Avenue	Thursday, July 30, 2015

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 HCM 2010 v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. Detailed turning movement count data is included in Appendix B and the Synchro worksheets are provided in Appendix C.

Figure 10: Existing Traffic Counts

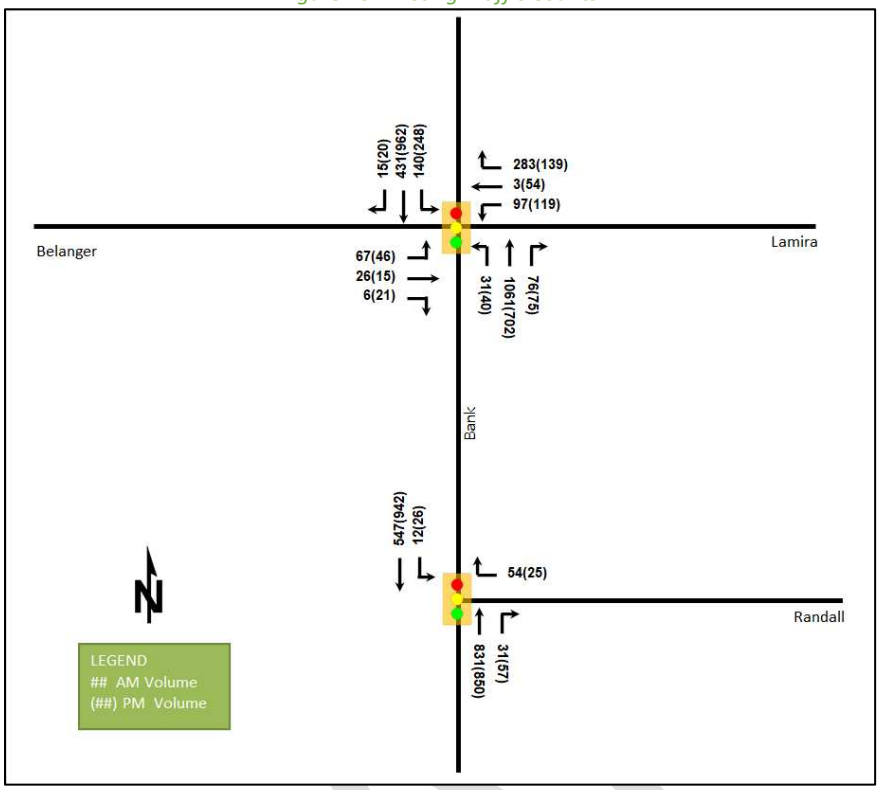


Table 2: Existing Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Belanger Avenue / Lamira Street *Signalized*	EB	A	0.40	29.2	28.3	A	0.39	27.1	21.4
	WBL/T	A	0.40	31.8	28.6	B	0.69	44.5	46.9
	WBR	A	0.56	7.2	17.9	A	0.36	6.9	13.1
	NBL	A	0.10	14.5	m6.5	A	0.26	26.3	15.4
	NBT/R	D	0.90	31.8	**#180.1**	B	0.66	25.7	91.8
	SBL	B	0.67	31.0	**#39.3**	B	0.63	19.2	**#69.0**
	SBT/R	A	0.26	10.6	34.7	A	0.51	11.0	90.2
	Overall	**C**	**0.72**	**24.0**	-	**B**	**0.68**	**19.4**	-
Bank Street & Randall Avenue *Signalized*	WBR	A	0.12	0.5	0.0	A	0.04	3.0	2.7
	NBT	A	0.49	10.8	58.0	C	0.74	18.7	66.4
	SBL	A	0.05	5.0	m2.0	A	0.22	16.5	7.5
	SBT/R	A	0.31	6.5	20.4	C	0.76	19.6	70.5
	Overall	**A**	**0.35**	**8.8**	-	**A**	**0.39**	**18.9**	-

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 0.90
m = metered queue
# = queue exceeds storage or mid-block length

During both the AM and PM peak hours, the study area intersections are anticipated to operate well.

The intersection of the Bank Street at Belanger Avenue/Lamira Street may exhibit extended queues on the northbound shared through/right-turn movements during the AM peak hour, and on the southbound left-turn movement during both peak hours.

2.2.8 Collision Analysis

Collision data have been acquired from the City of Ottawa open data website (data.ottawa.ca) for five years prior to the commencement of this TIA for the surrounding study are 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 are included in Appendix D.

Table 3: Study Area Collision Summary, 2015-2019

		Number	%
Total Collisions		**62**	**100%**
Classification	**Fatality**	0	0%
	Non-Fatal Injury	19	31%
	Property Damage Only	43	69%
Initial Impact Type	**Angle**	11	18%
	Rear end	21	34%
	Sideswipe	3	5%
	Turning Movement	13	21%
	SMV Unattended	3	5%
	SMV Other	6	10%
	Other	5	8%
Road Surface Condition	**Dry**	40	65%
	Wet	13	21%
	Loose Snow	5	8%
	Slush	3	5%
	Ice	1	2%
Pedestrian Involved		8	13%
Cyclists Involved		7	11%

Figure 11: Study Area Collision Records – Representation of 2015-2019

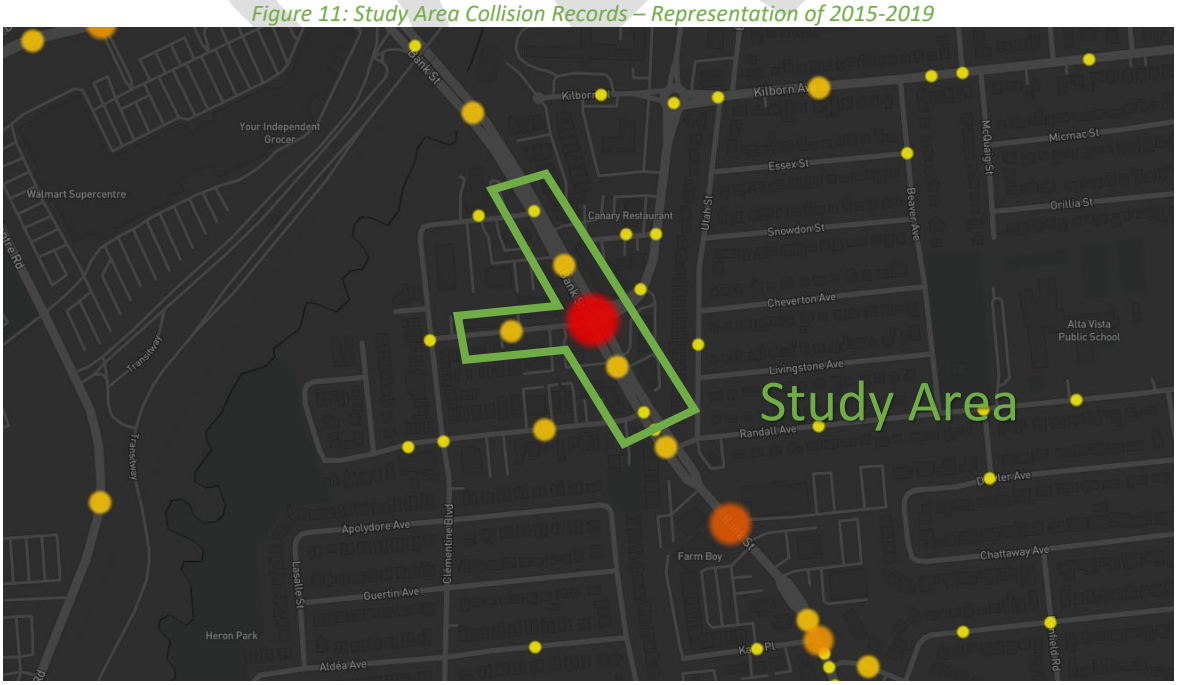


Table 4: Summary of Collision Locations, 2015-2019

	Number	%
Intersections / Segments	**62**	**100%**
Bank St @ Ohio St	1	2%
Bank St @ Belanger Ave/Lamira St	38	61%
Bank St @ Rockingham Ave	3	5%
Belanger Ave Btwn Clementine Blvd & Bank St	4	6%
Bank St Btwn Ohio St & Belanger Ave	4	6%
Bank St Btwn Belanger Ave & Rockingham Ave	12	19%

Within the study area, the intersection of Bank Street at Belanger Avenue/Lamira Street and the segment of Bank Steet between Belanger Avenue and Rockingham Avenue are noted to have experienced higher collisions than other locations. Table 5 and Table 6 summarize the collision types and conditions for these locations.

Table 5: Bank Street at Belanger Avenue/Lamira Street Collision Summary

		Number	%
Total Collisions		**38**	**100%**
Classification	**Fatality**	0	0%
	Non-Fatal Injury	14	37%
	Property Damage Only	24	63%
Initial Impact Type	**Angle**	5	13%
	Rear end	12	32%
	Sideswipe	1	3%
	Turning Movement	13	34%
	SMV Other	4	11%
	Other	3	8%
Road Surface Condition	**Dry**	26	68%
	Wet	9	24%
	Loose Snow	3	8%
Pedestrian Involved		3	8%
Cyclists Involved		0	0%

The Bank Street at Belanger Avenue/Lamira Street intersection had a total of 38 collisions during the 2015-2019 time period, with 24 involving property damage only and the remaining 14 having non-fatal injuries. The collision types are most represented by turning movement with 13 collisions, followed by twelve rear end collisions, with the remaining collision types represented by angle, SMV other, other, and sideswipe. Turning movement collisions are likely due to the channelized right-turn from Lamira Street and the skewed geometry of the intersection. The rear end collisions are typical of congested conditions and the shared through/right-turn lanes. Weather conditions are not considered to have influenced collisions at this location. The Bank Street Renewal will remove the channelized right-turn from Lamira Street and the protected intersection design will likely reduce collisions in the future. No further action is recommended at this time.

Table 6: Bank Steet Segment Between Belanger Avenue & Rockingham Avenue Collision Summary

		Number	%
Total Collisions		**12**	**100%**
Classification	**Fatality**	0	0%
	Non-Fatal Injury	0	0%
	Property Damage Only	12	100%
Initial Impact Type	**Angle**	4	33%
	Rear end	6	50%
	Sideswipe	2	17%
Road Surface Condition	**Dry**	8	67%
	Loose Snow	2	17%
	Slush	2	17%
Pedestrian Involved		0	0%
Cyclists Involved		0	0%

The Bank Steet segment between Belanger Avenue and Rockingham had a total of 12 collisions during the 2015-2019 time period, all involving property damage only. The collision types are most represented by rear end with six collisions, followed by angle with four collisions with the remaining two sideswipe collisions. Rear end collisions are typical of congested areas. Angled collisions are generally represented by left-turning movements and may be influenced by the private accesses along the segment. Weather conditions are not considered to have influenced collisions at this location.

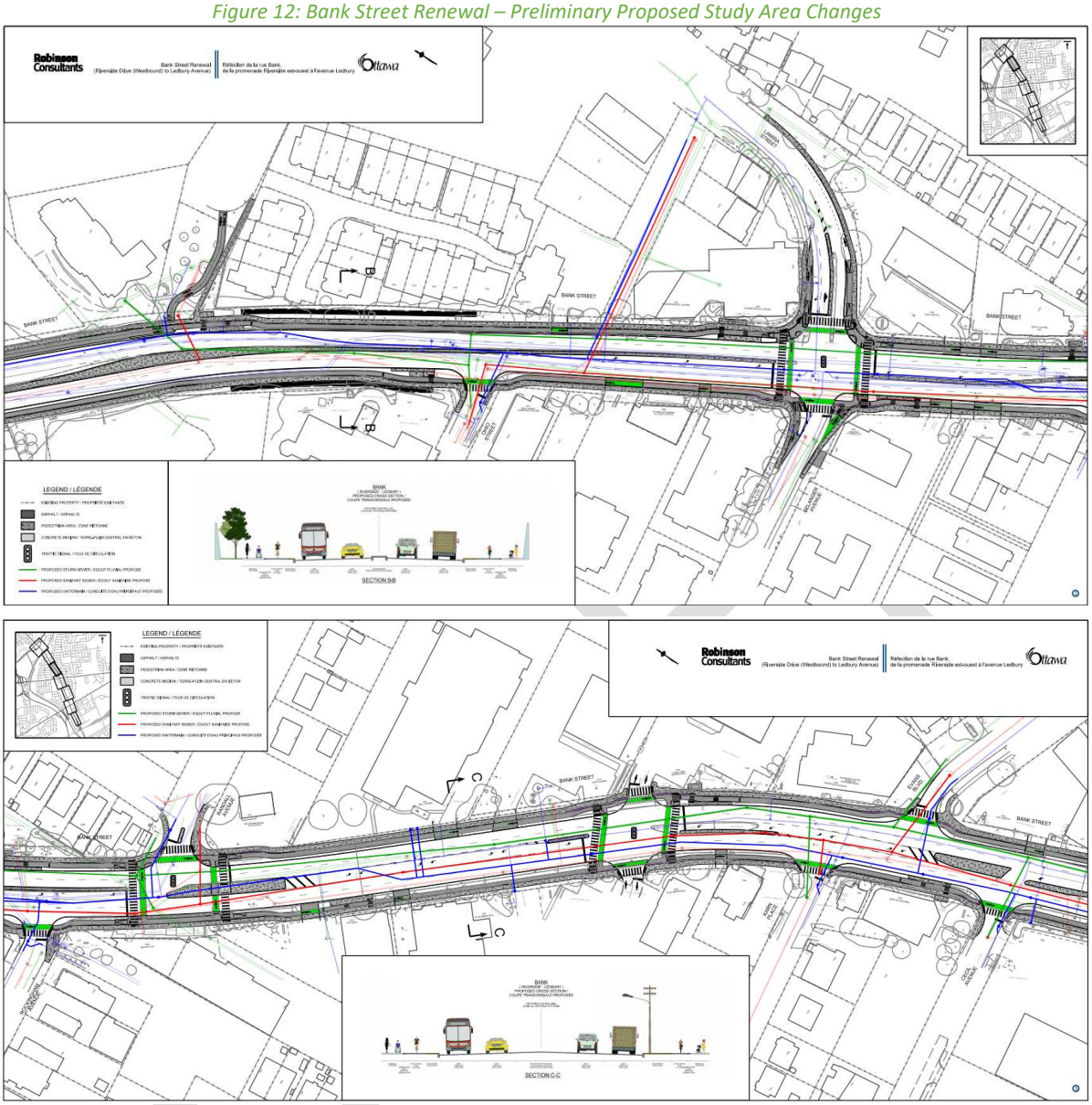
2.3 Planned Conditions

2.3.1 Changes to the Area Transportation Network

The Transportation Master Plan's (TMP) Rapid Transit and Transit Priority Network (RTTP) identifies isolated transit priority measures along Bank Street within the Affordable Network diagram.

The Bank Street Renewal (Riverside Drive (Westbound) to Ledbury Avenue) is a project that is currently in the detailed design phase of the project underway by the City of Ottawa. The construction is scheduled in early Winter 2022, and the completion of the entire project will be based on the future budget. The renewal will include cycletracks along Bank Street, protected intersection configurations and a raised centre median. Figure 12 illustrates examples of the changes anticipated to the area intersections.

Figure 12: Bank Street Renewal – Preliminary Proposed Study Area Changes



Source: https://ottawa.ca/en/city-hall/public-engagement/projects/bank-street-renewal-riverside-drive-westbound-ledbury-avenue Accessed: September 2, 2021

2.3.2 Other Study Area Developments

1330, 1344 and 1346 Bank Street, and 2211 Riverside Dive

The proposed development application includes a Zoning By-law Amendment to allow the construction of a 27-storey mixed use building with 309 residential units and 3,603 ft^2 commercial space as well as a 29-storey apartment building with 228 residential units. The development is predicted to generate 73 new AM two-way peak-hour auto trips and 54 new PM two-way peak-hour auto trips. (Parsons, 2021)

1335 and 1339 Bank Street

The proposed development application includes a Zoning By-law Amendment to allow the construction of a 26-storey mixed use building with 391 residential units and 525 m^2 commercial space. The development is forecasted

to generate 61 new AM two-way peak-hour auto trips and 37 new PM two-way peak-hour auto trips. (Parsons, 2020)

3 Study Area and Time Periods

3.1 Study Area

The study area will include the intersections of:

- Bank Street at:
  - Belanger Avenue/Lamira Street
  - Randall Avenue
- Belanger Avenue at:
  - Site Access (Future Conditions)

The boundary road will be Belanger Avenue and Bank Street, and no screenlines are present within proximity to the site.

3.2 Time Periods

As the proposed development is mixed-use development with residential units, commercial units, and office units, therefore, the AM and PM peak hours will be examined.

3.3 Horizon Years

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

4 Exemption Review

Table 7 summarizes the exemptions for this TIA.

Table 7: Exemption Review

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

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

5 Development-Generated Travel Demand

5.1 Mode Shares

Examining the mode shares presented in the TRANS Trip Generation Manual (2020) for the district derived from the most recent National Capital Region Origin-Destination survey (OD Survey), the existing mode shares by land use and peak period for Alta Vista have been summarized in Table 8.

Table 8: TRANS Trip Generation Manual Recommended Mode Shares – Alta Vista

Travel Mode	Multi-Unit (High-Rise)		Commercial Generator		Employment Generator
	AM	PM	AM	PM	AM and PM
Auto Driver	38%	45%	64%	60%	69%
Auto Passenger	12%	16%	9%	20%	7%
Transit	42%	28%	12%	9%	18%
Cycling	2%	2%	1%	0%	3%
Walking	7%	9%	14%	11%	3%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

Being within 700 metres-walk (or a 400 metres linear distance) of the Billing's Bridge BRT station, a higher transit mode is considered achievable at this location. Given that the residential transit mode share is already high (42%) during AM peak, this mode share is proposed to remain, and a seven percent shift to transit mode taken from the auto mode is proposed for PM peak. A ten percent shift to transit mode from the auto mode is proposed for each the commercial and employment generator land uses. The proposed modified mode share targets are summarized in Table 9.

Table 9: Proposed Development Mode Shares – Within 700 m of Rapid Transit

Travel Mode	Multi-Unit (High-Rise)		Commercial Generator		Employment Generator
	AM	PM	AM	PM	AM and PM
Auto Driver	38%	38%	54%	50%	59%
Auto Passenger	12%	16%	9%	20%	7%
Transit	42%	35%	22%	19%	28%
Cycling	2%	2%	1%	0%	3%
Walking	7%	9%	14%	11%	3%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

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 commercial component from the ITE Trip Generation Manual 10th Edition (2017) using the City-prescribed conversion factor of 1.28. Table 10 summarizes the person trip rates for the proposed residential land uses for each peak period and the person trip rates for the non-residential land uses by peak hour.

Table 10: Trip Generation Person Trip Rates by Peak Period

Land Use	Land Use Code	Peak Period	Vehicle Trip Rate	Person Trip Rates
Multi-Unit High-Rise	221 & 222 (TRANS)	AM	-	0.80
		PM	-	0.90
Land Use	**Land Use Code**	**Peak Hour**	**Vehicle Trip Rate**	**Person Trip Rates**
General Office	710 (ITE)	AM	1.16	1.48
		PM	1.15	1.47
Shopping Centre	820 (ITE)	AM	0.94	1.20
		PM	3.81	4.88

Using the above person trip rates, the total person trip generation has been estimated. Table 11 summarizes the total person trip generation for the residential and non-residential land uses.

Table 11: Total 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	**Units / GFA**	**AM Peak Hour**			**PM Peak Hour**		
		In	**Out**	**Total**	**In**	**Out**	**Total**
General Office	5,365 ft^2	7	1	8	1	7	8
Shopping Centre	3,791 ft^2	3	2	5	9	10	19

Internal capture rates from the ITE Trip Generation Handbook 3rd Edition have been assigned to the development's retail component for mixed-use developments. The rates summarized in Table 12 represent the percentage of trips to/from the retail use based on the residential component.

Table 12: 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 35% have been included, a value taken as a moderately conservative interpretation from the rates presented in the ITE Trip Generation Handbook 3rd Edition.

Using the above mode share targets for a BRT area, the internal capture and pass-by rates, and the person trip rates, the person trips by mode have been projected. Table 13 summarizes the trip generation by mode and peak hour using the residential peak hour adjustment factor and the non-residential trip generation using the internal capture and pass-by reductions.

Table 13: 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	38%	7	16	23	38%	14	10	24
	Auto Passenger	12%	2	5	7	16%	6	4	10
	Transit	42%	9	20	29	35%	14	10	24
	Cycling	2%	1	1	2	2%	1	0	1
	Walking	7%	2	3	5	9%	4	3	7
	Total	**100%**	**20**	**44**	**64**	**100%**	**37**	**26**	**63**
General Office	Auto Driver	59%	4	1	5	59%	1	4	5
	Auto Passenger	7%	0	0	1	7%	0	0	1
	Transit	28%	2	0	2	28%	0	2	2
	Cycling	3%	0	0	0	3%	0	0	0
	Walking	3%	0	0	0	3%	0	0	0
	Total	**100%**	**7**	**1**	**8**	**100%**	**1**	**7**	**8**
Shopping Centre	Auto Driver	54%	1	1	2	50%	3	2	5
	Auto Passenger	9%	0	0	0	20%	1	1	2
	Transit	22%	0	0	1	19%	1	1	2
	Cycling	1%	0	0	0	0%	0	0	0
	Walking	14%	0	0	0	11%	1	0	1
	Internal Capture	*varies*	*0*	*0*	*0*	*varies*	*-1*	*-2*	*-3*
	Pass-by	*35%*	*-1*	*-1*	*-2*	*35%*	*-3*	*-4*	*-7*
	Total	**100%**	**2**	**1**	**3**	**100%**	**5**	**4**	**9**
Total	Auto Driver	-	12	18	30	-	18	16	34
	Auto Passenger	-	2	5	7	-	7	5	13
	Transit	-	11	20	31	-	15	13	28
	Cycling	-	1	1	2	-	1	0	1
	Walking	-	2	3	5	-	5	3	8
	Total	-	**29**	**46**	**75**	-	**43**	**37**	**80**

As shown above, a total of 30 new AM and 34 new PM 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 existing district travel and these patterns were applied based on the build-out of Alta Vista. Table 14 below summarizes the distributions.

Table 14: OD Survey Distribution – Alta Vista

To/From	% of Trips
North	30%
South	15%
East	10%
West	45%
Total	**100%**

5.4 Trip Assignment

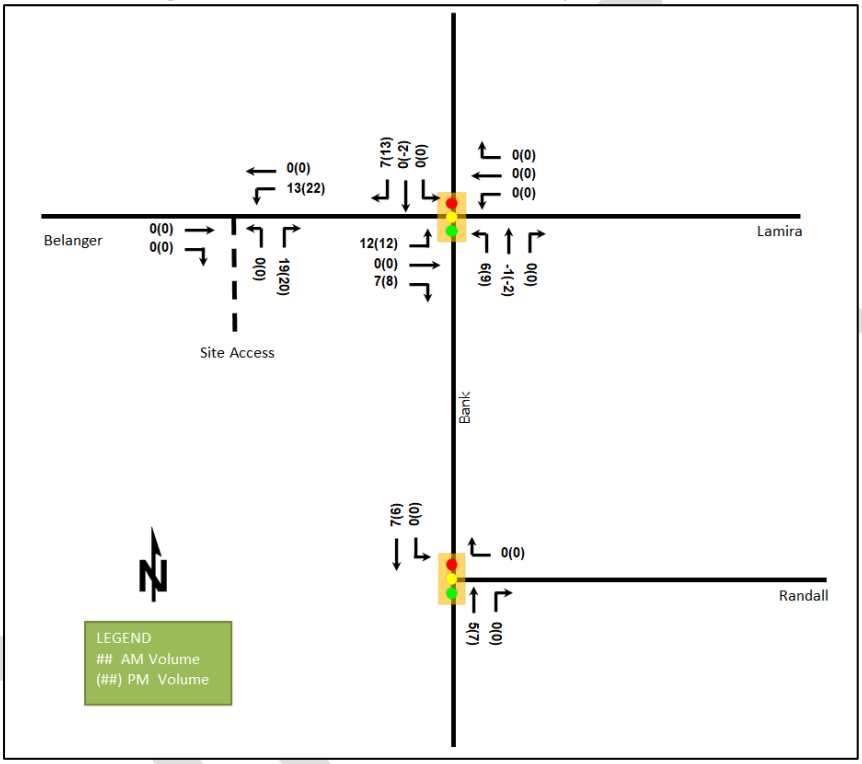
Using the distribution outlined above, turning movement splits, and access to major transportation infrastructure, the trips generated by the site have been assigned to the study area road network. Table 15 summarizes the

proportional assignment to the study area roadways, and Figure 13 illustrates the new site generated and pass-by volumes.

Table 15: Trip Assignment

To/From	Via
North	30% Bank Street (N)
South	15% Bank Street (S)
East	10% Bank Street (N)
West	20% Bank Street (N), 25% Bank Street (S)
Total	**100%**

Figure 13: New Site Generation 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 . and have been incorporated into the road network analysis.

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. The TRANS model plots and a summary of the results of the model interpolation are provided in Appendix E.

In general, the growth rates in the study area derived from the two TRANS model horizons are projected to be negative in the northbound direction and slightly positive in the southbound direction. When reviewing the existing volumes, it was noted that the southbound volumes were lower than historical values. Resultantly, growth rates derived from the existing horizon to the 2031 model horizon will be peak-directionally applied to the

appropriate roadway's mainline volumes as a conservative growth scenario. Table 16 summarizes the growth rates applied within the study area.

Table 16: Applied Study Area Growth Rates

Street	AM Peak Hour		PM Peak Hour	
	Northbound	Southbound	Northbound	Southbound
Bank Street	-	1.80%	1.80%	-

6.3 Other Developments

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

- 1330, 1344 and 1346 Bank Street, and 2211 Riverside Dive
- 1335 and 1339 Bank Street

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

7 Demand Rationalization

7.1 2026 Future Background Operations

Figure 14 illustrates the 2026 background volumes and Table 17 summarizes the 2026 background intersection operations. The level of service for signalized intersections is based on HCM 2010 v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2026 future background horizon are provided in Appendix E.

Figure 14: 2026 Future Background Volumes

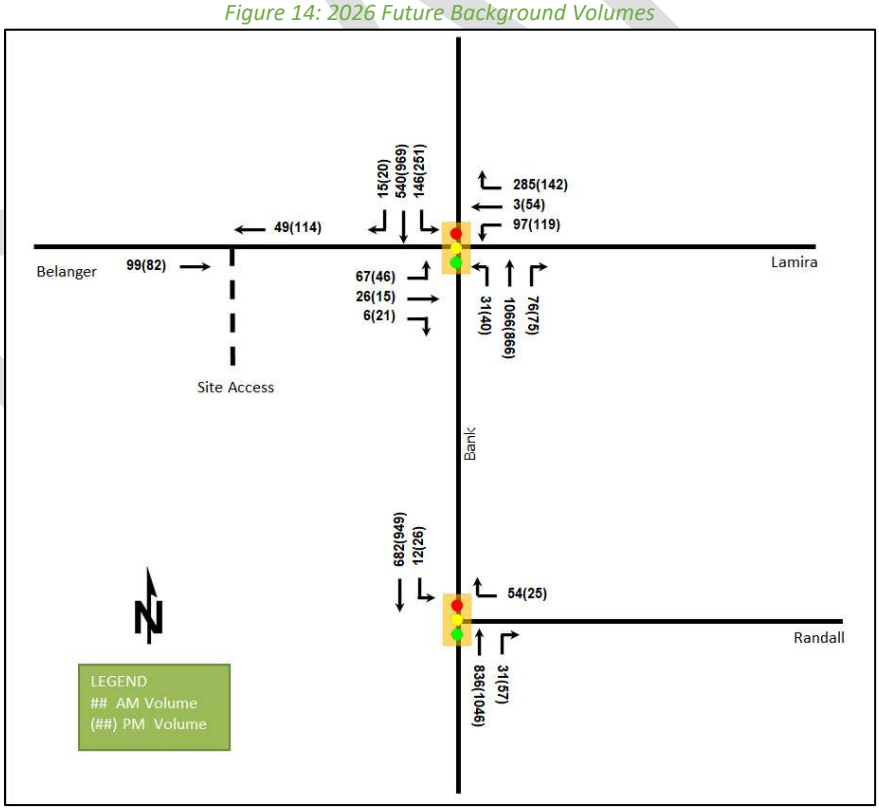


Table 17: 2026 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Belanger Avenue / Lamira Street *Signalized*	EB	A	0.35	27.7	25.7	A	0.35	26.1	19.1
	WBL/T	A	0.39	31.6	26.4	B	0.65	43.7	42.3
	WBR	A	0.53	7.0	17.3	A	0.35	7.3	12.5
	NBL	A	0.10	14.5	m6.8	A	0.21	23.4	13.6
	NBT/R	C	0.80	25.9	**#155.7**	B	0.68	25.8	**#111.1**
	SBL	B	0.61	24.7	**#30.3**	B	0.61	18.8	**#63.5**
	SBT/R	A	0.29	10.8	39.3	A	0.46	9.9	78.3
	Overall	**B**	**0.65**	**20.2**	**-**	**B**	**0.67**	**19.3**	**-**
Bank Street & Randall Avenue *Signalized*	WBR	A	0.10	0.4	0.0	A	0.04	4.3	3.2
	NBT	A	0.44	10.2	50.7	D	0.81	21.5	**#77.4**
	SBL	A	0.04	4.8	m1.7	A	0.23	17.6	7.2
	SBT/R	A	0.35	6.4	20.4	B	0.69	17.8	61.6
	Overall	**A**	**0.32**	**8.2**	**-**	**A**	**0.41**	**19.6**	**-**

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00
m = metered queue
# = queue exceeds storage or mid-block length

During both the AM and PM peak hours at the 2026 future background horizon, the study area intersections operate similarly to the existing conditions. Extended queues are forecasted along Bank Street on the northbound approaches at both study area intersections during the PM peak hour.

7.2 2031 Future Background Operations

Figure 15 illustrates the 2031 background volumes and Table 18 summarizes the 2031 background intersection operations. The level of service for signalized intersections is based on HCM 2010 v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets for the 2031 future background horizon are provided in Appendix F.

Figure 15: 2031 Future Background Volumes

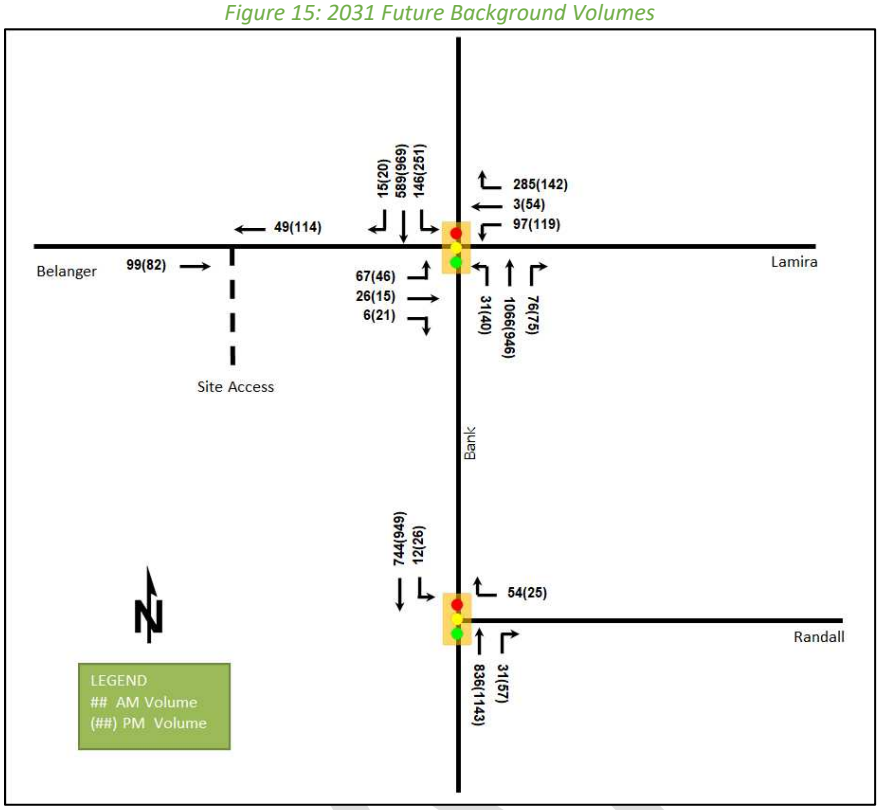


Table 18: 2031 Future Background Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Belanger Avenue/Lamira Street *Signalized*	EB	A	0.35	27.7	25.7	A	0.35	26.1	19.1
	WBL/T	A	0.39	31.6	26.4	B	0.65	43.7	42.3
	WBR	A	0.53	7.0	17.3	A	0.35	7.3	12.5
	NBL	A	0.10	14.6	m6.9	A	0.21	23.4	13.6
	NBT/R	C	0.80	25.9	**#155.7**	C	0.74	27.8	**#127.5**
	SBL	B	0.61	24.7	**#30.3**	B	0.64	23.3	**#71.1**
	SBT/R	A	0.32	11.0	43.2	A	0.46	9.9	78.3
	Overall	**B**	**0.65**	**20.0**	-	**C**	**0.71**	**20.6**	-
Bank Street & Randall Avenue *Signalized*	WBR	A	0.10	0.4	0.0	A	0.04	5.6	3.7
	NBT	A	0.44	10.2	50.7	D	0.88	25.9	**#99.2**
	SBL	A	0.04	4.7	m1.6	A	0.23	17.6	7.1
	SBT/R	A	0.38	6.5	21.5	B	0.69	17.8	61.6
	Overall	**A**	**0.32**	**8.2**	-	**A**	**0.45**	**22.1**	-

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00
m = metered queue
# = queue exceeds storage or mid-block length

The intersections at the 2031 future background horizon are anticipated to operate similarly to the 2026 background conditions. No new capacity issues are forecasted.

7.3 Modal Share Sensitivity and Demand Rationalization Conclusions

No capacity constraints are noted within the study area. As such, no rationalization of the modal share and projected volumes is required.

8 Transportation Demand Management

8.1 Context for TDM

The mode shares used within the TIA represent a shift from auto modes to transit modes. Overall, the modal shares are likely to be achieved and supporting TDM measures should be provided.

The subject site is within a within the Bank Arterial Mainstreet design priority area. Total bedrooms within the development are subject to the final unit count and layout selections by purchasers. No age restrictions are noted.

8.2 Need and Opportunity

The subject site has been assumed to rely predominantly on auto travel with an increase in transit ridership with the proximity to the BRT station, and those assumptions have been carried through the analysis. The study area intersections are anticipated to have residual capacity and the increase in transit ridership is achievable.

8.3 TDM Program

The "suite of post occupancy TDM measures" has been summarized in the TDM checklists for the both the residential and non-residential land uses. The checklist is provided in Appendix J. The key TDM measures recommended include:

- Display local area maps with walking and cycling routes, and transit route information and schedules at major entrances
- Provide a multimodal travel option information package to new residents
- Contract with providers to install on-site bikeshare (or other micro-mobility, e.g. scootershare) and carshare spaces
- Inclusion of a 1-year 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

9 Neighbourhood Traffic Management

Site traffic is proposed to access the arterial network via Belanger Avenue. The TIA Guidelines propose a threshold of 120 vehicles per peak hour for the classification of local roads, equivalent to two total cars per minute, which per City guidance is to be interpreted as two-way volumes.

The existing volumes on Belanger Avenue are 148 two-way vehicles in the AM peak hour and 196 two-way vehicles in the PM peak hour. Overall, the site is anticipated to generate approximately 30 and 34 two-way vehicle trips during the AM and PM peak hours, respectively, all of which will access Belanger Avenue. The site traffic will account for approximately 14-17% of the total traffic on Belanger Avenue, or a single vehicle every two minutes on either direction during the peak hours. While over the prescribed theoretical local road capacity, this volume increase is not considered a significant relative impact on Belanger Avenue and is furthermore confined to the under 25-metre section of road between the intersection and the site access.

10 Transit

10.1 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 19 summarizes the transit trip generation.

Table 19: Trip Generation by Transit Mode

Travel Mode	Mode Share	AM Peak Period			PM Peak Period		
		In	Out	Total	In	Out	Total
Transit	Varies	11	20	31	15	13	28

The proposed development is anticipated to generate an additional 31 AM peak hour transit trips and 28 PM peak hour transit trips. Of these trips, 20 outbound AM trips and 13 inbound PM trips are anticipated. From the trip distribution found in Section 5.3, these values can be further broken down.

Site-generated outbound AM trips break down to six trips to the north, three trips to the south, two trips to the east, and nine trips to the west. Site-generated inbound PM trips break down to five trips from the north, two trips each from the south and east, and six trips from the west.

The existing transit routes provide up to 11 buses in the peak direction, which would result in an averaged increase of under two additional riders per bus. Therefore, no service changes are anticipated as being required to accommodate site-generated transit trips.

10.2 Transit Priority

At the intersection of Belanger Avenue/Lamira Street and Bank Street, the site volumes will result in an approximate increase in delay for the southbound through/right-turn of maximum 0.1 seconds, the eastbound movement of maximum 3.3 seconds. No decrease in transit level of service is noted by these impacts.

11 Network Intersection Design

11.1 Network Intersection Control

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

11.2 Network Intersection Design

11.2.1 2026 Future Total Network Intersection Operations

Figure 16 illustrates the 2026 future total volumes and 2026 future total network intersection operations are summarized below in Table 20. The level of service for signalized intersections is based on HCM 2010 v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets have been provided in Appendix H.

Figure 16: 2026 Future Total Volumes

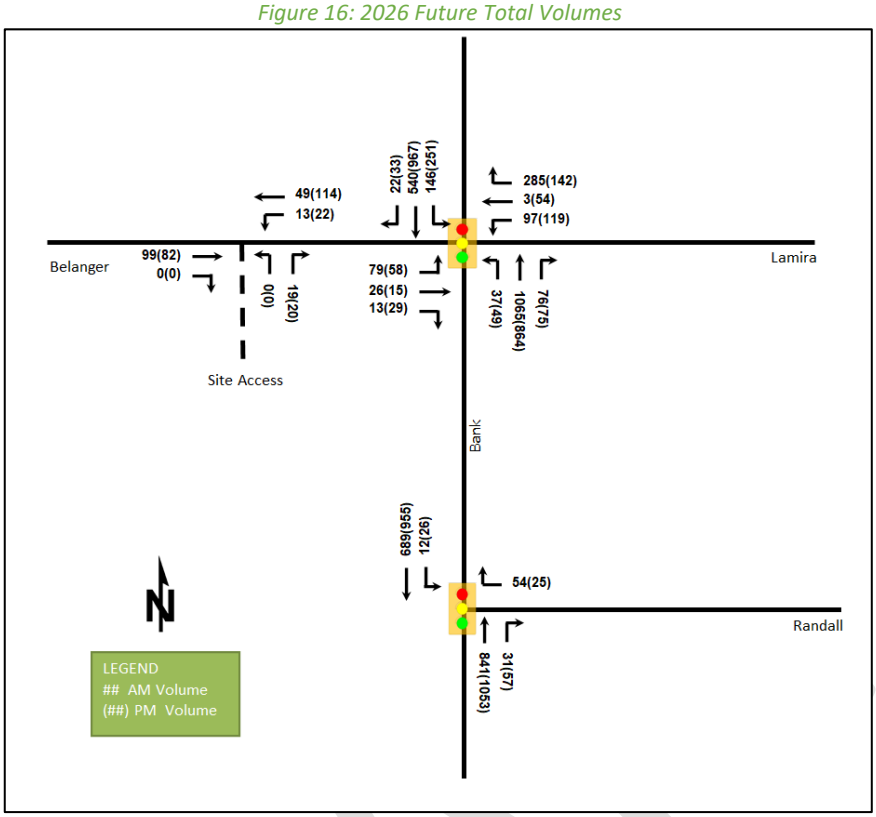


Table 20: 2026 Future Total Network Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Belanger Avenue / Lamira Street *Signalized*	EB	A	0.42	29.2	29.7	A	0.46	29.4	23.5
	WBL/T	A	0.36	30.8	26.1	B	0.66	44.5	42.5
	WBR	A	0.53	7.0	17.3	A	0.36	7.3	12.5
	NBL	A	0.11	14.9	m8.2	A	0.26	24.8	16.6
	NBT/R	D	0.81	26.0	**#155.5**	B	0.68	25.5	**#110.7**
	SBL	B	0.61	24.8	**#30.3**	B	0.61	18.6	**#62.9**
	SBT/R	A	0.30	10.9	39.8	A	0.46	9.9	79.6
	Overall	**B**	**0.67**	**20.3**	-	**B**	**0.67**	**19.4**	-
Bank Street & Randall Avenue *Signalized*	WBR	A	0.10	0.4	0.0	A	0.04	4.3	3.2
	NBT	A	0.45	10.3	51.2	D	0.82	21.8	**#79.3**
	SBL	A	0.04	4.8	m1.8	A	0.23	17.6	7.2
	SBT/R	A	0.35	6.6	21.6	B	0.70	17.9	62.2
	Overall	**A**	**0.32**	**8.3**	-	**A**	**0.41**	**19.8**	-

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00
m = metered queue
# = queue exceeds storage or mid-block length

The intersections for the 2026 future total horizon in the study area generally operate similarly to the 2026 future background conditions during the peak hours. No new capacity issues are noted.

11.2.2 2031 Future Total Network Intersection Operations

Figure 17 illustrates the 2031 future total volumes and the 2031 future total network intersection operations are summarized below in Table 21. The level of service for signalized intersections is based on HCM 2010 v/c calculations for individual lane movements and HCM 2000 v/c calculations for the overall intersection. The synchro worksheets have been provided in Appendix I.

Figure 17: 2031 Future Total Volumes

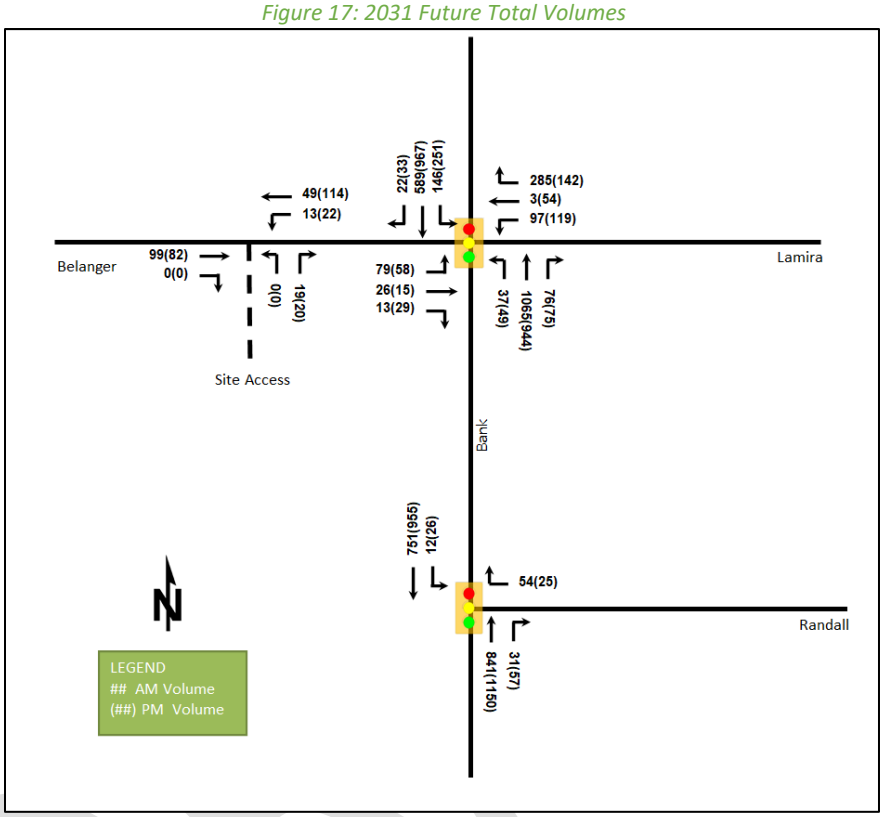


Table 21: 2031 Future Total Network Intersection Operations

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Belanger Avenue / Lamira Street *Signalized*	EB	A	0.42	29.2	29.7	A	0.45	29.4	23.5
	WBL/T	A	0.36	30.8	26.1	B	0.66	44.5	42.5
	WBR	A	0.53	7.0	17.3	A	0.36	7.3	12.5
	NBL	A	0.12	15.1	m8.4	A	0.26	24.8	16.5
	NBT/R	D	0.81	26.0	**#155.5**	C	0.74	27.6	**#127.2**
	SBL	B	0.61	24.8	**#30.3**	B	0.64	22.9	**#70.7**
	SBT/R	A	0.32	11.1	43.6	A	0.46	9.9	79.6
	Overall	**B**	**0.67**	**20.2**	-	**C**	**0.71**	**20.7**	-

Intersection	Lane	AM Peak Hour				PM Peak Hour			
		LOS	V/C	Delay	Q (95th)	LOS	V/C	Delay	Q (95th)
Bank Street & Randall Avenue *Signalized*	WBR	A	0.10	0.4	0.0	A	0.04	5.8	3.8
	NBT	A	0.45	10.3	51.2	D	0.89	26.3	**#100.2**
	SBL	A	0.04	4.8	m1.6	A	0.23	17.6	7.1
	SBT/R	A	0.38	6.7	22.6	B	0.70	17.9	62.2
	Overall	**A**	**0.32**	**8.3**	-	**A**	**0.45**	**22.3**	-

Notes: Saturation flow rate of 1800 veh/h/lane
PHF = 1.00
m = metered queue
# = queue exceeds storage or mid-block length

The intersections for the 2031 future total horizon in the study area operate similarly to the 2031 future background conditions during the peak hours. No new capacity issues are noted.

11.2.3 Network Intersection MMLOS

Table 22 summarizes the MMLOS analysis for the network intersections of Bank Street at Belanger Avenue/Lamira Street and Bank Street at Randall Avenue. The existing and future conditions will be the different and are considered in separate rows. The intersection analysis is based on the policy area of "Within 600 m of a rapid transit station." The MMLOS worksheets has been provided in Appendix G.

Table 22: Study Area Intersection MMLOS Analysis

Intersection	Pedestrian LOS		Bicycle LOS		Transit LOS		Truck LOS		Auto LOS	
	PLOS	Target	BLOS	Target	TLOS	Target	TrLOS	Target	ALOS	Target
Bank Street & Belanger Avenue / Lamira Street (Existing)	F	A	F	A	F	D	-	D	C	E
Bank Street & Belanger Avenue / Lamira Street (Future)	F	A	A	A	F	D	-	D	D	E
Bank Street & Randall Avenue (Existing)	F	A	F	A	C	D	-	D	A	E
Bank Street & Randall Avenue (Future)	E	A	A	A	D	D	-	D	A	E

The pedestrian LOS targets will not be met at the existing or future intersections along Bank Street. As is typical for arterial roads, the crossing distance does not permit the targets to be met, and to meet pedestrian LOS targets, the maximum crossing distance on all pedestrian crossings would need to be reduced to two lane-widths.

The bicycle LOS targets are not met for the existing intersection geometries but will be met once the Bank Street Renewal is complete.

The transit LOS targets will not be met at the existing or future intersections at the intersection of Bank Street at Belanger Avenue/Lamira Street. To meet transit LOS, the delay would need to be reduced to below 30 seconds on all transit approach movements.

11.2.4 Recommended Design Elements

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

12 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 with a total of 3,791 sq. ft. of commercial space and 5,365 sq. ft. of office space
- Accesses is proposed to Belanger Avenue via a full-moves access
- The development is proposed to be completed as a single phase by 2026
- The trip generation, location and safety triggers were met for the TIA Screening
- This report accompanies Official Plan Amendment and Zoning Bylaw Amendment

Existing Conditions

- Bank Street is an arterial road, and Lamira Street is a collector road in the study area
- Sidewalks are provided along both sides on Bank Street, Belanger Avenue, Heron Road, and Ohio Street, and one side on of Randall Avenue, the Transitway access, Clementine Boulevard, Lamira Street, and part of Rockingham Avenue
- A bike lane is provided along Bank Street north of Ohio Street to Riverside Drive, and a cycle track provided along Heron Road, and a multi-use pathway runs along the north side of Riverside Drive westbound
- Bank Street and Heron Road are spine routes, Lamira Street, Belanger Avenue, and Clementine Boulevard south of Belanger Avenue are local routes, Data Centre Road and the MUP north of Riverside Drive are major pathways, and Bank Street north of Heron Road and Heron Road are cross-town bikeways
- The high volumes roadways have produced a high number of collisions at the study area intersections, primarily at the Bank Street at Belanger Avenue/Lamira Street intersection, but also on the segment of Bank Steet between Belanger Avenue and Rockingham Avenue
- The collisions are predominantly turning movement and rear end at the Bank Street at Belanger Avenue/Lamira Street intersection, and predominantly rear end and angled on the segment of Bank Steet between Belanger Avenue and Rockingham Avenue, both locations will be improved through the City's Bank Street Revitalization project in the future
- Some extended queues on the northbound shared through/right-turn movements and southbound left-turn movement are noted at the Bank Street and Belanger Avenue/Lamira Street intersection at peak hours, but generally the intersections operate well

Development Generated Travel Demand

- The proposed development is forecasted produce 77 two-way people trips during the AM peak hour and 90 two-way people trips during the PM peak hour
- Of the forecasted people trips, 30 two-way trips will be vehicle trips during the AM peak hour and 34 two-way trips will be vehicle trips during the PM peak hour based on a higher transit modal share target due to the development being within 700 metres-walk of the Billing's Bridge BRT station
- Of the forecasted trips, 30% are anticipated to travel north, 10% to the east, 45% to the west, and 15% to the south

Background Conditions

- The background growth applied is an annual 1.80% growth on existing Bank Street mainline volumes
- All study area intersections will operate similarly to the existing conditions

TDM

- Supportive TDM measures to be provided as part of the proposed development should include:
    - Display local area maps with walking and cycling routes, and transit route information and schedules at major entrances
    - Provide a multimodal travel option information package to new residents
    - Contract with providers to install on-site bikeshare (or other micromobility, e.g. scootershare) and carshare spaces
    - Inclusion of a 1-year 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

NTM

- The site traffic will account for approximately 14-17% of the total traffic on Belanger Avenue, which is over the local road thresholds in both peak hours, however any site impacts are confined to the short stretch of roadway between the site access and the intersection

Transit

- 20 outbound AM transit trips and 15 inbound PM transit trips are anticipated from the development
- The existing transit routes provide up to 11 buses in the peak direction, which would result in under two passengers increase per bus and no service changes are anticipated as being required to accommodate site-generated transit trips
- At the intersection of Bank Street and Belanger Avenue/Lamira Street, the additional site volumes will result in an approximate increase in delay for the southbound through/right-turn of maximum 0.1 seconds, the eastbound movement of maximum 3.3 seconds. No decrease in transit level of service is noted by these impacts

Network Intersection Design

- Generally, the network intersections at the future total horizons will operate similarly to the background conditions
- The pedestrian LOS targets will not be met at the existing or future intersections along Bank Street as crossing distances are in excess of two lane-widths
- The bicycle LOS targets are not met for the existing intersection geometries but will be met once the Bank Street Renewal is complete
- The transit LOS targets will not be met at the existing or future intersections at the intersection of Bank Street at Belanger Avenue/Lamira Street due to delays in excess of 30 seconds

13 Next Steps

Following the circulation and review of the TIA, any outstanding comments will be documents within the context of the Official Plan Amendment and Zoning Bylaw Amendment in the Step 4 Strategy Report. Once remaining TIA Steps are completed and sign-off has been received from City Transportation Project Manager, a signed and stamped final report will be provided to City staff.

Appendix A

TIA Screening Form and PM Certification Form

13 Markham Avenue
Ottawa ON K2G 3Z1

City of Ottawa 2017 TIA Guidelines
Step 1 - Screening Form

Date: 27-Oct-21
Project Number: 2021-093
Project Reference: 1400 Bank Street

1.1 Description of Proposed Development	
Municipal Address	1400 Bank Street
Description of Location	Ward 17, Southwest corner of the Bank Street and Belanger Avenue/Lamira Street intersection
Land Use Classification	Arterial Mainstreet Zone (AM1 (1913))
Development Size	160 apartment units, 3,791 sq. ft. of commercial space, and 5,365 sq. ft. of office space
Accesses	One full-moves access onto Belange Avenue
Phase of Development	Single Phase
Buildout Year	2026
TIA Requirement	Full TIA Required

1.2 Trip Generation Trigger		
Land Use Type	Townhomes or apartments	
Development Size	160	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?	Yes
Location Trigger	Yes

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

Appendix B

Turning Movement Counts

Transportation Services - Traffic Services

Work Order 34332

Turning Movement Count - Full Study Summary Report

BANK ST @ KILBORN AVE/BELANGER AVE

Survey Date: Wednesday, January 28, 2015

Total Observed U-Turns

Northbound: 73 Southbound: 17
Eastbound: 0 Westbound: 2

AADT Factor 1.00

Full Study

	BANK ST									KILBORN AVE/BELANGER AVE									
	Northbound				Southbound					Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	22	894	59	**975**	83	371	12	**466**	**1441**	51	22	7	**80**	56	2	131	**189**	**269**	**1710**
08:00 09:00	25	1014	78	**1117**	147	456	15	**618**	**1735**	57	19	5	**81**	111	6	291	**408**	**489**	**2224**
09:00 10:00	37	727	59	**823**	95	575	25	**695**	**1518**	45	24	19	**88**	89	18	181	**288**	**376**	**1894**
11:30 12:30	34	741	76	**851**	141	707	22	**870**	**1721**	57	6	14	**77**	114	30	151	**295**	**372**	**2093**
12:30 13:30	22	581	75	**678**	139	711	20	**870**	**1548**	57	15	11	**83**	107	12	154	**273**	**356**	**1904**
15:00 16:00	33	709	63	**805**	187	856	15	**1058**	**1863**	48	12	21	**81**	101	34	171	**306**	**387**	**2250**
16:00 17:00	32	702	75	**809**	246	962	20	**1228**	**2037**	46	15	21	**82**	119	54	139	**312**	**394**	**2431**
17:00 18:00	21	695	77	**793**	216	723	22	**961**	**1754**	51	17	11	**79**	122	25	142	**289**	**368**	**2122**
Sub Total	226	6063	562	**6851**	1254	5361	151	**6766**	**13617**	412	130	109	**651**	819	181	1360	**2360**	**3011**	**16628**
U Turns				**73**				**17**	**90**				**0**				**2**	**2**	**92**
Total	226	6063	562	**6924**	1254	5361	151	**6783**	**13707**	412	130	109	**651**	819	181	1360	**2362**	**3013**	**16720**
EQ 12Hr	314	8428	781	**9624**	1743	7452	210	**9428**	**19052**	573	181	152	**905**	1138	252	1890	**3283**	**4188**	**23240**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	314	8428	781	**9624**	1743	7452	210	**9428**	**19052**	573	181	152	**905**	1138	252	1890	**3283**	**4188**	**23240**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**1.00**						
AVG 24Hr	412	11040	1023	**12608**	2283	9762	275	**12351**	**24959**	750	237	198	**1185**	1491	330	2476	**4301**	**5486**	**30445**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

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

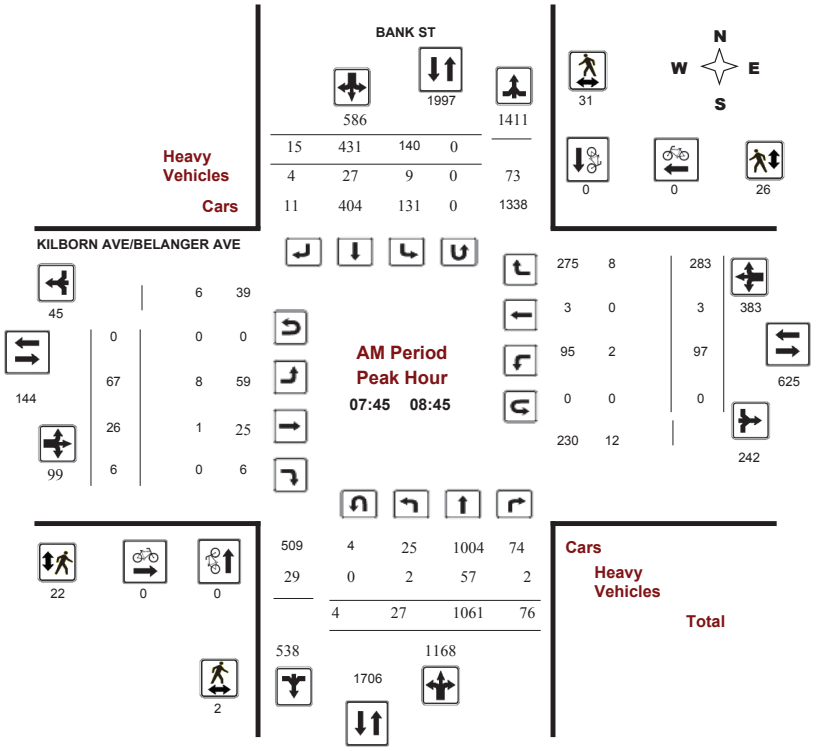
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

BANK ST @ KILBORN AVE/BELANGER AVE

Survey Date: Wednesday, January 28, 2015 **WO No:** 34332

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



Comments

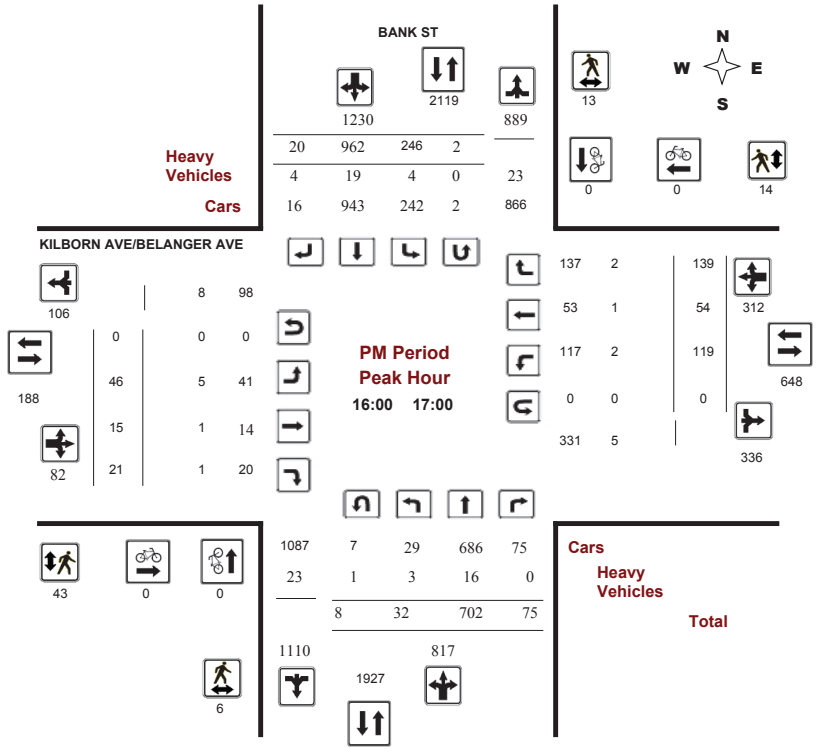
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

BANK ST @ KILBORN AVE/BELANGER AVE

Survey Date: Wednesday, January 28, 2015 **WO No:** 34332

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



Comments

Transportation Services - Traffic Services

Work Order 35034

Turning Movement Count - Full Study Summary Report

BANK ST @ RANDALL AVE

Survey Date: Thursday, July 30, 2015

Total Observed U-Turns

Northbound: 1 Southbound: 0

Eastbound: 0 Westbound: 0

AADT Factor .90

Full Study

	BANK ST								RANDALL AVE									
	Northbound				Southbound				Eastbound				Westbound					
Period	LT	ST	RT	NB TOT	LT	ST	RT	SB TOT	STR TOT	LT	ST	RT	EB TOT	LT	ST	RT	WB TOT	STR TOT	Grand Total
07:00 08:00	0	672	22	**694**	11	456	0	**467**	**1161**	0	0	0	**0**	0	0	43	**43**	**43**	**1204**
08:00 09:00	0	836	26	**862**	12	517	0	**529**	**1391**	0	0	0	**0**	0	0	67	**67**	**67**	**1458**
09:00 10:00	0	791	41	**832**	9	568	0	**577**	**1409**	0	0	0	**0**	0	0	42	**42**	**42**	**1451**
11:30 12:30	0	823	42	**865**	12	644	0	**656**	**1521**	0	0	0	**0**	0	0	31	**31**	**31**	**1552**
12:30 13:30	0	909	52	**961**	30	699	0	**729**	**1690**	0	0	0	**0**	0	0	31	**31**	**31**	**1721**
15:00 16:00	0	841	55	**896**	31	898	0	**929**	**1825**	0	0	0	**0**	0	0	23	**23**	**23**	**1848**
16:00 17:00	0	778	76	**854**	37	914	0	**951**	**1805**	0	0	0	**0**	0	0	34	**34**	**34**	**1839**
17:00 18:00	0	805	80	**885**	24	608	0	**632**	**1517**	0	0	0	**0**	0	0	24	**24**	**24**	**1541**
Sub Total	0	6455	394	**6849**	166	5304	0	**5470**	**12319**	0	0	0	**0**	0	0	295	**295**	**295**	**12614**
U Turns				**1**				**0**	**1**				**0**				**0**	**0**	**1**
Total	0	6455	394	**6850**	166	5304	0	**5470**	**12320**	0	0	0	**0**	0	0	295	**295**	**295**	**12615**
EQ 12Hr	0	8972	548	**9522**	231	7373	0	**7603**	**17125**	0	0	0	**0**	0	0	410	**410**	**410**	**17535**
Note: These values are calculated by multiplying the totals by the appropriate expansion factor.													**1.39**						
AVG 12Hr	0	8075	493	**8569**	208	6635	0	**6843**	**15412**	0	0	0	**0**	0	0	369	**369**	**369**	**15781**
Note: These volumes are calculated by multiplying the Equivalent 12 hr. totals by the AADT factor.													**.90**						
AVG 24Hr	0	10579	646	**11226**	272	8692	0	**8964**	**20190**	0	0	0	**0**	0	0	483	**483**	**483**	**20673**
Note: These volumes are calculated by multiplying the Average Daily 12 hr. totals by 12 to 24 expansion factor.													**1.31**						

Comments:

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

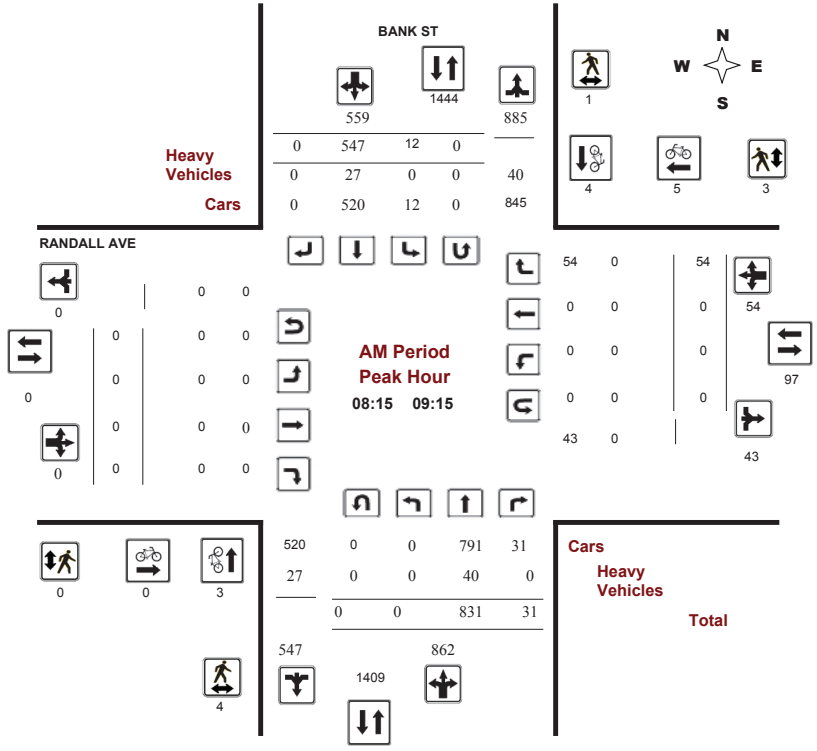
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

BANK ST @ RANDALL AVE

Survey Date: Thursday, July 30, 2015
Start Time: 07:00

WO No: 35034
Device: Jamar Technologies, Inc



Comments

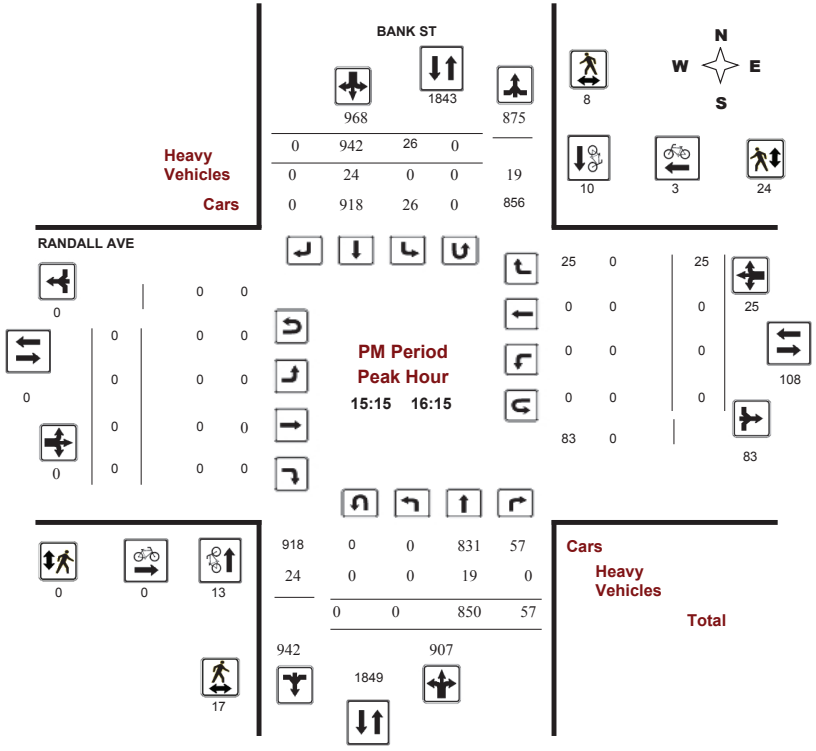
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

BANK ST @ RANDALL AVE

Survey Date: Thursday, July 30, 2015
Start Time: 07:00

WO No: 35034
Device: Jamar Technologies, Inc



Comments

Appendix C

Synchro Intersection Worksheets – Existing Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	26	6	97	3	283	31	1061	76	140	431	15
Future Volume (vph)	67	26	6	97	3	283	31	1061	76	140	431	15
Satd. Flow (prot)	0	1560	0	0	1665	1469	1595	3180	0	1595	3147	0
Flt Permitted		0.692			0.700		0.470			0.091		
Satd. Flow (perm)	0	1096	0	0	1220	1407	776	3180	0	153	3147	0
Satd. Flow (RTOR)		4				314		9			6	
Lane Group Flow (vph)	0	110	0	0	111	314	34	1263	0	156	496	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		22.4			20.4	20.4	39.8	39.8		54.4	54.4	
Actuated g/C Ratio		0.25			0.23	0.23	0.44	0.44		0.60	0.60	
v/c Ratio		0.40			0.40	0.56	0.10	0.90		0.67	0.26	
Control Delay		29.2			31.8	7.2	14.5	31.8		31.0	10.6	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.2			31.8	7.2	14.5	31.8		31.0	10.6	
LOS		C			C	A	B	C		C	B	
Approach Delay		29.2			13.6			31.3			15.5	
Approach LOS		C			B			C			B	
Queue Length 50th (m)		12.9			14.7	0.0	2.8	~139.5		14.2	24.6	
Queue Length 95th (m)		28.3			28.6	17.9	m6.5	#180.1		#39.3	34.7	
Internal Link Dist (m)		168.3			242.0			149.0			322.6	
Turn Bay Length (m)						65.0	60.0			56.5		
Base Capacity (vph)		361			375	650	342	1409		244	1903	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.30			0.30	0.48	0.10	0.90		0.64	0.26	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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

Maximum v/c Ratio: 0.90

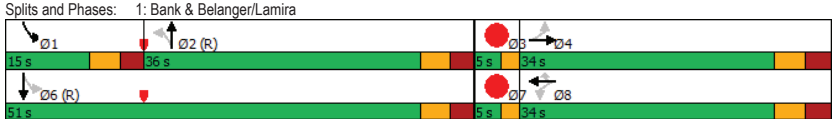
Intersection Signal Delay: 24.0	Intersection LOS: C
Intersection Capacity Utilization 80.4%	ICU Level of Service D
Analysis Period (min) 15	

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

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

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	54	831	31	12	547
Future Volume (vph)	0	54	831	31	12	547
Satd. Flow (prot)	0	1510	3205	0	1658	3221
Flt Permitted					0.258	
Satd. Flow (perm)	0	1484	3205	0	450	3221
Satd. Flow (RTOR)		146	7			
Lane Group Flow (vph)	0	60	957	0	13	608
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	61.0		61.0	61.0
Total Split (%)		32.2%	67.8%		67.8%	67.8%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	54.8		54.8	54.8
Actuated g/C Ratio		0.28	0.61		0.61	0.61
v/c Ratio		0.12	0.49		0.05	0.31
Control Delay		0.5	10.8		5.0	6.5
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		0.5	10.8		5.0	6.5
LOS		A	B		A	A
Approach Delay	0.5		10.8			6.5
Approach LOS	A		B			A
Queue Length 50th (m)		0.0	43.8		0.6	15.8
Queue Length 95th (m)		0.0	58.0		m2.0	20.4
Internal Link Dist (m)	292.7		258.7			149.0
Turn Bay Length (m)					67.5	
Base Capacity (vph)		517	1954		274	1961
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.12	0.49		0.05	0.31

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 72 (80%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
2: Bank & Randall

09/14/2021

Maximum v/c Ratio: 0.49

Intersection Signal Delay: 8.8	Intersection LOS: A
Intersection Capacity Utilization 54.6%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira

09/14/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	15	21	119	54	139	40	702	75	248	962	20
Future Volume (vph)	46	15	21	119	54	139	40	702	75	248	962	20
Satd. Flow (prot)	0	1532	0	0	1688	1483	1537	3256	0	1658	3290	0
Flt Permitted		0.670			0.772		0.262			0.177		
Satd. Flow (perm)	0	1049	0	0	1342	1447	418	3256	0	308	3290	0
Satd. Flow (RTOR)		20				154		13			3	
Lane Group Flow (vph)	0	91	0	0	192	154	44	863	0	276	1091	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		18.8			18.8	18.8	36.1	36.1		58.0	58.0	
Actuated g/C Ratio		0.21			0.21	0.21	0.40	0.40		0.64	0.64	
v/c Ratio		0.39			0.69	0.36	0.26	0.66		0.63	0.51	
Control Delay		27.1			44.5	6.9	26.3	25.7		19.2	11.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		27.1			44.5	6.9	26.3	25.7		19.2	11.0	
LOS		C			D	A	C	C		B	B	
Approach Delay		27.1			27.8			25.7			12.6	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		10.5			30.8	0.0	5.0	61.5		17.5	45.3	
Queue Length 95th (m)		21.4			46.9	13.1	15.4	91.8		#69.0	90.2	
Internal Link Dist (m)		168.3			242.0			148.8			322.6	
Turn Bay Length (m)						65.0	60.0			56.5		
Base Capacity (vph)		336			413	551	167	1314		437	2119	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.27			0.46	0.28	0.26	0.66		0.63	0.51	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

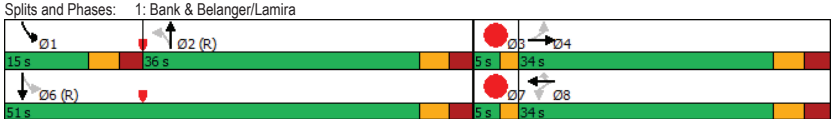
Intersection Summary

Maximum v/c Ratio: 0.69

Intersection Signal Delay: 19.4	Intersection LOS: B
Intersection Capacity Utilization 70.2%	ICU Level of Service C
Analysis Period (min) 15	

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

Splits and Phases: 1: Bank & Belanger/Lamira



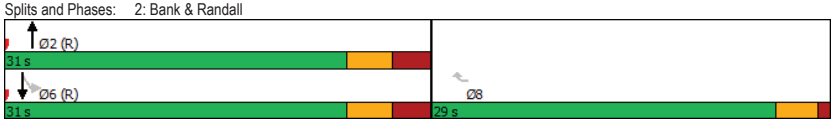
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	25	850	57	26	942
Future Volume (vph)	0	25	850	57	26	942
Satd. Flow (prot)	0	1510	3273	0	1658	3316
Flt Permitted					0.187	
Satd. Flow (perm)	0	1480	3273	0	324	3316
Satd. Flow (RTOR)		43	14			
Lane Group Flow (vph)	0	28	1007	0	29	1047
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	31.0		31.0	31.0
Total Split (%)		48.3%	51.7%		51.7%	51.7%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	24.8		24.8	24.8
Actuated g/C Ratio		0.42	0.41		0.41	0.41
v/c Ratio		0.04	0.74		0.22	0.76
Control Delay		3.0	18.7		16.5	19.6
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		3.0	18.7		16.5	19.6
LOS		A	B		B	B
Approach Delay	3.0		18.7			19.6
Approach LOS	A		B			B
Queue Length 50th (m)		0.0	46.5		2.0	49.7
Queue Length 95th (m)		2.7	66.4		7.5	70.5
Internal Link Dist (m)	292.7		258.7			148.8
Turn Bay Length (m)					67.5	
Base Capacity (vph)		641	1361		133	1370
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.04	0.74		0.22	0.76

Intersection Summary
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 29 (48%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 18.9	Intersection LOS: B
Intersection Capacity Utilization 56.2%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 2: Bank & Randall



Appendix D

Collision Data

Accident Date	Accident Year	Accident Time	Location	Environment Condition	Light	Traffic Control	Traffic Control Condition	Classification Of Accident	Initial Impact Type	Road Surface Condition
4/28/2015	2015	17:12	BANK ST @ ROCKINGHAM AVE	01 - Clear	01 - Daylight	02 - Stop sign		02 - Non-fatal injury	02 - Angle	01 - Dry
1/7/2015	2015	15:31	BANK ST @ ROCKINGHAM AVE	03 - Snow	01 - Daylight	02 - Stop sign		03 - P.D. only	99 - Other	06 - Ice
2/17/2016	2016	15:30	BANK ST @ ROCKINGHAM AVE	01 - Clear	01 - Daylight	02 - Stop sign		03 - P.D. only	03 - Rear end	02 - Wet
3/4/2015	2015	13:29	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	02 - Angle	01 - Dry
1/6/2015	2015	22:39	BANK ST @ KILBORN AVE/BELANGER AVE	03 - Snow	07 - Dark	01 - Traffic signal		02 - Non-fatal injury	03 - Rear end	03 - Loose snow
4/12/2015	2015	17:00	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	03 - Rear end	01 - Dry
3/30/2015	2015	21:09	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	07 - Dark	01 - Traffic signal		03 - P.D. only	99 - Other	01 - Dry
3/17/2015	2015	7:59	BANK ST @ KILBORN AVE/BELANGER AVE	02 - Rain	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	02 - Wet
3/20/2015	2015	13:18	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	01 - Dry
4/2/2015	2015	20:06	BANK ST @ KILBORN AVE/BELANGER AVE	02 - Rain	07 - Dark	01 - Traffic signal		03 - P.D. only	05 - Turning movement	02 - Wet
6/5/2015	2015	14:38	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
2/28/2015	2015	14:43	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	02 - Angle	01 - Dry
6/29/2015	2015	16:22	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
9/12/2015	2015	10:45	BANK ST @ KILBORN AVE/BELANGER AVE	02 - Rain	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	02 - Wet
12/4/2015	2015	13:42	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
11/20/2015	2015	9:13	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
9/1/2016	2016	11:46	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	02 - Angle	01 - Dry
10/6/2016	2016	12:05	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	03 - Rear end	01 - Dry
9/26/2016	2016	5:41	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	07 - Dark	01 - Traffic signal		02 - Non-fatal injury	02 - Angle	01 - Dry
8/12/2016	2016	14:51	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
8/12/2016	2016	14:51	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
6/3/2016	2016	7:03	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
5/13/2017	2017	13:54	BANK ST @ KILBORN AVE/BELANGER AVE	02 - Rain	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	02 - Wet
11/22/2017	2017	10:49	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	05 - Turning movement	02 - Wet
2/14/2017	2017	18:03	BANK ST @ KILBORN AVE/BELANGER AVE	03 - Snow	07 - Dark	01 - Traffic signal		03 - P.D. only	05 - Turning movement	03 - Loose snow
1/1/2017	2017	11:41	BANK ST @ KILBORN AVE/BELANGER AVE	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	99 - Other	02 - Wet
3/1/2017	2017	8:36	BANK ST @ KILBORN AVE/BELANGER AVE	02 - Rain	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	05 - Turning movement	02 - Wet
1/14/2018	2018	12:21	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	05 - Turning movement	02 - Wet
2/7/2018	2018	17:20	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	03 - Snow	05 - Dusk	01 - Traffic signal		03 - P.D. only	05 - Turning movement	03 - Loose snow
2/14/2018	2018	21:50	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	07 - Dark	01 - Traffic signal		02 - Non-fatal injury	07 - SMV other	01 - Dry
5/31/2018	2018	13:32	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	07 - SMV other	01 - Dry
7/5/2018	2018	15:20	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	07 - SMV other	01 - Dry
8/1/2018	2018	17:19	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	01 - Dry
8/7/2018	2018	12:46	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		02 - Non-fatal injury	07 - SMV other	01 - Dry
10/18/2018	2018	16:12	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	99 - Other	01 - Dry
10/30/2018	2018	16:10	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	04 - Sideswipe	01 - Dry
10/27/2018	2018	15:04	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	03 - Rear end	01 - Dry
1/14/2019	2019	10:58	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	02 - Angle	01 - Dry
7/18/2019	2019	14:15	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	01 - Dry
8/30/2019	2019	15:15	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	01 - Clear	01 - Daylight	01 - Traffic signal		03 - P.D. only	05 - Turning movement	01 - Dry
10/3/2019	2019	20:16	BANK ST @ KILBORN AVE/BELANGER AVE (0007208)	02 - Rain	07 - Dark	01 - Traffic signal		02 - Non-fatal injury	05 - Turning movement	02 - Wet
9/11/2019	2019	16:16	BANK ST @ OHIO ST (0002239)	01 - Clear	01 - Daylight	02 - Stop sign		03 - P.D. only	99 - Other	01 - Dry
1/27/2015	2015	11:00	BANK ST btwn OHIO ST & BELANGER AVE	01 - Clear	01 - Daylight	10 - No control		02 - Non-fatal injury	07 - SMV other	01 - Dry
8/27/2015	2015	17:40	BANK ST btwn OHIO ST & BELANGER AVE	01 - Clear	01 - Daylight	10 - No control		02 - Non-fatal injury	03 - Rear end	01 - Dry
2/25/2016	2016	1:54	BANK ST btwn OHIO ST & BELANGER AVE	02 - Rain	07 - Dark	10 - No control		02 - Non-fatal injury	07 - SMV other	04 - Slush
3/18/2019	2019	9:02	BANK ST btwn OHIO ST & BELANGER AVE (__3ZA3BQ)	01 - Clear	01 - Daylight	10 - No control		02 - Non-fatal injury	03 - Rear end	01 - Dry
1/26/2016	2016	13:33	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
5/23/2017	2017	11:48	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	04 - Sideswipe	01 - Dry
5/10/2017	2017	16:00	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
3/26/2017	2017	13:55	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	02 - Rain	01 - Daylight	10 - No control		03 - P.D. only	02 - Angle	03 - Loose snow
1/26/2016	2016	13:33	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
5/23/2017	2017	11:48	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	04 - Sideswipe	01 - Dry
5/10/2017	2017	16:00	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
3/26/2017	2017	13:55	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE	02 - Rain	01 - Daylight	10 - No control		03 - P.D. only	02 - Angle	03 - Loose snow
1/23/2019	2019	18:30	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE (__3ZBOEG)	03 - Snow	07 - Dark	10 - No control		03 - P.D. only	02 - Angle	04 - Slush
12/2/2019	2019	17:28	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE (__3ZBOEG)	01 - Clear	07 - Dark	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
1/23/2019	2019	18:30	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE (__3ZBOEG)	03 - Snow	07 - Dark	10 - No control		03 - P.D. only	02 - Angle	04 - Slush
12/2/2019	2019	17:28	BANK ST btwn BELANGER AVE & ROCKINGHAM AVE (__3ZBOEG)	01 - Clear	07 - Dark	10 - No control		03 - P.D. only	03 - Rear end	01 - Dry
4/29/2015	2015	8:30	BELANGER AVE btwn CLEMENTINE BLVD & BANK ST	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	02 - Angle	01 - Dry
2/29/2016	2016	13:05	BELANGER AVE btwn CLEMENTINE BLVD & BANK ST	01 - Clear	01 - Daylight	10 - No control		03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
2/25/2017	2017	16:30	BELANGER AVE btwn CLEMENTINE BLVD & BANK ST	02 - Rain	01 - Daylight	10 - No control		03 - P.D. only	06 - SMV unattended vehicle	02 - Wet
11/13/2018	2018	14:15	BELANGER AVE btwn CLEMENTINE BLVD & BANK ST (__3ZBOUA)	03 - Snow	01 - Daylight	10 - No control		03 - P.D. only	06 - SMV unattended vehicle	02 - Wet

Appendix E

Synchro Intersection Worksheets – 2026 Future Background Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	26	6	97	3	285	31	1066	76	146	540	15
Future Volume (vph)	67	26	6	97	3	285	31	1066	76	146	540	15
Satd. Flow (prot)	0	1561	0	0	1665	1469	1595	3180	0	1595	3156	0
Flt Permitted		0.718			0.661		0.444			0.103		
Satd. Flow (perm)	0	1138	0	0	1152	1407	734	3180	0	173	3156	0
Satd. Flow (RTOR)		4				285		9			4	
Lane Group Flow (vph)	0	99	0	0	100	285	31	1142	0	146	555	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		22.3			20.3	20.3	40.1	40.1		54.5	54.5	
Actuated g/C Ratio		0.25			0.23	0.23	0.45	0.45		0.61	0.61	
v/c Ratio		0.35			0.39	0.53	0.10	0.80		0.61	0.29	
Control Delay		27.7			31.6	7.0	14.5	25.9		24.7	10.8	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		27.7			31.6	7.0	14.5	25.9		24.7	10.8	
LOS		C			C	A	B	C		C	B	
Approach Delay		27.7			13.4			25.6			13.7	
Approach LOS		C			B			C			B	
Queue Length 50th (m)		11.4			13.2	0.0	2.6	~116.2		13.0	28.3	
Queue Length 95th (m)		25.7			26.4	17.3	m6.8	#155.7		#30.3	39.3	
Internal Link Dist (m)		168.3			242.0			148.9			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		375			354	630	326	1420		255	1914	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.26			0.28	0.45	0.10	0.80		0.57	0.29	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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

Maximum v/c Ratio: 0.80

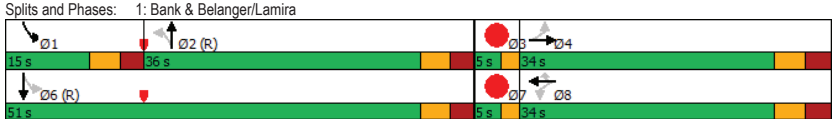
Intersection Signal Delay: 20.2	Intersection LOS: C
Intersection Capacity Utilization 80.6%	ICU Level of Service D
Analysis Period (min) 15	

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

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

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	54	836	31	12	682
Future Volume (vph)	0	54	836	31	12	682
Satd. Flow (prot)	0	1510	3205	0	1658	3221
Flt Permitted					0.293	
Satd. Flow (perm)	0	1484	3205	0	510	3221
Satd. Flow (RTOR)		178	7			
Lane Group Flow (vph)	0	54	867	0	12	682
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	61.0		61.0	61.0
Total Split (%)		32.2%	67.8%		67.8%	67.8%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	54.8		54.8	54.8
Actuated g/C Ratio		0.28	0.61		0.61	0.61
v/c Ratio		0.10	0.44		0.04	0.35
Control Delay		0.4	10.2		4.8	6.4
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		0.4	10.2		4.8	6.4
LOS		A	B		A	A
Approach Delay	0.4		10.2			6.3
Approach LOS	A		B			A
Queue Length 50th (m)		0.0	38.2		0.5	16.0
Queue Length 95th (m)		0.0	50.7		m1.7	20.4
Internal Link Dist (m)	292.7		258.7			148.9
Turn Bay Length (m)					67.5	
Base Capacity (vph)		540	1954		310	1961
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.10	0.44		0.04	0.35

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 72 (80%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
2: Bank & Randall

09/14/2021

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 8.2	Intersection LOS: A
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira

09/14/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	15	21	119	54	142	40	866	75	251	969	20
Future Volume (vph)	46	15	21	119	54	142	40	866	75	251	969	20
Satd. Flow (prot)	0	1530	0	0	1688	1483	1537	3265	0	1658	3290	0
Flt Permitted		0.713			0.774		0.290			0.156		
Satd. Flow (perm)	0	1115	0	0	1346	1447	461	3265	0	271	3290	0
Satd. Flow (RTOR)		20				142		11			3	
Lane Group Flow (vph)	0	82	0	0	173	142	40	941	0	251	989	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		17.8			17.8	17.8	37.8	37.8		59.0	59.0	
Actuated g/C Ratio		0.20			0.20	0.20	0.42	0.42		0.66	0.66	
v/c Ratio		0.35			0.65	0.35	0.21	0.68		0.61	0.46	
Control Delay		26.1			43.7	7.3	23.4	25.8		18.8	9.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		26.1			43.7	7.3	23.4	25.8		18.8	9.9	
LOS		C			D	A	C	C		B	A	
Approach Delay		26.1			27.3			25.7			11.7	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		9.3			28.0	0.0	4.3	66.7		14.7	36.8	
Queue Length 95th (m)		19.1			42.3	12.5	13.6	#111.1		#63.5	78.3	
Internal Link Dist (m)		168.3			242.0			149.1			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		357			414	543	193	1377		413	2157	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.23			0.42	0.26	0.21	0.68		0.61	0.46	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

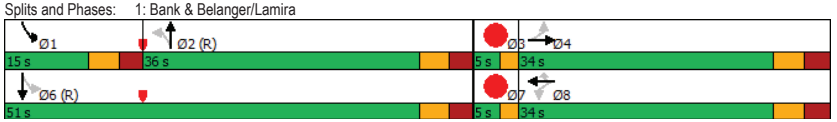
Intersection Summary

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 19.3	Intersection LOS: B
Intersection Capacity Utilization 74.1%	ICU Level of Service D
Analysis Period (min) 15	

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	25	1046	57	26	949
Future Volume (vph)	0	25	1046	57	26	949
Satd. Flow (prot)	0	1510	3278	0	1658	3316
Flt Permitted					0.161	
Satd. Flow (perm)	0	1480	3278	0	279	3316
Satd. Flow (RTOR)		30	11			
Lane Group Flow (vph)	0	25	1103	0	26	949
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	31.0		31.0	31.0
Total Split (%)		48.3%	51.7%		51.7%	51.7%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	24.8		24.8	24.8
Actuated g/C Ratio		0.42	0.41		0.41	0.41
v/c Ratio		0.04	0.81		0.23	0.69
Control Delay		4.3	21.5		17.6	17.8
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		4.3	21.5		17.6	17.8
LOS		A	C		B	B
Approach Delay	4.3		21.5			17.7
Approach LOS	A		C			B
Queue Length 50th (m)		0.0	53.3		1.8	43.1
Queue Length 95th (m)		3.2	#77.4		7.2	61.6
Internal Link Dist (m)	292.7		258.7			149.1
Turn Bay Length (m)					67.5	
Base Capacity (vph)		634	1361		115	1370
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.04	0.81		0.23	0.69

Intersection Summary

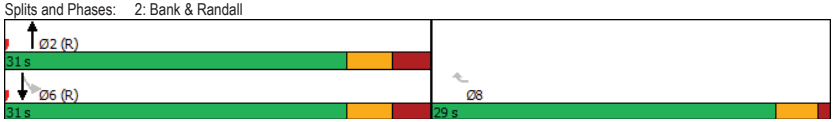
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 29 (48%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 19.6	Intersection LOS: B
Intersection Capacity Utilization 61.9%	ICU Level of Service B
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall



Appendix F

Synchro Intersection Worksheets – 2031 Future Background Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	67	26	6	97	3	285	31	1066	76	146	589	15
Future Volume (vph)	67	26	6	97	3	285	31	1066	76	146	589	15
Satd. Flow (prot)	0	1561	0	0	1665	1469	1595	3180	0	1595	3158	0
Flt Permitted		0.718			0.661		0.423			0.103		
Satd. Flow (perm)	0	1138	0	0	1152	1407	700	3180	0	173	3158	0
Satd. Flow (RTOR)		4				285		9			4	
Lane Group Flow (vph)	0	99	0	0	100	285	31	1142	0	146	604	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		22.3			20.3	20.3	40.1	40.1		54.5	54.5	
Actuated g/C Ratio		0.25			0.23	0.23	0.45	0.45		0.61	0.61	
v/c Ratio		0.35			0.39	0.53	0.10	0.80		0.61	0.32	
Control Delay		27.7			31.6	7.0	14.6	25.9		24.7	11.0	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		27.7			31.6	7.0	14.6	25.9		24.7	11.0	
LOS		C			C	A	B	C		C	B	
Approach Delay		27.7			13.4			25.6			13.7	
Approach LOS		C			B			C			B	
Queue Length 50th (m)		11.4			13.2	0.0	2.6	~116.2		13.0	31.4	
Queue Length 95th (m)		25.7			26.4	17.3	m6.9	#155.7		#30.3	43.2	
Internal Link Dist (m)		168.3			242.0			148.9			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		375			354	630	311	1420		255	1915	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.26			0.28	0.45	0.10	0.80		0.57	0.32	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira 09/14/2021

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

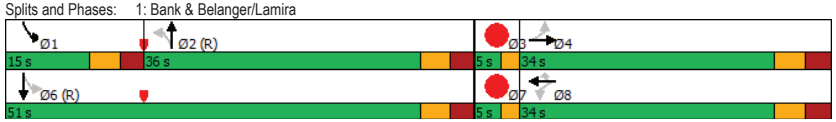
Intersection Summary

Maximum v/c Ratio: 0.80

Intersection Signal Delay: 20.0	Intersection LOS: C
Intersection Capacity Utilization 80.6%	ICU Level of Service D
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	54	836	31	12	744
Future Volume (vph)	0	54	836	31	12	744
Satd. Flow (prot)	0	1510	3205	0	1658	3221
Flt Permitted					0.293	
Satd. Flow (perm)	0	1484	3205	0	510	3221
Satd. Flow (RTOR)		178	7			
Lane Group Flow (vph)	0	54	867	0	12	744
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	61.0		61.0	61.0
Total Split (%)		32.2%	67.8%		67.8%	67.8%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	54.8		54.8	54.8
Actuated g/C Ratio		0.28	0.61		0.61	0.61
v/c Ratio		0.10	0.44		0.04	0.38
Control Delay		0.4	10.2		4.7	6.5
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		0.4	10.2		4.7	6.5
LOS		A	B		A	A
Approach Delay	0.4		10.2			6.4
Approach LOS	A		B			A
Queue Length 50th (m)		0.0	38.2		0.5	17.1
Queue Length 95th (m)		0.0	50.7		m1.6	21.5
Internal Link Dist (m)	292.7		258.7			148.9
Turn Bay Length (m)					67.5	
Base Capacity (vph)		540	1954		310	1961
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.10	0.44		0.04	0.38

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 72 (80%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
2: Bank & Randall

09/14/2021

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 8.2	Intersection LOS: A
Intersection Capacity Utilization 54.8%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira

09/14/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	46	15	21	119	54	142	40	946	75	251	969	20
Future Volume (vph)	46	15	21	119	54	142	40	946	75	251	969	20
Satd. Flow (prot)	0	1530	0	0	1688	1483	1537	3269	0	1658	3290	0
Flt Permitted		0.713			0.774		0.290			0.127		
Satd. Flow (perm)	0	1115	0	0	1346	1447	461	3269	0	221	3290	0
Satd. Flow (RTOR)		20				142		10			3	
Lane Group Flow (vph)	0	82	0	0	173	142	40	1021	0	251	989	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		17.8			17.8	17.8	37.7	37.7		59.0	59.0	
Actuated g/C Ratio		0.20			0.20	0.20	0.42	0.42		0.66	0.66	
v/c Ratio		0.35			0.65	0.35	0.21	0.74		0.64	0.46	
Control Delay		26.1			43.7	7.3	23.4	27.8		23.3	9.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		26.1			43.7	7.3	23.4	27.8		23.3	9.9	
LOS		C			D	A	C	C		C	A	
Approach Delay		26.1			27.3			27.6			12.6	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		9.3			28.0	0.0	4.3	75.2		18.0	36.8	
Queue Length 95th (m)		19.1			42.3	12.5	13.6	#127.5		#71.1	78.3	
Internal Link Dist (m)		168.3			242.0			149.0			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		357			414	543	193	1373		391	2157	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.23			0.42	0.26	0.21	0.74		0.64	0.46	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

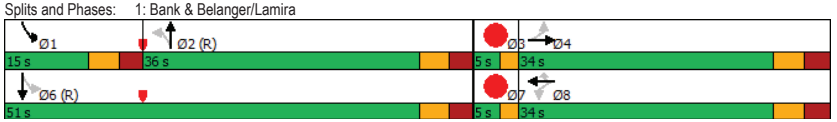
Intersection Summary

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 20.6	Intersection LOS: C
Intersection Capacity Utilization 76.4%	ICU Level of Service D
Analysis Period (min) 15	

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	25	1143	57	26	949
Future Volume (vph)	0	25	1143	57	26	949
Satd. Flow (prot)	0	1510	3283	0	1658	3316
Flt Permitted					0.161	
Satd. Flow (perm)	0	1480	3283	0	280	3316
Satd. Flow (RTOR)		22	10			
Lane Group Flow (vph)	0	25	1200	0	26	949
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	31.0		31.0	31.0
Total Split (%)		48.3%	51.7%		51.7%	51.7%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	24.8		24.8	24.8
Actuated g/C Ratio		0.42	0.41		0.41	0.41
v/c Ratio		0.04	0.88		0.23	0.69
Control Delay		5.6	25.9		17.6	17.8
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		5.6	25.9		17.6	17.8
LOS		A	C		B	B
Approach Delay	5.6		25.9			17.7
Approach LOS	A		C			B
Queue Length 50th (m)		0.2	60.8		1.8	43.1
Queue Length 95th (m)		3.7	#99.2		7.1	61.6
Internal Link Dist (m)	292.7		258.7			149.0
Turn Bay Length (m)					67.5	
Base Capacity (vph)		629	1362		115	1370
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.04	0.88		0.23	0.69

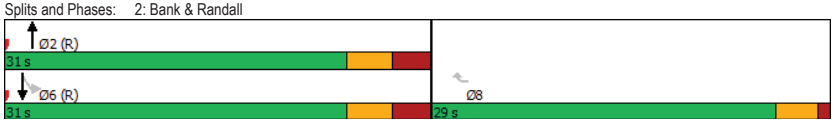
Intersection Summary
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 29 (48%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 22.1	Intersection LOS: C
Intersection Capacity Utilization 64.7%	ICU Level of Service C
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall



Appendix G

MMLOS Analysis

Multi-Modal Level of Service - Intersections Form

Consultant	CGH Transportation Inc.	**Project**	1400 BankStreet
Scenario	Existing/Future	**Date**	9/14/2021
Comments			

	INTERSECTIONS	Bank Street at Belanger Avenue/ Lamira Street				Bank Street at Randall Avenue				Bank Street at Belanger Avenue/ Lamira Street (future)				Bank Street at Randall Avenue (future)			
	Crossing Side	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Pedestrian	Lanes	7	8	6	4	6	7	3		6	5	4	3	5	5	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	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	Median > 2.4 m	No Median - 2.4 m	
	Conflicting Left Turns	Permissive	Permissive	Protected/ Permissive	Permissive	No left turn / Prohib.	No left turn / Prohib.	Permissive		Permissive	Permissive	Permissive	Permissive	No left turn / Prohib.	No left turn / Prohib.	Permissive	
	Conflicting Right Turns	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	No right turn	Permissive or yield control		Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	Permissive or yield control	No right turn	Permissive or yield control	
	Right Turns on Red (RToR) ?	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed	RTOR allowed		RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR prohibited	RTOR allowed	
	Ped Signal Leading Interval?	No	No	Yes	Yes	No	No	No		No	No	Yes	Yes	No	No	No	
	Right Turn Channel	No Channel	No Channel	No Channel	Conventional with Receiving Lane	No Channel	No Right Turn	No Channel		No Channel	No Channel	No Channel	No Channel	No Channel	No Right Turn	No Channel	
	Corner Radius	15-25m	3-5m	10-15m	10-15m	15-25m	No Right Turn	10-15m		15-25m	5-10m	10-15m	10-15m	15-25m	No Right Turn	10-15m	
	Crosswalk Type	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Zebra stripe hi-vis markings	Std transverse markings	Std transverse markings	Std transverse markings		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	5	-7	25	59	26	33	70		24	44	61	78	49	69	73	
	Ped. Exposure to Traffic LoS	F	F	F	D	F	E	C	-	F	E	C	B	D	C	C	-
	Cycle Length	90	90	90	90	90	90	90		90	90	90	90	90	90	90	
	Effective Walk Time	16	16	14	29	7	7	41		16	16	14	29	7	7	41	
	Average Pedestrian Delay	30	30	32	21	38	38	13		30	30	32	21	38	38	13	
	Pedestrian Delay LoS	D	D	D	C	D	D	B	-	D	D	D	C	D	D	B	-
	Level of Service	F	F	F	D	F	E	C	-	F	E	D	C	D	D	C	-
		F				F				F				D			
	Approach From	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST	NORTH	SOUTH	EAST	WEST
Bicycle	Bicycle Lane Arrangement on Approach	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic		Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	Curb Bike Lane, Cycletrack or MUP	
	Right Turn Lane Configuration			≤ 50 m						Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
	Right Turning Speed			>25 km/h						Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
	Cyclist relative to RT motorists	-	-	E	-	-	-	-	-	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	-
	Separated or Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	Mixed Traffic	-	Separated	Separated	Separated	Separated	Separated	Separated	Separated	-
	Left Turn Approach	≥ 2 lanes crossed	≥ 2 lanes crossed	One lane crossed	No lane crossed	≥ 2 lanes crossed		No lane crossed		2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	2-stage, LT box	
	Operating Speed	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h		> 50 to < 60 km/h		> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	> 50 to < 60 km/h	
	Left Turning Cyclist	F	F	E	C	F	-	C	-	A	A	A	A	A	A	A	-
	Level of Service	-	-	E	-	-	-	-	-	A	A	A	A	A	A	A	-
		E				-				A				A			
Transit	Average Signal Delay	≤ 40 sec	≤ 40 sec	≤ 10 sec	> 40 sec	≤ 20 sec	≤ 20 sec			≤ 30 sec	≤ 40 sec	> 40 sec	≤ 40 sec	≤ 20 sec			
	Level of Service	E	E	B	F	C	C	-	-	D	E	F	E	C	-	-	-
		F				C				F				C			
Truck	Effective Corner Radius																
	Number of Receiving Lanes on Departure from Intersection																
	Level of Service	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		-				-				-				-			
Auto	Volume to Capacity Ratio	0.71 - 0.80				0.0 - 0.60				0.81 - 0.90				0.0 - 0.60			
	Level of Service	C				A				D				A			

Appendix H

Synchro Intersection Worksheets – 2026 Future Total Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	26	13	97	3	285	37	1065	76	146	540	22
Future Volume (vph)	79	26	13	97	3	285	37	1065	76	146	540	22
Satd. Flow (prot)	0	1553	0	0	1665	1469	1595	3180	0	1595	3140	0
Flt Permitted		0.699			0.693		0.441			0.103		
Satd. Flow (perm)	0	1101	0	0	1207	1407	729	3180	0	173	3140	0
Satd. Flow (RTOR)		7				285		9			6	
Lane Group Flow (vph)	0	118	0	0	100	285	37	1141	0	146	562	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		22.4			20.4	20.4	39.9	39.9		54.4	54.4	
Actuated g/C Ratio		0.25			0.23	0.23	0.44	0.44		0.60	0.60	
v/c Ratio		0.42			0.36	0.53	0.11	0.81		0.61	0.30	
Control Delay		29.2			30.8	7.0	14.9	26.0		24.8	10.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.2			30.8	7.0	14.9	26.0		24.8	10.9	
LOS		C			C	A	B	C		C	B	
Approach Delay		29.2			13.2			25.6			13.8	
Approach LOS		C			B			C			B	
Queue Length 50th (m)		13.6			13.1	0.0	3.3	~115.7		13.0	28.7	
Queue Length 95th (m)		29.7			26.1	17.3	m8.2	#155.5		#30.3	39.8	
Internal Link Dist (m)		168.3			242.0			149.3			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		364			371	630	323	1414		254	1899	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.32			0.27	0.45	0.11	0.81		0.57	0.30	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira 11/18/2021

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

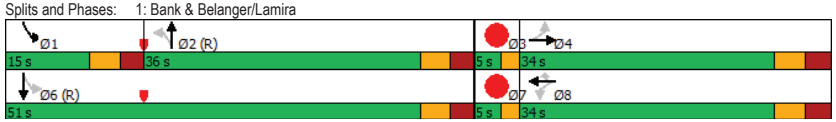
Intersection Summary

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 20.3	Intersection LOS: C
Intersection Capacity Utilization 80.6%	ICU Level of Service D
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	54	841	31	12	689
Future Volume (vph)	0	54	841	31	12	689
Satd. Flow (prot)	0	1510	3205	0	1658	3221
Flt Permitted					0.291	
Satd. Flow (perm)	0	1484	3205	0	507	3221
Satd. Flow (RTOR)		176	7			
Lane Group Flow (vph)	0	54	872	0	12	689
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	61.0		61.0	61.0
Total Split (%)		32.2%	67.8%		67.8%	67.8%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	54.8		54.8	54.8
Actuated g/C Ratio		0.28	0.61		0.61	0.61
v/c Ratio		0.10	0.45		0.04	0.35
Control Delay		0.4	10.3		4.8	6.6
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		0.4	10.3		4.8	6.6
LOS		A	B		A	A
Approach Delay	0.4		10.3			6.5
Approach LOS	A		B			A
Queue Length 50th (m)		0.0	38.5		0.5	17.0
Queue Length 95th (m)		0.0	51.2		m1.8	21.6
Internal Link Dist (m)	292.7		258.7			149.3
Turn Bay Length (m)					67.5	
Base Capacity (vph)		539	1954		308	1961
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.10	0.45		0.04	0.35

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 72 (80%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
2: Bank & Randall

11/18/2021

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 8.3	Intersection LOS: A
Intersection Capacity Utilization 54.9%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira

11/18/2021

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	15	29	119	54	142	49	864	75	251	967	33
Future Volume (vph)	58	15	29	119	54	142	49	864	75	251	967	33
Satd. Flow (prot)	0	1523	0	0	1688	1483	1537	3265	0	1658	3274	0
Flt Permitted		0.673			0.765		0.287			0.158		
Satd. Flow (perm)	0	1048	0	0	1330	1447	450	3265	0	275	3274	0
Satd. Flow (RTOR)		23				142		11			5	
Lane Group Flow (vph)	0	102	0	0	173	142	49	939	0	251	1000	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		17.7			17.7	17.7	38.0	38.0		59.1	59.1	
Actuated g/C Ratio		0.20			0.20	0.20	0.42	0.42		0.66	0.66	
v/c Ratio		0.46			0.66	0.36	0.26	0.68		0.61	0.46	
Control Delay		29.4			44.5	7.3	24.8	25.5		18.6	9.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.4			44.5	7.3	24.8	25.5		18.6	9.9	
LOS		C			D	A	C	C		B	A	
Approach Delay		29.4			27.7			25.5			11.6	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		12.1			28.0	0.0	5.3	66.2		14.7	37.2	
Queue Length 95th (m)		23.5			42.5	12.5	16.6	#110.7		#62.9	79.6	
Internal Link Dist (m)		168.3			242.0			149.0			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		338			409	543	190	1384		414	2151	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.30			0.42	0.26	0.26	0.68		0.61	0.46	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

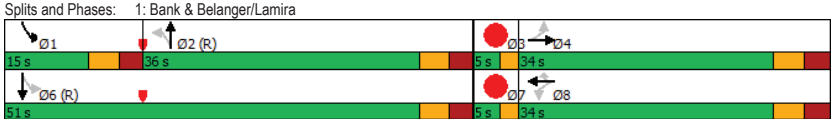
Intersection Summary

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 19.4	Intersection LOS: B
Intersection Capacity Utilization 74.0%	ICU Level of Service D
Analysis Period (min) 15	

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	25	1053	57	26	955
Future Volume (vph)	0	25	1053	57	26	955
Satd. Flow (prot)	0	1510	3278	0	1658	3316
Flt Permitted					0.161	
Satd. Flow (perm)	0	1480	3278	0	279	3316
Satd. Flow (RTOR)		30	11			
Lane Group Flow (vph)	0	25	1110	0	26	955
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	31.0		31.0	31.0
Total Split (%)		48.3%	51.7%		51.7%	51.7%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	24.8		24.8	24.8
Actuated g/C Ratio		0.42	0.41		0.41	0.41
v/c Ratio		0.04	0.82		0.23	0.70
Control Delay		4.3	21.8		17.6	17.9
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		4.3	21.8		17.6	17.9
LOS		A	C		B	B
Approach Delay	4.3		21.8			17.8
Approach LOS	A		C			B
Queue Length 50th (m)		0.0	53.8		1.8	43.5
Queue Length 95th (m)		3.2	#79.3		7.2	62.2
Internal Link Dist (m)	292.7		258.7			149.0
Turn Bay Length (m)					67.5	
Base Capacity (vph)		634	1361		115	1370
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.04	0.82		0.23	0.70

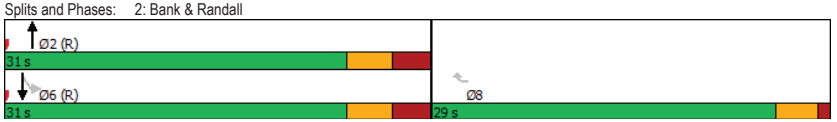
Intersection Summary
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 29 (48%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 19.8	Intersection LOS: B
Intersection Capacity Utilization 62.1%	ICU Level of Service B
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall



Appendix I

Synchro Intersection Worksheets – 2031 Future Total Conditions

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	79	26	13	97	3	285	37	1065	76	146	589	22
Future Volume (vph)	79	26	13	97	3	285	37	1065	76	146	589	22
Satd. Flow (prot)	0	1553	0	0	1665	1469	1595	3180	0	1595	3146	0
Flt Permitted		0.699			0.693		0.421			0.103		
Satd. Flow (perm)	0	1101	0	0	1207	1407	697	3180	0	173	3146	0
Satd. Flow (RTOR)		7				285		9			6	
Lane Group Flow (vph)	0	118	0	0	100	285	37	1141	0	146	611	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		22.4			20.4	20.4	39.9	39.9		54.4	54.4	
Actuated g/C Ratio		0.25			0.23	0.23	0.44	0.44		0.60	0.60	
v/c Ratio		0.42			0.36	0.53	0.12	0.81		0.61	0.32	
Control Delay		29.2			30.8	7.0	15.1	26.0		24.8	11.1	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.2			30.8	7.0	15.1	26.0		24.8	11.1	
LOS		C			C	A	B	C		C	B	
Approach Delay		29.2			13.2			25.7			13.8	
Approach LOS		C			B			C			B	
Queue Length 50th (m)		13.6			13.1	0.0	3.3	~115.7		13.0	31.8	
Queue Length 95th (m)		29.7			26.1	17.3	m8.4	#155.5		#30.3	43.6	
Internal Link Dist (m)		168.3			242.0			149.1			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		364			371	630	309	1414		254	1903	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.32			0.27	0.45	0.12	0.81		0.57	0.32	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lanes, Volumes, Timings
1: Bank & Belanger/Lamira 11/18/2021

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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

Maximum v/c Ratio: 0.81

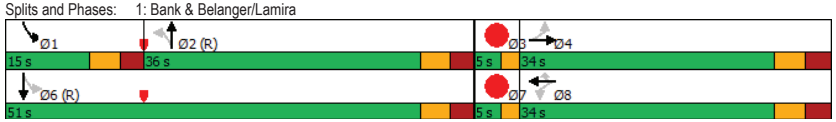
Intersection Signal Delay: 20.2	Intersection LOS: C
Intersection Capacity Utilization 80.6%	ICU Level of Service D
Analysis Period (min) 15	

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

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

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	54	841	31	12	751
Future Volume (vph)	0	54	841	31	12	751
Satd. Flow (prot)	0	1510	3205	0	1658	3221
Flt Permitted					0.291	
Satd. Flow (perm)	0	1484	3205	0	507	3221
Satd. Flow (RTOR)		176	7			
Lane Group Flow (vph)	0	54	872	0	12	751
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	61.0		61.0	61.0
Total Split (%)		32.2%	67.8%		67.8%	67.8%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	54.8		54.8	54.8
Actuated g/C Ratio		0.28	0.61		0.61	0.61
v/c Ratio		0.10	0.45		0.04	0.38
Control Delay		0.4	10.3		4.8	6.7
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		0.4	10.3		4.8	6.7
LOS		A	B		A	A
Approach Delay	0.4		10.3			6.6
Approach LOS	A		B			A
Queue Length 50th (m)		0.0	38.5		0.5	18.1
Queue Length 95th (m)		0.0	51.2		m1.6	22.6
Internal Link Dist (m)	292.7		258.7			149.1
Turn Bay Length (m)					67.5	
Base Capacity (vph)		539	1954		308	1961
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.10	0.45		0.04	0.38

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 72 (80%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.45

Intersection Signal Delay: 8.3	Intersection LOS: A
Intersection Capacity Utilization 54.9%	ICU Level of Service A
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	58	15	29	119	54	142	49	944	75	251	967	33
Future Volume (vph)	58	15	29	119	54	142	49	944	75	251	967	33
Satd. Flow (prot)	0	1523	0	0	1688	1483	1537	3269	0	1658	3274	0
Flt Permitted		0.673			0.765		0.287			0.129		
Satd. Flow (perm)	0	1049	0	0	1330	1447	457	3269	0	224	3274	0
Satd. Flow (RTOR)		23				142		10			5	
Lane Group Flow (vph)	0	102	0	0	173	142	49	1019	0	251	1000	0
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8	2			6		
Detector Phase	4	4		8	8	8	2	2		1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0		5.0	10.0	
Minimum Split (s)	33.3	33.3		33.3	33.3	33.3	34.9	34.9		10.9	34.9	
Total Split (s)	34.0	34.0		34.0	34.0	34.0	36.0	36.0		15.0	51.0	
Total Split (%)	37.8%	37.8%		37.8%	37.8%	37.8%	40.0%	40.0%		16.7%	56.7%	
Yellow Time (s)	3.3	3.3		3.3	3.3	3.3	3.3	3.3		3.3	3.3	
All-Red Time (s)	3.0	3.0		3.0	3.0	3.0	2.6	2.6		2.6	2.6	
Lost Time Adjust (s)		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Lost Time (s)		6.3			6.3	6.3	5.9	5.9		5.9	5.9	
Lead/Lag	Lag	Lag		Lag	Lag	Lag	Lag	Lag		Lead		
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes	Yes	Yes		Yes		
Recall Mode	None	None		None	None	None	C-Max	C-Max		None	C-Max	
Act Effct Green (s)		17.7			17.7	17.7	37.7	37.7		59.1	59.1	
Actuated g/C Ratio		0.20			0.20	0.20	0.42	0.42		0.66	0.66	
v/c Ratio		0.45			0.66	0.36	0.26	0.74		0.64	0.46	
Control Delay		29.4			44.5	7.3	24.8	27.6		22.9	9.9	
Queue Delay		0.0			0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		29.4			44.5	7.3	24.8	27.6		22.9	9.9	
LOS		C			D	A	C	C		C	A	
Approach Delay		29.4			27.7			27.5			12.5	
Approach LOS		C			C			C			B	
Queue Length 50th (m)		12.1			28.0	0.0	5.3	74.8		17.6	37.2	
Queue Length 95th (m)		23.5			42.5	12.5	16.5	#127.2		#70.7	79.6	
Internal Link Dist (m)		168.3			242.0			149.1			322.6	
Turn Bay Length (m)						42.0	60.0			56.5		
Base Capacity (vph)		338			409	543	191	1376		393	2151	
Starvation Cap Reductn		0			0	0	0	0		0	0	
Spillback Cap Reductn		0			0	0	0	0		0	0	
Storage Cap Reductn		0			0	0	0	0		0	0	
Reduced v/c Ratio		0.30			0.42	0.26	0.26	0.74		0.64	0.46	

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 19 (21%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Lane Group	Ø3	Ø7
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	3	7
Permitted Phases		
Detector Phase		
Switch Phase		
Minimum Initial (s)	1.0	1.0
Minimum Split (s)	5.0	5.0
Total Split (s)	5.0	5.0
Total Split (%)	6%	6%
Yellow Time (s)	2.0	2.0
All-Red Time (s)	0.0	0.0
Lost Time Adjust (s)		
Total Lost Time (s)		
Lead/Lag	Lead	Lead
Lead-Lag Optimize?	Yes	Yes
Recall Mode	None	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		

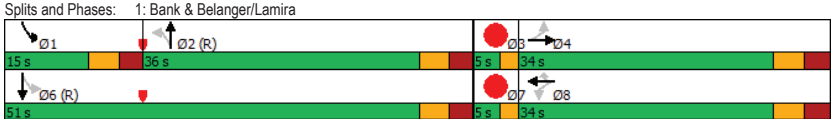
Intersection Summary

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 20.7	Intersection LOS: C
Intersection Capacity Utilization 76.3%	ICU Level of Service D
Analysis Period (min) 15	

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

Splits and Phases: 1: Bank & Belanger/Lamira



Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	0	25	1150	57	26	955
Future Volume (vph)	0	25	1150	57	26	955
Satd. Flow (prot)	0	1510	3283	0	1658	3316
Flt Permitted					0.161	
Satd. Flow (perm)	0	1480	3283	0	280	3316
Satd. Flow (RTOR)		21	10			
Lane Group Flow (vph)	0	25	1207	0	26	955
Turn Type		Perm	NA		Perm	NA
Protected Phases			2			6
Permitted Phases		8			6	
Detector Phase		8	2		6	6
Switch Phase						
Minimum Initial (s)		5.0	10.0		10.0	10.0
Minimum Split (s)		29.0	29.2		24.2	24.2
Total Split (s)		29.0	31.0		31.0	31.0
Total Split (%)		48.3%	51.7%		51.7%	51.7%
Yellow Time (s)		3.0	3.3		3.3	3.3
All-Red Time (s)		1.0	2.9		2.9	2.9
Lost Time Adjust (s)		0.0	0.0		0.0	0.0
Total Lost Time (s)		4.0	6.2		6.2	6.2
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode		Ped	C-Max		C-Max	C-Max
Act Effct Green (s)		25.0	24.8		24.8	24.8
Actuated g/C Ratio		0.42	0.41		0.41	0.41
v/c Ratio		0.04	0.89		0.23	0.70
Control Delay		5.8	26.3		17.6	17.9
Queue Delay		0.0	0.0		0.0	0.0
Total Delay		5.8	26.3		17.6	17.9
LOS		A	C		B	B
Approach Delay	5.8		26.3			17.8
Approach LOS	A		C			B
Queue Length 50th (m)		0.3	61.2		1.8	43.5
Queue Length 95th (m)		3.8	#100.2		7.1	62.2
Internal Link Dist (m)	292.7		258.7			149.1
Turn Bay Length (m)					67.5	
Base Capacity (vph)		628	1362		115	1370
Starvation Cap Reductn		0	0		0	0
Spillback Cap Reductn		0	0		0	0
Storage Cap Reductn		0	0		0	0
Reduced v/c Ratio		0.04	0.89		0.23	0.70

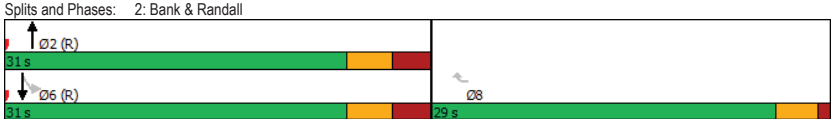
Intersection Summary
Cycle Length: 60
Actuated Cycle Length: 60
Offset: 29 (48%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 22.3	Intersection LOS: C
Intersection Capacity Utilization 64.9%	ICU Level of Service C
Analysis Period (min) 15	

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

Splits and Phases: 2: Bank & Randall



Appendix J

TDM Checklist

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

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

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

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

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☑
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☐